Service Manual

Tektronix

**PQA200
Picture Quality Analysis System**

071-0092-02

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

⚠️ *WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.*

⚠️ *CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use Caution When Servicing the CRT. To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

X-Radiation. To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.

Preface

This manual contains the servicing information for the PQA200 Picture Quality Analysis System. This instrument is composed of a personal computer (hereafter called the server) that contains the PQA200 system hardware and application software.

The information included in this manual explains how to verify, service, troubleshoot, and repair the system to the module level:

- *Specifications* describes functional characteristics and performance requirements for the PQA200 Picture Quality Analysis System.

- *Operating Information* tells you how to install and operate the instrument.

- *Theory of Operation* provides descriptions of the PQA200 system modules.

- *Performance Verification* describes how to verify the functional performance of the PQA200 system.

- *Adjustment Procedures* gives the field adjustment procedures.

- *Maintenance* contains the following information:

  - How to safely handle static sensitive modules and components

  - How to remove and replace modules

  - Diagnostic and Troubleshooting information and procedures

- *Options* provides a brief description of the available options for the PQA200 system.

- *Replaceable Parts List* gives all module and mechanical parts that comprise the PQA200 system. Parts are identified on an indexed illustration to make them easier to identify.

- The appendices consist of the following items:

  - *Appendix A* provides the procedure to follow in the event that the operating system software needs to be repaired. Installing the application software and loading the video test sequences are also explained.

  - *Appendix B* describes the PQA200 application directory structure and the supporting files.

  - *Appendix C* provides a listing of the 601-525 and 601-625 video test sequences on each of the CD-ROM disks. The scene characteristics are also given.

Related Manuals

ThePQA200 Picture Quality Analysis System user documentation consists of the following:

■ The *PQA200 Picture Quality Analyzer User Manual* details how to operate this picture quality analysis system.

Manual Conventions

The following terms and conventions are used throughout this manual:

■ The term PQA200 system is used interchangeably with the more formal term PQA200 Picture Quality Analysis System.

■ The term server refers to the personal computer (PC) that hosts the PQA200 Picture Quality Analysis System.

Introduction

This manual contains maintenance information for thePQA200 Picture Quality Analysis System. Take a few minutes to read this short introduction before doing any repair or service work on the instrument.

Before You Begin

This manual is for servicing the PQA200 Picture Quality Analysis System. To prevent injury to yourself or damage to the PQA200 system, fulfill the following requirements before you attempt service:

- Be sure you are a qualified service person.

- Read the Safety Summary found at the beginning of this manual.

- Read this sections *Service Strategy.*

When using this manual to service your PQA200 system, be sure to heed all warnings, cautions, and notes.

Service Strategy

This manual contains the following maintenance and repair procedures:

- Periodic maintenance

- Performance verification

- Field adjustments

- Module removal and replacement

- Module-level fault diagnosis

Once you isolate a problem with a module, use the *Replaceable Parts List* in this manual to determine the correct module part number to order from Tektronix.

Tektronix Service Offerings

Tektronix provides service to cover repair under warranty. Other services are available that may provide a cost-effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians, trained on Tektronix products, are best equipped to service your PQA200 system. Tektronix technicians are appraised of the latest information on improvements to the product as well as the latest product options.

Warranty Repair Service

Tektronix warrants this product for one year from the date of purchase. (The warranty appears after the title page and copyright page in this manual.) Tektronix technicians provide warranty service at most Tektronix service locations worldwide. Your Tektronix product catalog lists all service locations worldwide.

Repair Service

Tektronix offers single per-incident and annual maintenance agreements that provide Depot Service repair of this product.

Of these services, the annual maintenance agreement offers a particularly cost-effective approach to service for many owners of the PQA200 Picture Quality Analysis System. Such agreements can be purchased to span several years.

Self Service

Tektronix supports repair to the module level by offering a *Module Exchange* program.

Module Exchange. This service reduces down time for repair by allowing you to exchange most modules for remanufactured ones. Tektronix ships you an updated and tested exchange module from the Beaverton, Oregon, service center. Each module comes with a 90-day service warranty.

For More Information. Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services previously described.

Contacting Tektronix

Product support	For questions about using Tektronix measurement products, call toll free in North America: 1-800-833-9200 6:00 a.m. – 5:00 p.m. Pacific time
	Or contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office.
Service support	Tektronix offers extended warranty and calibration programs as options on many products. Contact your local Tektronix distributor or sales office.
	For a listing of worldwide service centers, visit our web site.
For other information	In North America: 1-800-833-9200 An operator can direct your call.
To write us	Tektronix, Inc. Department or name (if known) P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com

PQA200 Picture Quality Analysis System Service Manual

Specifications

Specifications

This section lists the electrical, physical, and environmental characteristics of the PQA200 Picture Quality Analysis System.

Product Description

The PQA200 analysis system is built into a personal computer (called the server) that uses Microsoft® Windows NT Workstation 4.0 as its operating system (see Figure 1–1). The PQA200 Picture Quality Analysis System has a standard configuration that can be used to determine the picture quality of 601 serial digital video test sequences. The addition of Option 01, the composite video option, permits the testing of composite video test sequences.
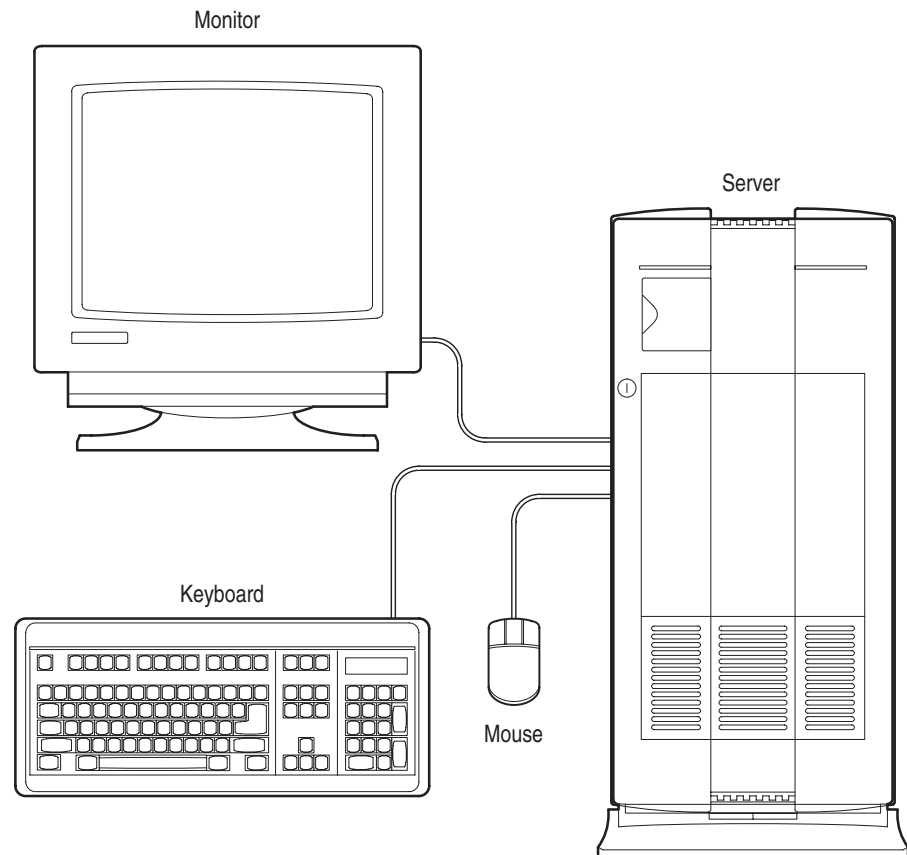
Figure 1–1: Components of the PQA200 Picture Quality Analysis System

The system consists of the following components:

■ The key system components, installed in the server, are the Analyzer DSP module and the Generator DSP module. These are identical modules.

■ The Composite video option, also installed in the server, consists of the composite decoder module (for capture of composite video) and the composite video encoder module (for the generation of composite video test sequences).

■ PQA200 Picture Quality Analysis System application software consists of the user interface, video capture, measurement, and results presentation. It also has the generate application. Additional support features include setups, printing, and a 601 digital video signal output for external display.

■ An SVGA display monitor.

Operating Features

The standard and Option 01 configurations of the PQA200 system lets you to do the following tasks:

■ Generate video test sequences in serial digital component and (with Option 01) composite analog signal formats.

■ Capture video test sequences in serial digital component and (with Option 01) composite analog signal formats.

■ Make PQR and PSNR picture quality measurements on captured and stored video test sequences.

■ Compare results from multiple measurements.

■ Display live video on the SVGA monitor.

■ Display reference video, captured video, and result maps (PQR and PSNR) on the provided SVGA monitor or, using the 601 serial digital output, on a serial digital video display monitor.

■ Display a selected field of the reference sequence, captured sequence, or results map.

■ Display measurement results in various modes – graphs, details, summary, and picture difference maps – with rapid switching through the results display modes to compare data.

■ Choose to apply preprocessing corrections to the detected gain, level, shift, and cropping prior to making measurements.

■ Define preference set ups that restore frequently used application configurations.

■ Load reference and generator video test sequences from CD-ROM disks.

■ Store and retrieve results to and from the server floppy disk drive, the server hard disk, and the network file systems (when connected to a network).

■ Configure system settings such as time-outs, measurement limits, and display model parameters.

■ Enter control commands through the keyboard and with mouse clicks on the virtual front panel display.

■ Print results and screen captures or save them as PostScript or ASCII text files for later printing or transfer to other applications such as a spread sheet or data base program.

■ Use an on-line help system.

Specification Tables

The tables list the specifications for the PQA200 Picture Quality Analysis System. Refer to the following definitions for an explanation of each specification table column heading.

The following definitions describe the information you will find in the specification tables.

■ **Specification**. A document or a section of a document that lists and describes characteristics and performance requirements of equipment and certain programming material.

■ **Characteristic**. A property of the product.

■ **Description.** A statement that describes a characteristic usually in limit form. This statement is considered to be binding on the company (seller), and can be verified by performing the appropriate portion of the Performance Verification Procedure, or by a separate and available procedure.

■ **Supplemental information.** Statements that explain performance requirements or provide performance information. These are not considered to be statements of guaranteed performance and are not ordinarily supported by a performance check.

Performance Conditions

The Performance requirements are valid within the environmental limits if the instrument was adjusted at $25°$ C $\pm 5°$ C and you allowed a minimum warm-up time of 20 minutes.

Hardware Specifications

Table 1–1: DSP board

Characteristic	Description	Supplemental information
Input Signal Format	Receives 270 MB/s serial digital signal	Complies with ITU–R BT.601, BT.656, and SMPTE 259M
Channel 1: Main In and Main Out		Active loop-through, BNC, 75 Ω terminating
Channel 2: Ref In and Ref Out		Active loop-through SMB, 75 Ω terminating
Channel 1 to Channel 2 Isolation		30 dB to 300 MHz
Input Return Loss		At least 15 dB (1 MHz to 270 MHz), with power on
Serial Receiver Equalization Range		Proper operation with coaxial cable up to 14.5 dB loss at 135 MHz. Typical operation; to 300 meters with Belden 8281 coaxial cable.
Active loop-through output characteristics		Meets SMPTE 259M levels and rise and fall times. No reclocking is done on loop-through output.
Loop Output Return Loss		At least 15 dB (1 MHz to 270 MHz), with power on.
Output Signal Format	270 MB/s serial digital signal	Complies with ITU–R BT.601, BT.656, and SMPTE 259M. Exception: output frequency accuracy only specified when not referenced to an external input signal.
Output impedance		75 Ω
Return Loss		At least 15 dB (1 - 270 MHz), with power on
Output level	800 mV ± 80mV	
Rise/Fall		0.3 ns to 1.2 ns, measured 20% to 80%
Jitter – Internal Reference		Less than 0.2 UI, typically 0.3 ns peak-to-peak.
Jitter – External Reference		Depends on the reference input. Typically peaking at 0.05 dB. Jitter attenuation 3 dB point is typically at 650 kHz.
Frequency	270 Mbit/s	
Frequency accuracy		±1.5 ppm over temperature range plus ±1 ppm per year drift, when using the internal oscillator.
Output Connector		BNC

Table 1–2: NTSC/PAL Decoder board

Characteristic	Performance requirement	Supplemental information
Input Channels		
Video Format	NTSC, NTSC No Setup, PAL (B, D, G, H, and I)	
Composite Input type		Passive loop-through, 75 Ω, compensated, BNC
Return loss		40 dB up to 6 MHz on composite video
Loop-through insertion loss		0.6dB Max to 6MHz for composite video
Input amplitude range		+5%, −20% typical
Hum range	0.5 V peak-to-peak	
Frequency range		±20ppm
Genlock jitter		0.5 degree on 0 dB signal, −20dB hum, −50dB SNR
S–Video Input type		Standard S-Video and connector. No loop-through, terminated.
Return loss		25 dB typical
601 Out (serial digital video)		
Connectors		One BNC, one SMB. Identical signals on both output connectors.
Format	270 MB/s serial component only	Complies with ITU-R BT.601, BT.656, and SMPTE 259M
Output level	800 mV ± 80mV	
Rise/Fall	0.4 ns to 1.2 ns, measured 20% to 80%	
Jitter	< 0.2UI above 10 Hz	
Output impedance		75 Ω, 15dB return loss 5 to 270 MHz
Frequency		270 Mbit/s nominal, tracks input signal
Output mode		8 bit or 9 bit, not user selectable
Conversion Accuracy		
Gain	1 ± 2% low frequency	
Flatness	1% to 5 MHz for luma, relative to 500 kHz	
Luma linearity		2%
Differential Gain		1%
Differential Phase		1 degree
Black Level Error		10 mV

Table 1–3: NTSC/PAL Encoder board

Characteristic	Performance requirement	Supplemental information
Genlock (analog black burst) input	Burst locks to NTSC or PAL composite video	Does not lock to monochrome input video
Format	NTSC, NTSC No Setup, PAL (B, D, G, H, and I)	
Input type		Passive loop-through, BNC, 75 Ω, compensated
Return loss		40 dB to 6 MHz on composite video
Loop-through insertion loss		0.6 dB maximum to 6 MHz for composite video
Color Framing (Genlocked to input reference)		Correct color framing detected for signals having no greater than ±45 degrees SCH phase error. Color framing is maintained, once obtained, until the SCH phase error exceeds a nominal value of 125 degrees. Burst must be present and be within ±3 dB of nominal levels.
Burst lock jitter		SNR > 50 dB SNR is defined as the ratio of 0.714 V_{P-P} video to the rms value of white gaussian noise over a 5 MHz bandwidth.
Genlock noise performance		Genlock will be maintained with a SNR > 40 dB or 60 Hz hum <0.714 V_{P-P}.
Burst lock phase change with input burst amplitude		≤2.5 degrees over a burst amplitude range of nominal value ±3 dB
Burst lock phase change with input signal APL		≤1 degree over input signal APL range of 10% to 90%
Output Channels		
Analog video format	NTSC, NTSC No Setup, PAL (B, D, G, H, and I)	NTSC; SMPTE 170M, with and without pedestal. PAL; CCIR 625
Composite output		75 Ω BNC
Composite return loss		>40 dB to 5.5 MHz at 75 Ω
S–Video (Y/C) output		75 Ω Standard S-Video
Y/C S-video crosstalk		≥50 dB down
S-video return loss		25 dB typical, to 5.5 MHz at 75 Ω
601 In		
Format	270 MB/s serial component video	Complies with ITU-R BT.601, BT.656, and SMPTE 259M.
Input type		Non loop-through, 75 Ω terminated SMB
Return loss		≥15 dB to 270 MHz

Table 1–3: NTSC/PAL Encoder board (cont.)

Characteristic	Performance requirement	Supplemental information
Serial receiver equalization range		Proper operation with coaxial cable up to 14.5 dB loss at 135 MHz using coaxial cable with $1/\sqrt{F}$ loss characteristics. Nominally 150 meters of Belden 8281 coaxial cable.
Serial Black Out		
Format	270 MB/s serial component video	Complies with ITU-R BT.601, BT.656, and SMPTE 259M
Output type		75 Ω, SMB
Amplitude	800 mV± 100 mV	
Rise/Fall time		0.3 ns to 1.2 ns, measurement 20% to 80%
Return loss		≥15 dB from 5 MHz to 270 MHz
Jitter		≤0.2 UI above 10 Hz. Only when burst genlocked.
Encoder Conversion Accuracy at Output		
Amplitude accuracy	Within 1%	
Frequency response		Within 1% to 5 MHz, relative to 400 kHz
Group delay		10 ns or less at 5 MHz, relative to luma transition
Luminance Linearity		≤1%, measured with a 5-step staircase
Differential Gain		≤0.5%
Differential phase		≤0.5 degree
Chrominance to Luminance Gain Error		≤2%
Chrominance to Luminance Delay Error		≤7 ns
Field and Line Tilt		≤0.5%
S/N Ratio	≥60 dB (unweighted, 5 MHz low-pass filtered)	
Composite DC offset	≤50 mV	

System Components

Table 1–4: System components

Characteristic	Supplemental information
Computer Server Type	Compaq ProLiant 2500
Form Factor	Full tower PC form with detached CRT screen, mouse and keyboard
Processor	200 MHz Pentium Pro
RAM Memory	128 MB
Bus	PCI / EISA
Expansion Slots	6 PCI slots or 6 EISA slots
Graphics	1024×768 resolution with 32 k colors
Non-volatile Storage	One 9 Gigabyte SCSI hard drive
	One 3.5 inch disk drive
	One CD ROM drive
Server Interfaces	Two serial ports
	One parallel port (printer)
	Keyboard port
	Mouse port
Display	
SVGA Monitor	The display monitor is a high-quality Tektronix SVGA monitor.
Digital Picture Monitor Output	An ancillary display may be attached. The output protocol is ITU-R BT.601.
Front Panel	Virtual front panel on external display monitor. User input is made using the mouse and keyboard.
Video Graphics module	64-bit PCI graphics card

Power Specifications

Table 1–5: Power requirements

Characteristics	Supplemental information
Line Voltage	100 to 240 VAC
Line Frequency	60 Hz / 50 Hz
Rated Input Current	6 A to 3 A
Power Consumption	165 Watts (server only)

Mechanical (Physical) Characteristics

Table 1–6: PQA 200 mechanical characteristics

Characteristics	Supplemental information
Dimensions	Base unit (does not include monitor, keyboard, pedestal, or mouse)
Height	17.92 inches (45.52 cm)
Width	8.83 inches (22.43 cm)
Depth	22.67 inches (57.58 cm)
Net Weight	65 lbs. (without accessories) (29.54 kg)
Shipping Weight	100 lbs. (45.45 kg) (with all accessories except monitor – monitor is shipped separately).

Environmental Characteristics

Table 1–7: PQA 200 environmental characteristics

Characteristics	Supplemental information
Temperature	
Non-operating (storage)	-30° C (-22° F) to $+50^\circ$ C (122° F) (max. rate of change 20° C or 36° F per hour)
Operating	$+10^\circ$ C (50° F) to $+35^\circ$ C (95° F) (max. rate of change 20° C or 36° F per hour)
Altitude	
Non-operating	0 to 30,000 feet (9144 meters)
Operating	0 to 10,000 feet (3048 meters)
Humidity	
Operating	8% to 90% up to $+35^\circ$ C (95° F)
Non-operating	5% to 95% up to $+50^\circ$ C (122° F) Maximum wet bulb temperature 38.7° C (101.7° F)

Safety and Compliances

Table 1–8: Safety standards

Category	Standards
U.S. Nationally Recognized Testing Laboratory Listing	UL1950 – Safety of Information Technology Equipment, Including Electrical Business Equipment
Canadian Certification	CAN/CSA C22.2 No. 950 – Safety of Information Technology Equipment, Including Electrical Business Equipment

Table 1–8: Safety standards (cont.)

Category	Standards
European Union Compliance	Low Voltage Directive 73/23/EEC; amended by 93/68/EEC: EN60950 – Safety of Information Technology Equipment, Including Electrical Business Equipment
Additional Compliance	IEC950 – Safety of Information Technology Equipment, Including Electrical Business Equipment

Table 1–9: Safety certification compliance

Category	Description
Temperature (operating)	+10° C to +35° C
Altitude (maximum operating)	2000 Meters
Safety Class	Class I – grounded product
Pollution Degree	Pollution Degree 2 Rated for indoor use only

Table 1–10: Certifications and compliances

Category	Standard
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 50081-1 Emissions: 　　EN 55011　　　　Radiated Class A: 30 MHz to 1 GHz 　　　　　　　　　　Conducted Class A: 150 kHz to 30 MHz EN 50082-1 Immunity: 　　IEC 801-2 (1984)　Electrostatic Discharge Immunity　　8 kV Air Discharge: 　　IEC 801-3　　　　RF Electromagnetic Field Immunity　　3 V/M CW 　　IEC 801-4　　　　Electrical Fast Transient/Burst Immunity　1 kV AC ports, 　　　　　　　　　　0.5 kV DC/input/control lines Conditional Statements: 　1)　Using the high quality Tektronix shielded cables attached to the ECL Ser/Par and ECL Control ports that it was qualified with. 　2)　Using a conductive EMI gasket applied inside the rear edge of the PC. Low Voltage directive 73/23/EEC, amended by 93/68/EEC: 　　EN 60950　　　　Safety of Information Technology Equipment, Including Electrical Business Equipment

Operating Information

Operating Information

This section provides installation instructions and gives a brief overview of how to operate the PQA200 Picture Quality Analysis System. For detailed operating information, refer to the *PQA200 Picture Quality Analysis System User Manual* provided with the instrument or software upgrade kit. The user manual should be considered the correct source of operating information in case of a conflict between the service manual and the user manual.

Installation

To install the PQA200 Picture Quality Analysis System, you need basic technical knowledge in connecting and operating computer equipment. The application software comes installed as purchased from Tektronix. As shipped there were no known viruses. If you install other applications or use the server for a general purpose computer you should use virus scanning software to protect the server from the introduction of a virus.

The installation of the PQA200 Picture Quality Analysis System involves selecting an installation site, installing the server tower pedestal and door, and connecting all the cabling. Once all items have been unpacked, the assembly of the individual items making up the system should only require a few minutes. Save the shipping carton and all the inserts for use if reshipment of the server becomes necessary. Repackaging instructions are provided in the *Maintenance* section beginning on page 6–31.

⚠ **CAUTION.** *To avoid damage to the PQA200 system during shipping, retain the original shipping carton. Shipping the PQA200 system in any other packaging may void the warranty.*

Standard Accessories
Standard accessories are shipped with the PQA200 Picture Quality Analysis System. All items except the monitor are in the carton containing the Server. The accessories parts list with part numbers is provided *Appendix G* of the *PQA200 Picture Quality Analysis System User Manual*.

■ Tektronix 17-inch SGVA monitor and monitor cable. The monitor power cord is shipped in the PQA200 system accessories package.

■ Compaq server with the analyzer and generator DSP modules, the video module, and the application software already installed. If Option 01 is ordered, the composite encoder and decoder modules are also installed.

- Keyboard

- Mouse

- Tower pedestal

- Server door

- *PQA200 Picture Quality Analysis System User Manual*

- Compaq documentation and back-up copies of the Compaq software

- Windows NT software and documentation package (Windows NT is installed on the PQA200. The software is provided in case the loaded version becomes corrupted.)

- Emergency repair disk (use this disk as described in the Windows NT System Guide)

- PQA200 system Application Installation CD-ROM (provided for reinstalling the PQA200 system software in case it becomes corrupted)

- CD-ROM set of 10 disks containing selected video test sequences for the PQA200 Picture Quality Analysis System. Test sequences for 525-line video format and for 625-line video format are included.

- CD-ROM containing impaired video test sequences in 525-line and 625-line video format with known and quantified impairments for use in testing the functional performance of the PQA200.

- Two power cords (one each for the server and the monitor)

- One low-loss 75Ω coaxial cable with BNC connectors for use in video signal interconnections

Option 01 Accessories   The following items are supplied in addition to the standard accessories with the Option 01 systems.

- One 75 Ω adapter coaxial cable, length 8 inches, with a male BNC connector on one end and a male SMB connector on the opposite end for encoder to generator DSP interconnection.

- Two 75 Ω coaxial cables, length 8 inches, with male SMB connectors on both ends for encoder to generator DSP and decoder to analyzer DSP interconnections.

- Two 75 Ω BNC terminations for use in terminating the passive loop through connections of the encoder and decoder modules.

- Two S-Video cables, length 72 inches, with standard S-Video connectors on both ends for use in S-Video signal interconnections.

Assembling the PQA200 Picture Quality Analysis System

Before you begin to assemble the PQA200 system, make sure that you have selected an appropriate location. A good site, as specified by Compaq, includes the following features:

- A sturdy, level site that includes dedicated and properly grounded circuits, air conditioning equipment, and static electricity protection.

- A 3 inch (7.6 cm) clearance at the front and back of the computer for proper ventilation (You will probably want additional access to the rear panel for connecting signals.)

- A separate electrical circuit for the server.

- A place where no heavy electrical equipment will be located near the server.

Once a good site has been selected, begin assembling the sPQA200 system using the procedure given below. (The system components are shown in Figure 2–1.)

Figure 2–1: The PQA200 Picture Quality Analysis System

WARNING. Be careful lifting and moving the PQA200 server. It is heavy.

1. Install the pedestal on the PQA200 server.

    a. Carefully set the server on its top.

    b. Align the post on the pedestal with the slots in the server case.

    c. Slide the pedestal into the slots until the retaining clip on the pedestal snaps into place on the server base.

    d. Carefully turn the server over to set it upright on the pedestal.

2. Install the door on the front of the server.

    a. Line up the hinge pins of the two hinges on the right side of the server door with the hinge pin holes in the server chassis.

    b. Lower the hinge pins into the hinge pin holes and close the door to make sure it fits correctly.

3. Connect the keyboard connector to the keyboard port on the rear panel of the PQA200 server. See Figure 2–2 for the location of the connectors on the rear panel.

4. Connect the mouse connector to the mouse port on the rear panel of the PQA200 server.

5. If the PQA200 is being connected to a network, connect it now. Two types of ethernet ports are provided: an AUI port and an RJ45 port. See Figure 2–2. The ethernet ports do not require termination if they are not in use.

NOTE. Although the PQA200 Picture Quality Analysis System is based on a standard computer configuration, do not use the server for any other purpose or install boards not provided or recommended by Tektronix. Doing so can cause your system to operate in an unexpected manner and will void your warranty. However, you may connect it to an appropriate network. The network administrator must configure the server correctly for the local network.

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6. Connect the monitor cable to the monitor and to the rear of the PQA200 server at the SVGA Video port of the video module (see Figure 2–2). Do not use the standard server monitor port for this connection.

7. Connect the power cord to the monitor and to a power source.

8. Connect the power cord to the PQA200 server and to a power source.

Figure 2–2: The rear panel of the PQA200 server

Power Mains

The server and monitor are designed to operate from a single-phase power source having one of its current-carrying conductors at or near earth ground (the neutral conductor). Systems that have both current-carrying conductors live with respect to ground, such as phase-to-phase or multiphase systems, are not recommended as power sources. A protective ground connection, by way of the grounding conductor, in the power cord is essential for safe operation.

⚠ *WARNING. This equipment is designed for connection to an earth-grounded AC outlet. The grounding plug is an important safety feature. To avoid risk of electrical shock or damage to your equipment, do not disable this feature.*

Mains Voltage Range
The server operates from 100 VAC to 230 VAC power mains. The monitor operates on either 115 VAC or 230 VAC source without having to set a voltage selection switch.

Mains Frequency   The server and the monitor both operate on either 50 or 60 Hz line frequencies.
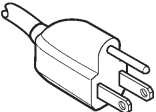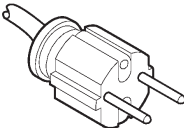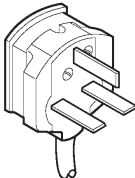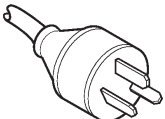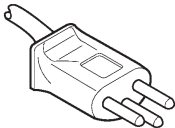
⚠ *CAUTION. To prevent damage to the server, you should protect the instrument from power fluctuations and temporary interruptions with a regulating uninterruptable power supply (UPS). This device protects the hardware from damage caused by power surges and voltage spikes. In addition, it keeps the system in operation during a power failure.*

Power Cord Options

Any one of the power cord options shown in Table 2–1 is provided at no change when ordered with the instrument. The optional power cord replaces the standard North American power cord.

Table 2–1: Power cord identification

Plug configuration	Normal usage	Option number
	North America 125 V/15 A Plug NEMA 5-15P	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	Switzerland 230 V	A5

PQA200 I/O

The PQA200 rear panel input/output connectors (I/O) are located in expansion slots on the server rear panel. The circuit cards are two DSP modules (analyzer and generator) and the SVGA video card. The SVGA video card provides increased capability over the standard video monitor output. This increased capability is needed to adequately view the video test sequences.

The composite video option, Option 01, consists of two additional modules: a composite decoder, for conversion of composite video to 601 serial digital format, and a composite encoder, for converting the 601 serial digital output of the generator DSP into a composite video signal.

Figure 2–3 shows the arrangement of the I/O connectors. The standard instrument rear panel does not include the Option 01 decoder and encoder nomenclature or connector access holes, and the Video module is located in slot 5. A detailed description of each of the connectors follows the illustration.
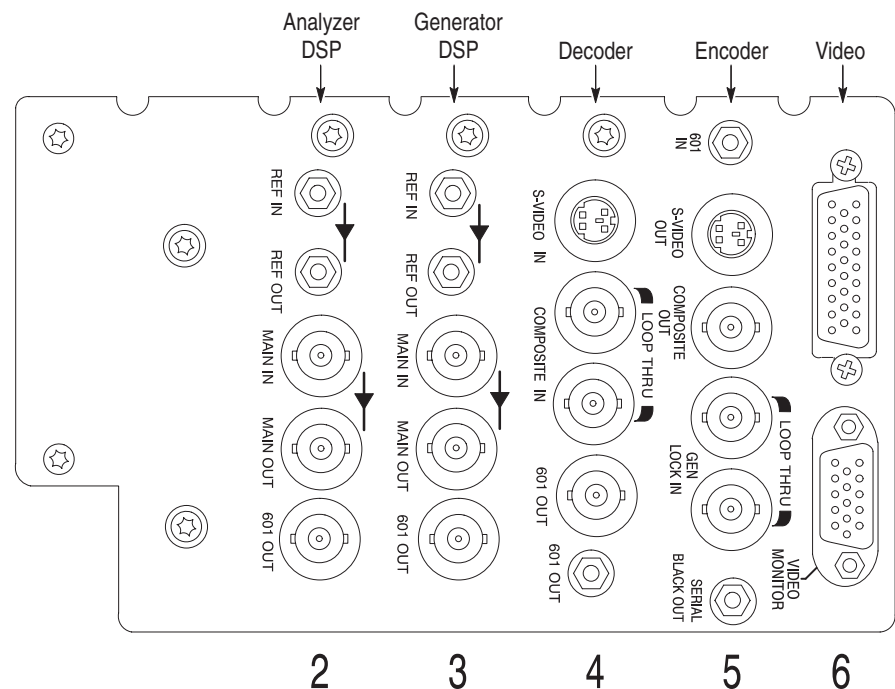
Figure 2–3: The PQA200 signal I/O ports with Option 01

Inputs and Outputs   The Analyzer and Generator DSP modules are exactly the same. The channels comply with ITU-R BT.601, BT.656, SMPTE 259M, 272M, and RP165. The difference in operation and purpose of the connectors on the DSP modules is controlled by software.

Both DSP modules have the following connectors:

- MAIN IN – 270 MB/s serial component input, 75 Ω BNC

- MAIN OUT – 270 MB/s serial component active loop through, 75 Ω BNC

- REF IN – 270 MB/s serial component input 75 Ω SMB

- REF OUT – 270 MB/s serial component active loop through, 75 Ω SMB

- 601 OUT – 270 MB/s 601 serial digital component output, 75 Ω BNC

Analyzer DSP Connections. Serial digital video to be viewed or captured is connected to the analyzer Main In BNC connector. See Figure 2–4 for a simplified block diagram of the analyzer connections. You can use the active loop through Main Out connector to supply the video signal for the other devices in the system or to view the input video using a serial digital monitor. The analyzer 601 Out connector provides a separate video signal that can be applied to a serial digital monitor. The video signal from the 601 Out connector is determined by the selection made in the 601 Display configuration menu. The Ref In SMB connector is for use with the Option 01 composite decoder. The Ref Out connector is available for viewing the input signal on a serial digital monitor or other purpose you choose.
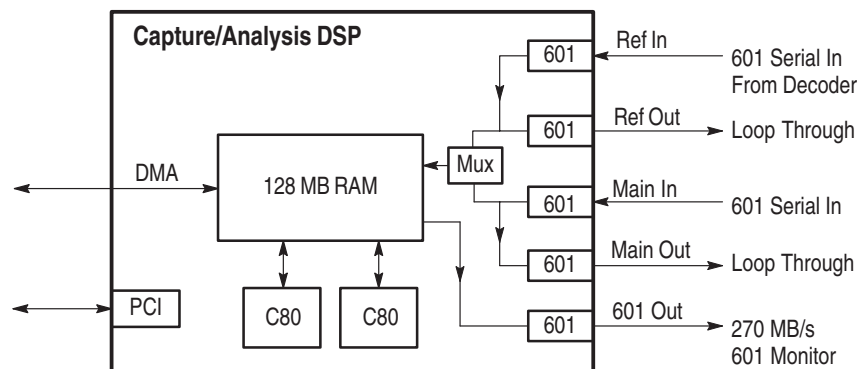
Figure 2–4: Analyzer DSP connections

Decoder Connections. The decoder module accepts NTSC, NTSC No Setup, or PAL I video in either composite video or S-Video format. A simplified diagram of the decoder connections is shown in Figure 2–5. The composite video input is output on an active loop-through connector. The analog input signal is converted to 601 serial video for application to the analyzer DSP. The 601 serial video is available on both an SMB connector and a BNC connector.

The decoder module requires the standard 0 to 1 V input. That input is mapped into decimal 16 to 235 output levels (8-bit mode). Signals with lower amplitude will caused reduced decoder accuracy.

The Decoder module connectors are the following:

- S-VIDEO IN – Standard S-Video input connector, NTSC or PAL

- COMPOSITE – Composite video NTSC/PAL passive loop-through, two 75 Ω BNC connectors

- 601 OUT – Serial digital 601 output, 75 Ω BNC

- 601 OUT – Serial digital 601 output, 75 Ω SMB
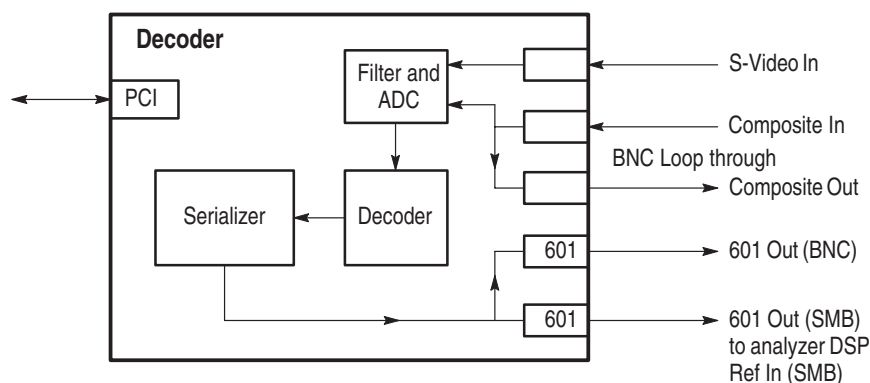
Figure 2–5: Decoder module connections

Generator DSP Connections. The 601 Out connector is the generator output port. Connect the input of the device to be tested to this BNC connector. See Figure 2–6 for a simplified block diagram of the generator connections.

The generator can be synchronized to an external 601 serial digital source by connecting that source to the Main In connector of the generator. The generator free runs when a 601 serial reference is not connected to either the Main In connector or the Ref In connector. Free-run operation is typical for 601 serial digital testing.

When testing analog devices, the generator Ref In SMB connector can be used to apply the serial black burst synchronization signal from the encoder to the generator Ref In to synchronize the generator and encoder modules to an external analog composite or black burst reference signal applied to the encoder Genlock loop through connector.

NOTE. *To avoid a synchronization conflict it is important to have the appropriate connections made when selecting the source of the lockup signal. If you are going to use the generator DSP serial digital signal for genlock, do not connect the serial black signal from the encoder to the generator DSP Ref In connector. If you are going to use the serial black burst from the encoder as the genlock source, do not connect a serial digital reference signal to the generator DSP Main In connector.*
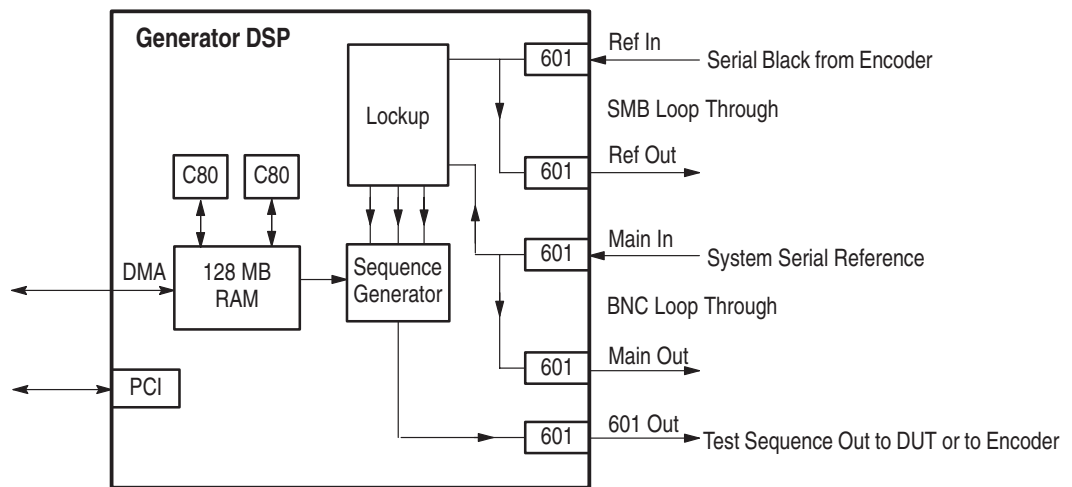
Figure 2–6: Generator DSP connections

Encoder Connections. The encoder module accepts the 601 serial output of the generator DSP and converts it to NTSC, NTSC No Setup, or PAL I analog video in both composite video and S-Video format. A simplified diagram of the connections is shown in Figure 2–7. The encoder may be genlocked (synchronized) to either the 601 serial digital video from the generator DSP or an external analog black burst reference.

When Black Burst is selected as the lockup source, the encoder module extracts the horizontal and vertical sync signals from the applied analog reference video and creates a serial black burst signal that is applied to the generator DSP Ref In connector. That serial black burst signal synchronizes the generator DSP with the encoder.

When Serial Video is selected as the lockup source, the encoder 27 MHz oscillator is synchronized to a 27 MHz clock recovered from the serial digital video input from the generator DSP. The recovered 27 MHz clock is filtered (integrated) to remove jitter, but there will be more jitter in the recovered clock than is present with an analog black burst lock.

The Encoder module connectors are the following:

■ 601 IN – Serial digital 601 input, 75 Ω SMB

■ S-VIDEO OUT – Standard S-Video output connector, NTSC or PAL

■ COMPOSITE OUT – Composite video output, 75 Ω BNC

■ GENLOCK – Passive loop through, two 75 Ω BNC connectors

■ SERIAL BLACK OUT – Synchronization signal to the generator reference in, 75 Ω SMB. The serial black burst signal is valid only when an external analog reference is applied and Black Burst is the selected lockup source. Connect the serial black burst signal to the generator DSP Ref In connector only when an analog reference signal is connected to the encoder Genlock loop-through connector and Black Burst is the selected lockup source.
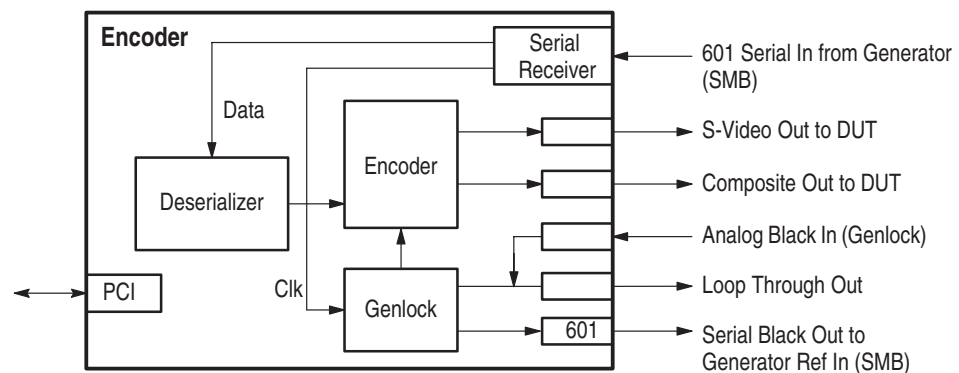
Figure 2–7: Encoder module connections

DSP Module   The DSP module contains two TMS320C80 integrated circuits with five processors each. These share 128 MB of fast SDRAM. The DSP module accepts Rec. 601 serial digital component video inputs and performs picture quality calculations relative to reference video stored on the hard disk drive. While test video input arrives through the input ports on the card rear panel connectors, reference sequences are loaded through the PCI bus. The DSP module also can output processed program output video in Rec. 601 serial format. The analyzer DSP and the generator DSP modules are identical. Their specific operation for either analysis of the incoming signal or generation of a test signal is software controlled.

Composite Video Decoder Module

The composite analyzer is formed by the analyzer DSP and an optional composite video decoder module. The Decoder module accepts NTSC, NTSC No Setup, or PAL analog video and converts it to Rec. 601 serial digital format for application to the analyzer DSP. Input can be in either composite or S-Video format. The serial digital Rec. 601 output of the decoder is presented on the rear panel to be externally connected to analyzer DSP Ref In connector. A second 601 out connector is available for monitoring the serial video signal.

Composite Video Encoder Module

The composite generator is formed by the generator DSP and an optional composite video encoder module. As are the other modules, the encoder is a plug in circuit board that communicates with the server and the generator DSP through the PCI bus.

The Composite Encoder module accepts 601 video at 270 MHz and converts it to NTSC, NTSC No Setup, or PAL. The outputs are composite video and S-Video.

The encoder module requires standard Rec. 601 input serial digital signals and can be genlocked through the passive analog loop-through input.

Cables and Mating Connectors

The PQA200 serial 601 Main In and generator 601 Out connectors require 75 Ω coaxial cables with BNC male connectors. Additional 75 Ω coaxial cables are required to make the loop-through connections. The active loop-through connectors on the analyzer and generator DSP modules do not need terminations on the outputs if you choose not to connect them.

Either the standard PQA200 system or the Option 01 PQA200 system can be used to test 601 serial digital video signals. Typical connection for serial digital testing are shown in Figure 2–8. The generator free runs on its internal 27 MHz oscillator. An additional connection you may want to use is to apply a serial digital reference signal to the generator Main In connector. The generator oscillator is then synchronized to the applied serial reference.
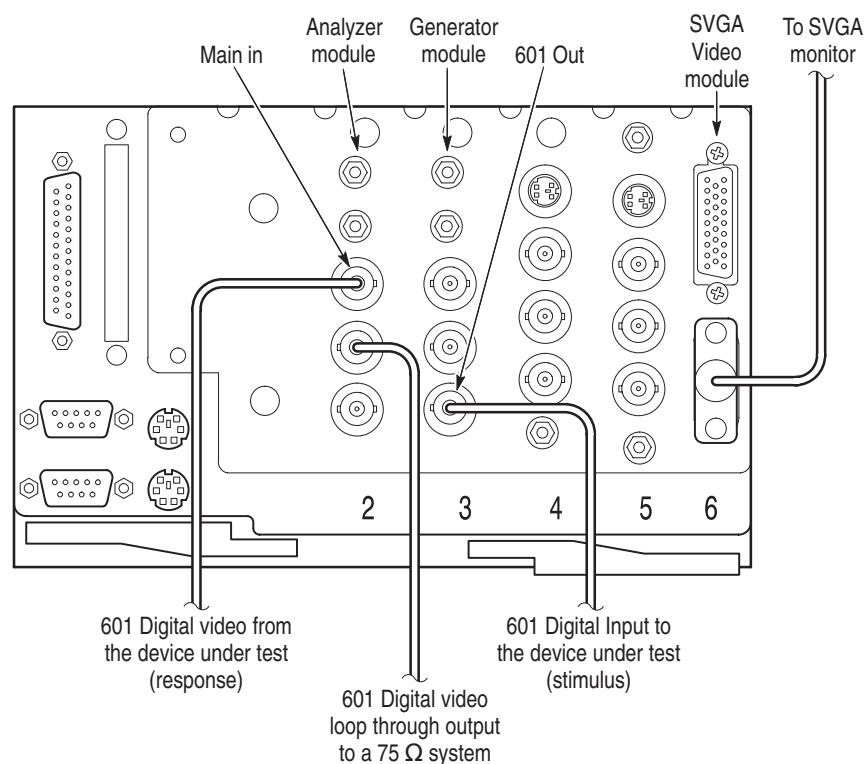
Figure 2–8: PQA 200 signal connections for stand-alone serial digital signal testing

With the composite video option installed, additional interconnection cables are required. A coaxial cable with a BNC connector on one end and an SMB connector on the other is required to connect the generator 601 BNC output to the encoder 601 In SMB input connector. Two short coaxial cables with SMB connectors on both ends are needed. One is used to connect the Serial Black Out SMB connector to the generator DSP Ref In SMB connector.

The second is used to connect the 601 Out SMB connector to the analyzer DSP Ref In SMB connector. Do not connect the Serial Black Out signal to the generator DSP Ref In connector unless you are also providing an analog composite genlock signal so shown in Figure 2–9.

Do not connect the encoder Serial Black Out signal to the generator DSP Ref In connector unless you are also providing an analog composite genlock signal as shown in Figure 2–9 and you are going to select Black Burst as the lockup source. Use a 75 Ω termination on the second Genlock Loop Thru connector as shown in Figure 2–9 if you do not connect it to a 75 Ω system.
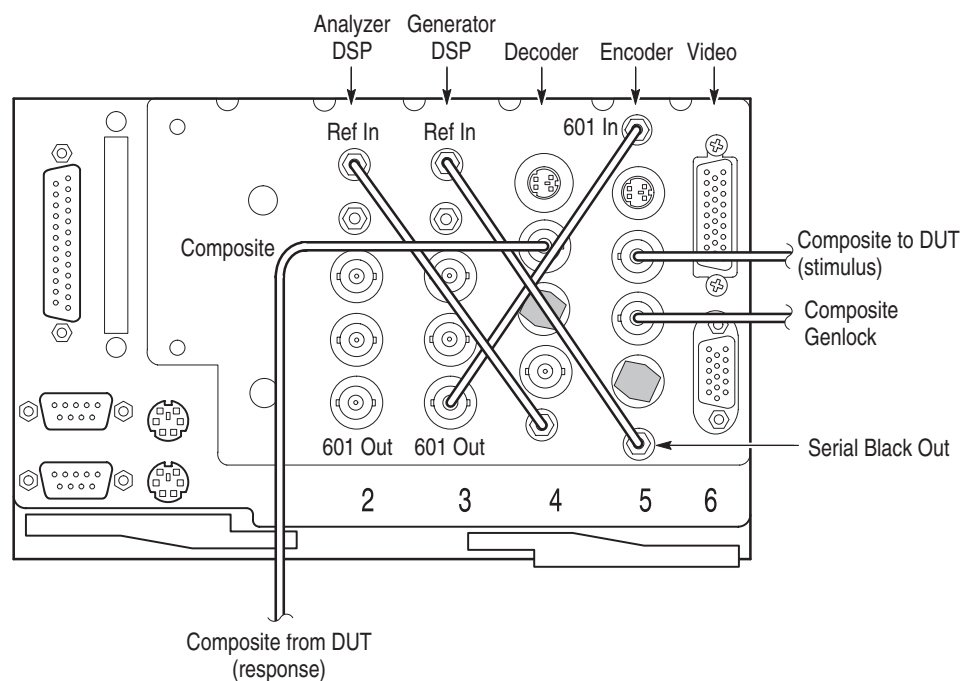
Figure 2–9: Option 01 connection using Serial Black Burst genlock

The connections for using the generator serial digital video signal as the lockup source are shown in Figure 2–10. Connected as shown, the generator free runs on its own internal reference oscillator.
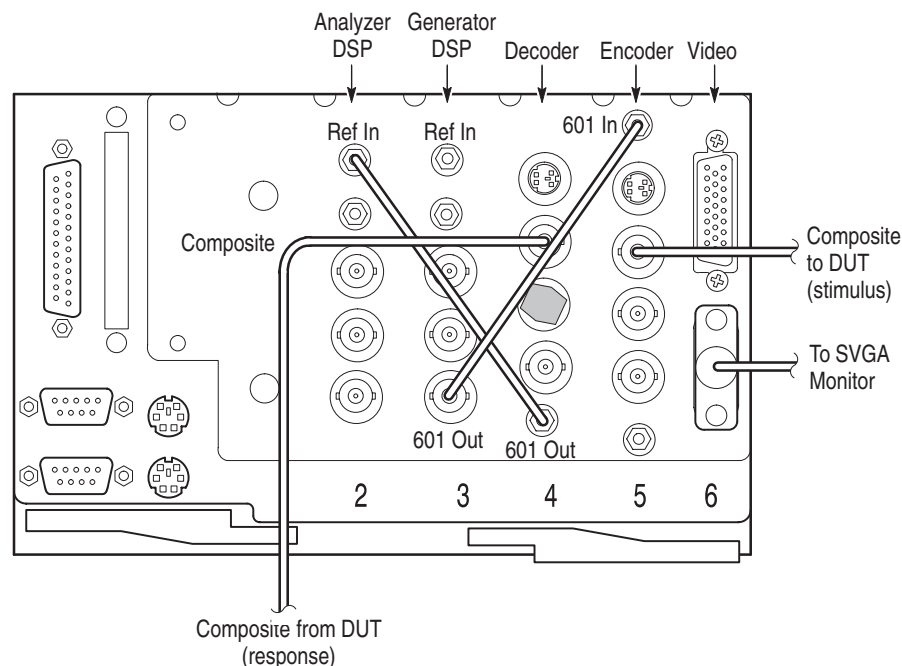
Figure 2–10: Option 01 connections using serial digital genlock (lockup)

The coaxial cables to make the interconnections for the Option 01 instrument are provided. Two 75 Ω terminations are provided to terminate the passive loop-through connection. On the decoder module Composite BNC connector and the encoder Genlock BNC connector, use a 75 Ω termination on any unconnected passive loop-through BNC connectors when an input signal is connected.

Log In

This information takes you through power up, log in, and to the point where you select an application. Specific information about how to run the applications is contained in the *PQA200 Picture Quality Analysis System User Manual.*

Power Up   Once you have installed the PQA200, it is ready to operate. Slide the power switch cover plate to the right as shown in Figure 2–11 and press in the power switch to turn the server on. Whenever you power on the server, it goes through the Windows NT initialization process. (For more information on the Windows NT initialization process, please see the Windows NT documentation.) When it is finished, press CTRL + ALT + Delete as instructed by the message box to display the login dialog box.
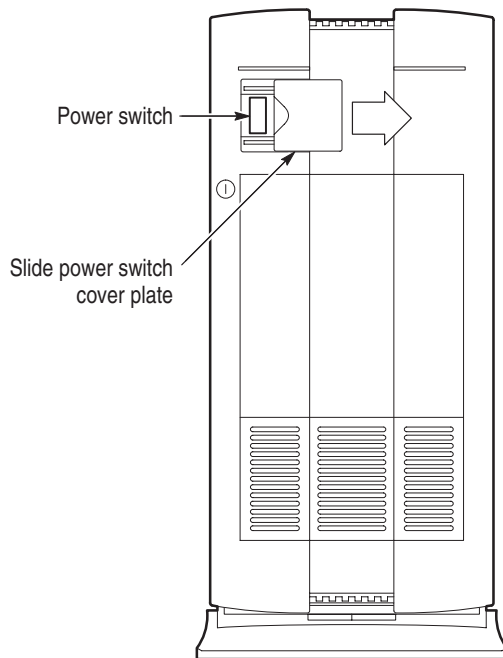
Figure 2–11: Turning on the PQA200 Picture Quality Analysis System

Log in as "Administrator" and use the password "PQA200." If you are not allowed in, the password may have been changed. When servicing the analyzer always log in as an administrator, which gives extra privileges. You are required to use this log in when performing any software upgrades.

Operators should always log in using "PQA200" as the name. This log in does not require a password; press return when the password is requested. This type of log in is limited and does not allow full access of servicing. You are allowed to load generator and reference video test sequences.

There are two other types of users. The first is "guest" and requires no password. A guest has only limited access to files and applications. The second is "admin-tek-service." This log in provides full administrative privileges to Tektronix service personnel for instrument repair. It has a secret password, that cannot be changed by the user.

NOTE. An "Administrator" is a member of the administrator group and has all the privileges. If you are connected to a network, you may have more "power" than you realize within the network. If the server is connected to a network, do not perform normal day-to-day operations while logged in as an administrator.

You can change the administrator password or establish a password for user or guest. It is recommended that you do not change the password for the "admin-tek-service" account. If you change any of the passwords, be sure to create a new emergency repair disk, which allows you to reinstall the data base that contains the user, guest, and administrator passwords. Refer to *Creating an Emergency Repair Disk* on page A–2.

Diagnostics

The PQA200 has limited built-in self diagnostics to act as the first level of failure location and to act as part of the functional verification check.

Power-On Diagnostics

The PQA200 performs power-on diagnostic testing. This testing consists of running the Windows NT power-on tests for checking the server and the boot-up testing of the PQA200 DSP modules.

Additional diagnostic tests are performed on the Option 01 encoder and decoder modules to determine if they are operational. Refer to *Encoder/Decoder Diagnostics* on page 6–22 for further information on accessing the diagnostics to manually run the tests.

Field Service

You may service the the PQA200 Picture Quality Analysis System yourself or you may have Tektronix service the sPQA200 system.

If you have the ability to diagnose and repair module level defects, the service manual will aid you in module-level trouble isolation of the PQA200 modules. Once a problem module is identified, you can order a exchange replacement module. You will then have to install the module, configure the server as necessary, and do any system calibration that may be needed. Troubleshooting of the server is not included in the service manual.

If you prefer to have Tektronix or a Tektronix authorized service center diagnose and repair the PQA200 Picture Quality Analysis System, including any server problems, contact your local Tektronix representative to arrange for either local service or shipment to Factory Service. A field service or factory service technician performing the repairs will replace the defective module, verify the the instrument functionality, and ship it back to the customer. Defective modules are returned to a central repair facility for component-level repair where the boards are repaired, tested, and recalibrated to support the exchange repair program. Refer to *Contacting Tektronix* in the *Preface* of this manual for information on obtaining additional customer support.

Installing Test Sequence Files

The PQA200 application software is preloaded in the D:/PQA200 directory on the server 9 GB hard drive. The directory structure shown in Figure 2–12 is created when the application is loaded. The software files are automatically placed in the appropriate sub-directory. The program binary files are loaded into the bin sub-directory along with the supporting files for the application. See *Appendix B* for additional information on the directory files.
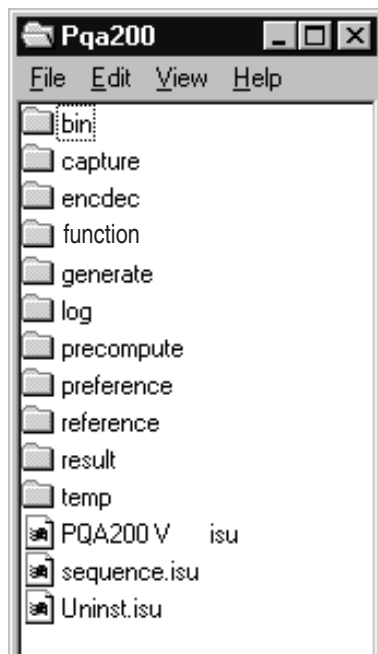
Figure 2–12: PQA 200 directory structure

The video test sequences used for making the factory test are also loaded on the hard disk drive. The analyzer is configured and ready to use with the installed video test sequences. Additional PQA200 test sequence files are provided on CD-ROM disks in both 601-525 and 601-625 format. Install any of the additional video test sequences you want to use for testing. Generate files are about 102 Mbytes each, and reference files are from 42 Mbytes to 49 Mbytes each. To conserve hard drive space for the capture files, you should load only the sequences you are going to test with.

1. Select the CD-ROM disk containing the test sequences you want to install.

2. Insert the CD in the CD reader of the server; an InstallShield Wizard is activated when the CD is detected and read.

3. Follow the installation instructions that are displayed. Refer to *Installing the Generator and Reference Sequences* on page A–5 for further information, if needed.

Preference Preset

The PQA200 Picture Quality Analysis System supports saving and recalling instrument configuration setups. A preference preset file contains all of the static configuration elements defining the PQA200 behavior. Once saved to the preference directory, a preset file can be used to restore that configuration of the instrument settings.

From the factory there is one preset installed and one created at the first shutdown of the PQA200 application. These are factory and shutdown. The factory preset is a read only file. The factory preset is used to set up the PQA200 for factory and service testing procedures. Use the factory preset to remove any settings remaining from previous operation and begin a new setup with known settings. After making new configuration settings, give the preset a new name and save it to make a new preference preset.

At shutdown of the PQA200 application, the present settings are saved for restoration in a preference preset file called "shutdown." If the shutdown preset is the selected preference preset for startup, those shutdown settings are restored the next time the application is started. For additional information on creating and activating Preference presets, refer to *Preference Configuration Menu* in the *PQA200 Picture Quality Analysis System User Manual*.

Virtual Front Panel Controls, Indicators, and Display

Once you have correctly completed the log in, you have access to the PQA200 application menus and displays. Double click on the PQA200 icon to start the application. The PQA200 Picture Quality Analysis System user interface consists of a virtual front panel (shown in Figure 2–13 with menus) and other configuration control panels that provide access to all the configuration settings and operating control choices.
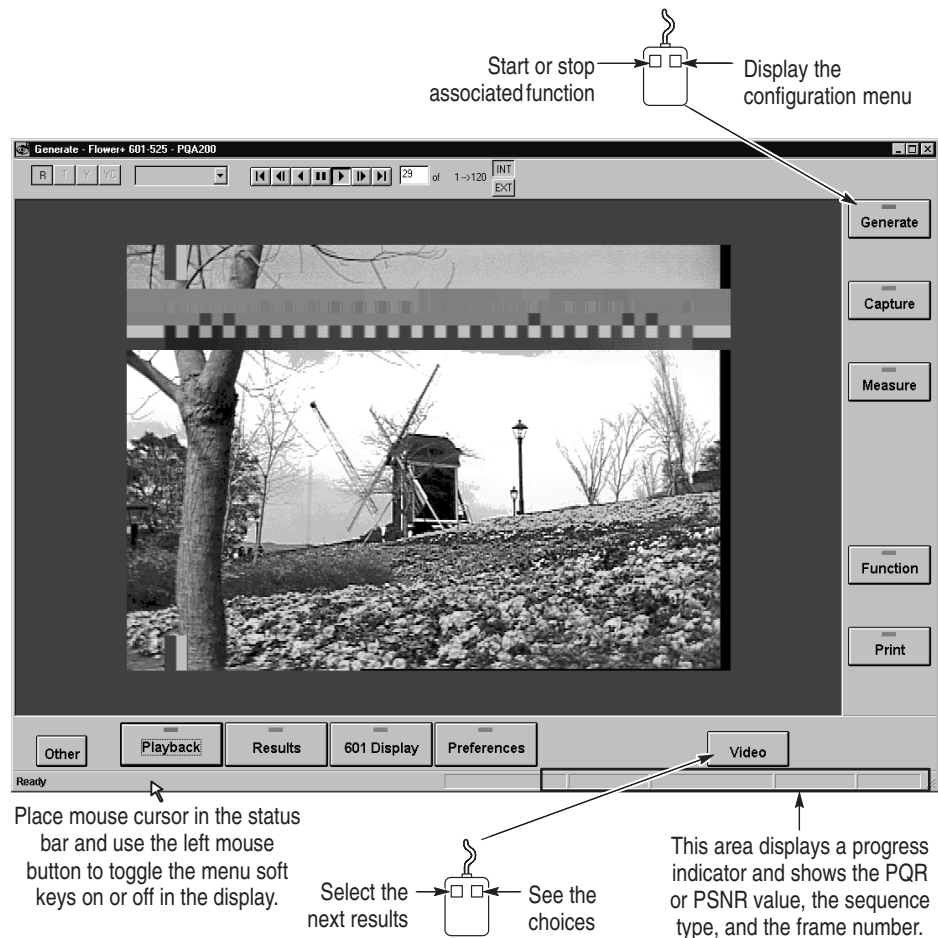
Figure 2–13: Virtual front panel with soft key menus

The displays are viewed on the monitor, and all the controls are selected using the mouse pointer and activated by clicks or presses of the mouse buttons. The keyboard can be used to input alpha or numeric information when appropriate.

The arrow keys of the key board are used to step changeable parameters up and down when that parameter is selected using the mouse cursor. The vertical cursor that is displayed in the graphical results display is also positionable using both

the arrow keys and the mouse cursor. The Windows NT operating controls provide access to any server configurations that must be made or changed.

Soft Key Controls   The main control soft keys located to the right of and below the display provide access to the various configuration menus and processes. These menus are used to control the operation of the PQA200 and to make any configuration changes to the parameters that control the various modes of operation. You can remove the soft keys from the display by clicking in the bar at the bottom of the PQA200 screen. Click in the bar again to make the soft keys reappear.

Click the left mouse button on the soft key to start or stop the associated function. Click the right mouse button on the soft key to bring up the configuration menu associated with the function.

NOTE. If you click on a soft key to start a process and the configuration for that process is not correct, you will get an error message instead of starting the process. Correct the configuration, and the process will continue with the action you want.

Soft Key Behavior. Most of the main menu soft keys have left mouse button and right mouse button selections. A click of the left mouse button activates or toggles a specific feature. A small indicator in the soft key is turned on when the function associated with that soft key is active. A click of the right mouse button on the major function soft keys displays the configuration menu associated with the soft key. (A press and hold of the left mouse button for longer than about 1 second has the same result as clicking the right mouse button.) The soft key functions are shown in Table 2–2.

Table 2–2: Soft key control behavior

Soft key name	Left mouse button click	Right mouse button click
Generate	Activates or terminates a generate task	Displays the Generate Configuration menu
Capture	Activates or terminates a capture task	Displays the Capture Configuration menu
(Start)	Starts capturing a user sequence for striping	
Measure	Activates or terminates a measurement task	Displays the Measure Configuration menu
(Set Region)	Sets crop limits for a defined sub region	

Table 2–2: Soft key control behavior (cont.)

Soft key name	Left mouse button click	Right mouse button click
Function (Learning)	Activates or terminates a function task Starts and stops a Learn Mode function creation	Displays the Function Configuration menu
Print	Displays the Print setup menu	Displays the Page Setup menu
Summary/ Detail/ Graph/ Video	Cycles through the measurement results displays. The label on the soft key changes to show the results type being displayed.	Display a pop up menu showing the results displays that you can select. If a choice is unavailable for the present application, the choice is grayed out.
Preference	Restores the user preference setup (any in-process activity is terminated)	Displays the Preference Configuration menu
601 Display	Activates or terminates the external monitor display	Displays the External 601 Display Configuration menu
Results	Activates or terminates a results display activity	Displays the Result Configuration menu
Playback	Activates or terminates a playback activity	Displays the Playback Configuration menu
Other	Accesses the menu choices of Video Controls on/off, View Graph Legend on/off, View Transcript, Working Directory, File Operations, Update Database, Display Settings, Hardware Settings and Diagnostics, Save Values to Disk, Help, Minimize, and Exit.	Same as a left mouse button click

Text Editing and Keyboard Controls

The server keyboard is used to enter file names, directory locations, and various alpha or numeric variables. Any parameter field in the configuration menus permitting alpha or numeric entries can be edited using the edit features of the keyboard. Use the tab and shift-tab keys to select the button choices in the configuration menus. Use the enter key to activate a selected button (a small outline is shown around the button label when the button is selected). The Esc button exits an active configuration menu.

Display Behavior

All the PQA200 displays are in windows on the SVGA computer monitor supplied with the server. In each of the four measurement views (summary, detail, graph, video) the sequence name, the measurement name (PQR, PSNR), and the format (601-525, 601-625, NTSC, NTSC No Setup, or PAL I) are displayed for the current test sequence.

Video Sequences. You can select live video, a captured video sequence, or a stored video sequence file to display using the menu choices associated with the playback configuration menu (refer to *Playback Configuration Menu* in the *PQA200 Picture Quality Analysis System User Manual* for configuring information).

Results Displays. You can view measurement results as a summary, as field-by-field details, as a graphical display, or as a video picture difference sequence. You can use the measurement results to determine overall picture quality or to examine specific fields of a video sequence for problem areas.

External Display. You can connect a serial digital component video monitor to the 601 digital picture monitor output to view the PQR and PSNR picture difference maps at full resolution. In addition, you can view input signals and captured signals in full digital component video resolution. You can configure the external digital picture monitor display in a display configuration menu. Access the external display configuration menu by clicking the right mouse button on the 601 Display soft key to bring up the menu window.

Configuration Menus

All the configuration menus are accessed by click of the right mouse button (a long click and hold of the left mouse button also works). Refer to *Soft Key Controls* on page 2–21. Refer to the *PQA200 Picture Quality Analysis System User Manual* for a description of the configuration menus and the user configuration choices.

Other Soft Key Choices

Press the Other soft key to access some operation supporting functions. The choices are shown in Figure 2–14. Refer to the *PQA200 Picture Quality Analysis System User Manual* for further information on the Other Soft Key.

View Graph Legend. The graph legend is available for display only while graph results are displayed. Turn the legend on or off using the selection on the Other soft key or with the Legend soft key in the graph display.

View Video Controls. The Video Controls are available during playback operation and when viewing video of either test sequences or maps. Turn it off by deselecting the choice in the Other soft key choices.

View Transcript Window. The transcriptwindow lists the application activities that have occurred and are occurring for use as a debugging tool. Use the scroll bar to move through the list of events if necessary.
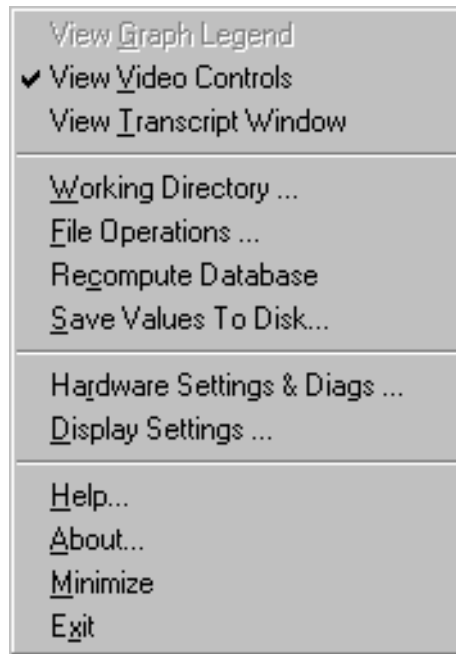
Figure 2–14: Supporting functions under the Other soft key

Working Directory. The PQA200 application looks for its files in the working directory. Use this window to select the working directory shown in Figure 2–15 by double clicking on a directory name. Double click on the [..] symbol to go up the directory tree one directory at a time. You can also enter or edit the path directly in the Path edit field. To save your changes, either select the OK soft key or press the enter key. The Working Directory window closes.

NOTE. The working directory must contain all the PQA200 sub-directories. The application software expects to find the files in specific directories. If you select a working directory that is not structured as needed for the application, the supporting files for generate, results, and so on, will not be available. On the server, the appropriate working directory is D:\PQA200.
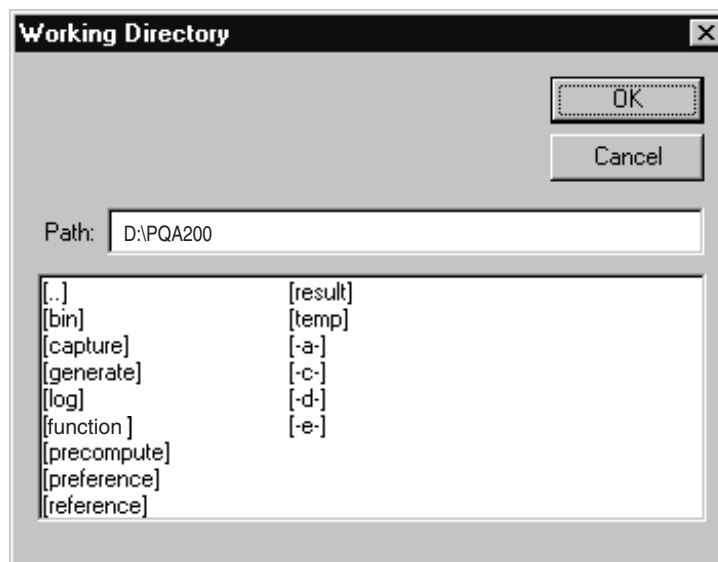
Figure 2–15: Working directory selection screen

File Operations. Use the File Operations screen to move files between the internal hard drive and the 1.44 Meg disk drive and to retrieve files from the CD-ROM drive. The dialog box for the File Operation menu is shown in Figure 2–16. Traverse down the directory tree by double clicking on a directory name in the top window. Select a file by clicking on the name in the bottom window. Travel back up the directory tree by double clicking on the ".." selection.

Click on the arrow to display the Network Drive Selection screen
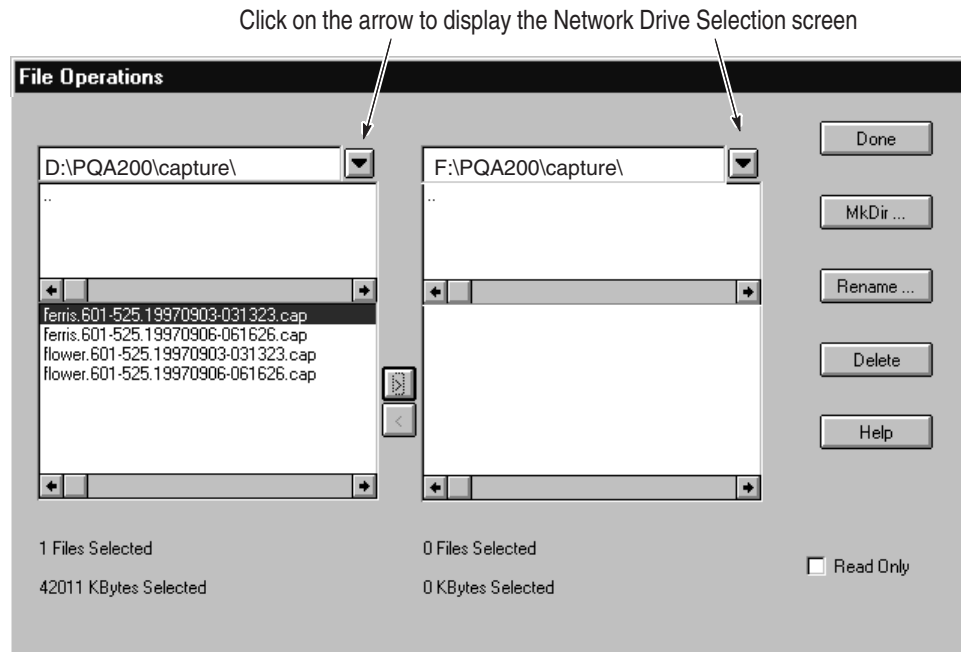
Figure 2–16: File Operations menu under the Other soft key

Select Network Drive. Access the Select Network Drive dialog screen, shown in Figure 2–17, by clicking on the selection arrow next to the directory label field (shown in Figure 2–16).

The choices include the hard disk drive, the floppy disk drive, the CD drive, and any available network drives. Select both the source directory and target directory for file transfers as appropriate. Files can be transferred in either direction between currently selected drives.
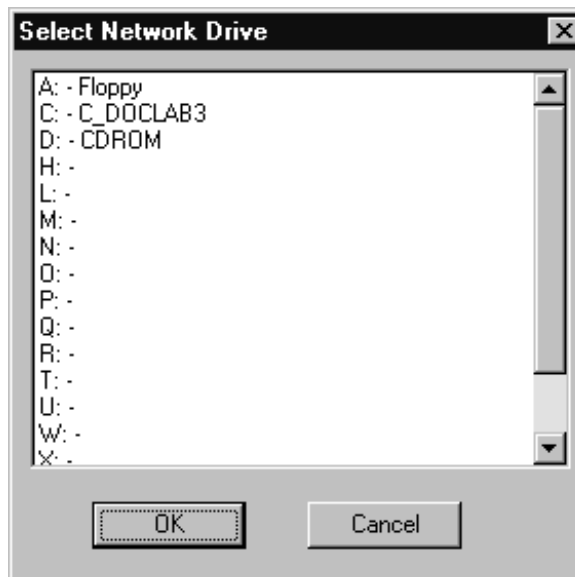
Figure 2–17: Select Network Drive menu

Recompute Database. As user references, alias-named test sequences, and user sequence files are captured, the information about the names assigned to the files and the references that are associated with the files is stored in text files in the PQA200 bin directory. To regain disk space, delete unused user references, alias-named test captures, and user-named sequences.

Use the Recompute Database selection as part of the disk-space clean up after deleting a large number of user files or after adding user files from another PQA200. When the database is recomputed, the system updates database files to delete associations that are no longer in use, and adds new associations of the user files copied to the PQA200.

Save Values to Disk. This selection saves the summary and detail results of the current results displays to a text file on the selected disk drive. The Save As menu shown in Figure 2–18 is displayed when you select the Save Values to Disk feature. You can name the file by clicking in the file name field and editing the default name. You can use the Save in: choice to select a drive where you want to save the files.
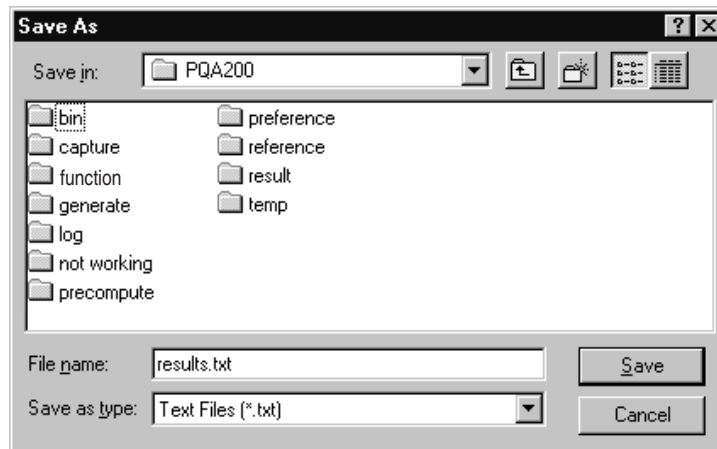
Figure 2–18: The Save As menu for saving results text files

Click the arrow key in the Save in: edit field to display the network selection menu shown in Figure 2–19. In this menu you can select any drive on the network you have access to for saving the results text files. The Help ? in this menu accesses the server What's This help for information on the choices in the menu.
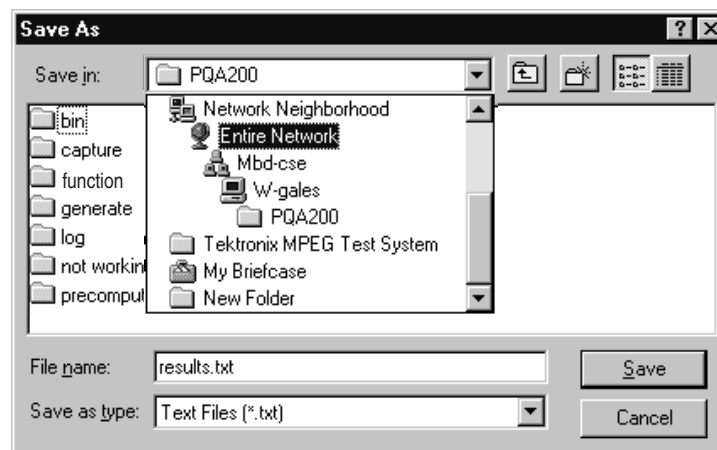
Figure 2–19: The network selection menu for choosing the location to store results text files

Display Settings. Click on the Display Setting selection in the Other menu choices to show the Display Settings controls (see Figure 2–20). The display setting controls are used to adjust the brightness and contrast of the maps and video displays individually. The controls adjust the display that is active when the Display Settings menu is activated. The menu label changes to indicate the active display type (Video, PQR Maps, or PSNR Maps).
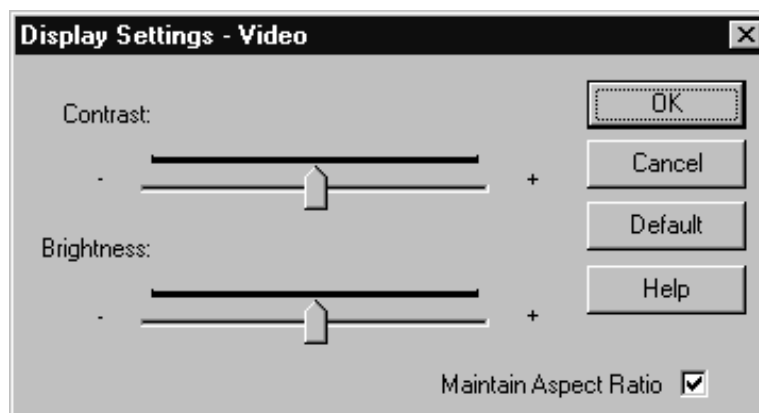
Figure 2–20: Display settings controls

Select Maintain Aspect Ratio to have map or video displays keep the same vertical-to-horizontal ratio when you resize the PQA200 window. If Maintain Aspect Ratio in not checked, the map and video displays resize in the same proportions as the PQA200 window.

Hardware Settings. The controls for setting the slot locations for the analyzer DSP and generator DSP modules are in the Hardware Settings menu (shown in Figure 2–21). Click on a slot in the configuration menu to switch from Analyzer to Generator to Empty (undesignated). If you switch the function of the Analyzer and Generator, you must reconnect the rear panel signal cables appropriately for the designated task of the DSP modules. The default configuration places the analyzer DSP in slot 2 and the generator DSP in slot 3. Slot 1 is empty and slot 6 has the video circuit card installed. The video card is not a recognized PQA200 system module and is shown as Unknown in the Hardware Settings menu.
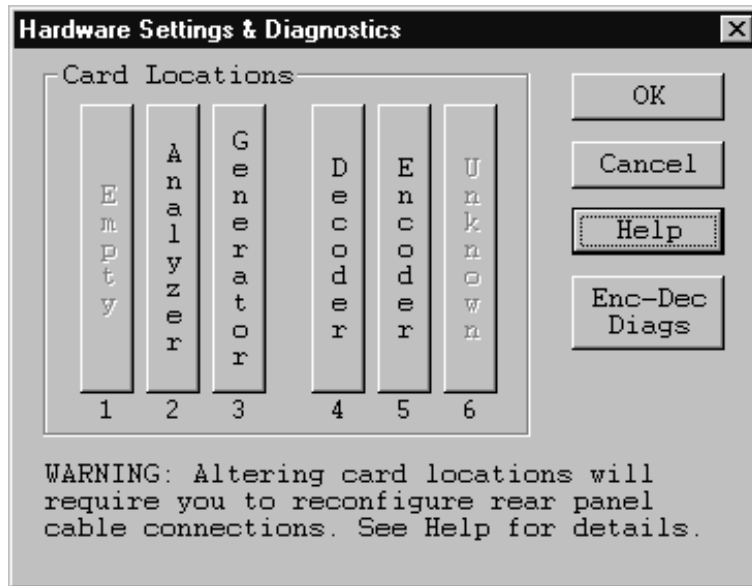
Figure 2–21: Hardware settings menu

Encoder/Decoder Diagnostics. Click the Encoder/Decoder soft key selection in the Hardware Settings menu to access the Option 01 user diagnostics (shown in Figure 2–22). The diagnostic tests for each module are separately selectable. They provide pass/fail testing of the Encoder and Decoder module circuitry. When you run the tests, the results are displayed in the Results box with the name of the test and the pass or fail result of the test. The Encoder Diagnostics need more time to complete than the Decoder diagnostics. Use the scroll bar to view the completed test results.
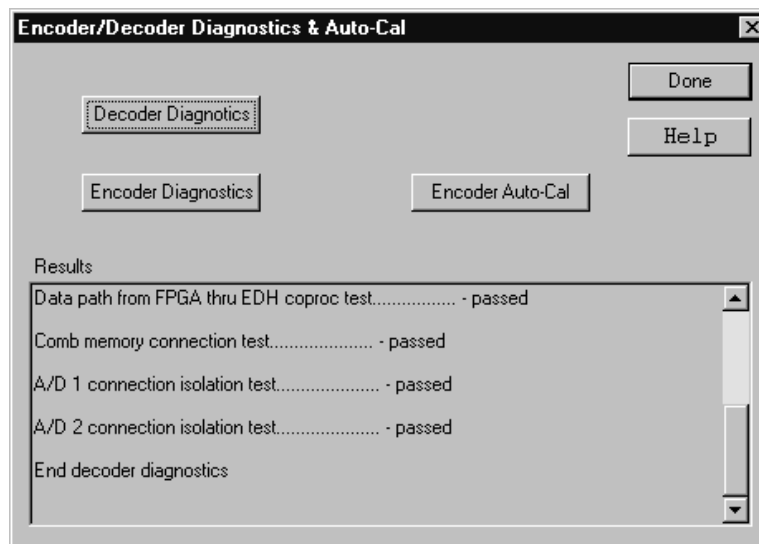
Figure 2–22: Encoder/Decoder diagnostics and Encoder Auto-Cal

Encoder Auto-Cal. The automatic calibration routine compensates the adjustments of the encoder module for temperature changes and aging. Typically, you would use this feature about every six months to maintain optimum encoder operating. Another good time to use it would be if the Encoder diagnostic tests start showing soft failures (failures that occur with temperature changes). The PQA200 must be allowed to completely warm up (about 20 minutes) before the using the automatic calibration feature.

Help Menu. The PQA200 Picture Quality Analysis System has a Windows based help system. You can obtain general help on the PQA200 using the Help choice in the Other soft key selection list. The Help Topics contents screen shown in Figure 2–23 is displayed. You can use the contents help screen to navigate through the user interface for information entirely within the help system.

Use the mouse to select a content area and double click to open the book. When you see a topic you want to read about, either double click on the topic or select Display in the Help Topics screen to display the help about that topic.

Select the Index tab to do a search by topic or select the Find tab to do a search of words in the help file. Refer to the Windows NT documentation for more information on using a Windows-based help system.

Click on the Help button in a configuration menu to enter the help system at a screen related to that configuration menu.
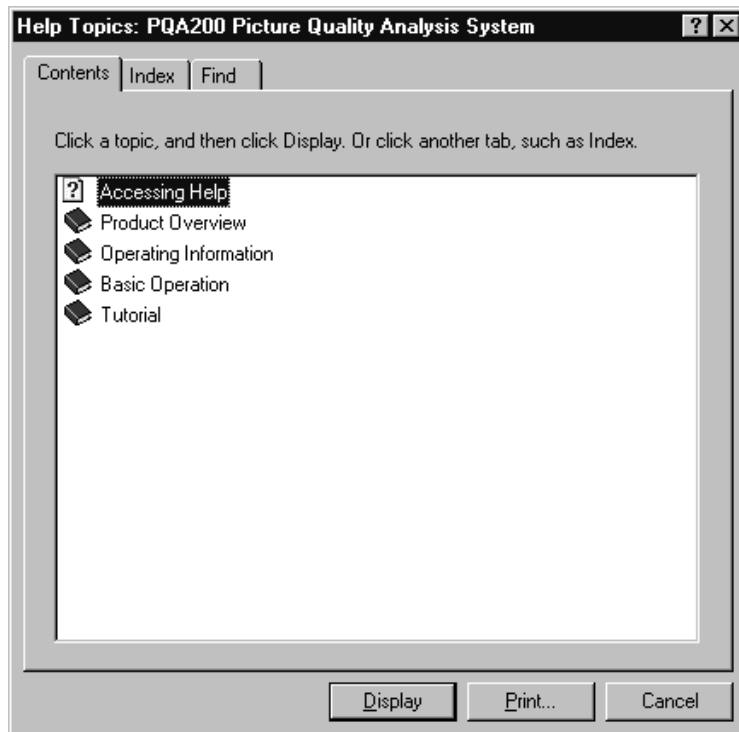
Figure 2–23: Help system contents screen

Minimize, Exit, and About. The Minimize choice reduces the PQA200 application to an icon, but leaves the application running. Exit terminates the application and saves the current configuration settings in the shutdown preferences preset file. If the shutdown preset file is selected either as the startup preset or as the preset to be restored when the Preference soft key is clicked, the configuration settings at the last application exit will be restored. The About choice displays the copyright information for the application.

Messages and Prompts   Messages and prompts inform you of certain actions. See *Appendix F* for a list of Option 01 and system error messages and their meanings.

Progress Indicator. In the status bar at the bottom of the display, a progress indicator, shown in Figure 2–24, shows the name of the activity that is occurring and its progress. If multiple actions are occurring, for example obtaining the results for several test sequences, the progress bar will restarts with each new action. When the final action has finished, the progress bar is removed, and the action line states that the action has completed. The transcript window also displays the action that is occurring in text format.
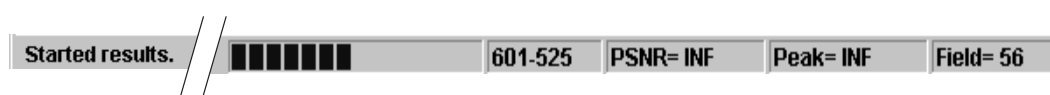
Figure 2–24: Progress indicator shown across the bottom of the display

Capture Mode. Several different Capture Mode dialogs are displayed, depending upon the choices made in the Capture Configuration menu. Activity messages are displayed in the status bar. The messages indicate such activity as waiting for a sequence, capturing, saving, and time out. The progress indicator shows the state of the named activity when appropriate.

Measure Mode. During a picture quality measurement, the status bar displays the progress of the measurement. To the right of the progress indicator, you will see the measured value for the field, the peak measurement that occurs during the measurement, and a field indicator showing the current field being measured. The peak value found as all the fields are measured is held when the measurement is finished. The same messages are displayed when a measurement results file is restored for viewing.

Configuration Errors. If you click the left mouse button on any of the PQA200 function soft keys that have associated configuration menus, you will get an error message if the configuration is incorrectly set up to produce the action you selected. For example, if you click on the Results soft key and there are no results selected, an error message displays.

Theory of Operation

Theory of Operation

The PQA200 Picture Quality Analysis System is a picture quality measurement instrument that produces repeatable, objective measurement of picture quality impairment.

Measurement results are based on a frame-by-frame comparison between the original (reference) video material and the reconstructed video obtained after the digital data has been processed by a variety of methods. For PQR measurements, both the reference sequence and the captured test sequence are applied to an algorithm that predicts how a human viewer would perceive the changes in the video due to the system under test. This process normalizes the two sequences. After normalization, the two sequences are compared to develop the JND numbers from which the PQR rating is determined.

For the PSNR comparison, the PQA200 system directly determines the differences introduced by the processing system (impairments, artifacts, or degradations). These differences are used to calculate the PSNR value. The PSNR number is a raw data comparison of the two sequences without regard to how a human viewer might perceive the picture quality.

Functional Operation

The PQA200 Picture Quality Analysis System provides quantitative objective measures of degradation in quality of video sequences as they are transported. Compression coding-decoding may be employed in such transport. How the PQA200 Analyzer is used is depicted in the following diagram.
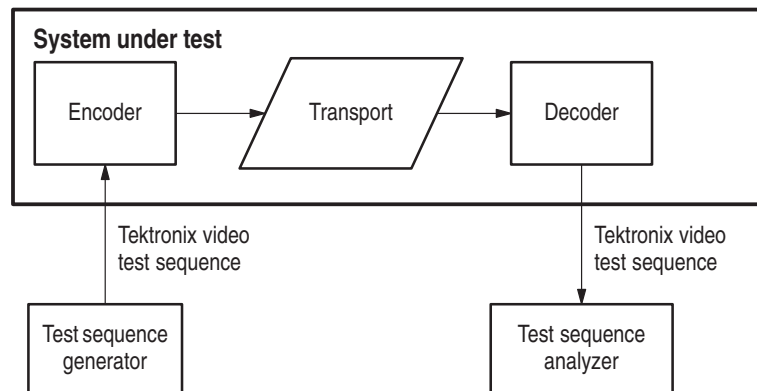
Figure 3–1: Test setup for direct measurement of system fidelity

In order to measure impairments a transport system causes, special video test signals with calibration striping are used. The striping is encoded with the test sequence identification and frame indicators and provides the information needed for shift correction and normalization of the captured sequence. The PQA200 analyzer compares the normalized captured sequence with a stored reference sequence and derives the picture quality measurements. The functional operation of the PQA200 system is shown in the following diagram.
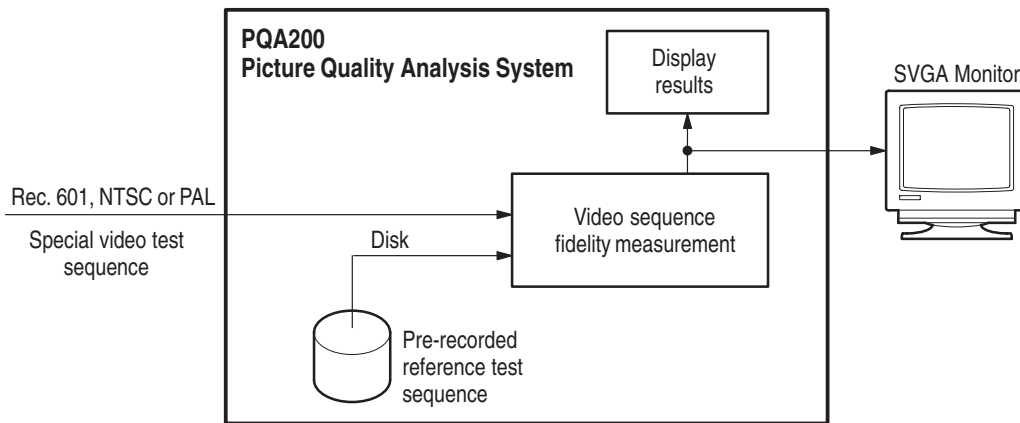
Figure 3–2: Functional operation diagram

The PQA200 system receives transported video sequences encoded in serial Rec. 601, NTSC, PAL or S-Video. The server must have a copy of the original test sequence stored internally. Video sequence fidelity measurements are performed by comparing the normalized transported sequence to the copy of the original sequence. The results are displayed on the SVGA monitor. Live incoming video can also be displayed to monitor the transport stream. Visual assessment of quality degradation can be made by displaying selected segments of the original test sequence and the transported test sequence, along with associated difference maps, on an optional external 601 digital monitor display.

Hardware Implementation

The analyzer, generator, encoder, and decoder card are implemented in plug in modules on a PCI bus, connected to a PC-NT system through a PCI bridge. The PC-NT system has enough memory, disk space, and mainframe computing power to provide for smooth user interface support and data flow. The user interface is supported with the attached monitor/mouse/keyboard of the server platform. The hardware functionality is divided between the standard analyzer and generator DSP boards and the optional NTSC/PAL composite video encoder and decoder boards.

The analyzer DSP board performs video processing. Its functions are test sequence recognition and capture, sequence normalization, application of visual model filter algorithms, and composing the output for visual inspection of

transported and original test sequences on an attached SVGA computer monitor. The I/O to the DSP board is implemented in serial 601 format. If only serial 601 input is required for the instrument, the NTSC/PAL composite video option modules can be omitted.

When installed, the NTSC/PAL decoder board 601 serial digital output is linked to the analyzer DSP board using an active loop-through input connection. If the loop-through is not continued to a 75 Ω system, the active loop-through need not be terminated. The 601 output of the generator DSP is connected to the composite encoder module to a 75 Ω terminated SMB input connector.

You can use an external encoder and decoder to make composite measurements. When testing against the 601 digital reference, you will see the total effects of the encoder, decoder, and the system under test. You must use the Tektronix Option 01 encoder and decoder to capture a composite testing reference for the comparison to de-embed the encoder and decoder effects from the measurement.

Composite video sequences have a different color phase for each field. All possible color phases for the selected format (NTSC or PAL) are sent. If a captured composite test reference is selected as the reference sequence, the Option 01 decoder looks for the sequence with field color phasing that matches the captured reference color phasing and signals the analyzer to capture the sequence. The correct color phase must be captured so that a correct comparison can be made. Refer to *Creating a Testing Reference* in the *PQA200 Picture Quality Analysis System User Manual* for more information on testing against a captured reference.

Data Flow   The data flow occurs in several phases. These are as follows:

- Waiting for the test sequence

- Capturing and saving the test sequence

- Performing measurements and saving the results

- Displaying results

Waiting for a Sequence. In this phase, the PQA200 analyzer is monitoring the input and waiting to recognize the presence of an embedded test sequence.

The serial digital signal arrives at the DSP board at 270 Mb/s. The arriving video fields are scanned in real time for the presence of a keying pattern embedded into the active video portion of a PQA200 system video test sequence. In the mode where the PQA200 system is looking for a specific pattern (as opposed to any valid test sequence pattern) downloading of the copy of the corresponding original sequence into DSP memory begins even before the arrival of the test sequence is detected.

Capturing the Test Sequence. When the arrival of the specified test sequence is detected, two seconds of active video are captured into the DSP board memory and saved to the server hard disk drive.

Performing the Measurement. In this phase, the captured test sequence and the reference sequence are compared, passing them through a variety of DSP filters and deriving measures using various algorithms. The results are communicated to the server for display and archival.

Displaying the Results. Finally, the statistics of measures are displayed on the server SVGA monitor. This process also allows for qualitative visual comparison of incoming and reference test sequences by playing them into a high resolution external serial digital video monitor.

Functional Block Overview

The PQA200 system is shown in block form in Figure 3–3. The composite video option is included in this discussion. A Rec. 601 digital video signal source from either the generator or user-supplied equipment is applied to a system under test. The system under test injects its output into the PQA200 system analyzer DSP Main loop-through input BNC connector. When a test sequence is recognized, the sequence is captured by the DSP module.

The JND and/or PSNR differencing algorithms compare the captured video test sequence with the previously stored matching reference test sequence obtained from the server hard disk drive. The field-by-field differences between the two sequences (artifacts of the processing by the system under test) are determined.

For many applications, the inputs are analog composite video signals. In that case, the generator DSP output is fed to an encoder that converts the Rec. 601 serial digital signal to composite video (either NTSC or PAL as selected by the user). The analog signal is then injected into the system under test. The resulting output from the system under test is then fed to a composite decoder to be converted back to a serial digital signal for application to the analyzer DSP. The composite encoder and decoder may be user provided equipment or the modules provided with the Option 01 Composite Video option of the PQA200 system.

A discussion of the server or the video module is not included in this functional description. Refer to the Compaq manuals for information on the server.
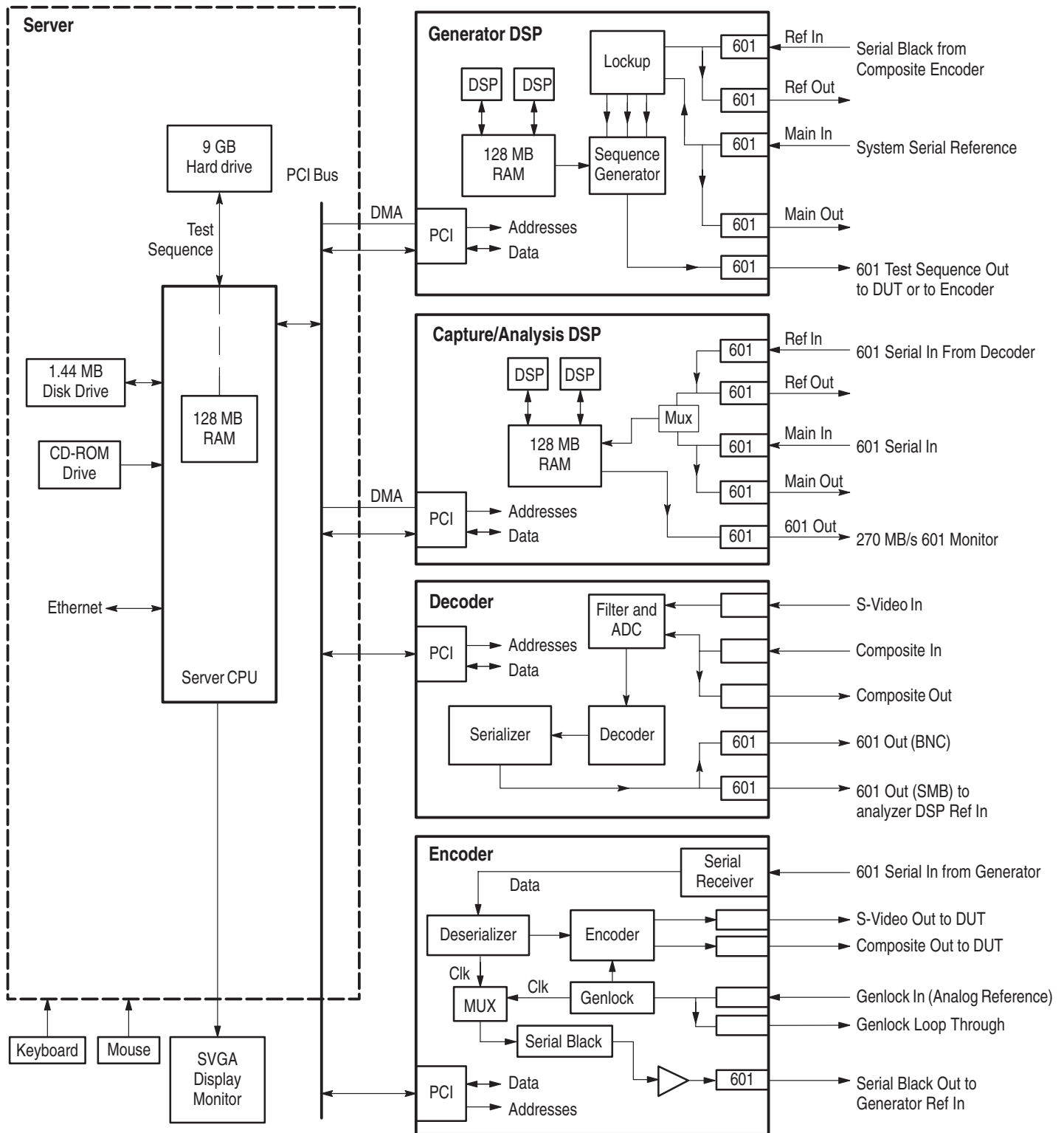
Figure 3–3: PQA200 Picture Quality Analysis System block diagram with encoder/decoder option

Composite Generator Configurations

The composite generator consists of the generator DSP and the composite encoder (Option 01). You have several options regarding synchronization of the generator to the encoder: Black Burst Lockup, Serial Video Lockup with the generator in the free-run mode, and Serial Video Lockup with the generator synchronized to an external serial digital video reference.

Black Burst Lockup. To use an analog composite signal to the encoder for genlock, make the connection between the encoder serial black out connector and the generator DSP Ref In connector as shown in Figure 3–4. Connect the analog composite signal used as a reference to one of the Genlock loop through BNC connectors. You must connect the Genlock loop-through output to a 75 Ω system or terminate it with a 75 Ω BNC termination.

If you choose not to connect a genlock signal to the encoder module, the serial black output from the encoder continues but becomes invalid. When the serial black out signal is not a valid synchronization signal or if you are not going to use Black Burst lockup, you must disconnect the serial black signal from the generator DSP Ref In connector. The configuration is then valid for the Serial Video lockup mode of composite generator operation.
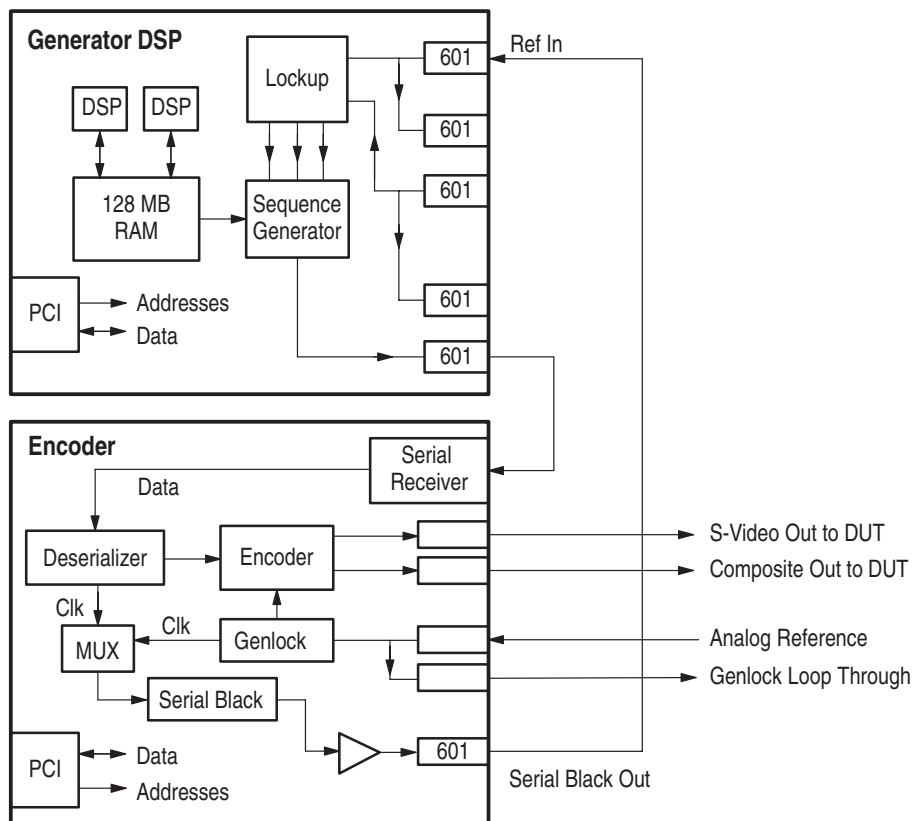
Figure 3–4: Composite generator with external analog reference

Serial Video Lockup. When connected as shown in Figure 3–5 the serial digital video signal from the generator is the source of the synchronizing signal to the encoder board. You can choose to allow the generator DSP to free run on its internal reference or you can synchronize the generator DSP to a serial video reference. The external serial digital is connected to the generator DSP Main In BNC connector. To avoid a synchronization conflict, do not connect a serial digital video signal to the generator DSP Main In connector when you use the serial black output signal of the encoder for genlock.
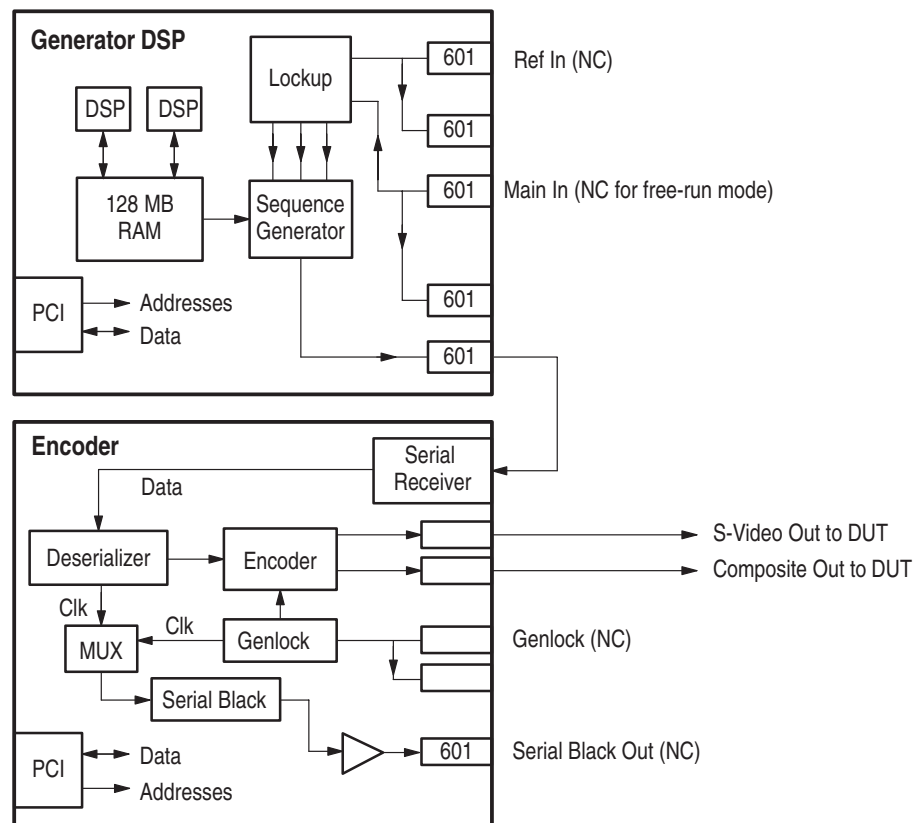
Figure 3–5: Composite generator free-run mode

Composite Analyzer Configuration
The composite analyzer consists of the analysis DSP and the composite decoder. A connection diagram is shown in Figure 3–6. Either composite video or S-Video input signal is accepted (not both at the same time). You must connect the composite out loop through signal to an external 75 Ω system or terminate it with a 75 Ω termination.
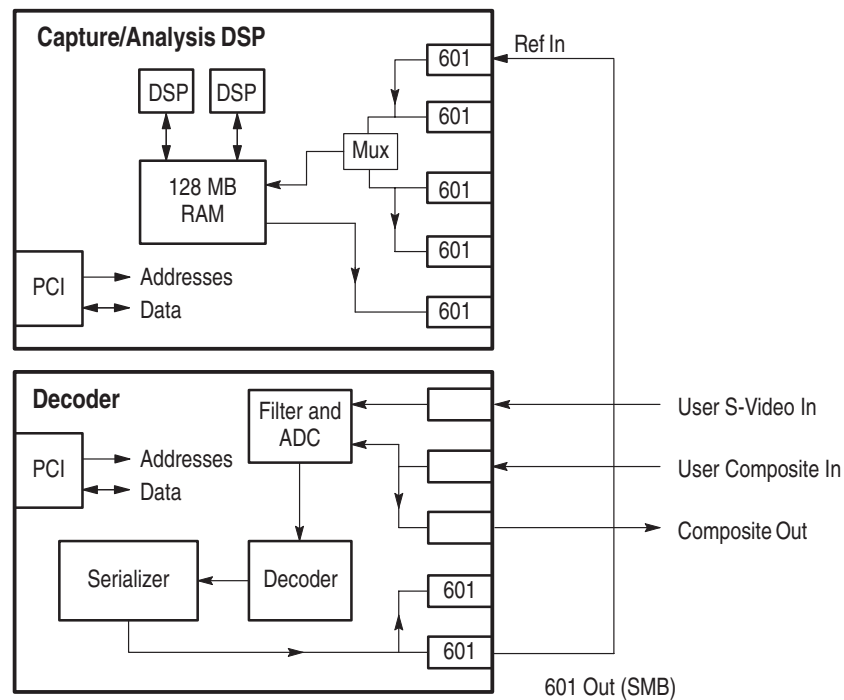
Figure 3–6: Composite analyzer block diagram

DSP System Operation

The DSP card processes video data using two on-board DSP processors. The board has a PCI interface, two serial digital video input interfaces with active loop-through outputs, and a serial digital video output interface. The PCI interface is for control, video data, and DSP program code download. The serial digital video interfaces are for real-time capture and playback of digital video.

The DSP module can output processed program output video in Rec. 601 serial format. The 601 Out connector of the generator DSP provides test video sequences to a device or system under test. The 601 Out connector of the analyzer DSP provides serial digital component video that can be viewed on a high resolution external digital video monitor.

The DSP system is made up of two DSP processors, a 128 MB of single-cycle (SDRAM) main memory, a boot ROM, a 64kB shared memory, some control

and status registers, a PCI FIFO (first in, first out), and an I/O Video ASIC. Video from the ASIC (application specific integrated circuit) is transferred in 1Kb blocks into memory to form *fields*. The analyzer and generator DSP modules are identical. Their operation as an analyzer or as a generator is software controlled.

Serial Digital I/O Block Description

The serial digital I/O system comprises two serial input connectors (Main In and Ref In) and associated deserializers, two serial active loop-through connectors (Main Out and Ref Out) and associated amplifier, a serial output connector (601 Out) and associated serializer, and a clock generator. The Main In, Main Out, and 601 Out connectors are BNC. The Ref In and Ref Out connectors are SMB. A simplified block diagram of the I/O section of the DSP module is shown in Figure 3–7.
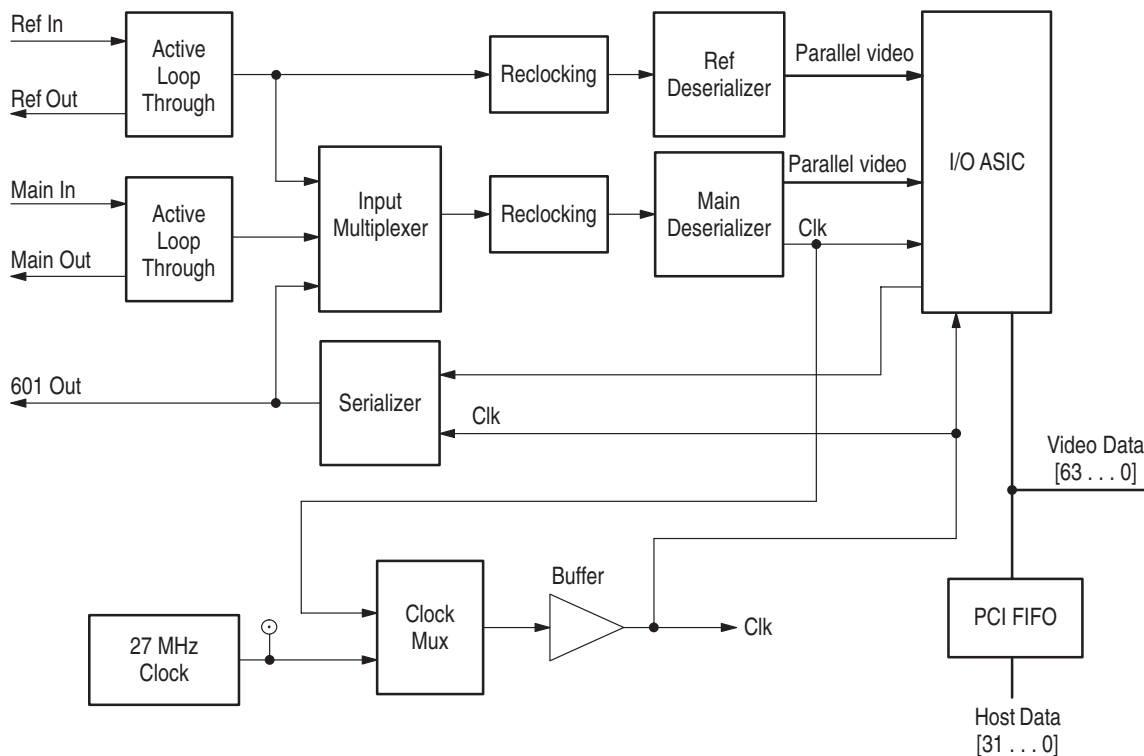
Figure 3–7: Digital signal processor module I/O section simplified block diagram

Main In. The Main In connector feeds a cable equalizer through a return-loss matching network. A carrier detect output from the cable equalizer is fed to the status port so the system can determine if an input is present. The software looks at the carrier detect bits before attempting to use either the Main In or the Ref In input as the signal source.

The output of the cable equalizer drives the active loop-through output driver and the input multiplexer. The other inputs to the input multiplexer are from the other channel and from the output (to allow loopback for self-test).

Only the primary input to the I/O ASIC has timing extraction. There is a 3:1 input multiplexer into the main deserializer. This allows either input to be used in single channel mode with the data coming through the main deserializer. The second deserializer will only be active in two channel mode. If both input channels are being used simultaneously, they must be identically timed and synchronized to the same clock. The third multiplexer input is a feedback from the serializer that is used for diagnostic testing.

Serial to Parallel Converter. The output of the input multiplexer goes to a reclocking circuit that drives a serial-to-parallel converter (deserializer). The serial-to-parallel converter also does the descrambling. The circuit outputs are parallel video and clock. Source terminations are used in the lines to the buffer ASIC. The clock goes two places, to the I/O ASIC and to the clock multiplexer.

No precision clocks needed in the DSP section; the I/O functions drive the clock source decisions. The input locks to the incoming stream provided it meets SMPTE 259M specifications. There are no circuit provisions made to lock to very jittery input streams or to attenuate jitter on the active loop-through outputs.

27 MHz Oscillator. An internal 27 MHz oscillator is used when there is no external video signal supplied. The 2:1 clock multiplexer is under software control. There are multiple clock outputs to allow each DSP in the module to have a dedicated clock line.

In internal clock mode (also referred to as free-run mode), the program output must meet the SMPTE 259M frequency accuracy and jitter specifications. To meet these requirements, an accurate crystal oscillator is used as the internal clock source. The oscillator is a 27MHz $\pm$1ppm TCXO. The oscillator drives the clock multiplexer as one of the two possible inputs. The output of the clock multiplexer drives a clock buffer.

Decoder Valid. Status bits from the reclocking circuit and the serial-to-parallel converter are combined to derive the main decoder valid signal (MAIN-DECVAL). This signal is checked by the software before attempting to use the clock or video from the Main input. If the system is deriving the clock from this input, and MAINDECVAL goes low, the clock multiplexer automatically reverts to the internal clock source.

Output. The output serializer drives a connected cable directly. One output of the serializer is fed back to the input multiplexer to for use in a loop-back self-test.

DSP Block Description   The DSP devices are two TMS320C80 microcircuits with five processors each. These processors share 128 MB of fast SDRAM. The analyzer DSP accepts serial digital component video inputs that adhere to ITU Recommendation 601 coding formats. The DSP does the signal matching and normalization of the captured video sequence prior to making the PQR calculations relative to stored references. PSNR picture difference calculations are done by the server CPU after normalization by the DSP. A simplified block diagram of the DSP portion of the module is shown in Figure 3–8.
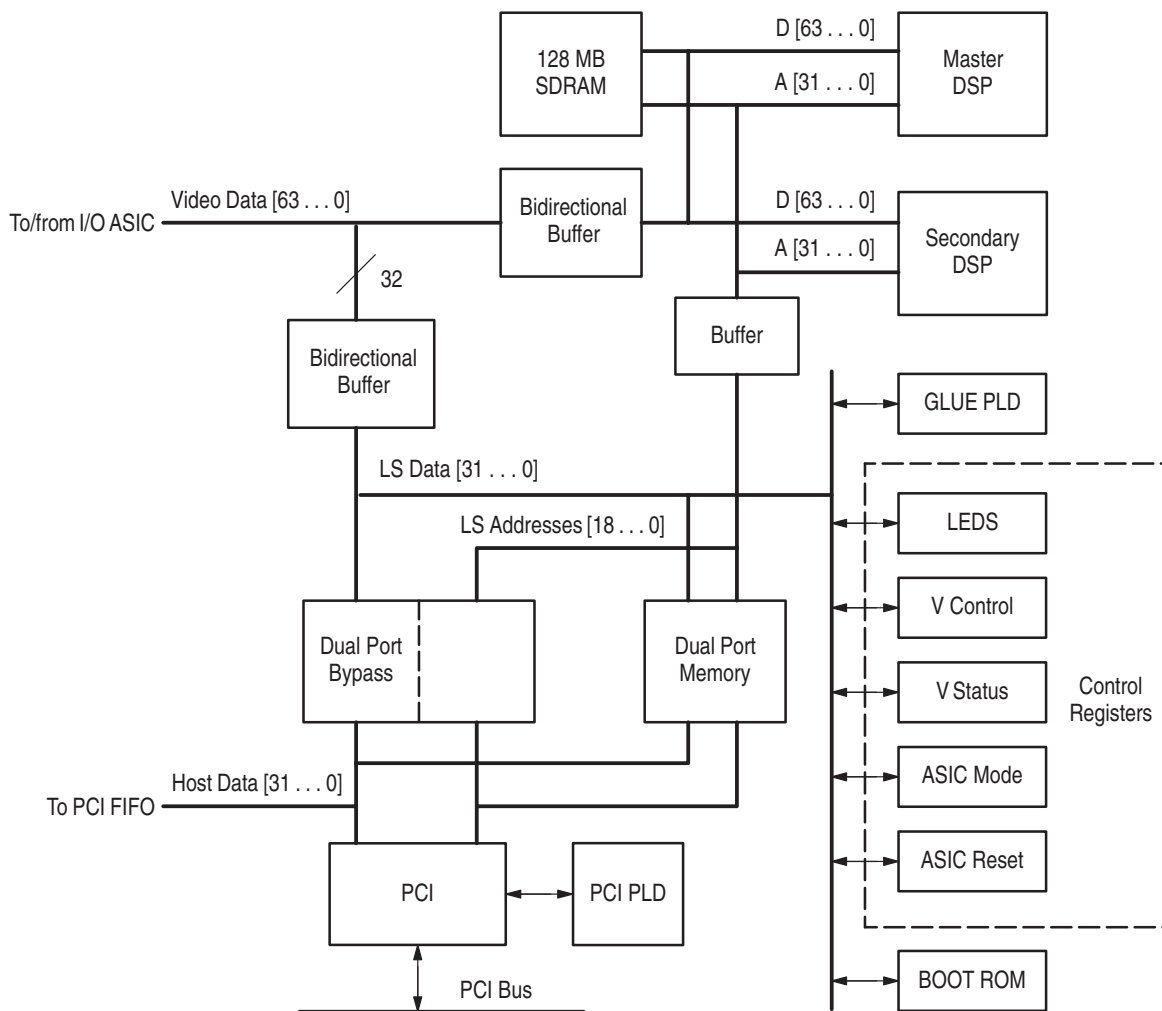
Figure 3–8: Digital signal processor module DSP section simplified block diagram

PCI Bus Interface PCI is the bus interface between the plug in modules and the server. The PCI system is made up of a PCI interface chip, 64kB of Dual Port shared memory, a discrete status register, PCI FIFOs, and a PCI control circuit (PLD). The DSP system can generate interrupts onto the PCI bus. The PCI system can also generate interrupts to the DSP system.

The PCI system provides setup and control messages to the DSP processors through the Dual Port shared memory system. DMA transfers that bypass the Dual Port shared memory can be initiated by the PCI host or by the on-board DSP processors.

Boot ROM The Boot ROM is a 4 Mbit Flash EPROM, 8 bits wide. It contains the boot steps used to start up the DSP module when the server is started. The DSP start up diagnostics are contained in the Boot ROM.

The Boot ROM is not programmable on board the module. It is installed in its socket after programming. The programming stored in the Boot ROM performs the following functions:

- Initializes all hardware devices (for example, it resets the I\O Video ASIC)
- Initializes the DSP processors
- Performs minimal diagnostics:
    - Control port read/write
    - Quick Dual Port Read/Write
    - Quick SDRAM Read/Write

After the reset, the DSP processors wait for a signal from the server (PCI) to start download operation. Once the download is complete, the DSP vectors to the starting address of the downloaded programming.

Composite Decoder

The composite analyzer is formed by a DSP and an optional composite video decoder module that accepts composite video or S-Video and converts it to 601 video at 270 MHz. The decoder block diagram is shown in Figure 3–9. As are the other modules, the decoder is a plug-in circuit board that communicates with the server and the analyzer DSP through the PCI bus.

Input The decoder module input accepts standard level analog video. Input can be composite or S-Video. The input consist of clamping circuitry, buffering, and multiplexing switching. Composite video input is buffered and goes to the Luma output that is applied to the sync stripper. With an S-video input signal, the separate chroma and luma video information are buffered outputs. A calibration signal is applied to the third input to the multiplexer.
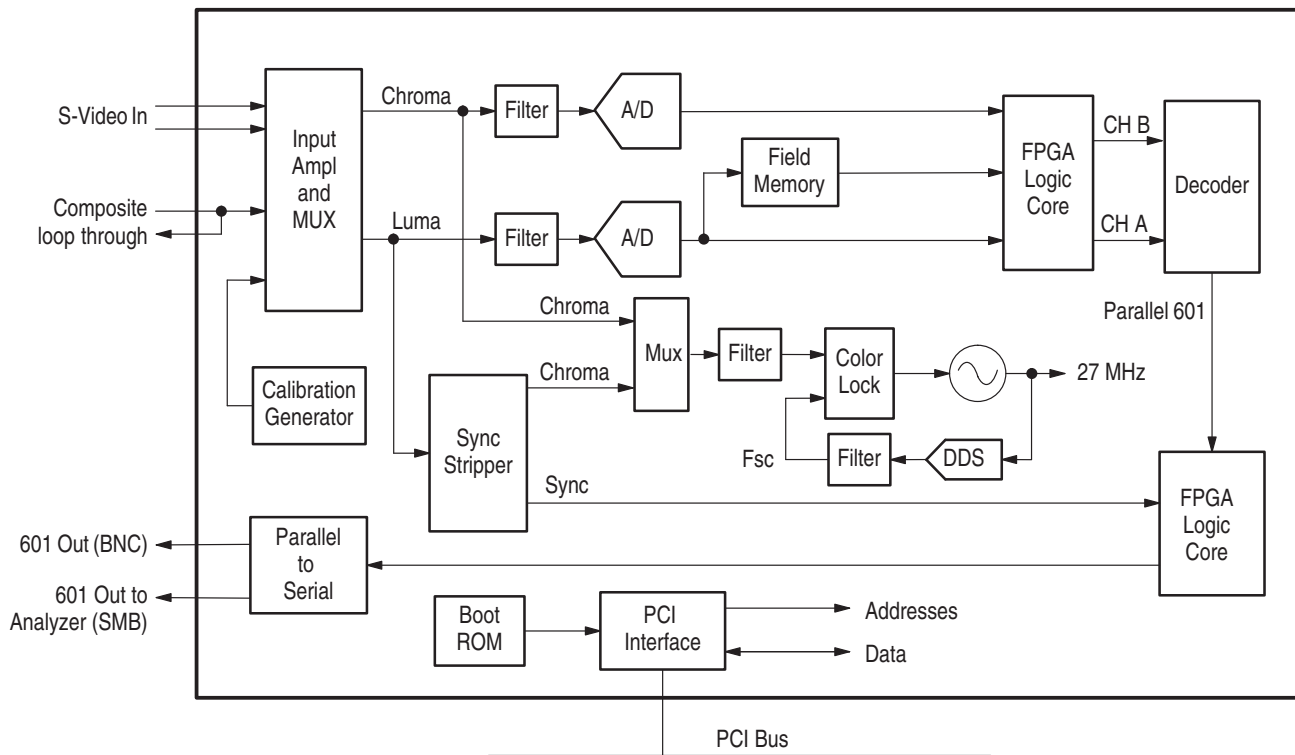
Figure 3–9: Decoder simplified block diagram

Calibration Generator   The calibration circuitry applies accurate 2 and 3 volt DC levels to the video input circuitry. The FPGA (field-programmable gate array) device averages the resulting values from the converters and compares them to an internal constant. The results of the comparison drives an LED indication circuit to show if the relative A/D output value is high or low. There is also a diagnostic mode signal, a 2-V ramp, that can be applied to the video output amplifiers for testing. Calibration and diagnostics modes are normally manually selected by setting the mode switch on the board. However, when the mode switch is set to the run position, the diagnostics routines can drive the DAC circuitry for closed-loop testing.

Sync Stripper   The sync stripper ASIC outputs a signal during the sync portion of the video that is used for coarse timing. The input clamp circuit must be running for this sync stripper to work correctly. The chroma output is applied to 2:1 MUX that selects between the S-Video chroma and the chroma stripped from the composite video signal for the color lock circuit. The sync is applied to the FPGA device.

A/D Converters The analog inputs are attenuated to fill the A/D converter full scale range and are anti-alias filtered for application to the A/D converters. The output of the A/D converters are buffered then decimated by half-band filters before being applied to the decoder device. When converted to 601 format, the standard video input maps into decimal 16 to 235 output levels in 8-bit mode and 32 to 470 levels in 9-bit mode. Signals with lower amplitudes will result in reduced decoder accuracy and signals exceeding the standard amplitude by a certain amount are clipped.

Conversion clocks are derived from a color lock circuit that compares burst from the input to an Fsc (subcarrier signal) developed by a DDS (direct digital synthesizer) device running on the 27 MHz oscillator frequency.

Decoder The Ch A and Ch B decoder inputs are 10-bit data from the FPGA. The standard operating mode of the decoder uses an adaptive notch / 3-line comb filter. The field memory stores a field or frame of data used to develop the optional temporal filtering. Luminance data always goes to channel A of the decoder device. Channel B input can be the chrominance (S-Video mode) or delayed luminance for field and frame comb filter modes. The decoder output is fed back to the FPGA device for rounding, dither, and clipping.

FPGA The input and output of the decoder device goes to a field programmable gate array (FPGA) device that handles switching, clipping, and dithering to reduce truncation effects. The FPGA device is programmed with the logic to handle the operation of the decoder module. Operating modes of the decoder module are set by filling the appropriate registers on the decoder board through the PCI bus at the time a decoder operation is started.

Color Lock The Chroma portion of the clamped video or the chroma from the S-Video signal is applied to a Color Lock ASIC that controls the phase of the 27 MHz VCO (voltage-controlled oscillator). The VCO output is then used throughout the decoder module as the clocking signal. The 27 MHz clock signal also drives a circuit (DDS - direct digital synthesizer) that develops the Fsc (subcarrier frequency). The Fsc circuit is reset every color frame to correct for any slight frequency errors. The Fsc output completes the phase-lock-loop back to the Color Lock ASIC.

Parallel to Serial Converter The data bits are serialized in Rec. 601 format and applied to the 601 Out connector on the rear panel of the decoder module. The 601 serial digital signal is externally connected to analyzer DSP input for capture and analysis.

PCI Interface The PCI Interface circuitry connects the encoder module to the host processor. A programmable logic device contains the logic circuitry to address the chips on the decoder module. Addressing and data transfers to the devices on the module from the host processor is handled by the PCI interface. The PCI interface is configured from the Boot ROM.

Composite Encoder

The composite generator is formed by a DSP and an optional composite video encoder module. The encoder block diagram is shown in Figure 3–10. As are the other modules, the encoder is a plug in circuit board that communicates with the server and the generator DSP through the PCI bus.

The NTSC/PAL Encoder module accepts 601 video at 270 MHz and converts it to NTSC (with or without setup) or PAL. The outputs are composite video and S-Video.

The following are requirements of the encoder module for the generator:

- The mode is set by filling the appropriate registers on the encoder board through the PCI bus interface.

- The module requires standard Rec, 601 input serial digital signals.

- The module is genlocked either through the passive analog loop-through input or by the recovered clock from the serial digital video input.

Serial Receiver   The serial digital input signal from the generator DSP is applied to a serial receiver for cable compensation. From the receiver the serial digital signal is applied to a serial-to-parallel converter. The recovered parallel 10-bit video data is clocked into a FIFO circuit. From the FIFO circuit, the data is clocked out with a 27 MHz clock that is locked either to the analog black burst input or the recovered clock from the serial digital signal input.

Encoder   The parallel video is clocked out of the FIFO circuit to an encoder ASIC using the internal 27 MHz clock. The encoder develops the video as Y/C component output. The Y/C output is processed through the DAC, the low-pass filter, and the output amplifier. The Y and C outputs are applied to a summing circuit to obtain the composite video output signal.

Genlock   The genlock circuitry on the encoder board is similar to the color lock circuitry on the decoder board, shown in Figure 3–9. A sync stripper circuit in the genlock circuitry develops a clamped video output along with composite sync. The Chroma portion of the clamped video is stripped and applied to a Chroma subcarrier lock ASIC that controls the phase of the 27 MHz VCO (voltage-controlled oscillator). The VCO output is then used throughout the encoder module as the clocking signal.
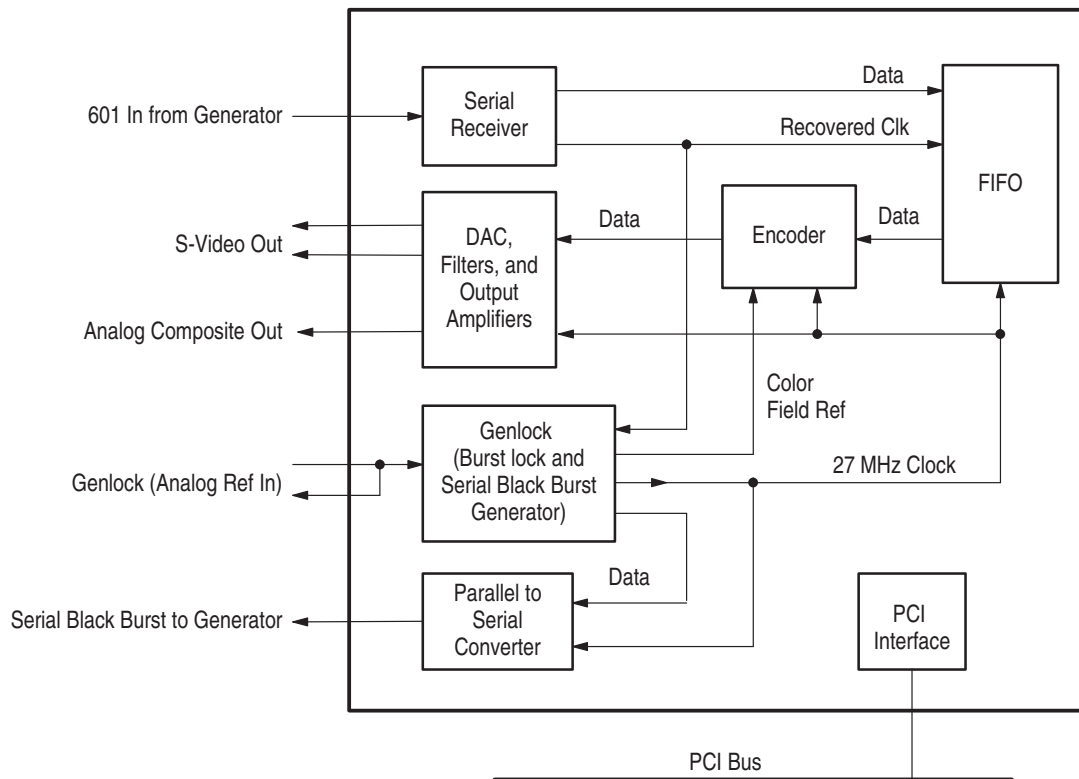
Figure 3–10: Encoder simplified block diagram

The 27 MHz clock signal also drives a circuit that develops the Fsc (subcarrier frequency). The Fsc circuit is reset every color frame to correct for any slight frequency errors. The Fsc output completes the phase lock loop back to the Chroma subcarrier lock ASIC.

Serial Black Burst   A programmable gate array device is used to generate the timing , detect Color Field, and generate the 601 serial black burst. The serial black burst signal is applied to the generator DSP to provide a genlock signal to that module. The external analog black burst signal has less jitter than the recovered clock from the serial digital input signal. If the encoder is locked to the analog black burst input signal, the recovered clock from the serial digital video is at the same rate, but the two are not phase-locked. The FIFO circuit accommodates the phase difference.

PCI Interface   The PCI Interface circuitry connects the encoder module to the host processor.

Performance Verification

Performance Verification

This section contains procedures for verifying that the instrument performs according to the characteristics stated in the *Specifications* section.

If the instrument is not able to pass these tests, refer to the *Maintenance* section for troubleshooting procedures.

NOTE. *To complete the procedures in this section you need a basic understanding of the Windows NT operating system, and thePQA200 Picture Quality Analysis System application. For detailed operating instructions, refer to the Windows NT manuals and the* PQA200 Picture Quality Analysis System User Manual.

Test Interval

Perform the procedure once every 2000 hours of operation or every 12 months to ensure that the performance is within tolerance.

Prerequisites

The tests in this section comprise an extensive, valid confirmation of performance and functionality when the following performance conditions have been met:

- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in the *Specifications* section.

- The instrument must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 4–1 lists the test equipment needed to complete the Performance Verification procedure. The table identifies examples and minimum tolerances, where applicable. If you substitute other equipment for the examples listed in Table 4–1, the equipment must meet or exceed the tolerances.

Table 4–1: Required equipment list

Test equipment	Minimum requirement	Example
Serial digital video monitor	Receives and displays serial digital video signals in ITU-R BT.601 format.	Sony video monitor with serial digital interface, BVM-14F5U with Option BKM-21D
Test Oscilloscope	Bandwidth DC to 1 GHz	Tektronix TDS 784 Oscilloscope
Matching Pad	75 Ω to 50 Ω matching pad	Tektronix AMT75
Frequency Counter with 1 MΩ probe	Frequency 100 MHz 10-digit resolution; accuracy 0.1 ppm (referenced to WWV, GPS, or with a high accuracy time base).	Hewlett-Packard Model 53131A
75 Ω coaxial cables (2)	Low-loss video cable, double shielded; BNC male to BNC male 72 in.	Tektronix part number 012-0159-01
75 Ω SMB to BNC adapter cables (2)	BNC male to SMB female, test equipment interconnection, 39.5 in.	Tektronix part number 174-3579-00
S-Video signal cable	Standard S-Video cable, 72 in., 4 pin DIN connectors on both ends.	Tektronix part number 012-1554-00
S-Video to dual BNC adapter cable	Standard S-Video connector to dual BNC male connector for Y and C outputs.	Pacific Radio Electronics S4P-Y-BNC-6
75 feed-through termination	Termination impedance 75 Ω; connectors BNC male to BNC female.	Tektronix part number 011-0051-01
BNC dual female connector	BNC barrel connector; BNC female to BNC female	Tektronix part number 103-0028-00
BNC to dual binding post adapter	BNC male connector with dual banana jack binding post with center and ground indicated.	Tektronix part number 103-0035-00
Impaired Video Test Sequence CD	Video test sequence with known impairments	Tektronix part number 063-3025-00

Procedure

1. Turn on the power switch. The power switch is located under the slide cover on the front panel of the PQA200.

2. Allow the PQA200 to go through the Windows NT initialization process. During this process, the server diagnostics and the DSP boot-up diagnostics are done. If the server fails to boot up correctly, refer the problem to a qualified service person.

3. When Windows NT initialization is finished, press CTRL + ALT + Delete, as instructed by the message box to log in.

4. Type `Administrator` for Username and `PQA200` for Password. Click on OK. If the default Administrator Username and Password have been changed, use the current valid Username and Password.

Load the Impaired Test Sequences

The following procedure loads the impaired video test sequences that are used for testing the system.

1. Place the impaired video test sequence CD-ROM in the CD drive. As soon as the CD is recognized, an Install Wizard is initiated to assist you in loading the test sequences. (Refer to *Installing the Generator and Reference Sequences* on page A–5 for the procedure for installing files from the CD-ROM disc.)

2. Load the three impaired video test sequences (Mobile+.601-525 or Mobile+.601-625 as needed for your system) from the Impaired Video Test Sequence CD-ROM to the hard disk drive.

NOTE. To make the verification procedure shorter, load only the reference and generate video sequences of the format that you expect to use most (601-625 or 601-525). The following procedure uses the Mobile3mbs+ impaired video test sequence to run the first impaired video measurement. If you want to test all the impaired video sequences, load them all now.

Table 4–2: Impaired video test sequences disk

Sequence format	Sequence title	Sample rate
601-525	Mobile3mbs+.601	3 Mbits/sec
601-525	Mobile6mbs+.601	6 Mbits/sec
601-525	Mobile9mbs+.601	9 Mbits/sec
601-625	Mobile3mbs+.601	3 Mbits/sec
601-625	Mobile6mbs+.601	6 Mbits/sec
601-625	Mobile9mbs+.601	9 Mbits/sec

Set Up the PQA200 System for Serial Digital Testing

The following procedure sets up the PQA200 Picture Quality Analysis System to generate a test sequence, capture that same test sequence, measure the captured test sequence against the stored reference sequence, and display the measurement results.

1. Connect the Generator 601 Out (BNC connector) to the Analyzer Main In (BNC connector) using 75 Ω coaxial cable as shown in Figure 4–1.

2. Double click on the PQA200 icon to start the application.

3. Use the BNC-to-BNC coaxial cable to connect the Main Loop Through Out BNC connector of the analyzer to the serial digital input of the external digital video monitor.

4. Set up the video monitor to view the serial digital input.

5. Right click the Preference soft key to display the Preference Configuration menu.

6. Click the down arrow in the Startup Presets name field.

   a. Click on the factory preset to select it.
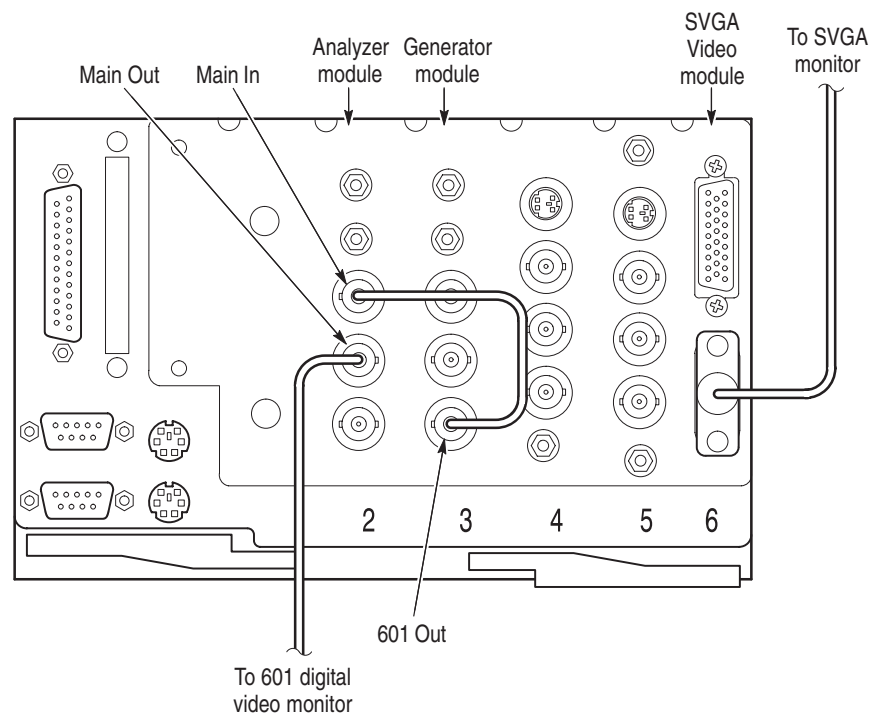
Figure 4–1: Initial connections for the functional check

7. Click OK to accept the change and exit the menu.

8. Click the Preference soft key to restore the factory configuration settings.

9. Right click the Generate soft key to display the Generate Configuration menu.

10. Select the correct signal type (601-525 or 601-625).

11. Select to generate the Mobile+ sequence.

12. Click OK to accept the changes and exit the menu.

13. Right click the Capture soft key to display the Capture Configuration menu.

14. Select the correct signal type (601-525 or 601-625). This selection must be the same signal type as the sequence you selected to generate for the test.

15. Select Mobile+ as the reference to use or use the factory default, Any Valid Sequence.

NOTE. The stored reference sequence names are available for selection. You may select Any valid sequence *as a capture choice, but if the captured sequence does not have a matching reference sequence stored in the reference directory, you get an error message when you try to measure it. You can add the matching reference to the hard disk later and select the sequence to be measured. When you start the measurement again, the matching reference file is found and the measurements you have selected are done.*

16. Either give the test an alias name or leave the test name edit field blank. If left blank, a default file name is given to the captured sequence when it is saved.

17. Click the OK button to accept the changes and exit the menu.

18. Right click the Measure soft key to display the Measure Configuration menu.

19. The captured sequence is the default choice to measure.

20. Select PQR Luma, PQR Luma & Chroma, and PSNR Luma in the Picture Quality Measurement box.

21. Click the OK button to accept the changes and exit the menu.

Unimpaired Sequence Test

1. Click the Generate soft key to start generating the Mobile+ test sequence.

2. Click the Capture soft key to start the capture operation.

3. Check that the test sequence is displayed on the external serial digital monitor to verify the Main Out active loop through.

4. Wait for the test sequence to be captured. The message "Captured sequence stored" with the name, format, and file extension is displayed when the capture is done. Note the time stamp of the sequence just stored for future reference. If you have several sequences of the same name, only the time stamp distinguishes one from another.

5. Click the Measure soft key to start the measurement.

You should see the PQR map of each field as it is being processed. The progress indicator and the messages in the status bar show you what is happening along with the field number that is being processed.

After the PQR analysis finishes, the PSNR measurement is started. The PSNR map of each field is also displayed as the measurements are made. When the measurements have completed, the Summary results are displayed.

6. Check the Summary results for the correct measurement values for the unimpaired video test sequence.

PQR Luma	0.00
PQR Luma & Chroma	0.00
PSNR Luma	Infinite

7. Click the soft key at the bottom right of the soft key menu selections (now labeled Summary). The label changes to Details, and Details table is displayed.

8. Check that the Details results PQR fields are all 0.00 and the PSNR fields are all INFINITE.

9. Click the soft key at the bottom right of the soft key menu selections (now labeled Details). The label changes to Graph, and the results graph is displayed.

10. Check the PSNR graph for a row of Xs at the bottom of the graph (X signifies infinite).

11. In the Legend box, select the PQR graph. Check the PQR graph results for a straight horizontal line graph at 0.

12. Select the PQR YC graph. Check the PQR graph results for a straight horizontal line graph at 0.

If PSNR and PQR values are correct, the generate, capture, measure, and results display functions of the DSP modules are verified for the unimpaired video sequences.

Impaired Sequence Test

After you have confirmed that the unimpaired video test is correct, use the following procedure to test one or more of the impaired video sequence. Measuring the impaired test sequence against the stored reference sequence provides a check on the operation of the measurement algorithm with different levels of impairment in the video material.

1. In the Generate Configuration menu, select one of the impaired video test sequences (for example, Mobile3mbs+).

2. In the Capture Configuration menu, select the correct signal type (601-525 or 601-625).

3. Select the Mobile+ reference sequence. This reference matches the name in the header ID for all the Mobile+ impaired video test sequences.

4. Click the Generate soft key to start generating the impaired test sequence.

5. Click the Capture soft key to start the capture operation.

6. Wait for the test sequence to be captured. The message "Capture sequence saved" with the name, format, and file extension is displayed when the capture is done. Note the time stamp of the sequence just saved for future reference. If you have several sequences of the same name, only the time stamp distinguishes one from another.

7. Click on the Measure soft key to start the measurement. The progress indicator and the messages in the status bar show you what is happening. As with a capture, features that become unavailable during a measure are grayed out. When all the measurements have completed, the Summary results are displayed.

8. Check the Summary results for the correct measurement values for the captured impaired video test sequence against the values given either in Table 4–3 or in Table 4–4, as appropriate. The values given in the tables after the PQR and PSNR numbers are the detected parameter values. The parameter values, especially the levels, are typical and can vary as the algorithm is adjusted.

   The PQR and PSNR values you measure should be very close to the values given in the tables. If the PQR and PSNR values are correct, the measure algorithms are verified.

9. If there is a significant difference between the measured PQR values or the PSNR values for an impaired sequence and the values given in the table for that sequence, recheck your configuration and redo the test. If the problem persists, refer it to a qualified service person.

Table 4–3: Mobile+.601-525 impaired video test sequence results and correction values

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	8.10	PQR Luma	5.40	PQR Luma	4.20
PQR Luma & Chroma	8.50	PQR Luma & Chroma	5.70	PQR Luma & Chroma	4.40
PSNR Luma	24.00	PSNR Luma	27.20	PSNR Luma	29.50
Y-XShift	0.006	Y-XShift	–0.006	Y-XShift	0.000
Cb-XShift	–0.006	Cb-XShift	0.001	Cb-XShift	0.002
Cr-XShift	0.003	Cr-XShift	–0.005	Cr-XShift	–0.002
Y-YShift	0.000	Y-YShift	0.000	Y-YShift	0.000

Table 4–3: Mobile+.601-525 impaired video test sequence results and correction values (cont.)

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
Cb-YShift	0.000	Cb-YShift	0.000	Cb-YShift	0.000
Cb-YShift	0.000	Cr-YShift	0.000	Cr-YShift	0.000
Left Crop	8	Left Crop	8	Left Crop	8
Top Crop	4	Top Crop	4	Top Crop	4
Right Crop	8	Right Crop	8	Right Crop	8
Bottom Crop	4	Bottom Crop	4	Bottom Crop	4
Y-Level	1.606	Y-Level	0.782	Y-Level	0.134
Cb-Level	0.089	Cb-Level	0.087	Cb-Level	0.058
Cr-Level	−0.463	Cr-Level	−0.045	Cr-Level	0.429
Y-Gain	0.978	Y-Gain	0.993	Y-Gain	0.999
Cb-Gain	0.986	Cb-Gain	0.992	Cb-Gain	0.992
Cr-Gain	0.992	Cr-Gain	1.000	Cr-Gain	0.995

Table 4–4: Mobile+.601-625 impaired video test sequence results

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	7.80	PQR Luma	5.30	PQR Luma	4.20
PQR Luma & Chroma	8.20	PQR Luma & Chroma	5.60	PQR Luma & Chroma	4.40
PSNR Luma	24.90	PSNR Luma	28.30	PSNR Luma	30.60
Y-XShift	0.001	Y-XShift	−0.005	Y-XShift	0.001
Cb-XShift	−0.004	Cb-XShift	0.001	Cb-XShift	0.001
Cr–XShift	−0.005	Cr-XShift	0.002	Cr-XShift	0.000
Y-YShift	0.000	Y-YShift	0.000	Y-YShift	0.000
Cb-YShift	0.000	Cb-YShift	0.000	Cb-YShift	0.000
Cr-YShift	0.000	Cr-YShift	0.000	Cr-YShift	0.000
Left Crop	8	Left Crop	8	Left Crop	8
Top Crop	0	Top Crop	0	Top Crop	0
Right Crop	8	Right Crop	8	Right Crop	8
Bottom Crop	0	Bottom Crop	0	Bottom Crop	0
Y-Level	0.085	Y-Level	−0.036	Y-Level	−0.116
Cb-Level	0.296	Cb-Level	0.119	Cb-Level	−0.011
Cr-Level	−0.455	Cr-Level	0.180	Cr-Level	0.111
Y-Gain	1.000	Y-Gain	0.999	Y-Gain	1.000

Table 4–4: Mobile+.601-625 impaired video test sequence results (cont.)

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
Cb-Gain	0.972	Cb-Gain	0.998	Cb-Gain	0.992
Cr-Gain	0.994	Cr-Gain	0.998	Cr-Gain	0.999

10. If you want additional verification of the measure algorithm, you can repeat the impaired video sequence test using another of the impaired video test sequences. The expected test results for the impaired video sequences are given either in Table 4–3 or in Table 4–4, as appropriate for the video format.

Check Analyzer DSP 601 Out Signal

The following procedure checks that the 601 Out connector provides a serial digital signal to the external serial digital monitor.

1. Disconnect the main loop-through out connection to the external digital monitor. You can also disconnect the generator 601 output from the analyzer Main In connector.

2. Connect the analyzer module 601 Out signal to the external monitor serial digital input connector as shown in Figure 4–2.

3. Right click the 601 Display soft key to display the External 601 Display Configuration menu.

4. Select Sequence as source of the video test sequence.

5. Select Mobile+ as the sequence to playback.

6. Check that Forward and Continuous are enabled.

7. Click OK to accept the changes and exit the menu.

8. Click on the 601 Display soft key to start the external video display of the Mobile+ signal.

9. After the sequence data is loaded from the server hard drive, the analyzer starts outputting the sequence. Check that the video display on the external digital component video monitor is correct.

10. Disconnect the cable going to digital component video monitor from the analyzer Main Out BNC connector.
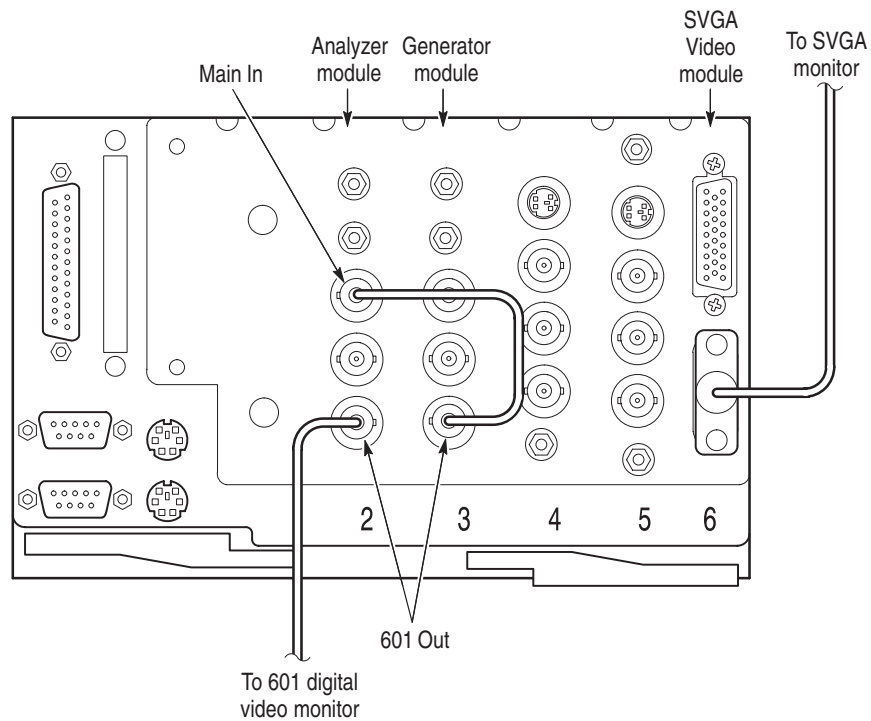
Figure 4–2: Connection for analyzer 601 Out check

Analyzer 601 Out Amplitude

The 601 Out signal amplitude is measured using a test oscilloscope and a 75 Ω to 50 Ω matching pad. The test oscilloscope setup is very important in order to obtain a stable display of on pulse of the serial digital signal so that the positive and negative amplitude values of the waveform can be checked as accurately as possible. The accuracy limits of the test equipment used precludes checking for the exact amplitude tolerance allowed for the Rec. 601 output (800 mV ± 80 mV). You can get a more accurate measurement if your test equipment is characterized to allow you to eliminate test equipment uncertainty from the measurement.

1. Connect the analyzer 601 Out connector through a 75 Ω coaxial cable and the 75 Ω to 50 Ω matching adapter to the CH1 input of the test oscilloscope.

2. Set the test oscilloscope for the settings given in Table 4–5. The parameters shown are for the example test oscilloscope given in the test equipment list. If you use an equivalent oscilloscope of a type other than the example, refer to the operating manual of that oscilloscope to determine the settings.

Table 4–5: Test oscilloscope settings

CH 1 Vertical controls	Setting
Coupling	DC
Bandwidth	Full
Vertical Scale	250 mV/div
Position	0 div
Offset	0 V
Deskew	0 s
Impedance	50 Ω
CH 1	On
Horizontal controls	**Setting**
Time Base	Main at 2 ns
Trigger Position	50%
Record Length	500
Acquisition controls	**Setting**
Mode	Average at 24
Repetitive	Off
Stop After	RunStop Button
Cursors	**Setting**
Function	V Bars
Mode	Independent
Time Units	Seconds
Amplitude Units	Base
Position 1	–5.7 ns
Position 2	–5.6 ns
Measurement	**Setting**
Gating	On
Cursor Type	V-Bar Cursors
Measure 1 Type	High
Measure 2 Type	Low
Measure 3 Type	C1 Rise 20% to 80%
Measure 4 Type	C1 Fall 20% to 80%
Measure 1 Source	CH 1
Measure 2 Source	CH 1
Measure 3 State	ON
Measure 4 State	ON

Table 4–5: Test oscilloscope settings (cont.)

Measurement	Setting
Method	Minimum
Trigger controls	**Setting**
Type	Pulse
Class	Width
Source	CH1
Polarity	Positive
Trigger When	Within Limits
High Limit	35 ns
Low Limit	14 ns
Level	0 V
Mode	Normal
Holdoff	250 ns

3. The display that results when the setup is completed should look approximately as shown in Figure 4–3.

4. From the test oscilloscope, record the CH 1 High amplitude of the digital waveform. The value is approximately 400 mV.

Figure 4–3: CH 1 high amplitude

5. In the test oscilloscope Trigger menu, set the polarity to negative. After the measurement stabilizes, record the CH 1 Low amplitude of the digital signal waveform. The low value should also be approximately 400 mV.
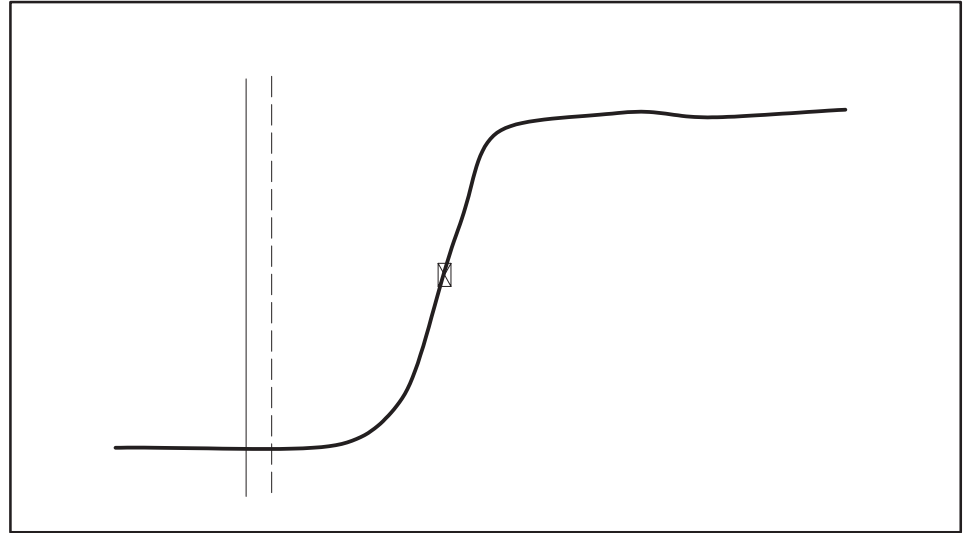
Figure 4–4: CH 1 low amplitude

6. Add the absolute values of the high and the low amplitudes of the waveform.

7. Check that the sum of the high and low amplitude measurements is within the range of 738 mV to 862 mV. The measurement uncertainty due the accuracy of the example test equipment is taken into consideration in this range to verify that the output is within the allowable limits of 800 mV ± 80 mV.

8. Move the right most cursor to a position just after the falling edge as shown in Figure 4–5. The falling edge will be between the two cursors.
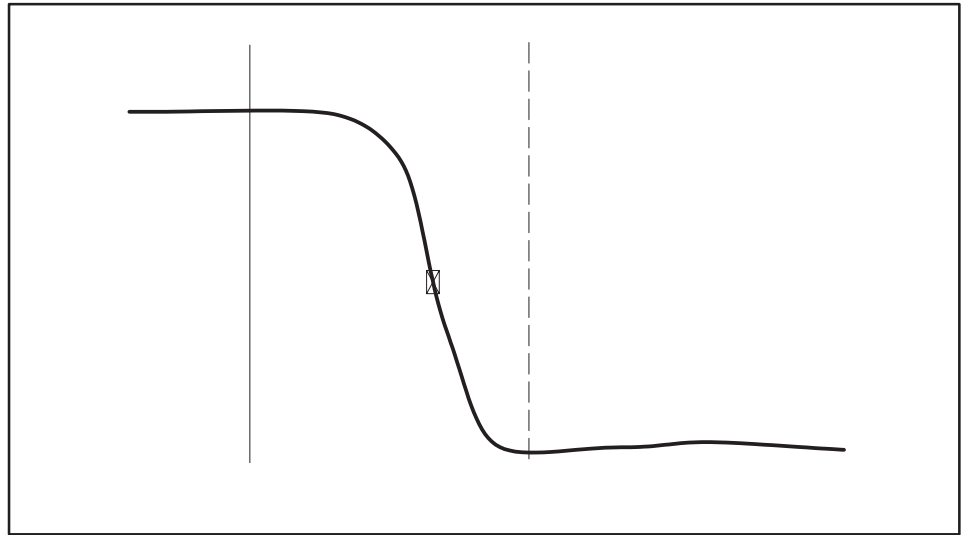
Figure 4–5: CH 1 fall time

9. Verify that the Fall measurement is 1.2 ns or less.

10. Change the test oscilloscope trigger polarity to negative. The display will look approximately as shown in Figure 4–6.

11. Verify for that the Rise measurement is 1.2 ns or less.
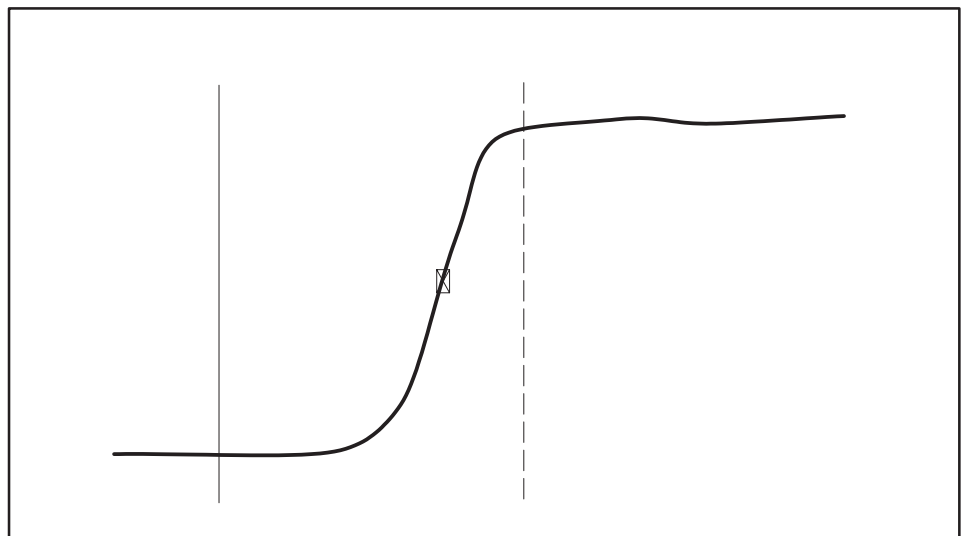
Figure 4–6: CH 1 rise time

Check Analyzer Main Out Loop Through Amplitude

1. Using the 75 Ω coaxial cable, connect the analyzer Main Out connector through the 75 Ω to 50 Ω matching pad to the CH1 input of the test oscilloscope.

2. Connect the generator 601 Out connector to the analyzer Main In connector as shown in Figure 4–7.

3. If the test oscilloscope is not already set up as shown in Table 4–5, make those setups now; then go to step 4.

4. Click on the Generate soft key to start sending the video test sequence.

5. The display that results when the setup is completed should look approximately as shown in Figure 4–3.

6. From the test oscilloscope, record the CH 1 High amplitude of the digital waveform. The value is approximately 400 mV.

7. In the test oscilloscope Trigger menu, set the polarity to negative. After the measurement stabilizes, record the CH 1 Low amplitude of the digital signal waveform. The low value should also be approximately 400 mV.

8. Add the absolute values of the high and the low amplitudes of the waveform.

9. Check that the sum of the high and low amplitude measurements is within the range of 738 mV to 862 mV.

10. Move the right most cursor to a position just after the falling edge as shown in Figure 4–5. The falling edge will be between the two cursors.

11. Verify that the Fall measurement is 1.2 ns or less.

12. Change the TDS 784 Trigger Polarity to Negative. The display will look approximately as shown in Figure 4–6.

13. Verify for that the Rise measurement is 1.2 ns or less.
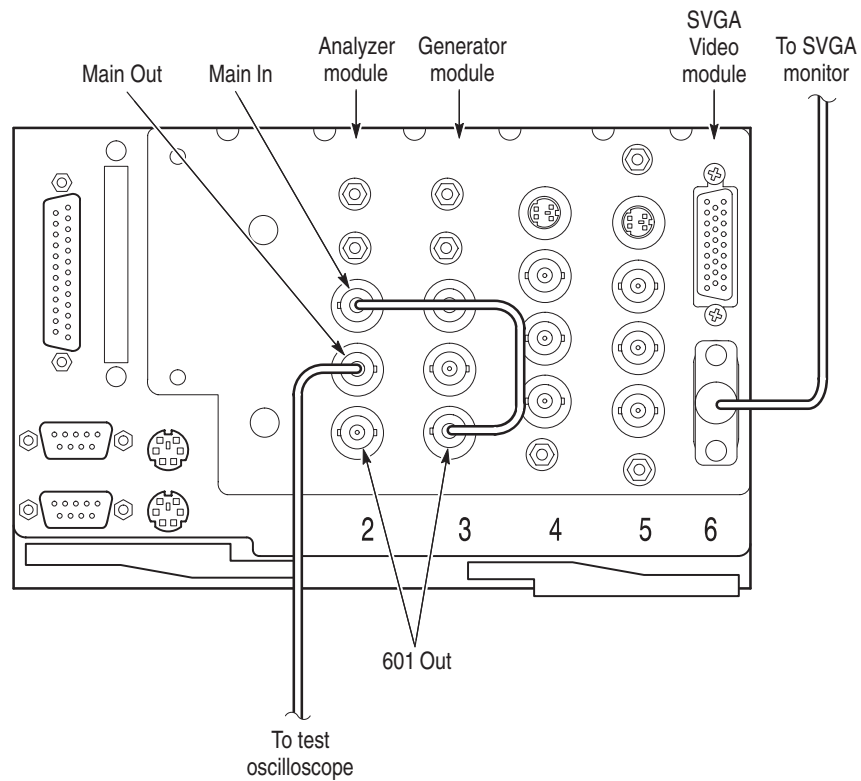
Figure 4–7: Connection for analyzer Main Out loop through check

Check Generator 601 Output

Check the generator output for the correct serial digital format at 270 MB/s and for the correct output level.

1. Connect the generator module 601 Out connector to the serial digital input of the external video monitor as shown in Figure 4–8.

2. Check that the video display on the external video monitor is correct.

3. Click on the Generate soft key to stop generating the video test signal.

4. Verify that the external video monitor display is frozen.

5. Disconnect the video test signal cable from the external digital component video monitor.
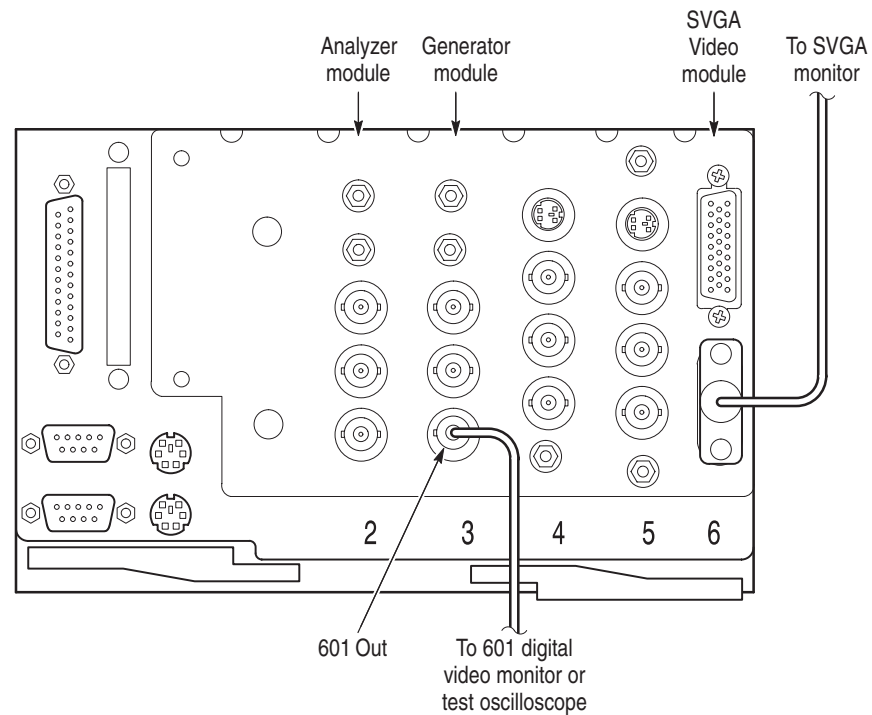
Figure 4–8: Connection for generator output check

6. Using the 75 Ω coaxial cable, connect the Generator 601 Out connector through the 75 Ω to 50 Ω matching pad to the CH1 input of the test oscilloscope.

7. If the test oscilloscope is not already set up as shown in Table 4–5, make those setups now; then go to step 8.

8. Click on the Generate soft key to start sending the video test sequence.

9. From the test oscilloscope, record the CH 1 Low amplitude of the digital waveform. The value is approximately 400 mV.

10. In the test oscilloscope Trigger menu, set the polarity to positive. After the measurement stabilizes, record the CH 1 High amplitude of the digital signal waveform.

11. Check that the sum of the high and low amplitude measurements is within the range of 738 mV to 858 mV.

Check Generator Main Loop Through

1. Disconnect the Generator 601 Out signal from the matching pad.
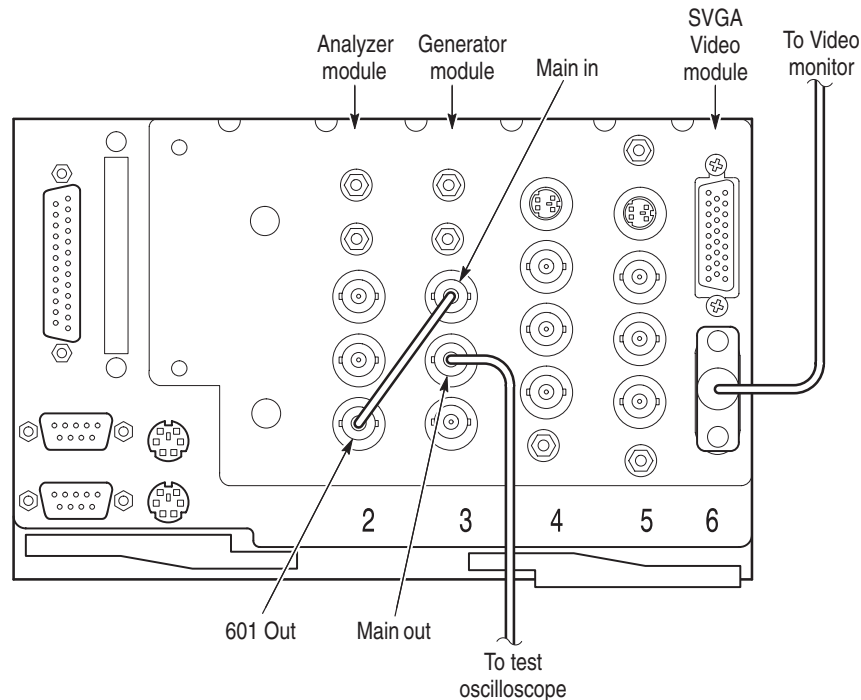
Figure 4–9: Connections for the Generator Main Out loop through check

2. Connect the Analyzer 601 Out connector to the Generator Main In connector using a 75 Ω coaxial cable.

3. Connect the Generator Main Out loop through connector to the matching pad on the test oscilloscope CH 1 input.

4. Right click the 601 Display soft key to display the External 601 Playback Configuration menu.

5. Select the Mobile+ sequence in 601-525 or 601-625 as appropriate to play back to the 601 out connector.

6. Check that the playback is set for Continuous Looping.

7. Click on the OK button to accept the changes and exit the menu.

8. Click the 601 Display soft key to start the playback.

9. From the test oscilloscope, record the CH 1 Low amplitude of the digital waveform. The value is approximately 400 mV.

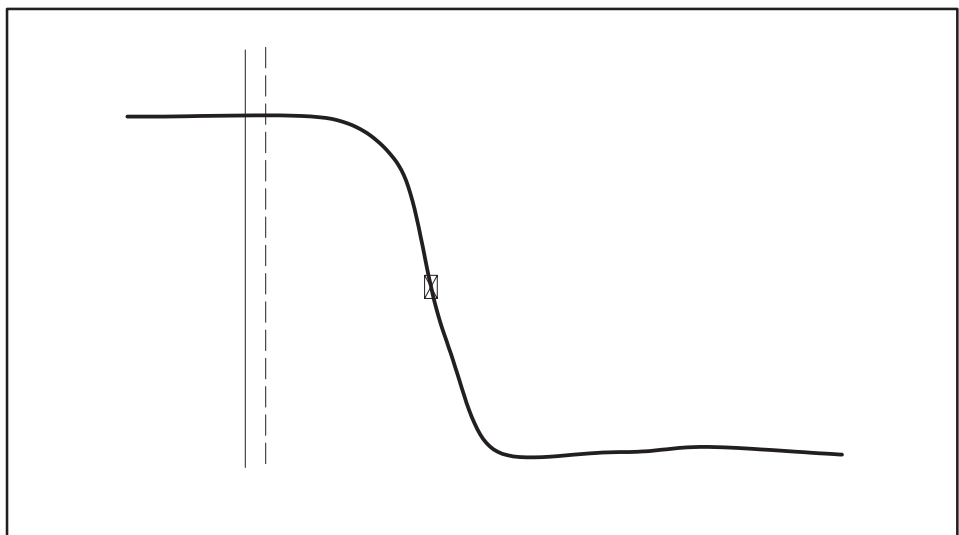**10.** In the test oscilloscope Trigger menu, set the polarity to positive. Let the measurement stabilize. Record the CH 1 High amplitude of the digital waveform.

11. Check that the sum of the high and low amplitude measurements is within the range of 738 mV to 862 mV.

12. This ends the functional verification procedure for the analyzer and generator BNC connections. Disconnect the cables and test equipment.

Analyzer and Generator Ref Out Loop Through Connectors

The SMB Ref In and Ref Out connectors on the analyzer and generator are used for making connections to the Option 01 encoder and decoder modules. You can check the Ref In and Ref Out loop through connectors for both the analyzer and the generator is the same manner as done for the Main In and Main Out loop connectors. You need two BNC-to-SMB adapter cables to make the signal connections needed.

1. Use the generator 601 Out connector to supply an input signal to the analyzer Ref In. Measure the peak-to-peak amplitude of the Ref Out signal using the same procedure steps used to check the analyzer *Main Out Loop Through Amplitude* given on page 4–15.

2. Use the analyzer 601 Out connector to supply an input signal to the generator Ref In. Measure the peak-to-peak amplitude of the Ref Out signal using the same procedure steps as used to check the generator *Main Out Loop Through Amplitude* given on page 4–18.

Option 1 Performance Verification

Performance verification of the Option 01 encoder and decoder modules consists of running the encoder and decoder user diagnostics, and then making PQR and PSNR picture quality measurements on unimpaired and impaired video test sequences.

The measurements are first made using a supplied test video sequence as the reference to verify the overall system. That same test video sequence is also captured as a new testing reference, and the measurements are redone using the new reference sequence. The second test eliminates the artifacts introduced by the encoder and decoder from the picture quality measurement and verifies capturing the correct color phase of the test video sequence. Finally, the test is done using an impaired test sequence as the test video sequence to capture.

In each of the tests, you check the measurement results against the expected values to verify the functionality of the encoder and decoder modules. The following procedure requires the PQA200 to be running and has passed the serial digital functional check.

Run Encoder and Decoder Diagnostics

1. Click the Other soft key to display the selection menu and click on Hardware Settings and Diags to display the Hardware Settings menu seen in Figure 4–10.
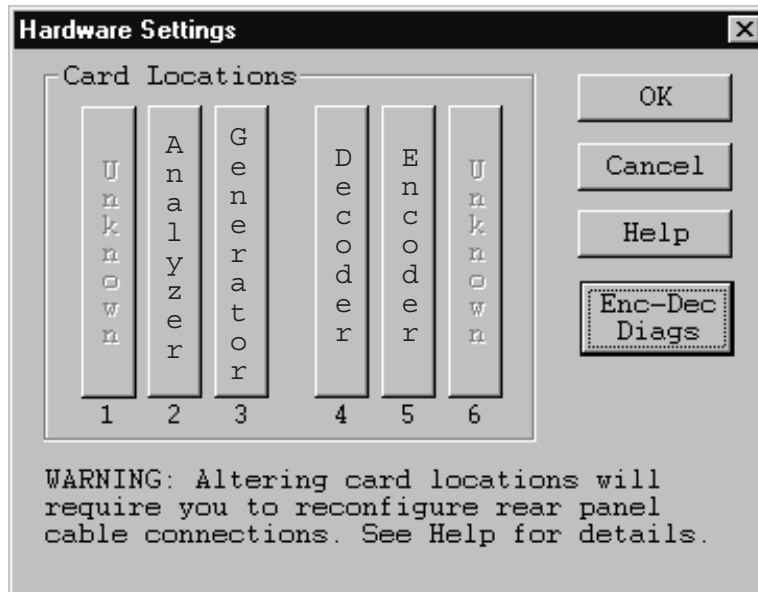
Figure 4–10: Hardware settings menu

2. A message stating that all the PQA200 applications must be stopped to continue appears. Continue with the hardware setup.

3. Click on the Enc-Dec Diags soft key to display the Encoder and Decoder Diagnostics menu shown in Figure 4–11. The diagnostic test for each module are separately selectable.

4. Click the Decoder diagnostics selection.

   As the tests run, the test names are displayed in the Results box with the pass or fail result of the test. Use the scroll bar to view the completed test results.

5. If the decoder shows diagnostic failures, perform the decoder adjustment procedure (refer to *Decoder Board Adjustments* on page 5–7) and rerun the Decoder diagnostics again. If the decoder diagnostic failure persist, the decoder module may need to be replaced.

6. Click the Encoder diagnostics selection.
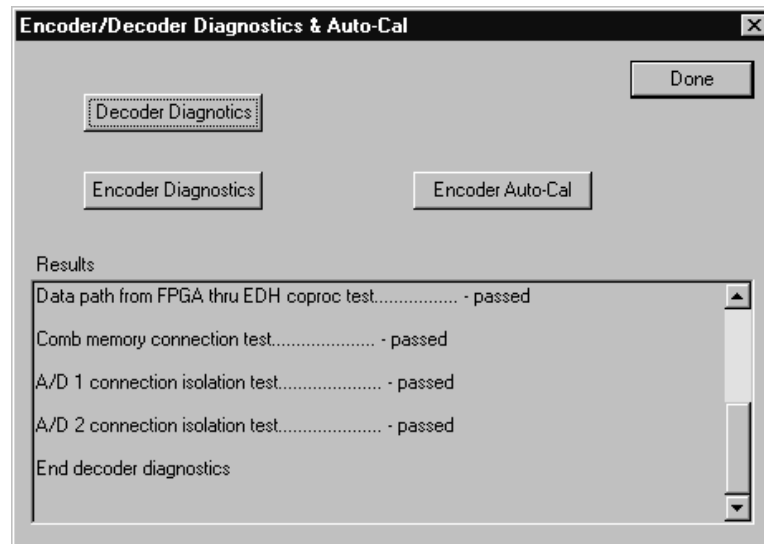
Figure 4–11: Encoder/Decoder diagnostics and Encoder Auto-Cal

7. All the diagnostic tests should show a pass result. If the encoder does not pass any of the tests, perform the Encoder Auto-Cal and rerun the Encoder diagnostics.

Encoder Auto-Cal. Typically, you would use the Encoder Auto-Cal feature about every six months to maintain optimum encoder operation. The automatic calibration routine compensates the adjustments of the encoder module for temperature changes and aging. Run the Encoder Auto-Cal procedure using the following steps.

1. Allow the PQA200 to completely warm up (about 20 minutes) before the using the automatic calibration feature. This time permits all the circuitry to stabilize, and the auto-cal adjustments are then optimized for the normal operating temperature.

2. Click the Encoder Auto-Cal selection.

3. After the auto calibration has finished, rerun the Encoder Diagnostics to check for pass or fail of the diagnostic tests.

4. If the encoder still shows diagnostic failures after the auto calibration, refer your PQA200 system to a qualified service person for repairs.

Set Up the PQA200 System for Composite Video Testing

The following procedure sets up the PQA200 Picture Quality Analysis System to generate an analog video test sequence, capture that same test sequence, measure the captured test sequence against the stored reference sequence, and display the measurement results. The cable connections required to interconnect the DSP modules with the encoder and decoder modules are shown in Figure 4–12. The encoder to generator DSP and decoder to analyzer DSP interconnection cable are standard accessories for Option 01.
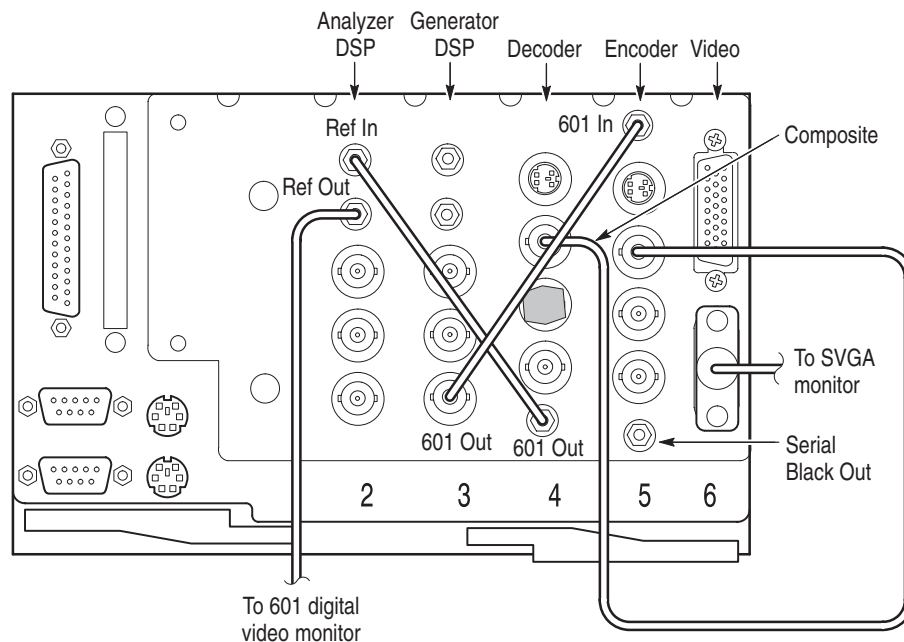
Figure 4–12: Connections for the encoder and decoder functional check

1. Connect the Generator 601 Out BNC connector to the encoder 601 In SMB connector using the 75 Ω coaxial interconnection cable provided.

2. Do not connect the encoder Serial Black Out connector to the generator DSP Ref In connector. If it is connected, disconnect it. Genlock (synchronizing the encoder to the generator) is derived from the serial digital video signal from the generator DSP.

3. Connect the decoder 601 Out SMB connector to the analyzer DSP Ref In SMB connector using one of the 75 Ω coaxial interconnection cable provided.

4. Use the BNC-to-BNC coaxial cable to connect the encoder Composite Out BNC connector to the decoder Composite loop-through input.

5. Terminate the decoder Composite loop-through connector using a 75 Ω BNC termination.

6. Use a BNC-to-SMB adapter coaxial cable to connect the analyzer Ref Out SMB connector to the 601 serial digital video monitor.

7. Set up the video monitor to view the serial digital input.

8. Double click on the PQA200 icon to start the application.

9. Right click the Preference soft key to display the Preference Configuration menu.

10. Click the down arrow in the Startup Presets name field.

11. Click on the factory preset to select it.

12. Click OK to accept the change and exit the menu.

13. Click the Preference softkey to restore the factory configuration settings.

14. Right click the Generate soft key.

15. Select the correct signal type for the test (NTSC, NTSC No Setup, or PAL). It is suggested that you do the first functional verification test using the format that you expect to use most or exclusively. You can elect to test for each of the signal types for a more thorough functional check.

16. Select to generate the Mobile+ sequence.

17. Click OK in the Generate Configuration menu to accept the changes and exit the menu.

18. Right click the Capture soft key to display the Capture Configuration menu.

19. Select the correct signal type for the test (NTSC, NTSC No Setup, or PAL).

20. Select Mobile+ as the reference sequence.

21. Set Capture As to Test.

22. Give the capture test an alias file name you can remember as you do the verification tests. For example, call the reference captured for NTSC "Mobile NTSC Test" and a reference captured for PAL "Mobile PAL Test".

23. Click OK in the Capture Configuration menu to accept the changes and exit the menu.

24. Right click on the Measure soft key. When a new test is captured it is the default choice to measure.

25. Select PQR Luma, PQR Luma & Chroma, and PSNR Luma in the Picture Quality Measurement box.

26. Click the OK button to accept the changes and exit the menu.

Composite Sequence Test Using a 601 Ref

1. Click the Generate soft key to start generating the Mobile+ test sequence.

2. Right click the Playback soft key to display the Playback Configuration menu.

3. Select Live as the choice to play back. Select the video format you have selected to capture in the Capture Configuration menu.

4. Click OK to accept the changes and exit the menu.

5. Click the Playback soft key to start the playback. The display is black until the generator starts the test sequence.

6. Click on the Capture soft key to start the capture operation.

7. Wait for the test sequence to be captured. The captured reference name, format, and file extension are displayed when the capture is done.

8. Click the Measure soft key to start the measurement. The captured test sequence is compared against the Mobile+ 601 reference, and the encoder and decoder effects are included in the measurements.

   The PQR map of each field is displayed as it is being processed. The progress indicator and the messages in the status bar show you what is happening and the field number that is being processed.

   After the PQR analysis finishes, the PSNR measurement starts. The PSNR map of each field is also displayed as the measurements are made. When the measurements have completed, the Summary results are displayed.

9. Check the Summary results against the typical values given for the unimpaired video test sequence in Table 4–6. The values you get for the PQR and PSNR numbers can be different, but should be about the same.

Table 4–6: Summary PQR for unimpaired sequence using a 601 digital reference sequence

Test	NTSC and NTSC no setup	PAL
PQR Luma	5.30	8.30
PQR Luma & Chroma	5.70	8.60
PSNR Luma	27.00	26.00

Composite Sequence Test Using a De-embedded Ref

1. Right click on the Capture soft key to re-display the Capture Configuration menu.

2. Select to capture as a reference. Mobile+ should still be the Reference Sequence selected.

3. Give the reference capture an alias name that helps you remember the correct capture and reference to associate it with. For example, NTSC Notch Mobile Ref or PAL Notch Mobile Ref.

4. Click the Decoder soft key to display the menu shown in Figure 4–13.
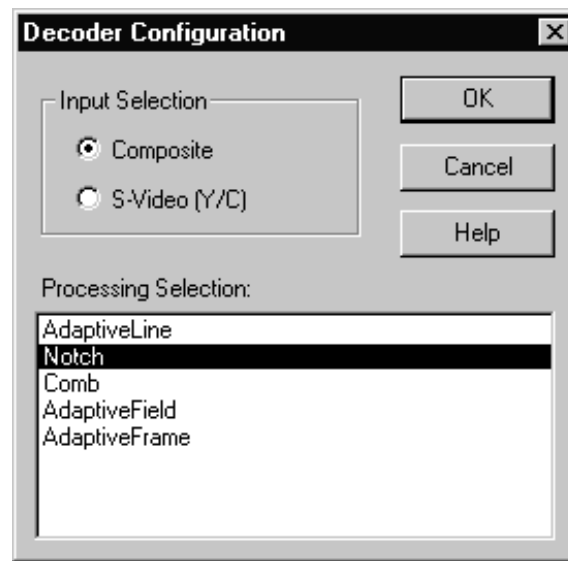
Figure 4–13: Decoder Configuration menu Notch processing selection

5. Select Notch processing.

6. Click OK button to accept the changes and go to the Capture Configuration menu.

7. Click OK to accept the changes and exit the menu.

8. Click the Capture soft key to capture of the test video sequence as a reference.

9. Wait for the capture and store to finish.

10. When the status bar indicates that the captured sequence is stored, right click the Capture soft key to re-display the Capture Configuration menu.

11. In the Reference Sequence field, select the alias name of the reference sequence you captured in step 8 (NTSC Notch Mobile Ref or PAL Notch Mobile Ref).

12. Select to capture as a test.

13. Give the test capture an alias name that helps you remember the correct capture and reference to associate it with. For example, NTSC Notch Mobile Test or PAL Notch Mobile Test.

14. Click OK to accept the changes and exit the menu.

15. Click the Capture soft key to capture the Mobile+ sequence as a test.

16. After the test sequence has been captured and stored, click the Measure soft key to start the measurements. This time the picture quality analysis is done with respect to the captured reference. The effects of the encoder and decoder modules are eliminated (de-embedded) from the analysis.

17. Check the Summary results against the typical values for the unimpaired video test sequence given in Table 4–7. The values you get for the PQR and PSNR numbers can be different, but should be about the same.

Table 4–7: Summary PQR for unimpaired sequence using a captured composite reference

Test	NTSC and NTSC no setup	PAL
PQR Luma	0.90	1.40
PQR Luma & Chroma	0.90	1.40
PSNR Luma	48.00	45.00

Composite Impaired Sequence Test

After you have confirmed that the unimpaired composite video test is correct, use the following procedure to test one or more of the impaired video sequences. Measuring the impaired test sequence against the stored reference sequence provides a check on the operation of encoder and decoder modules with different levels of impairment in the video material.

1. In the Generate Configuration menu, select one of the impaired video test sequences (for example, Mobile3mbs+).

2. In the Capture Configuration menu, select the correct signal type for the test (NTSC, NTSC No Set Up, or PAL).

3. Select Mobile+ as the reference sequence.

4. Set Capture As to Test. Give the test capture a meaningful alias name so you can identify it in a list of captured files. That name is also displayed on the results displays to identify the results.

5. Click on the Decoder soft key.

6. Select Adaptive Line processing. Adaptive Line should be used in most cases when testing against the 601 digital reference.

7. Click OK to accept the changes and go to the Capture Configuration menu.

8. Click OK again to exit the Capture Configuration menu.

9. Click on the Generate soft key to start generating the test sequence.

10. Click on the Capture soft key to start the capture operation.

11. Wait for the test sequence to be captured. The message "Capture sequence saved" with the name, format, and file extension is displayed when the capture is done.

12. Click on the Measure soft key to start the measurement. The progress indicator and the messages in the status bar at the bottom of the PQA200 display shows you what is happening. When all the measurements have completed, the Summary results are displayed.

13. Check the Summary results for the correct measurement values for the captured impaired video test sequence compared to the typical values given either in Table 4–8 or in Table 4–9, as appropriate. Note that the NTSC and NTSC No Setup sequences are given as the same number. There are some minor differences between the two sequence types, but no more than the expected tolerance for either type.

    The PQR and PSNR values you measure can be different than the typical values given in the tables, but they should be about the same. If the PQR and PSNR values are correct, the measure algorithms are verified.

14. If there is a significant difference between the PQR Luma value or the PSNR Luma values for an impaired sequence and the values given in the table for that sequence, check your setup again and redo the test. If the problem persists, refer the PQA200 system to a qualified service person.

Table 4–8: Mobile+ NTSC and NTSC No Setup impaired video test sequence results for composite video

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	9.00	PQR Luma	7.00	PQR Luma	6.30
PQR Luma & Chroma	9.50	PQR Luma & Chroma	7.5	PQR Luma & Chroma	6.75
PSNR Luma	23.00	PSNR Luma	25.00	PSNR Luma	25.70

Table 4–9: Mobile+ PAL impaired video test sequence results for composite video

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	10.20	PQR Luma	9.00	PQR Luma	8.60
PQR Luma & Chroma	10.80	PQR Luma & Chroma	9.50	PQR Luma & Chroma	9.00
PSNR Luma	23.30	PSNR Luma	24.50	PSNR Luma	25.00

15. If you want additional verification of the measure algorithm, you can repeat the impaired video sequence test using another of the impaired video test sequences.

S-Video Verification

You can check the S-Video functionality if you have an S-Video interconnection cable. The following procedure assumes that the composite video testing for Option 01 passed, and that the configuration settings are as made for those tests. Make the following changes to test the S-Video operation:

1. Connect the encoder S-Video out connector to the decoder S-Video input connector.

2. In the Capture Configuration menu, click on the Decoder button to display the Decoder Configuration menu shown in Figure 4–14.
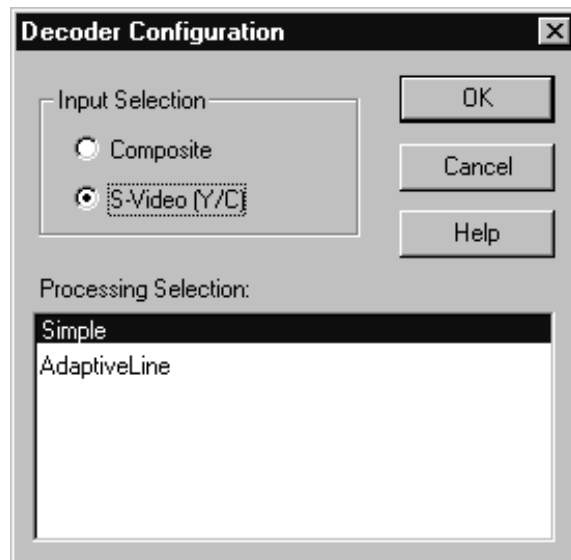
Figure 4–14: Decoder Configuration menu for S-Video

3. Select S-Video as the input selection and Simple as the processing selection. (Simple is the only available selection for PAL video format.)

4. Click OK to accept the change and exit to the Capture Configuration menu.

5. Click OK in the Capture Configuration menu to exit the menu.

6. Rerun both composite unimpaired sequence tests (601-ref and de-embedded) starting on page 4–24 and the composite impaired sequence test starting on page 4–26. You have to recapture a new reference to eliminate (de-embed) the effects of the encoder and decoder. The measurement values for the unimpaired S-Video tested against the 601 serial digital reference are shown in Table 4–10. The measurement values for the unimpaired S-Video tested against a captured S-Video reference that de-embeds the encoder and decoder effects are shown in Table 4–11.

Table 4–10: Summary picture quality values for unimpaired sequence against 601 serial digital reference

Test	NTSC and NTSC no setup	PAL
PQR Luma	2.10	2.20
PQR Luma & Chroma	2.30	2.40
PSNR Luma	47.60	43.50

The testing results for S-Video shown in Table 4–10 are better than the same tests made on the composite video reference. S-Video has its luminance and chrominance already separated, and the encoder and decoder processing is less of a factor on the measurement values obtained. Notice that the results shown in Table 4–11, obtained using the de-embedding technique, are similar to the results of the composite video tests shown in Table 4–7.

Table 4–11: Summary picture quality values for unimpaired sequence against captured S-Video reference using Simple processing

Test	NTSC and NTSC no setup	PAL
PQR Luma	0.90	0.95
PQR Luma & Chroma	0.90	0.95
PSNR Luma	49.20	49.15

7. Verify the measured results for the unimpaired video sequence and the impaired video sequence against the typical expected results shown in Table 4–12 or Table 4–13, as appropriate for the video format of the test.

Table 4–12: Mobile+ NTSC and NTSC No Setup impaired video test sequence results for S-Video

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	8.10	PQR Luma	5.50	PQR Luma	4.40
PQR Luma & Chroma	8.60	PQR Luma & Chroma	5.80	PQR Luma & Chroma	4.70
PSNR Luma	24.00	PSNR Luma	27.20	PSNR Luma	29.40

Table 4–13: Mobile+ PAL impaired video test sequence results for S-Video

Mobile at 3 MB/s		Mobile at 6 MB/s		Mobile at 9 MB/s	
PQR Luma	8.00	PQR Luma	5.60	PQR Luma	4.50
PQR Luma & Chroma	8.35	PQR Luma & Chroma	5.90	PQR Luma & Chroma	4.90
PSNR Luma	24.90	PSNR Luma	28.30	PSNR Luma	30.50

Format Verification

The functionality is verified using only one format, preferably the one you use for the majority of your testing. If you choose, you can redo all the tests in each of the video formats to verify the operation. In each step of the tests, select a different format than you used for the original testing. For example, if you used PAL format for the first test, select NTSC or NTSC No Setup. The expected measurement results for the impaired sequence testing are provided for each level of impairment of the provided impaired test sequences.

Decoder 601 Out Amplitude

The 601 Out signal amplitude is measured using a test oscilloscope and a 75 Ω to 50 Ω matching pad. The test oscilloscope setup is identical to that used to test the DSP module 601 output amplitude.

1. Connect the decoder 601 Out connector through a 75 Ω coaxial cable and the 75 Ω to 50 Ω matching adapter to the CH1 input of the test oscilloscope. See Figure 4–15 for the PQA200 rear panel connections.

2. Use the BNC-to-BNC coaxial cable to connect the encoder Composite Out BNC connector to the decoder Composite loop-through input.

3. Terminate the decoder Composite loop-through connector using a 75 Ω BNC termination.

4. Set the test oscilloscope for the settings given in Table 4–5. The parameters shown are for the example test oscilloscope given in the test equipment list. If you use an equivalent oscilloscope of a type other than the example, refer to the operating manual of that oscilloscope to determine the settings.
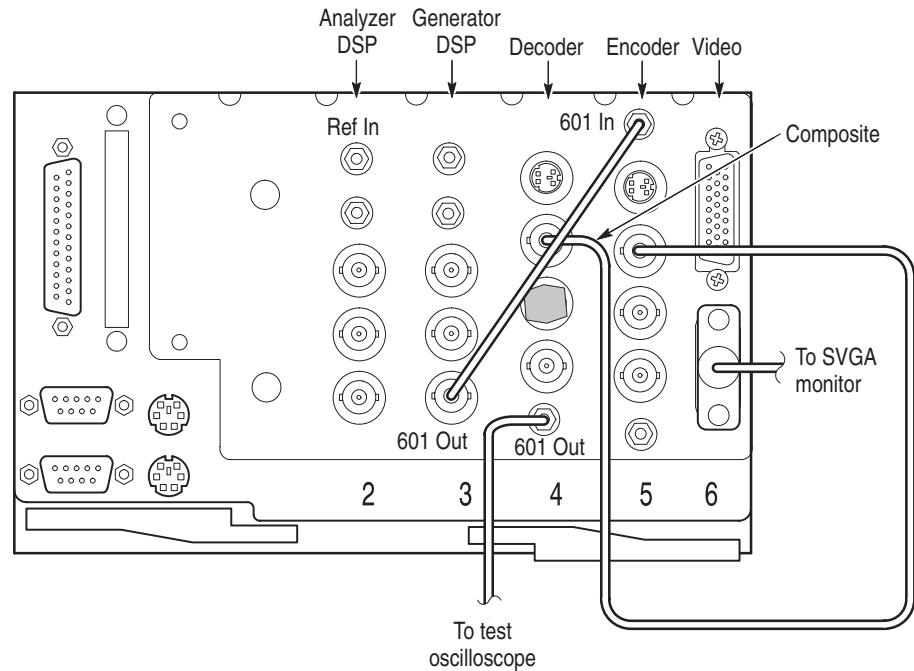
Figure 4–15: Connections for the decoder 601 output check

5. Double click on the PQA200 icon to start the application.

6. Right click the Generate soft key.

7. Select PAL format for the test.

8. Select to generate the Mobile+ sequence.

9. Select Continuous Looping.

10. Click the Encoder soft key to display the Encoder Configuration menu shown in Figure 4–16.

    a. Select Gaussian filter.

    b. Select the Serial Video Lockup (genlock) choice.

    c. Click the OK button to accept the choices and exit back to the Generate Configuration menu.
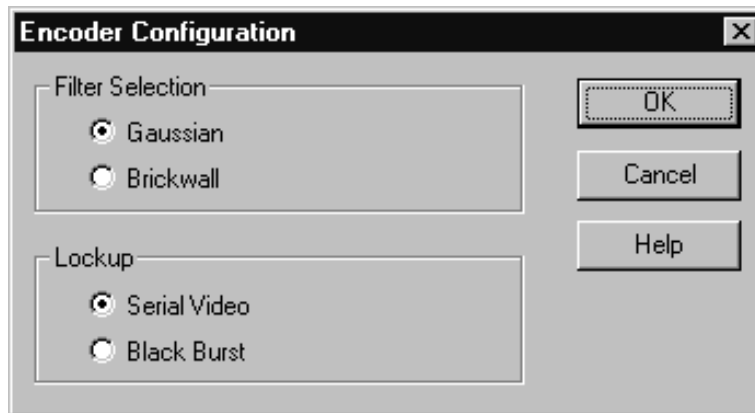
Figure 4–16: Encoder Configuration menu

11. Click OK in the Generate Configuration menu to accept the changes and exit the menu.

12. Right click the Capture soft key to display the Capture Configuration menu.

13. Select PAL format for the test.

14. Select Mobile+ as the reference sequence.

15. Click the Decoder soft key to display the Decoder Configuration menu.

16. Select Notch processing.

17. Click the OK button to accept the changes and exit to the Capture Configuration menu.

18. Click OK in the Capture Configuration menu to accept the changes and exit the menu.

19. Click the Generate soft key to start generating the test signal.

20. The display that results when the setup is completed should look approximately as shown in Figure 4–3.

21. From the test oscilloscope, record the CH 1 High amplitude of the digital waveform. The value is approximately 400 mV.

22. In the test oscilloscope Trigger menu, set the polarity to negative. After the measurement stabilizes, record the CH 1 Low amplitude of the digital signal waveform. The low value should also be approximately 400 mV.

23. Add the absolute values of the high and the low amplitudes of the waveform.

24. Check that the sum of the high and low amplitude measurements is within the range of 738 mV to 862 mV. The measurement uncertainty due the

accuracy of the example test equipment is taken into consideration in this range to verify that the output is within the allowable limits of 800 mV $\pm$ 80 mV.

25. If the 601 output peak-to-peak amplitude is not with the expected limits, perform the Decoder Adjustment procedure. Refer to *Decoder Board Adjustments* on page 5–7.

Check Encoder Output Amplitude Accuracy

This check verifies the operation of the Encoder Auto-Cal routine by first running the auto calibration feature, then checking that the Luminance and Chrominance gain and DC offset values are within the specified ranges. Both the composite video and S-Video output are checked.

Run the Encoder Auto-Cal Routine. Allow the PQA200 to completely warm up (about 20 minutes) before the using the automatic calibration feature. This time permits all the circuitry to stabilize and the auto-cal adjustments are then optimized for the normal operating temperature.

1. Click the Other soft key to display the selection menu and click on Hardware Settings and Diags to display the Hardware Settings menu seen in Figure 4–17. You will get a message telling you that all PQA200 applications must be stopped to continue. Click OK to continue.
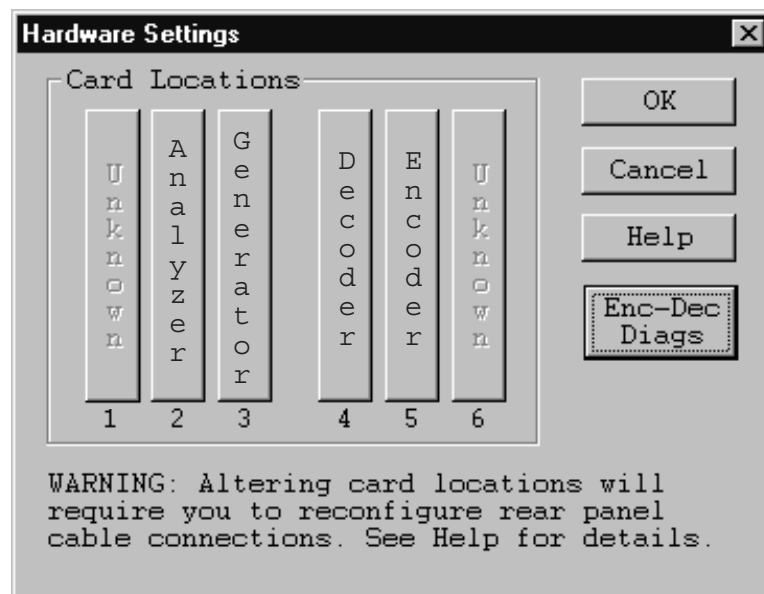
Figure 4–17: Hardware settings menu

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2. Click on the Enc-Dec Diags soft key to display the Encoder and Decoder Diagnostics menu shown in Figure 4–18.
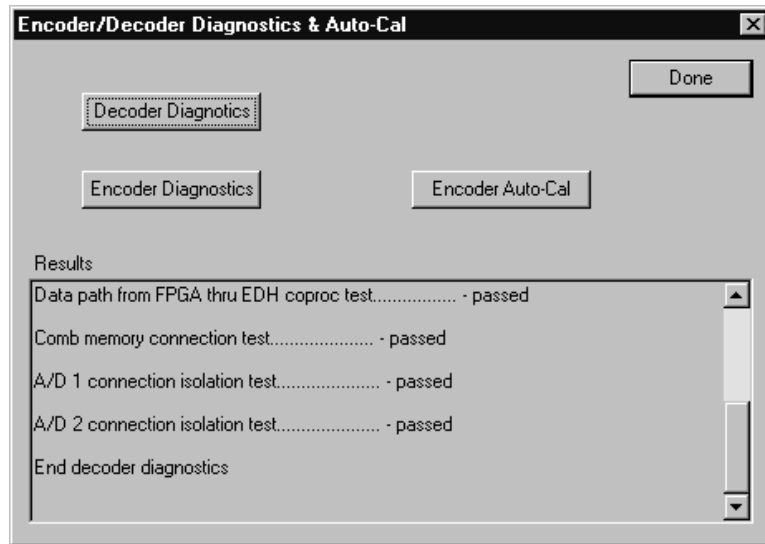
Figure 4–18: Encoder/Decoder diagnostics and Encoder Auto-Cal

3. Click the Encoder Auto-Cal selection.

4. After the auto calibration has finished, run the Encoder Diagnostics to check for pass or fail of the diagnostic tests.

5. If the the encoder shows diagnostic failures after the auto calibration, refer your PQA200 system to a qualified service person for repairs.

Setup for Auto-Cal Verification. Connect the test equipment and adapter cables as shown in Figure 4–19.
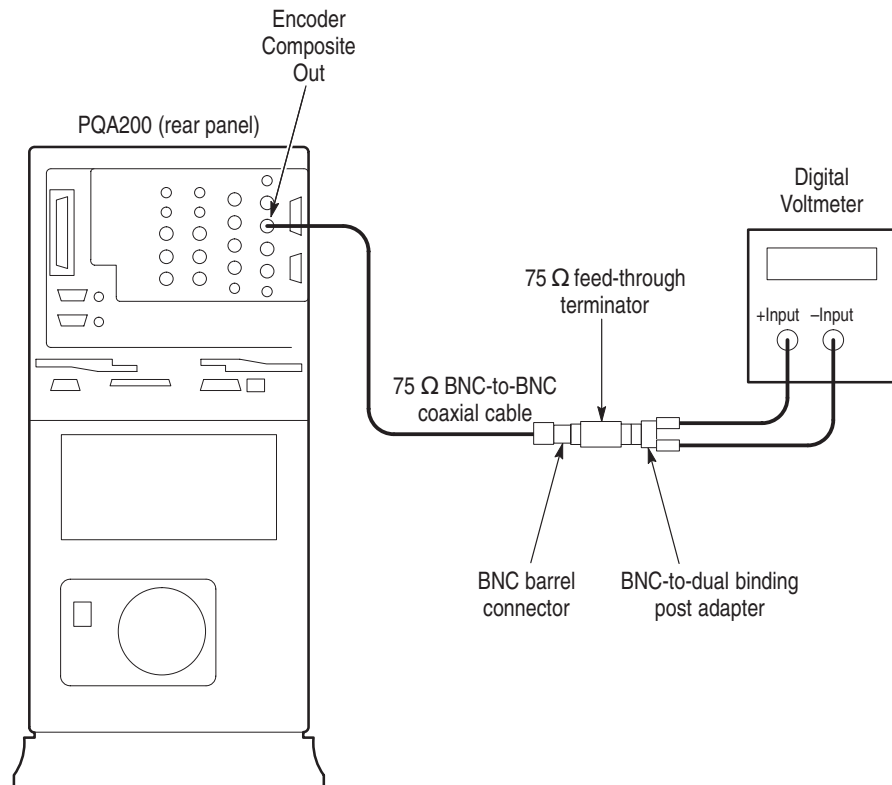
Figure 4–19: Setup for Composite video luma (Y) and chroma (C) gain and offset

1. Connect a 75 Ω cable to the Composite Output BNC connector on the encoder module.

2. Connect a 75 Ω feed-through termination to the coaxial cable BNC connector. Use a BNC female barrel connector to connect the termination to the adapter cable.

3. Connect a BNC to banana jack dual binding post adapter on the 75 Ω feed-through termination.

4. Connect the digital voltmeter + lead to the banana jack center conductor (RED) binding post and connect the – lead to the ground (BLACK) binding post.

5. Set the digital voltmeter to measure DC voltage on the 2 V range.

 Diagnostic Routine. Run the supplied diagnostic routine to provide the reference DC voltage level inputs to the encoder.

1. Use the Windows NT directory tools to locate the diagnostic executable file. It is fount in the PQA200/bin/support directory. The diagnostic file name is mmcodecs.exe.

2. Double click on the file name to start the diagnostic routine. A small PQA Encoder/Decoder dialog box is displayed.

NOTE. *This version of the PQA Encoder/Decoder diagnostics does not have a help file provided.*

3. In the dialog box, hold the mouse button down on Option to display the choices and select the encoder diagnostics. The Encoder diagnostic window appears.

PAL Luminance Gain and DC Offset.

1. In the encoder diagnostics window, select PAL Blanking and press GO (see Figure 4–20).

2. Record the composite blanking DC level indicated on the voltmeter. The expected range is 0 ± 50 mV.

3. Connect the S-Video to BNC adapter cable to the S-Video connector of the encoder module.

4. Move the 75 Ω feed-through termination from the composite video coaxial cable to the Y channel BNC connector of the S-Video to BNC adapter cable. Use a BNC female barrel connector to connect the termination to the adapter cable. See Figure 4–21 for the setup connections.
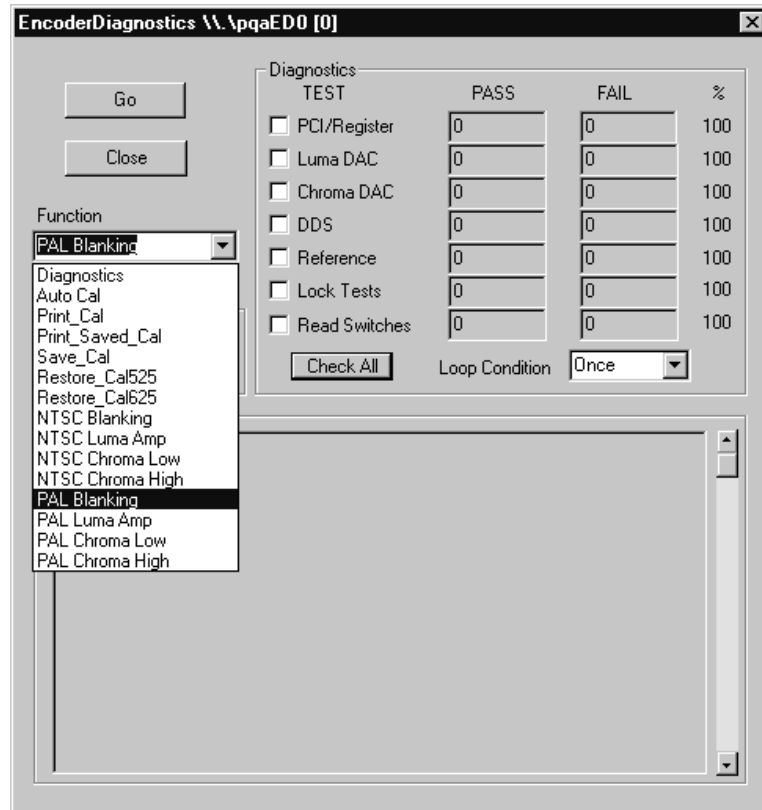
Figure 4–20: Encoder diagnostics selection menu

5. Record the S-Video Y channel blanking DC level indicated on the digital voltmeter. The expected range is 0 V $\pm$ 25 mV.

6. Move the 75 Ω feed-through termination from the S-Video Y channel connector to the S-Video C channel connector.

7. Record the S-Video C channel blanking DC level indicated on the digital voltmeter. The expected range is 0 V $\pm$ 25 mV.

8. Move the 75 Ω feed-through termination from the S-Video C channel connector back to the S-Video Y channel connector.

9. In the encoder diagnostics window select PAL Luma AMP and press GO.

10. Record the S-Video Y channel luminance level indicated on the digital voltmeter.

11. Move the 75 Ω feed-through termination from the S-Video Y channel connector back to the Composite Output cable connector.
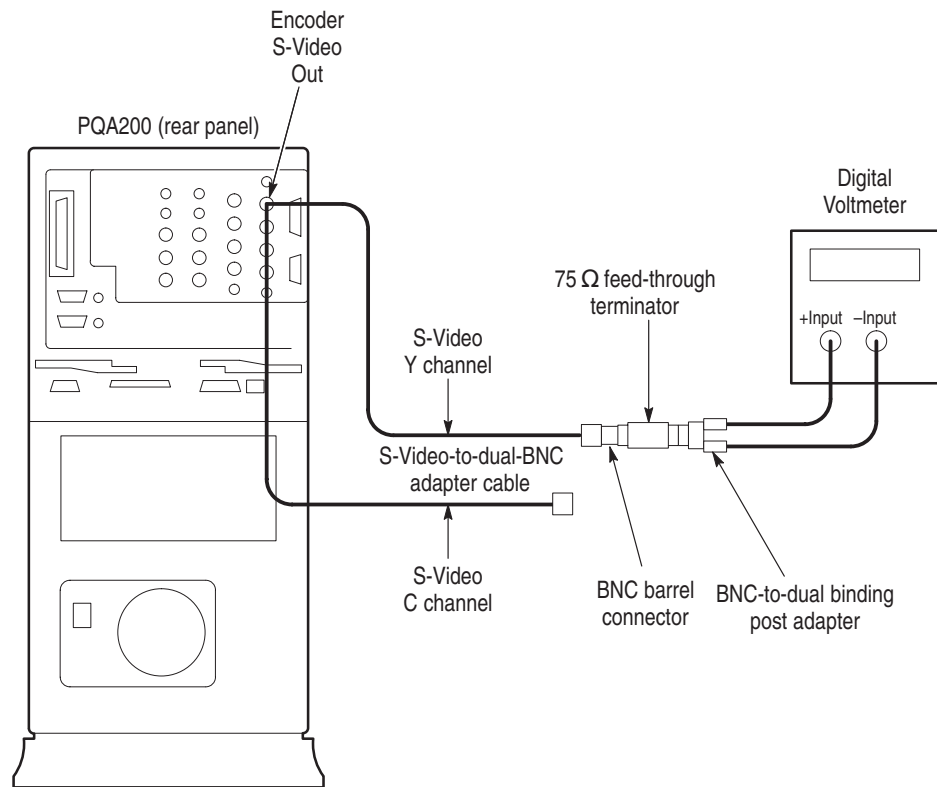
Figure 4–21: Setup for S-Video luma (Y) and chroma (C) gain and offset

12. Record the composite luminance amplitude indicated on the digital voltmeter.

13. Compute the net result (the difference between composite blanking and composite luminance levels) for Composite video. Check that the result is 700 mV $\pm$ 7 mV.

14. Compute the net result (the difference between S-Video blanking and S-Video luminance levels) for the S-Video signal. Check that the result is 700 mV $\pm$ 14 mV.

PAL Chrominance Gain and DC Offset.

1. In the encoder diagnostics window, select PAL Chroma Low and press GO.

2. Record the composite output minus chroma level indicated on the digital voltmeter. The expected value is near –350 mV.

3. Move the 75 Ω feed-through termination from the Composite Output coaxial cable connector to the S-Video C channel cable connector.

4. Record the S-Video C channel minus chroma level indicated on the digital voltmeter. The expected value is near –350 mV.

5. In the encoder diagnostics window, select PAL Chroma High and press GO.

6. Record the S-Video C channel plus chroma level indicated on the digital voltmeter. The expected value is near +350 mV.

7. Move the 75 Ω feed-through termination from the S-Video C channel connector back to the Composite Output cable connector.

8. Record the composite output plus chroma level indicated on the digital voltmeter. The expected value is near +350 mV.

9. Compute the composite video net results (add composite chroma plus and minus amplitude for the peak-to-peak value). Check that the result is 700 mV ± 7 mV.

10. Compute the S-Video net results (add S-Video chroma plus and minus amplitude for the peak-to-peak value). Check that the result is 700 mV ± 14 mV.

Check Encoder Serial Black Out Genlock

This procedure checks the encoder module genlock function and the Serial Black Output amplitude.

1. Connect a composite reference video source of the format you are testing (with burst) to the encoder Genlock feed through. Terminate the feed through using a 75 Ω BNC termination.

2. Connect test oscilloscope to the generator DSP Ref Out SMB connector.

3. Using the SMB to BNC 75 Ω coaxial adapter cable, connect the generator Ref Out connector through the 75 Ω to 50 Ω matching pad to the CH1 input of the test oscilloscope.

4. Connect the encoder Composite output to a composite video monitor setup to display the video format (NTSC, NTSC No Setup, or PAL) you want to use for the test.

5. Right click the Generate soft key to display the Generate Configuration menu.
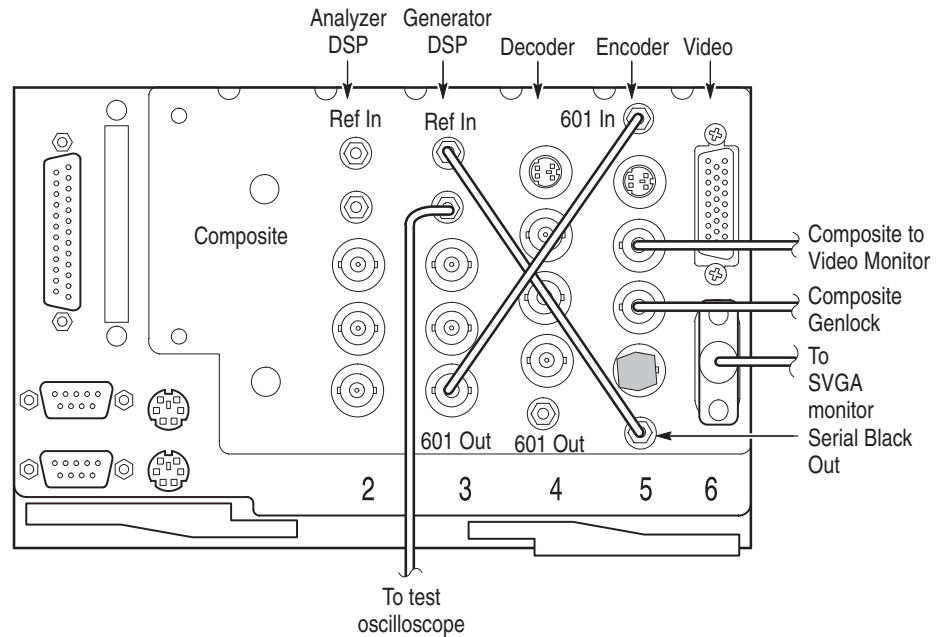
Figure 4–22: Connections for Serial Black Out and Genlock check

6. In the Generate Configuration menu, select to generate a video sequence of the correct format for your test (NTSC, NTSC No Setup, or PAL) continuously.

7. Click on the Encoder soft key to display the Encoder Configuration menu.

8. In the Encoder Configuration menu, select Gaussian filtering and Serial Black lockup for the Genlock.

9. Click OK to accept the changes and exit to the Generator Configuration menu.

10. Click OK again to accept all the changes and exit the Generator Configuration menu.

11. Click the Generator soft key to start outputting the test sequence.

12. Check that the composite video sequence is displayed correctly on the video monitor.

13. Set up the test oscilloscope as shown in Table 4–5.

14. From the test oscilloscope, record the CH 1 High amplitude of the digital waveform. The value is approximately 400 mV.

15. In the test oscilloscope Trigger menu, set the polarity to negative. After the measurement stabilizes, record the CH 1 Low amplitude of the digital signal waveform.

16. Add the absolute values of the low and high amplitudes of the waveform.

17. Check that the sum of the high and low amplitude measurements is within the range of 723 mV to 877 mV. The measurement uncertainty due the accuracy of the example test equipment is taken into consideration in this range to verify that the output is within the allowable limits of 800 mV $\pm$ 100 mV.

Check the DSP 27 MHz Clock Frequency

Use the following procedure to check the oscillator frequency of the analyzer and generator DSP modules.

Test Equipment Setup   **1.** Set up the test equipment.

Table 4–14: Frequency counter setup

Feature	Mode	Status
Measure	Freq	
Limits	Run	
Channel 1		Connected
Trigger	Sensitivity	OFF
Input impedance	50 Ω/1 M	1 MΩ
Input coupling	DC/AC	AC
Attenuation	x10 Atten	OFF
Filter	10 kHz Filter	OFF

2. Be sure that you wear a static grounding wrist strap.

3. Turn off power to the server.

4. Remove the server top cover. Refer to the *Removing the Server Top Cover* on page 6–5 for the procedure.

5. Connect a 1 MΩ probe to the frequency counter Channel 1 input connector.

6. Connect the probe ground lead to chassis ground of the server.

7. Carefully touch the probe tip to the oscillator 27 MHz Clk test point of the generator DSP module. See Figure 4–23 for the location of the test point.

Rear of instrument

Clock test point

27 MHz Clk

C285

Figure 4–23: Oscillator test point for frequency check

NOTE. *This oscillator is temperature sensitive. Allow the server to warm up for 20 minutes before checking the frequency.*

8. Check the frequency counter for a reading of 27 MHz $\pm$ 27 Hz (26,999.973 to 27,000,027 Hz).

9. Move the counter probe tip to the analyzer DSP oscillator test point.

10. Check the frequency counter for a reading of 27 MHz $\pm$ 27 Hz (26,999.973 to 27,000,027 Hz)

11. Disconnect the test equipment and reinstall the server top cover.

Adjustment Procedures

Adjustment Procedures

This section provides the recommended field adjustments for the PQA200 Picture Quality Analysis System.

Equipment Required

Table 5–1 lists the test equipment needed to perform the adjustment procedure. The table identifies examples and provides the minimum tolerances, where applicable. If equipment is substituted, it must meet or exceed the tolerances listed.

Table 5–1: Required equipment list

Test equipment	Characteristic	Example
Frequency counter with 1 MΩ test probe	Frequency 100 MHz, 10-digit readout, accuracy 0.1 ppm. (Referenced to WWV, GPS, or with a high accuracy time base.)	Hewlett-Packard Model 53131A
Screwdriver with T-15 Torx Tip		Standard tool
Adjustment tool	Plastic handle, small metallic bit. Less than three inches overall.	Tektronix part number 003-1433-01
Digital Voltmeter	DC 1 V to 20 V, accuracy ± 0.5%	Tektronix DM2510 Program-mable Multimeter
PCI circuit board extender	5V, 32-bit PCI bus extender card	Kaitek Engineering Model 34-06-TP Tektronix part number 018-0226-00

DSP 27 MHz Oscillator Frequency Adjustment

Use the following procedure to adjust the oscillator frequency of the analyzer and generator DSP modules.

NOTE. It is not necessary to do this adjustment, and it should not be attempted, if the oscillator frequency is within specification when checked in the performance verification procedure.

If the oscillator is not working or cannot be adjusted, refer to the *Maintenance* section on page 6–6 for PQA200 module replacement instructions.

Test Equipment Setup   **1.** Set up the test equipment.

Table 5–2: Frequency counter setup

Feature	Mode	Status
Measure	Freq	
Limits	Run	
Channel 1		
	Trigger Sensitivity	OFF
Input impedance	50 Ω/1 M	1 MΩ
Input coupling	DC/AC	AC
Attenuation	x10 Atten	OFF
Filter	10 kHz Filter	OFF

2. Be sure that you wear a static grounding wrist strap.

3. Turn off power to the server.

4. Remove the server top cover. Refer to the *Removing the Server Top Cover* on page 6–5 for the procedure.

5. Remove the analyzer DSP module. Refer to *Removing a PQA200 Module* on page 6–6 for the removal procedure.

6. Insert the PCI circuit board extender into the analyzer DSP module slot.

7. Insert the analyzer DSP module in the PCI extender board connector.

8. Turn the power to the server back on and wait for the initialization process to complete. It is not necessary to log in or start the PQA200 application.

NOTE. This adjustment is temperature sensitive. The server should be allowed to warm up for 20 minutes before attempting to make the final adjustment to the limits given in step 12. This centers the operating range of the oscillator so that it will remain in specification with aging and temperature variations.

---

9. Connect a 1 MΩ probe to the frequency counter Channel 1 input connector.

10. Connect the probe ground lead to chassis ground of the server.

11. Carefully touch the probe tip to the oscillator 27 MHz Clk test point of the analyzer DSP module. See Figure 5–1 for the test point location.
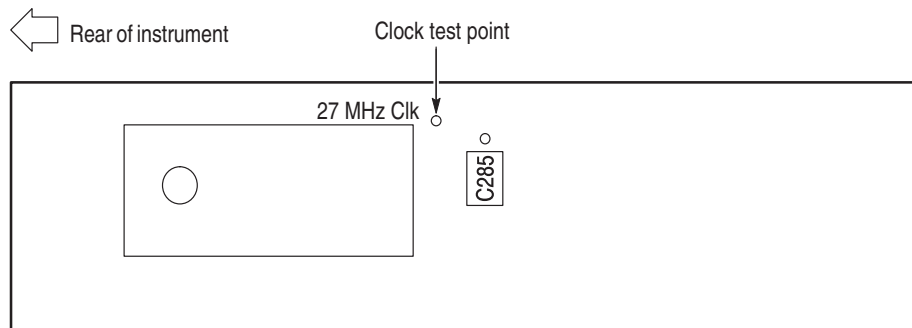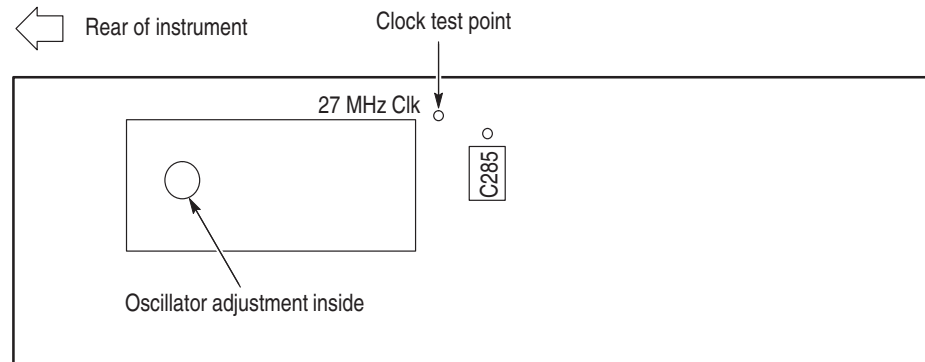
Figure 5–1: 27 MHz clock test point for frequency adjustment

⚠ *CAUTION. When inserting the metal bit of the adjustment tool in the oscillator adjustment access hole, do not let it slip off the oscillator adjustment. The metal tip can possibly short the +5 V to ground and cause an inductor on the reverse side of the board to open.*

12. Adjust the frequency counter for a reading of 27 MHz ± 5 Hz (26,999.995 to 27,000,005 Hz).

NOTE. The oscillator frequency specification is ± 27 Hz, but you must adjust the frequency to ± 5 Hz or less to allow for temperature variations while operating.

13. Turn off power to the server.

14. Remove the analyzer DSP module from the PCI extender board.

15. Remove the extender board from the server board connector.

16. Reinsert the analyzer DSP module in the server slot.

17. Align the module connector with the server connector and press down firmly to seat the module.

18. Reinstall the module hold-down screw.

19. Remove the generator DSP module.

20. Insert the PCI circuit board extender into the generator DSP module slot.

21. Insert the generator DSP module in the PCI extender board connector.

22. Turn the power to the server back on and wait for the initialization process to complete, and wait a few minutes for the oscillator temperature to stabilize.

23. Touch the frequency counter probe tip to the generator DSP 27 MHz Clk test point.

24. Adjust the frequency counter for a reading of 27 MHz $\pm$ 5 Hz (26,999.995 to 27,000,005 Hz).

25. Turn off power to the server.

26. Remove the generator DSP module from the PCI extender board.

27. Remove the extender board from the server connector.

28. Reinsert the generator DSP module in the server module slot.

29. Align the module connector with the server connector and press down firmly to seat the module.

30. Reinstall the module hold-down screw.

31. Install new cable ties used to hold the DSP module extenders in the front card cage slots. (These ties are very important to be in place if the server is going to be shipped commercially.)

This completes the adjustment procedure for the DSP modules.

Encoder Auto Cal

The adjustment procedure for the encoder module consists of checking the reference voltage for the correct level and running the encoder auto calibration routing. The automatic calibration routine compensates the adjustments of the encoder module for temperature changes and aging. Typically, you would use this feature about every six months to maintain optimum encoder operation. Use the following procedure to perform the encoder module adjustments.

Check the Encoder Reference Voltage

1. Locate the 1.250 V reference voltage test point TP75. The loop of the test point is near the center of the encoder board just above the gray plastic shell of a test connector (see Figure 5–2).

2. Set the DVM to measure DC voltage on the 2 V range.

3. Connect the – (GND) lead of the DVM to server chassis and the + lead to TP75.

4. Check for a reference voltage of 1.250 V $\pm$ 3 mV.

5. If the reference voltage is correct, continue with the encoder auto-calibration routine. If the reference voltage is out of tolerance, do not run the auto-calibration routine. Refer the problem to a qualified service person.

6. Replace the top server cover to allow the operating temperature to stabilize.
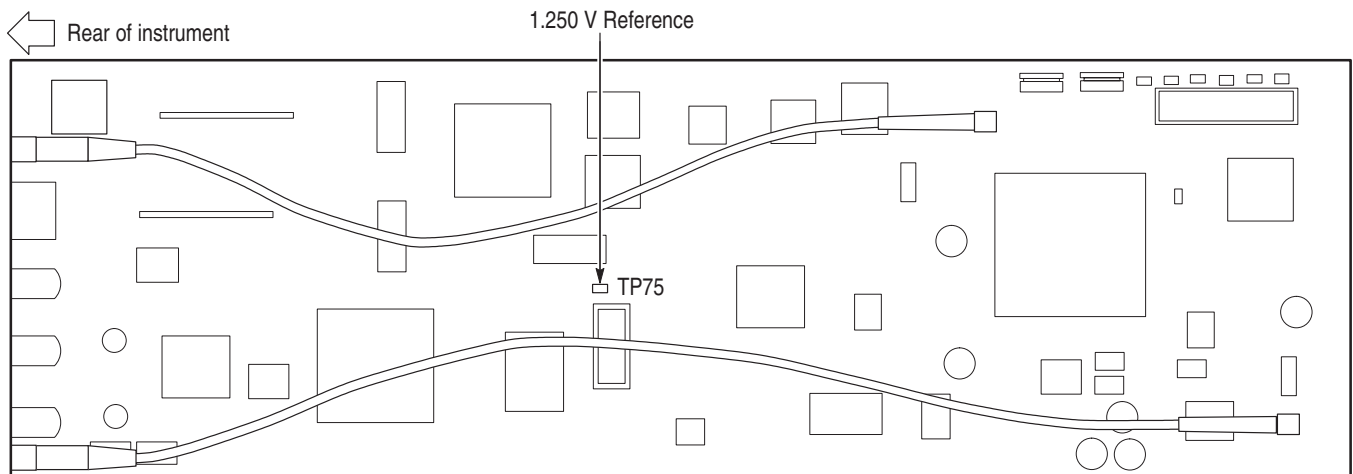
Figure 5–2: Location of TP75, the 1.250 V encoder auto-cal reference test point

Run the Encoder Auto Calibration Routine

1. Allow the PQA200 to completely warm up (about 20 minutes) before the using the automatic calibration feature. This time permits all the circuitry to stabilize and the auto-cal adjustments are then optimized for the normal operating temperature.

2. Click the Other soft key to display the selection menu and click on Hardware Settings and Diags to display the Hardware Settings menu seen in Figure 5–3. You will get a message telling you that all PQA200 applications must be stopped to continue. Click OK to continue.
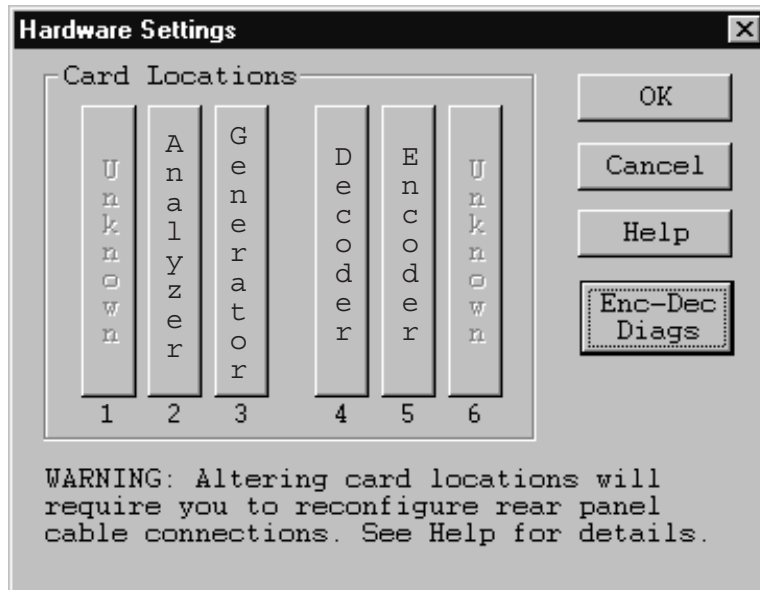
Figure 5–3: Hardware settings menu

3. Click on the Enc-Dec Diags soft key to display the Encoder and Decoder
Diagnostics menu shown in Figure 5–4.
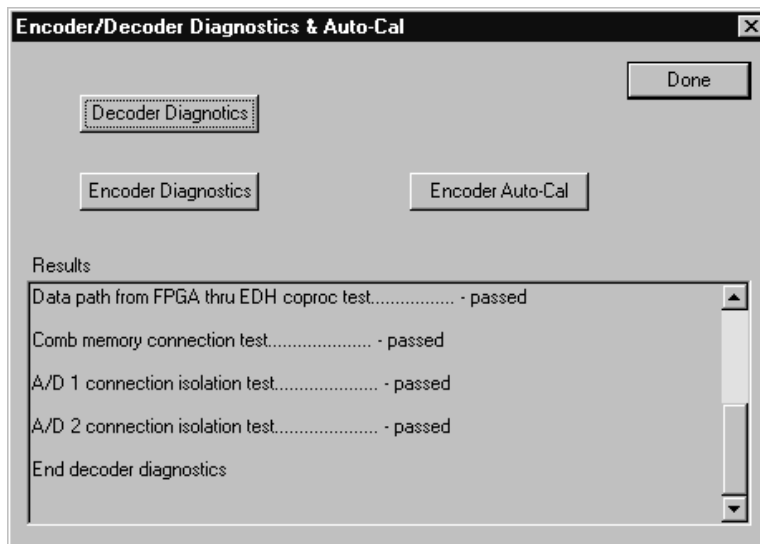
Figure 5–4: Encoder/Decoder diagnostics and Encoder Auto-Cal

4. Click the Encoder Auto-Cal selection.

5. After the auto calibration has finished, run the Encoder Diagnostics to check for pass or fail of the diagnostic tests.

6. If the the encoder shows diagnostic failures after the auto calibration, refer your PQA200 system to a qualified service person for repairs.

Decoder Board Adjustments

The hardware of the decoder module supports a field calibration procedure. The adjustments of the Luma and Chroma gain have built in indicators for showing the accuracy of the adjustments.

Adjust Luma Gain   **1.** Set the Mode switch to position 1 (see Figure 5–5).
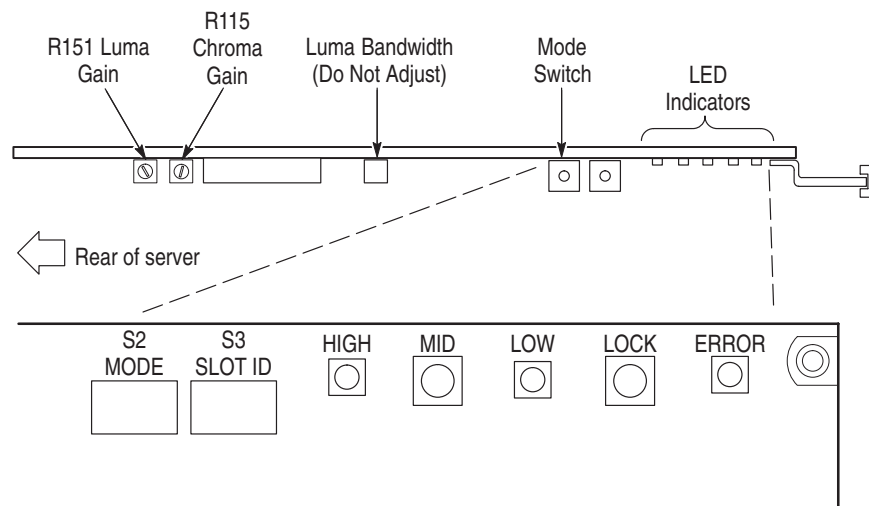
Figure 5–5: Decoder board LED indicator locations

2. Adjust R151 Luma Gain (see Figure 5–6) until the MID (green) LED indicator is on and the LOW and HIGH LED indicators are either equal or off. The Luma Gain adjustment is about one third of the way down from the top of the board.
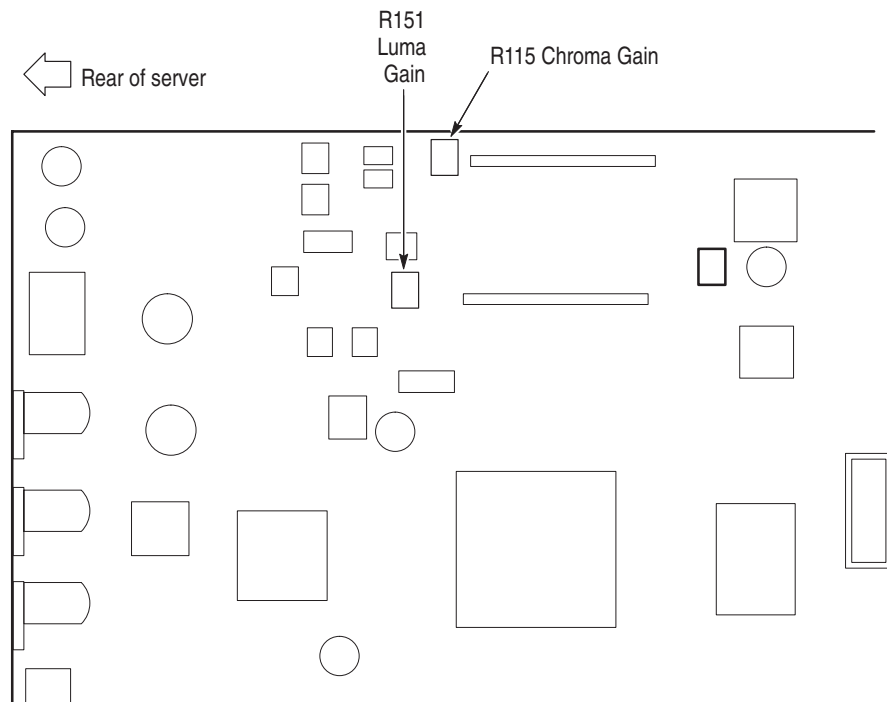
Figure 5–6: Decoder board adjustment locations

Adjust Chroma Gain

1. Set Mode switch to position 2.

2. Adjust R115 Chroma Gain until the MID (green) LED indicator is on and the LOW and HIGH LED (red) indicators are equal or off. The Chroma Gain adjustment is at the top of the board.

3. Set Mode switch to 0 (normal run mode).

4. Check the blanking adjustment on the HIGH and LOW LED indicators. Both red LED indicators should be off but it is normal for them to blink occasionally as the blanking level is adjusted.

Run the Decoder Diagnostic

1. In the menu selections under the Other soft key, click the Hardware Settings & Diag selection. You will get a message telling you that all PQA200 applications must be stopped to continue. Click OK to continue.

2. From the Hardware Settings menu select ENC-DEC Diagnostics.

3. In the ENC-DEC Diagnostics menu select Decoder Diags.

4. Verify that all diagnostics pass. If they do not, refer your instrument to a qualified service person for repairs.

5. Disconnect all test equipment and reinstall the top server cover.

This completes the field adjustments for the PQA200 sPQA200 system.

Maintenance

Maintenance

This section provides the service information for the PQA200 Picture Quality Analysis System. Information about the following topics is provided: Handling Static-Sensitive Components, Cleaning and Inspection, Removal and Replacement Instructions, Server Diagnostics, and Troubleshooting.

Preparation

These maintenance instructions are for qualified technicians. Be sure to read the Safety Summaries at the front of the manual before beginning service.

Prior to removing the covers from the server, read *Handling Static-Sensitive Components*.

Handling Static-Sensitive Components

This instrument contains electrical components that are susceptible to damage from static discharge. Static voltages from 1 kV to 30 kV are common in unprotected environments. Table 6–1 shows the relative static discharge susceptibility of various semiconductor classes.

Table 6–1: Static susceptibility

Semiconductor class	Voltage
ECL	200 V - 500 V
Shottky Signal Diodes	250 V
Shottky TTL	500 V
HF Bipolar Transistors	400 V - 600 V
JFETs	600 V - 800 V
Linear Microcircuits	400 V - 1000 V
Low Power Schottky TTL	900 V
TTL	1200 V

Observe the following precautions to avoid damaging static-sensitive devices:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive components or assemblies.

3. Discharge the static voltage from your body by wearing a wrist grounding strap when handling static-sensitive components. Service assemblies containing static-sensitive components at static-free work stations.

4. Remove any device capable of generating or holding a static charge from the work station surface.

5. Whenever possible keep the component leads shorted together.

6. Pick up components by the body, never by the leads.

7. Do not slide components over any surface.

8. Avoid handling components in areas where the floor or work surface covering is capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only special antistatic suction or wick-type desoldering tools.

Cleaning and Inspection

Preventive maintenance consists of cleaning and visual inspection. The schedule depends on the severity of the operating environment. Under average conditions, perform preventive maintenance after 2000 hours of operation.

Clean the entire Test System often enough to prevent dust and dirt from accumulating. Dirt can act as a thermal insulating blanket that prevents effective heat dissipation. In addition, dust buildup can provide high-resistance electrical leakage paths between conductors or components in a humid environment.

Exterior. Cleaning the exterior consists of an occasional wiping of the outside surfaces with a damp soft cloth. Do not use commercial cleaners because they could discolor or damage the finish.

Check all of the server and Monitor air vents on a regular schedule to ensure that there is not a dust buildup that could impede the flow of cooling air.

Monitor. The screen requires occasional cleaning. Turn the Monitor off before cleaning its screen. Use a commercial glass cleaner and a soft, lint-free cloth to

remove surface grime and polish the faceplate. Use the minimum amount of cleaner necessary.

Keyboard. The keyboard may require occasional cleaning to remove lint or oil buildup. Use the following procedure to clean the keyboard.

1. Turn off the main power switch.

2. Unplug the keyboard from the server.

3. Clean all lint and loose debris from the keyboard with either clean, dry, low velocity air or with a clean, soft brush.

4. Clean the external surfaces with a soft cloth dampened with a solution of mild detergent and water. Do not allow solution to run into the keyboard.

CAUTION. If liquids such as coffee or soft drinks have gotten into the keyboard, intermittent operation can occur. If this has happened, consider replacing the keyboard.

Mouse. Occasional cleaning is necessary to remove accumulated lint, which hampers smooth ball movement. Use the following procedure to clean the inside of the ball cavity. If the mouse is damaged, replace it.

1. Turn off the main power switch.

2. Unplug the mouse from the server.

3. Turn over the mouse and loosen the ball retaining ring by inserting your fingers into the slots and turn in the direction indicated by the arrows (counterclockwise) approximately 45 degrees.

4. Turn the mouse right side up, cupping the bottom of the mouse in your hand, and gently tap until the retaining ring and ball drop into your hand.

5. Clean all lint and loose debris from the ball cavity with either clean, dry, low velocity air or with a clean, soft brush. Next, clean any remaining foreign material from the ball cavity with a soft, clean cloth. Do not use hydrocarbon or chemical-based cleaning solutions inside the ball cavity.

6. Replace the mouse ball and retaining ring. Rotate the retaining ring clockwise (opposite direction to the arrows) until the ring locks into place.

⚠ **WARNING.** *To avoid any potential of electrical shock, disconnect power before removing the server side panels or monitor covers.*

Interior. Interior cleaning is not recommended, but if necessary, use low-velocity, dry air to blow away dust or lint. If air alone does not remove all of the dust and lint, use a soft brush to complete the task. Exercise extreme care not to disturb components on the plug-in circuit boards during cleaning.

⚠ **CAUTION.** *This instrument contains static sensitive devices that can be damaged by static discharge. Wear a wrist grounding strap when working on or with modules inside the server cabinet.*

Removal and Replacement Instructions

The following procedures tell you how to remove and replace the analyzer and generator DSP modules, the video card, and the hard drive assembly. Part numbers for the modules are in the *Replaceable Parts List*. In compliance with the EISA standard the PQA200 system modules are in the server card cage.

Replaceable PQA200 Modules

The standard PQA200 Picture Quality Analysis System consists of the following replaceable components:

- Analyzer/Capture DSP module

- Generator DSP module

- Video Monitor module

- Composite encoder module (Option 01)

- Composite decoder module (Option 01)

Figure 6–1 on page 6–6 shows the location of the replaceable modules in the PQA200 Picture Quality Analysis System.

Recommended Tools

The following tools are recommended forPQA200 Picture Quality Analysis System assembly removal and replacement:

- An anti-static wrist strap for safe handling of assemblies containing static sensitive devices

- A screwdriver with T15 Torx tip to remove the module mounting screws

- A 1/4 inch or larger flat tip screwdriver to remove server side panel screws

NOTE. Security screws are installed to prevent the server card cage, the CPU unit, and the fan from being removed from the server. These screws are accessed by removing the server side panel. Attempting to force removal of the assemblies with a security screws installed can cause the release mechanisms to be broken.

Removing the Server Top Cover

The PQA200 system modules are located in the top server card cage.

1. Be sure that you are wearing a static grounding wrist strap.

2. Before removing the top cover, shut down the server and unplug the power cord.

3. The panel thumbscrews for the top and side panels are located in the front of the server behind the front door. If locked, unlock the front door and open the door.

4. One knurled thumbscrew holds the top panel in place. In most cases it is only finger-tight; if necessary, use a coin in the slot for added leverage.

5. Slide the top panel toward the rear of the instrument about 0.75 in (1.9 cm). Note that the EMI gasket material on the top cover makes the top cover hard to release.

6. Disengage the top panel tabs from the top of the server by sliding the top panel out about 0.375 in (1 cm).

7. Lift up and remove the top panel to gain access to the server EISA card cage. See Figure 6–1.

⚠ *CAUTION. The server interior can overheat, resulting in component damage, if the instrument is operated with the cover removed for more than a few minutes. Do not operate the server with any of the covers removed as they are an integral part of the cooling system.*

Top view of card cage with the Option 01 PQA200
modules installed (top cover removed)

◁ Rear of instrument

Analyzer DSP

Generator DSP

Decoder

Encoder

Monitor Driver

Slot

1

2

3

4

5

6
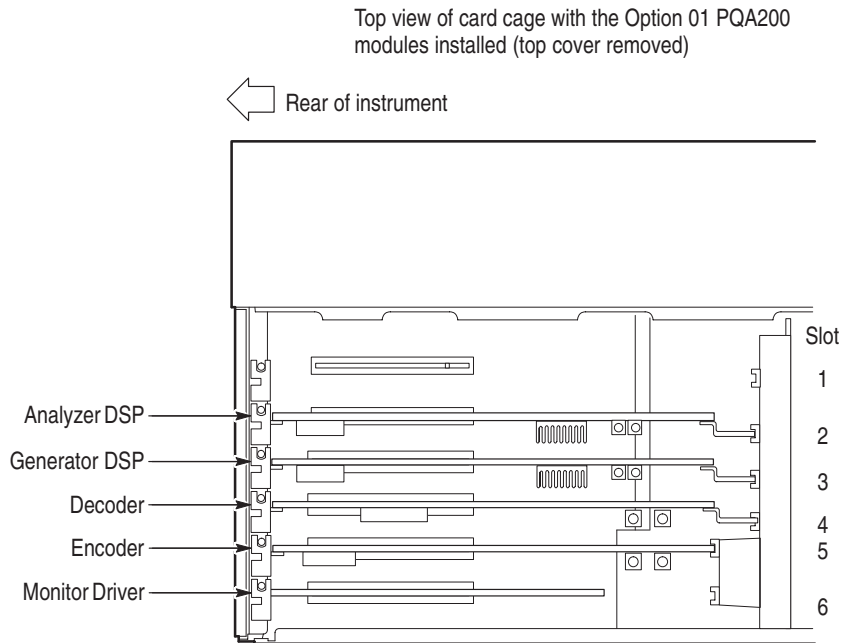
Figure 6–1: Top view of the server expansion card cage

**Removing a
PQA200 Module**

1. Remove the seven screws that hold the rear panel to the server card cage.
   Note that removing the rear panel is not necessary to remove and replace the
   video driver module. For the PQA200 system modules, the rear panel must
   be removed to provide more clearance for the board connectors.

2. Remove the two screws and flat washers from the 15-pin connector on the
   video driver module (see Figure 6–2).

3. Remove the nuts (7) and lock washers from all the SMB connectors on the
   encoder, decoder, and DSP modules using a 1/4 inch thin wall socket and
   remove the rear panel.

4. If there is a tie-down strap on the extension bracket of the module to be
   removed, cut it to release the module.

5. Remove the module holding screw from the module to be removed.

6. Carefully pull up on the module to loosen it from the module connector.

7. When the module is loose from the connector, slide the board extension up
   out of the front slot and turn the module so that the module connectors clear
   the card cage slots.

8. Lift the module up and out of the server.

9. Place any removed module on a static free work area.
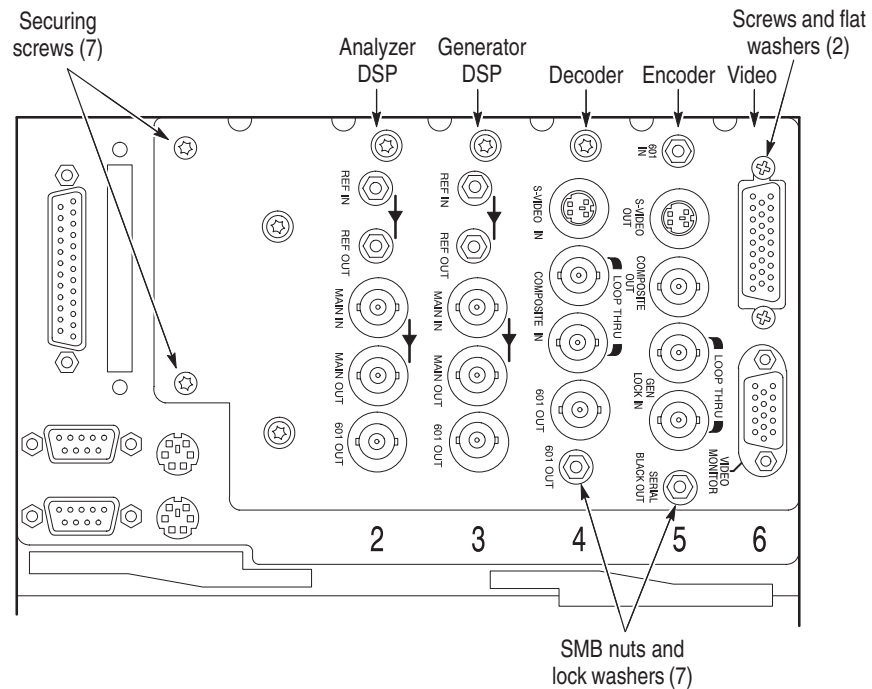
Figure 6–2: The PQA200 Option 01 rear panel

Reinstalling a PQA200 Module

1. Insert the module into the card cage at an angle that allows the module BNC connectors to clear the rear lip of the card cage and fit into the connector access slot in the card cage. Note, the encoder module and the video driver modules connectors will clear without angling the modules into place.

2. Carefully align the module edge connector with the card cage connector.

3. Apply firm pressure to completely seat the module in the connector.

4. Replace the module holding screw to hold the module in the card cage.

5. Use a new cable tie to replace the tie-down strap over the module extension bracket.

6. Replace the rear panel. Do not over tighten the panel holding screws.

7. Install the nuts and lock washers removed in step 3 on the encoder, decoder, and DSP SMB connectors. Tighten securely, but do not over tighten the nuts on the connectors. Note that the encoder SMB connectors (Serial Black and 601 In) may have to be held into the holes to get the nuts started and tightened. You can remove the Video module from slot 6 to access the connectors to hold them in place (especially the bottom one), if necessary.

8. If you removed the Video module replace it now.

9. Install the two screws and flat washers in the holes that secure the rear panel at the 15-pin connector on the Video module.

Reinstalling the Server Top Panel

Use the following procedure to reinstall the server top panel.

1. Set the top panel on top of the chassis rail.

2. Align the tabs on top panel to the server chassis slots and push the panel all the way on.

3. Slide the top panel forward until the front of the top panel is aligned with the front of the server.

4. Push in on the thumbscrew to start it and tighten it to hold the top panel in place.

5. Close the front door.

Removing the Hard Disk Drive

The server disk drive resides in the server front access disk bay. The server side panel must be removed to access the power cable and the SCSI cable to the drive.

1. Be sure that you are wearing a static grounding wrist strap.

2. Shut down the server and unplug the power cord.

3. Open the front door of the server.

4. Loosen completely the captive thumbscrew that holds the disk drive access door shut (see Figure 6–3) and lift the access door away from the server.

5. Loosen completely the two captive thumb screws securing the left side cover to the server chassis. In most cases they are only finger-tight; if necessary, use a coin in the slot for added leverage to loosen them.

6. Slide the side cover back about 1 inch to disengage the tabs on the side cover from the slots in the server chassis and remove the side cover.

PQA200
(front view with front door removed)

Side panel
thumbscrews

Thumbscrew
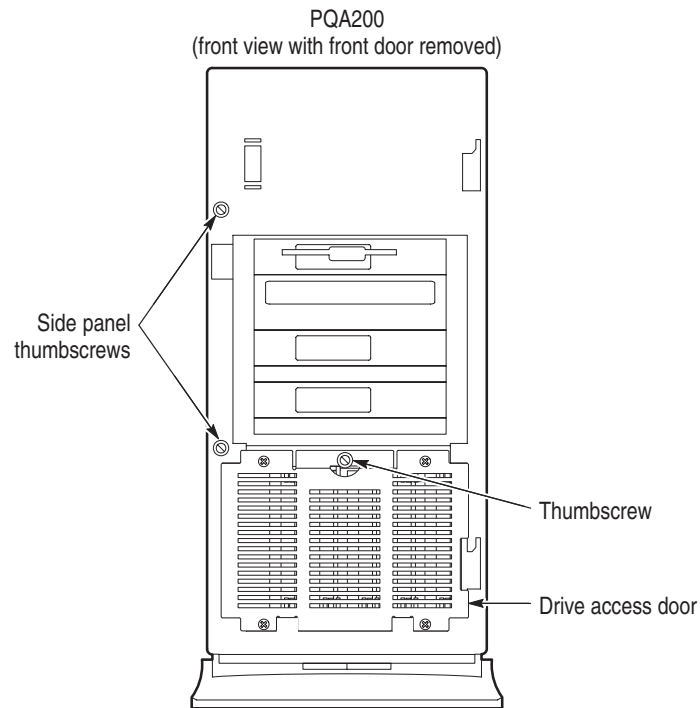
Drive access door

Figure 6–3: Front of server shown disk drive access

7. Unplug the disk drive power plug of the drive. See Figure 6–4.

8. Unplug the SCSI cable of the drive.

9. Grasp the plastic retaining clips that secure the disk drive in the bay (see Figure 6–4). Squeeze the retaining clips and pull the drive straight out about half way.

10. When the disk drive is part way out, place one hand under the drive to support it and pull the drive out of the server.

11. Place the drive on a static free work area.

Squeeze the retaining clips on both sides of the disk
drive to release the disk drive from mainframe.

Slide the disk drive out
of the mainframe.

Unplug the controller cable
from the disk drive.

Unplug the power cable
from the disk drive.
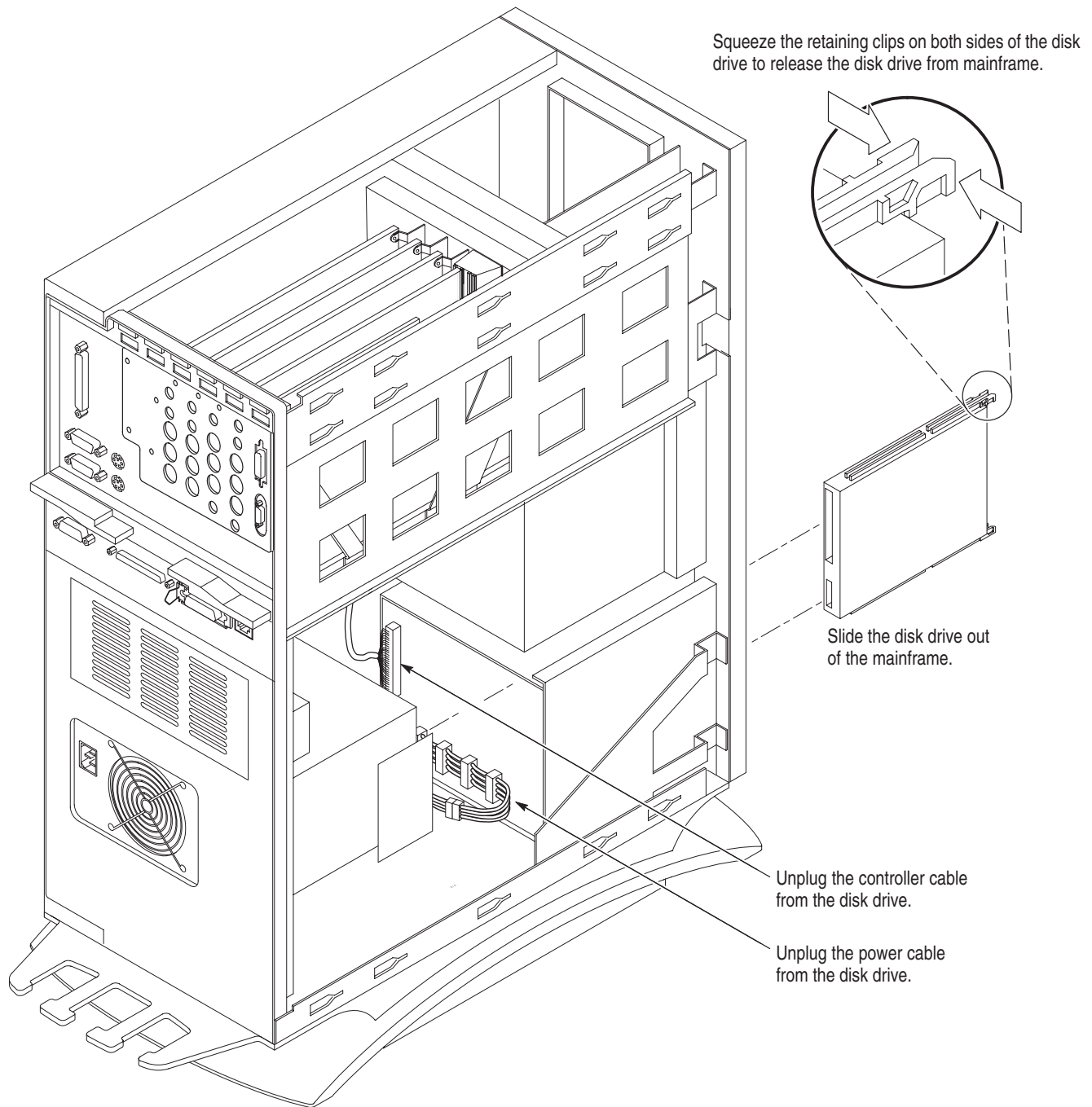
Figure 6–4: Removing the server hard disk drive

**Installing the Server
Hard Disk Drive**

1. Wear a static grounding wrist strap when handling a disk drive. Take care not to touch the components on the side of the drive.

2. Dress all cables away from the disk bay so that they do not interfere with installing the disk drive.

3. Check to be sure that there is no obstruction in the disk bay where the drive is going to be installed.

4. Holding the disk drive from the bottom, start the drive guides into the tracks.

5. Once the drive has started in, push in on the front of the drive until the retaining clips lock into place.

6. Connect the power and SCSI control cables to the drive.

7. Insert the tabs on the bottom of the front access door in the slots in the server chassis.

8. Close the door and push in the captive thumbscrew to start the screw threads and tighten the screw.

9. Align the tabs on the side panel with the slots in the server chassis and push the side panel tabs all the way into the slots. Then slide the side panel forward to its correct position.

10. Push in on the captive thumb screws to get them started, and tighten them to secure the side panel to the server.

11. Reinstall the top cover panel if it is not installed.

Server Diagnostics and PQA200 System Troubleshooting

ThePQA200 Picture Quality Analysis System consists of two major elements, a server (computer) and the PQA200 system hardware and software that are added to it. The computer has built-in diagnostic routines that check to see that critical items are present and can be accessed. The Analyzer hardware relies on isolating the defective module as the means of locating a failure. *Appendix B: Software Repair* has instructions for reloading both the operating system (Windows NT) and the application software.

There are two types of PC diagnostics. One is a set of tests that are automatically performed each time that the power is turned on. A second and more complete set is called in from a menu and provides the user with a choice of tests.

The PQA200 system troubleshooting routines are designed to isolate failures of the PQA200 Picture Quality Tester system hardware. The key hardware elements are the analyzer DSP and generator DSP modules for the standard instrument. The composite video option adds a decoder module and an encoder module.

Server Diagnostics   The server diagnostics ignore the PQA200 system modules and deal only with the PC. The power-on, self-test is run each time the server is powered on to determine that its hardware is operational. The diagnostics are a set of user selected test routines that can be used to look at specific areas of server operation. For more information consult the server manual provided by Compaq.

Power-On Self-Tests. This is a set of tests that run automatically at power up. If a system error occurs, an error code is displayed. For some error conditions, an audible alarm (consisting of one or more "beeps") is generated. Operation of the following server assemblies is checked:

- System Board

- Power Supply

- Memory

- Controllers

- Floppy Disk Drive

- Keyboard

A complete list of *"Error Codes and Instructions"* for the server is in the Compaq server manual.

Diagnostic Routines (DIAGS). These are the routines called from "Diagnostics and Utilities" selection of the "EISA Configuration Utility" menu. They provide routines to test, to inspect, to upgrade, and to diagnose the server. The following routines are called from the *"Diagnostics and Utilities"* menu:

- Test Computer

- Inspect Computer

- Upgrade Firmware

- Remote Utilities

- Diagnose Hard Drive

For more information on any of these items, consult *"Diagnostic Tools"* in the Compaq server manual.

If the server diagnostic program passes all tests, troubleshoot the PQA200 system hardware.

Troubleshooting the PQA200 System	To troubleshoot the PQA200 system, try to run the application. If the application runs, you can test the PQA200 system. If the application does not run, either the application software or one of the DSP modules may have failed. Instructions for *Software Repair* are located in *Appendix B*. Also, refer to *Fault Isolation* on page 6–13 for some suggestions on isolating the fault to a specific area or module.

Before attempting to repair the Analyzer test system, read the preliminary information.

Fault Isolation   Use the following fault isolation suggestions to determine the area or module causing a problem.

First Steps.

■   Examine the server for non-standard hardware or modules. The addition of modules not part of the PQA200 system can lead to compatibility problems.

■   Check the system for non-standard software installed on the server. The PQA200 system is not a general purpose computer, and some software can interfere with the operation of the PQA200 operating system firmware.

■   Look for failure and error messages. Refer to *Error Messages During Operation* on page 6–26 for a description of the error messages and possible action to take to correct the problem.

■   Is the system partially operational? Check the portions of the server that are apparently not operating correctly. Run simpler test. For example, make a digital signal measurement only to check the operation of the DSP modules. Check the analyzer DSP and decoder singly and as a unit; then check the generator DSP and encoder singly and as a unit to isolate the problem to a module.

■   Run the decoder and encoder module diagnostics to check for correct or incorrect test results.

■   Check the module LED indicators for error codes or correct operation.

Second Level.

■   If the system fails to boot up, remove the PQA200 modules to isolate the problem to either the server or the PQA200 modules. Troubleshoot this problem by removing the top cover of the server to check on the LED displays on the DSP, encoder, and decoder boards. If one or the other of the DSP modules does not have the LED displays working normally, suspect the DSP module that does not have a correct LED display. Refer to the DSP LED Codes on page 6–19 for a description of the LED boot up error codes and normal operation. If the boot up occurs normally with the PQA200 module removed, you will have to replace the defective DSP module.

- If the problem persists, remove the Encoder and Decoder modules. Make tests with the DSP modules only to determine if they are functioning correctly.

- Run a test with either the analyzer DSP only installed, or with the generator DSP only installed. If you have a source of 601 video, supply the analyzer with a signal and check live play back. For the generator DSP, connect the 601 out to a serial digital monitor, and generate a sequence to check for correct operation. You can use the Hardware Setup selection in the Other soft key menu to swap the function of a single DSP module between analyzer and generator to check both operations of the DSP.

PQA200 DSP Diagnostics

The PQA200 system diagnostics consist of the boot up tests that are done at power on. If the system boots up and the application runs, the majority of the DSP hardware is functional. An area of the circuitry that is not tested by the boot up tests is the PCI DMA operation. That area of operation can be tested using the DMA tests that are included in the testdsp test suite. The diagnostic tests are described in Table 6–2.

DMA Test Description

The tests provided in the testdsp program include various DMA tests. The main objective of these DMA tests is to check the operation of the PCI hardware/software subsystem on the PQA200 DSP board. The failure of one or more of these tests may indicate potential problems with PCI subsystem.

During a DMA read, data is transferred from the DSP memory to server memory. For a DMA write, date is transferred from the server memory to the DSP memory. The following tests are used to verify the DMA (direct memory access) circuitry. The test name is followed by the test number in the testdsp test suite.

Table 6–2: DMA Tests in the testdsp test suite

Test name	Required input	Description	Failure indication
DMA write (test #8)	None	This test writes a single field (field 1) of random numbers to DSP memory using DMA. No checking for the validity of the transferred data is done. It is only looking for a successful DMA write.	Any failure resulting from this test indicates a potential DMA write failure.
DMA write (test #31	None	Same as test #8. Only difference is that it writes field 2.	

Table 6–2: DMA Tests in the testdsp test suite (cont.)

Test name	Required input	Description	Failure indication
DMA read (test #7)	None	This test writes two fields (field 1 & 2) to DSP memory with known data. The fields are initialized with incremental 16 bit data. In other words, it puts 0 in first pixel, 1 in the next, and so on until the 64K value (16 bit) is reached. This process is repeated until the entire filed is initialized. After a successful DMA write, it reads back the data from DSP memory using DMA read. The validity of the data is checked by comparing both data sets. The comparison should result in zero difference if no errors occurred. This test writes two fields (field 1 & 2) to DSP memory with known data. The fields are initialized with incremental 16 bit data. In other words, it put 0 in first pixel, 1 in next and so on till 64K value (16 bit) is reached. This process is repeated until the entire filed is initialized. After successful DMA write, it reads back the data from DSP memory using DMA read. The validity of the data is checked by comparing both data sets. The comparison should result in zero difference if no errors occurred.	Any failure resulting from this test indicates a potential DMA read or write failure. This may also indicate potential DSP memory failure but it may be unlikely since complete memory test is also done as a part of the DSP boot ROM diagnostics during power up.
DMA performance (test #29)	None	This test writes 30 frames (field 1 & 2) to DSP memory with random data by varying DMA block size from 128K down to 2K. It reads back the data from DSP memory using DMA read. No checking for the validity of the transferred data is done. It is only looking for a successful DMA read/write for various block sizes.	Any failure resulting from this test indicates a potential DMA read or write failure.
DMA test using 601 Capture (test #35)	Any 601 video input (does not have to be a stripped video)	This test captures two 601 frames. The captured data is read using a DMA read, and than sent back to DSP memory with a DMA write. After the DMA round trip, the data is played on 601 output.	Any failure resulting from this test indicates a potential DMA read or write failure. Also visual inspection of 601 output data may help detect possible PCI FIFO type problems (vertical stripes or garbage data).

Testdsp Commands

The tests provided by the testdsp command were used in the development and testing of the DSP modules in manufacturing. The testdsp program remains in the PQA200/bin/support directory for use in testing the DMA circuitry that is not tested by the boot up diagnostics. The tests are run from a DOS window by typing the following command:

```
testdsp <options> <test> ...
```

where `<test>` may be the word `all`, `working`, or one or more of the test numbers from Table 6–3. The list of test options is given in Table 6–4.

The command `testDsp working` is equivalent to the following command:

`testDsp 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 18 20 21 22 23 26 29 30 31 32 35 36 47 48 49`

Running the DMA Tests. The DMA tests defined in Table 6–2 are run by using the testdsp command with the appropriate test number or set of numbers. For example, to run the DMA performance test, use the following command:

`testdsp 29`

This runs test 29 on the analyzer DSP module. To run the same test on the generator module, use the same command with a board argument as follows:

`testdsp -bd 1 29`

Table 6–3: Testdsp test suite

Test number	Test purpose	Test number	Test purpose
1	basic connectivity	31	DMA write (field 2)
2	request flood	32	acquire many, any target
3	single noop	33	acquire many, specific target
4	create sequence	34	acquire, specific target
5	acquire, no target Pattern A	35	capture-play
6	acquire, any target Pattern A	36	capture-play, any target
7	DMA read	37	capture, specific target
8	DMA write	38	loop through
9	dual-port read	39	loop through, any target
10	dual-port write	40	loop through, specific target
11	DMA write (too large)	41	field 1 target, any
12	dual-port performance	42	field 1 target, specific
13	acquire many frames	43	acquire overflow
14	shift detect	44	get info
15	level/gain/crop detect	45	early cancel acquire
16	jnd precompute mem error	46	bad sequence release
17	jnd mem error	47	jnd chroma maps
18	jnd precompute	48	shift detect Pattern B
19	jnd luma	49	level/gain/crop detect pattern B
20	shift correct	50	acquire, any target Pattern B
21	dual-port lockup	51	acquire, specific target Pattern B

Table 6–3: Testdsp test suite (cont.)

Test number	Test purpose	Test number	Test purpose
22	shift: shift/detect/correct/detect Pattern A	52	shift: shift/detect/correct/detect Pattern B
23	LG: correct/detect/correct/detect Pattern A	53	LG : correct/detect/correct/detect Pattern B
24	playback	54	calibrate port
25	jnd composite	55	encode stripe
26	jnd luma maps	56	decode stripe
27	jnd composite maps	57	capture 1 frame
28	dual-port ^C death	58	unexpected dma write
29	DMA performance	59	unexpected dma read
30	invalid request length		

Table 6–4: Testdsp options

Option	Purpose
-v	produce verbose diagnostics
-i	turn on the interactive mode
-f	flush the request queue (risky)
-bd #	specifies the board number to use (default is 0)
-cpu #	specifies the cpu number to use (use 0 or 1, default is 0)
-async	wait for replies and events with a separate thread
-dsig	use direct signaling through dual-port ram instead of the driver
-reset	reset the processor on startup
-busy	use a busy wait when sleeping instead of the driver
-ntsc	assume ntsc input and output (default)
-pal	assume pal input and output
-target #	specifies target id number for capture tests labeled as a "specific target." The number may be specified as decimal or hex (default is 512)
-port #	specifies input port; A or B (default is A)
-sleep	use the driver to sleep (opposite of -busy). This is the default.
-kick	signal the dsp (through dual-port ram) before sleeping on the request queue
-modulo #	specify the modulo used in createSequence and acquire requests (default is 8)
-load	saturate the cpu while tests are in progress

DSP Troubleshooting Checks

If the boot-up diagnostics do not pass because of a possible DSP module failure, the server usually will not complete the power-on initialization. Use the following checks to isolate the problem to either DSP.

1. Wear a static grounding wrist strap and use appropriate static protection procedures when working inside the server.

2. Turn off the power to the server and disconnect the power cord.

3. Remove the top cover of the server to gain access to the DSP modules. Refer to *Removing the Server Top Cover* on page 6–5 for that procedure.

4. Reconnect the power cord and, while watching the LED indicators located along the top edge at the front of the modules, turn the server power on.

CAUTION. *The server interior can overheat, resulting in component damage, if the instrument is operated with the cover removed for more than a few minutes. Do not operate the server longer than necessary to check the LED indicators with the top cover removed.*

5. Check that the eight LED indicators on both DSP modules (see Figure 6–5) come on and begin a step pattern as the boot up progresses. The Boot ROM codes are shown in Table 6–5
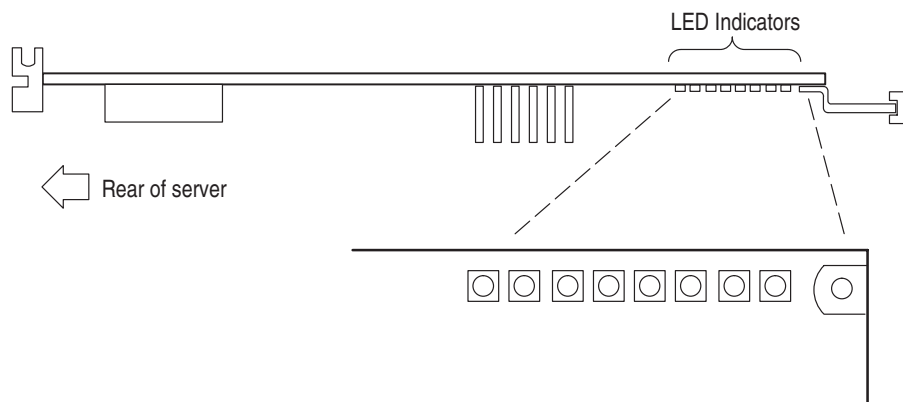
Figure 6–5: LED indicators on the DSP modules

DSP LED Codes

During Boot up and subsequently to Boot up, the DSP LED indicators display code patterns. A number of the codes occur as the normal boot up process. Others provide indication of a failure of the normal boot up process. The error codes repeatedly flash with a specific code when a Boot ROM diagnostic fails. The Boot ROM must be functional for these diagnostics to occur. If the module is completely inoperable, the Boot up diagnostic can not run.

To aid in diagnostics of a hardware problem, each test loop continues until it succeeds. Table 6–5 provides a description of the codes that are displayed. Black signifies off; white is on.

Table 6–5: DSP LED Codes
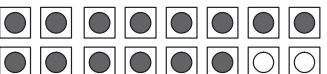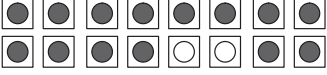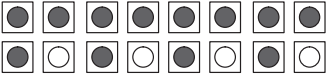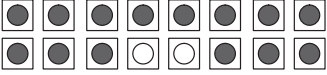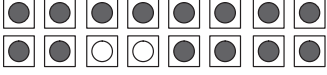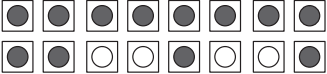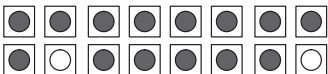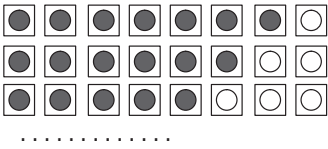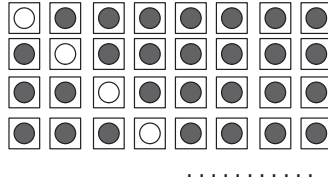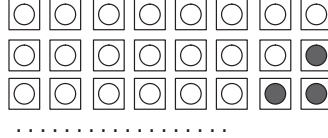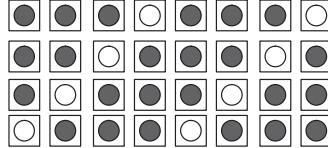
LED Indication	LED code meanings	Description
●●●●○○○○	Master C80 Processor is alive	The right four LED are lit to show that the master C80 processor is alive. If this fails to occur, either the master C80, the Boot ROM, or the bus connecting the parts are suspect.
○○○○●●●●	Slave C80 Processor is alive	The left four LED are lit to show that the slave C80 DSP processor is alive. If this fails to occur, either the master failed in trying to pass off control to the slave, or the slave C80 DSP or the bus to the C80 DSP is suspect.
●●●●●●●● ●●●●●●○○	Data bus failure	A flashing pattern of the rightmost two LED (0X03) indicates a likely data bus failure.
●●●●●●●● ●●●●●○○●	Address bus failure	A flashing pattern of the two LED next to rightmost LED (0x06) indicates a likely address bus failure. The failure pattern is followed by four other flashes that can be used to identify the first address that failed.
●●●●●●●● ●●●●○○●●	Boot ROM checksum failure	A flashing pattern of 0X0C indicates a failure in the Boot ROM checksum. Suspect a bad Boot ROM.
●●●●●●●● ●○●○●○●○	Bypass Port failure	A flashing pattern of 0X55 indicates the Boot ROM is unable to access either the Dual Port RAM interrupts or the PLX-9060 via the Bypass port.
●●●●●●●● ●●●○○●●●	Dual Port memory failure	A flashing pattern of 0X18 indicates a failure of the dual port memory. The failure pattern is followed by four other flashes that can be used to identify the 32-bit address of the first bad value.
●●●●●●●● ●●○○●●●●	SDRAM failure	A flashing pattern of 0X30 indicates a failure in the SDRAM.
●●●●●●●● ●●○○●○○●	DMA FIFO Programming Failure	A pattern of 0X36 indicates a lockup after programming the DMA. This test cannot be repeated, so the LED do not flash.

Table 6–5: DSP LED Codes (cont.)

LED Indication	LED code meanings	Description
	PLD Programming Failure	A pattern of 0X81 indicates a lockup after trying to program the inhibit bit in the PLD. This test cannot be repeated, so the LED do not flash.
	SDRAM test in progress	The SDRAM is tested after all other diagnostics are passed, and the board is waiting for the DSP application code to download. The LED light in succession to indicate the 16 MB SDRAM is being tested.
	Waiting for download	When the SDRAM test is complete, and a DSP application has not been started, the LED light in turn, making it look like they are bouncing back and forth. This is the normal indication that the DSP devices booted correctly and are operational.
	Downloading	During an application download, all the LED are set on. The LED count down using black for each segment that completes. Under normal circumstances, the download is done quickly and the flash is barely seen.
	Downloading error	If an error occurs that causes the DSP to hang, the halt is indicated by the LED being stuck in some stage of the download. This condition can occur with the application code being downloaded is corrupt in some way.
Normal Operation		
	Application is idle.	The right four LED are the master C80 indicators; the left four are the slave C80 indicators. When both are idle, the four master LED light in order, and the four slave LED light in order, making it look like two LED are flashing back and forth.
	Application is running.	As each DSP is called on to perform a task, the LED update for that DSP is halted, so while the master and slave C80 LED start in sync, they do not stay in sync.

6. Check that at the LED indicators on both modules begin a fast back and forth flash pattern at the end of boot up.

7. If the LED indicators on either DSP stop flashing with one or more LED on but not moving, suspect a problem with that DSP or corrupted application code.

8. Shut down the server. Use control-alt-delete to get the task list server and ask for a shutdown rather than a task termination.

9. Remove the suspect DSP module. Refer to *Removing a PQA200 Module* on page 6–6 for that procedure.

10. Power the server back on and check to see that the server completes the power on initialization correctly. You will not be able to run the complete application, but a good DSP will show the correct LED indications when it boots up correctly.

11. If the generator DSP module is installed, test the module by running the generator and viewing the 601 serial digital signal to verify that the generator DSP is operational.

12. If the analysis DSP module is installed, test the module by playing back a sequence for the external 601 monitor and viewing the 601 Out serial digital signal to verify that the analysis DSP is functional. If you have source for one of the video test references, you can run the capture, measure, and play back features to verify their operation. You can also swap the function of the DSP between analyzer and generator to check out the generate capability of a DSP.

Encoder and Decoder Diagnostics

1. Click the Other soft key to display the selection menu and click on Hardware Settings and Diags to display the Hardware Settings menu seen in Figure 6–6.

Figure 6–6: Hardware settings menu

2. Click on the Enc-Dec Diags soft key to display the Encoder and Decoder Diagnostics menu shown in Figure 6–7. The diagnostic test for each module are separately selectable.

3. Click the Decoder diagnostics selection.

   As the tests run, the test names are displayed in the Results box with the pass or fail result of the test. Use the scroll bar to view the completed test results.

4. If the decoder shows diagnostic failures, refer your PQA200 system to a qualified service person for repairs.

5. Click the Encoder diagnostics selection to run the diagnostics.

6. Check that all the diagnostic tests show a pass result. If all the encoder diagnostic tests show a pass result, go to step 8. If they do not all pass, continue with step 7.

7. Perform the Encoder Auto-Cal. The automatic calibration routine compensates the adjustments of the encoder module for temperature changes and aging. Typically, you would use this feature about every six months to maintain optimum encoder operation.
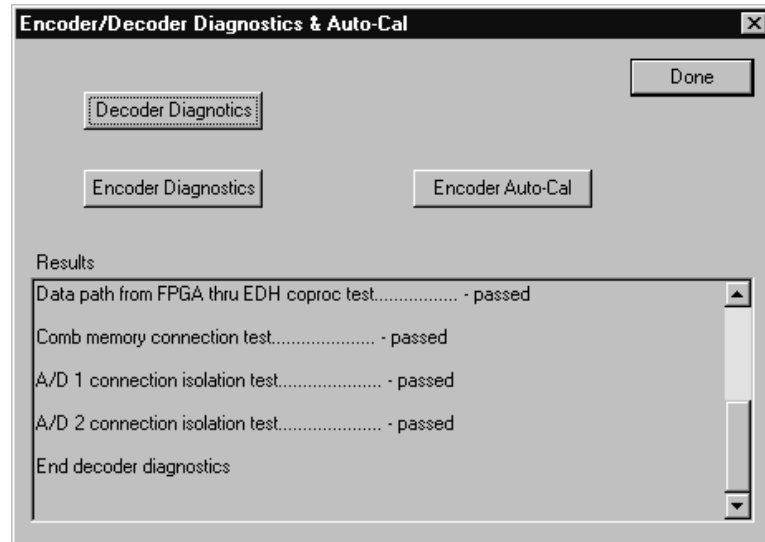
Figure 6–7: Encoder/Decoder diagnostics and Encoder Auto-Cal

      a. Allow the PQA200 to completely warm up (about 20 minutes) before the using the automatic calibration feature. This time permits all the circuitry to stabilize and the auto-cal adjustments are then optimized for the normal operating temperature.

      b. Click the Encoder Auto-Cal selection.

      c. After the auto calibration has finished, rerun the Encoder Diagnostics to check for pass or fail of the diagnostic tests.

  8. If the encoder still shows diagnostic failures after the auto calibration, refer your PQA200 system to a qualified service person for repairs.

Encoder LED Indicators   The encoder module has LED indicators (shown in Figure 6–8) to indicate normal and abnormal operation. Starting at the front of the encoder module and going to the rear, the LED indicators meanings are shown in Table 6–6.
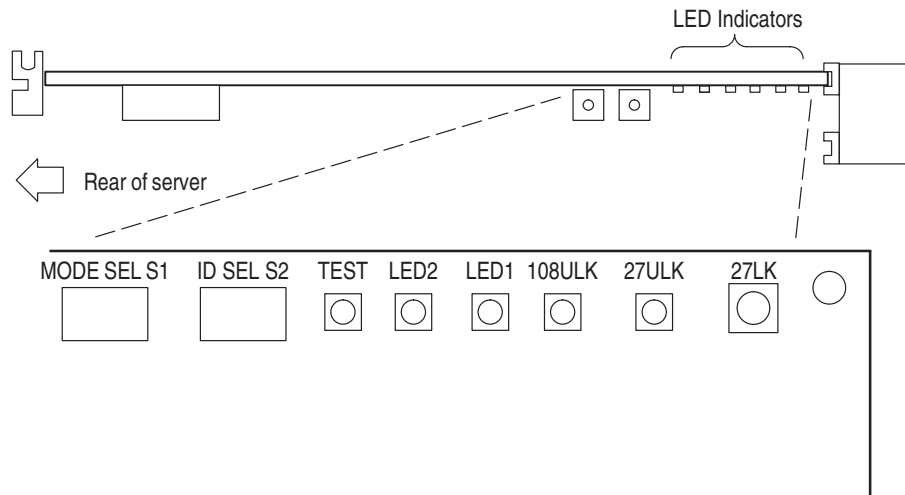
Figure 6–8: Encoder LED indicators

Table 6–6: Encoder LED indicators

LED Indicator	Meaning
27LK (Green)	The phase lock loop (PLL) controlling the 27 MHz VCO is operating properly.
27ULK (Red)	The phase lock loop controlling the 27 MHz VCO is not operating properly. Two different PLL can control the VCO: the black burst input or the serial video input.
108ULK (Red)	The phase lock loop controlling the 108 MHz VCO is not locked. The 108 MHz clock is used in the Color Field determination of the black burst input. The 108 MHz VCO is only needed in the black burst lock mode of operation.
LED 1 (Red)	Parallel serial data words passing through the two FIFO (U33 and U34) are not synchronized.
LED 2 (Red)	Indicates the condition at the output of the auto-cal comparator (U7). LED lit - high; LED off - low. This LED is only activated when in the FIFO pass mode of operation (trouble-shooting or evaluation non-normal operation).
Test (Red)	The Mode Sel switch (either the external switch or the equivalent software switch) is not in the normal operation position (position 0).

Decoder LED Indicators   The decoder module also has LED indicators (shown in Figure 6–9) to indicate normal and abnormal operation. Starting at the front of the encoder module and going to the rear, the LED indicators meanings are shown in Table 6–7.
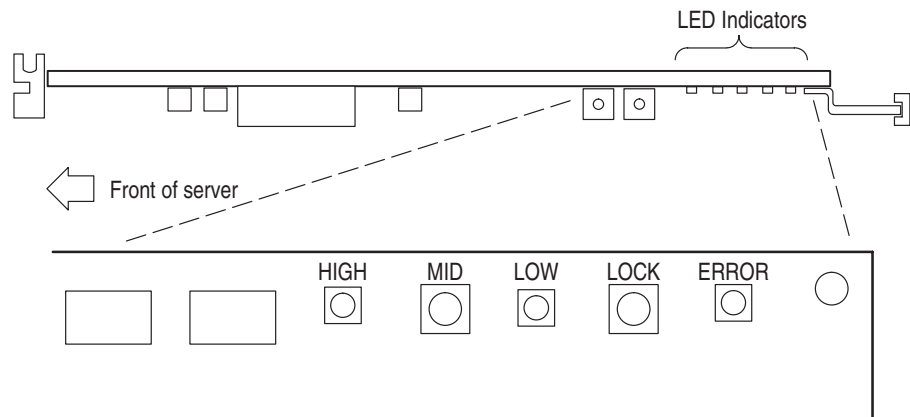
Figure 6–9: Decoder LED indicators

Table 6–7: Decoder LED indicators

LED Indicator	Meaning
Lock	Green LOCK indicates no major errors. If both LOCK and ERROR are on, then the FPGA (field programmable gate array) is not programmed.
Error	Red ERROR indicates any of a combination of sync present, burst present, burst lock, and serial lock errors, plus several more internal timing errors from the board horizontal counters, the vertical counters, and color frame decision circuits. The master lock flag is held high until everything is stable and ready to measure. Master lock is considered a fatal error if it persists.
Low	In Run Mode, the MID (green) LED should be on, and the red HIGH and LOW LED are off. except for occasional flashes as the blanking is adjusted. If either HIGH or LOW LED is on continuously, a blanking error is indicated.
Mid	In CAL Mode, HIGH and LOW indicate calibration levels. If MID is green then the gain is within 0.3%.
High	

Video Driver and Monitor Troubleshooting Checks

Use the video output of the server to isolate a monitor or video module problem.

1. Disconnect the SVGA monitor from the video driver module.

2. Remove the video driver module from the server. Refer to *Removing a PQA200 Module* on page 6–6 for the removal procedure.

3. Connect the SVGA monitor to the server video connector.

4. Restore power to the server. As part of the Windows NT initialization procedure you will be given the choice to boot up for a VGA display. Select to use the VGA option. If the video display is correct, the SVGA monitor is operational. If the display does not come up at this point, suspect a problem with the SVGA monitor.

Error Messages During Operation

The PQA200 operating system displays error messages to report an error in configuration or when an expected signal is missing or is incorrect in some detectable manner. Configuration error message occur if an action has been initiated when something in the underlying configuration for that action has an improper setting. For example, you click on Results and the error message "No results selected" appears. Configuration errors are corrected by making the correct configuration settings. In the case of the example, you would right click on the Results soft key and select one or more results to display.

System errors occur when an expected condition is not met. Some of those errors may be corrected by making a correction to input signals, such as making sure the amplitude is correct, that there is burst on the composite video or S-Video signal, or that you have the correct format signal applied.

Decoder Board Error Messages

Some error messages indicate a fatal error that prevents acquisition. Other errors indicate an out-of-range condition, but do not cause the PQA200 system to become inoperative. If the error persists after the corrective action has been tried, refer the problem to a qualified service person.

Table 6–8: Decoder error messages

Error messages	Meaning	Action to take
Blanking	Indicates that the internal digital blanking circuit is making many corrections in one direction and none in the other. This is a normal condition when the circuit is stabilizing, but should not happen for more than an few seconds.	Check that the applied video is within normal range, try connecting a known good signal to test.
Burst Lock	Indicates that the internal timing circuit is not in the slow speed, low jitter mode. In the Version 3.0 software release, Burst Lock is not a fatal error, but a warning. This allows capture and measurement of a slightly jittery signal.	Check that the correct input standard signal is applied. The input signal may not have burst or it may have excessive noise. Apply a known good signal to test.
Burst Present	Indicates that the amplitude of the burst on the input is not sufficient to allow proper timing extraction.	Check the burst on the input signal or apply a known good signal to test.
Input Video Over Range – Check for Proper Termination	This message appears when either A/D converter indicates clipping. This normally occurs if the input is more than about 125% of normal.	Check the input signal amplitude. Check that the loop-through is properly terminated, either into a 75 Ω system or with a 75 Ω termination on the unused loop-through connector.
Master Lock	Indicates a combination of sync present, burst present, burst lock, serial lock, and several more internal timing errors from the board horizontal counters, the vertical counters and color frame decision circuits. The master lock flag is held high until everything is stable and ready to measure. Master lock is considered a fatal error if it persists. Note: The Burst Lock error is not included in the Master Lock error in Version 3.0 firmware.	Check that video format is correct (NTSC or PAL). The error will also occur if the input is non-standard video such as from a VCR that has not been time-base-corrected. Apply a known good signal to test.
Serial Lock	Indicates that the output serializer is not locked. The message means that the 601 output from the decoder module is probably not working.	Check all the input and signal interconnections.
Sync Present	Indicates that no sync pulses are being detected on the input. The error happens when there is no signal connected or it is very low in amplitude. It can also happen when the signal source is incorrectly selected, such as asking for a S-Video signal when the input is really a composite signal and visa-versa.	Check that the decoder is correct set for the type of signal applied. Apply a known good signal to test.

Encoder Board Error Messages

The encoder module has two sets of error messages depending on the Lockup selection in the Encoder Configuration menu. One set is for Lockup using the serial video input as the lockup (genlock) source. The second is for when you are using the black burst and an applied analog reference as the source of lockup.

Table 6–9: Encoder error messages

Error messages	Meaning	Action to take
Serial video lockup		
Serial Phase Lock Loop	Indicates that the 27 MHz VCO (voltage-controlled oscillator) is not locked to the recovered clock of the incoming serial video signal.	When this error happens at the same time as the Video Lock error message it indicates the same problems. If the Serial Phase Lock Loop error occurs alone, a problem with the encoder module is indicated and the problem needs to be referred to a qualified service person.
Video Lock	Indicates that the serial signal is absent or is too low in amplitude, or that the serial receiver is not locked to the incoming serial signal.	Check that a 270 MB/s serial signal of the correct amplitude is applied to the 601 In connector of the encoder module. Apply a known good signal to test.
Black burst lockup		
Burst Lock	Indicates that the internal phase lock loop circuit that controls the 27 MHz VCO (voltage-controlled oscillator) is not in the slow-speed, low-jitter mode.	Check that the Genlock signal is the same format (NTSC or PAL) as selected by the system. Check that the Genlock signal has a burst and that it is not excessively noisy. Apply a known good signal to test.
Burst Present	Indicates that the amplitude of the burst on the input is not sufficient to allow proper timing extraction.	Check the burst on the input signal or connect a known good signal to the Genlock loop through to test.
Master Lock	Indicates a combination of sync present, burst present, burst lock, serial lock, and several more internal timing errors from the board horizontal counters, the vertical counters and color frame decision circuits. The master lock flag is held high until everything is stable and ready to measure.	Check that the video format is correct (NTSC or PAL). The error will also occur if the input is non-standard video such as from a VCR that has not been time-base-corrected. Apply a known good signal to test.
	If Master Lock, Sync Locked, and Burst Present errors are listed together, typically there is no analog Black Burst input or it is very low amplitude video.	Check that an analog reference video signal is applied to the Genlock loop through on the encoder board. Apply a known good signal to test.
	If Master Lock and Burst Lock are listed together, it may be because the incoming Black Burst video format does not match the format selected for the system.	Check that the signal applied to the Genlock loop through is the same format as selected for the test. Either apply the correct format analog reference video (NTSC or PAL I) or use Serial Digital Video lockup.

Table 6–9: Encoder error messages (cont.)

Error messages	Meaning	Action to take
Black burst lockup		
	If Master Lock is the only error message listed there is either a format matching problem or an internal timing problem on the encoder module.	Check that the Serial Video input matches the format selected for the system (NTSC or PAL I).
		Check that the Black Burst video format applied to the Genlock loop through matches the system selected format.
		If the formats are correct and the error persists, refer the problem to a qualified service person.
Unknown	Indicates an unknown error has occurred. One possible cause is that the output serializer is not locked. This condition probably indicates that the 601 output from the encoder board is not working. A second possibility is that the SC/H phase lock loop is not locked to the internal 27 MHz clock.	Check the 601 serial output of the encoder for a correct signal. You can use an external serial digital monitor to view the signal to check. Refer the problem to a qualified service person.

System Error Messages

Most of the error messages are associated with parameters. A list of parameters that can be used follows:

■ Request Names: Acquire request, jnd request, and jndPrecompute request

■ Standard Names: NTSC and PAL

■ Port Names: port A (Main) and port B (Ref)

Table 6–10: System error messages

Error messages	Meaning	Action to take
General errors		
<--Error event, sz☐4, #0x00000000, req=<request name> type=OutOfMem,	This error means one of two things: 1. Memory on the DSP became too fragmented and a large allocation failed. 2. A memory leak has occurred.	Retry the operation. It should work. Restart the application. The DSP memory is released for use.
Unexpected exception	This error occurs when there is a serious internal software error. There are no known errors of this type in the released version of software.	Contact your Tektronix representative or Tektronix Customer Service. Refer to *Contacting Tektronix* in the Preface of this manual.

Table 6–10: System error messages (cont.)

Error messages	Meaning	Action to take
General errors		
Can't get async read results: semaphore timeout	This error can occur on rare occasions. It may indicate a DSP hardware problem.	Restart the application. If the condition persists, contact your Tektronix representative or Tektronix Customer Service.
Capture errors		
601 input connect detect carrier. . . check your connections.	This error indicates that a 601 digital signal is not detected on the input.	Check your cable connections. Apply a known good signal to test. Check the input signal for a valid 601 serial digital format.
No input signal is present on <port name>	The error message defines the meaning.	Check for a valid input signal on the named port.
You have requested <standard name> but port <port name> is currently receiving <standard name>	This error indicates that the standard requested for an operation is not valid for the signal that is applied to the named port.	Apply the correct standard signal or change the configuration to match the applied signal standard.
601 Display error		
601 output requires inputs for port a and port b either be disconnected or the same standard as the output, in this case; <standard name> currently port <port name> is receiving <standard name).	This error indicates that you have selected to output a different video standard on the 601 display than the analyzer is configured to capture.	Make sure that the analyzer output (601 display) and input (capture) are the same video standard. The DSP can only operate in one format, the input and output must match.
Measure errors		
The manual left and right cropping is larger than the image (the image width is 720)	This error means that the manual left and right cropping values you have set overlap.	Restore the default cropping values or set the left and right cropping values to valid cropping values.
The manual top and bottom cropping is larger than the image (the image height is 486)	This error means that the manual top and bottom cropping values you have set overlap.	Restore the default cropping values or set the top and bottom cropping values to valid cropping values.
<file name>: can't write: tried 699840, did 0: file system full	This error occurs when there is not enough disk space on the hard drive to save the file. You can get this error when a capture is trying to save or when measurement results are being saved when the disk drive runs out of storage space.	Remove some older capture and results files and try again. Refer to *Disk Space Management* in the *PQA200 Picture Quality Analysis System User Manual* for a further discussion of this error.

Replacement Modules

Once you have isolated a problem to a module, you can obtain a replacement exchange module through the Tektronix board exchange program. Refer to *Module Servicing* on page 8–1 in the *Replaceable Parts* section of this manual for information on the module exchange program.

Repackaging

The PQA200 Picture Quality Test System is shipped in a carton designed to provide it with the maximum protection. If the instrument is subsequently shipped, you will need to use this carton and the instrument support inserts to provide adequate protection.

NOTE. The PQA200 shipping carton must be used to return the instrument to Tektronix service centers. We cannot honor the warranties if the server is not shipped in its original carton or a purchased replacement carton.

Obtaining Replacement Packaging

New packaging material is available from Tektronix. The part numbers are in Table 6–11 and in the Replaceable Mechanical Parts List in the Service Manual. Packaging components are shown in Figure 6–10. Each component has an index number which also appears in Table 6–11. To obtain these items contact your nearest Tektronix office or representative.

Table 6–11: Packaging material

Item	Tektronix part number	Index number
Top cushion (cardboard insert)	004-4912-00	1
Instrument support inserts; top and bottom	004-4913-00	2
Shipping box	004-4914-00	3

Repackaging the Server

When the server is shipped, it is important to provide maximum protection. Figure 6–10 shows how to repackage the server for shipment. As the figure shows, it is not necessary to have the keyboard, mouse, or server pedestal boxes in the package for reshipment. However, the server pedestal and door must be removed from the server for reshipment.

Remove the server door first. Open the door and lift up on the door to disengage the hinge pins of the two hinges on the right side of the server door from the hinge pin holes in the server chassis.

Then remove the server pedestal as follows:

1. Carefully place the server on its top.

2. Locate the retaining clip that holds the pedestal on the server.

3. Use your thumb to release the retaining clip and slide the pedestal to disengage the pedestal from the server.
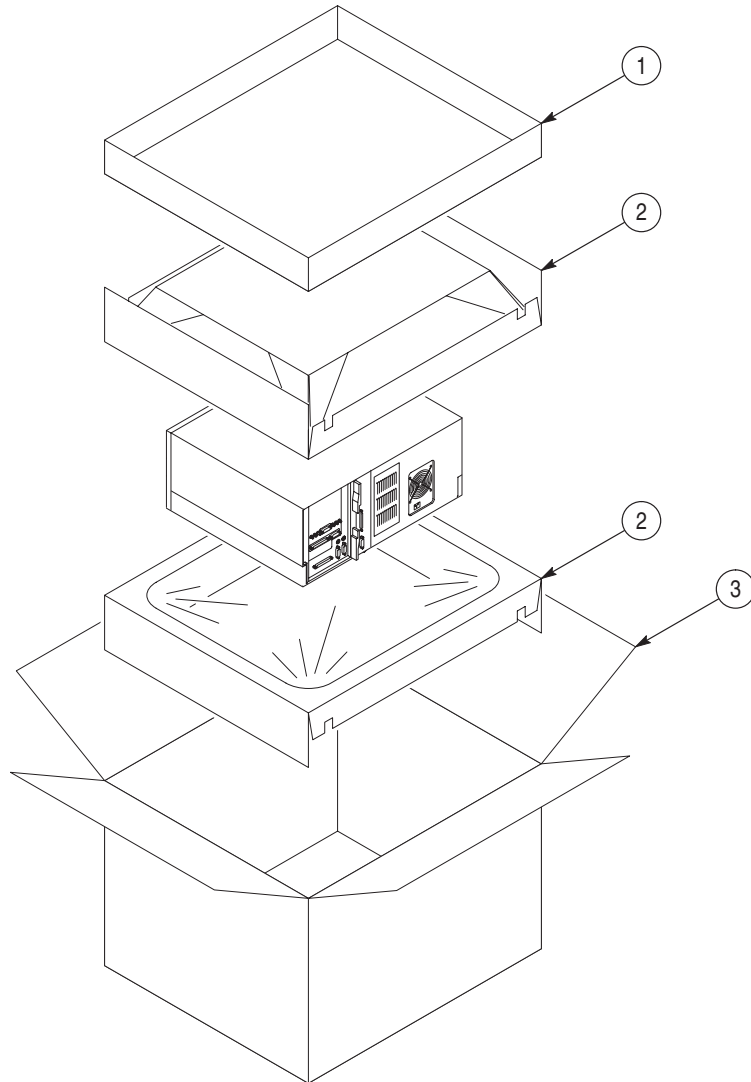
Figure 6–10: Repackaging the PQA200 server

Repackaging the Monitor   If the monitor is being shipped, it should be packaged in accordance with the instructions contained in its documentation.
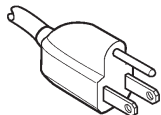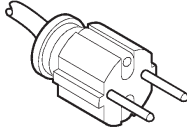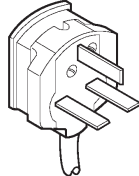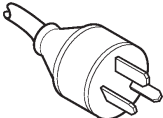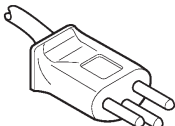
Options

Options

The power cord options shown in Table 7–1 are available for the PQA200 Picture Quality Analysis System.

Table 7–1: Power cord options

Plug configuration	Normal usage	Option number
	North America 125 V/15A Plug NEMA 5-15P	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	Switzerland 230 V	A5

Option 01 Composite Video

The composite video option adds an encoder module for use in generating NTSC or PAL composite video and S-Video PQA200 test video sequences. The encoder module accepts 601 digital video from the generator DSP and performs the encoding to composite video. A decoder module is used with the analyzer DSP to capture NTSC and PAL composite video or S-Video. Composite video signals are converted to 601 digital video for application to the analyzer DSP for processing.

Replaceable Parts

Replaceable Parts

This section contains a list of the replaceable modules for the PQA200 Picture Quality Analysis System. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number

- Instrument type or model number

- Instrument serial number

- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Module Servicing

Modules can be serviced through one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

Module Exchange

In some cases you may exchange your module for a re-manufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

Module Repair and Return

You may ship your module to us for repair, after which we will return it to you.

New Modules

You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for thePQA200 Picture Quality Analysis System. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations Abbreviations conform to American National Standard ANSI Y1.1-1972.

Mfr. Code to Manufacturer Cross Index The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers cross index

Mfr. code	Manufacturer	Address	City, state, zip code
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105-3608
060D9	UNITREK CORPORATION	3000 COLUMBIA HOUSE BLVD, SUITE 1 20	VANCOUVER, WA 98661
0B445	ELECTRI-CORD MFG CO INC	312 EAST MAIN STREET	WESTFIELD, PA 16950
0J9P9	GEROME MFG CO INC	PO BOX 737 403 NORTH MAIN	NEWBERG, OR 97132
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214-4657
2W733	BELDEN WIRE & CABLE COMPANY	2200 US HWY 27 SOUTH PO BOX 1980	RICHMOND, IN 47374
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53, RT 80 BOX A	DELAWARE WATER GAP, PA 18327
32997	BOURNS INC	TRIMPOT DIVISION 1200 COLUMBIA AVE	RIVERSIDE, CA 92507-2114
46628	LOGITECH INC	6505 KAISER DR	FREMONT, CA 94555
5F520	PANEL COMPONENTS CORP	PO BOX 115	OSKALOOSA, IA 52577-0115
65867	SEAGATE PERIPHERALS INC	920 DISC DRIVE	SCOTTS VALLEY, CA 95066-4544
65685	COMPAQ COMPUTER CORP	20555 FM 149 DEPT M PO BOX 69000	HOUSTON, TX 77269–2025
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
80126	PACIFIC ELECTRICORD CO	747 WEST REDONDO BEACH PO BOX 10	GARDENA, CA 90247-4203
86928	SEASTROM MFG CO INC	456 SEASTROM STREET	TWIN FALLS, ID 83301
TK1869	ALPS	100 N CNTRE AVE	ROCKVILLE CENTRE, NY 11570
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2383	PANASONIC INDUSTRIAL CO	1600 MCCANDLESS DR	MILPITAS, CA 95035
TK2541	AMERICOR ELECTRONICS LTD	UNIT-H 2682 W COYLE AVE	ELK GROVE VILLAGE, IL 60007
TK2548	XEROX CORPORATION	14181 SW MILLIKAN WAY	BEAVERTON, OR 97005
TK2607	VANSTAR CORPORATION	OREGON CORP ACCOUNTS DIVISION 16280 SW UPPER BOONES FERRY RD	PORTLAND, OR 97224
TK6159	RICHEY ELECTRONICS INC	3601 SW MURRY BLVD SUITE 60	BEAVERTON, OR 97005

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
8-1	671-4084-00			2	CKT BD ASSY: DSP (ANALYZER AND GENERATOR)	80009	671-4084-00
	407-4566-00			3	BRACKET: REAR PANEL MOUNT, EXTENDER, AL	TK1943	407-4566-00
	131-6095-00			5	CONN, RF: MCX, SMB FEMALE, STR, 50 OHM, 6MM H X 2MM TAIL, GOLD/NICKEL	00779	829559-2
-2	671-4219-00			1	CKT BD ASSY: DECODER BD, OPT 1	80009	671-4219-00
	407-4564-00			1	BRACKET: REAR PANEL MOUNT, OPT 01 DECODER, AL	TK1943	407-4564-00
	311-5065-00			2	RES, VAR: 50 OHM, 20% 0.25W, SIDE ADJUST, 4MM SQ, SMD, 16MM (OPT 01 DECODER)	32997	3314Z-1-500G/3341 Z-1-500E
-3	671-4222-00	B010100	B020150	1	CKT BD ASSY: ENCODER BD, OPT 1	80009	671-4222-00
-3	671-4222-01	B020151		1	CKT BD ASSY: ENCODER BD, OPT 1	80009	671-4222-01
	407-4563-00			1	BRACKET: REAR PANEL MOUNT, OPT 01 ENCODER, AL	TK1943	407-4563-00
	174-3939-00			1	CA ASSY, RF: COAXIAL, RFD, 1, 75 OHM, RG179, DOUBLE SHIELDED, 12.5 L (OPT 01 ENCODER)	060D9	174-3939-00
	174-3940-00			1	CA ASSY, RF: COAXIAL, RFD, 1, 75 OHM, RG179, DOUBLE SHIELDED, 10.0 L (OPT 01 ENCODER)	060D9	174-3940-00
-4	039-0040-00			1	CKT BD ASSY:VGA CARD:64-BIT PCI GRAPHICS BOARD	TK2607	MIL/2P/4N
-5	118-9713-00			1	COMPUTER, PC: PQA200 CONFIGURED PLATFORM, PENTIUM PC, PROLIANT 2500R, 200 MHZ, P6-200, 128MEG RAM	TK2607	118-9713-00
-6	119-5874-00			1	DISK DRIVE: WINCHESTER,3.5 INCH, 1.6 INCHES HIGH, SCSI, ST-19171W	65867	ST-19171W
-7	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,CDPL,T-10 TORX DR	0KB01	211-0409-00
-8	210-0803-00			2	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL CD PL	86928	ORDER BY DESCRIPTION
-9	213-1094-00			14	SCREW, TPG TF: 6-32 X 0.250, PNH, STL, ZINC, T-15 TORX, TAPTITE	80009	213-1094-00
-10	337-4157-01			1	SHIELD EMI: 6.200 X 3.850, 0.00075 IN MIN NICKEL, BRIGHT, PQA200 OPT01	TK1943	337-4157-01
-10	337-4156-00			1	SHIELD EMI: 6.200 X 3.850, 0.00075 IN MIN NICKEL, BRIGHT, PQA200 STD	TK1943	333-4156-00
-11	386-6981-00			1	PLATE: REAR PANEL NUTPLATE, CRS,2.7 X 1.375, STD	0J9P9	386-6981-00
-12	386-6974-00			1	BRACKET:REAR PANEL MOUNT	0J9P9	386-6974-00
	348-0274-00			1	SHLD GSKT,ELEK:FINGER TYPE, 0.5 FT.	30817	97-555-05
	119-5696-00			1	DISPLAY,MONITOR:17 IN MULTI-SCAN COLOR CRT,IIC BUS MICRO PROCESSOR & ENHANCED OSD,XP217C,	TK2383	TX-D7F35R
					STANDARD ACCESSORIES		
-13	174-3916-00			2	CA ASSY,RF:COAXIAL,RFD,1,75 OHM,9.0 L, BNC PLUG X SMB JACK (OPT 01)	80009	174-3916-00
-14	174-3915-00			1	CA ASSY, RF: COAXIAL, RFD, 1, 8.0 L, 75 OHM , SMB JACK BOTH ENDS (OPT 01)	80009	174-3915-00

Replaceable parts list (cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
-15	161-0066-00			1	CA ASSY, PWR: 3,18 AWG, 250V/10A, 98 INCH, STR, IEC320, RCPT X NEMA 5-15P, US, SAFETY CONTROLLED	0B445	ECM-161-0066-00
-16	012-0159-01			1	CA ASSY, RF: COAXIAL, LOW LOSS; RFD, 75 OHM, DUAL SHIELD, (2) TINNED COPPER, 72 L, BNC, MALE, STR, BOTH ENDS, CRIMP	060D9	012-0159-01
	012–1554–00			2	CABLE,RF: COAXIAL, SVHS CABLE, 4, 75 OHM, DUL COAX, 72.0 L (6 FT),(MINI–DIN,4 POS,MALE,STR,GOLD (OPT 01)	TK6159	012–1554–00
	119–4330–02			1	POINTER ASSY:MOUSE,400 DPI MOUSE,LOGITECH,SAD35–6MD OR COMPAQ M–S34	46628 / 65685	SAD35–6MD / 1411189–401
	119–5193–00			1	KEYBOARD,ASSY:WINDOWS 95 SOLUTION KEYBOARD WITH 4–PIN MINI DIN CONNECTOR OR COMPAQ RT101 OR TEK W95 VERSION	TK1869 / 65685 / 80009	122047–001 / 120375–001 / 119–5193–00
	011-0102-01			2	TERMINATION, COAXIAL: 75 OHM, BNC (OPT 01)	80009	011-0102-01
	063-1912-01			1	SOFTWARE PKG:WINDOWS NT 4.0,CDROM	80009	063-1912-01
	063-2971-00			1	SOFTWARE PKG:WINDOWS NT EMERGENCY REPAIR DISK,BLANK,3.5 HD DISKETTE	TK2548	063-2971-00
	063-2999-02			1	SOFTWARE PKG:APPLICATION SOFTWARE,VER 3.0,PQA200	TK2548	063-2999-02
	063-3023-00			1	VIDEO TEST SEQUENCES (525 LINE AND 625 LINE FORMAT), CD SET (10 DISKS)	80009	063-3023-00
	063-3025-00			1	IMPAIRED VIDEO TEST SEQUENCES (525 LINE AND 625 LINE FORMAT), CD DISK	80009	063-3025-00
	071-0091-03			1	MANUAL, TECH: USER, PQA200 PICTURE QUALITY ANALYSIS SYSTEM, VERSION 3.0	TK2548	071-0091-03
					OPTIONAL ACCESSORIES		
	161-0066-09			1	CA ASSY,PWR:3,0.75MM SQ,250V/10A,99 INCH,STR,IEC320, RCPT,EUROPEAN (EUROPEAN OPTION A1 ONLY)	2W733	ORDER BY DESCR
	161-0066-10			1	CA ASSY,PWR:3,0.1MM SQ,250V/10A,2.5 METER,STR, IEC320,RCPT X 13A,FUSED UK PLUG(13A FUSE),UNIT (UNITED KINGDOM OPTION A2 ONLY)	TK2541	ORDER BY DESCR
	161-0066-11			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER,STR, IEC320,RCPT,AUSTRALIA (AUSTRALIA OPTION A3 ONLY)	80126	ORDER BY DESCR
	161-0154-00			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER,STR, IEC320,RCPT,SWISS (SWISS OPTION A5 ONLY)	5F520	86515030
	071-0092-01			1	MANUAL,TECH:SERVICE,PQA200 PICTURE QUALITY ANALYSIS SYSTEM	TK2548	071-0092-01
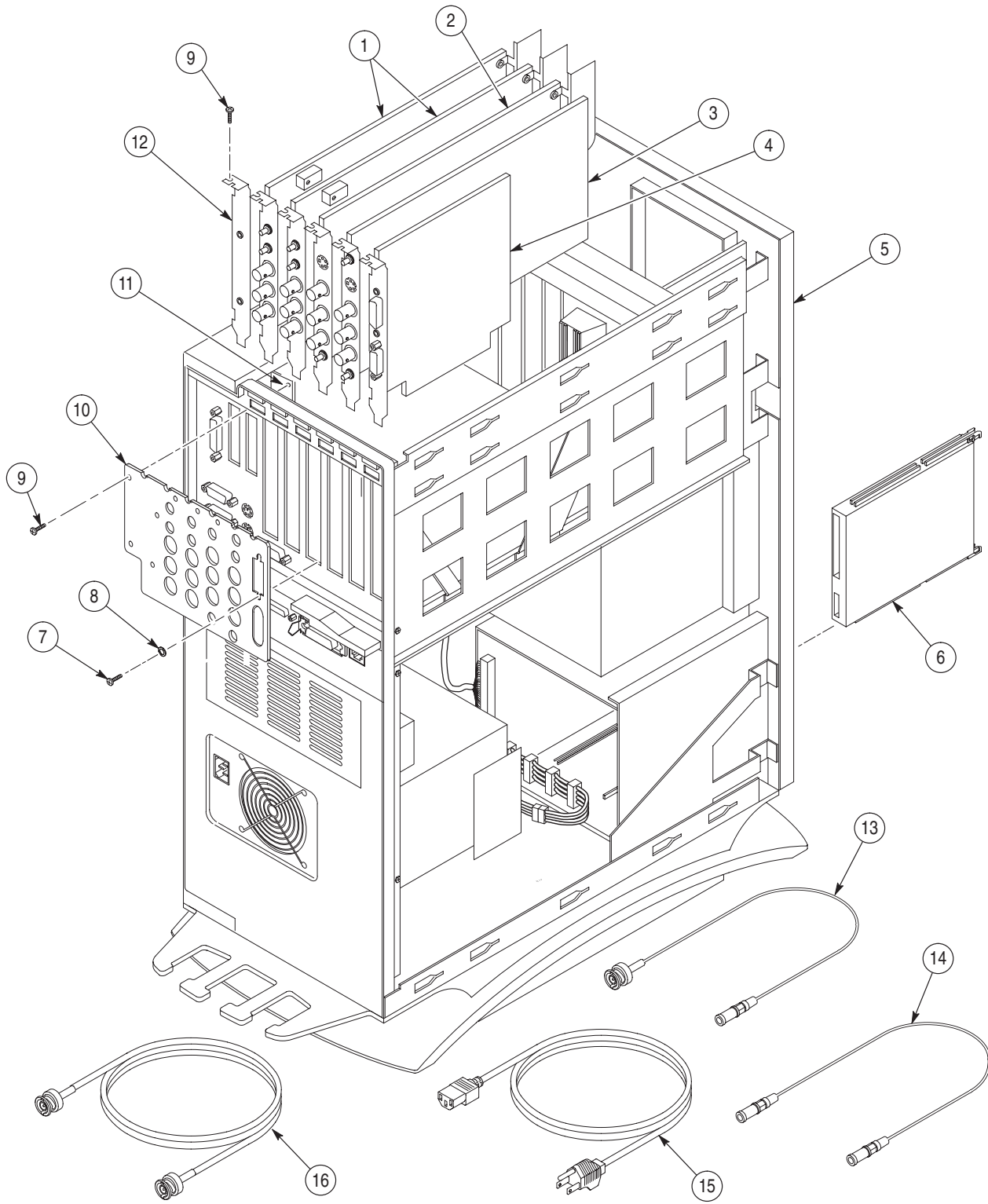
Figure 8–1: PQA200 Picture Quality Analysis System

PQA200 Picture Quality Analysis System Service Manual

Appendices

Appendix A: Software Repair

The information in this appendix explains how to create and use an Emergency Repair Disk, gives instructions on reloading the PQA200 software, and how to load the video test sequences.

If an Application Locks

As with all software, the application may lock up. In most cases the easiest way out is through the Windows NT End Task utility. The following procedure uses this utility to unlock the application.

1. Press Ctrl+Alt+Del to access the Windows NT Security dialog box.

2. Choose the Task List command button to bring up the Task List dialog box.

3. Click on the locked application.

4. Click on the End Task command button. This should close the locked application.

If this does not close the locked application try performing the following three-step procedure.

1. Press Ctrl+Alt+Del to access the Windows NT Security dialog box.

2. Choose the Shutdown command button to bring up the Shutdown dialog box.

3. Choose the Shutdown and Restart option button and then choose OK.

If this does not end the application or shut down the unit, power the Server down for a few minutes, and then proceed with a normal power up.

NOTE. It is not good practice to power down the Server without first exiting Windows NT. Only use this method if the Server is not responsive.

Creating and Using an Emergency Repair Disk

An emergency repair disk, specific to the system, is supplied with each PQA 200 analyzer. Whenever you upgrade the software or change your password, it is strongly recommended that you also create a new emergency repair disk. This will minimize the chances that you will need to completely re-load the operating software for a minor problem.

Use the emergency repair disk to restore your system to its initial setup state if your system files become corrupt and you are unable to recover the previous start up configuration (Last Known Good – the Windows NT startup screen option). If you don't have the emergency repair disk, you will have to reinstall Windows NT. Please see the Windows NT System Guide, provided with your back-up copy of Windows NT, for the procedure required to restore your system.

You may also need the emergency repair disk to restore user passwords if they are forgotten. Be sure to update the emergency repair disk each time you add a user or change a password.

CAUTION. *The files on the Emergency Repair Disk are PQA200-specific; that is, the disk shipped with an PQA200 is the ONLY one that will work with that unit. Do not lose this disk. If you lose the Emergency Repair Disk provided with your PQA200, create a new one as described below.*

Creating an Emergency Repair Disk

To create an emergency repair disk, mark a High Density 3.5-inch disk clearly as the emergency repair disk for PQA200 serial number B0xxxxx and then perform the following steps.

NOTE. *The emergency repair disk is PQA200-specific. Make sure that the emergency repair disk is clearly marked with its PQA200 serial number. The serial number of your PQA 200 analyzer appears on the original emergency repair disk and on the server rear panel, near the power input connector.*

1. Choose Run from the Windows NT Start menu.

2. Type rdisk in the Run dialog box. The Repair Disk Utility dialog box, as shown below, opens.
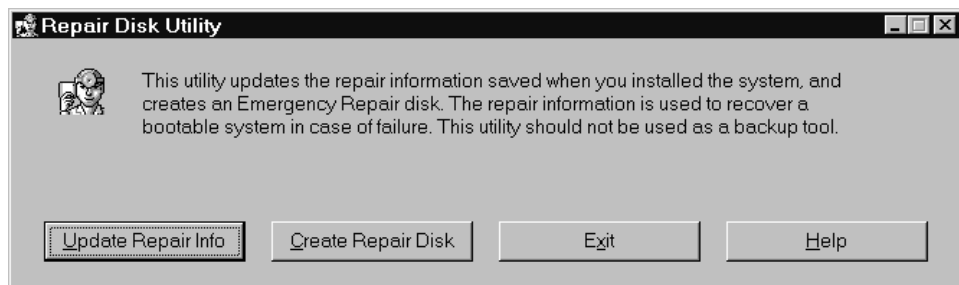
3. Click Update Repair Info to save your current configuration. A message appears to remind you that earlier repair information is overwritten. Click Yes to continue.

4. When the process is complete, a message appears to ask if you wish to create an Emergency Repair Disk. Click Yes. The message shown below appears.

Repair Disk Utility ☒

⚠ Label a floppy disk 'Emergency Repair Disk' and insert it into drive A:. Select OK when the disk is in the drive.

Warning: All data in the floppy disk will be erased.

[OK] [Cancel]
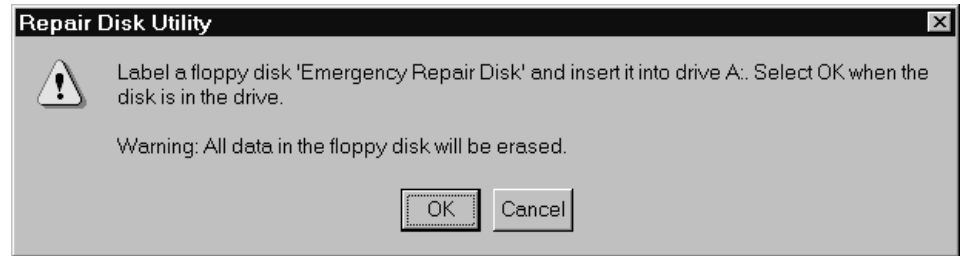
5. Insert a 3.5-inch disk in drive A and click OK. Rdisk formats the disk and copies the configuration files onto it.

6. When the operation is complete, click Exit in the Repair Disk Utility dialog box. Remove the disk from drive A and keep it in a safe place.

Using the Emergency Repair Disk

Always refer to the Windows NT documentation if you need more information.

1. Verify that you have a source of setup information available (the Windows NT back up software package).

2. Insert the Windows NT Setup disk.

3. Restart the PQA200.

4. When the Windows NT Setup Screen appears, press R (repair).

5. When prompted, insert the emergency repair disk.

6. The emergency repair disk performs the following:

   ■ Runs CHKDSK.EXE on the WINNT and SYSTEM partitions.

   ■ Verifies each file in the installation and replaces any that are missing or corrupt.

   ■ Replaces the System, Security, and Security Accounts Manager hives in the registry.

   ■ Reinstalls the Boot Loader (the boot sector, BOOT.INI, etc.).

Reinstalling the PQA200 Picture Quality Analysis System Software

Use the procedures below to reinstall your PQA200 software if it is accidently deleted or becomes corrupted. The application software is supplied on CD-ROM.

NOTE. The following instructions are for reinstalling the PQA 200 application software on a machine running Windows NT Workstation 4.0 only; procedures for upgrading the software may be different. If you are installing a software upgrade, follow the instructions provided with the upgrade kit.

Installing the PQA200 Application Program

Reinstalling the software involves the following procedures:

- Place the software install disk in the CD player.

- The CD should be read and the Install Wizard is displayed.

- Select to do a full installation or a restoration of selected files as required to restore the application.

Standard Instrument Encoder and Decoder Driver

The PQA200 application software supports both the standard instrument and the Option 01 instrument, but when reloaded into the server it is automatically setup for Option 01. In the standard instrument without the encoder and decoder circuit boards, the device driver for those boards must be disabled to prevent an error message about the modules not being installed. If the error message appears when starting the PQA200 application, clicking OK allows the application to continue. Turning off the driver stops the message from appearing.

Use the following procedure to turn off the encoder and decoder device driver in the standard instrument.

1. In the Windows NT screen, use the Start button in the task bar to select the Windows NT Control Panel (Start, Settings, Control Panel).

2. In the Control Panel click on Devices two times quickly to open the device drivers control menu.

3. Scroll down the list of device drivers to the PQA Encoder/Decoder Driver and select it.

4. On the right side of the drivers list, select Disabled and close the window.

5. Close the Control Panel window.

When you start the PQA200 application with Version 2.0 firmware in a standard instrument, the error message about no encoder and decoder modules being installed will not be displayed with the device driver disabled.

Installing the Generator and Reference Sequences

The test sequences are supplied on CD-ROM disks in Header Only and Header Plus generator sequences. The reference sequences are extracted from the generator sequences in the installation process. During installing, you have to select which generator sequences and reference you want to install.

1. Place the disk containing the sequences you want to install in the CD drive.

2. As with the Application Program disk, the CD should read automatically and the Install Wizard is displayed. The first installation window shows the standard warning that you should close any programs you have running, and it shows the copyright warning. Click on Next to continue the installation procedure.
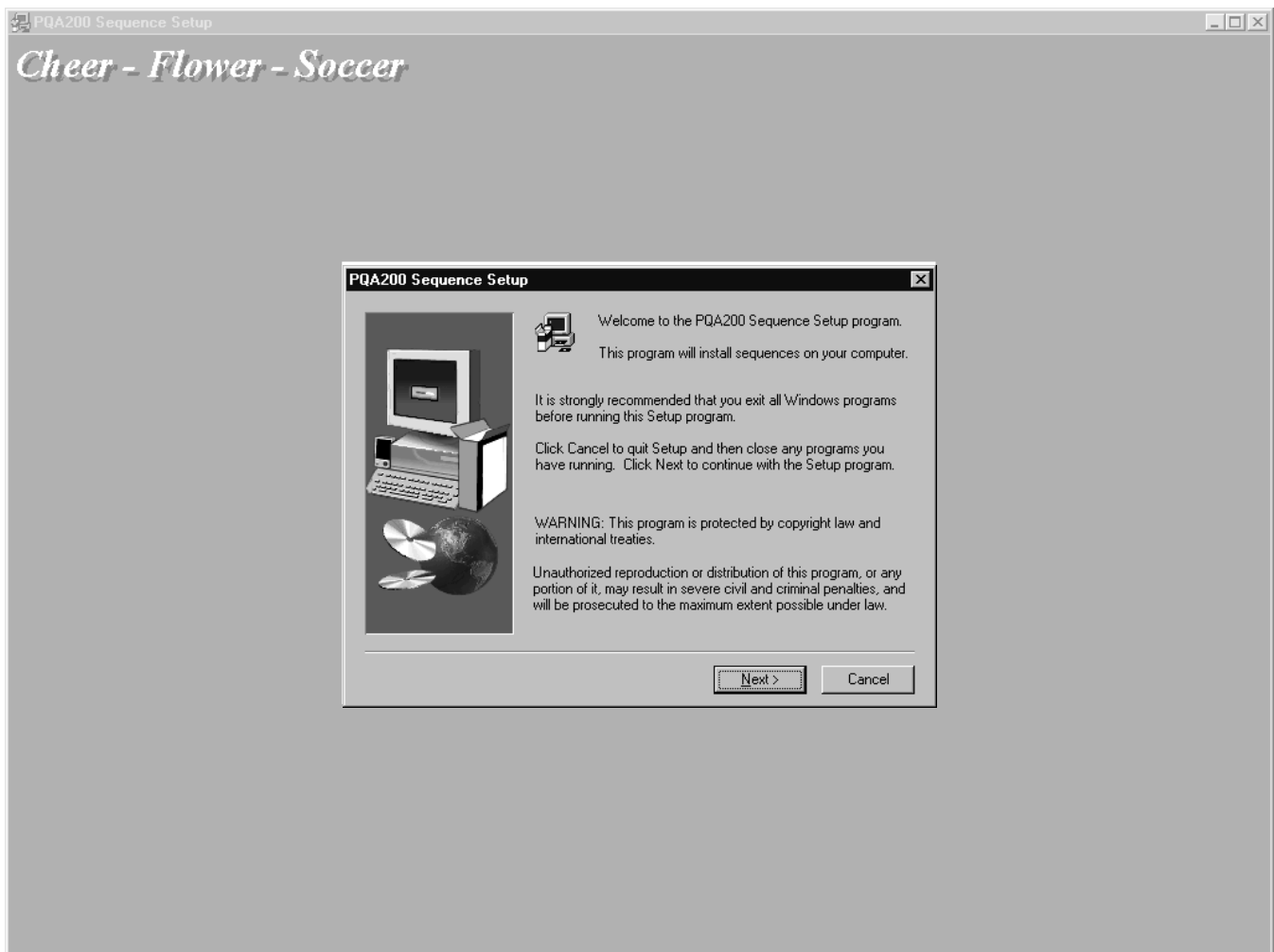
3. The second window shows the default destination folder where the files you select later are to be saved. The default for normal installation of the files is the D drive in the PQA200 directory. If that selection is all right for your system, click on Next to continue the installation, and skip to step 5.
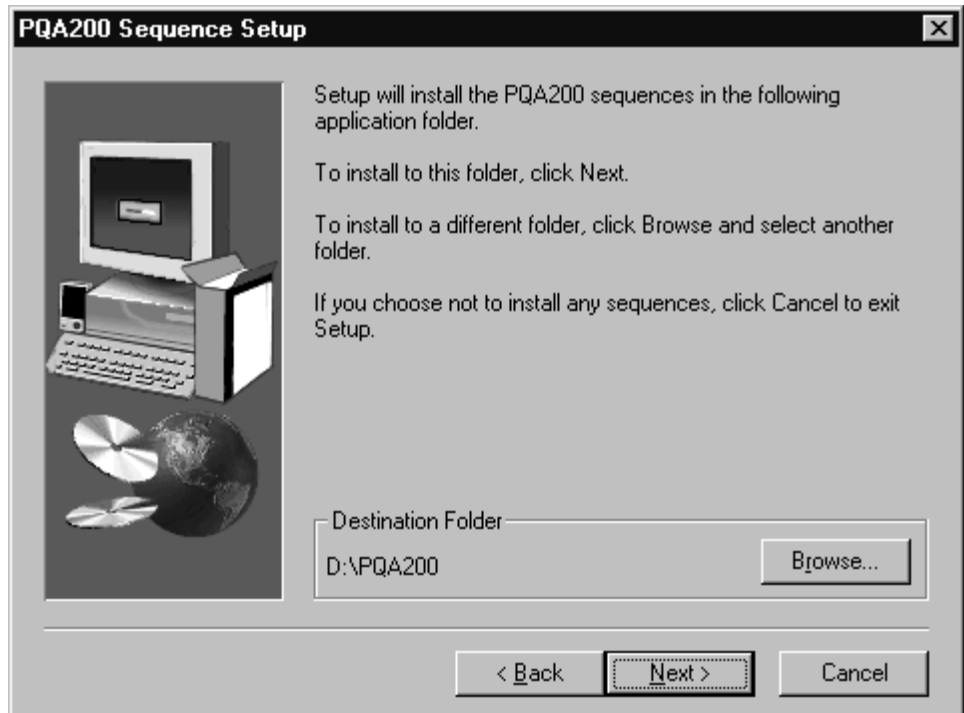
4. Click on the Browse soft key to select other destinations for the files including any network drives that are accessible. After you have made your selection, click on the OK button to accept the change and exit the menu.

Choose Folder

Please choose the installation folder.

Path:

`d:\Pqa200`

Directories:

- d:\
- Pqa200

OK

Cancel

Network...

Drives:

d: doclab

5. Click on the Next button to continue the process. The next window is the selection window for choosing the test sequence or sequences you want to store on the server hard drive.

6. Click in the check box to select a test sequence for installation. At this point all the sub-components of the selected test sequence (generator, generator plus, reference, and reference plus) are selected for installation.

NOTE. *The selections available under the Change soft key apply only to the highlighted test sequence name. If you want to make change selections for another sequence highlight the sequence name before you click on the Change soft key.*
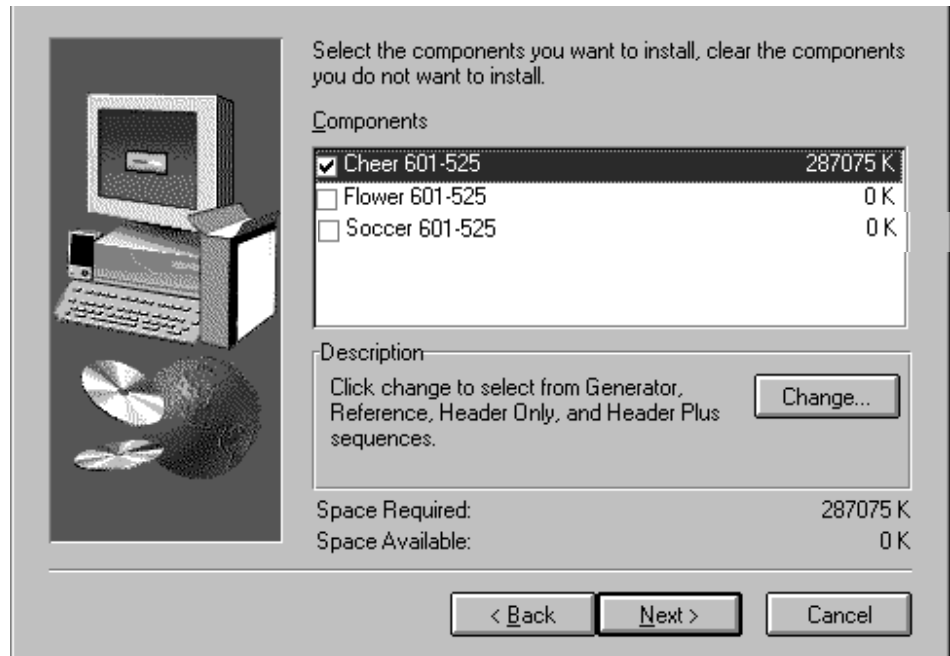
7. If you do not want to install all the sub-components of a test sequence, click on the Change soft key. If you want to store all the sub-components, go to step 10.

8. The window displayed when Change is selected permits you to clear any of the sub-components of a test sequence you do not want to install. Click in the check box to deselect any part of the test sequence. Note that if you deselect them all, the main test sequence selection also becomes unselected.

9. Click on the Continue soft key to continue the installation after you have completed the sub-component selections.

Select Sub-components

Select the components you want to install, clear the components you do not want to install.

Sub-components

☑ Generator Header Only	102523 K
☑ Generator Header Plus	102523 K
☑ Reference Header Only	41014 K
☑ Reference Header Plus	41014 K

Description

Install generator header only sequence

Space Required: 287075 K
Space Available: 0 K

Continue
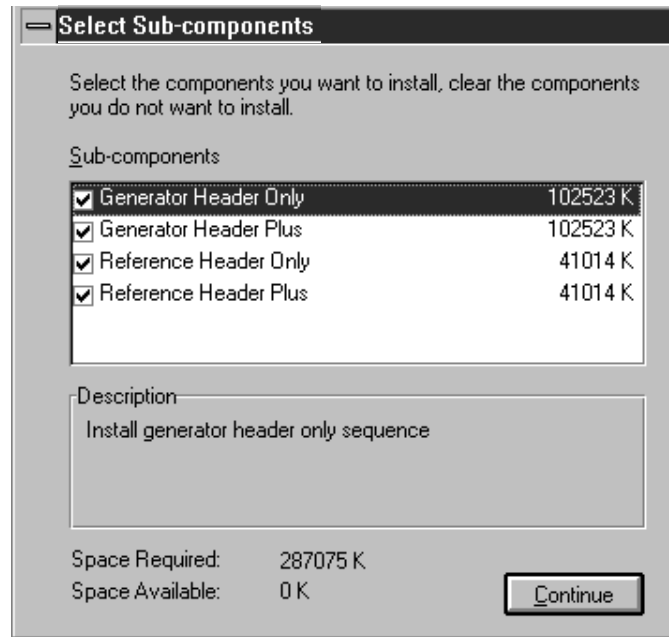
10. The amount of disk space needed to store the selected test sequence components is displayed along with the amount of space available. If there is not enough disk storage space available, you will get a message to that effect with a suggestion to either make more disk space or modify your selection to reduce the storage space required. You can delete unneeded generator and reference sequences using the Windows NT file manager or the PQA200 file operations menu. Generator video sequences are about 102 Mbytes each, and reference video sequences are about 42 Mbytes each.

11. Click on Next to commence installing the files. A list of all the files you have selected for installation is displayed. If those selections are not as you want, go back to step 8 to correct the selection list. If the list is correct, click on the Continue soft key to install the files.

The generator and reference files you selected are automatically stored in the correct folders in the PQA200 directory (generator and reference respectively).

Appendix B: PQA200 Directories and Files

The application software for the PQA200 consists of a number of directories and files. Note that nine directories are installed on the system drive (d:\) and the application files are loaded into these directories. The path is provided for each directory and file.

```
Path: D:\PQA200
```

\bin	<Dir>
\capture	<Dir>
\encdec	<Dir>
\function	<Dir>
\generate	<Dir>
\log	<Dir>
\precompute	<Dir>
\preference	<Dir>
\reference	<Dir>
\results	<Dir>
\temp	<Dir>

```
Path: D:\PQA200\bin
```

\drivers	<Dir>
\fonts	<Dir>
\support	>Dir>
Mfc42.dll	An executable file extension.
mfc42.dll	An executable file extension.
msvcrt.dll	An executable file extension.
mfco42d.dll	An executable file extension.
msvcrtd.dll	An executable file extension.
pqa200.exe	The PQA200 application executable file.
pqa200ip.exe	An application initialization executable file.
pqa200ui.cnt	The online help contents file.
pqa200ui.exe	The PQA200 user interface executable file.
pqa200ui.GID	A file generated by the online help system.
pqa200ui.hlp	The online help file.
tekseqs.map	A list of the Tektronix video test sequences recognized.
caprefs.map	A list of the user named captured references. The user named references map to the user named test sequences.
userseqs.map	A list of the user named captured test sequences.
startup.prf	The startup preference file.

```
Path:D\PQA200\bin\support
```

iptools.ZIP	
Mfc42.dll	An executable file extension.

mfc42.dll	An executable file extension.
mfc4o42.dll	An executable file extension.
mmcodecs.exe	The encoder and decoder diagnostics executable file.
msvcrt.dll	An executable file extension.
msvcrtd.dll	An executable file extension.
testdsp.exe	The DSP diagnostics executable file.

Path: D:\PQA200\capture

Location of all the captured (.cap) test video sequences. A new capture file is saved to this directory every time a captured file is saved to hard disk. Each file will have a time stamp to show the date and time of capture as well as the captured test sequence name and format id.

Path: D:\PQA200\encdec

Location of all the supporting files for the encoder and decoder. These files are a set of files that control the operating mode of the encoder and decoder modules.

Path: D:\PQA200\function

Location of all the function files (.tcl) for running automated testing sequences. These files are the scripts needed to run functions. Several function files are provided from Tektronix; others are user-generated files.

Path: D:\PQA200\generate

Location of all the generate (.gen) test video sequences. These files are the Tektronix provided test sequence loaded to the hard drive from CD-ROM or from another networked source.

Path: D:\PQA200\log

Location of all the log files. The log files are a set of files that record the activity of the application. The normal activity is record in the log file. User interface errors are recorded in the uierr file.

Path: D:\PQA200\precompute

Location of files that are precomputed as part of the measure process. The precomputed files are held here until needed for the measurement.

Path: D:\PQA200\preference

Location of all the preference (setup) files (.prf). These files are a set of text files that contain the setup information for the configuration files. The factory preference file contains the factory configuration settings. The shutdown preference file contains the configuration settings that were in effect at the time the PQA200 application was normally exited. The other preference files are user generated and named configuration settings.

Recalling these configuration files and saving others is controlled in the Preference configuration menu.

Path: D:\PQA200\reference

Location of all the stored reference (.ref) video sequences. These files are the Tektronix provided reference sequences loaded to the hard drive from CD-ROM or from a another networked source. They may also be test sequences captured as a reference.

Path: D:\PQA200\results

Location of all the measurement results files (.plm), (.jlm), (.jcm). New results files are saved for each measurement done on a captured video test sequence. The results files for a designated measurement or set of measurements call be recalled for display using the Results Configuration menu selections.

Path: D:\PQA200\temp

Location of the temporary files generated during the application processes. These temporary files are cleared when the process that generates them has completed.

Appendix C: Video Test Sequences

The video test sequences are provided on CD-ROM disk in 601-525 and 601-625 digital video formats. There are five disks for the 525 sequences and five disks for the 625 sequences. The disk contents and the characteristics of the video in the test sequences are shown in Table C–1 for 601-525 format and in Table C–2 for 602-625 format. Each of the files is provided as Header Only and Header Plus video test sequences for the generator. The analyzer references are extracted from the generator video sequences during loading.

NOTE. Sequence of the same name in 525 and 625 formats do not necessarily have exactly the same content. Though very similar, the test sequences were acquired at different times; they were not converted from one format to another.

Table C–1: Video test sequences for 601-525 format

Disk number	File name	Sequence title	Characteristic	Motion	Source
1	Flower	Flower Garden	Color details, landscape	Slow Pan	CCIR 15
	Cheer	Cheerleaders	Fast complex sports, rich background	Sports	CCIR 39
	Kiel	Kiel Harbor 4	Luminance detail, landscape	Zoom	CCIR 26
2	Tempete	Tempete	Horizontal, vertical, luminance, color detail	Random motion	CCIR 44
	Susie	Susie	Skin tone, talking head	Slow	CCIR 16
	Tennis	Table tennis	Multiple random motion, sports	Pan	CCIR 29
3	Football1	Football1	Sports, busy, large objects	Rapid motion	CCIR 38
	Football2	Football2	Slowly milling people, sports	Slow moving objects	CCIR 38
	Ferris	Ferris Wheel	Luminance and color details	Fast, complex	CCIR 36
4	Diva	Diva	Titles on busy scene	Slow	CCIR 43
	Mobile	Mobile and Calendar	Random motion of objects	Slow	CCIR 30
	Shinjuku	Shinjuku	Horizontal and vertical detail	Slow pan	CCIR 37
5	Wool	Balls of wool	Moving colors	Medium	CCIR 27
	Popple	Popple	Moving colors	Pan, rotate	CCIR 28
	Lily	Lily Pond	Luminance resolution	Still	CCIR 1

Table C–2: Video test sequences for 601-625 format

Disk number	File name	Sequence title	Characteristic	Motion	Source
1	Flower	Flower Garden	Color details, landscape	Slow Pan	CCIR 15
	Soccer	Soccer	Sports action	Fast	RAI
	Kiel	Kiel Harbor 4	Luminance detail. land-scape	Zoom	CCIR 26
2	Tempete	Tempete	Horizontal, vertical, luminance, color detail	Random motion	CCIR 44
	Susie	Susie	Skin tone, talking head	Slow	CCIR 16
	Tennis	Table tennis	Multiple random motion, sports	Pan	CCIR 29
3	Ski	Ski race	Sports, moving objects	Pan, zoom	RAI
	Auto	Auto race	Sports, moving objects	Fast	RAI
	BBC	BBC disc	Random movement	Circular	CCIR 23
4	Diva	Diva	Titles on busy scene	Slow	CCIR 43
	Mobile	Mobile and Calendar	Random motion of objects	Slow	CCIR 30
	Sailboat	Sailboat	Moving colors	Slow	CCIR 14
5	Wool	Balls of wool	Moving colors	Medium	CCIR 27
	Popple	Popple	Moving colors	Pan, rotate	CCIR 28
	Lily	Lily Pond	Luminance resolution	Still	CCIR 1

The impaired video test sequences are provided to check the functionality of the PQA200. The impaired test sequences are provided as Mobile Header Plus sampled at different bit rates. When they are measured, the reference used in all cases is the Mobile+ reference sequence as identified from the header ID of the captured test sequence.

Table C–3: Impaired video test sequences disk

Sequence format	Sequence title	Sample rate
601-525	Mobile3mbs+.601	3 Mbits/sec
601-525	Mobile6mbs+.601	6 Mbits/sec
601-525	Mobile9mbs+.601	9 Mbits/sec
601-625	Mobile3mbs+.601	3 Mbits/sec
601-625	Mobile6mbs+.601	6 Mbits/sec
601-625	Mobile9mbs+.601	9 Mbits/sec