Test Equipment Depot
1-800-517-8431

Service Manual

Tektronix

RTX130A
QAM & VSB RF Signal Generator

071-1863-00

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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.

No Power Switch. Power supply cord is considered the disconnecting device; disconnect the mains power by means of the power cord.

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.

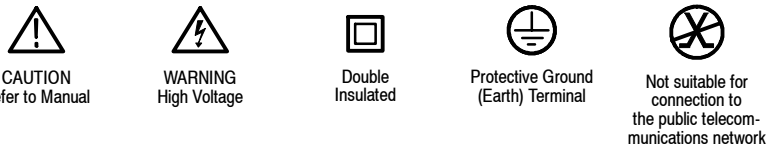
Terms on the Product. These terms may appear on the product:

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:



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, disconnect the mains power by means of the power cord or, if provided, the power switch.

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.

Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Mercury Nortification. This product uses an LCD backlight lamp that contains mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities or, within the United States, the Electronics Industries Alliance (www.eiae.org) for disposal or recycling information.

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, mercury, and hexavalent chromium.

Preface

This is the service manual for the RTX130A QAM & VSB RF Signal Generator. This manual contains information needed to service an RTX130A to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Furthermore, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the RTX130A and the characteristics that apply to it.
- *Theory of Operation* contains circuit descriptions that support service to the module level.
- *Performance Verification* contains procedures for confirming that an RTX130A functions properly and meets warranted characteristics.
- *Maintenance* contains information and procedures for performing preventive and corrective maintenance of an RTX130A. These instructions include cleaning, module removal and installation, and fault isolation to the module level.
- *Options* contains descriptions of factory-installed options and field-upgradable options.
- *Diagrams* contains block diagram and interconnection diagram.
- *Replaceable Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

This manual uses certain conventions with which you should become familiar.

Some sections of the manual contain procedures for you to perform. To keep those instructions clear and consistent, this manual uses the following conventions:

- Names of front panel controls and menus appear in the same case (initial capitals, all uppercase, and so forth) in the manual as is used on the RTX130A front panel and menus.
- Instruction steps are numbered unless there is only one step.
- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.

  Example: To power on the RTX130A, press the **ON/STBY** switch.
- *Italic* text refers to document names or sections. Italics are also used in NOTES, CAUTIONS, and WARNINGS.

  Example: The *Diagrams* section, beginning on page 6-1, includes a block diagram and an interconnect diagram.

Modules

Throughout this manual, any replaceable component, assembly, or part of the RTX130A is referred to generically as a module. In general, a module is an assembly (like a circuit board), rather than a component (like a resistor or an integrated circuit). Sometimes a single component is a module. For example, the chassis of the RTX130A is a module.

Safety

Symbols and terms related to safety appear in the *General Safety Summary* and *Service Safety Summary* near the beginning of this manual.

Finding Other Information

Other documentation for the RTX130A includes:

- The *RTX130A QAM & VSB RF Signal Generator User Manual* (Tektronix part number 071-1861-00) contains a tutorial to quickly describe how to operate the RTX130A. It also includes an in-depth discussion on how to use the RTX130A features.

Introduction

This manual contains information needed to properly service the RTX130A QAM & VSB RF Signal Generator, as well as general information critical to safe and effective servicing.

To prevent personal injury or damage to the RTX130A, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person.
- Read the *General Safety Summary* and the *Service Safety Summary,* beginning on page vii.

When using this manual for servicing, be sure to follow all warnings, cautions, and notes.

Performance Check Interval

Generally, the performance check described in Section 3, *Performance Verification*, should be done every 12 months. In addition, a performance check is recommended after module replacement.

If the RTX130A does not meet performance criteria, repair is necessary.

Strategy for Servicing

This manual contains all the information needed for periodic maintenance of the RTX130A.

This manual also contains all information for corrective maintenance down to the module level. To isolate a failure to a module, use the fault isolation procedures found in *Troubleshooting*, part of Section 5, *Maintenance*. To remove and replace any failed module, follow the instructions in *Removal and Installation Procedures*, also part of Section 5. After isolating a faulty module, replace it with a fully-tested module obtained from the factory. Section 8, *Replaceable Parts List,* contains part number and ordering information for all replaceable modules.

Tektronix Service Offerings

Tektronix provides service to cover repair under warranty as well as other services 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 are well trained to service the RTX130A. They have access to the latest information on improvements to the RTX130A as well as the latest new options.

Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. The warranty appears after the title page in this manual. Tektronix technicians provide warranty service at most Tektronix service locations. The Tektronix product catalog lists all worldwide service locations or you can visit our Web site for service information: www.tektronix.com.

Self Service

Tektronix supports repair to the module level by providing Module Exchange.

Module Exchange. This service reduces down-time for repair by allowing you to exchange most modules for remanufactured ones. 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 these repair or adjustment services.

Specifications

Product Overview

The RTX130A QAM & VSB RF Signal Generator generates QAM and 8VSB modulated signals that are compliant with the DVB-C/ITU-T J.83 Annex A/B/C and ATSC standards. In addition to the RF signal output feature, the RTX130A records and plays MPEG-2 transport streams that are compliant with ATSC, DVB, and ARIB standards.

The RTX130A provides the following features:

- 16/64/256QAM and 8VSB modulation formats
- Modulation frequency range: 50 MHz to 860 MHz
- 44 MHz or 36 MHz IF output
- Support the following standards:
  - DVB-C/ITU-T J.83 Annex A (Option M1)
  - ITU-T J.83 Annex B (Option M2)
  - ITU-T J.83 Annex C (Option M3)
  - ATSC (Option M4)
- Data rate: 200 Mbps maximum (RAM mode); 256 Kbps minimum
- Hierarchy display of stored or captured transport streams
- 188, 204, 208 bytes packet size, S-TMCC, M-TMCC, non transport stream, and partial transport stream output formats
- Real-time updating of stream parameters; continuity_counter, PCR/PTS/DTS, TOT/TDT/STT, NPT, and Reed Solomon (ISDB-T only)
- Continuous recording of captured streams
- PCR jitter insertion
- Triggered stream capture
- Full remote control using Ethernet interface
- Scheduler application for automated stream playout and record (Option SC only)

The RTX130A includes the ReMux application software that provides the capability to create a transport stream of super frame structure defined in the ISDB-S systems from an MPEG2 transport stream.

Specifications

Tables 1-1 through 1-4 list the functional, electrical, mechanical, and environmental characteristics of the RTX130A. Table 1-5 lists the national and international standards to which the RTX130A complies.

All listed specifications are guaranteed unless labeled with “typical”. Typical specifications are provided for your convenience but are not guaranteed.

Performance Conditions

The electrical characteristics listed on the following pages are valid under the following conditions:

- The RTX130A must be in an environment where the temperature, altitude, humidity, and vibration conditions are within the operating limits described in Table 1-4 on page 1-12.
- The RTX130A must have a warm-up period of at least 20 minutes.
- The RTX130A must be operating at an ambient temperature between +5 °C to +40 °C, unless otherwise noted.

Functional Specifications

Table 1-1: Functional specifications

Characteristics	Description
System configuration	
System OS	Windows XP Professional
CPU	1.3 GHz
System memory	512 MB
Display	640 x 480 VGA resolution with 256 K colors
Storage device	
Hard disk drive	160 GB
DVD ± RW drive	Read and write: DVD+R, DVD+RW, DVD-R, DVD-RW, CD-R, and CD-RW Read only: DVD-ROM and CD-ROM
Expansion slot	1 - PCI slot

Electrical Specifications

Table 1-2: Mainframe

Characteristics	Description
Maximum output rate	
Hard disk	≥ 120 Mbps
RAM	≥ 200 Mbps
Maximum record rate	
Hard disk	≥ 120 Mbps (File size: < 4 GB, just after disk format operation) ≥ 90 Mbps (File size: 33 GB, just after disk format operation)
RAM	≥ 200 Mbps
Internal reference clock	For Output_clock, PCR/PTS/DTS, packet operation timing, and TDT/STT time.
Reference clock (on shipping)	27 MHz ± 1 ppm
Reference clock stability, typical	± 1 ppm/year ± 1 ppm (5 °C to 40 °C)
External reference/clock input	
Connector type	BNC
Input impedance, typical	50 Ω
Reference input	
Frequency	8.129698 MHz, 10 MHz, and 27 MHz
Input level, typical	Sine wave: 0 ± 6 dBm Square wave: 0.5 Vp-p to 3.0 Vp-p
Clock input	
Frequency	160 kHz to 25 MHz (parallel clock) 1.28 MHz to 32 MHz (serial clock)
Input level, typical	0.5 V to 3.0 V
External trigger input/MISC output	
Connector type	BNC
Input impedance, typical	1 kΩ
Threshold level	Rising and falling edges are programmable.
High level	> 3.5 V (maximum input voltage: 7 V)
Low level	< 0.8 V
Output level	
High level	> 2.2 V (with 50 Ω termination)
Low level	< 0.8 V (with 50 Ω termination)
Output impedance	50 Ω

Table 1-2: Mainframe (Cont.)

Characteristics	Description
PLL	
Frequency	50 MHz to 100 MHz, locked to reference clock
Output clock	50 MHz maximum (serial clock) 26.75 MHz maximum (parallel clock)
Output rate	214 Mbps maximum 64 Kbps minimum
TS clock (Internal and external reference, 27 MHz and 10 MHz)	TS clock = (X / (2 * Y * Z)) * 27 MHz $15362 < X < 31248$ $1686 < Y < 3376$ $2 \leq Z \leq 65536$
(External parallel clock)	TS clock = (X / (2 * Y * Z)) * external parallel clock, 214 MHz maximum $15632 < X < 31248$ $1 < Y < 16383$ $2 \leq Z \leq 65536$
(External serial clock)	TS clock = (X / (2 * Y * Z)) * external serial clock / 8,32 MHz maximum $15632 < X < 31248$ $1 < Y < 16383$ $2 \leq Z \leq 65536$
P/N and Jitter (serial clock)	$<$ -104 dBc/Hz at 21.455707 MHz +20 kHz (RBW=300 Hz)
SPI interface	
Connector type	D-sub, 25 pin
Data rate	256 Kbps to 214 Mbps
Pin assignments	1 DCLK 2 GND 3 to 10 DATA 7 to DATA 0 11 DVALID 12 PSYNC 13 Shield 14 $\overline{\text{DCLK}}$ 15 GND 16 to 23 $\overline{\text{DATA 7}}$ to $\overline{\text{DATA 0}}$ 24 $\overline{\text{DVALID}}$ 25 $\overline{\text{PSYNC}}$

Table 1-2: Mainframe (Cont.)

Characteristics	Description
Output	
Output level, typical	330 mV to 550 mV (termination: internal 100 Ω, external 100 Ω), bus LVDS with 50 Ω termination
Offset	1.1 V to 1.5 V
Output resistance, typical	100 Ω, between differential outputs (output off)
Data delay, typical	± 5 ns from the falling edge of DCLK (see Figure 1-1 on page 1-11)
Input	
Input level, typical	> +100 mV, < -100 mV, (RI+)-(RI-) with 100 Ω termination
Input resistance, typical	100 Ω (between differential inputs)
Clock pulse width, typical	T/2 ± T/10, T=1/f (f=byte clock frequency) (see Figure 1-1 on page 1-11)
Data hold time, typical	T/2 ± T/10, T=1/f (f=byte clock frequency, data are latched on DCLK rising edge) (see Figure 1-1 on page 1-11)
ASI/SMPTE310M interface	
Connector type	BNC
Impedance	75 Ω
Data rate	256 Kbps to 214 Mbps (ASI), 19.3 Mbps (SMPTE310M)
Output	
Output voltage	800 mV ± 10%
Jitter (ASI)	≤ 0.2 UI p-p
Jitter (SMPTE310M)	Past 1st edge < 1.4 ns Past 2nd edge < 2 ns Prev 1st edge < 1.4 ns
Rise/fall time	ASI: ≤ 1.2 ns (20% to 80%) SMPTE310M: 0.4 ns ≤ X ≤ 5 ns (20% to 80%)
Return loss	ASI: < -17 dB (5 MHz to 270 MHz) into 75 Ω load SMPTE310M: < -30 dB (5 MHz to 38.7 MHz) into 75 Ω load
Input	
Input voltage, typical	200 mV to 880 mV
Return loss	ASI: < -17 dB (5 MHz to 270 MHz) into 75 Ω load SMPTE310M: < -17 dB (5 MHz to 38.785316 MHz) into 75 Ω load
Data format	Accepts both byte and packet modes.

Table 1-2: Mainframe (Cont.)

Characteristics	Description
RF/IF output	
Connector type	BNC
Output impedance, typical	75 Ω
Digital modulation standard	DVB-T/ITU-T J8.3 Annex A (Option M1) The following parameters conform to the standard: Symbol rate: 1 Msps to 6.9565 Msps (IF output) 5 Msps to 6.9565 Msps (RF output) Modulation: 16/64/256QAM Outer cording: RS (204, 188) Roll off: 0.15 ITU-T J.83 Annex B (Option M2) The following parameters conform to the standard: Symbol rate: 5.056941/5.360537 Msps Modulation: 64/256QAM Outer cording: RS (128, 122) Roll off: 0.18/0.12 Interleaving: Level 1 (64 QAM only) I=128, J=1 Level 2 I=128, J=1 (Control Word: 0001) I=64, J=2 (0011) I=32, J=4 (0101) I=16, J=8 (0111) I=8, J=16 (1001) I=128, J=1 (0000) I=128, J=2 (0010) I=128, J=3 (0100) I=128, J=4 (0110) I=128, J=5 (1000) I=128, J=6 (1010) I=128, J=7 (1100) I=128, J=8 (1110) ITU-T J.83 Annex C (Option M3) The following parameters conform to the standard: Symbol rate: 1 Msps to 5.3097 Msps (IF output) 5 Msps to 5.3097 Msps (RF output) Modulation: 64QAM Outer cording: RS (204, 188) Roll off: 0.13 ITU-T J.83 Annex C-JCTEA The following parameters conform to the standard: Symbol rate: 5.274 Msps Modulation: 64QAM Outer cording: RS (204, 188) Roll off: 0.13

Table 1-2: Mainframe (Cont.)

Characteristics	Description
	ATSC (Option M4) The following parameters conform to the standard: Symbol rate: 10.762237 Msps Modulation: 8VSB Outer cording: RS (187, 207) Roll off: 0.1152
RF output	
Frequency	50 MHz to 860 MHz (setting resolution: 12.5 kHz steps)
Output amplitude, typical	45 dBmV to 58 dBmV (setting resolution: 1 dB steps)
EVM (ITU-T J.83 Annex A)	256QAM < 2.5% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.1% (RMS), 50 MHz to 860 MHz @ > 52 dBmV 64QAM < 2.7% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.3% (RMS), 50 MHz to 860 MHz @ > 52 dBmV 16QAM < 3.0% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.8% (RMS), 50 MHz to 860 MHz @ > 52 dBmV
EVM (ITU-T J.83 Annex B)	256QAM < 2.5% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.1% (RMS), 50 MHz to 860 MHz @ > 52 dBmV 64QAM < 2.7% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.3% (RMS), 50 MHz to 860 MHz @ > 52 dBmV
EVM (ITU-T J.83 Annex C and Annex C for JCTEA)	64QAM < 2.7% (RMS), 50 MHz to 750 MHz @ 45 dBmV to 52 dBmV < 3.3% (RMS), 50 MHz to 860 MHz @ > 52 dBmV
SN (8VSB)	> 27.0 dB, 190 MHz to 860 MHz @ 45 dBmV to 52 dB mV > 25.0 dB, 190 MHz to 860 MHz @ > 52 dB mV > 25.0 dB, < 190 MHz @ 45 dB mV to 58 dBmV
Return loss	< -12 dB @ 50 MHz to 860 MHz
IF output	
Frequency	36 MHz, 44 MHz
Output amplitude	35 dBmV
EVM (ITU-T J.83 Annex A)	256QAM: < 0.8% (RMS), 64QAM: < 0.9% (RMS), 16QAM: < 0.9% (RMS) (symbol rate: ≥ 1 Msps, IF frequency: 36 MHz)
EVM (ITU-T J.83 Annex B)	256QAM: < 0.8% (RMS), 64QAM: < 0.9% (RMS) (IF frequency: 36 MHz)

Table 1-2: Mainframe (Cont.)

Characteristics	Description
EVM (ITU-T J.83 Annex C and Annex C for JCTEA)	64QAM: < 0.9% (RMS) (symbol rate: ≥ 1 Msps, IF frequency: 36 MHz)
SN (8VSB)	> 34 dB (IF frequency: 36 MHz)
Return loss	< -20 dB @ 5 MHz to 44 MHz
VGA output	
Connector type	D-sub, 15 pin
Pin assignments	1 RED, 2 GREEN, 3 BLUE, 4 NC, 5 GND, 6 GND, 7 GND, 8 GND, 9 NC, 10 GND, 11 NC, 12 NC, 13 HSYNC, 14 VSYNC, 15 NC
USB 2.0 interface	
Number of connectors	2
Pin assignments	1 VCC, 2 -DATA, 3 +DATA, 4 GND
LAN interface	10/100/1000 Base-T Ethernet interface
Connector type	RJ45
Pin assignments	1 MDI_0+, 2 MDI_0-, 3 MDI_1+, 4 MDI_2+, 5 MDI_2-, 6 MDI_1-, 7 MDI_3+, 8 MDI_3-

Table 1-2: Mainframe (Cont.)

Characteristics	Description
Printer port	Supports SPP (Standard Parallel Port), EPP (Enhanced Parallel Port), and ECP (Extended Capabilities Port) modes.
Connector type	D-sub, 25 pin
Pin assignments	1 STROBE, 2 D0, 3 D1, 4 D2, 5 D3, 6 D4, 7 D5, 8 D6, 9 D7, 10 ACK, 11 BUSY, 12 Paper Empty, 13 SELECT, 14 AUTOLF, 15 ERR, 16 INIT, 17 SELECT, 18 GND, 19 GND, 20 GND, 21 GND, 22 GND, 23 GND, 24 GND, 25 GND
Serial interface (Com)	RS-232C
Connector type	D-sub, 9 pin
Pin assignments	1 DCD, 2 RX, 3 TX, 4 DTR, 5 GND, 6 DSR, 7 RTS, 8 CTS, 9 RI
IEEE1394B interface	
Compliant	IEEE1394B-2002
Pin assignments	1 TPB-, 2 TPB+, 3 TPA-, 4 TPA+, 5 TPA (R), 6 VG, 7 NC, 8 VP, 9 TPB (R)
AC line power	
Rating Voltage	100 VAC to 240 VAC, CAT II
Voltage Range	90 VAC to 250 VAC
Frequency Range	50 Hz to 60 Hz
Maximum power	180 VA
Maximum current	1.3 A
Main fuse data	5 A Time-delayed, 250 V (not operator replaceable) 2 A Time-delayed, 250 V (not operator replaceable)

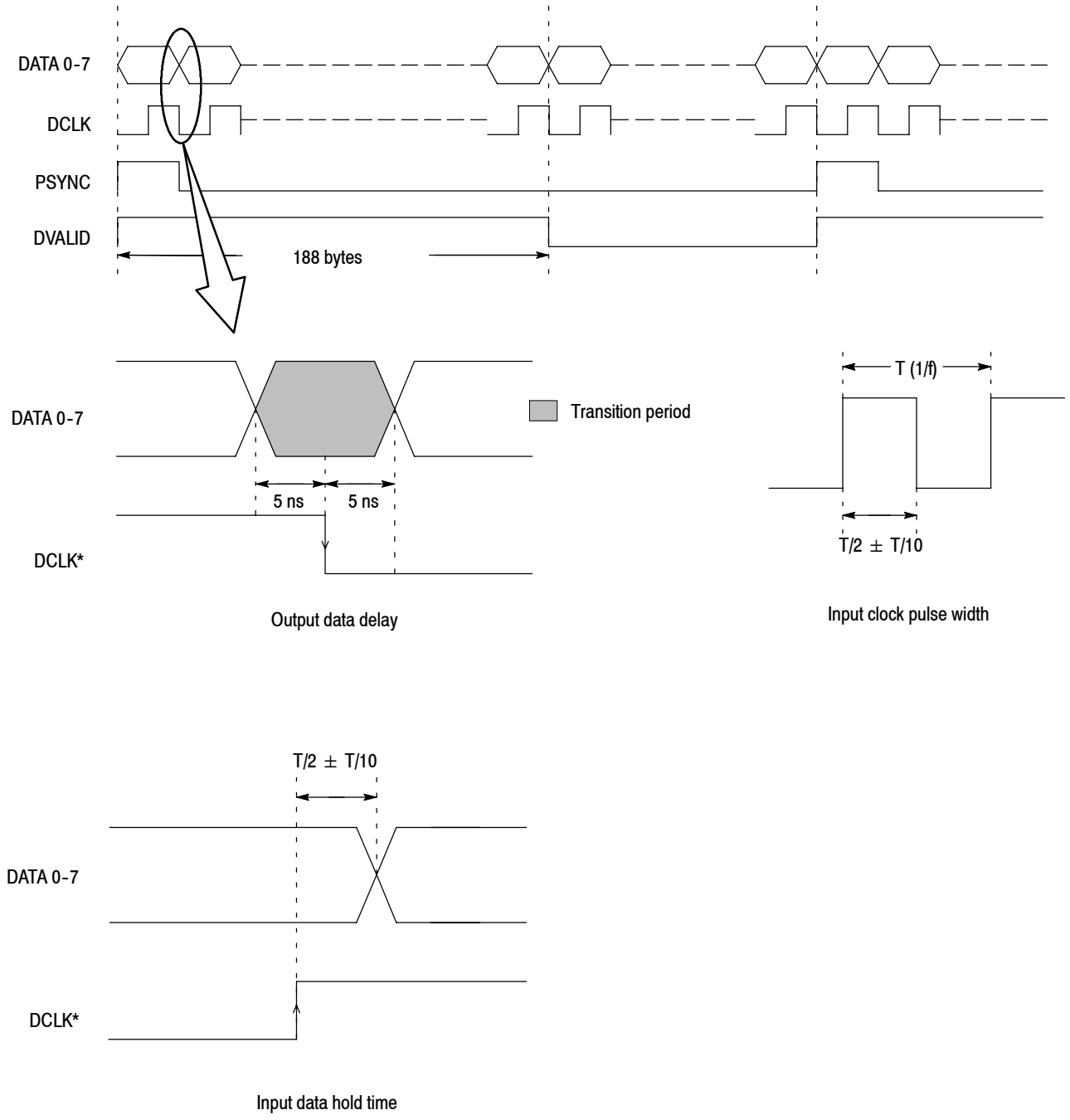


Figure 1-1: Timing diagram of the SPI interface

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Mechanical (Physical) Characteristics

Table 1-3: Mechanical characteristics

Characteristics	Description
Net weight	
Standard	Approximately 6 kg (13.2 lb)
Dimensions	
Height	132 mm (5.2 in), without feet
Width	214 mm (8.4 in)
Length	435 mm (17.1 in)

Environmental Characteristics

Table 1-4: Environmental characteristics

Characteristics	Description
Temperature	
Operating	+5 °C to +40 °C
Non-operating	–20 °C to +60 °C
Relative humidity	
Operating	20% to 80% (No condensation) Maximum wet-bulb temperature 29 °C
Non-operating	5% to 90% (No condensation) Maximum wet-bulb temperature 29 °C
Altitude	
Operating	Up to 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km
Non-operating	Up to 15 km (50,000 feet)
Dynamics	
Vibration	
Operating	2.65 m/s^2 rms (0.27 $Grms_)$, 5 Hz to 500 Hz, 10 min, three axes
Non-operating	22.3 m/s^2 rms (2.28 Grms), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s^2 (30 G), half-sine, 11 ms duration
Installation requirements	
Power dissipation	100 W maximum. Maximum line current is 1.3 A_{rms} at 50 Hz

Table 1-4: Environmental characteristics (Cont.)

Characteristics	Description
Surge current	≦ 12 A peak for less than 5 line cycles at 25 °C after product has been off for at least 30 seconds
Cooling clearance	
Top clearance	5 cm (2 in)
Side clearance	5 cm (2 in)
Rear clearance	5 cm (2 in)

Certifications and Compliances

Table 1-5: Certifications and compliances

Category	Standards or description	
EC Declaration of Conformity	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EMC Directive 89/336/EEC:	
	EN 55011	EMC requirement for Class A electrical equipment for measurement, control and laboratory use
	EN 61000-3-2	AC Power Line Harmonic Emissions
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance Criterion B)
	IEC 61000-4-3	RF Electromagnetic Field Immunity (Performance Criterion A)
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance Criterion B)
	IEC 61000-4-5	Power Line Surge Immunity (Performance Criterion B)
	IEC 61000-4-6	Conducted RF Immunity (Performance Criterion A)
	IEC 61000-4-11	Voltage Dips and Interruptions Immunity (Performance Criterion B)
	Low Voltage Directive 73/23/EEC: Amended by 93/68/EEC:	
	EN 61010-1: 2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
Australia/New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radio Communications Act per the following standard(s):	
	AS/NZS 2064.1/2	Industrial, Scientific, and Medical Equipment: 1992

Table 1-5: Certifications and compliances (Cont.)

Category	Standards or description	
Safety	Complies with the following safety standards/regulations:	
	UL 61010-1	Standard for Electrical Measuring and Test Equipment.
	CAN/CSA C22.2 No.61010-1-04	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.
	EN 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.
Installation (Overvoltage) Category	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:	
	CAT III	Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.
	CAT II	Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
	CAT I	Secondary (signal level) or battery operated circuits of electronic equipment.
Overvoltage Category	Overvoltage Category II (as defined in IEC 61010-1)	
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.	
	Pollution Degree 1	No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
	Pollution Degree 2	Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
	Pollution Degree 2	Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
Pollution Degree	Pullution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.	
IEC Characteristics	Equipment type: Test and Measuring Installation Category II (as defined in IEC 61010-1, Annex J) Pollution Degree 2 (as defined in IEC 61010-1) Safety Class I - grounded product	

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks or modules in the RTX130A. The *Diagrams* section, beginning on page 6-1, includes a block diagram and an interconnect diagram.

A12 Main Board

The A12 Main board consists of the following blocks:

PCI Interface

The PCI interface consists of a PCI target and a PCI master. The PCI target has three base address register areas. The PCI master has two DMA controllers used to transfer data from the A12 Main board to the system memory or from the system memory to the A12 Main board.

Mega FIFO

The Mega FIFO has 32 MB for playing and 32 MB for recording a stream data. It consists of two 256 megabit synchronous DRAM and FPGA. This FIFO is used to compensate for non-realtime operation of Windows XP.

TS Controller

The TS controller consists of the following blocks:

TS Packet Type Controller. This controller sets a packet size of 188, 204, 208, and Non TS (free length) as a TS packet type. For a Non TS format, the controller also sets a packet length (16-255) and data length (16-255). The data length shows an effective data length in one TS packet.

Data Valid Controller. This block generates a data valid signal that synchronizes with the first byte of a TS packet when stream output is started.

Psync Controller. Psync is a signal to identify the sync byte in a transport stream. When the controller is not in the Psync Regeneration mode, Psync is recognized as the first byte of a transport stream. In this case, Psync is output in the constant interval even when the sync byte is rewritten in the value except for 47h. For the Super Frame mode, Psync is output only once in 384 packets.

Psync Regenerator. This block becomes active when the Psync Regeneration mode is set. The block detects the sync byte (47h) in a data stream and regenerates a Psync signal. The psync generator supports 188, 204, 208 TS packets only.

PCR/DTS Updater. This block consists of a PCR counter and update logic. The PCR counter is a complex counter, which consists of a 9-bit counter (range 0-299) and 33-bit counter. The counter counts the 27 MHz standard frequency. The update logic replaces the PCR and PTS/DTS values in a transport stream with the sum of the original value and the PCR counter value.

Receive Rate Counter. This 24-bit counter is used for receive-rate calculation on recording process. When using a data valid signal (DVALID), the counter counts byte data rate. When not using DVALID, the counter counts receive clock.

Transmit Byte Counter. This 32-bit counter counts transmitted bytes. This counter can be read by the control software.

Interrupt Controller

The interrupt controller sends the following interruption signals to the CPU: Play FIFO empty, Record FIFO full, external trigger, 10 Hz, Playout DMA transfer finished, and Record DMA transfer finished. These interruptions can be disabled by the RTX130A application software. At power on, all interruptions are disabled.

TS Clock Generator

The TS clock generator consists of a VCO (Voltage Control Oscillator), phase detector, frequency divider. The VCO is used for generating a TS clock, and it covers frequencies of 400 MHz to 800 MHz. The frequency divider divides the clock by 65536 to 1.

Reference Clocks

The reference clocks consist of 27 MHz TCXO and half-divided output of 54 MHz clock generator. These clocks are used to compare the frequency of the TS Clock Generator.

A20 PCI Backplane Board

The A20 PCI Backplane board consists of the following connectors and circuitries:

PCI and ISA Connectors

The J100, J110, and J120 connectors are PCI slots for 5 V. The J130 connector is a PCI slot for 3.3 V and is reserved in the future. The J100 connector is the system slot and is used to install the CPU board (single board computer: SBC). The J110 and J120 connectors are used to install the A12 Main board and the A180 QAM Modulator board.

ATX Power Control Circuit

The PWR_Button line (Pins 9 and 10 of J310) of the SBC is connected to the power switch on the A35 Power Switch board through the A30 Front Panel board. When the power switch is pressed, the SBC causes the PSON# signal to go low. When the PSON# signal becomes low, Q10 turns on and +12 V main power is also on. When the power switch is pressed again, its status is sent to BIOS and the PSON# signal turns high. This circuit includes a +12 V to +5 V DC-DC converter, a +12 V to +3.3 V converter, and a +12 V to –12 V converter.

Interconnect Circuit

There are four connectors in the interconnect circuit: J230, J240, J290, and J310. J230 is used to connect the board to the LCD interface on the CPU board. J290 is used to connect the board to COM2 on the CPU board. J310 is used to connect the board to the hard disk drive LED and reset/power button on the CPU board. J240 is used to connect the board to the A30 Front Panel board. This circuit also has an RS-232C level converter.

Fan Speed Control Circuit

U700 (PIC Micro) controls the internal fan revolution. It gets the temperature data from the sensors (U720 and U730) through 12C BUS and controls the supply voltage to the fan (7 V to 11.5 V).

IEEE1394b Interface

The IEEE1394 interface consists of the 1394b link-layer device (U110), cable transcriver/arbiter (U120), oscillator (Y100), serial EEPROM (U140), regulators (U130 and U230), and IEEE1394b connector (J140).

A180 QAM Modulator Board

Figure 2-1 shows the block diagram of the A180 QAM Modulator board.

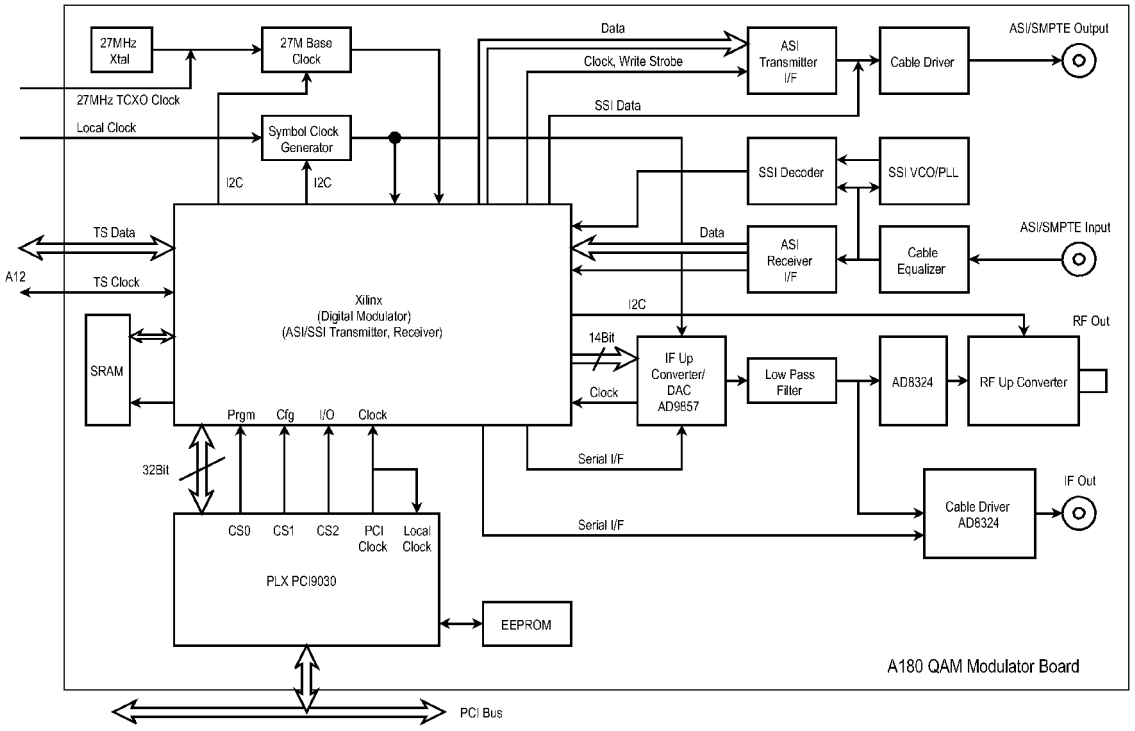

Figure 2-1: Block diagram of the A180 QAM Modulator board

PCI Interface

U3 (PLX PCI9030) is a PCI target device. The application software controls the A180 board via PCI 9030. An EEPROM (U4) is connected to PCI 9030 and it contains the PCI configuration data for the A180 board.

Digital Modulator

U37 (Xilinx Spartan-3 XC3S1500-4) is a re-configurable device that is configured via the PCI bus. The application software configures the device as an ITU-T J.83 Annex A, B, C/C-JCTEA, or ATSC 8 VSB modulator.

SRAM

U13 is a 128 K by 36 bit synchronous-pipelined burst SRAM. The J.83 Annex B modulator uses the SRAM for interleave storage, but other modulators do not use it.

Local Bus Interface

The Local Bus interface consists of U5, U6, U7, and U8. U5 is a local bus data driver/receiver, U6 is a control signal driver/receiver, U7 is an LVDS receiver, and U8 is an LVDS driver.

Base Clock Generator and Symbol Clock Generator

U11 (symbol clock generator) and U12 (base clock generator) are programmable clock generators. The application software can program these clock generators via I2C interface in the digital modulator.

Switching Regulator

U35 is a switching regulator for the internal supply voltage of the digital modulator. It converts +3.3 V to +1.2 V.

Linear Voltage Regulator

U36 is a linear voltage regulator for the auxiliary supply voltage of the digital modulator. It converts +3.3 V to + 2.5 V.

Cable Equalizer and ASI Receiver

U14 is a cable equalizer for an ASI/SMPTE310M signal. The ASI receiver converts an 8B/10B signal to a parallel signal.

SMPTE310M Receiver

U15 is a programmable SMPTE receiver that can be re-programmed via the J4 connector. There are an SMPTE310M decoder and PLL controller in U15.

ASI Transmitter

U18 (CY7B9234) is an ASI transmitter. It converts parallel data to 8B/10B serial data.

Output Selector

U20 (MC100EL57) is an output selector. It selects one of the four input status; low level, loop-through signal, SMPTE310M signal and ASI output.

Cable Driver

U21 (CLC007) is a cable driver. It can drive a 75 Ω coaxial cable.

SMPTE310M VCO Circuit

M1 is a VCO for the SMPTE310M receiver. The frequency is controlled by an SMPTE310M input signal.

Quadrature Digital Up-Converter and DAC

U22 (AD9857) is a quadrature digital up-converter and DAC. It consists of digital filters, quadrature modulator, DDS (direct digital synthesis), and 14-bit DAC. The quadrature modulator converts I/Q data to real data. The 14-bit DAC converts the digital output from the quadrature modulator to an analog signal.

Low Pass Filter

The low pass filter is connected to the output of AD9857. It is a 7th order elliptic filter and removes Nyquist images.

Buffer Driver and Cable Driver

U39 and U40 are buffer drivers (AD8131). U42 and U52 are the cable drivers (AD8324). The cable driver is gain programmable over a range of 60 dB.

RF Up-Converter

U44 (MT5100) is an RF up-converter. The converter has the output frequency range of 50 MHz to 860 MHz and output level of 45 dBm to 58 dBm. The output level is set using the cable drivers (described in the preceding paragraph).

Power Supply

The power supply consists of U38, U41 (LT1370), U43, U45 (LT1372), U47, U49, and U50. U41 is a part of the +7 V switching power supply. U43 is a linear voltage regulator that generates a +6 V from +7 V. The RF up-converter uses the voltage. U 50 is a linear voltage regulator that generates +5 V from +7 V. Maximum current of the +6 V regulator is +1.5 A and that of the +5 V regulator is 0.5 A. U38 is a linear voltage regulator that converts +5 V to + 3.3 V. U45 is a part of +14 V switching power supply. U47 is a linear voltage regulator that generates + 12 V from + 14 V and it supplies + 12V to the SMPTE310M VCO. U 49 is a negative regulator that generates –5 V from –12 V.

A30 Front Panel Board

The A30 Front Panel board consists of the front panel processor circuit, LVDS receiver for FPD (flat panel display) link, video inverter circuit, rubber contact switches, three connectors, and three LEDs.

Front-panel Key Interface and LED Control

The state of the front-panel keys are read by the one chip processor on the board and any setting changes are reported to the SBC through COM2. The processor also controls the LED on/off state.

LVDS Receiver for FPD Link

The LVDS receiver converts the four LVDS data streams back into 28 parallel bits of CMOS/TTL data (24 bits of RGB and 4 bits of Hsync, Vsync, DE, and CNTL).

Video Inverter Circuit

The video inverter circuit consists of an FPGA and SRAM. The circuit converts the display data upside down because the LCD display is attached to the chassis upside down.

A35 Power Switch Board

The A35 Power Switch board is connected to the A20 PCI Backplane board through the A30 Front Panel board. There are two USB connectors on the board that are directly connected to the USB2.0 interface connector on the CPU board. The board also has the power supply module for the LCD back light.

A40 AC Distributer Board

The A40 AC Distributer board supplies standby power (5VSB) to the SBC and the ATX power control circuit on the A20 Backplane board.

A50 Disk I/F Board

The A50 disk I/F board connects the secondary IDE connector on the CPU board with the DVD drive module.

Performance Verification

Performance Verification

This section provides procedures to verify the performance and functionality of the RTX130A.

Equipment Required

Table 3-1 lists the test equipment required to perform all of the performance verification procedures. The table identifies examples of recommended equipment and lists the required precision where applicable. If you substitute other test equipment for the examples listed, the equipment must meet or exceed the listed tolerances.

Table 3-1: Equipment required for performance verification

Item	Qty.	Minimum requirements	Recommended equipment
Frequency counter	1 ea.	Frequency range: 27 MHz to 200 MHz Precision: 8 digits or higher	Agilent Technologies 53181A
MPEG analyzer	1 ea.		Tektronix MTS430 or MTS400
Function generator	1 ea.	Frequency: 40 M clock pattern Amplitude: 3 V Outputs: 2 channel	Tektronix AFG3102
Oscilloscope	1 ea.	Bandwidth: 1 GHz or higher	Tektronix TDS5104B
MPEG transport stream monitor	1 ea.		Tektronix MTM400 Option QA/QB2/QC/VS[1]
PC	1 ea.	Microsoft Internet Explorer (Version 5) and Java Virtual Machine (Version 5) must be installed	
Probe	1 ea.		Tektronix P5050
75 Ω signal adapter	1 ea.	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75
BNC(Fe)-to-F(Ma) adapter	1 ea.	75 Ω	Tektronix part number 103-0158-00
20 dB attenuator	2 ea.	75 Ω	Mini-Circuits HAT-20-75
50 Ω BNC cable	2 ea.	Length: 42 inches	Tektronix part number 012-0057-01
75 Ω BNC cable	1 ea.	5C-2V, 1 m	Canare DH5C01-S-SA
Parallel interface cable	1 ea.	25-pin, D-type	Tektronix part number 012-A220-00 (supplied with the RTX130A)
IEEE1394b cable	1 ea.	9 pin-9 pin	
Crossover Ethernet cable	1 ea.		

Table 3-1: Equipment required for performance verification (Cont.)

Item	Qty.	Minimum requirements	Recommended equipment
IEEE1394b hard disk drive	1 ea.		Novac NV-HD352WB and hard disk drive (Tektronix part number 119-7146-00)

[1] **MTM400 option(s) required depends on the modulation option(s) installed in the instrument to be tested as follows:**
RTX130A Option M1: Option QA
RTX130A Option M2: Option QB2
RTX130A Option M3: Option QC
RTX130A Option M4: Option VS

RTX130A Test Record

Photocopy this page and use it to record the performance test result.

Table 3-2: RTX130A test record

Serial Number:	Cal Date:	Temperature:	Humidity:

Performance Test	Minimum	Measured	Maximum
Internal Clock Frequency	26.999973 MHZ	MHz	27.000027 MHz

Procedures

The following conventions are used in the performance verification procedures:

- Each test lists the characteristic that is being tested and the equipment required to perform the test.
- Each test contains complete setup instructions, which allows you to perform each test individually or in order.
- The equipment connection illustrations are specific to the recommended equipment (equipment nomenclature is labeled). If you are using substitute equipment, the location of your signal connections may vary from those in the illustrations.

NOTE. Before you begin the performance verification procedures, be sure that the RTX130A is operating in an environment that is within the operating limits described in Table 1-4 on page 1-12.

In addition, the RTX130A and the test equipment must be warmed up for at least 20 minutes to ensure accurate test results.

Internal Clock Output Level and Frequency Accuracy

This test verifies the internal clock output level and frequency accuracy.

Equipment required	Oscilloscope Frequency counter 50 Ω BNC cable

1. Use the 50 Ω BNC cable to connect the Trig In/Out connector on the RTX130A to the oscilloscope CH1 input. See Figure 3-1.

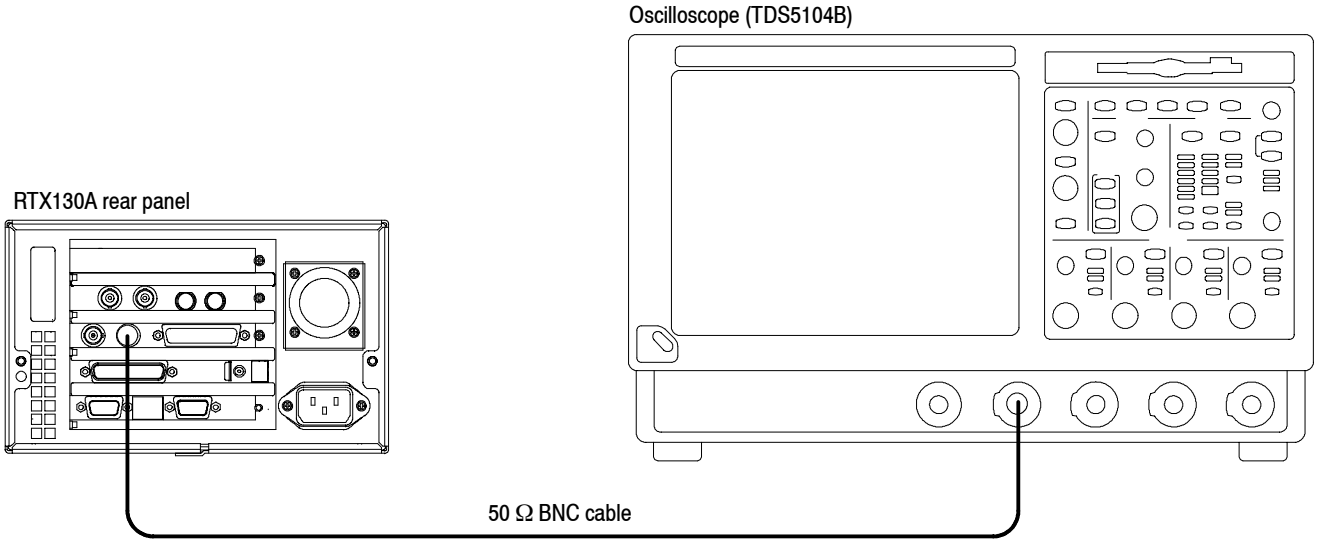

Figure 3-1: Equipment connection for checking the internal clock output level

2. Select **Play > Others** on the RTX130A to open the **Others** dialog box.
3. In the dialog box, select the **Ext Trigger BNC** button to open the Ext Trigger BNC dialog box.
4. In the dialog box, set **BNC IN/OUT** to **Output** and **BNC OUT Selection** to **27MHz**.

5. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . 1 V/div (CH1)
Input impedance . . . . . 50 Ω
Horizontal scale . . . . . 10 ns/div
Trigger position 50%
Acquire mode . . . . . Average 16
Trigger mode . . . . . Auto
Trigger level . . . . . 1.20 V
Trigger source CH1
Trigger slope . . . . . Rising Edge
Input coupling . . . . . DC
Measure . . . . . High Level, Low level

6. Verify that the measured values are as follows:

High Level: > 2.2 V
Low Level: < 0.8 V

7. Disconnect the 50 Ω BNC cable from the oscilloscope CH1 input, and then connect the BNC cable to the CH1 connector on the frequency counter. See Figure 3-2.

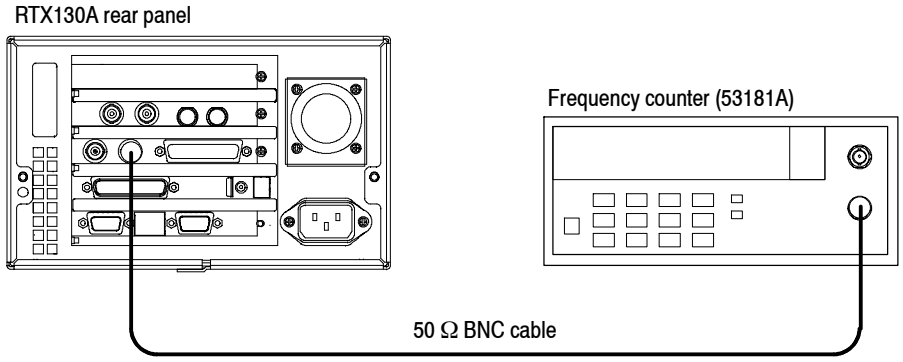

Figure 3-2: Equipment connection for checking the internal clock frequency

8. Set the frequency counter settings as indicated below:

MEASURE Frequency1
Gate Time: 0.20 s
CHANNEL1 . . . . . Coupling: DC
Impedance: 50
Trigger: AUTO TRIG ON

9. Verify that the frequency counter reading falls within the range of 26.999973 MHz to 27.000027 MHz (< 1.0 ppm).

10. In the Ext Trigger BNC dialog box, change **BNC IN/OUT** to **Input**.

11. Disconnect the BNC cable from the RTX130A and frequency counter.

SPI Interface

This test verifies that transport stream data is correctly played from and recorded through the SPI In/Out connector on the RTX130A.

Equipment required	MPEG analyzer Parallel interface cable test40.TRP file

Checking the Play Operation.

1. Use the parallel interface cable to connect the SPI In/Out connector on the RTX130A to the DVB SPI In connector on the MPEG analyzer. See Figure 3-3.

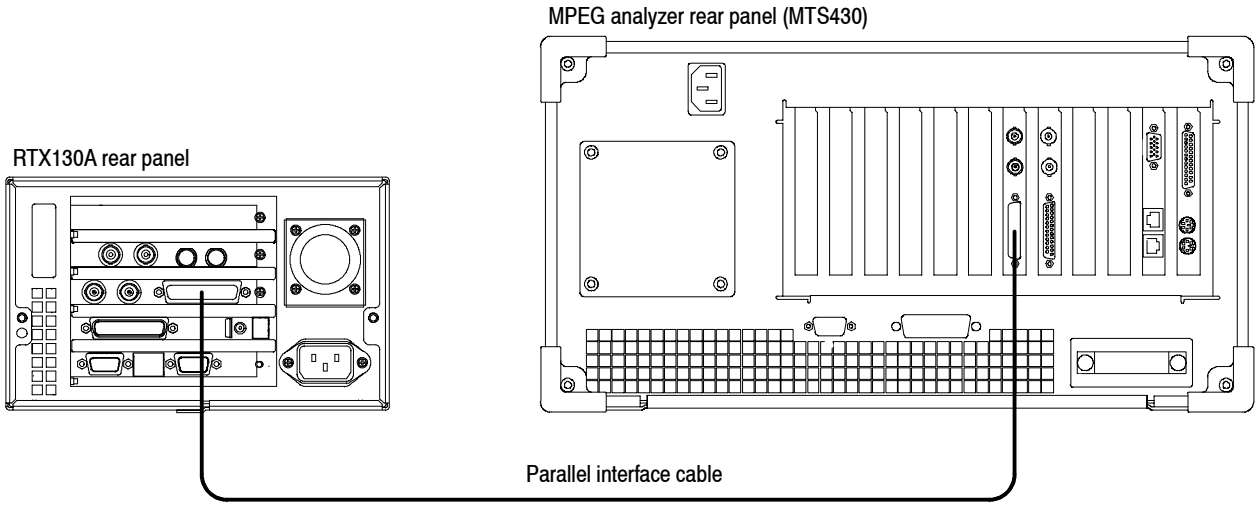

Figure 3-3: Equipment connection for checking the play operation- SPI interface

2. Start the **MPEG Player** application on the MPEG analyzer.

3. Set the application to the Record mode.

4. Open the **test40.TRP** file on the RTX130A.

   a. Select **File > Open** in the Play screen to open the **Select File** dialog box.

   b. In the dialog box, select the **test40.TRP** file.

5. On the RTX130A, make the following settings:

   Play menu
   Data rate . . . . 214 Mbps
   Update . . . . . Off
   Source . . . . . RAM

6. On the MPEG analyzer, make the following settings:

   Record
   Source . . . . . SPI
   Target . . . . . RAM, Size: 100 MB

   File
   Save Mode . . Overwrite
   Save . . . . . E:\MTXRTX_Test streams\Record_Files\SPI214Mbps

7. Press the **PLAY** button on the RTX130A to start playing the test40.TRP file.

8. Verify that the hierarchic view is displayed on the MPEG analyzer screen. In addition, verify that the bit rate is **214 Mbps** and the packet size is **188** bytes.

9. Click the **Record** button on the MPEG Player application to record the file.

10. After recording is completed, press the **STOP** button on the RTX130A.

Checking the Record Operation.

11. Change the interface cable connection from DVB/SPI In connector to DVB/SPI Out connector on the MPEG analyzer.

12. Press the **REC** button on the RTX130A to display the Record screen.

13. On the RTX130A, make the following settings:

   Record menu
   Source . . . . . SPI
   Target . . . . . RAM
   Record Size . . 100 MB

   File menu
   Save Mode . . Over Write
   Save . . . . . D:\Record_Files\SPI214Mbps

14. Change the MPEG analyzer to the Play mode.

15. Select **File > Open** on the MPEG analyzer to display the Open dialog box.

16. In the dialog box, navigate to the **E:\MTXRTX_Test streams\ Record_Files**, and then select the **SPI214Mbps.trp** file.

17. On the MPEG analyzer, make the following settings:

    Play menu
    Data Rate . . . 214 Mbps
    Update . . . . . Off
    Source . . . . . RAM

18. Click the **PLAY** button on the MPEG Analyzer to start playing the **SPI214Mbps.trp** file.

19. Verify that the hierarchic view is displayed on the RTX130A screen. In addition, verify that the bit rate display is **214 Mbps** and the packet size display is **188** bytes.

20. Press the **REC** button on the RTX130A to record the file.

21. After recording is completed, click the **Stop** button on the MPEG analyzer.

22. Exit the MPEG Player application on the MPEG analyzer.

Checking the Recorded File.

23. Change the interface cable connection from DVB/SPI Out connector to DVB/SPI In connector on the MPEG analyzer.

24. Start the **TS Compliance Analyzer** on the MPEG analyzer.

25. In the **Open Transport Stream** dialog box, select **Real-time Analysis**, and then make the following settings:

    Interfaces . . . . . DVB Parallel
    Interface Settings . . . . Time Stamping

26. Click the **OK** button.

27. Press the **PLAY** button on the RTX130A to display the Play screen.

28. Select **File > Open** to open the **Select File** dialog box.

29. In the dialog box, navigate to the **D:\ Record_Files** directory, and then select the **SPI214Mbps.trp** file.

30. Select **Play > Update > On** on the RTX130A.

31. Press the **PLAY** button on the RTX130A to start playing the SPI214Mbps.trp file.

32. Verify that the hierarchic view is displayed on the screen and that no error messages appear. In addition, verify that the bit rate is **40 Mbps** and that the transport stream packet size is **188** bytes.

NOTE. Ignore Program 3 and PID 120 (0x78) errors in the hierarchical view because these are caused by the original test40.TRP file.

33. Press the **STOP** button on the RTX130A.

34. Close the TS Compliance Analyzer window.

External Clock/Reference and External Trigger Inputs

This test confirms that the external clock/reference input (Clock/Ref In) and external trigger input (Trig In/Out) on the RTX130A are functioning correctly.

Equipment required	MPEG analyzer
	Function generator
	Two 50 Ω BNC cables
	Parallel interface cable
	test64.TRP file

1. Use a 50 Ω BNC cable to connect the Clock/Ref In connector on the RTX130A to the Ch1 connector on the function generator. See Figure 3-4.

2. Use the 50 Ω BNC cable to connect the Trig In/Out connector on the RTX130A to the Ch2 connector on the function generator. See Figure 3-4.

3. Use the parallel interface cable to connect the SPI In/Out connector on the RTX130A to the DVB/SPI In connector on the MPEG analyzer. See Figure 3-4.

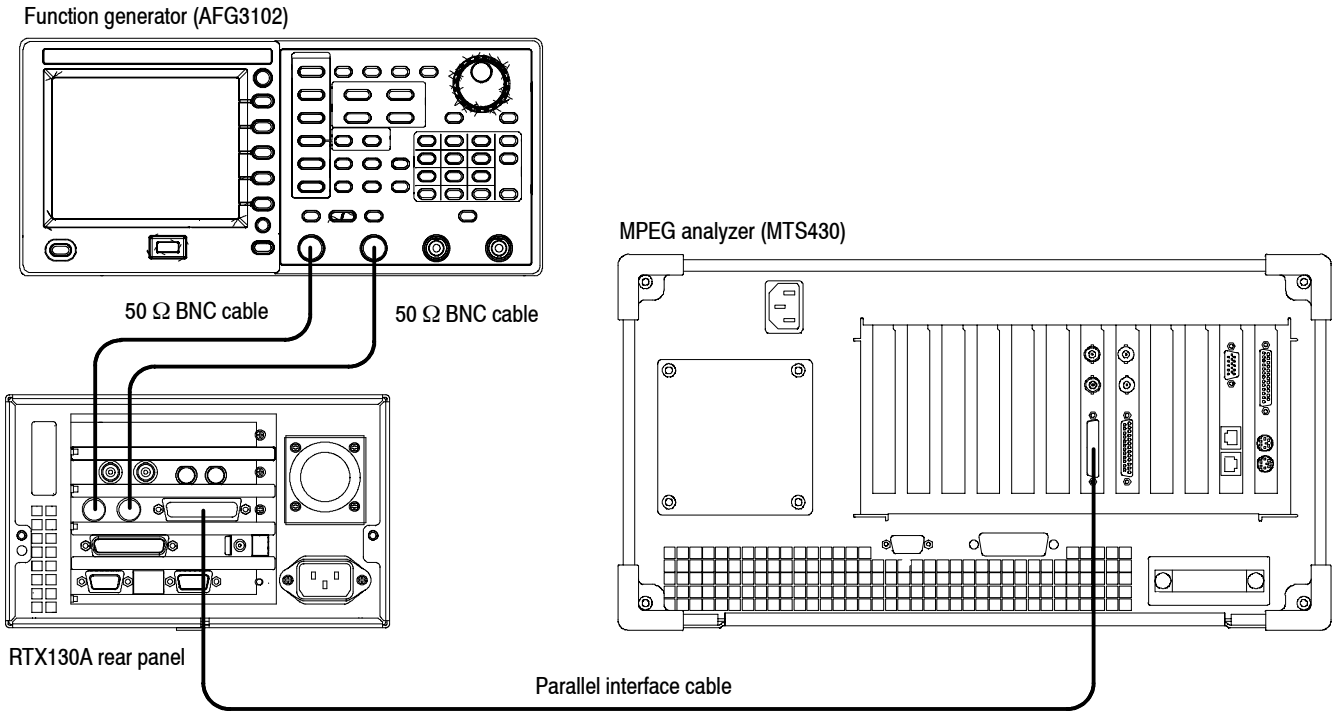

Figure 3-4: Equipment connections for checking the external clock/reference and trigger inputs

4. Set the function generator settings as indicated below:

   Ch 1 output
   Function . . . . . Square
   Run Mode . . . . . Continuous
   Frequency . . . . . 10 MHz
   Output Amplitude . . . . 0.5 V
   Output Offset . . . . . 2.0 V

   Ch 2 output
   Function . . . . . Arb (Edit: Point Number: 100, All Data: 16382)
   Run Mode . . . . . Continuous
   Output Menu . . . . . Load Impedance: 1 kΩ
   Output Amplitude . . . . 1.75 V
   Output Offset . . . . . 0.875 V

5. Press the **On** button of the Ch1 output on the function generator.

6. Open the **test64.TRP** file on the RTX130A.

   a. Select **File > Open** in the Play screen to open the **Select File** dialog box.

   b. In the dialog box, select the **test64.TRP** file.

7. Set **Play > Update > On**.
8. Select **Play > Clock** to open the **Clock** dialog box.
9. In the Clock dialog box, select **ExtRef 10**.
10. Press the **PLAY** button on the RTX130A to start playing the test64.TRP file.
11. Verify that PLL unlock error does not occur on the RTX130A.
12. Start the **TS Compliance Analyzer** on the MPEG analyzer.
13. In the **Open Transport Stream** dialog box, select **Real-time Analysis**, and then make the following settings:

    Interfaces . . . . . DVB Parallel
    Interface Settings . . . . Time Stamping

14. Click the **OK** button.
15. Verify that the hierarchic view is displayed on the MPEG analyzer screen and that no error messages appear. In addition, verify that the bit rate is **64 Mbps** and the packet size is **188** bytes.

NOTE. Ignore Program 3 and PID 120 (0x78) errors in the hierarchical view because these are caused by the original test40.TRP file.

16. Change the clock source setting on the RTX130A and output frequency setting on the function generator with the following and then repeat step 15.

Clock source setting (RTX130A)	Output frequency setting (function generator)
ExtRef 27	27 MHz
Ext Ref 8.126984 MHz	8.126984 MHz
Ext P Clk	8 MHz

17. Change the output frequency of the function generator to 32 MHz.
18. Select **Play > Clock** on the RTX130A to open the **Clock** dialog box.
19. In the dialog box, select **Ext S Clk**.
20. Repeat step 15 and verify that all items in the **Priority 1** row are green.

NOTE. Ignore 2.3.a PCR Repetition and 2.5 PTS errors in the Priority 2 row.

21. Press the **STOP** button on the RTX130A to stop the stream output.

22. Select **Play > Clock** on the RTX130A to open the **Clock** dialog box.
23. In the dialog box, select **Internal**.
24. Press the **On** button of the Ch1 output on the function generator to stop the signal output.
25. Press the **On** button of the Ch2 output on the function generator to start the signal output.
26. Select **Play > Others** on the RTX130A to open the **Others** dialog box.
27. In the dialog box, set **Ext Play Start** to **Rise**.
28. Verify that the RTX130A starts playing when the **Output** menu is set to **Invert** on the function generator.
29. Press the **STOP** button on the RTX130A to stop the stream output.
30. Press the **On** button of the Ch2 output on the function generator to stop the signal output.
31. Return **Ext Play Start** to **Off** on the RTX130A.
32. Disconnect all cables from the RTX130A, function generator, and MPEG analyzer.

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ASI/SMPTE310M Interface

This test verifies that transport stream data is correctly played from and is recorded through the ASI/SMPTE310M interface on the RTX130A.

Equipment required	MPEG analyzer
	Oscilloscope
	75 Ω BNC cable
	75 Ω signal adapter
	test40.TRP file
	Flower.trp file

Checking the Output Signal.

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the ASI/SMPTE Output connector on the RTX130A to the oscilloscope CH1 input. See Figure 3-5.

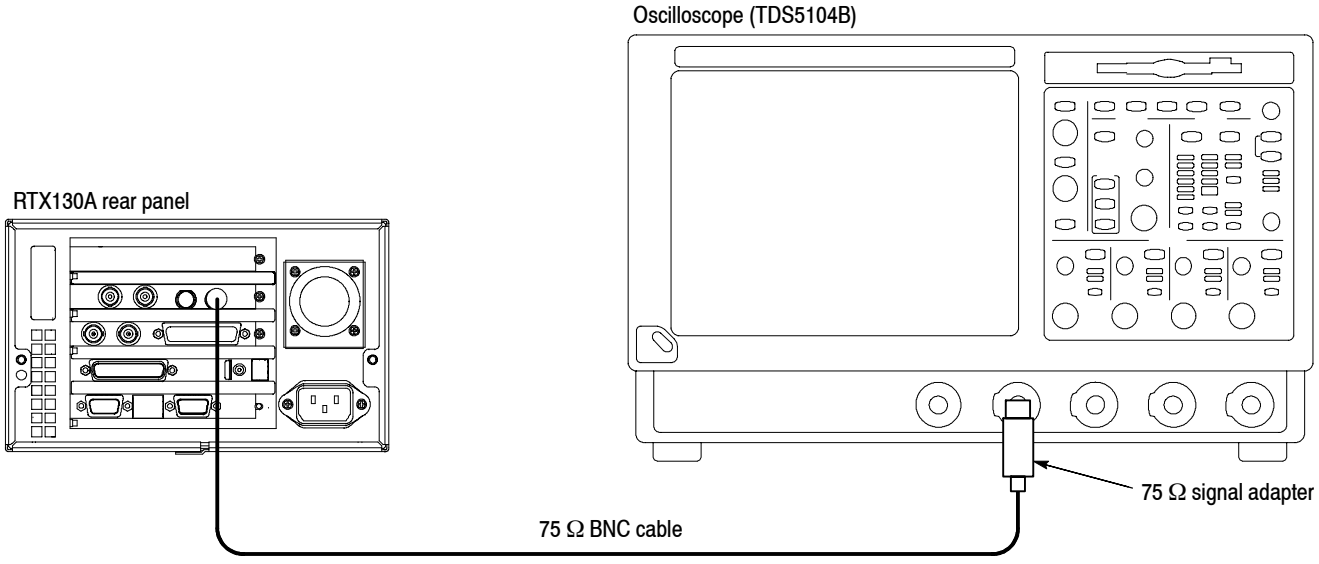

Figure 3-5: Equipment connection for checking the output signal- ASI interface

2. Set the oscilloscope settings as indicated below:

   Vertical scale . . . . . 200 mV/div
   Input impedance . . . . . 50 Ω
   Horizontal scale . . . . . 1.25 ns/div
   Trigger position 50%
   Acquire mode . . . . . Average 32
   Trigger mode . . . . . AUTO
   Trigger source CH1
   Trigger level . . . . . 0 V
   Trigger slope . . . . . Rising Edge
   Input coupling . . . . . DC
   Measure . . . . . Amplitude, Rise Time, Fall Time
   Gating . . . . . Cursor Curs1 Pos1: –2.5 ns/Curs2: 2.75 ns

3. Open the **test40.TRP** file on the RTX130A.

   a. Select **File > Open** in the Play screen to open the **Select File** dialog box.

   b. In the dialog box, select the **test40.TRP** file.

4. Press the **PLAY** button to start playing the test40.TRP file.

5. Use the oscilloscope to measure that the amplitude, rise and fall times are as follows:

   Amplitude: 740 mV to 860 mV
   Rise and fall time: ≤ 1.2 ns

Checking the ASI Play Operation.

6. Disconnect the BNC cable from the 75 Ω signal adapter on the oscilloscope, and then connect the cable to the ASI/SMPTE In connector on the MPEG analyzer. See Figure 3-6.

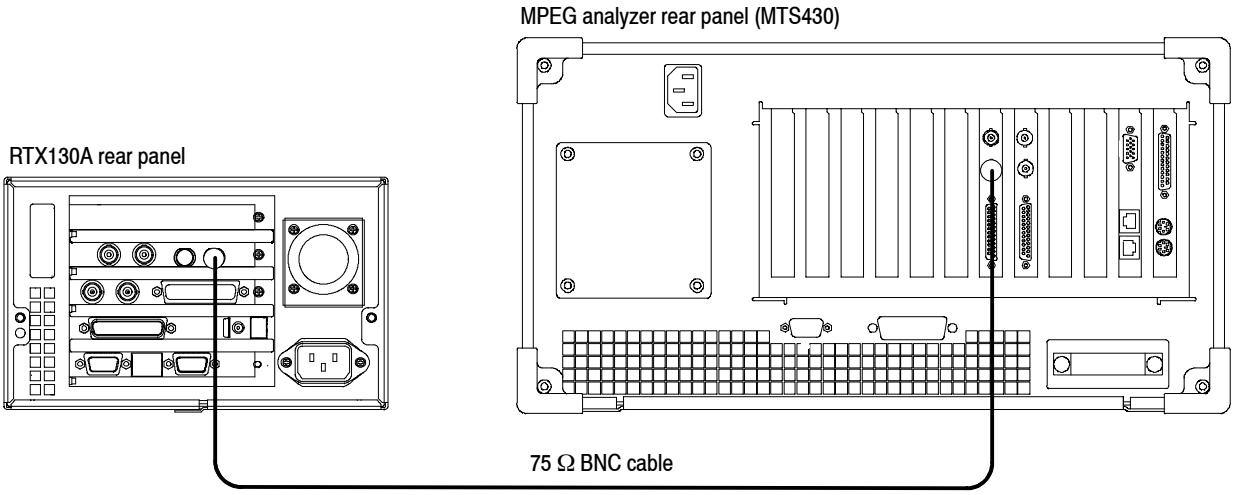

Figure 3-6: Equipment connections for checking the ASI play operation

7. Start the **MPEG Player** application on the MPEG analyzer.
8. Set the application to the **Record** mode.
9. Set the MPEG analyzer settings as indicated below:

Record menu
Source SPI/ASI/310M
Target . . . . . RAM, Record Size: 100 MB

SPI/ASI/310M menu
Input Port . . . BNC
BNC Port . . . ASI

File menu
Save Mode . . Over write
Save . . . . . E:\MTXRTX_Test streams\Record_Files\ASI214Mbps.trp

10. On the RTX130A, make the following settings:

Play menu
Clock . . . . . Data Rate: 214 Mbps
Update . . . . . Off
Source . . . . . RAM

QAM/VSB menu
BNC Port . . . ASI
Through Out . Off
RF Out . . . . . Off

11. Press the **PLAY** button on the RTX130A to start playing the test40.TRP.

12. Verify that the hierarchic view is displayed on the MPEG analyzer screen. In addition, verify that the bit rate is **214 Mbps** and the packet size is **188** bytes.

13. Click the **Record** button on the MPEG Player application to record the file.

14. After recording is completed, press the **STOP** button on the RTX130A.

15. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

Checking the ASI Record Operation.

16. Use the 75 Ω BNC cable to connect the ASI/SMPTE Input connector on the RTX130A to the ASI/SMPTE Out connector on the MPEG analyzer. See Figure 3-7.

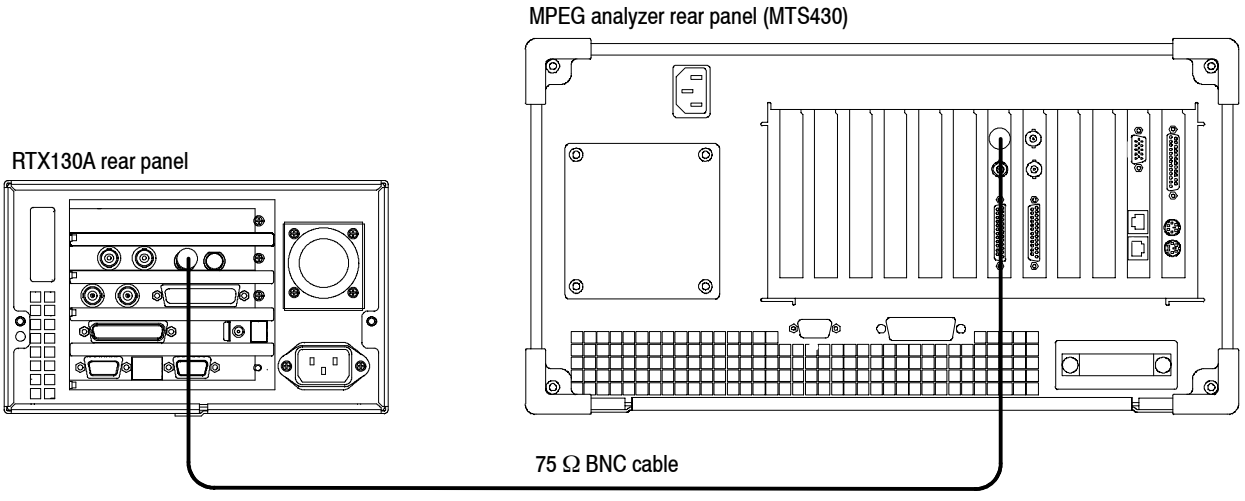

Figure 3-7: Equipment connection for checking the ASI record operation

17. Press the **REC** button on the RTX130A to display the Record screen.

18. On the RTX130A, make the following settings:

Record menu
Source . . . . . QAM/VSB
Record size . . . . . 100 MB
Target . . . . . RAM

QAM/VSB menu
BNC Port . . . . . ASI

File menu
Save Mode . . . . . Over Write
Save . . . . . D:\Record_Files\ASI214Mbps.trp

19. Set the MPEG analyzer to the Play mode.

20. Select **File > Open** on the MPEG analyzer to display the Open dialog box.

21. In the dialog box, navigate to the **E:\MTXRTX_Test Streams\Record_Files** directory, and then select the **ASI214Mbps.trp** file.

22. On the MPEG player, make the following settings:

Play menu
Clock . . . . . Data Rate: 214 Mbps
Update . . . . . Off
Source . . . . . RAM

SPI/ASI/310M menu
BNC Port . . . . . ASI
Through Out . . . . Off

23. Click the **PLAY** button on the MPEG analyzer to start playing the ASI214Mbps.trp file.

24. Verify that the hierarchic view is displayed on the RTX130A screen. In addition, verify that the bit rate is **214 Mbps** and packet size is **188** bytes.

25. Press the **REC** button on the RTX130A to record the file.

26. After recording is completed, click the **Stop** button on the MPEG analyzer.

27. Exit the MPEG Player application on the MPEG analyzer.

28. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

Checking the Recorded File.

29. Use the 75 Ω BNC cable to connect the ASI/SMPTE Output connector on the RTX130A to the ASI/SMPTE In connector on the MPEG analyzer. See Figure 3-8.

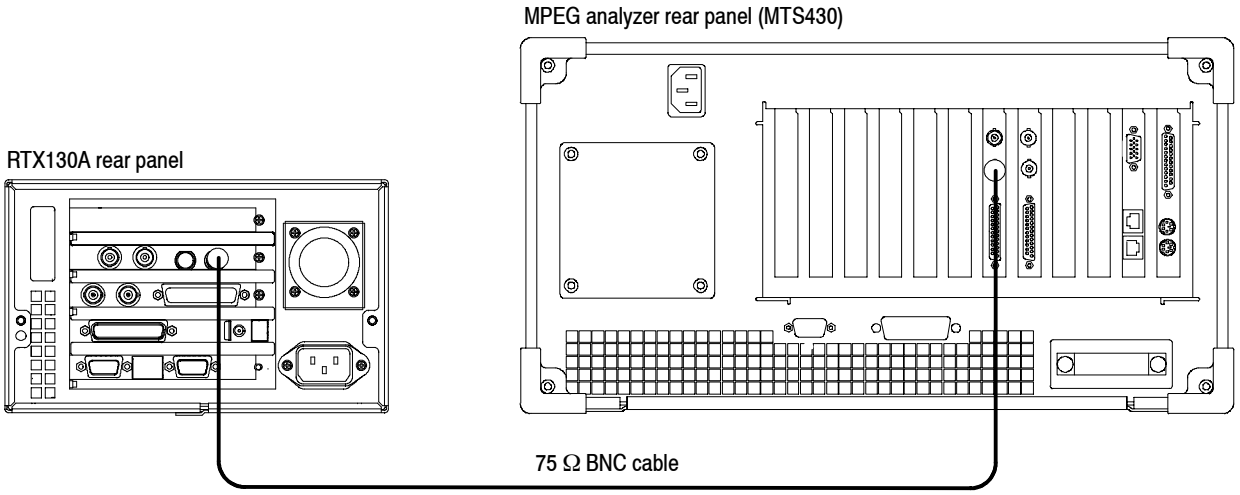

Figure 3-8: Equipment connection for checking the recorded file- ASI interface

30. Press the **PLAY** button on the RTX130A to display the Play screen.

31. Select **Play > Update > On**.

32. Open the **ASI214Mbps** file on the RTX130A.

a. Select **File > Open** to open the **Select File** dialog box.

b. In the dialog box, navigate to the **D:\Record_Files** directory, and then select the **ASI214Mbps.trp** file.

33. Press the **PLAY** button to start playing the file.

34. Start the **TS Compliance Analyzer** on the MPEG analyzer.

35. In the **Open Transport Stream** dialog box, select **Real-time Analysis**, and then make the following settings:

Interfaces . . . . . ASI
Interface Settings . . . . Time Stamping

36. Click the **OK** button.

37. Verify that the hierarchic view is displayed on the screen and that no error messages appear. In addition, verify that the bit rate is **40 Mbps** and that the packet size is **188** bytes.

NOTE. Ignore Program 3 and PID 120 (0x78) errors in the hierarchical view because these are caused by the original test40.TRP file.

38. Press the **STOP** button on the RTX130A to stop the stream output.

39. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

Checking the 8VSB Play Operation.

40. Use the 75 Ω BNC cable to connect the ASI/SMPTE Output connector on the RTX130A to the ASI/SMPTE In connector on the MPEG analyzer. See Figure 3-9.

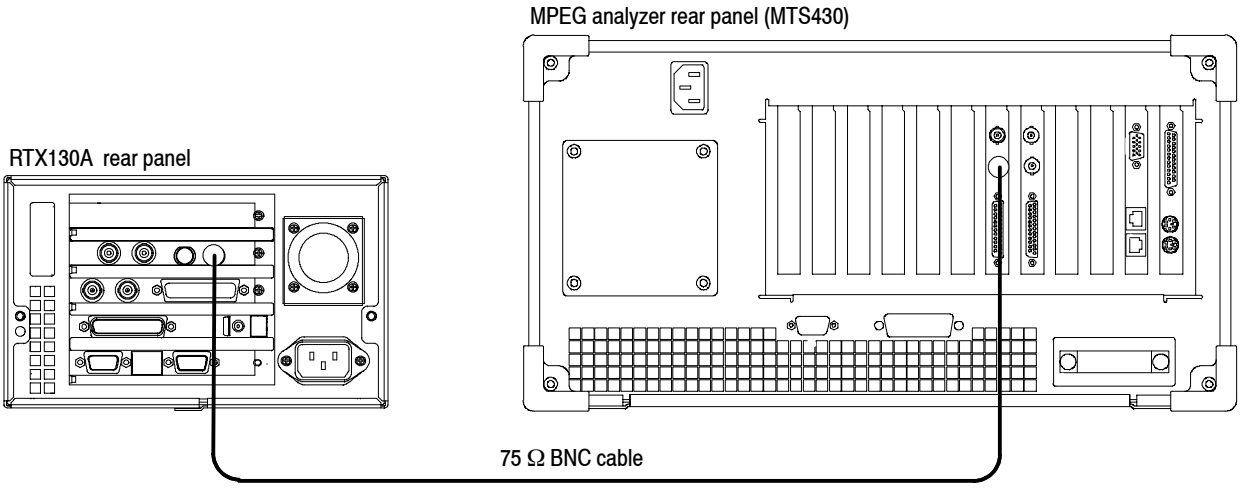

Figure 3-9: Equipment connection for verifying the 8VSB play operation

41. Start the **MPEG Player** application on the MPEG analyzer.

42. Set the application to the **Record** mode.

43. Set the MPEG analyzer settings as indicated bellow:

Record menu
Source SPI/ASI/310M
Target . . . . . RAM, Record Size: 100 MB

SPI/ASI/310M menu
Input Port . . . . . BNC
BNC Port 310M

File menu
Save Mode . . . . . Over write
Save . . . . . E:\MTXRTX_Test streams\Record_Files\S310M.trp

44. Open the **Flower.trp** file on the RTX130A.

a. Select **File > Open** to open the **Select File** dialog box.

b. In the dialog box, navigate to the **D:\525** directory, and then select the **Flower.trp** file.

45. On the RTX130A, make the following settings:

Play menu
Clock . . . . . Data Rate: 19.392658 Mbps
Update . . . . . Off
Source . . . . . RAM

QAM/VSB menu
BNC Port 310M 8VSB
Through Out . . . . Off
RF Out . . . . . Off

46. Press the **PLAY** button on the RTX130A to start playing the Flower.trp file.

47. Verify that the hierarchic view is displayed on the MPEG analyzer screen. In addition, verify that the bit rate is **19.392 Mbps** and packet size is **188** bytes.

48. Click the **Record** button on the MPEG Player application to record the file.

49. After recording is completed, press the **STOP** button on the RTX130A.

50. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

Checking the 8VSB Record Operation.

51. Use the 75 Ω BNC cable to connect the ASI/SMPTE Input connector on the RTX130A to the ASI/SMPTE Out connector on the MPEG analyzer. See Figure 3-10.

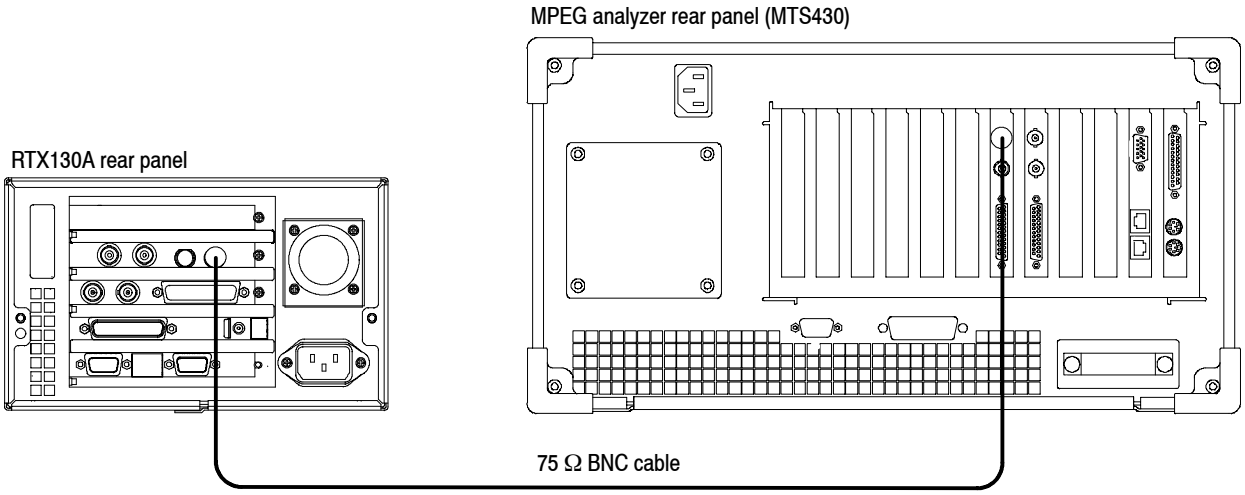

Figure 3-10: Equipment connection for verifying the 8VSB record operation

52. Press the **REC** button on the RTX130A to display the Record screen.

53. On the RTX130A, make the following settings:

Record menu
Source . . . . . QAM/VSB
Record size . . . . . 100 MB
Target . . . . . RAM

QAM/VSB menu
BNC Port 310M 8VSB

File menu
Save Mode . . . . . Over Write
Save . . . . . D:\Record_Files\S310M.trp

54. Set the MPEG analyzer to the Play mode.

55. Select **File > Open** on the MPEG analyzer to display the Open dialog box.

56. In the dialog box, navigate to the **E:\MTXRTX_Test Streams\Record_Files** directory, and then select the **S310M.trp** file.

57. On the MPEG player, make the following settings:

Play menu
Update . . . . . Off
Source . . . . . RAM

SPI/ASI/310M menu
BNC Port 310M 8VSB
Through Out . . . . Off

58. Click the **Play** button on the MPEG analyzer to start playing the S310M.trp file.

59. Verify that the hierarchic view is displayed on the RTX130A screen. In addition, verify that the bit rate is **19.392 Mbps** and packet size is **188** bytes.

60. Press the **REC** button on the RTX130A to record the file.

61. After recording is completed, click the **Stop** button on the MPEG analyzer.

62. Exit the MPEG Player application on the MPEG analyzer.

63. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

Checking the Recorded File.

64. Use the 75 Ω BNC cable to connect the ASI/SMPTE Output connector on the RTX130A to the ASI/SMPTE In connector on the MPEG analyzer. See Figure 3-11.

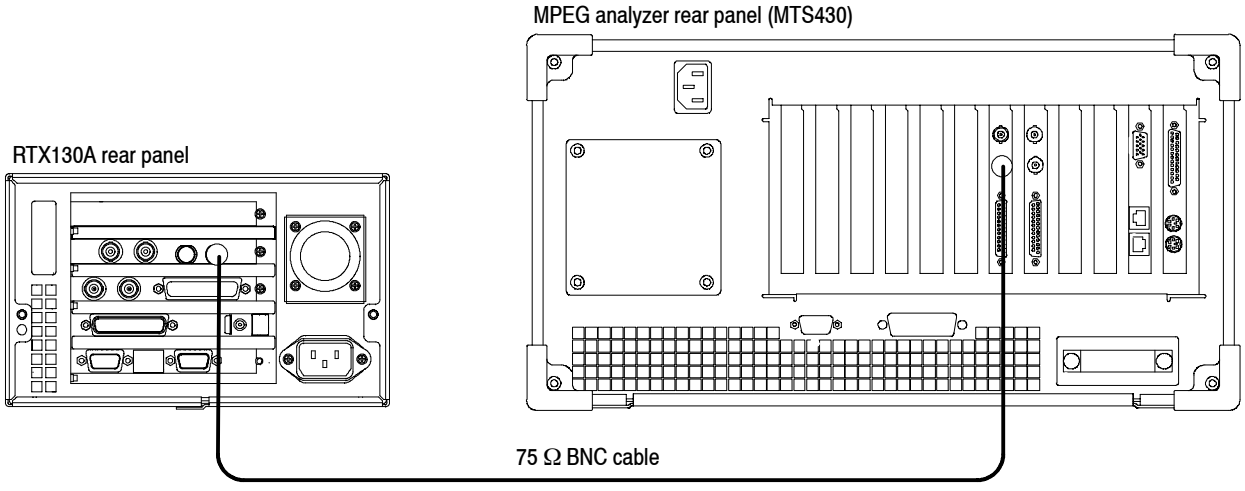

Figure 3-11: Equipment connection for verifying the recorded file- SMPTE310M interface

65. Press the **PLAY** button on the RTX130A to display the Play screen.

66. Open the **310M.trp** file on the RTX130A.

a. Select **File > Open** to open the Select File dialog box.

b. In the dialog box, navigate to the **D:\Record_Files** directory, and then select the **310M.trp** file.

67. Select **Play > Update > On**.

68. Press the **PLAY** button to start playing the file.

69. Start the **TS Compliance Analyzer** on the MPEG analyzer.

70. In the **Open Transport Stream** dialog box, select **Real-time Analysis**, and then make the following settings:

Interfaces . . . . . ASI
Interface Settings . . . . Time Stamping

71. Verify that the hierarchic view is displayed on the MPEG analyzer screen and that no error messages appear. In addition, verify that the bit rate is **19.392 Mbps** and that the packet size is **188** bytes.

NOTE. Ignore 3.4.a Unref PID error in the Priority 3 row.

72. Press the **STOP** button on the RTX130A to stop the stream output.

73. Disconnect the 75 Ω BNC cable from the RTX130A and MPEG analyzer.

74. Delete the **Record_Files** folder on the D: drive of the RTX130A.

RF Output

This test verifies the RF output. If the RTX130A has more than one modulation option, then repeat this procedure for each option. The following equipment is required for this test:

Equipment required	MPEG transport stream monitor
	PC (for controlling the MPEG transport stream monitor)
	Two 20 dB attenuators (75 Ω)
	BNC(Fe)-to-F(Ma) adapter
	75 Ω BNC cable
	Crossover Ethernet cable
	Flower.trp file

Initial Setup for the RTX130A.

1. Open the **Flower.trp** file on the RTX130A.
   a. Select **File > Open** to open the **Select File** dialog box.
   b. In the dialog box, navigate to the **D:\525** directory, and then select the **Flower.trp** file.
2. Select **Play > Clock** to open the **Clock** dialog box.
3. In the dialog box, select the **Fixed ES Rate** check box.
4. Select **Play > Update > On**.
5. Select **Play > Other** to open the **Others** dialog box.
   a. Set **Standard** to **MPEG2**.
   b. Select **Update**, and then set **Update Method** to **Hardware** in the Select Update Item dialog box.
6. Select **QAM/VSB > RF Output > On**.
7. Select **QAM/VSB > Modulation** to open the **Modulation** dialog box.
8. In the dialog box, make the following settings:

Standard	to match the standard to be tested.
Modulation	64 QAM (except for the ATSC standard)
Symbol Rate	5 M sps (for Annex A or C)
RF Center Frequency	200 MHz
RF Level	45 dBmV
Output	RF

9. Press the **PLAY** button on the RTX130A to start playing the Flower.trp file.

Checking the Output for Errors.

10. Use the 75 Ω BNC cable, two 20 dB attenuators, and BNC(Fe)-to-F(Ma) adapter to connect the RF Out connector on the RTX130A to the RF input on the MPEG transport stream monitor. See Figure 3-12.

NOTE. For the MTM400 Option QB2 and Option VS, use the RF cable (Tektronix part number 174-5135-00) to connect the ASI/SMPTE OUT connector on the interface card to the ASI/SMPT IN connector on the Transport Processor card.

11. Use the crossover Ethernet cable to connect the MPEG transport stream monitor to a PC. See Figure 3-12.

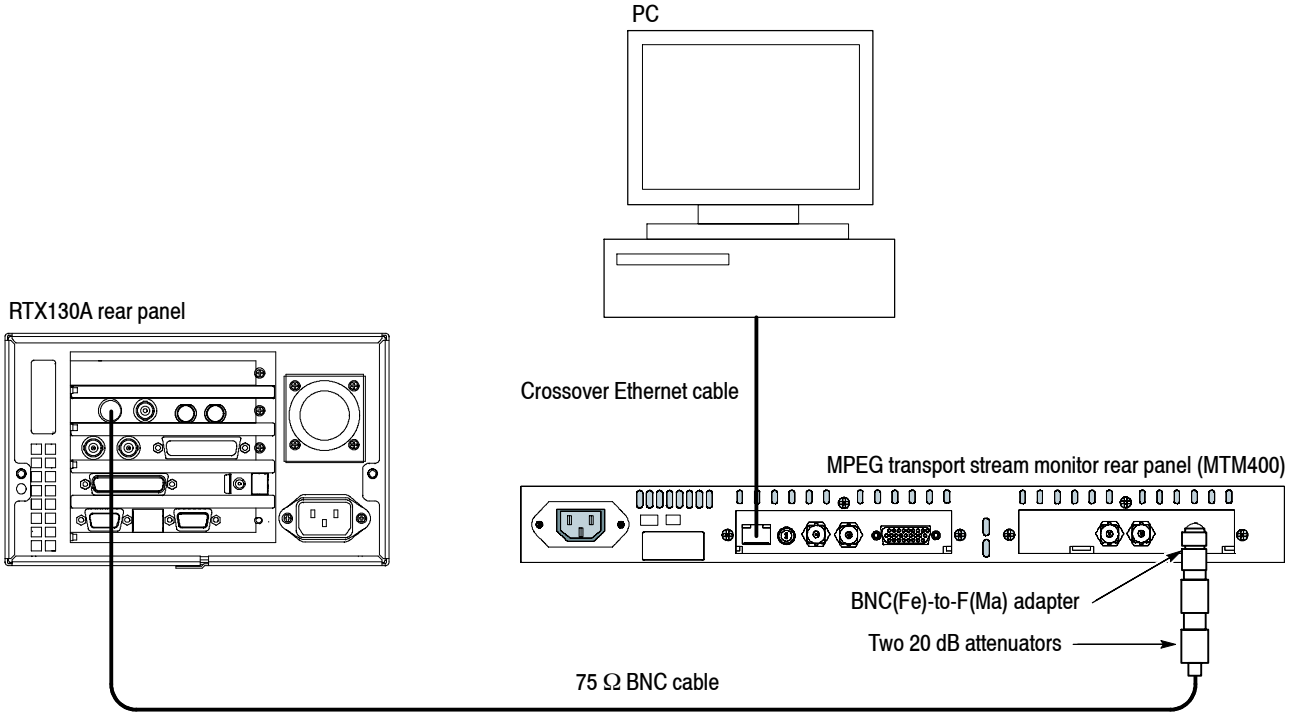

Figure 3-12: Equipment connection for checking the output for errors

12. Set the MPEG transport stream monitor as indicated below by clicking the item button:

Configuration screen:

Standard . . . . . DVM (QAM module) or
MPEG (8 VSB module)
Region (or Type) . . . . . Standard
Interface . . . . . QAM A/B/C or 8 VSB Interface
Stream Name . . . . . don't care
Template Checking . . . . . unchecked
Maintenance Mode . . . . . unchecked

QAM Settings or Interface Settings dialog box: (click the Config... button on the Configuration screen.)

- For Annex A and C:

  Rx Frequency [MHz] 200.0
  Symbol Rate [MS/s] 5.0
  Constellation 64
  Inversion . . . . . unchecked
  PLL Bandwidth . . . . . Normal
  AFG Range . . . . . Normal
  Analysis Mode . . . . . MPEG

- For Annex B:

  Tuner Frequency . . . . . 200000 kHz
  Modulation Format . . . . . auto
  Interleaving Mode . . . . . auto
  Carrier Lock . . . . . normal
  Tuner Phase Noise . . . . . high
  Equalization Range . . . . . normal

- For ATSC:

  Tuner Frequency . . . . . 200000 kHz
  IF Spectrum . . . . . normal
  Channel State . . . . . auto
  NTSC Rejection Filter . . . . . auto
  Carrier Lock . . . . . normal
  Tuner Phase Noise . . . . . normal
  Signal Detection . . . . . VSB

Tests Grouped by Priority 1 2 3 screen (see Figure 3-13):

All tests should be enabled with the following exceptions: 1.6 PID and 2.2 CRC should be disabled. Any Table test that refers to a table other than PAT or PMT should also be disabled. For example, disable any reference to NIT, SDT, EIT, RST, and TDT. (These are Priority 3 tests.) Right click the state icon for 2.3a PCR Repetition, select Properties, and then set the time value to 50 ms.

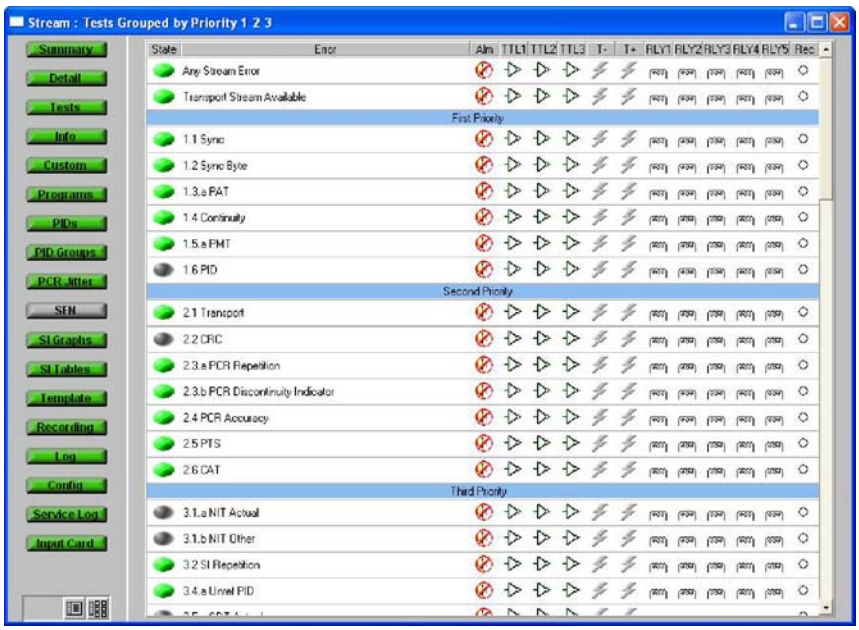

Figure 3-13: Tests Grouped by Priority 1 2 3 screen (Annex A)

NOTE. Some status icons may turn white by themselves. This is acceptable and indicates that these tests do not apply.

PIDs screen: (only for the ATSC standard)

Unref PID test should be disabled.

13. When the status icon in the Tests screen have all turned yellow or green (except for disabled or not applicable tests), right click the **Transport Stream Available** status icon, and then select **Reset**. Within a minute, all status icons turn green.

14. Click the **Input Card** button on the Configuration screen.

15. Verify that the measurement values are as follows (wait few minutes until the values become stable):

EVM (QAM A/B/C):	< 2.7%
EVM (8 VSB):	< 4.5%

16. Change **RF Center Frequency** to **450 MHz** on the RTX130A.

a. Select **QAM/VSB > Modulation** to open the **Modulation** dialog box.

b. In the dialog box, set the **RF Center Frequency** to 45**0 MHz**.

c. Select the **OK** button.

d. Press the **PLAY** button to output the RF signal.

17. Change **Tuner Frequency** in the Input Card dialog box to **450 MHz** on the MPEG transport stream monitor.

18. When the status icon in the Tests screen have all turned yellow or green (except for disabled or not applicable tests), right click the **Transport Stream Available** status icon, and then select **Reset**. Within a minute, all status icons turn green.

19. Repeat steps 14 and 15.

20. Repeat steps 16 through 19 for the frequency of 750 MHz.

21. Disconnect the 75 Ω BNC cable from the RTX130A.

IEEE1394b Interface

This test verifies that the IEEE1394b interface is functioning correctly.

Equipment required	IEEE1394b hard disk drive IEEE1394b cable (9 pin–9 pin)) test40.TRP file

1. Use the IEEE1394b cable to connect the IEEE1394b connector on the RTX130A to the IEEE1394b hard disk drive. See Figure 3-14.

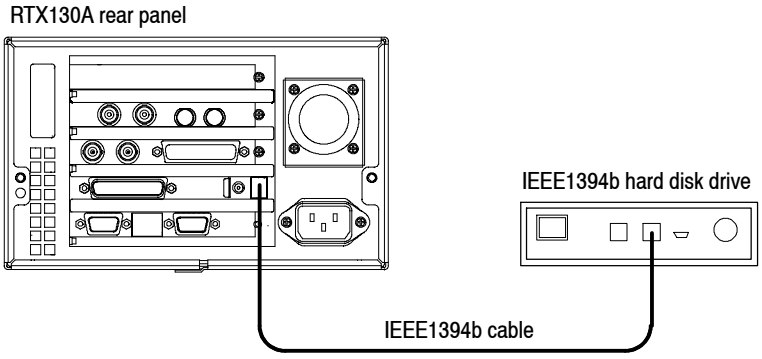

Figure 3-14: Equipment connection for checking the IEEE1394b interface

2. Select **Play** > **Minimize** to minimize the RTX130A application.
3. Power on the IEEE1394b hard disk drive.
4. Double-click the **My Computer** icon on the Windows desktop to open the My Computer window.
5. In the Window, verify that the hard disk drive is recognized as the **F:** (or **G:**) drive.
6. Use the windows file copy operation to copy the **test40.TRP** file on the **D:** drive to **F:** (or **G:**) drive.
7. Verify that the test40.TRP file is copied to the F: (or G:) drive correctly.
8. Delete the test40.TRP file from the F: (or G:) drive.
9. Power off the IEEE1394b hard disk drive.

This completes the RTX130A performance verification.

Maintenance

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the RTX130A. The following subsections are included:

- *Preparation* — Introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* — Information and procedures for inspecting the RTX130A and cleaning its external and internal modules.
- *Removal and Installation Procedures* — Procedures for the removal of defective modules and replacement of new or repaired modules.
- *Troubleshooting* — Information for isolating and troubleshooting failed modules. Troubleshooting trees are included.
- *Using the Recovery Discs* — Procedures for reinstalling the Windows XP operating system and the RTX130A application if the RTX130A does not boot.

Related Maintenance Procedures

The following sections contain information and procedures related to maintenance.

- Section 2, *Theory of Operation*, contains a circuit description at the module or block level.
- Section 3, *Performance Verification*, contains procedures that may be useful in isolating problems to modules by testing the RTX130A performance.
- Section 6, *Diagrams*, contains a block diagram using individual modules as blocks and an interconnection diagram showing connections between the modules.
- Section 7, *Replaceable Parts List,* lists all field replaceable modules by part number.

Preparation

Before servicing this product, read the *General Safety Summary, Safety Summary, Introduction* at the front of the manual, and the ESD information below.

CAUTION. Static discharge can damage any semiconductor component in the RTX130A.

Preventing ESD

When performing any service that requires internal access to the RTX130A, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Perform service of static-sensitive modules only at a static-free work station.
4. Do not allow anything capable of generating or holding a static charge on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

Inspection and Cleaning

Inspection and Cleaning describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the RTX130A. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent the RTX130A from malfunctioning and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the RTX130A and using general care when operating it.

How often preventative maintenance should be performed depends on the severity of the environment in which the RTX130A is used. A proper time to perform preventive maintenance is just before the RTX130A adjustment.

General Care

The cabinet helps keep dust out of the RTX130A, and is needed to meet EMI and cooling requirements. The cabinet should be in place when operating the RTX130A. The front cover protects the front panel and display from dust and damage. Install the front cover when storing or transporting the RTX130A.

Inspection and Cleaning Procedures

Inspect and clean the RTX130A as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and break-down. (Dirt acts like an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause an RTX130A failure, especially under high-humidity conditions.

CAUTION. Avoid the use of chemical cleaning agents that might damage the plastics used in this RTX130A. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use an ethyl alcohol solution as a cleaner and rinse with deionized water.

Inspection — Exterior. Inspect the outside of the RTX130A for damage, wear, and missing parts, using Table 4-1 as a guide. An RTX130A that appears to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the RTX130A.

Table 4-1: External inspection check list

Item	Inspect for	Repair action
Cabinet, front panel, and cover.	Cracks, scratches, deformations, damaged hardware or gaskets.	Repair or replace defective module.
Front-panel buttons	Missing, damaged, or loose buttons.	Repair or replace missing or defective buttons.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Repair or replace defective modules. Clear or wash out dirt.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Repair or replace damaged or missing items, frayed cables, and defective modules.

Cleaning Procedure — Exterior. To clean the RTX130A exterior, perform the following steps:

1. Remove loose dust on the outside of the RTX130A with a lint-free cloth.
2. Remove remaining dirt with a lint-free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the light filter protecting the monitor screen with a lint-free cloth dampened with a gentle, general purpose detergent-and-water solution.

CAUTION. To prevent getting moisture inside the RTX130A during external cleaning, use only enough liquid to dampen the cloth or applicator.

Inspection — Interior. To access the inside of the RTX130A for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the RTX130A for damage and wear, using Table 4-2 as a guide. Defects found should be repaired immediately.

CAUTION. To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the RTX130A.

Table 4-2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove failed module and replace with a fresh module.
Resistors	Burned, cracked, broken, blistered condition.	Remove failed module and replace with a fresh module.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove damaged module and replace with a fresh module from the factory.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

Cleaning Procedure — Interior. To clean the RTX130A interior, perform the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in ethyl alcohol and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

STOP*. If, after performing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

3. If steps 1 and 2 do not remove all the dust or dirt, the RTX130A may be spray washed using a solution of ethyl alcohol by performing steps 4 through 8.
4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the ethyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot (120 °F to 140 °F) deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature (125 °F to 150 °F) circulating air.

Lubrication. There is no periodic lubrication required for the RTX130A.

Removal and Installation Procedures

This subsection contains procedures for removal and installation of all mechanical and electrical modules.

Preparation

WARNING. Before performing this or any other procedure in this manual, read the Safety Summary *found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to components of the RTX130A, read* Installation *in Section 2, and* Preventing ESD *in this section.*

This subsection contains the following items:

- Preparatory information that you need to properly perform the procedures that follow.
- List of tools required to remove and disassemble all modules.
- Three module locator diagrams for finding the External modules (see Figure 4-2 on page 4-11), Board modules (see Figure 4-3 on page 4-12), and Internal modules (see Figure 4-4 on page 4-13).
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- A disassembly procedure for removal of all the major modules from the RTX130A at one time and for reassembly of those modules into the RTX130A. Such a complete disassembly is normally only done when completely cleaning the RTX130A. (Instructions for doing the actual cleaning are found under *Inspection and Cleaning* at the beginning of this section.)

WARNING. Before performing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.

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General Instructions

Read these general instructions before removing a module.

First read over the *Summary of Procedures* that follows to understand how the procedures are grouped. Then read *Equipment Required* for a list of the tools needed to remove and install modules in the RTX130A.

If you are removing a module for service, begin by performing the procedure *Access Procedure* (page 4-14). By following the instructions in that procedure, you remove the module to be serviced while removing the minimum number of additional modules.

Summary of Procedures

The procedures are described in the order in which they appear in this section. In addition, you can look up any procedure for removal and reinstallation of any module in the *Table of Contents* of this manual.

- The *Access Procedure* on page 4-14 first directs you to the procedure(s) (if any) that are required to access the module to be serviced, then it directs you to the procedure to remove that module.

Table 4-3: Summary of procedures

Procedure	Module		Page
Procedures for External Modules	■ Cabinet ■ Right-side cover ■ Left-side cover	■ Front-panel unit ■ Front-panel assembly	4-15
Procedures for Board Modules	■ A180 QAM Modulator board ■ A12 Main board ■ CPU board	■ A20 PCI Backplane board ■ Printer connector	4-21
Procedures for Internal Module	■ DVD drive ■ Hard disk drive ■ Internal and external fans	■ 12 V main power supply ■ A40 AC Distributer board ■ RFI filter	4-26

Required Equipment. Most modules in this RTX130A can be removed with a screwdriver handle mounted with a size T-10 Torx screwdriver tip. *Use this tool whenever a procedure step instructs you to remove or install a screw unless a different size screwdriver is specified in that step.* All equipment required to remove and reinstall each module is listed in the first step of its procedure.

Table 4-4: Tools required for module removal

Item No.	Name	Description
1	Screwdriver handle	Accepts Torx®-driver bits
2	T-10 Torx® tip	Torx®-driver bit for T-10 size screw heads
3	T-15 Torx® tip	Torx®-driver bit for T-15 size screw heads
4	Nut driver, $^1/_4$ inch	Standard tool

RTX130A Orientation

In this manual, procedures refer to “front,” “back,” and “top” of the RTX130A. Figure 4-1 shows how the sides are referenced. Figures 4-2 through 4-4 show the modules that make up the RTX130A.

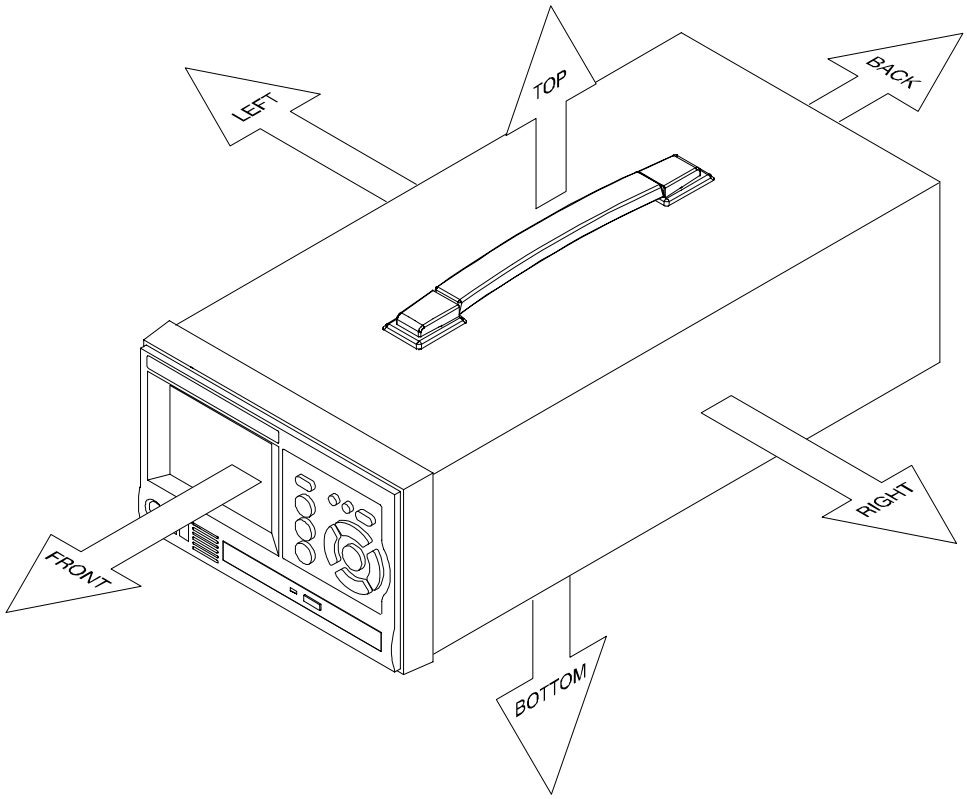

Figure 4-1: RTX130A orientation

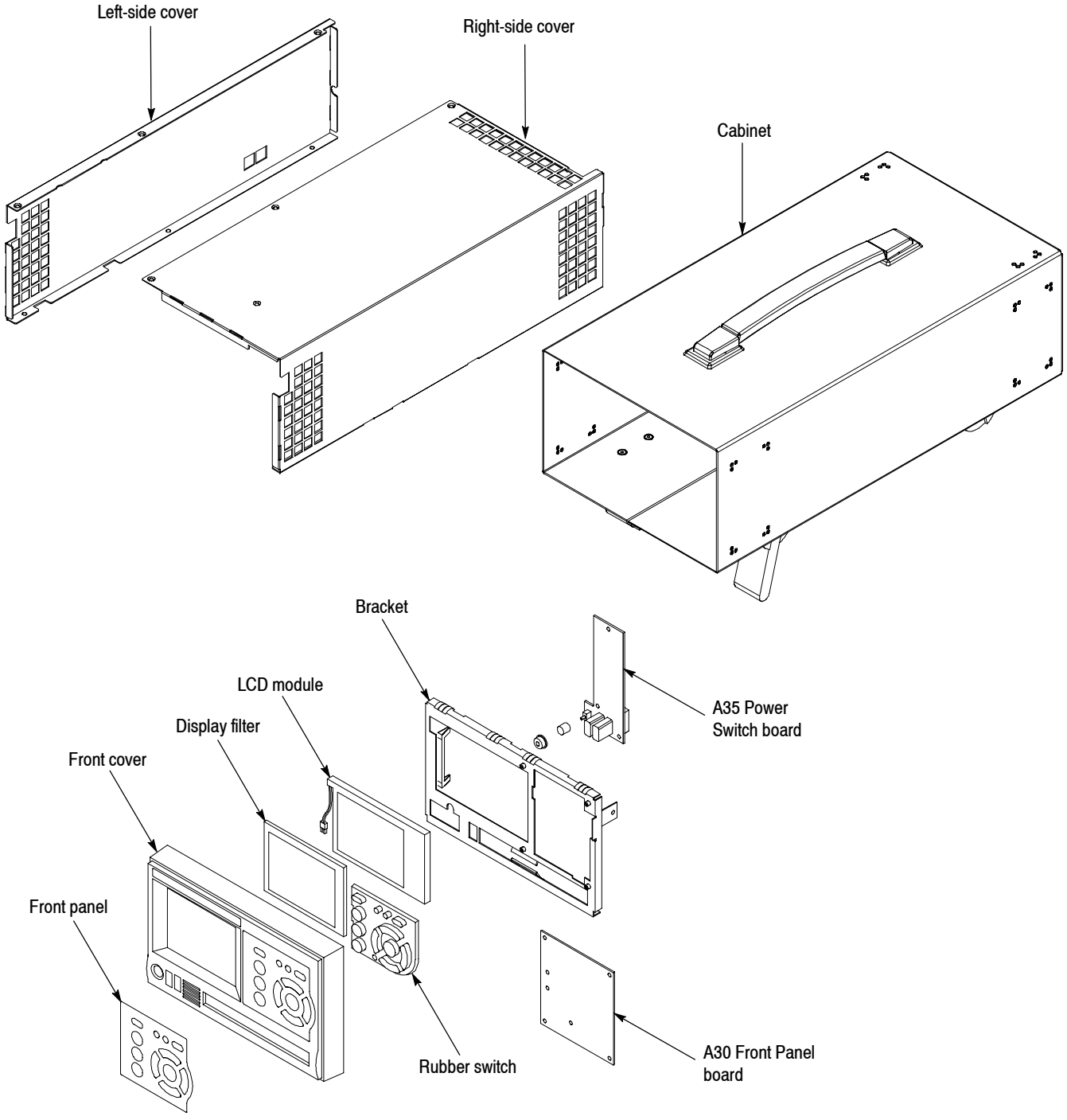

Figure 4-2: External modules

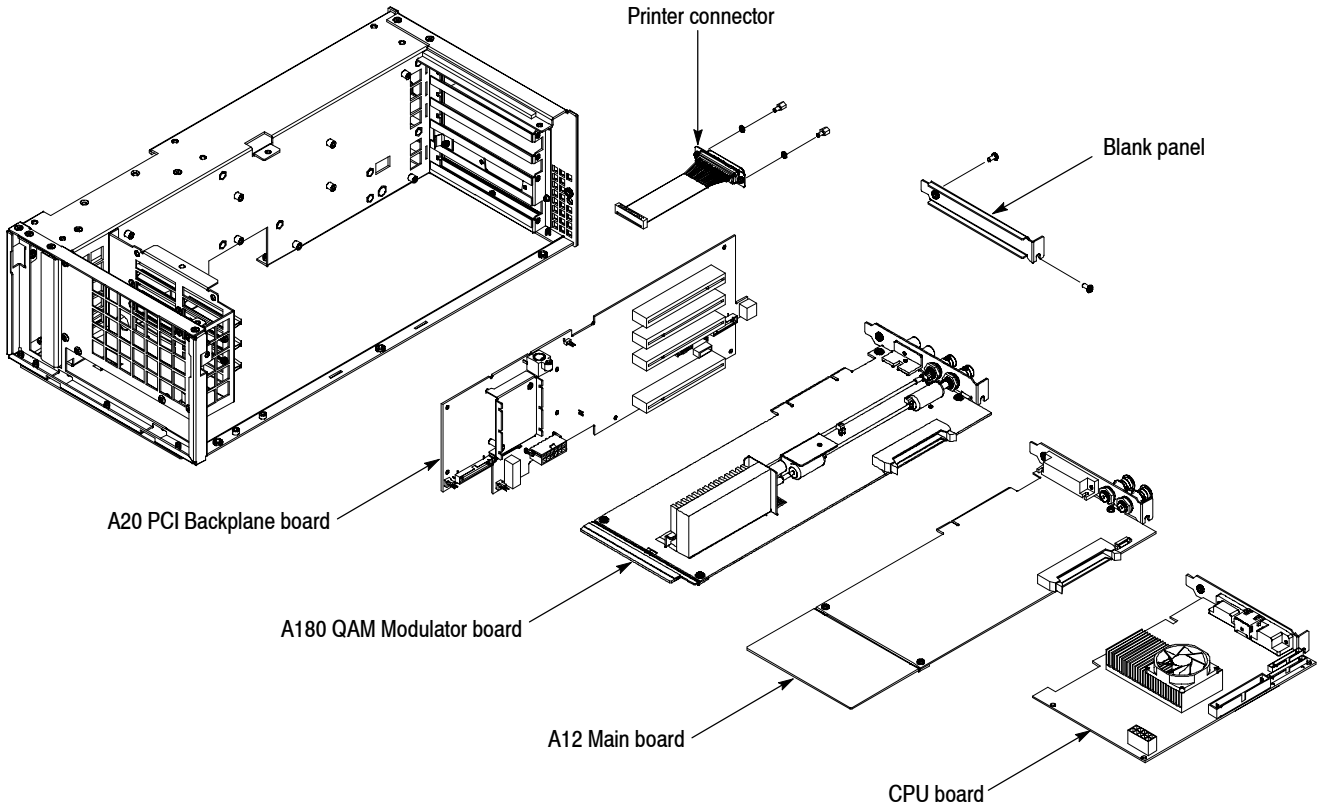

Figure 4-3: Board modules

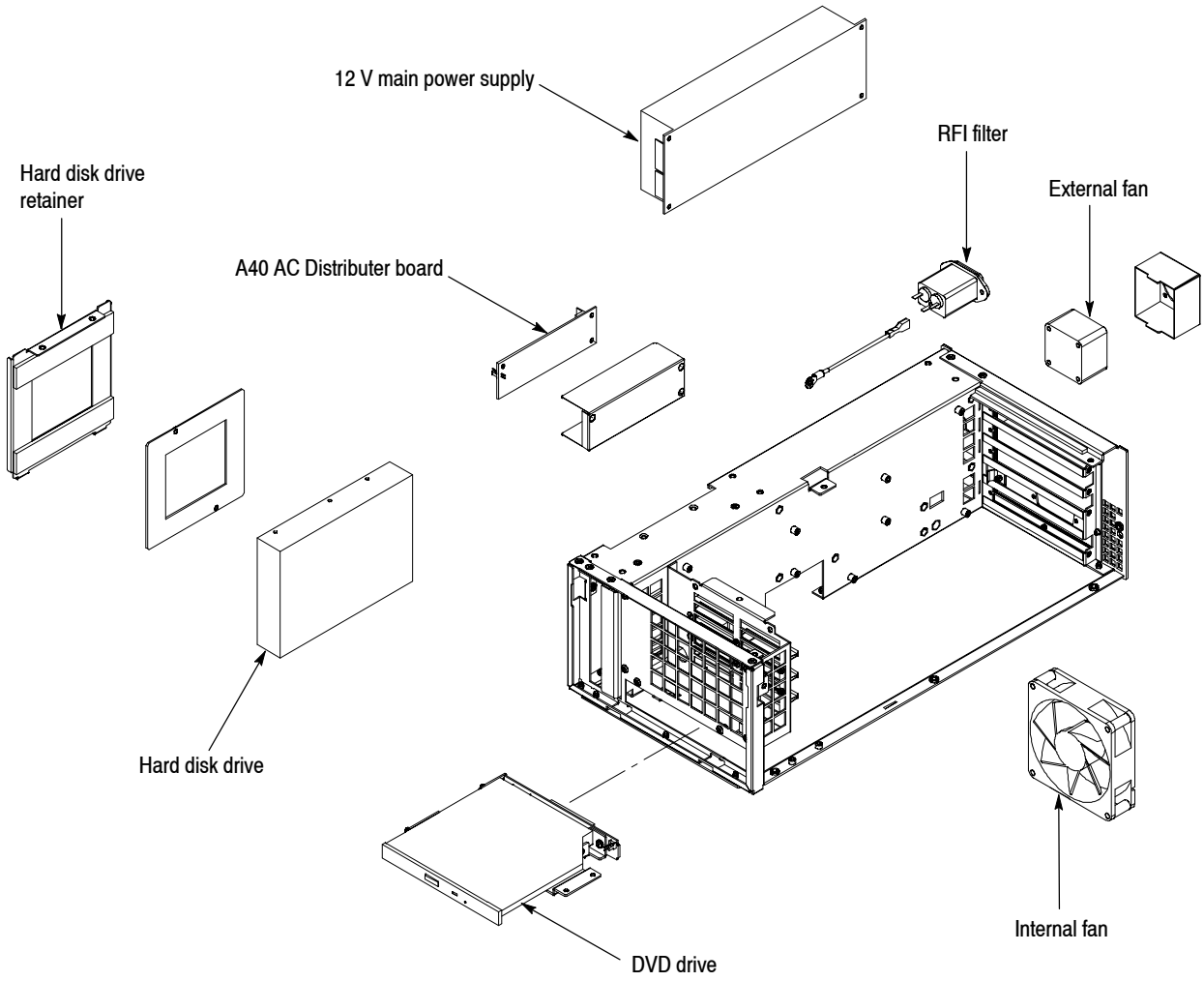

Figure 4-4: Internal modules

Access Procedure

When you have identified the module to be removed for service, read *General Instructions* found on page 4-8. Then use the flowchart in Figure 4-5 to determine which procedures to use for removing the module. The removal procedures end with installation instructions.

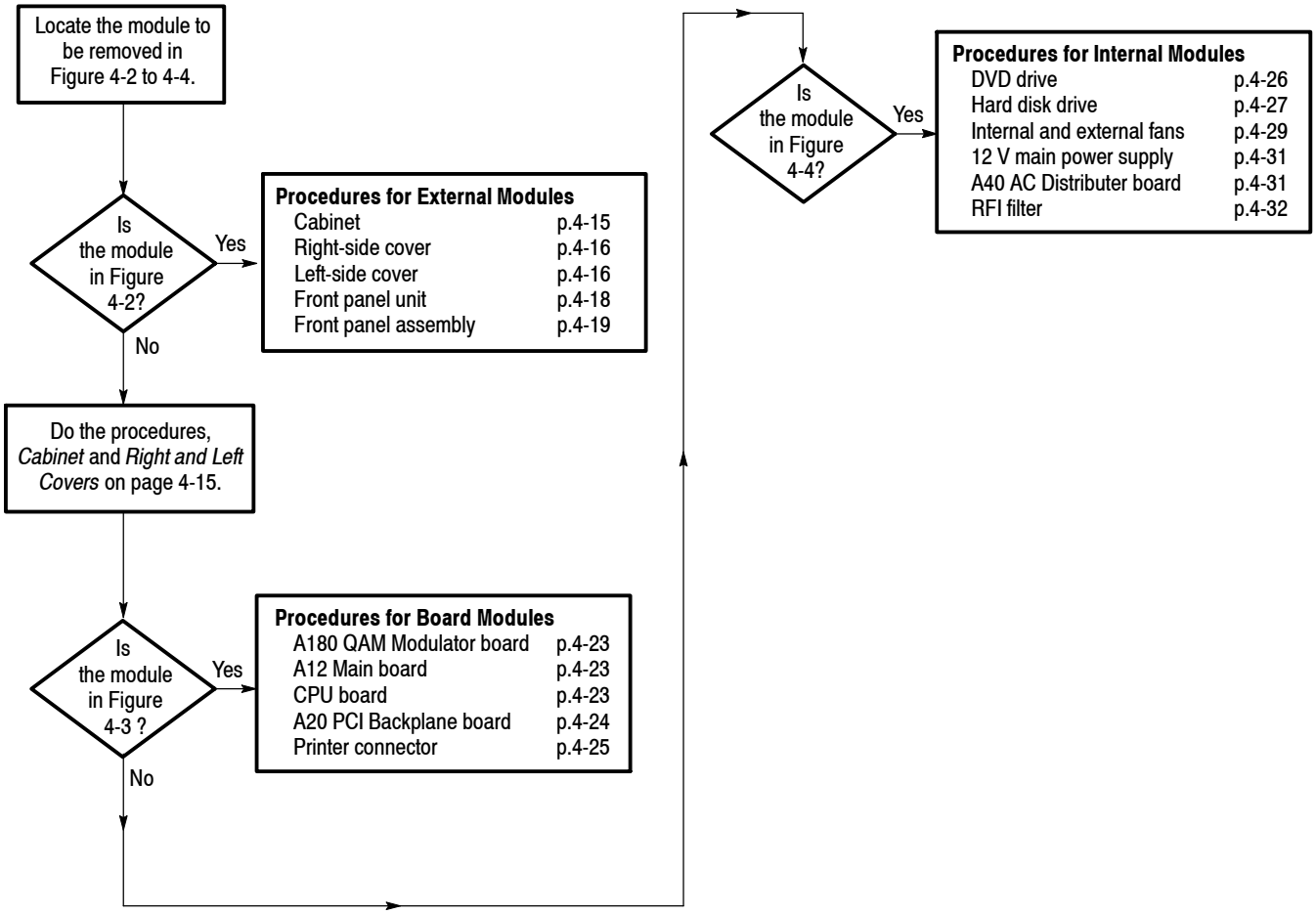

Figure 4-5: Guide to removal procedures

Procedures for External Modules

Do the *Access Procedure* (page 4-14) before doing any procedure in this group. This group contains the following procedures:

- *Cabinet*
- *Right-side cover*
- *Left-side cover*
- *Front-panel unit*
- *Front-panel assembly*

Cabinet

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-15 Torx tip.
   b. Locate the cabinet in the locator diagram *External modules*, Figure 4-2, on page 4-11.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its rear is facing you.
3. Use a screwdriver with a T-15 Torx tip to remove the two screws securing the cabinet to the RTX130A. See Figure 4-6 on page 4-16.
4. Grasp the right and left edges of the cabinet toward the back. Push the chassis rear panel toward the front of the RTX130A to separate it from the cabinet.
5. Slide the cabinet off the RTX130A.
6. *Reinstallation:* Perform steps 3 through 5 in reverse order to reinstall the cabinet.

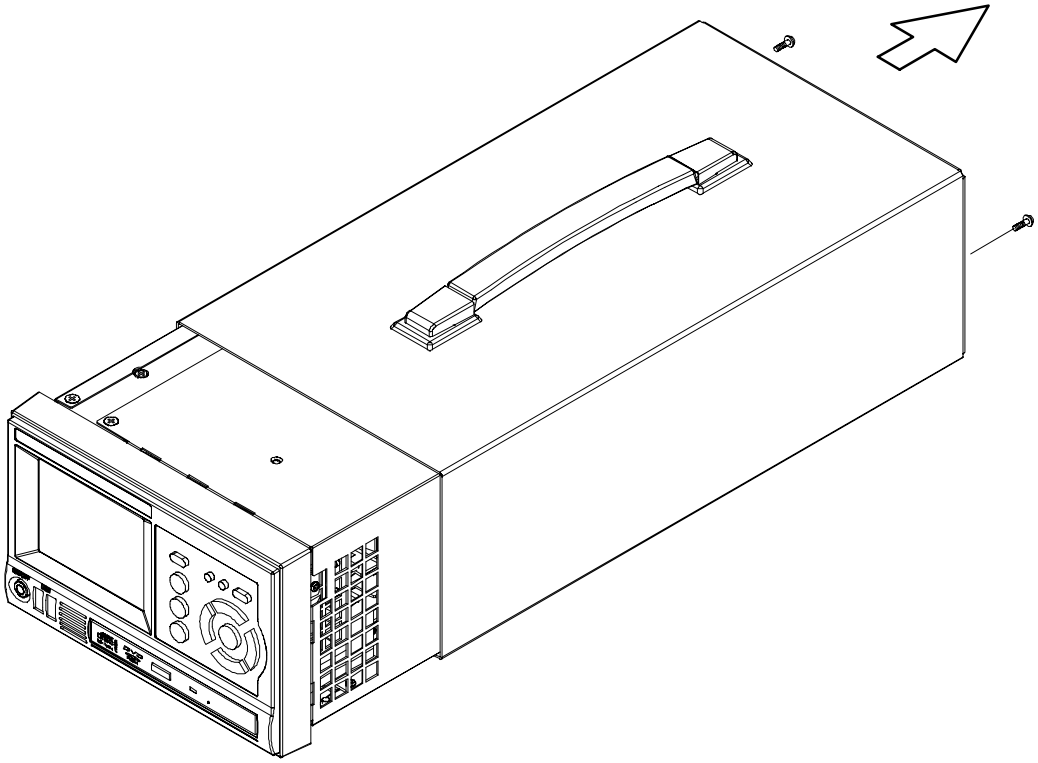

Figure 4-6: Cabinet removal

Right-Side Cover

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the right-side cover in the locator diagram *External modules*, Figure 4-2, on page 4-11.
2. *Orient the instrument:* Set the RTX130A so its left side is down on the work surface and its front is facing you.
3. Use a screwdriver with a T-10 Torx tip to remove the seven screws securing the right-side cover to the top and bottom of the chassis. See Figure 4-7.
4. Remove the right-side cover from the chassis.
5. *Reinstallation:* Perform steps 3 and 4 in reverse order to reinstall the right-side cover.

Left-Side Cover

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.

b. Locate the left-side cover in the locator diagram *External modules*, Figure 4-2, on page 4-11.

2. *Orient the instrument:* Set the RTX130A so its right side is down on the work surface and its front is facing you.

3. Use a screwdriver with a T-10 Torx tip to remove the six screws securing the left-side cover to the top and bottom of the chassis. See Figure 4-7.

4. Remove the left-side cover from the chassis.

5. *Reinstallation:* Perform steps 3 and 4 in reverse order to reinstall the left-side cover.

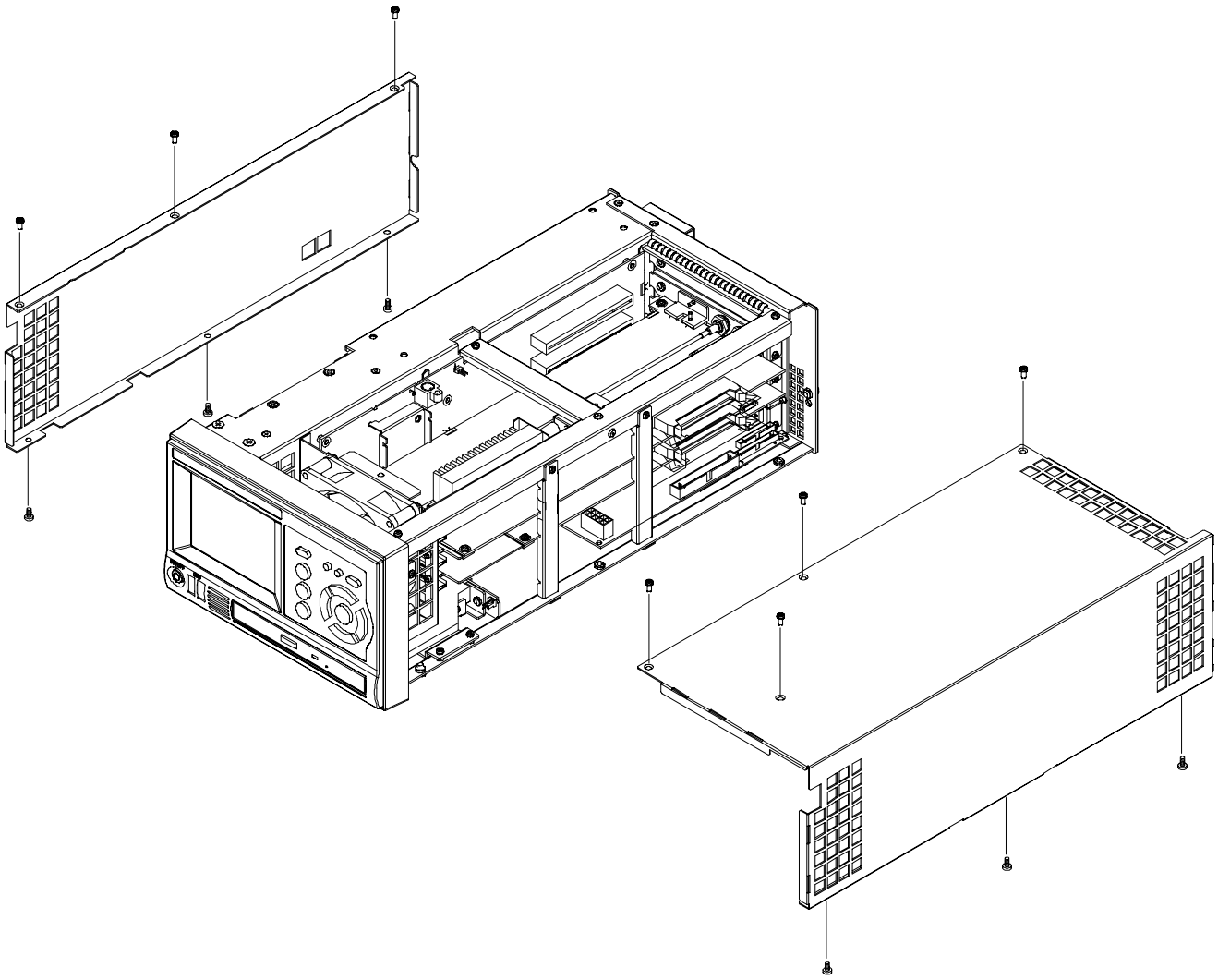

Figure 4-7: Right-side and left-side cover removal

Front-Panel Unit

1. *Assemble equipment and locate module to be removed:*
   - **a.** You need a screwdriver with a T-10 Torx tip.
   - **b.** Locate the front-panel unit in the locator diagram *External modules*, Figure 4-2, on page 4-11.
2. *Orient instrument:* Set the RTX130A so its bottom is down on the work surface and its front is facing you.
3. *Remove front-panel unit:* See Figure 4-8.
   - **a.** Use a screwdriver with a T-10 Torx tip to remove the four screws securing the front-panel unit to the chassis.
   - **b.** Grasp the front-panel unit and pull it forward.
   - **c.** Disconnect the cable from J100 on the A30 Front Panel board.
   - **d.** Disconnect the cable from J100 on the A35 Power Switch board.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the front-panel unit.

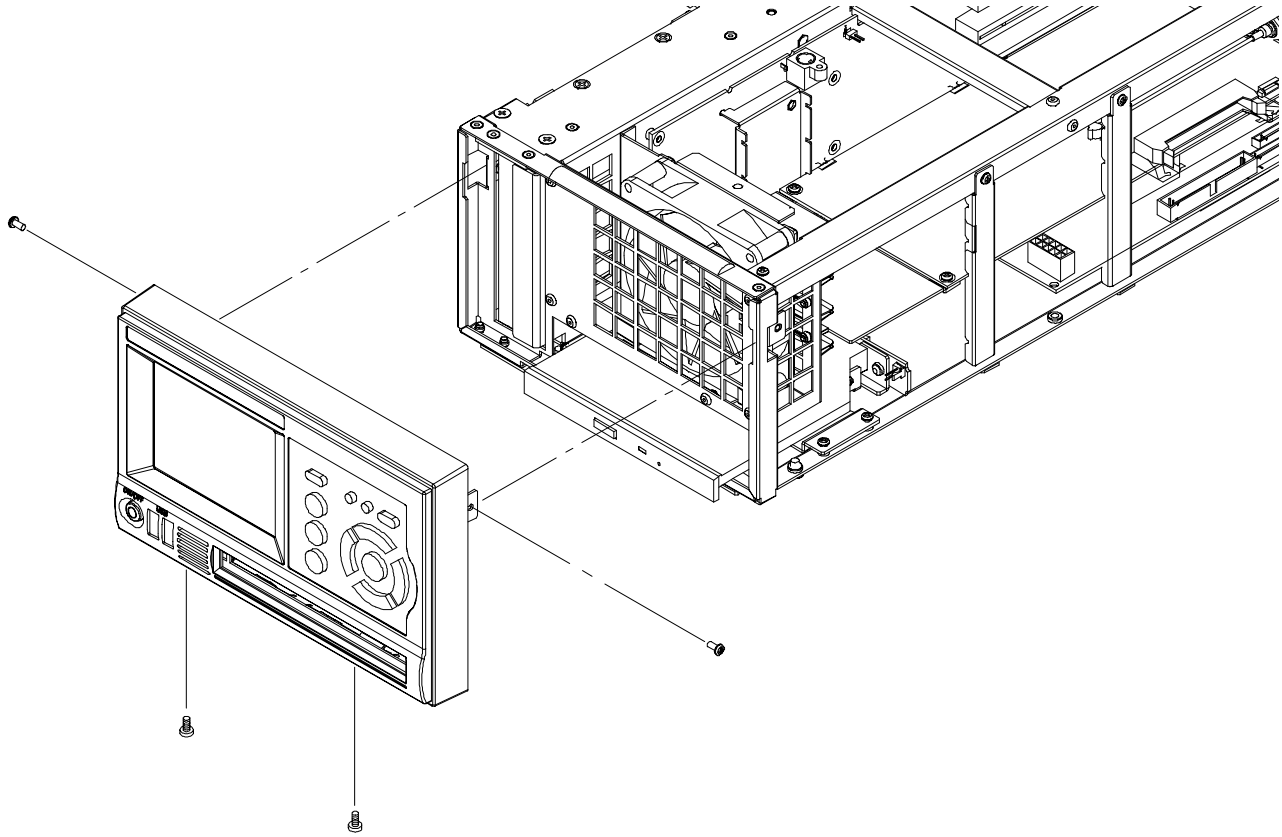

Figure 4-8: Front-panel unit removal

Front-Panel Assembly

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the front-panel assembly in the locator diagram *External modules*, Figure 4-2, on page 4-11.
2. *Remove the front cover:* See Figure 4-9 on page 4-20.
   a. Press the two latches at the bottom of the front cover to release it from the front cover bracket.
   b. Pull the front cover forward, away from the front cover bracket.
3. *Remove the A30 Front Panel board:* See Figure 4-9 on page 4-20.
   a. Disconnect the cables from J100, J300, and J320 on the A30 Front Panel board.
   b. Use a screwdriver with with a T-10 Torx tip to remove the four screws securing the A30 Front Panel board to the front cover bracket.
   c. Lift the board away.
4. *Remove the A35 Power Switch board:* See Figure 4-9 on page 4-20.
   a. Disconnect the cables from J100, J130, and CN1 on the A35 Power Switch board.
   b. Use a screwdriver with a T-10 Torx tip to remove the three screw securing the A35 Power switch board to the front cover bracket.
   c. Lift the board away.
5. Now hand disassemble the front-panel assembly components using Figure 4-9 as a guide. Reverse the procedure to reassemble.
6. *Reinstallation:* Perform steps 2 through 5 in reverse order to reinstall the front-panel assembly.

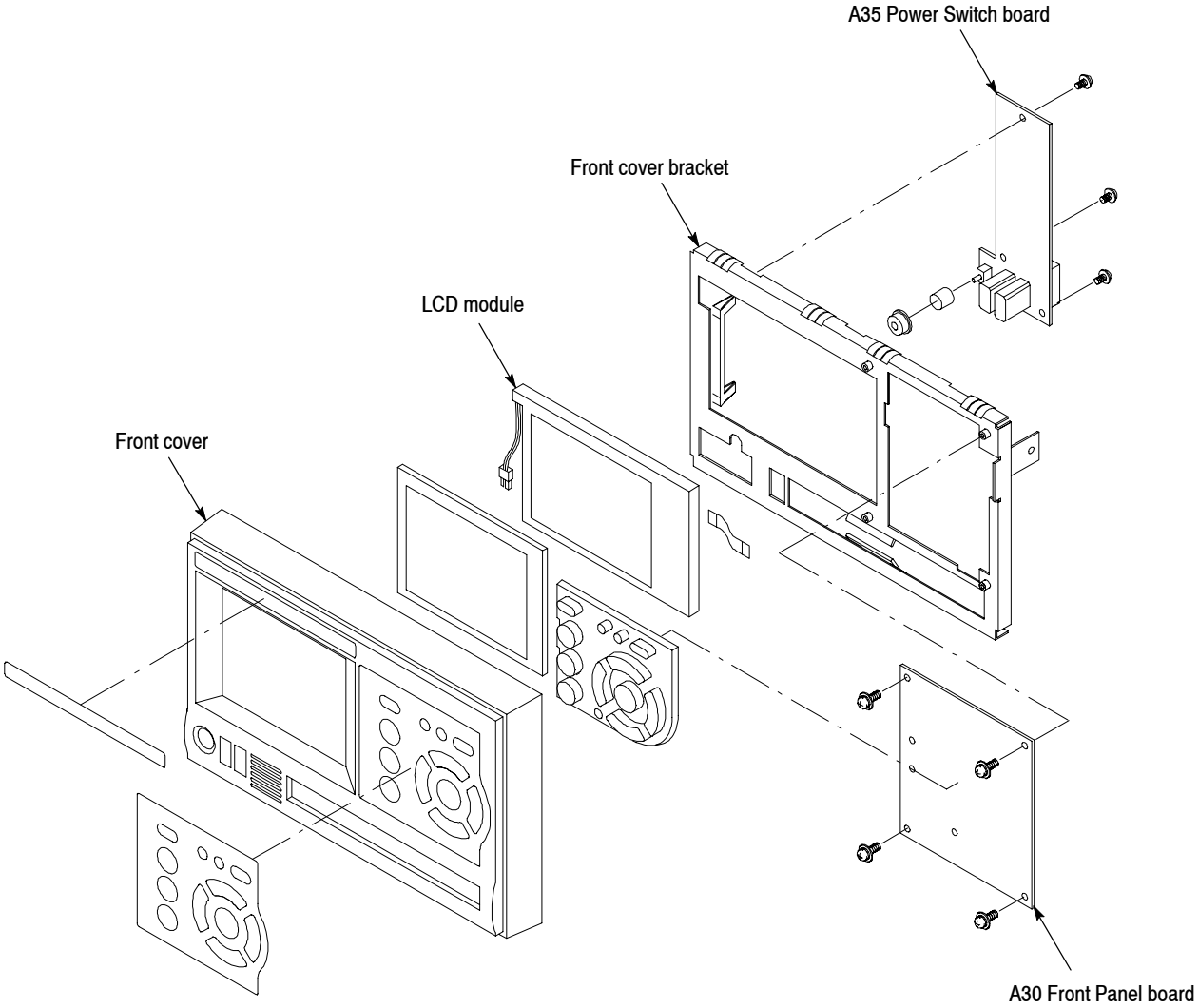

Figure 4-9: Disassembly of front-panel assembly

Procedures for Board Modules

Perform the *Access Procedure* (on page 4-14) before doing any procedure in this group. The procedures are:

- *Top frame and board retainers*
- *A180 QAM Modulator board*
- *A12 Main board*
- *CPU board*
- *A20 PCI Backplane board*
- *Printer connector*

Top Frame and Board Retainers

1. *Assemble equipment and locate modules to be removed:*
   - You need a screwdriver with a T-10 Torx tip.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its right side is facing you.
3. *Remove the board retainers:* See Figure 4-10 on page 4-22.
   a. Use a screwdriver a T-10 Torx tip to remove the two screws securing the board retainers to the chassis.
   b. Lift the retainers away from the chassis.
4. *Remove the top frame:* See Figure 4-10 on page 4-22.
   a. Use a screwdriver with a T-10 Torx tip to remove the three screws securing the top frame to the chassis.
   b. Lift the top frame away from the chassis.

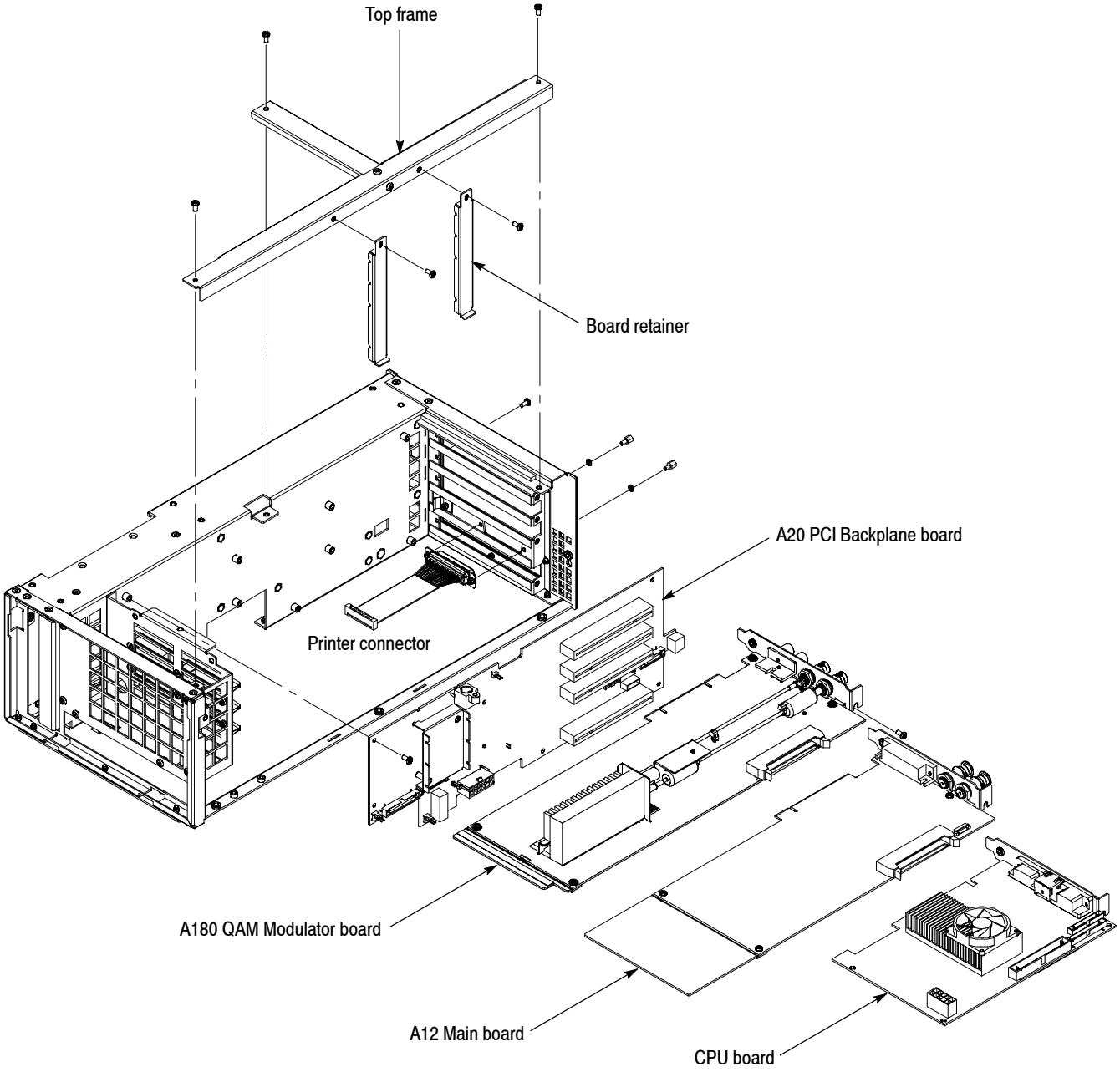

Figure 4-10: A180 QAM Modulator board, A12 Main board, CPU board, and A20 PCI Backplane board removal

A180 QAM Modulator Board

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the A180 QAM Modulator board in the locator diagram *Board modules*, Figure 4-3, on page 4-12.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its right side is facing you.
3. *Remove the output board:* See Figure 4-10 on page 4-22.
   a. Disconnect the cable from the A12 Main board.
   b. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the board bracket to the chassis. See Figure 4-10 on page 4-22.
   c. Grasp the board and slide it out.
4. *Reinstallation*: Do step 3 in reverse order to reinstall the output board.

A12 Main Board

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the A12 Main board in the locator diagram *Board modules*, Figure 4-3, on page 4-12.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its right side is facing you.
3. *Remove the A12 Main board:* See Figure 4-10 on page 4-22.
   a. Disconnect the cable from the A180 QAM Modulator board.
   b. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the board bracket to the chassis. See Figure 4-10 on page 4-22.
   c. Grasp the board and slide it out.
4. *Reinstallation*: Do step 3 in reverse order to reinstall the A12 Main board.

CPU Board

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the CPU board in the locator diagram *Board modules*, Figure 4-3, on page 4-12.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its right side is facing you.

3. *Remove the CPU board:* See Figure 4-10 on page 4-22.
   a. Disconnect these cables:
      - The cable from the hard disk drive at CN1.
      - The cable from the Printer connector at CN3.
      - The cable from the A50 Disk I/F Board at CN4.
      - The cable from the A20 PCI Backplane board at CN5, CN6, CN9, and CN14.
      - The cable from the A35 Power Switch board at CN7.
   b. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the board bracket to the chassis. See Figure 4-10 on page 4-22.
   c. Grasp the board and slide it out.
4. *Reinstallation*: Do step 3 in reverse order to reinstall the CPU board.

NOTE. After you replace the CPU board, you must set the BIOS configuration. Refer to Setting BIOS Configuration *on page 4-35.*

A20 PCI Backplane Board

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the A20 PCI Backplane board in the locator diagram *Board modules*, Figure 4-3, on page 4-12.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its right side is facing you.
3. *Remove the A20 PCI Backplane board:* See Figure 4-10 on page 4-22.
   a. Remove the A180 QAM Modulator board as described on page 4-23.
   b. Remove the A12 Main board as described on page 4-23.
   c. Remove the CPU board as described on page 4-23.
   d. Disconnect these cables:
      - The cable from the A40 AC Distributer board at J220.
      - The cable from the 12 V main power supply at J160 and J170.
      - The cable from the external fan at J190.

- The cable from the internal fan at J180.
- The cables from the A30 Front Panel board at J240 and J250.
- The cable from the hard disk drive.

e. Use a screwdriver with a T-10 Torx tip to remove the ten screws securing the A20 PCI Backplane board to the chassis.

f. Lift the board up and away from the chassis.

4. *Reinstallation*: Do step 3 in reverse order to reinstall the A20 PCI Backplane board.

Printer Connector

1. *Assemble equipment and locate modules to be removed:*

a. You need a screwdriver with a $^1/_4$ inch nut driver.

b. Locate the connector in the locator diagram Board *modules,* Figure 4-3, page 4-12.

2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its rear is facing you.

3. *Remove the Printer connector:* See Figure 4-10 on page 4-22.

a. Remove the A180 QAM Modulator board as described on page 4-23.

b. Remove the A12 Main board as described on page 4-23.

c. Disconnect the cable from CN3 on the CPU board.

d. Use a $^1/_4$ inch nut driver to unscrew the two hex-headed mounting posts securing the connector to the chassis.

e. Pull the connector away from the chassis.

4. *Reinstallation:* Perform step 3 in reverse order to reinstall the Printer connector.

Procedures for Internal Modules

Perform the *Access Procedure* (on page 4-14) before doing any procedure in this group. The procedures are:

- *DVD drive*
- *Hard disk drive*
- *Internal and external fans*
- *12 V main power supply*
- *A40 AC Distributer board*
- *RFI filter*

DVD Drive

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the DVD drive in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its front is facing you.
3. *Remove the DVD drive:* See Figure 4-11.
   a. Remove the front-panel unit as described on page 4-18.
   b. Disconnect the cables from J100 and J120 on the A50 Disk I/F board.
   c. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the DVD drive mount bracket to the chassis.
   d. Lift up the DVD drive with the bracket and A50 Disk I/F board from the chassis.
4. *Remove the DVD drive from the bracket and the board:* Remove the four screws securing the DVD drive to the bracket and the board.
5. *Reinstallation:* Perform steps 3 and 4 in reverse order to reinstall the DVD drive.

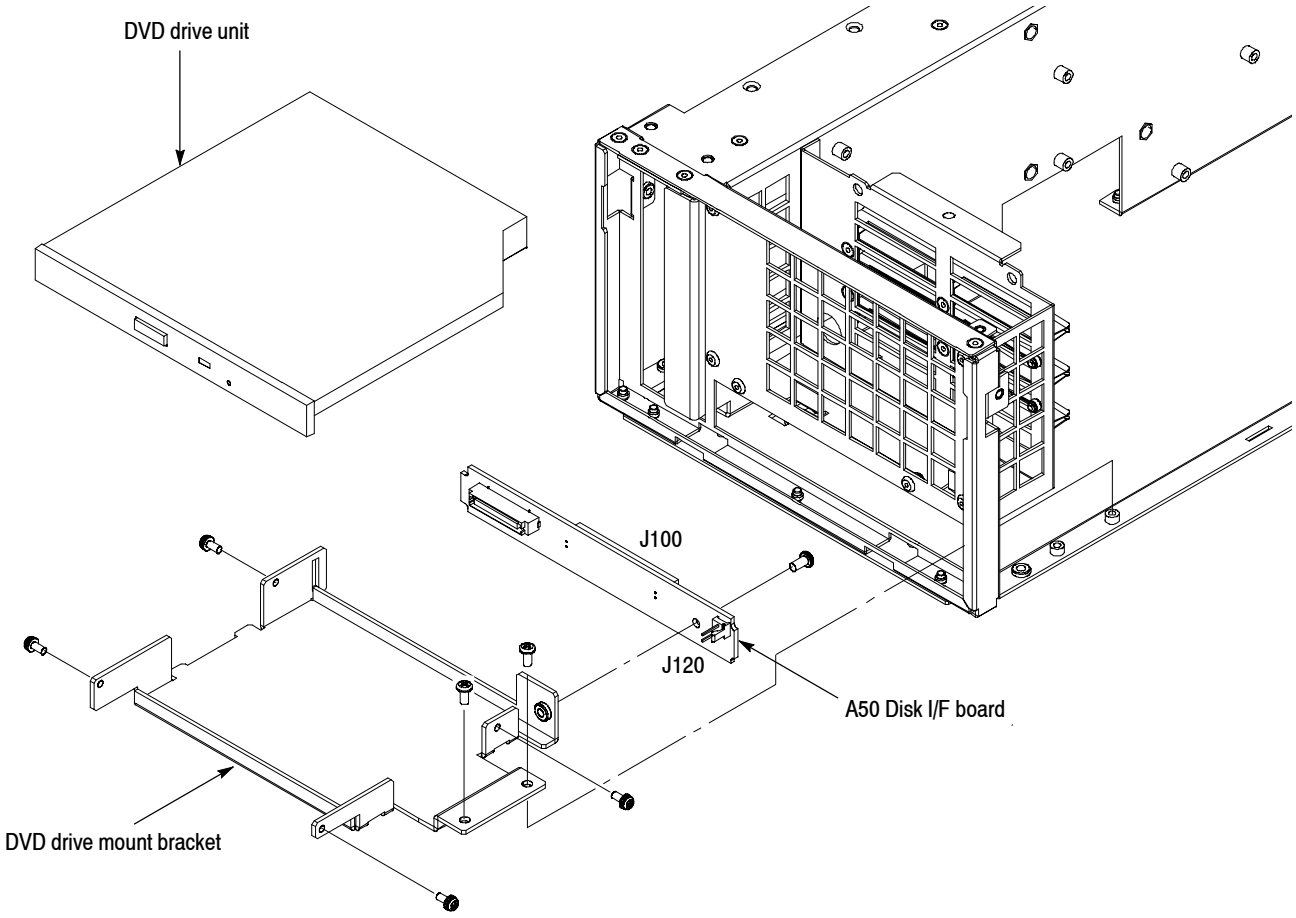

Figure 4-11: DVD drive removal

Hard Disk Drive

1. *Assemble equipment and locate module to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the hard disk drive in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its left side is facing you.
3. *Remove the hard disk drive:* See Figure 4-12 on page 4-28.
   a. Disconnect two cables from the hard disk drive.
   b. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the hard disk drive retainer to the chassis.
   c. Remove the two screws securing the plate to the hard disk drive.

d. Grasp the hard disk drive and pull it gently away from the chassis.

4. *Reinstallation:* Perform step 3 in reverse order to reinstall the hard disk drive.

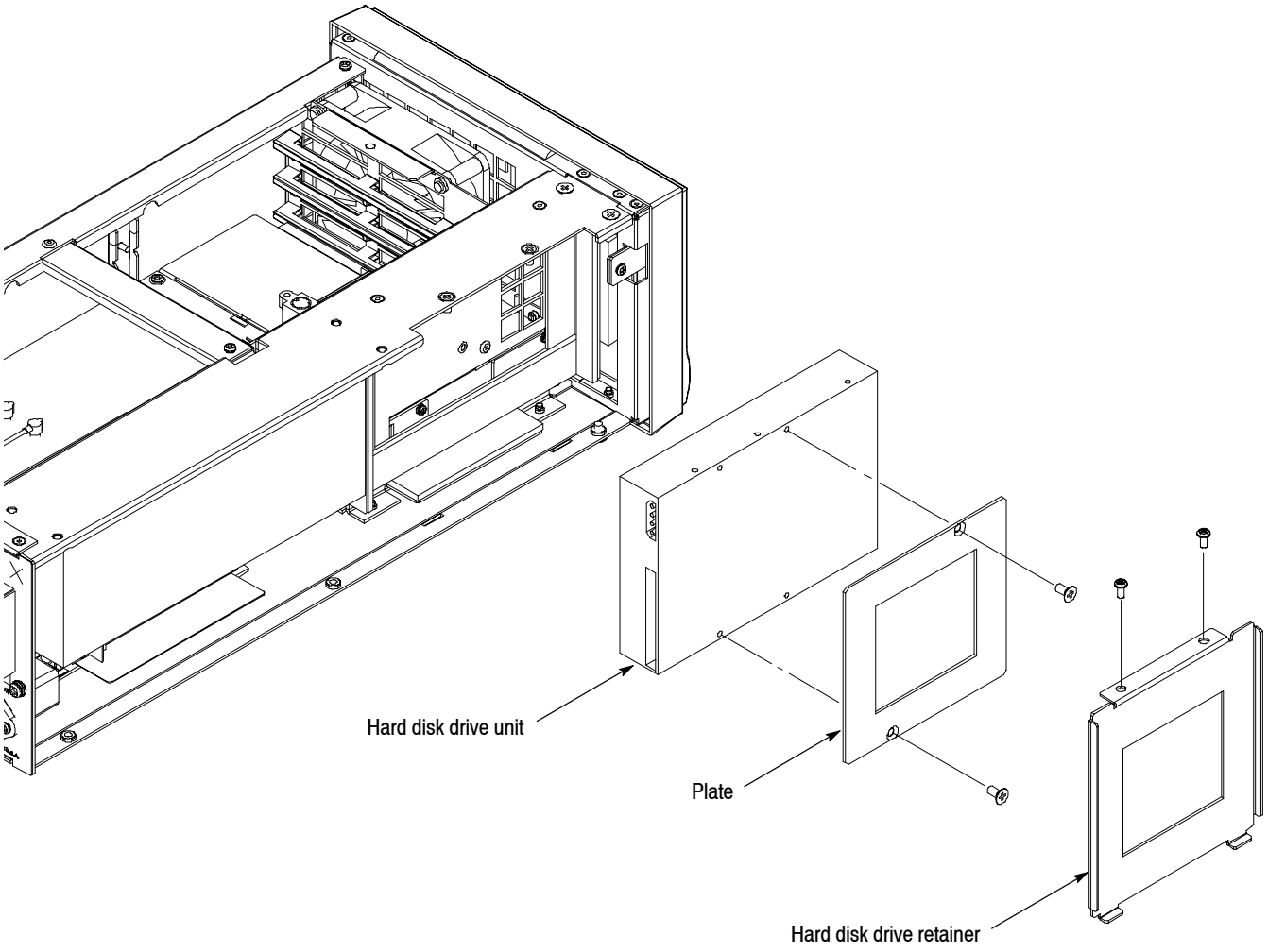

Figure 4-12: Hard disk drive removal

Doing the Performance Verification and Running Sysprep. If you replace the hard disk drive, you must perform the following steps:

- Do the performance verification procedures (refer to *Performance Verification* on page 3-1).
- Run the sysprep batch file:

1. Select **File > Exit** to exit the RTX130A application. The Windows XP desktop appears.
2. Select **Start > Run** to open the Run dialog box.
3. Click the **Browse** button.
4. Select **C:\Sysprep\sysprep.bat**.
5. Click the **OK** button.

Internal and External Fans

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the fans in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its front is facing you.
3. *Remove the internal fan:* See Figure 4-13 on page 4-30.
   a. Disconnect the cable from J180 on the A20 PCI Backplane board.
   b. Remove the two rivets securing the fan to the chassis.
   c. Lift the fan up out of the chassis.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the internal fan.
5. *Remove the external fan:* See Figure 4-13 on page 4-30.
   a. Set the RTX130A so its bottom is down on the work surface and its rear is facing you.
   b. Disconnect the cable from J190 on the A20 PCI Backplane board.
   c. Use a screwdriver with a T-10 Torx tip to remove the four screws securing the fan and fan cover to the chassis.
6. *Reinstallation:* Perform step 5 in reverse order to reinstall the external fan.

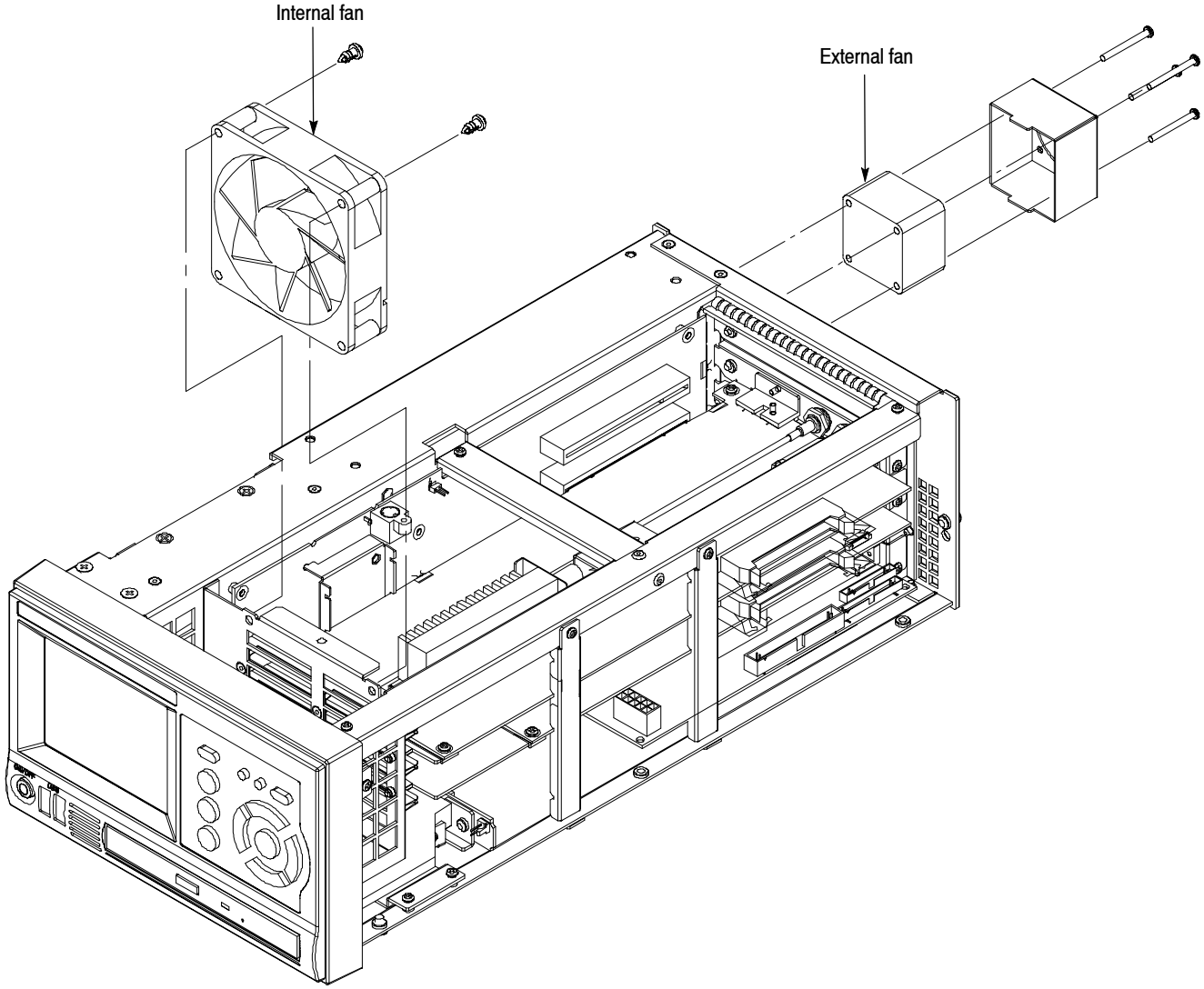

Figure 4-13: Internal and external fan removal

12 V Main Power Supply

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the 12 V main power supply in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its left side is facing you.
3. *Remove the 12 V main power supply:* See Figure 4-14 on page 4-32.
   a. Disconnect the cables from CN1, CN2, CN3, and CN4.
   b. Use a screwdriver with a T-10 Torx tip to remove the four screws securing the 12 V main power supply to the chassis.
   c. Lift the power supply away from the chassis.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the 12 V main power supply.

A40 AC Distributer Board

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a T-10 Torx tip.
   b. Locate the A40 AC Distributer board in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its left side is facing you.
3. *Remove the A40 AC Distributer board:* See Figure 4-14 on page 4-32.
   a. Disconnect the cables from J100, J110, and J120.
   b. Use a screwdriver with a T-10 Torx tip to remove the three screws securing the A40 AC Distributer board to the chassis.
   c. Lift the board away from the chassis.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the A40 AC Distributer board.

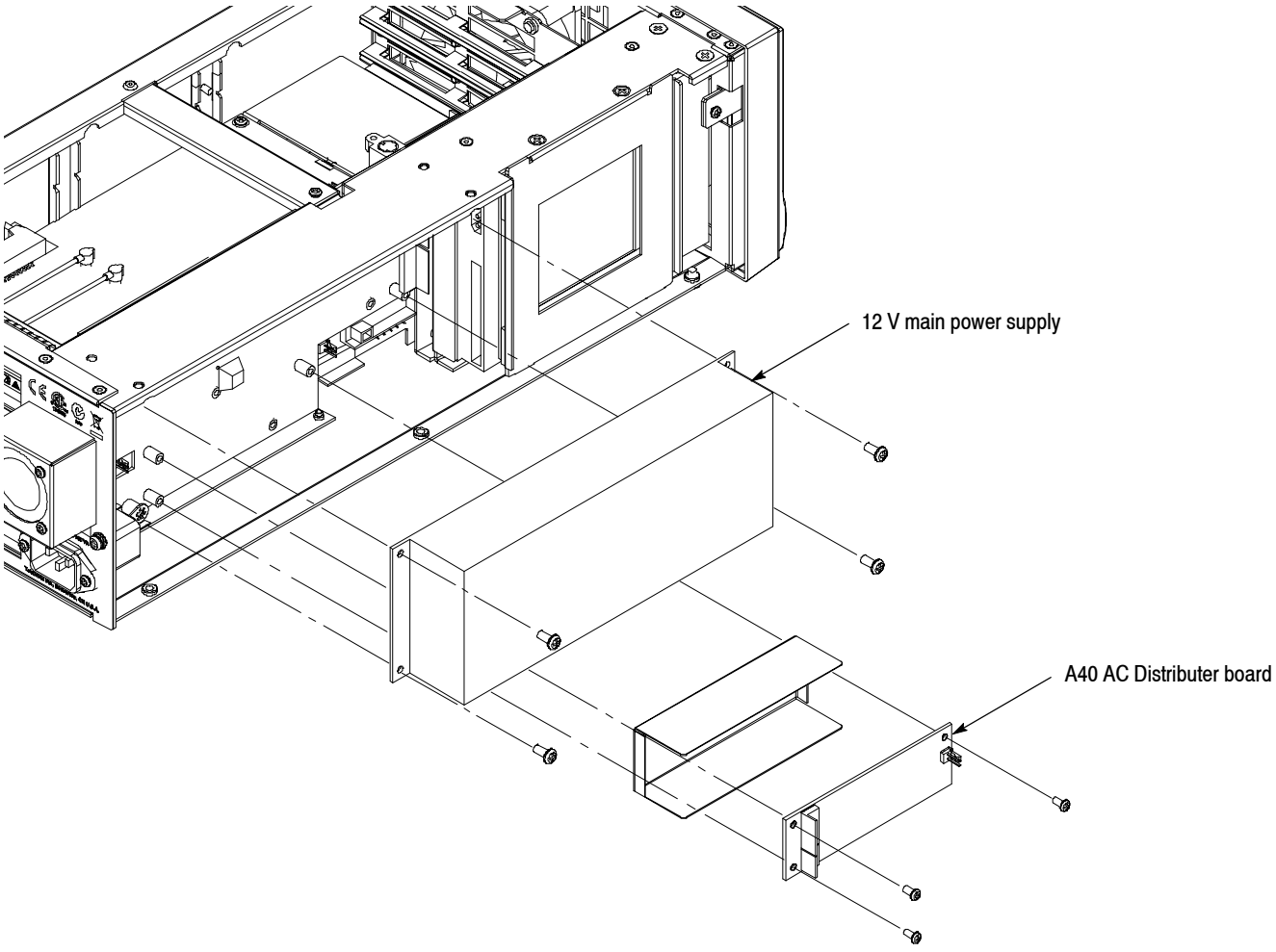

Figure 4-14: 12 V main power supply and A40 AC Distributer board removal

RFI filter

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You need a screwdriver handle, a T-10 Torx tip, and a T-15 Torx tip.
   - **b.** Locate the RFI filter in the locator diagram *Internal modules,* Figure 4-4, page 4-13.
2. *Orient the instrument:* Set the RTX130A so its bottom is down on the work surface and its rear is facing you.
3. *Remove the RFI filter:* See Figure 4-15.
   - **a.** Disconnect the two cables from the RFI filter.
   - **b.** Use a screwdriver with a T-15 Torx tip to remove the screw securing the ground lead to the chassis.

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c. Use a screwdriver with a T-10 Torx tip to remove the two screws securing the RFI filter to the chassis.

d. Pull the RFI filter away from the chassis.

4. *Reinstallation:* Perform step 3 in reverse order to reinstall the RFI filter.

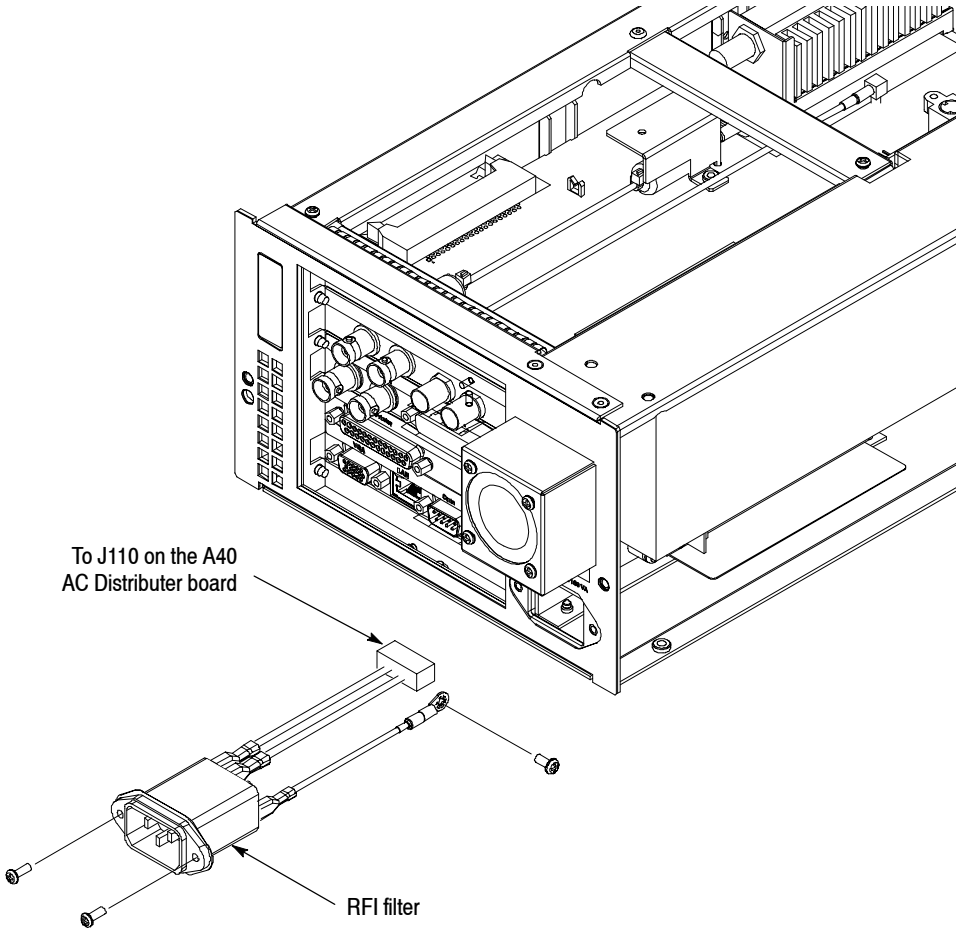


Figure 4-15: RFI filter removal

Setting the BIOS Configuration

This section provides information needed to set the BIOS configuration after you change the CPU board.

Procedure

CAUTION. It is very important to follow this procedure exactly or the instrument will not operate correctly.

Perform the following procedure to set the BIOS configuration:

1. Connect the USB keyboard to the USB connector on the front panel.
2. Power on the instrument, and then press the **Del** key immediately. The **AwardBIOS CMOS Setup Utility screen** appears.
3. Use the arrow keys to select **Load Optimized Defaults**, and then press the **Enter** key. The Load Optimized Defaults (Y/N)? message appears.
4. Enter **Y**, and then press the **Enter** key.
5. Set the BIOS configuration as follows. Use the arrow keys to highlight each item, and then press the **Enter** key to select the item.

   Standard CMOS Features

Data (mm:dd:yy)	: Set the current date.
Time (hh:mm:ss)	: Set the current time.
Drive A	: **None**

   Advanced BIOS Features

First Boot Device	: **USB-FDD**
Second Boot Device	: **CDROM**
Third Boot Device	: **HDD-0**

   Advanced Chipset Features

Boot Display	: **CRT+LFT**

   Integrated Peripherals

Super IO Device	: Onboard FDC Controller : **Disabled**
Onboard Serial Port 2	: **Disabled**
Onboard Serial Port 4	: **Disabled**

PC Health Status

CPU Warning Temperature	: **66 °C/151 °F**
Shutdown Temperature	: **70 °C/158 °F**

6. Use the arrow keys to select **Save & Exit Setup**, and then press the **Enter** key. The Save to CMOS and Exit (Y/N)? message appears.

7. Enter **Y**, and press the **Enter** key.

Troubleshooting

This subsection contains troubleshooting trees designed to isolate faulty modules in the RTX130A.

Troubleshooting Trees

Figures 4-16 through 4-25 show the troubleshooting procedure for the RTX130A.

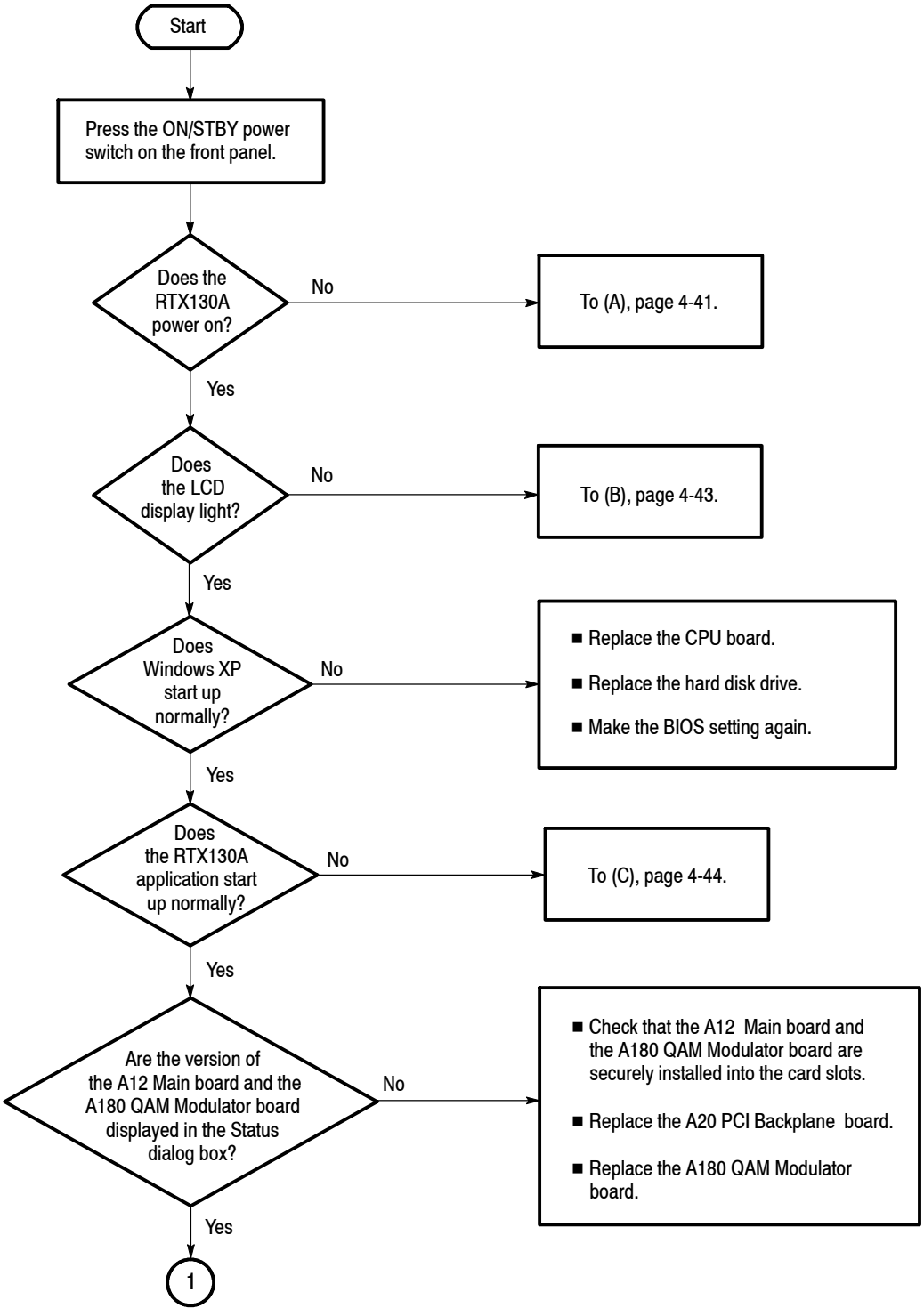


Figure 4-16: Troubleshooting procedure (1)

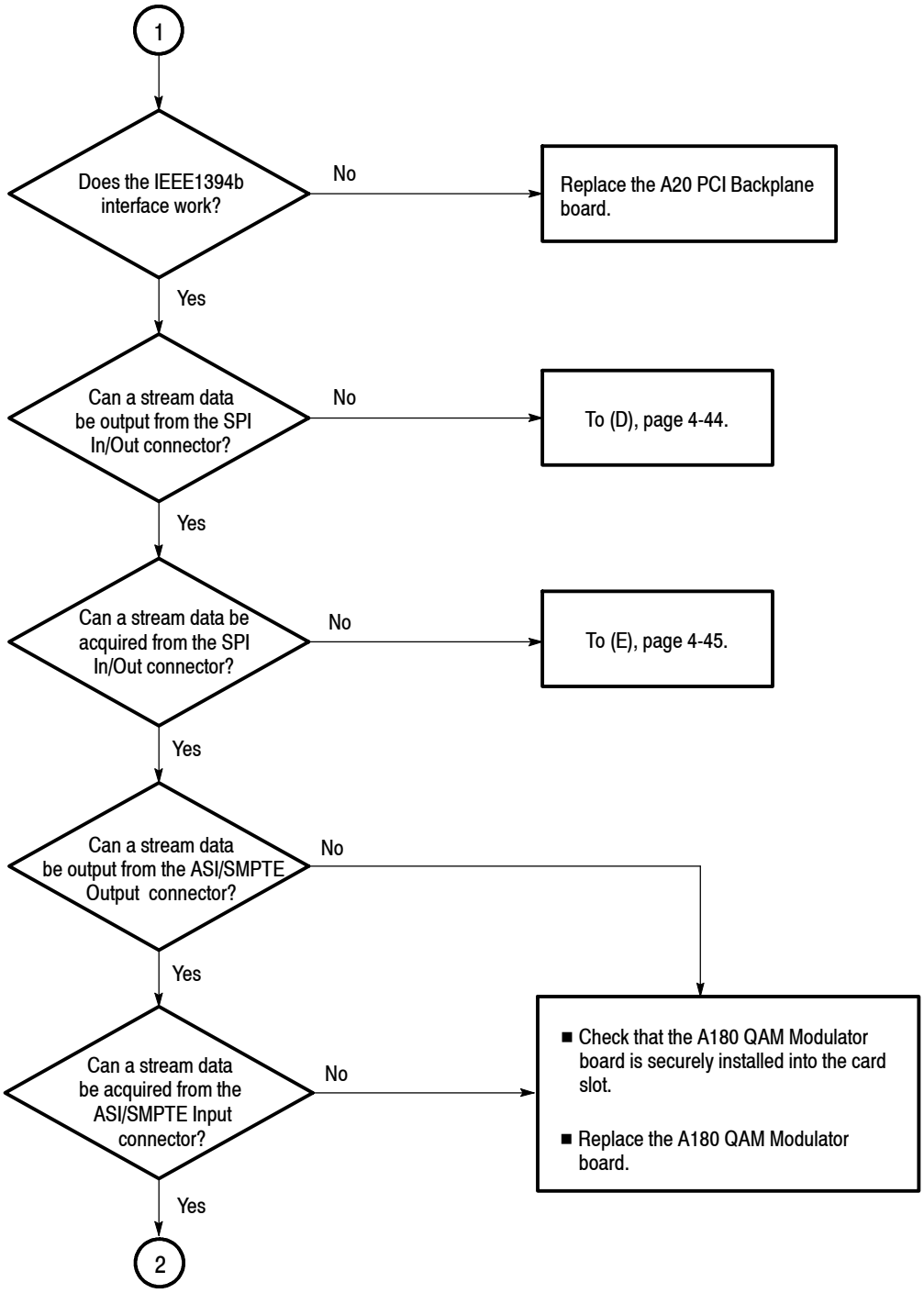


Figure 4-17: Troubleshooting procedure (2)

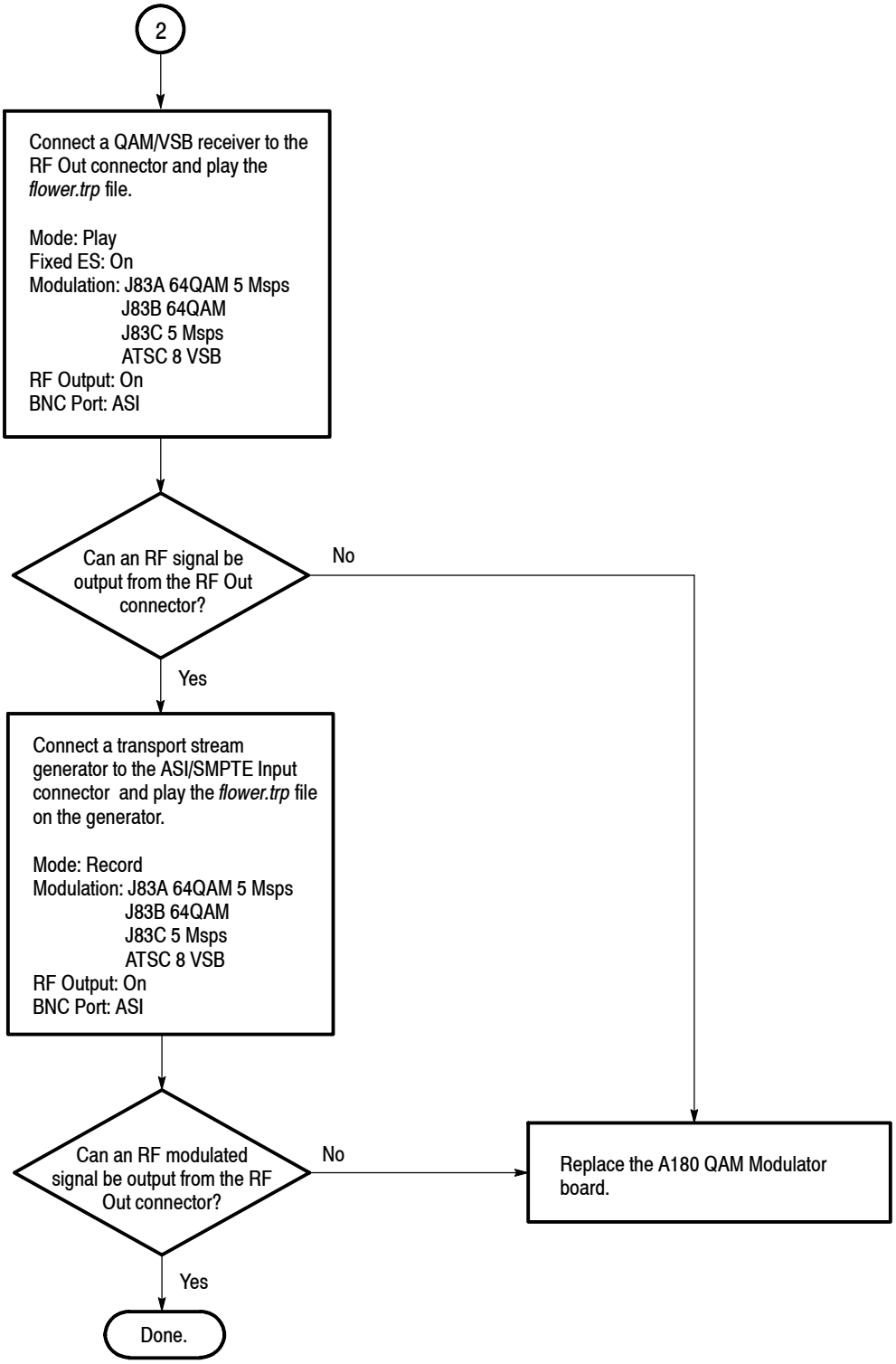


Figure 4-18: Troubleshooting procedure (3)

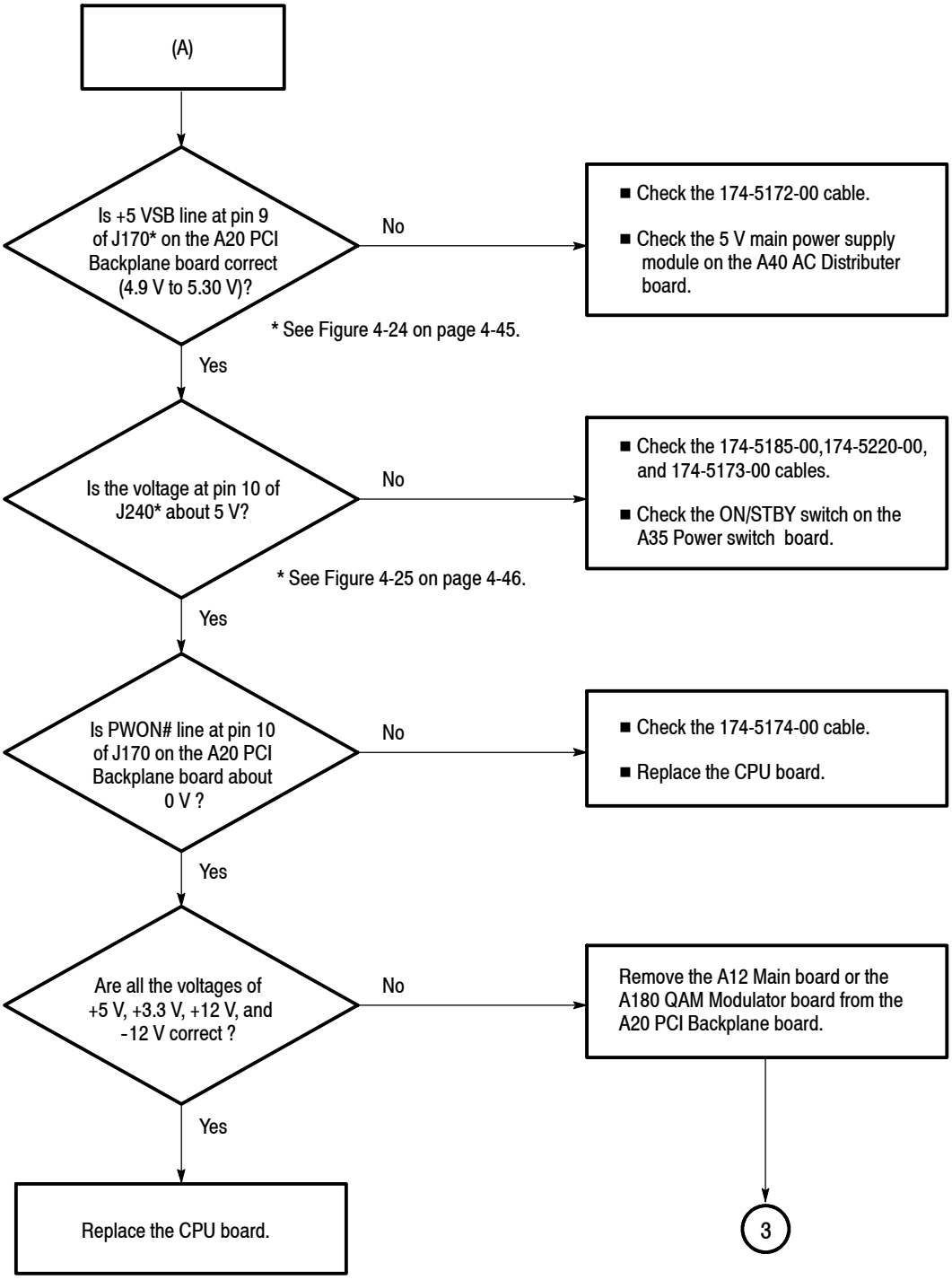


Figure 4-19: Troubleshooting procedure (4)

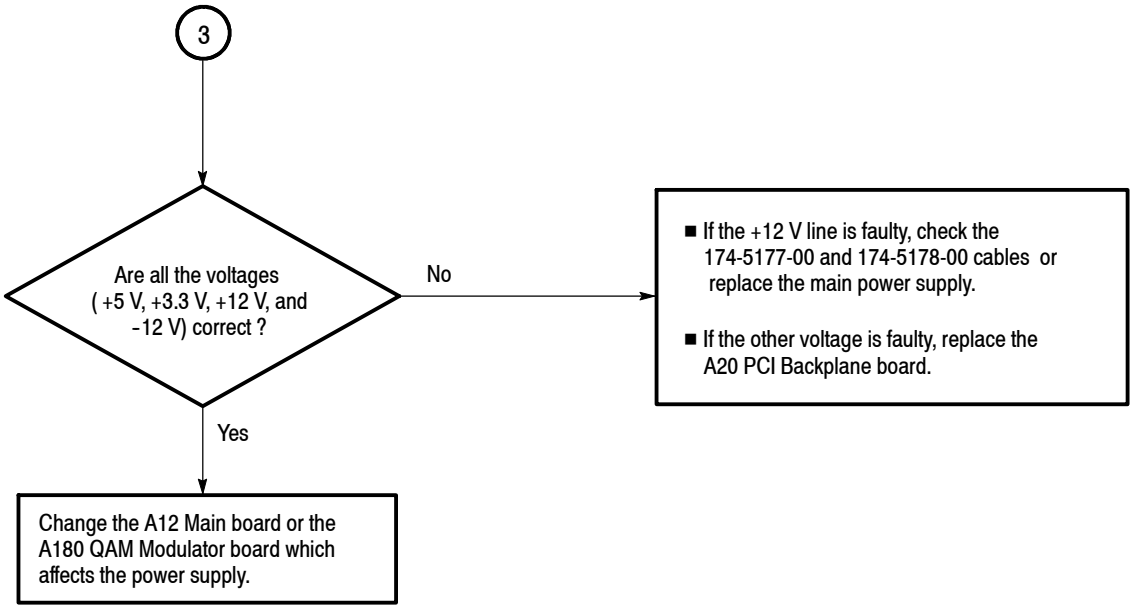


Figure 4-20: Troubleshooting procedure (5)

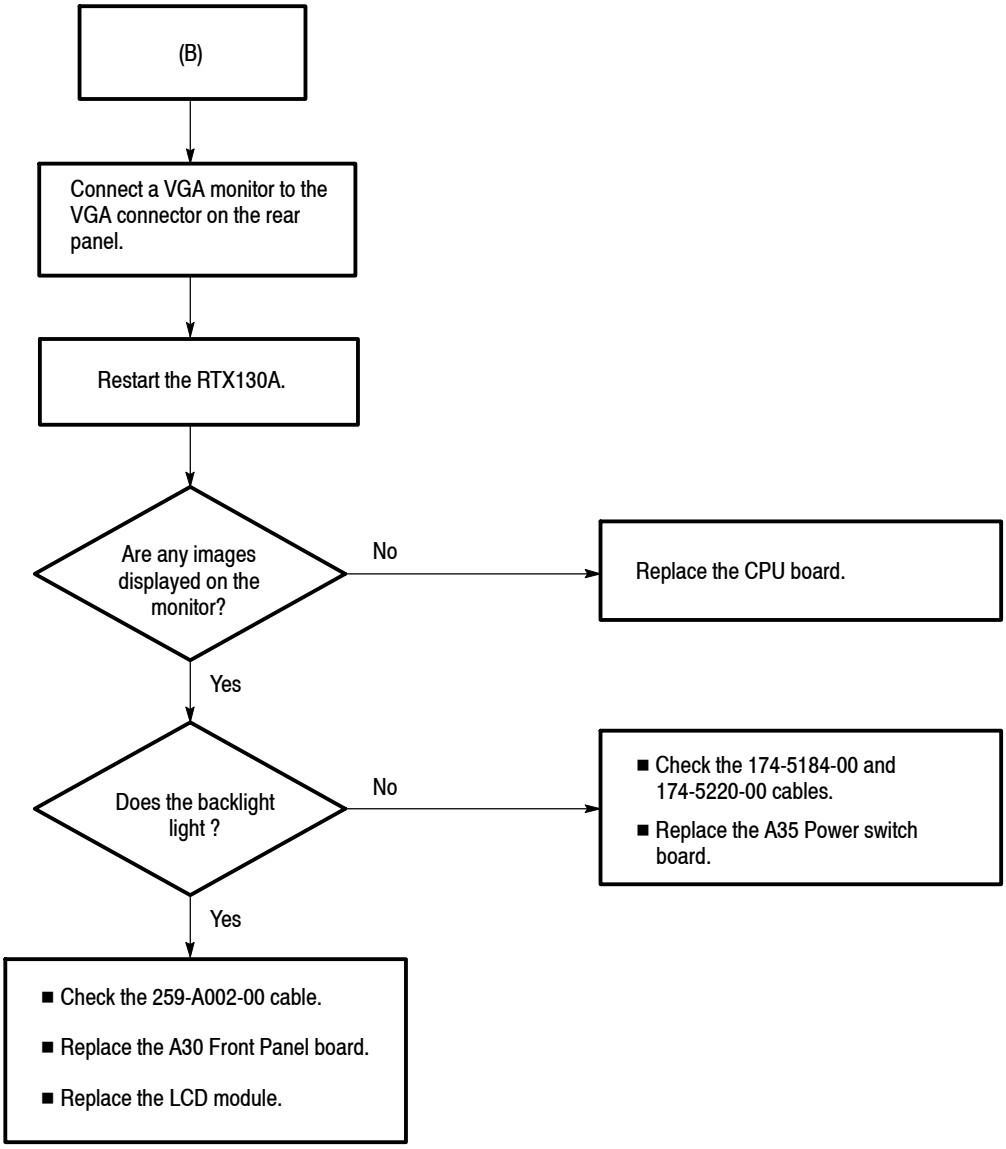


Figure 4-21: Troubleshooting procedure (6)

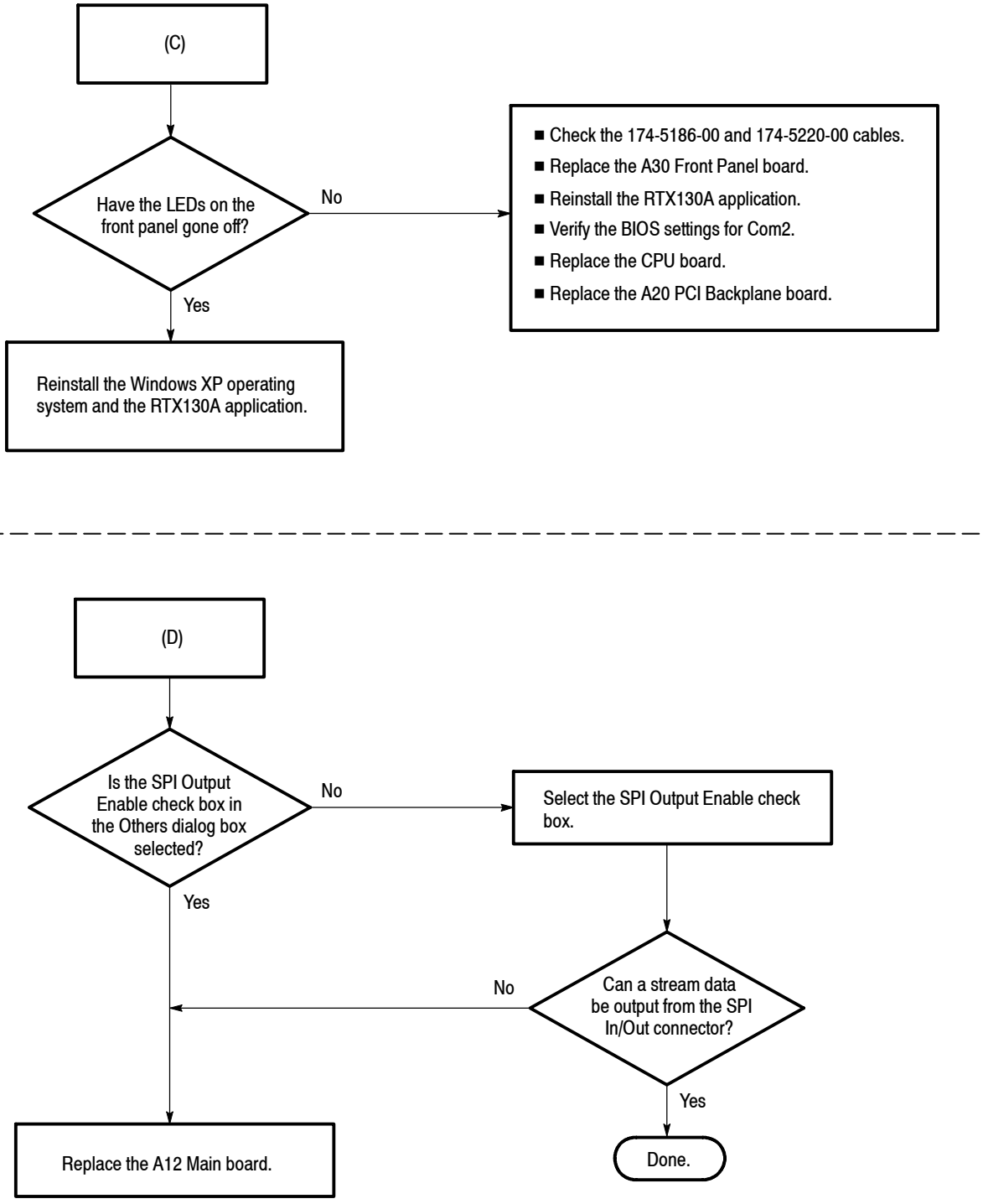


Figure 4-22: Troubleshooting procedure (7)

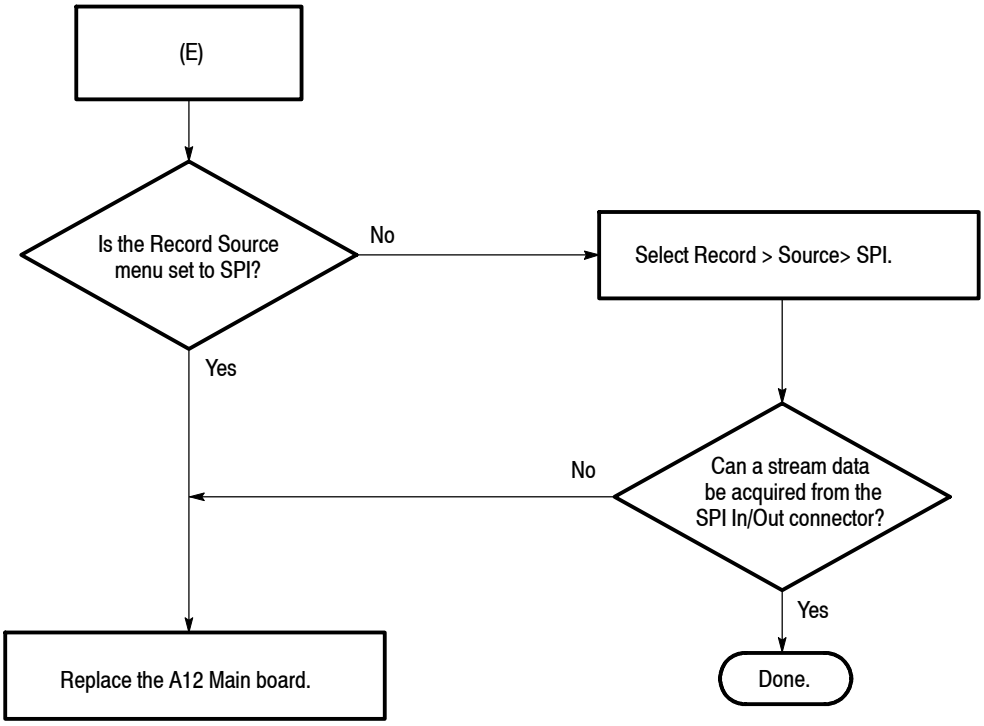


Figure 4-23: Troubleshooting procedure (8)

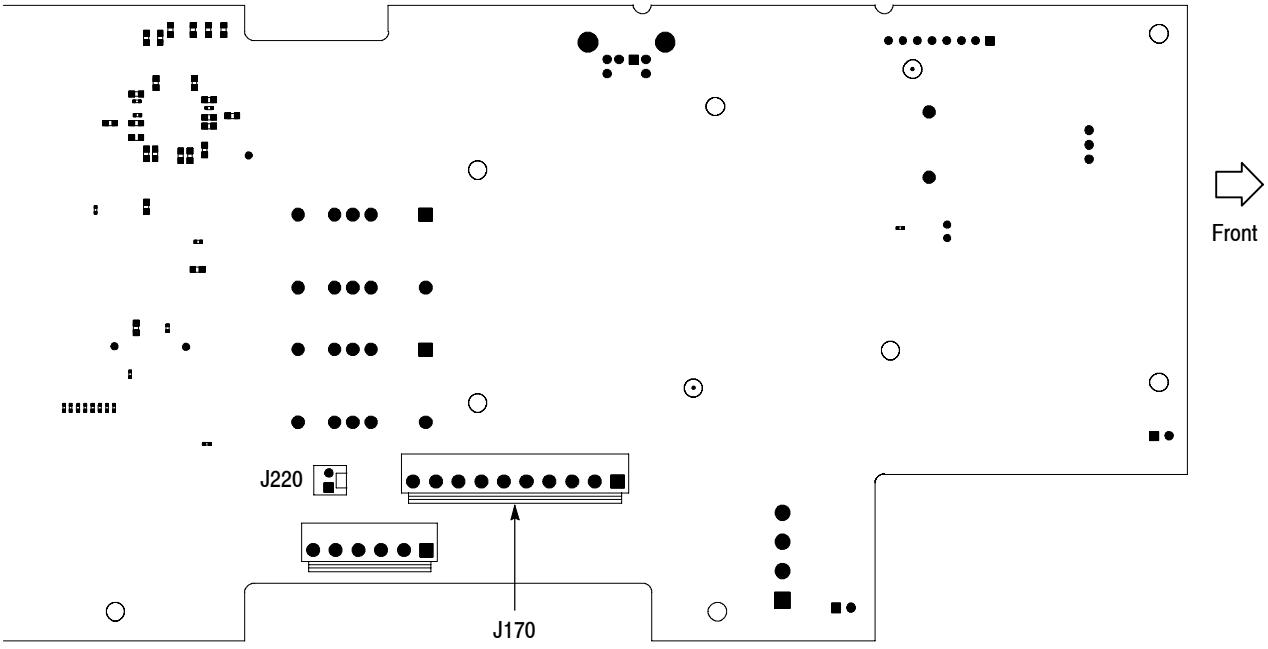


Figure 4-24: A20 PCI Backplane board view- back side

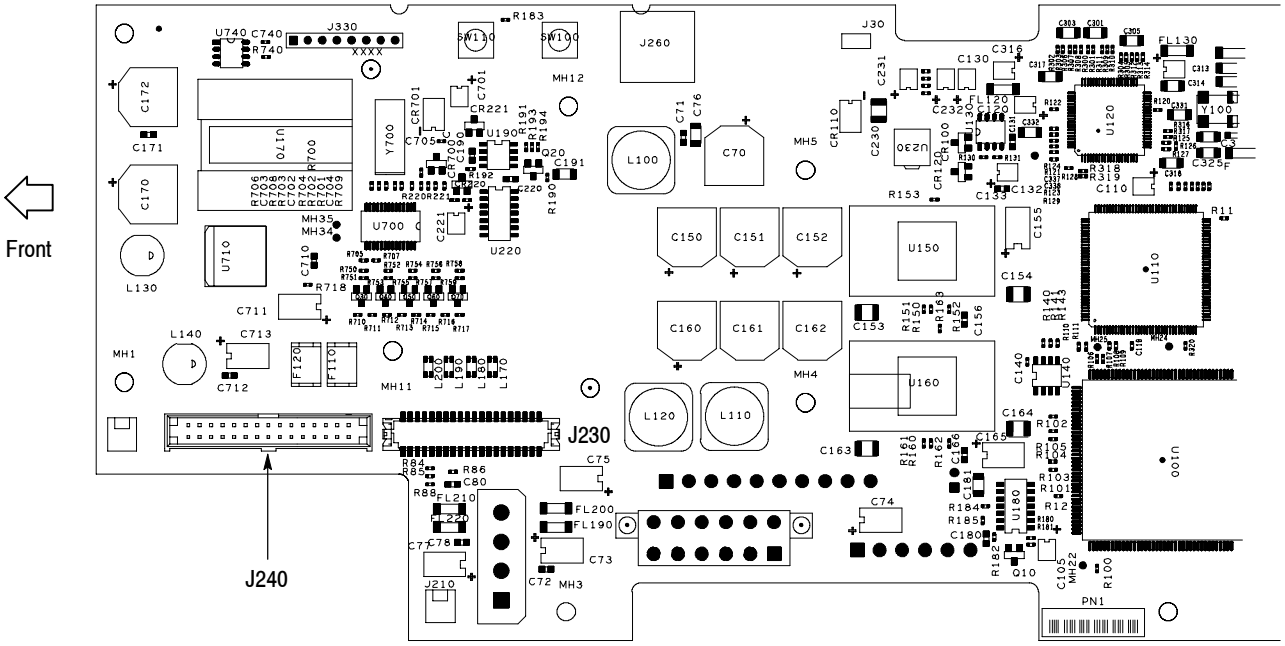


Figure 4-25: A20 PCI Backplane board view- right side

Using the Recovery Discs

If the RTX130A does not boot, you can reboot the RTX130A by using the recovery discs provided with the instrument. Use the procedures in this section to reinstall the Windows XP operating system and the RTX130A application software.

Reinstalling Windows XP

NOTE. Before beginning this procedure, connect the keyboard and mouse provided with the instrument to the front-panel USB connectors.

Perform the following procedure to reinstall the Windows XP operating system:

1. Insert the **Windows XP Professional Operating System Recovery Disc** into the DVD drive.
2. Turn off, then turn on the instrument. The RTX130A runs from the disc.
3. Follow the installation instructions on the screen.
4. When the **Easy Restore** window appears, click **Continue** to start the recovery process.
5. Click **Yes** in the **Warning** dialog box to continue the process. The process takes about 10 minutes.
6. When the Message dialog box appears, press the eject button on the DVD drive, and then press any key to reboot the instrument.
7. When the Windows XP Professional Setup dialog box appears, follow the installing instructions on the screen.

When all settings for Windows XP are completed, the Windows desktop appears.

NOTE. If the dialog box for setting up the drive appears, use the inf file in the following directory of the Application Software Recovery CD: Application_Software\program file\Tektronix\MPEGPlayer\Inf

Reinstalling the RTX130A Application

Perform the following procedure to reinstall the RTX130A application software:

1. Insert the **Application Software Recovery** CD into the DVD drive.
2. Double-click the **E: drive** icon (substitute your DVD drive letter if it is different than E).
3. Double-click the **Application_Software** folder.
4. Double-click the **setup.exe** icon.
5. Follow the on-screen instructions to complete the installation.

Restoring the IEEE1394b Port Speed Setting

The IEEE1394 port speed of the RTX130A is set to S400/S800 at the factory. However, when you reinstall the Windows XP operating system, this setting returns to the default value (S400). After you reinstall the operating system, perform the following procedure to restore the IEEE1394b port speed setting:

1. Select **Start > Run** to open the Run dialog box.
2. Enter **regedit** in the Run dialog box, and then click **OK**. The **Registry Editor** window appears.
3. In the Registry Editor window, select **Edit > Find** to open the Find dialog box.
4. Enter **SidSpeed** in the Find dialog box, and then click **Find Next**.
5. In the file list on the right side of the window, double-click the **SidSpeed** icon. The **Edit DWORD Value** dialog box appears as shown in Figure 4-26.

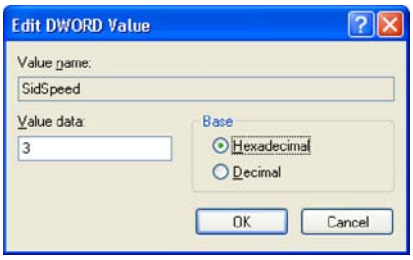


Figure 4-26: Edit DWORD Value dialog box

6. In the Edit DWORD Value dialog box, enter **3** in the **Value data** text box.

7. Click **OK** to close the dialog box and apply the setting change.
8. Click the close button on the title bar to close the Registry Editor window.

Options

Options

This section describes options that are available for the RTX130A.

The following options are available:

Options	Description
Modulation mode option	
Option M1	Adds DVB-C/ITU-T J.83 Annex A modulation mode
Option M2	Adds ITU-T J.83 Annex B modulation mode
Option M3	Adds ITU-T J.83 Annex C modulation mode
Option M4	Adds ATSC modulation mode
Software option	
Option SC	Adds the Scheduler application
Service options	
Option D1	Provides calibration data
Option D3	Provides calibration data for 3 years
Option D5	Provides calibration data for 5 years
Option C3	Provides calibration services for 3 years
Option C5	Provides calibration services for 5 years
Option R3	Extends the instrument warranty to 3 years
Option R5	Extends the instrument warranty to 5 years
Power cord options	
Option A0	North America power cord
Option A1	Universal Euro power cord
Option A2	United Kingdom power cord
Option A3	Australia power cord
Option A4	240 V North America power cord
Option A5	Switzerland power cord
Option A6	Japan power cord
Option A10	China power cord
Option A99	No power cord

Diagrams

Diagrams

This section contains the following diagrams:

- Block diagram of the RTX130A
- Interconnect diagram of the RTX130A

Block diagrams show the modules and functional blocks in the RTX130A. Interconnect diagrams show how the modules in the RTX130A connect together.

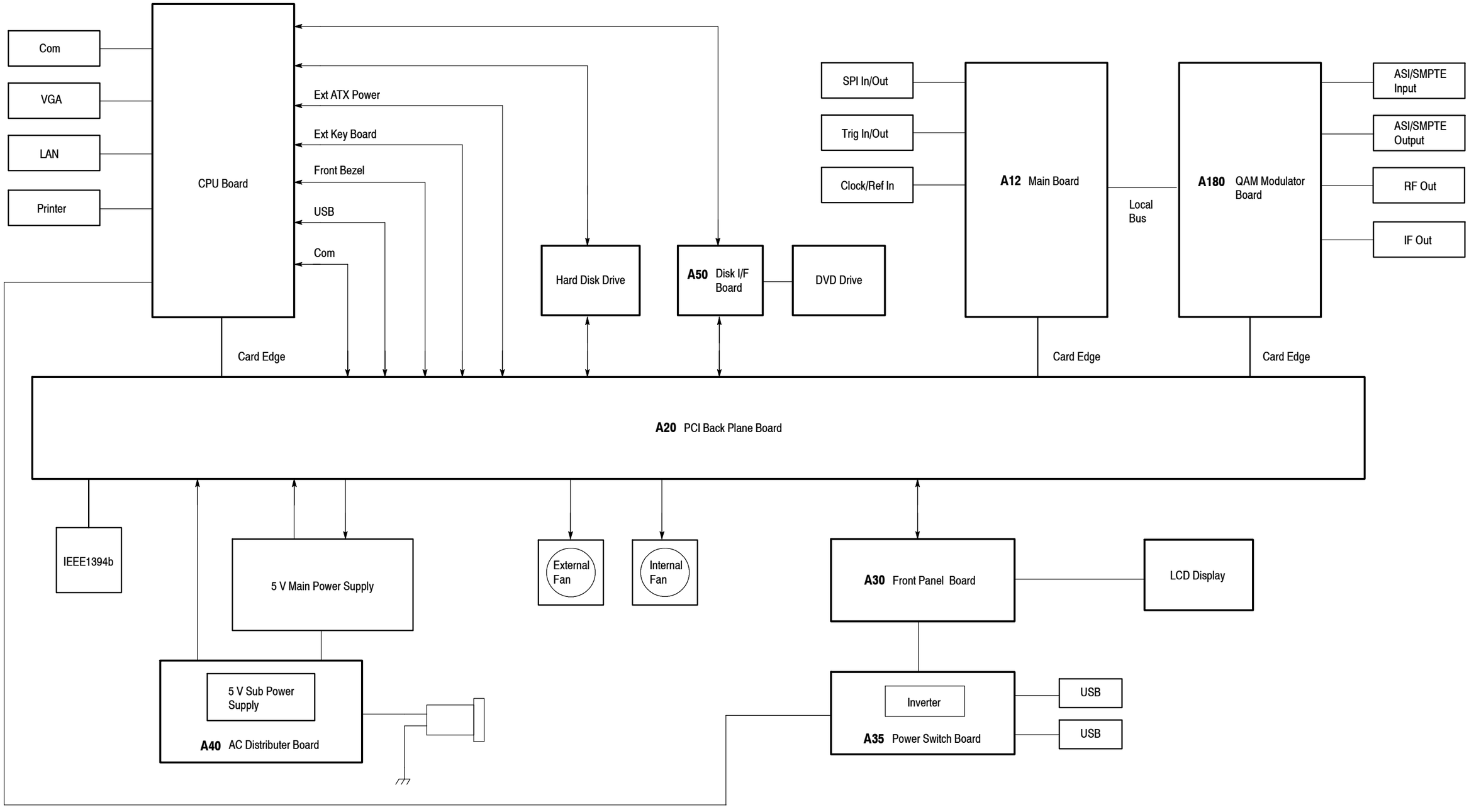


Figure 6-1: RTX130A block diagram

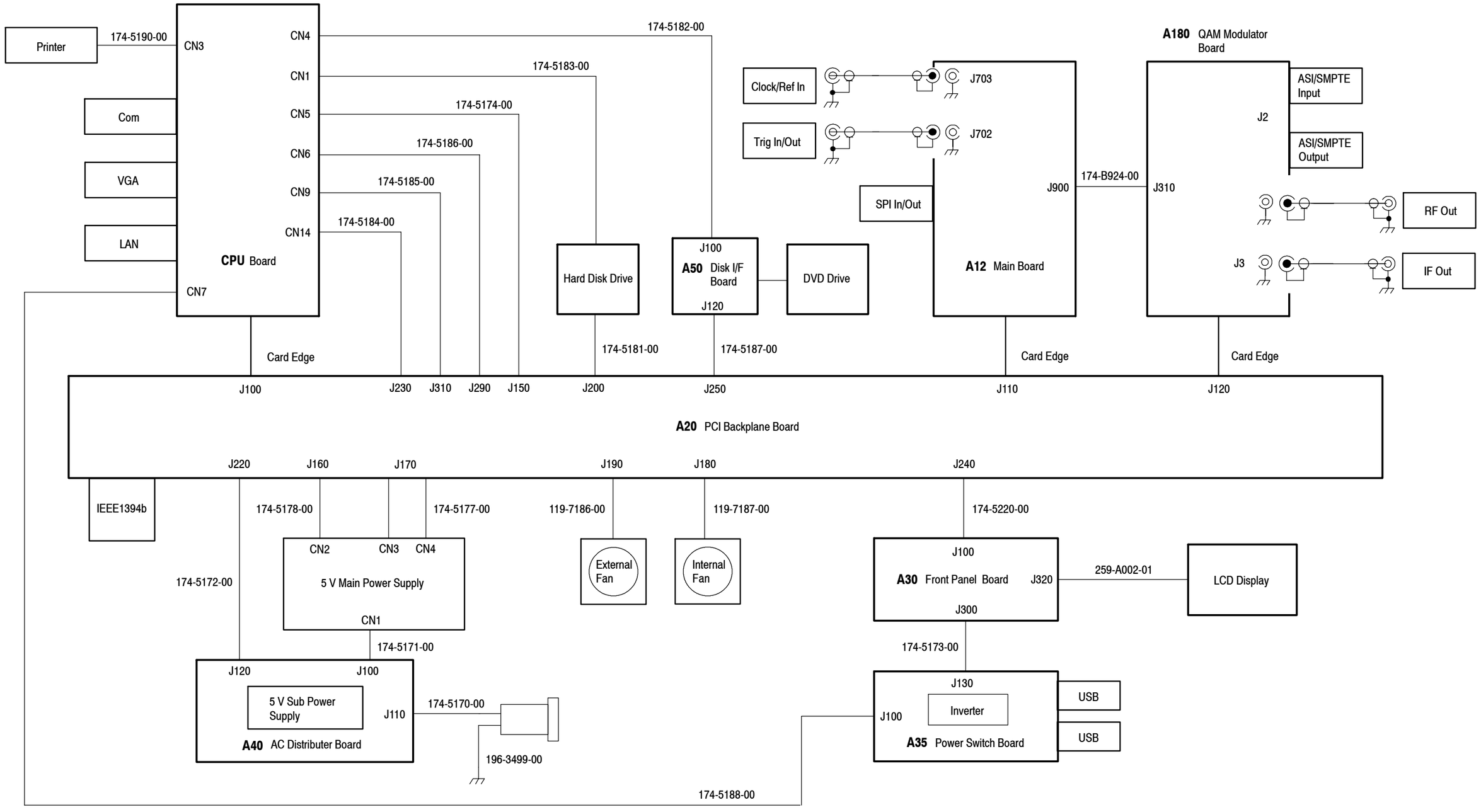


Figure 6-2: RTX130A interconnect diagram

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the RTX130A. 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:

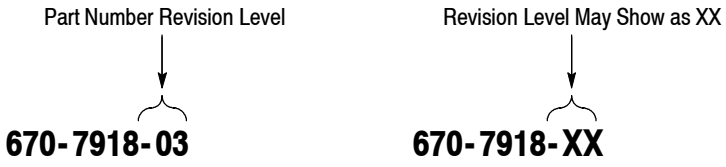
- Part number (see Part Number Revision Level below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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.

Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For most parts in this manual, you will find the letters XX in place of the revision level number.



When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

Module Servicing

Modules can be serviced by selecting 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 remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-833-9200. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix Web site for a list of offices: www.tektronix.com

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 the RTX130A. 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.

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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
S3109	FELLER	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
TK2432	UNION ELECTRIC	15/F #1, FU-SHING N. ROAD	TAIPEI, TAIWAN ROC
2W733	BELDEN CORPORATION	2200 US HIGHWAY 27 SOUTH PO BOX 1980	RICHMOND IN 47375-0010
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-1-1	211-0374-00			6	SCREW,MACHINE:6-32X0.25,FLH,100 DEG,STL ZN-CM1,T10 TORX	80009	
-2	337-4345-00			1	SHIELD,ELEC:COVER,LEFT,MTX100A,AL	80009	
-3	390-1212-01			1	CABINET ASSY;WRAP AROUND HOUSING,0.050 AL,SILVER GRAY,W/FEET&HANDLE,SAFETY CONTROLLED	80009	
-4	211-0711-00			2	SCR,ASSEM WSHR;6-32X0.250,PNH,STL,CDPL,T-15 TORX DR,MACHINE,W/SQ CONE WASHER	80009	
-5	335-1374-00			1	MARKER,IDENT;LABEL,MKD WARNING TO AVOID ELECTRIC,50.8MMX25.4MM,0.002 POLYESTER(3M 7982), OVER LAMINATE W/0.001 FLEVCON,W/ADHESIVE BACK, SAFETY CONTROLLED	80009	
-6	063-3868-00			1	SOFTWARE PKG;MICROSOFT WINDOWS XP PROFESSIONAL,INCLUDES SERVICE PACK 2,1-2 PROCESSOR VERSION;CERTIFICATE OF AUTHENTICITY	80009	
-7	337-4346-00			1	SHIELD,ELEC:COVER,RIGHT,MTX100A,AL	80009	
-8	211-0374-00			7	SCREW,MACHINE:6-32X0.25,FLH,100 DEG,STL ZN-CM1,T10 TORX	80009	

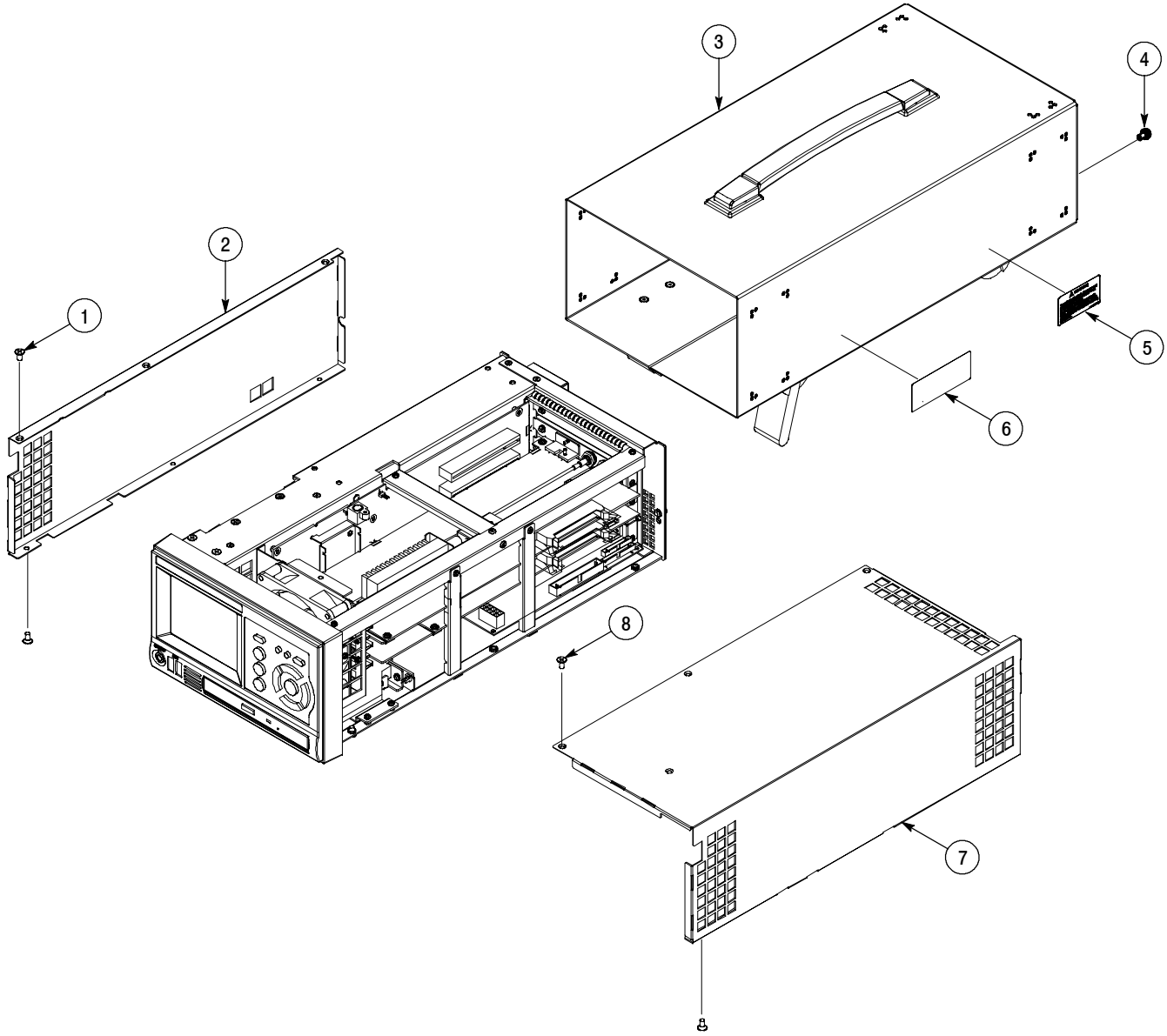

Figure 7-1: Cabinet and covers

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-2-1	211-0734-00			2	SCREW,MACHINE:6-32X0.25,FLH,100 DEG,STL ZN-CM1, T10 TORX	80009	
-2	211-0373-00			2	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-3	343-1708-00			1	RETAINER:HARD DISK DRIVE,W/POLYURETHANE, MTX100A,AL	80009	
-4	211-0734-00			2	SCREW,MACHINE:6-32X0.25,FLH,100 DEG,STL ZN-CM1, T10 TORX	80009	
-5	211-0734-00			2	SCREW,MACHINE:6-32X0.25,FLH,100 DEG,STL ZN-CM1,T10 TORX	80009	
-6	386-7460-00			1	PLATE:HDD,AL	80009	
-7	650-4862-00			1	HARD DISK DRIVE:160GB,3.5 INCH,7200RPM,ATA-100	80009	
-8	211-0373-00			3	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-9	671-5979-00			1	CIRCUIT BD ASSY;A40,SUB POWER,389-3738-00 WIRED	80009	
-10	342-1138-00			1	INSULATOR:CKT BOARD,POLYCARBONATE,A40 BOARD	80009	
-11	211-0373-00			4	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-12	119-7147-00			1	POWER SUPPLY;85V-264VAC IN,12VDC 12.5A OUT, LEA150F-12-R,COSEL	80009	
-13	211-0711-00			1	SCR,ASSEM WSHR;6-32X0.250,PNH,STL,CDPL,T-15 TORX DR,MACHINE,W/SQ CONE WASHER	80009	
-14	196-3496-00			1	LEAD,ELECTRICAL;18 AWG,4.0 L,5-4 SAFETY CON-TROLLED	80009	
-15	119-6009-00			1	FILTER,RFI;3A,250VAC,0.5,MA,0.15OHM;SAFETY CONTROLLED	80009	
-16	211-0372-00			2	SCREW,MACHINE:4-40X0.312,PNH,STL ZN-CM1,T10 TORX	80009	
-17	200-4974-00			1	COVER,FAN;REAR,MTX100A,AL	80009	
-18	211-1161-00			4	SCREW,MACHINE;4-40X1.500,PNH HEAD,T-10 TORX, ZINC PL	80009	
-19	119-7186-00			1	CABLE,ASSEMBLY,4,18AWG,60MM L,HDD POWER (40 SQ FAN)	80009	
-20	335-1371-00			1	MARKER,IDENT:MKD CONNECTORS FOR A180,RTX130A	80009	
-21	335-1364-00			1	MARKER,IDENT:MKD CONNECTORS FOR A12, POLYCARBONATE	80009	
-22	335-1363-00			1	MARKER,IDENT:MKD CONNECTORS PRINTER&IEEE1394B, POLYCARBONATE	80009	
-23	335-1362-00			1	MARKER,IDENT:MKD CONNECTORS FOR CPU BD, POLYCARBONATE	80009	
-24	335-0133-00			1	MARKER,IDENT;BLANK LABEL FOR MES LINES; THT-37-483-10MONOCHROME DISPLY;TDS300,TDS400 SERIES,SAFETY CONTROLLED	80009	
-25	441-2404-00			1	CHASSIS,ASSY;MAIN,MTX100A,AL	80009	
-26	210-0164-00			2	RIVET,SOLID;0.163 ODX0.415 L,PANEL RANGE HEAD STYLE,NYLON	80009	
-27	119-7187-00			1	FAN 119569400 W/CABLE 18CM L(92 SQ FAN)	80009	
-28	211-0373-00			2	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	

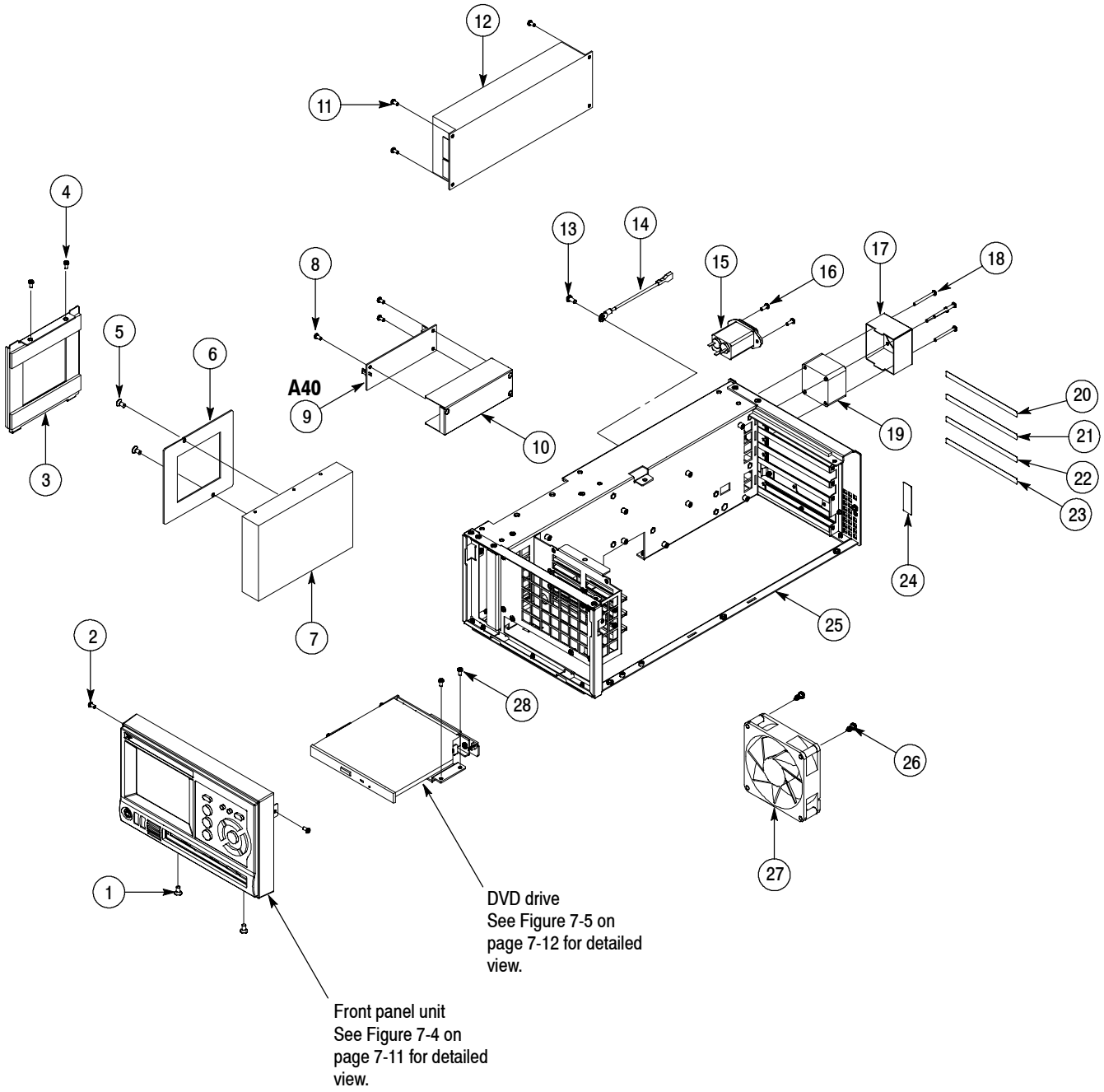

Figure 7-2: Internal modules (1)

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-3-1	650-4933-00			1	PROCESSOR MODULE W/BRACKET+LABEL 334A48100	80009	
-2	671-5975-00			1	CIRCUIT BD ASSY;A12,MAIN,389-3734-00 WIRED	80009	
-3	671-5987-00			1	CIRCUIT BD ASSY;A180	80009	
-4	211-0373-00			10	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-5	671-5976-00			1	CIRCUIT BD ASSY;A20,PCI BACK PANEL,389-3735-00 WIRED	80009	
-6	174-5190-00			1	CABLE ASSEMBLY,28AWG FLAT,1.27CTR,W/CONN D-SUB25&2X13	80009	
-7	210-0054-00			2	WASHER,LOCK;#4 SPLIT,0.025 THK STL CD PL	80009	
-8	214-3903-01			2	SCREW,JACK:4-40X0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CAD PLATE	80009	
-9	211-0373-00			4	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-10	333-4518-00			1	PANEL,PCI:BLANK,NI PL,STL	80009	
-11	211-0373-00			4	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-12	211-0373-00			3	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-13	426-2624-00			1	FRAME,SECTION:TOP,MTX100A,STL	80009	
-14	211-0373-00			2	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-15	343-1697-00			2	RETAINER:CKT BD,PCI,MTX100A,STL	80009	

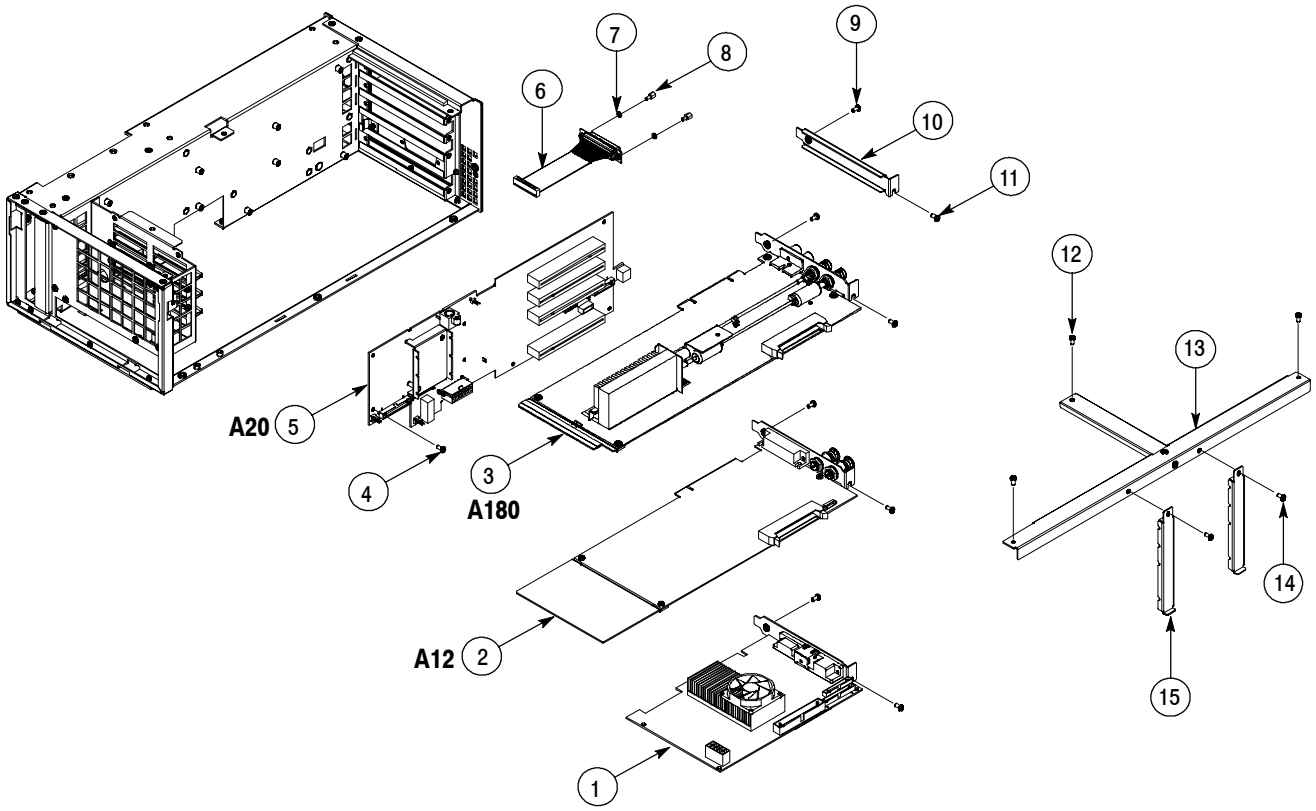

Figure 7-3: Internal modules (2)

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-4-1	335-1370-00			1	MARKER,IDENT:MKD RTX130A,POLYCARBONATE, W/ADHESIVE BACK,SAFETY CONTROLLED	80009	
-2	200-4983-00			1	COVER,FRONT:ABS,TV GRAY,WITH CONDUCTIVE	80009	
-3	378-A048-01			1	FILTER,LCD:ACRYL,MTX100	80009	
-4	650-4802-00			1	LCD MODULE:4 INCH,TFT,VGA [LTMO4C380K]	80009	
-5	200-4910-00			1	COVER,SHIELD:PACKING LCD REAR,PORYCARBONATE SHEET,T0.5	80009	
-6	259-A002-01			1	FLEX CIRCUIT:A60,LCD I/F	80009	
-7	407-5048-00			1	BRACKET,ASSY:FRONT COVER,STL & SST,MTX100	80009	
-8	366-A046-00			1	PUSH BUTTON,POWER:SILVER GRAY,ABS	80009	
-9	384-A222-00			1	EXTENSION SHAFT:POWER BUTTON,POLYACETAL,MTX100	80009	
-10	671-5978-XX			1	CIRCUIT BD ASSY:A35 POWER SW,389-3737-00 WIRED	80009	
-11	211-0373-00			3	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-12	671-5977-XX			1	CIRCUIT BD ASSY:A30 FRONT PANEL,389-3736-00 WIRED	80009	
-13	211-0373-00			4	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-14	260-A148-00			1	SWITCH,RUBBER:SILICON,FRONT PANEL	80009	
-15	333-A437-00			1	PANEL,FRONT:KEYBOARD,MTX100,POLYCARBONATE,TO.25	80009	

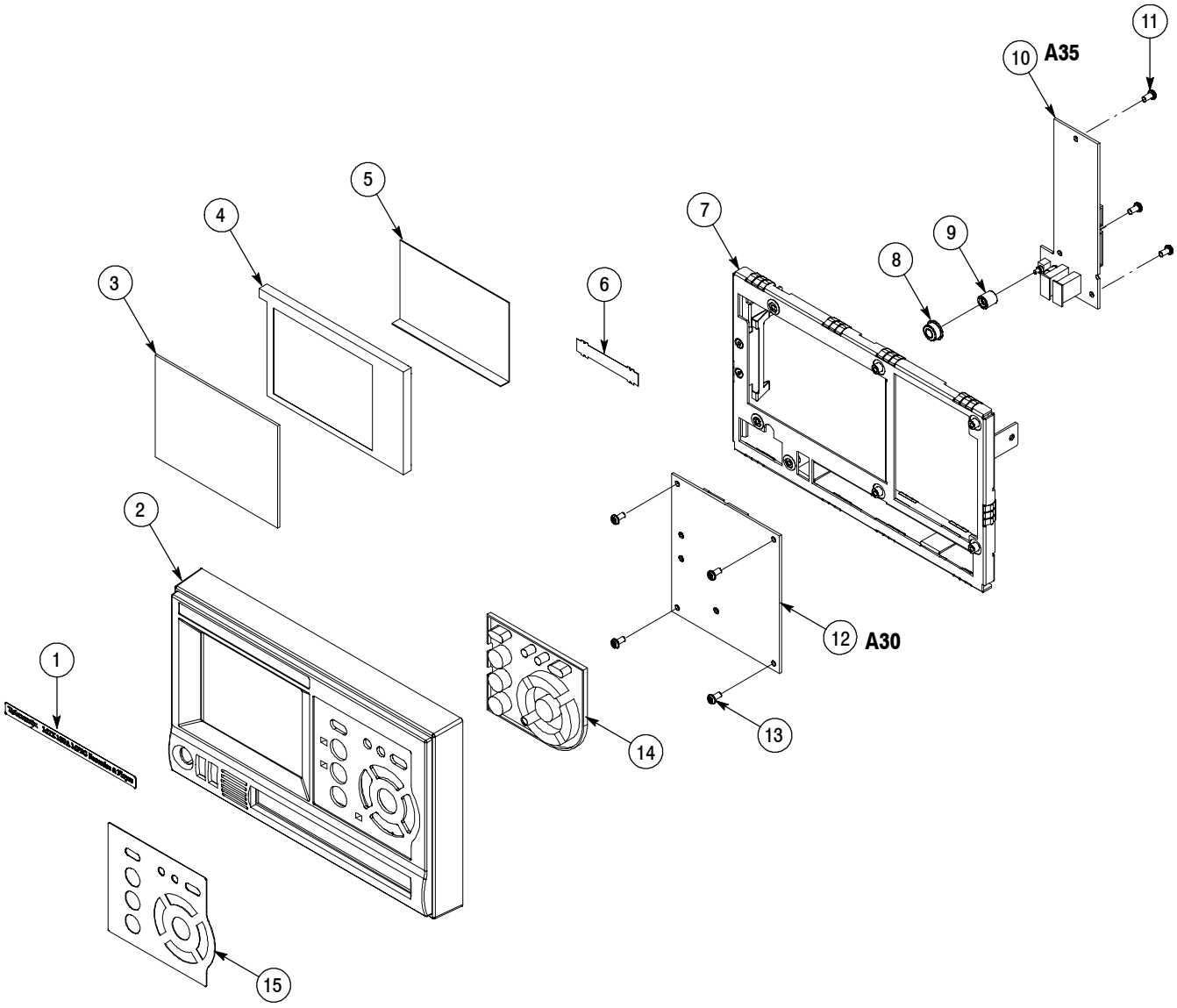

Figure 7-4: Front-panel unit

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-5-1	119-7123-00			1	DISK DRIVE;OPTICAL,CD-RW/DVD-R/RW DVD+R/RW,16.7 MB/SEC,650MEG/8.5GIG,IDE/ATAPI;TEAC MODEL DV-W28E-793	80009	
-2	671-5980-XX			1	CIRCUIT BD ASSY:A50 DISK I/F,389-3739-00 WIRED	80009	
-3	211-0373-00			1	SCREW,MACHINE:4-40X0.25,PNH,STL ZN-CM1,T10 TORX	80009	
-4	211-A269-00			4	SCREW,MACHINE:M2X4MM L,PNHSTL ZN-C,CROSS REC,W/FLAT (6MM OD) WASHER	80009	
-5	407-5049-00			1	BRACKET:DVD DRIVE,MTX100A,AL	80009	

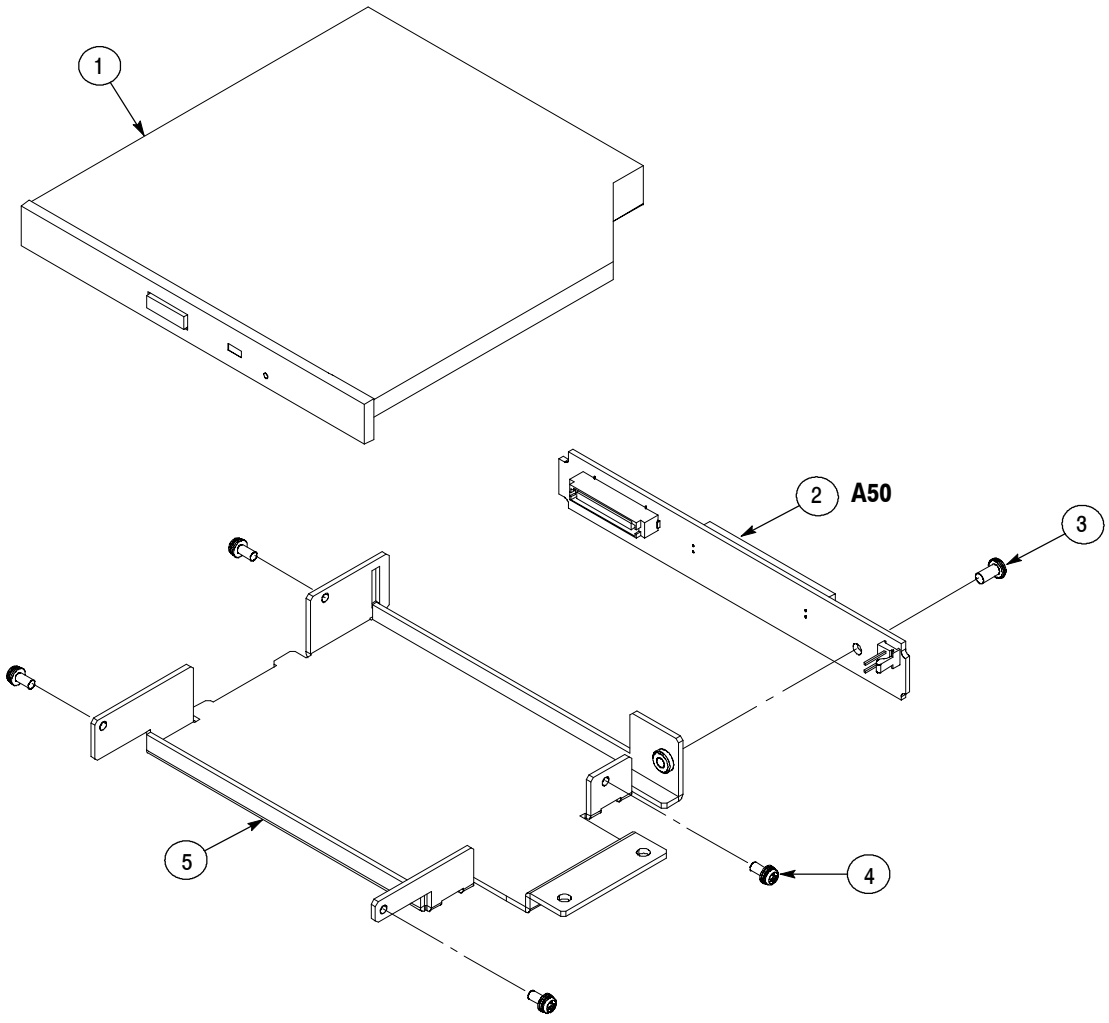

Figure 7-5: DVD drive unit

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7-6-1	174-5183-00			1	CABLE,ASSEMBLY,2X20,FLAT,430MM L,ULTRA ATA (CPU-HDD,HDD IDE)	80009	
-2	174-5181-00			1	CABLE,ASSEMBLY,4,18AWG,60MML,HDD POWER (HDD-A20,POWER)	80009	
-3	174-5172-00			1	CABLE,ASSEMBLY,2,22AWG,50MM L,W/CONN 22-01-3027 (MOLEX),(A20-A4-,5V STAND-BY)	80009	
-4	174-5177-00			1	CABLE,ASSEMBLY,7,18AWG,50MM l;VHR-10N&VHR-7N+ XHP-2(JST),(P/S-A20,POWER&CONTROL)	80009	
-5	174-5178-00			1	CABLE,ASSEMBLY,6,18AWG,110MM L,W/CONN VHR-6N (JST),(P/S-A20,GND)	80009	
-6	174-5171-00			1	CABLE,ASSEMBLY,2,18AWG,130MM l,W/CONN VHR-5N(JST) (P/S-A40)	80009	
-7	174-5170-00			1	CABLE,ASSEMBLY,2,18AWG,40MM l,AC INLET to A40 (INLET-A40)	80009	
-8	196-3449-00			1	LEAD,ELECTRICAL;18AWG,4.0 L,5-4 SAFETY CONTROLLED	80009	
-9	174-B924-00			1	CABLE,ASSEMBLY,SP,ELEC:80,30AWG,5CM L,FLAT,W/CONN (YAMAICHI)	80009	
-10	174-5190-00			1	CABLE,ASSEMBLY,28AWG FLAT,1.27CTR,W/CONN D-SUB25&2X13(DSUB25-CPU)	80009	
-11	174-5186-00			1	CABLE,ASSEMBLY,2X10,28AWG FLAT,1MM CTR,130MM L, RS232C SLOT PC TO A20,ST(CPU-A20,RS2-232C)	80009	
-12	174-5185-00			1	CABLE,ASSEMBLY,2X5,28AWG FLAT,1MM CTR,120MM L, PANNEL SLOT PC TO A20(CPU-A20,PANEL CONTROL)	80009	
-13	174-5184-00			1	CABLE,ASSEMBLY,14,30AWG 7TWISTED PAIRS,270MM L, LVDS SLOT PC TO A20(CPU-A20,LCD LVDS)	80009	
-14	174-5174-00			1	CABLE,ASSEMBLY,12,18AWG,150MM L,SLOT PC POWER (CPU-A20,CPU POWER)	80009	
-15	174-5182-00			1	CABLE,ASSEMBLY,2X22,28AWG FLAT,1MM CTR,350MM L, W/CONN ATA CABLES(CPU-A50,DVD IDE)	80009	
-16	174-5187-00			1	CABLE,ASSEMBLY,22AWG,180MM L,W/CONN 22-01-3027 (MOLEX),DVD-ROM POWER,ST(A20-A50,DVD POWER)	80009	
-17	174-5188-00			1	CABLE,ASSEMBLY,SP,ELEC;10,60CM L,26AWG AND 28 AWG(CPU-A35,USB)	80009	
-18	174-5220-00			1	CABLE,ASSEMBLY,2X15,28AWG FLAT,1MM CTR,300MM L,A20 TO A30	80009	
-19	174-5173-00			1	CABLE,ASSEMBLY,5,26AWG RBN,120MM L,W/CONN PHR-5(JST)(A30-A35)	80009	

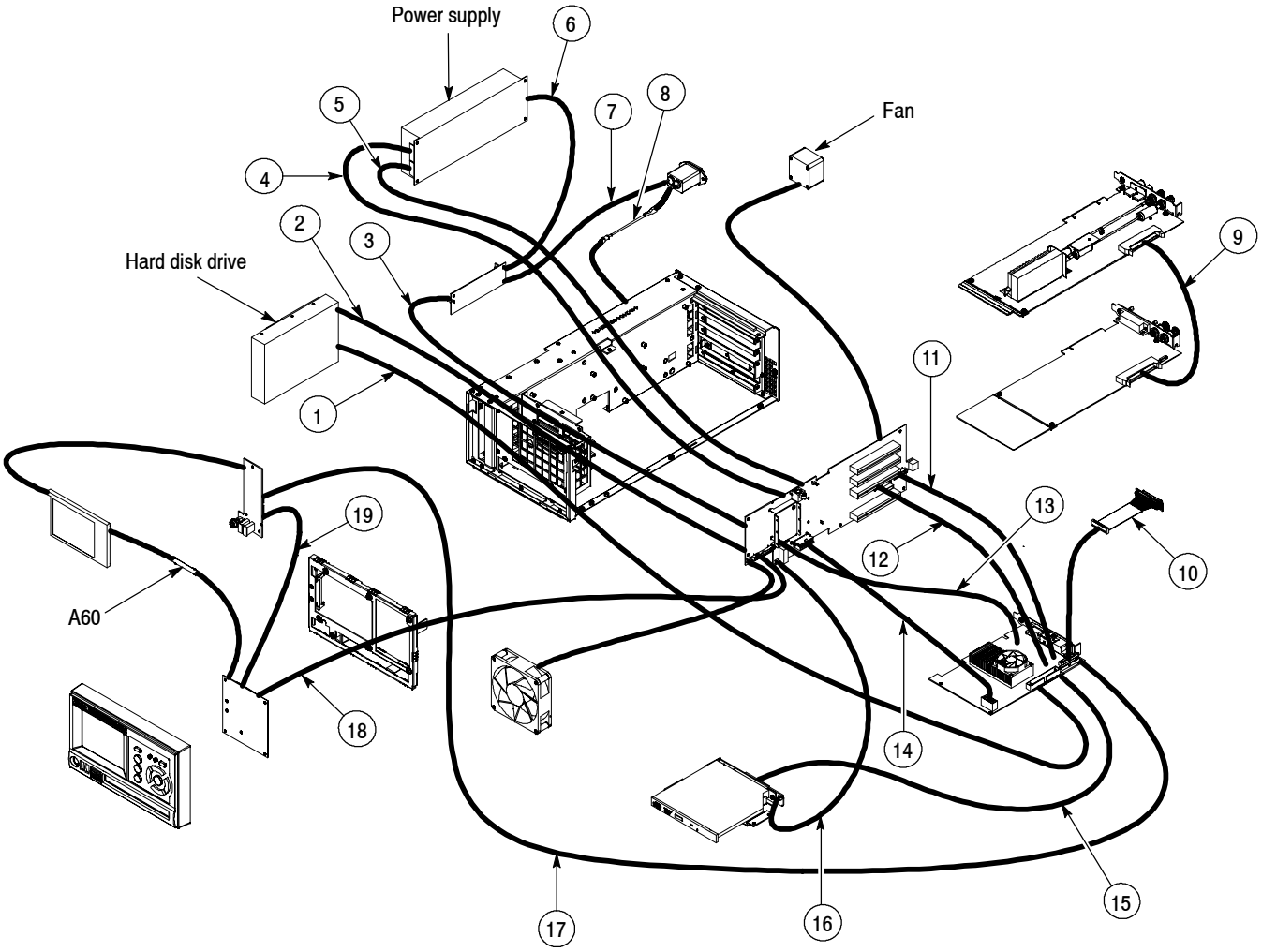

Figure 7-6: Cables

Replaceable parts list

Component number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
					STANDARD ACCESSORIES		
	071-1861-XX			1	MANUAL,TECH,USER,RTX130A,ENGLISH (OPTION L0)	80009	
	071-1862-XX			1	MANUAL,TECH,USER,RTX130A,JAPANESE (OPTION L5)	80009	
	063-3864-XX			1	SOFTWARE PKG:WINDOWSXP PROFESSIONAL RECOVERY,DVD-ROM	80009	
	063-3865-XX			1	SOFTWARE PKG:SAMPLE STREAMS,CD-ROM	80009	
	063-3866-XX			1	SOFTWARE PKG: APPLICATION SOFTWARE RECOVERY, CD-ROM	80009	
	063-3781-XX			1	SOFTWARE PKG: NERO CD/DVD BURNING SOFTWARE, CD-ROM	80009	
	012-A220-00			1	CABLE,INTCON:D-SUB 25,MALE TO MALE,STR,TWIST,2M L,SCREW 4-40	80009	
	119-6936-00			1	POINTER ASSY:OPTICAL MOUSE,USB,WHITE,OPTICAL THREE BUTTON WHEELED,W/USB to PS2 ADAPTER,ABS,SAFETY CONTROLLED	80009	
	119-B146-00			1	KEYBOARD:USB;MTX100,SAFETY CONTROLLED	80009	
	200-4853-00			1	COVER,FRONT;PROTECTIVE,PC/ABS FR110,W/TAPE;TV GRAY	80009	
	161-0066-00			1	CABLE ASSY,PWR; 3,18 AWG,250V/10A,98.0 L,STR,IEC320, RCPT X NEMA 5-15P,US,SAFETY CONTROLLED	S3109	
	161-0066-09			1	CABLE ASSY,PWR; 3,0.75MM SQ,250V/10A,99.0 L,STR, IEC320,RCPT,EUROPEAN,SAFETY CONTROLLED	S3109	
	161-0066-10			1	CABLE ASSY,PWR;3,1.0MM SQ,250V/10A,2.5 METER, STR,IEC320,RCPT X 13A,FUSED UK PLUG(13A FUSE), UNITED KINGDOM,SAFETY CONTROLLED	S3109	
	161-0066-13			1	CABLE ASSY,PWR;3,1.0MM SQ,250V/10A,2.5 METER, STR,IEC320,RCPT,AUSTRALIA,SAFETY CONTROLLED	S3109	
	161-0066-12			1	CABLE ASSY,PWR;3,18 AWG,250V/10A,98.0 L,STR,RCPT X NEMA 6-15P,US,SAFETY CONTROLLED	2W733	
	161-0154-00			1	CABLE ASSY,PWR;3,1.0MM SQ,250V/10A,2.5 METER, STR,IEC320,RCPT,SWISS,SAFETY CONTROLLED	S3109	
	161-0298-00			1	CABLE ASSY,PWR; 3,125V/7A,JAPAN,98 LONG,STR,NEMA 5-15P PLUG X IEC320/C-13 RECEPTACLE,SAFETY CONTROLLED		
	161-0304-00			1	CABLE ASSY,PWR;3,1.0MM SQ,250V/10A,2.5 METER, STR,IEC320,3C CERTIFICATION,RCPT,CHINA,SAFETY CONTROLLED	S3109	
					OPTIONAL ACCESSORIES		
	071-1863-XX			1	MANUAL,TECH:SERVICE,RTX130A	80009	
	----------			1	1700F05 SIDE-BY-SIDE RACK ADAPTER	80009	
	----------			1	1700F06 BLANK PANEL	80009	

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