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Instruction Manual

Tektronix

VX1411
VXIbus Mainframe

070-9602-00

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

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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.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To avoid potential hazards use this product only as specified.

Injury Precautions

Use Proper Power Cord. To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Avoid Overvoltage. To avoid electric shock or fire hazard, do not apply potential to any terminal, including the common terminal, that varies from ground by more than the maximum rating for that terminal.

Avoid Electric Shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

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.

Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse. To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere. To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

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

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:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to Manual



Double
Insulated

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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 main 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.

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Preface

The VX1411 Mainframe Instruction Manual provides information on using the mainframe. The manual includes the following chapters:

- Getting Started provides a brief description of the VX1411 Mainframe, a list of accessories that accompany the mainframe, installation and configuration procedures, and a functional check procedure.
- Operating Basics provides a functional overview of the mainframe and includes illustrations of the main components.
- Specifications lists all of the warranted characteristics, nominal traits, and typical characteristics of the mainframe.
- Performance Verification includes the performance verification procedures used to verify the advertised specifications of the mainframe.
- Maintenance is intended for qualified service personnel who need to service the mainframe. Module-level removal and replacement procedures and troubleshooting procedures are included in this chapter.
- Replaceable Parts includes a list of replaceable mechanical and electrical parts for the mainframe to be used with the maintenance chapter. It also includes the exploded view diagrams of the mainframe and options.
- Appendices include a power budget.
- Glossary.
- Index.

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Getting Started

This chapter provides an overview of the VX1411 Mainframe. It includes installation and configuration information on user installed options.

Product Description

The VX1411 Mainframe is a 13-slot, C-size, VXIbus Mainframe. It fully complies with the VXIbus Specification 1.4 requirements and is VXI*plug&play* compatible. The mainframe has the following features:

- Adequate available power for the majority of applications
- Intelligent cooling for installed modules
- High quality auto-configuration backplane
- Optional adjustable rackmounts and cable tray

These features are explained in more detail in the following paragraphs.

Power Supply

The VX1411 Mainframe provides all VXIbus voltages at levels necessary for most ATE applications. The power supply has a volt-ampere capacity of 904 VA, but only 500 watts is usable by VXI instrument modules at any one time (see *Appendix A: Power Budget Worksheet*). The mainframe accommodates exclusively digital applications, exclusively analog applications, or combinations of both.

The power supply plugs directly into the rear of the mainframe and has no cables to disconnect. Because of this, the power supply can easily be replaced in less than three minutes, keeping downtime to a minimum. The power supply automatically sets the ranges for the appropriate input voltage and frequency; no mechanical switch is required to select the correct line voltage.

Cooling

The VX1411 Mainframe provides optimal cooling for all installed modules. The mainframe is equipped with two efficient 2 speed fans. The fan speed can easily be manually switched from a low noise, low speed to high speed for maximum cooling.

Air is exhausted at the sides of the mainframe allowing you to stack the mainframe with other rackmount equipment. Additional equipment placed on or positioned above the product will not restrict airflow nor will that equipment be directly affected by exhaust air.

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CAUTION. *Make sure the ambient air temperature inside the rackmount enclosure remains below 55˚C.*

Cooling is not wasted on empty slots. IntelliGuides automatically direct air to only those slots containing modules; empty slots are shut off. The mainframe directs airflow across each installed module from the bottom to the top of each slot. Baffles balance the airflow from the front to back and across occupied slots in the mainframe.

You can easily remove the air filter from the rear of the mainframe within a matter of seconds. The fans can be easily replaced without disassembling the entire mainframe.

Backplane

The VX1411 Mainframe has an auto-configuration, solid-state backplane that uses electronic jumpers for the IACK and BUS GRANT signal lines. There are no jumpers to move or install on the backplane. This results in a high quality backplane that is ideal for ATE systems that must be reconfigured frequently.

Full differential distribution of the CLK10 signals provide a clean timing source for your VXIbus instruments.

Optional Rackmounts and Cable Tray

You can order the VX1411 Mainframe with user-installed rackmounts and cable tray. The cable tray provides a means to conveniently route cables from the front of the modules to the rear of the mainframe. Option 1U includes a 1.75-inch connector plate. You can install Option 1U to provide a 1.75-inch, 2.5-inch, or 4.25-inch deep cable tray.

The rackmount adapters let you recess the mainframe from the front panel mounting surface at specified depths from 0.735 inches to 5.735 inches in 0.5-inch increments. Similarly, you can configure the mainframe to extend out of the front of the rack at specified depths (0.57 inches to 5.57 inches in 0.5-inch increments).

You can install the rackmount kits along with the cable tray to provide vertical cable access to easily route cables to instruments above or below the mainframe while keeping lead lengths as short as possible.

You can also install an optional Lexan door with the rackmount kit.

NOTE. *If you choose to extend the mainframe out of the front of the rack, the mainframe cannot accept a door.*

Instructions for installing the cable tray begin on page 1–6 and instructions for the rackmounts begin on page 1–10.

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Options and Upgrade Kits

Table 1–1 lists the VX1411 Mainframe options and upgrade kits that you can purchase and install separately. Contact your local Tektronix representative for information on the upgrade kits.

Table 1–1: VX1411 Mainframe options and upgrade kits

Description	Option	Part Number
Rackmount Kit with Rack Slides	1R	020-2117-XX
Rackmount Kit with Rack Slides and Lexan Door	2R	020-2118-XX
Cable Tray Kit	1U	020-2119-XX

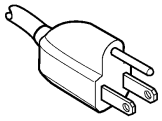
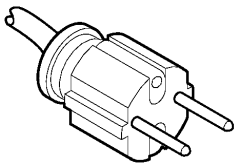
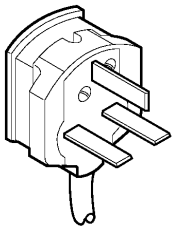
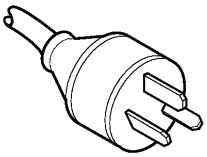
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Standard Accessories

The VX1411 Mainframe comes with the following standard accessories:

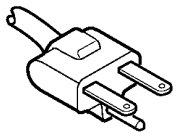
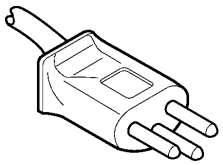
- *VX1411 Mainframe Instruction Manual*
- One Power cord (voltage range and plug type varies according to country, see Table 1–2)
- 5 x 20 mm line fuse, 4 A, 250 V
- 5 x 20 mm line fuse holder

Table 1–2: Power cord identification

Plug configuration	Normal usage	Option number
	North America 250V/13A Plug NEMA 5-15P	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3

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Table 1–2: Power cord identification (Cont.)

Plug configuration	Normal usage	Option number
	North America 230 V	A4
	Switzerland 230 V	A5

Optional Accessories

The VX1411 Mainframe has the following optional accessories:

- Single-wide front panel fillers (Tektronix part number 334-4170-00)
- Double-wide front panel fillers (Tektronix part number 334-4169-00)
- Single-wide EMI front panel fillers (Tektronix part number 333-4092-00)
- Double-wide EMI front panel fillers (Tektronix part number 333-4092-01)
- EMI intermodule shields (Tektronix part number 337-4041-00)
- Backplane EMI DIN shields (Tektronix part number 020-2144-00)

Selecting the Correct Power Cord and Fuse

The VX1411 Mainframe comes standard with a power cord and two fuses. Before installing the mainframe, you must determine the correct fuse for your application. Use the following information to determine the appropriate line fuse for the VX1411 Mainframe:

Table 1–3: Line fuse application

Line voltage	fuse
90 – 250V	10A fast, 0.25 x 1.25 in
207 – 250 V	4A time delay, 5 x 20mm, (use 5 x20mm fuseholder cap)

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Installation

This section describes the procedures to install your mainframe. It includes procedures for installing the mainframe with the rackmount or cable tray options.

This section does not include specific procedures for installing modules in the mainframe. Refer to your module documentation for information regarding the module installation instructions.

Site Considerations

The VX1411 Mainframe is designed to operate on a bench or in a rackmount environment. For proper cooling, allow at least two inches (5.1 cm) of clearance on the rear and sides of the mainframe. Determine how you will use your VX1411 Mainframe and follow the appropriate installation instructions. If you ordered your mainframe with the cable tray option and one of the rackmount options, install the cable tray before installing the rackmount.



WARNING. *Use care when lifting or moving the mainframe to avoid personal injury while performing the installation procedures.*

Cable Tray Installation

The VX1411 Mainframe comes a with 0.75-inch cable access area on the bottom of the mainframe (1-inch with the feet installed for bench-top operation). You can order the mainframe with an optional cable tray and install the cable tray following the procedures in this section. The option comes with a butch plate to mount cable connectors at the rear of the cable tray.

The cable tray option can be installed three different ways as shown in the following illustrations. In each example, place the mainframe upside-down or on one of the sides on a clean working surface and follow the instructions in the illustrations. To install the cable tray you need a T-15 and a T-20 Torx Driver.

Figure 1–1 on page 1–7 shows how to install Option 1U to provide a cable tray depth of 1.75 inches.

Figure 1–2 on page 1–8 shows how to install Option 1U to provide a cable tray depth of 2.5 inches.

Figure 1–3 on page 1–9 shows how to install Option 1U to provide a cable tray depth of 4.25 inches.

You can modify the butch plate to accept cable connectors at the rear of the mainframe. Specific instructions for modifying the butch plate are not given since the locations, types, and size of connectors vary with each application.

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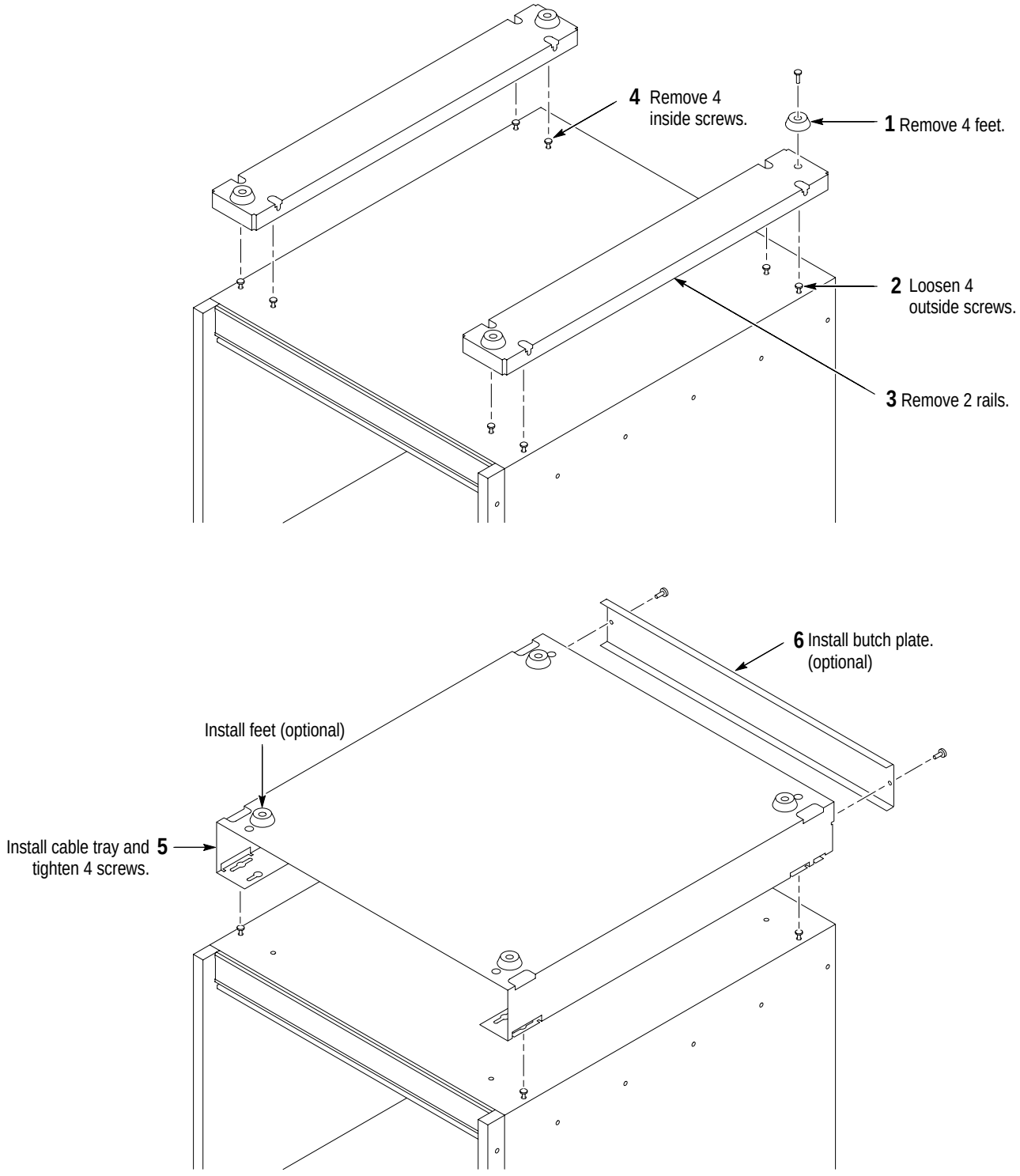


Figure 1–1: Installing the Option 1U as a 1.75-inch deep cable tray

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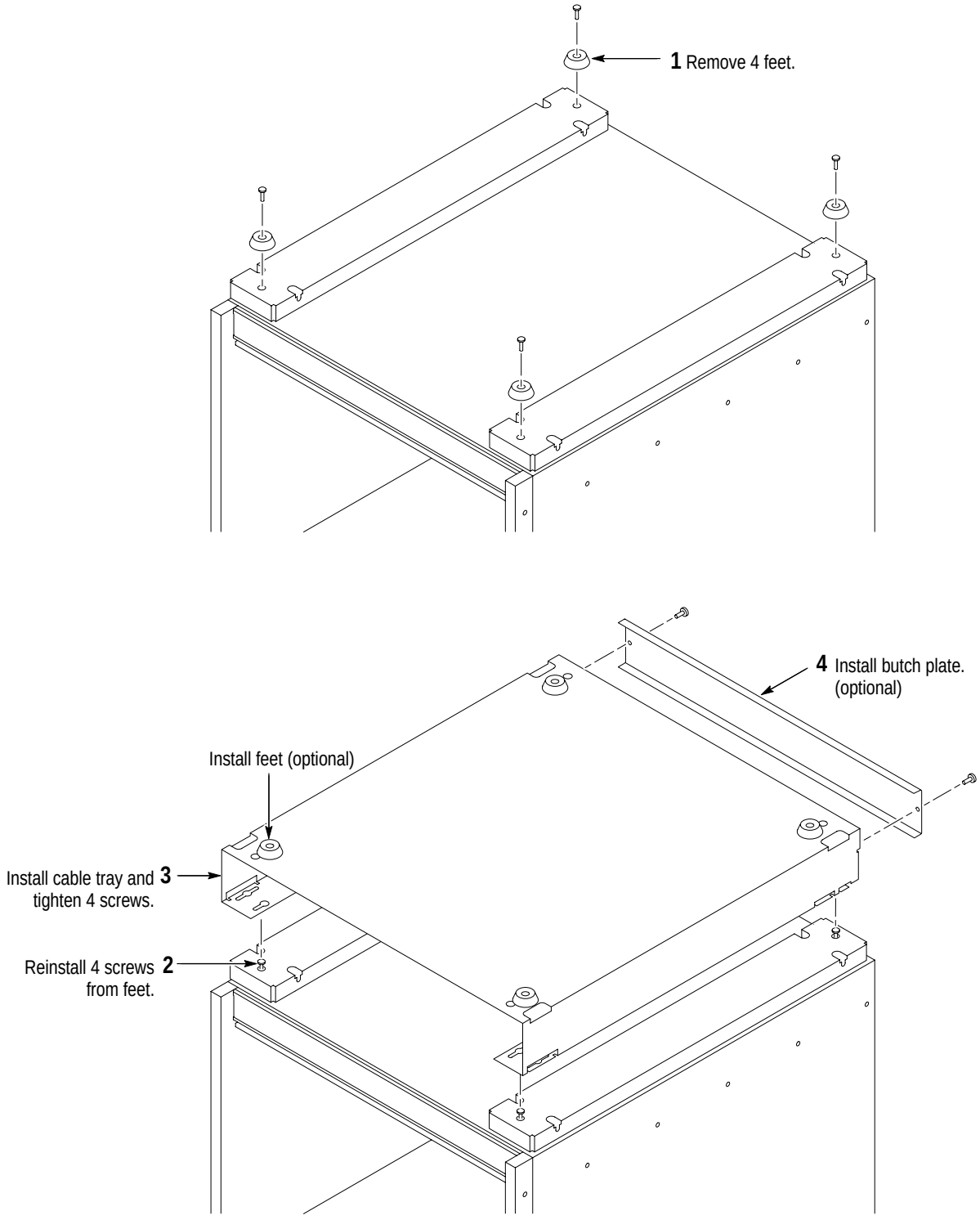


Figure 1–2: Installing the Option 1U as a 2.5-inch deep cable tray

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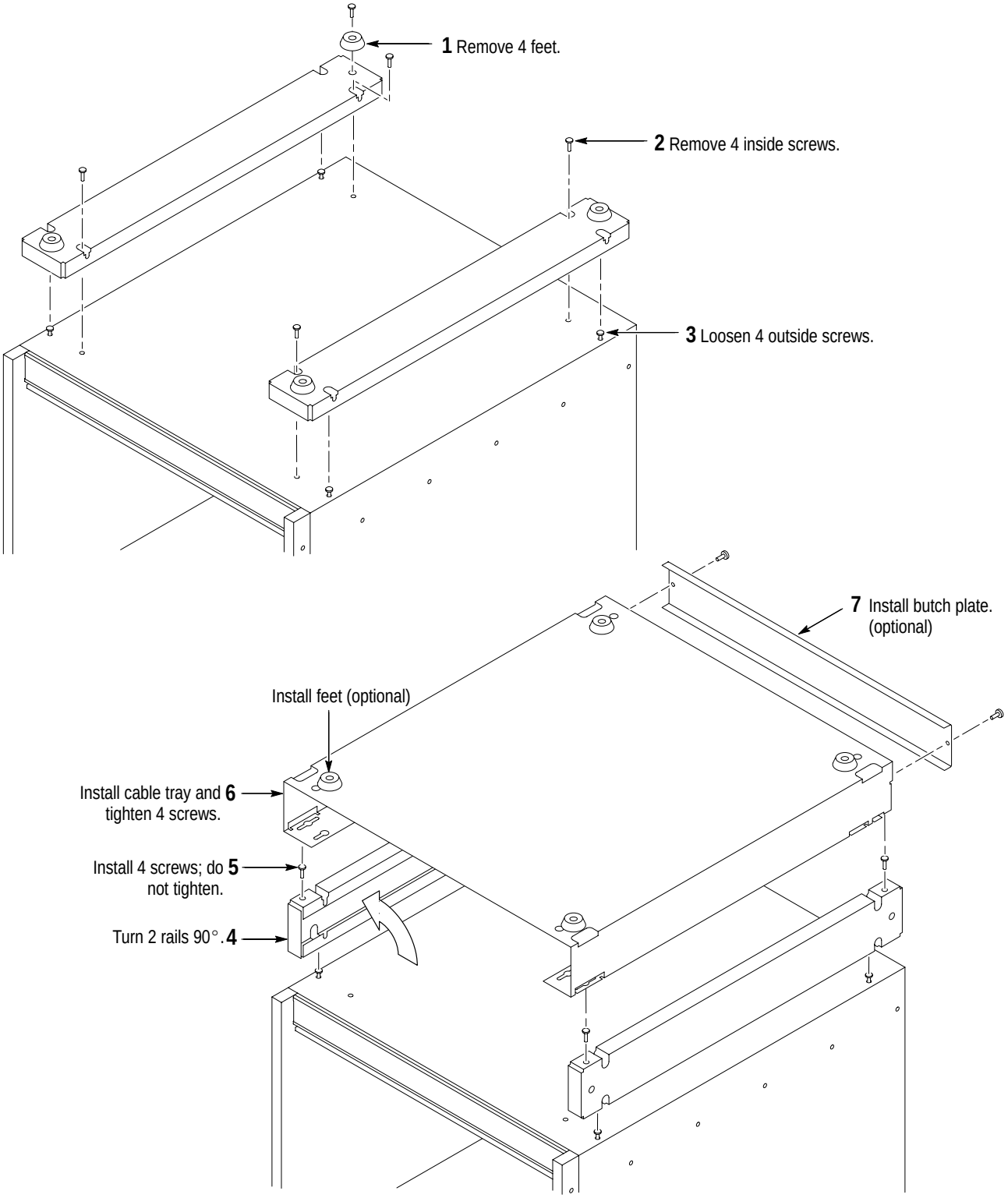


Figure 1–3: Installing the Option 1U as a 4.25-inch deep cable tray

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Rackmount Installation

The procedures for installing the rackmount kits are nearly identical for the Option 1R and 2R kits. You can install the Option 1R kit to either recess the mainframe from the front of the mainframe rack or to extend it out of the mainframe rack. However, you can only install the Option 2R kit so that the mainframe recesses into the rack.

The steps for installing the rackmount kits consist of installing the rackmount hardware to the mainframe and then installing the mainframe in the rack.

You will need the following tools to install the rackmount options:

- T-15 Torx Driver
- T-20 Torx Driver
- #2 Phillips Screw Driver

Install the Rackmount Kit Hardware

Refer to Figure 1–4 and perform the following steps to install the rackmount kit hardware:

1. Remove the rubber feet from the mainframe.
2. Determine whether you want to install the VX1411 Mainframe so that it extends out of the rack or is recessed within the rack.

   If you want to extend the VX1411 Mainframe from the front of the rack, position the rackmount bracket as shown on the right side of Figure 1–4. If you want to recess the VX1411 Mainframe in the rack, position the rackmount bracket as shown on the left side of Figure 1–4.
3. Determine how far you want to recess or extend the VX1411 Mainframe and install the rackmount adapter as shown using two 8-32 screws (included with the kit). Similarly, install the other bracket on the other side of the mainframe.

NOTE. *To comply with VXI*plug&play *mounting specifications, position the rackmount adapter at the mounting holes with the adjacent identifier keys (See Figure 1–4). This results in 3.960 inches (10.06 cm) from the module panel mounting surface to the rack frame mounting surface.*

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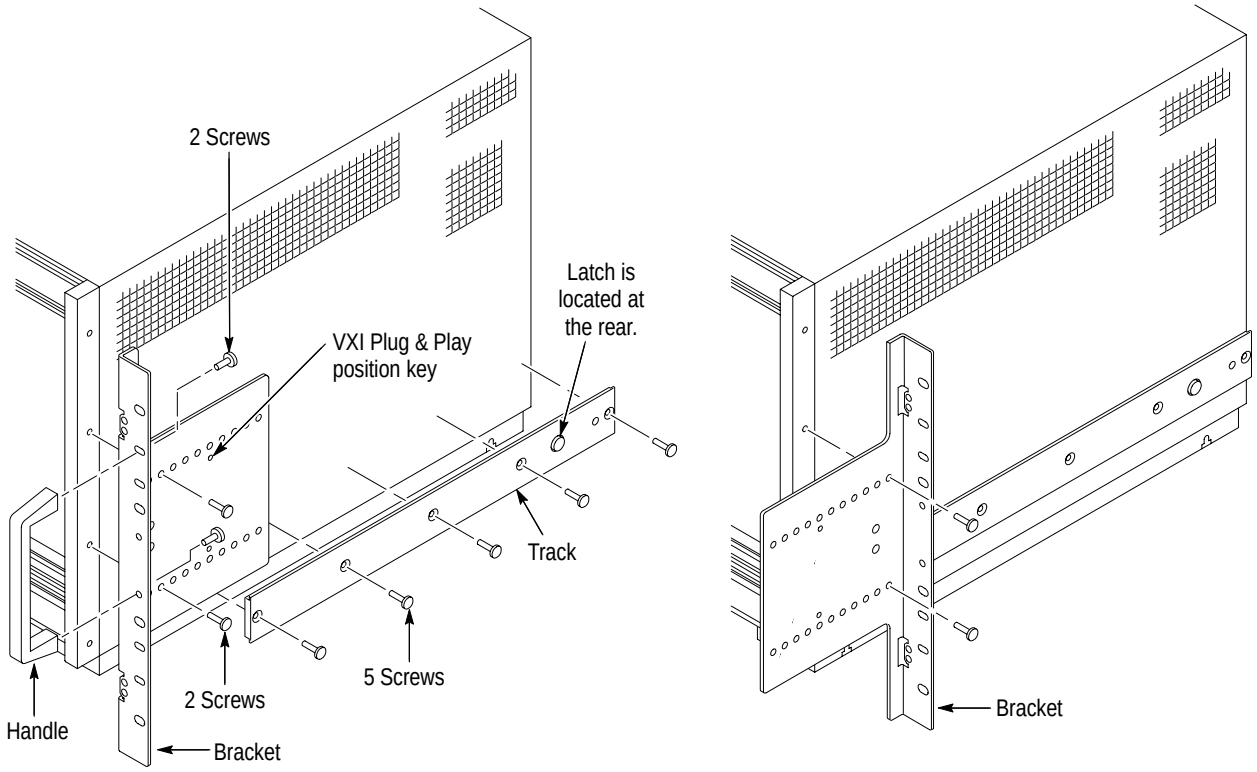


Figure 1–4: Installing the rackmount kit hardware

4. Remove the five 8-32 screws from both sides of the mainframe.

5. Attach the left and right inside tracks to the sides of the VX1411 Mainframe using five 8-32 flathead screws. Orient the button latch so that it faces away from the mainframe and toward the rear.

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Install the Mainframe in the Rack

Use the following procedure to install the VX1411 Mainframe in the rack:

1. Identify the right and left slide-out track assemblies: find the date code label on each assembly. The assembly to be mounted in the left side of the rack (the side nearest the left side of the mainframe when it is mounted in the rack) has a date code that ends with LH (for left hand). The right assembly has a date code ending with RH.
2. Measure the distance between the front and rear rail of the rack.
3. Align the rear bracket to the right slide-out track as shown in Figure 1–5. Note that the rear bracket has two pairs of mount-through holes. When aligning the bracket and the track, select a pair of holes that mount the rear bracket so the flange-to-flange distance (see Figure 1–5) matches the front rail to rear rail spacing that you just measured in step 2.

***NOTE**. If necessary, refer to the rackmount kit instructions for detailed installation information.*

4. Attach the rear bracket to the right slide-out track using two 10-32 screws and a bar nut as shown in Figure 1–5. Leave the screws loose so that you can adjust the overall length of the slide-out track assembly when installing the mainframe in the rack.
5. Repeat steps 3 and 4 to assemble the left slide-out track assembly.

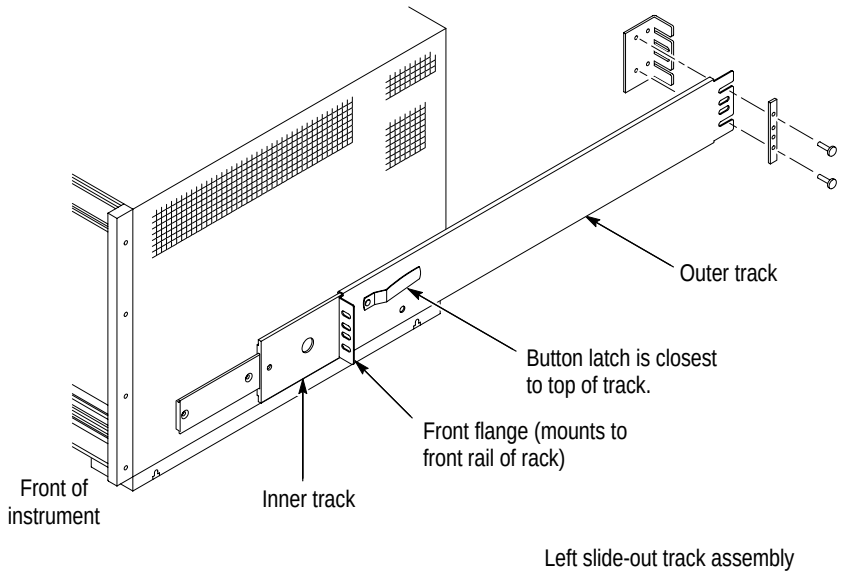


Figure 1–5: Assembling the slide-out track assemblies

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6. Select the mounting position in the rack: select two 0.5-inch spaced holes in the front rail and verify that the 1.5-inch and 14.00-inch clearances exist relative to the mounting holes as shown in Figure 1–6.

NOTE. *The 14-inch vertical clearance is only valid for the mainframe without the rubber feet and cable trays. Refer to Figures 4–3, 4–4, on page 4–10, for information on vertical clearances of the mainframe with cable tray options.*

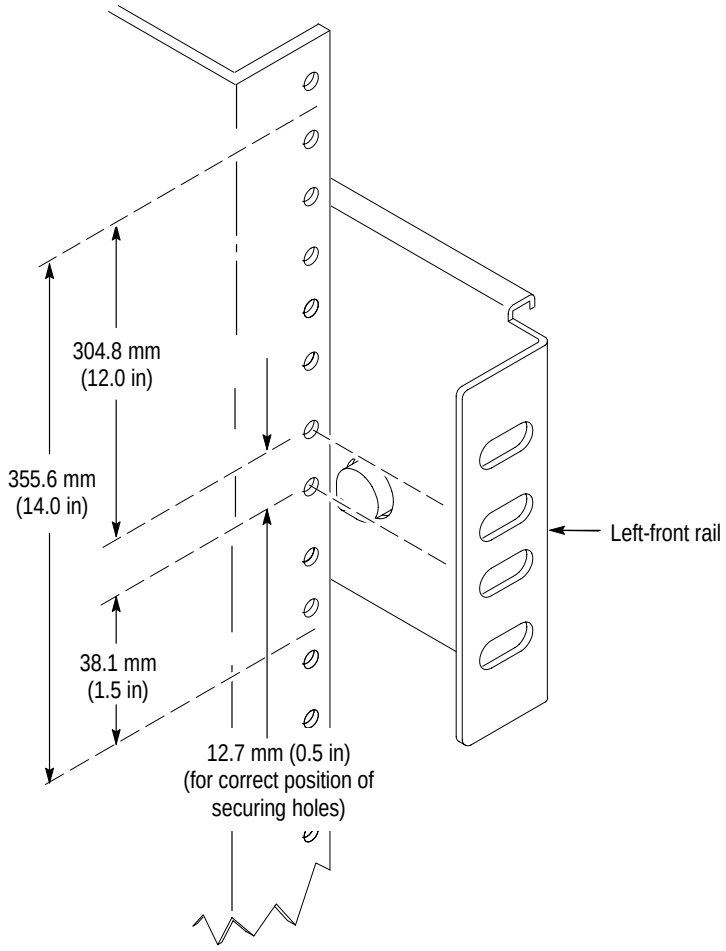


Figure 1–6: Vertical clearance for rack installation (standard mainframe)

7. Select the mounting method according to the rack type.

   To mount the slide-out tracks with the front and rear flanges outside of the front and rear rails, use method A shown in Figure 1–7 when doing step 8. Add a bar nut to the installation only if the rails have untapped holes.

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To mount with front and rear flanges inside of the rails, use mounting method B shown in Figure 1–7 when doing step 8. This mounting method assumes untapped holes.

8. Using the mounting method determined from the previous step, secure the right slide-out track assembly to the front and rear rails. Seat the screws fully, but lightly, to adjust the mounting later.

9. Tighten the screws left loose in step 4 to fix the front to rear flange spacing of the slide-out track assembly.

10. Repeat steps 6 through 9 to mount the left slide-out track assembly.

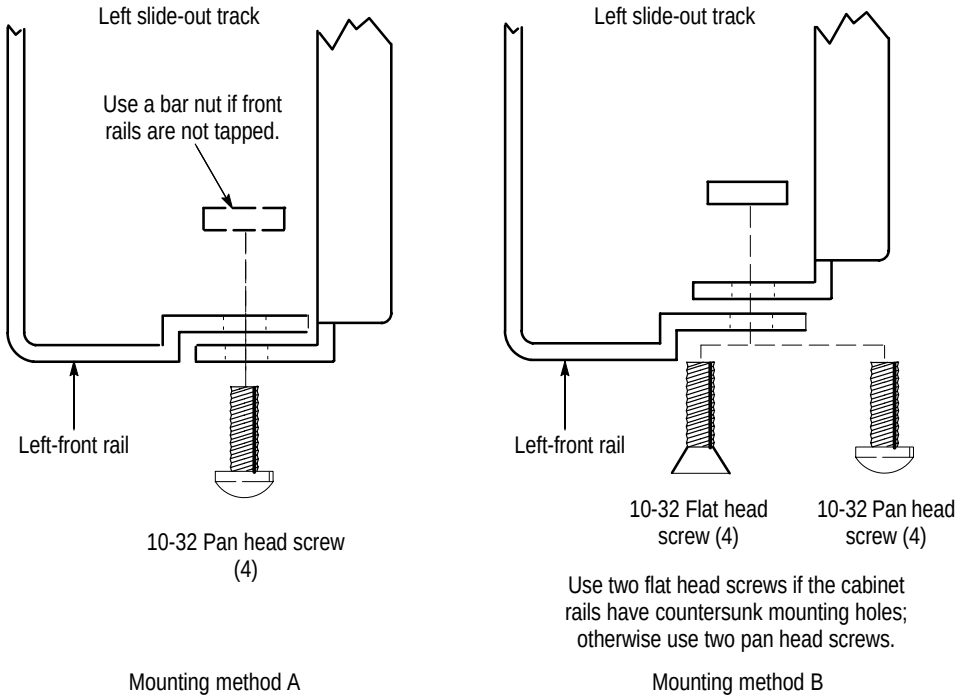


Figure 1–7: Installing the slide-out track assemblies in the rack (top view)



WARNING. *Installing the VX1411 Mainframe in the rack requires at least two people. Because of the size and weight of the mainframe, installing the mainframe alone can result in personal injury or equipment damage. One person should be on the left side of the mainframe with one hand holding the left front handle and with the other hand underneath the mainframe. The other person should do likewise on the right side of the mainframe.*

11. Fully extend the inner tracks of each slide-out section out of the front of the rack until they lock.

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12. Lift the mainframe and insert the left and right tracks that extend from the rear of the mainframe into the ends of the tracks that you just extended. Make sure that the tracks mounted on the mainframe slip just inside the inner tracks that you extended earlier.
13. Slide the mainframe back until it stops.
14. Push to release the button latches, located on the outside of each track, and continue to slide the mainframe all the way back into the rack cabinet.
15. Tighten the four screws that you left loose at the rear of the rack when you performed step 8 and pull the mainframe part way out of the rack. (Tighten the 10-32 screws using 28 inch-lbs of torque.)
16. Be sure that the screws that you left loose at the front of the rack are loose enough to allow the slide-out track assemblies to seek the normal positions.
17. Tighten the screws and push the mainframe all the way into the rack. If the tracks do not slide smoothly, readjust the level using the method described in steps 15 and 16. (Tighten the 10-32 screws using 28 inch-lbs of torque.)
18. Install the proper power cord at the rear of the mainframe.

Install the Option 2R Rackmount Door

Refer to Figure 1–8 and perform the following steps to install the rackmount door for Option 2R:

1. Install the bottom halves of the two hinges to the left rackmount bracket as shown in Figure 1–8.
2. Install the top halves of the hinges on the door.
3. Install the catch on the right rackmount bracket.

   You can adjust the catch position forward or back to assure a flush fit between the door and the rackmount bracket.
4. Lift the rackmount door and mate the door with the hinges.

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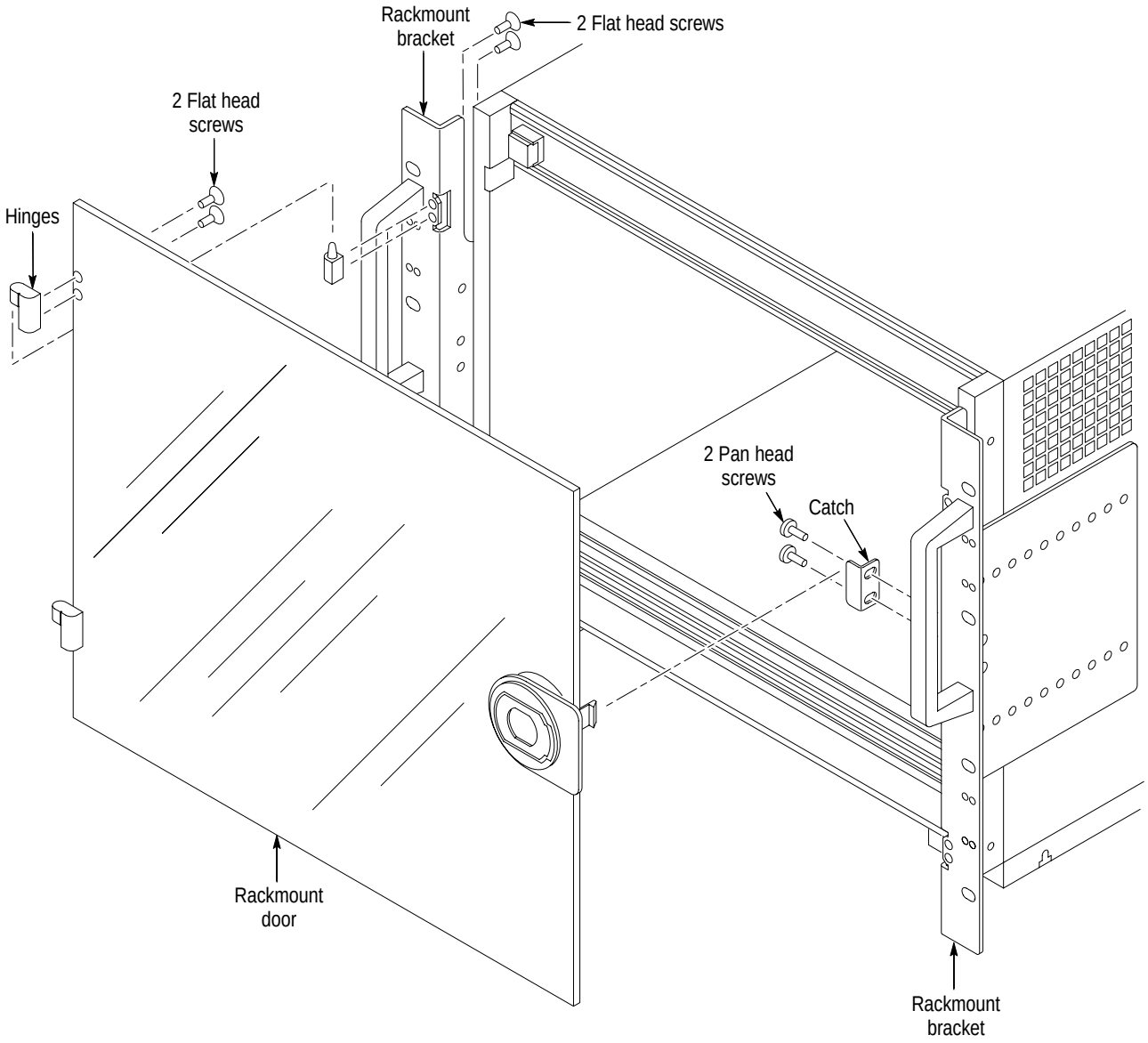


Figure 1–8: Installing the rackmount door (Option 2R)

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Configuration

After installing the mainframe you are ready to configure it for your applications. If you have not already done so, install your VXIbus modules in the mainframe following the installation guidelines for your VXIbus module.

NOTE. *If some VXI modules do not install fully into the mainframe, it may be necessary to remove the shutter and spring from the card guide. For some double-wide modules it may be convenient to remove only one of the shutters instead of disassembling the shutter. To remove the card guides refer a qualified service person to* Procedure 4: Removing the Card Guides *beginning on page 6–9 in the Maintenance chapter.*

Module Selection and Design Guidelines

The VX1411 Mainframe is UL listed to UL 3111-1 and CAN/CSA C22.2 No. 1010.1 and is IEC 1010-1 compliant. You should use VXIbus modules with the mainframe that are listed or designed to limit electric shock and fire.

- Investigate the possibility of fire hazards due to the availability of power from the mainframe exceeding 150 W per slot. Use similar considerations for VXIbus Modules that externally receive power greater than 150 W per slot.
- Printed wiring boards should be flame rated UL 94V–1 or better.
- To prevent possible electrical shock, limit the voltage to the mainframe interface or chassis to less than 60 VDC, 30 V_{RMS}, or 42.4 V_{pk}.
- Ensure that high voltage measuring inputs provide a means of limiting unintended voltages that may reach the mainframe interface or chassis to less than 60 VDC, 30 V_{RMS}, or 42.4 V_{pk}.

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Install Empty Slot Panel Fillers

If you have any unused (empty) slots in your mainframe, you may install the empty slot panel fillers. Install either the optional single-wide or double-wide fillers.

CAUTION. *Use only Tektronix front panels; otherwise the shutters may activate, effectively robbing airflow from installed modules. Installing the fillers provides improved cooling for installed modules and improved EMI shielding.*

Refer to Figure 1–9 for information on installing the slot fillers.

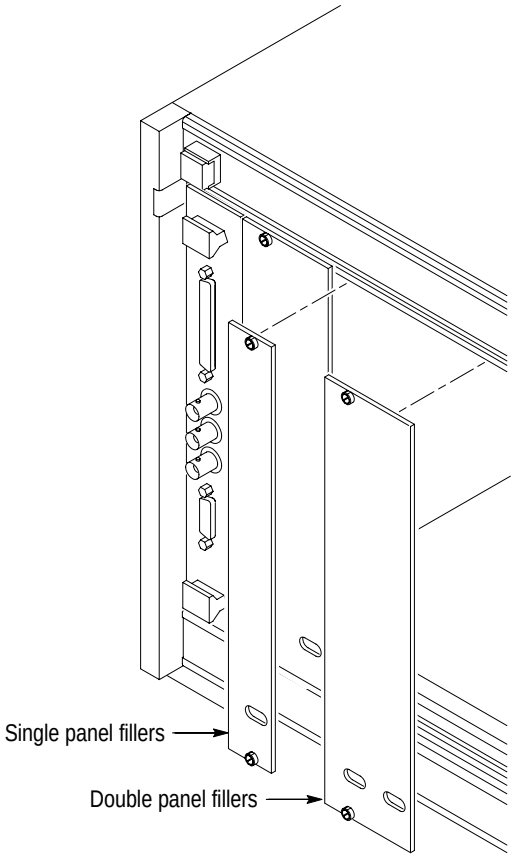


Figure 1–9: Installing the empty slot panel fillers

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Safety and Chassis Grounds

The left rear of the VX1411 Mainframe has a connection point for the chassis ground (see Figure 1–10).

WARNING. *The safety ground screw must always be in place to ensure the proper bonding of the power supply to the mainframe. You can use the chassis ground connection to connect the grounds of one or more instruments to the mainframe. This ensures a common ground connection between instruments.*

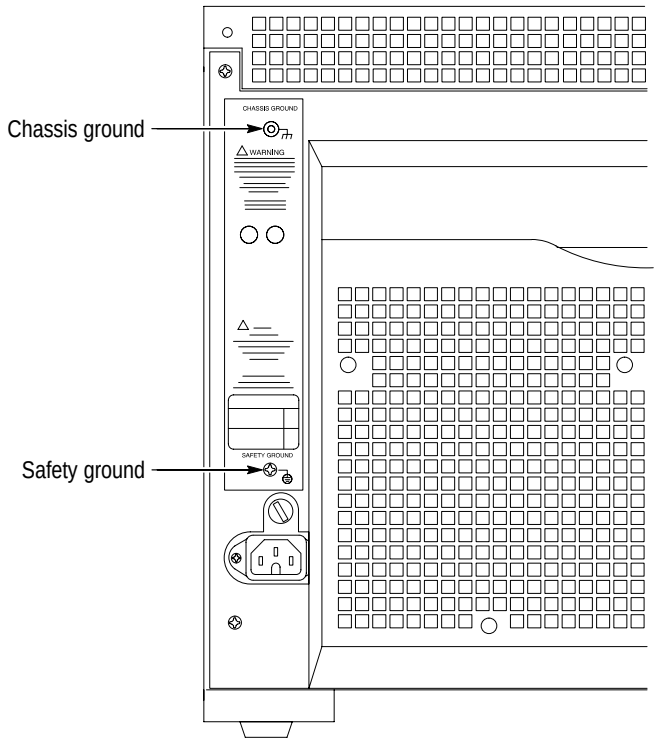


Figure 1–10: Locations of safety and chassis ground connections on left rear of the mainframe

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EMI Configurations

Perform the following steps if you intend to install the optional EMI shields (part numbers are listed under *Optional Accessories* on page 1–5):

1. To install the Backplane EMI DIN shields, determine the slot connectors where you want to install the shields.
2. Remove any modules surrounding the slots where you intend to install the Backplane EMI DIN shields.
3. Refer to Figure 1–11 and install the shields over the backplane connector.
4. Mount the connector in place using two 4-20 thread forming screws.
5. Reinstall any modules that you removed in step 2.

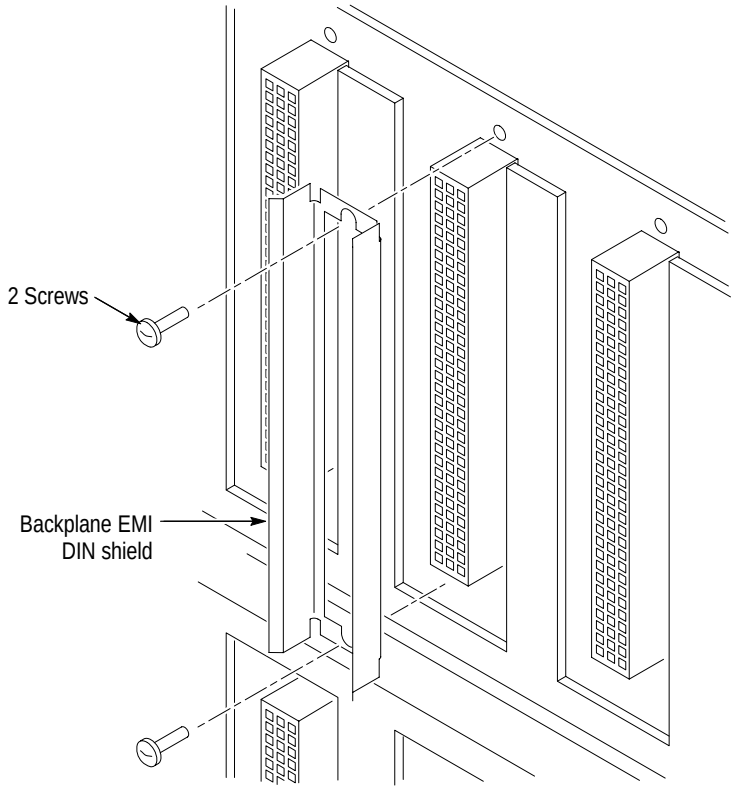


Figure 1–11: Installing the backplane EMI DIN Shields

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***NOTE**. It is only necessary to install the EMI intermodule shields if your VXIbus module does not have EMI shielding.*

6. Refer to Figure 1–12 and slide the EMI intermodule shields between the grooves of the card guide on one side of each installed VXIbus module. This is recommended to use with unshielded modules; the shielding may not be compatible with some modules. The shield conforms with the VXI specification for intermodule shielding.

7. Install a blank EMI front panel for each empty slot making sure that the EMI shielding is in contact with the adjacent front panel.

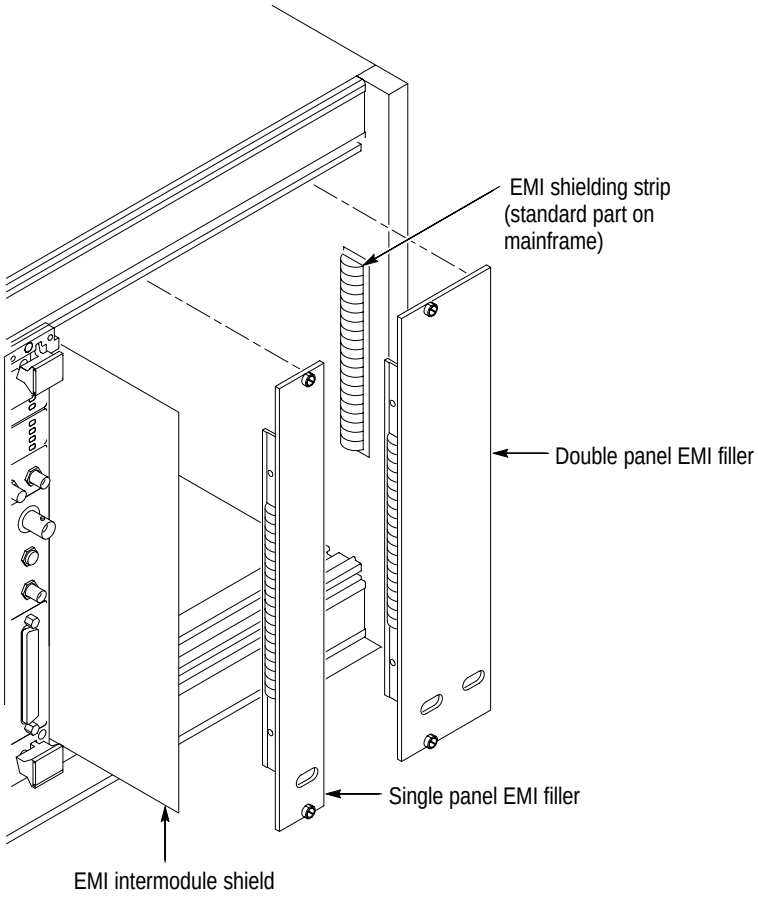


Figure 1–12: Installing the EMI intermodule shield and front panel EMI fillers

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Functional Check

Use the information in this section to determine that the VX1411 Mainframe operates properly. The functional check consists of checking the power supply voltages from the extender card with a digital voltmeter.

Connect one lead of the voltmeter to the extender card pins inserted into slot 0 of the mainframe. Connect the reference lead of the voltmeter to one of the ground pins. Compare each voltage reading to the values listed in Table 1–4.

Table 1–4: Power supply voltages P1 and P2 of the extender card

Pin	Supply	Acceptable voltage range
P1 – A32	+5 V	4.875 V to 5.25 V
P1 – A31	–12 V	–12.6 V to –11.64 V
P2 – C32	–24 V	–25.2 V to –23.28 V
P2 – A2	–2 V	–2.1 V to –1.9 V
P1 – C31	+12 V	11.64 V to 12.6 V
P2 – C31	+24 V	23.28 V to 25.2 V
P2 – C4	–5.2 V	–5.46 V to –5.044 V
P2 – A31 or B31	Logic Ground	

If the voltages are within the specified ranges, your mainframe is functional.

***NOTE**. Operators may perform exterior surface and fan filter cleaning as described in the* Maintenance *chapter.*

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Operating Basics

This chapter provides a brief overview of the VX1411 Mainframe including illustrations and descriptions of switches, indicators, and connectors.

Figure 2–1 shows the front view of the VX1411 Mainframe. All of the mainframe slots are labeled on the top and bottom of the mainframe. Slot 0 is reserved for the mainframe controller; all other slots are available for any VXIbus modules.

IntelliGuides on the bottom of each slot automatically open when you install a module. The guides remain closed for empty slots to direct airflow only where it is needed.

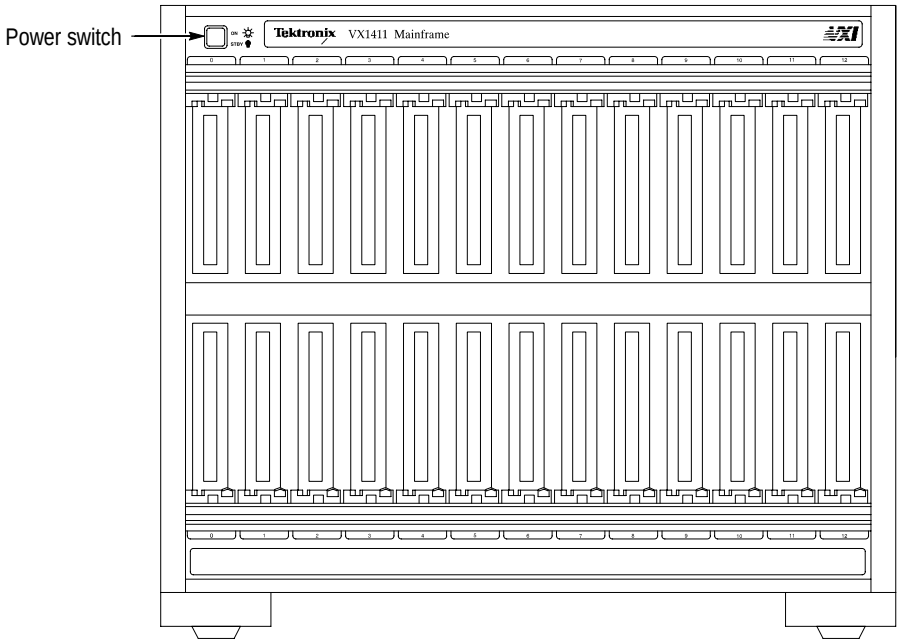


Figure 2–1: Front view of the VX1411 Mainframe

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The On/Standby switch on the top-left corner of the front panel applies DC voltages to the mainframe. The switch is a momentary contact switch. The switch is lighted when DC voltages are applied to the mainframe.

Figure 2–3 shows the rear view of the standard VX1411 Mainframe.

The AC power connector is located on the bottom left side on the rear of the mainframe. The AC fuse holder is located just above the power connector.

The chassis ground screw (if installed) can be used to connect multiple mainframes to a common ground point.

The fan filter is located on the back of the mainframe. The filter slides easily into the mainframe; there is no need to remove any covers to replace or clean the fan filter.

Fan Speed Control

The Fan Speed switch controls the speed of the system cooling fans. When the switch is set to the low position, the fans are set to a low speed to reduce fan noise. When the switch is in the FULL position, the fans operate at full speed.

To maintain appropriate power supply cooling, set the fan speed switch according to Figure 2–2. For high module loads and high ambient temperatures, set the fan speed switch to full.

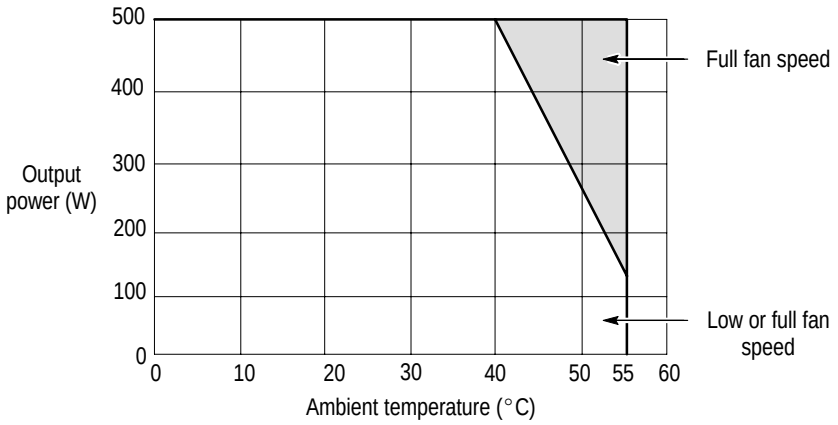


Figure 2–2: Power output fan Vs temperature for the 2 fan speeds

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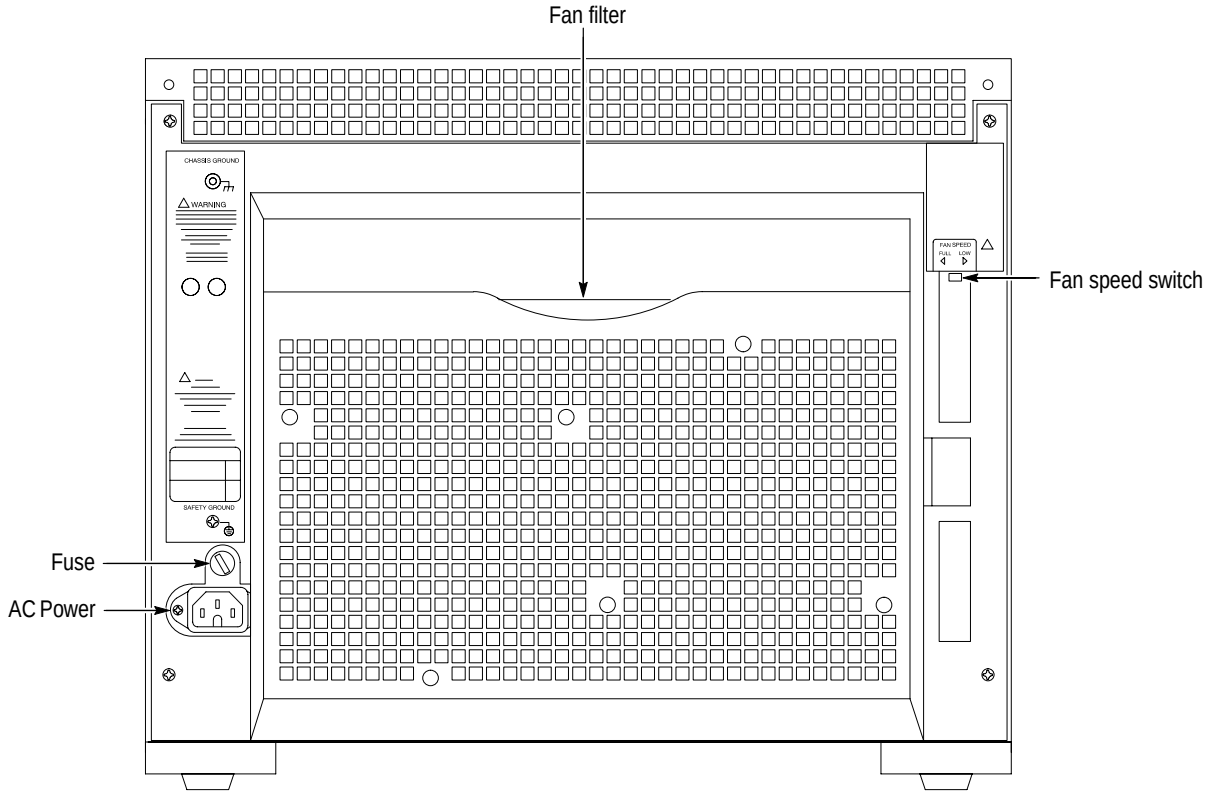


Figure 2–3: Rear View of the VX1411 Mainframe

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Reference

This chapter provides reference information on the mainframe and its connectors.

Backplane Connectors

Table 3–1 shows the P1 connector pinouts for all slots in the VX1411 Mainframe. Table 3–2 shows the P2 connector pinouts for slots 1 to 12 and Table 3–3 shows the pinouts for the Slot 0 P2 connector.

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Table 3–1: P1 Connector pinouts

Pin	Row A	Row B	Row C
1	D00	BBSY*	D08
2	D01	BCLR*	D09
3	D02	ACFAIL*	D10
4	D03	BG0IN*	D11
5	D04	BG0OUT*	D12
6	D05	BG1IN*	D13
7	D06	BG1OUT*	D14
8	D07	BG2IN*	D15
9	GND	BG2OUT*	GND
10	SYSCLK	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	BERR*
12	DS1*	BR0*	SYSRESET*
13	DS0*	BR1*	LWORD*
14	WRITE*	BR2*	AM5
15	GND	BR3*	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	SERCLK	A17
22	IACKOUT*	SERDAT*	A16
23	AM4	GND	A15
24	A07	IRQ7*	A14
25	A06	IRQ6*	A13
26	A05	IRQ5*	A12
27	A04	IRQ4*	A11
28	A03	IRQ3*	A10
29	A02	IRQ2*	A09
30	A01	IRQ1*	A08
31	–12 V	+5 V STDBY	+12 V
32	+5 V	+5 V	+5 V

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Table 3–2: P2 Connector pinouts for slots 1 – 12

Pin	Row A	Row B	Row C
1	ECLTRG0	+5 V	CLK10+
2	–2 V	GND	CLK10–
3	ECLTRG1	RSV1	GND
4	GND	A24	–5.2 V
5	LBUSA00	A25	LBUSC00
6	LBUSA01	A26	LBUSC01
7	–5.2 V	A27	GND
8	LBUSA02	A28	LBUSC02
9	LBUSA03	A29	LBUSC03
10	GND	A30	GND
11	LBUSA04	A31	LBUSC04
12	LBUSA05	GND	LBUSC05
13	–5.2 V	+5 V	–2 V
14	LBUSA06	D16	LBUSC06
15	LBUSA07	D17	LBUSC07
16	GND	D18	GND
17	LBUSA08	D19	LBUSC08
18	LBUSA09	D20	LBUSC09
19	–5.2 V	D21	–5.2 V
20	LBUSA10	D22	LBUSC10
21	LBUSA11	D23	LBUSC11
22	GND	GND	GND
23	TTLTRG0*	D24	TTLTRG1*
24	TTLTRG2*	D25	TTLTRG3*
25	+5 V	D26	GND
26	TTLTRG4*	D27	TTLTRG5*
27	TTLTRG6*	D28	TTLTRG7*
28	GND	D29	GND
29	RSV2	D30	RSV3
30	MODID	D31	GND
31	GND	GND	+24 V
32	SUMBUS	+5 V	–24 V

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Table 3–3: P2 Connector pinouts for slot 0

Pin	Row A	Row B	Row C
1	ECLTRG0	+5 V	CLK10+
2	–2 V	GND	CLK10–
3	ECLTRG1	RSV1	GND
4	GND	A24	–5.2 V
5	MODID12	A25	LBUSC00
6	MODID11	A26	LBUSC01
7	–5.2 V	A27	GND
8	MODID10	A28	LBUSC02
9	MODID09	A29	LBUSC03
10	GND	A30	GND
11	MODID08	A31	LBUSC04
12	MODID07	GND	LBUSC05
13	–5.2 V	+5 V	–2 V
14	MODID06	D16	LBUSC06
15	MODID05	D17	LBUSC07
16	GND	D18	GND
17	MODID04	D19	LBUSC08
18	MODID03	D20	LBUSC09
19	–5.2 V	D21	–5.2 V
20	MODID02	D22	LBUSC10
21	MODID01	D23	LBUSC11
22	GND	GND	GND
23	TTLTRG0*	D24	TTLTRG1*
24	TTLTRG2*	D25	TTLTRG3*
25	+5 V	D26	GND
26	TTLTRG4*	D27	TTLTRG5*
27	TTLTRG6*	D28	TTLTRG7*
28	GND	D29	GND
29	RSV2	D30	RSV3
30	MODID00	D31	GND
31	GND	GND	+24 V
32	SUMBUS	+5 V	–24 V

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Specifications

This chapter contains the complete specifications for the VX1411 Mainframe. Within each section, the specifications are arranged in functional groups such as: *AC Power Source*, *Secondary Power*, *Cooling*, *Safety*, *Environmental*, *Backplane*, and *Mechanical*.

All specifications are warranted unless they are designated *typical*. *DC Voltage Regulation* is a warranted characteristic and can be directly checked by procedures contained in the *Performance Verification* chapter beginning on page 5–1; *DC Voltage Regulation* is listed in **boldface** under the Characteristics column.

If the characteristic is noted as *typical*, the characteristic is not warranted. Typical characteristics describe typical or average performance and provide useful reference information.

Table 4–1: AC power source

Characteristic	Description
Source Voltage	90 V_{RMS} to 250 V_{RMS}, continuous range
Source Frequency	45 Hz to 66 Hz or 360 Hz to 440 Hz, 115 V operation 45 Hz to 66 Hz, 230 V operation
Power Consumption	800 W line power maximum
Fuse Rating	
90 V – 250 V Operation	0.25 in × 1.25 in, Fast Blow, 10 A, 250 V
207 V – 250 V Operation	5 mm × 20 mm, Slow Blow, 4 A, 250 V
Inrush Surge Current	70 A maximum
Input Current	8 A maximum at 90 V_{RMS} 3.5 A maximum at 207 V_{RMS}
Power Factor Correction	Typically 0.99 at 60 Hz operation and 0.95 at 400 Hz operation
Power Disconnect	Front Panel On/Standby. No primary switch on rear panel. Power cord provides main power disconnect.

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Table 4–2: Secondary power

Characteristic	Description	
Maximum Power Available		
Mainframe (Power available to modules)	500 W, 0° C to 55° C	
DC Current Capacity (I_{MP})	Voltage	I_{MP} (steady-state current)
	+24 V	7 A
	+12 V	6 A
	+5 V	60 A
	–2 V	–10 A
	–5.2 V	–20 A
	–12 V	–6 A
	–24 V	–7 A
AC Current Capacity (I_{MD})	Voltage	I_{MD} (dynamic current)
	+24 V	5 A
	+12 V	2 A
	+5 V	10 A
	–2 V	–5 A
	–5.2 V	–7 A
	–12 V	–2 A
	–24 V	–5 A
DC voltage regulation	Voltage	Tolerance, $\triangle$V
	+24 V	+1.2 V, –720 mV
	+12 V	+600 mV, –360 mV
	+5 V	+250 mV, –125 mV
	–2 V	–100 mV, +100 mV
	–5.2 V	–260 mV, +156 mV
	–12 V	–600 mV, +360 mV
	–24 V	–1.2 V, +720 mV

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Table 4–2: Secondary power (Cont.)

Characteristic	Description	
Maximum DC load ripple/noise	Voltage	Ripple/Noise
	+24 V	150 mV_{p-p}
	+12 V	50 mV_{p-p}
	+5V	50 mV_{p-p}
	–2 V	50 mV_{p-p}
	–5.2 V	50 mV_{p-p}
	–12 V	50 mV_{p-p}
	–24 V	150 mV_{p-p}
Maximum DC Induced Ripple/Noise	Voltage	Ripple/Noise
	+24 V	150 mV_{p-p}
	+12 V	50 mV_{p-p}
	+5V	50 mV_{p-p}
	–2 V	50 mV_{p-p}
	–5.2 V	50 mV_{p-p}
	–12 V	50 mV_{p-p}
	–24 V	150 mV_{p-p}
Protection	Overvoltage and short circuit protection results in the supply shutting down and trying immediately to come back on (hic–cup mode). This operation continues until the supply is shut off or the fault is remedied. Overtemperature protection results in the supply shutting down and staying down until the temperature drops below a threshold at which time the supply will come back on. Undervoltage protection results in the supply shutting down and staying down until the AC line input achieves high enough voltage at which time the supply will turn on.	

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Table 4–3: Cooling

Characteristic	Description
Slot Thermal Capacity	Figure 4–2 on page 4–5 shows the cooling curve of the mainframe.
Cooling System	Forced air circulation (positive pressurization) with one removable filter. Two internal DC fans provide cooling for the power supply and the 13 VXIbus module slots.
Fan Speed Control	A rear panel switch chooses between full speed and low speed. See Figure 4–1 on page 4-4 for maximum power that the power supply can deliver while maintaining proper cooling Vs temperature for the two fan speeds.
Slot Activation	Installing a VXIbus module activates the cooling for the corresponding occupied slots by opening the IntelliGuide mechanism. Only provides cooling to installed modules.
Slot Airflow Direction	P2 to P1, bottom of module to the top of module
Mainframe Intake	Bottom rear of mainframe
Mainframe Exhaust	Top sides of mainframe, also on top rear of mainframe
Cooling Clearance	Two inches on both sides and rear of mainframe
Pressurization	Positive (modules pressurized)
Filter Access	Filter accessible from rear of the mainframe

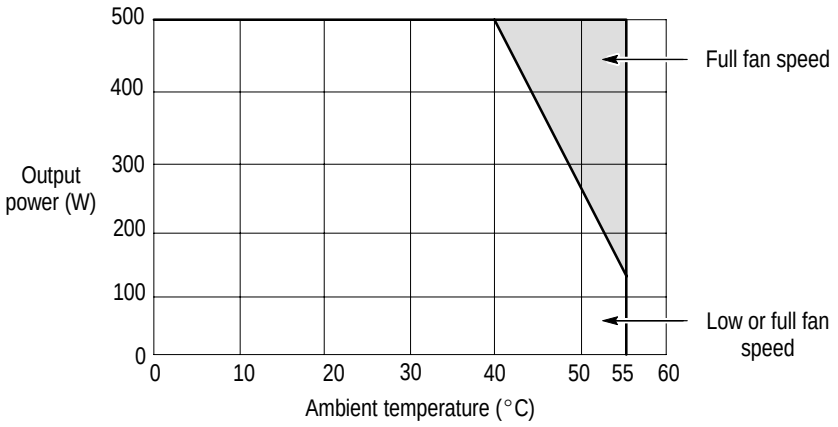


Figure 4–1: Power output versus temperature for the 2 fan speeds

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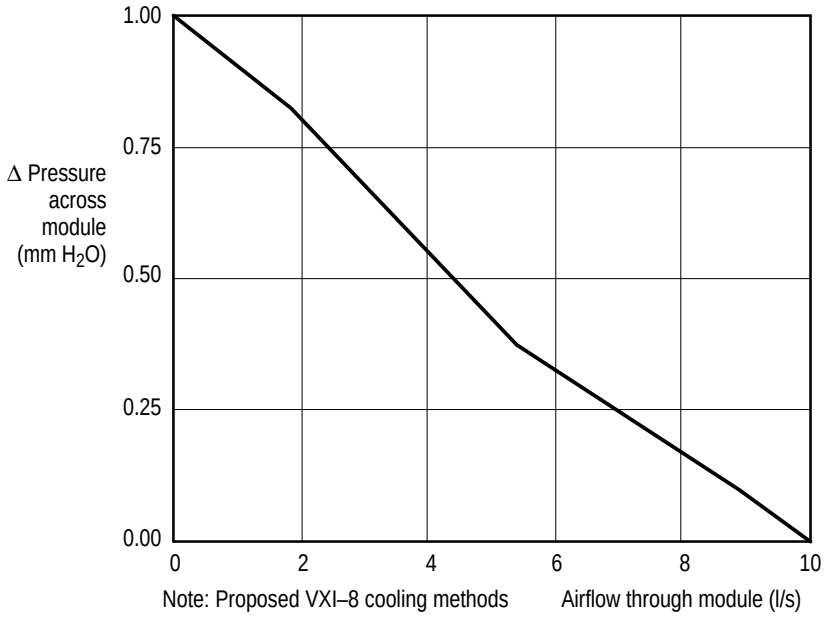


Figure 4–2: Mainframe cooling curve

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Table 4–4: Environmental

Characteristic	Description
Classification	The VX1411 Mainframe is suitable for operation in the Tektronix and MIL-T-28800E (Type III, Class 5, Style E or F) environments as specified in this table.
Atmospherics	
Temperature	Meets the limits stated in MIL-T-28800E for Type III, Class 5
Operating	0° C to 55° C, derated 1° C/1000 ft. (305 m) above 5000 ft. (1524 m)
Nonoperating	–40° C to 75° C
Relative Humidity	
Operating	Up to 95% at up to 30° C and up to 45% at up to 55° C
Nonoperating	Up to 95% at up to 55° C
Altitude	
Operating	15,000 ft. (4570 m) Operating temperature derated 1° C/1000 ft. (305 m) above 5000 ft. (1524 m)
Nonoperating	40,000 ft. (12,190 m)
Dynamics	
Random Vibration	Three axis, 30 minutes total, 10 minutes per axis
Operating	0.27 g_{RMS} total from 5 Hz to 500 Hz
Nonoperating	2.28 g_{RMS} total from 5 Hz to 500 Hz
Mechanical Shock Operating	Half sine, 30 g, 11 ms duration, three drops each side, 18 shocks total. Meets functional shock requirements of MIL-T-28800E, Type-III, Class 5
User Bench Handling Operating	Each edge lifted four inches and allowed to free fall onto a solid wooden bench surface. Rear face exempted.

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Table 4–5: Certifications and compliances

Characteristic	Description
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/ECC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EMC Directive 89/336/EEC: EN 55011 Class A Radiated and Conductive Emissions EN60555-2 AC Power Line Harmonic Emissions. EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity Low Voltage Directive 73/23/EEC: EN61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use
Immunity, Enclosure, Electrostatic Discharge (ESD)	Up to 8 kV with no change to control settings or impairment of normal operation, and up to 15 kV with no loss of stored data or damage that prevents recovery of normal operation by the user. (IEC 801-2)
Immunity, Enclosure, Radio Frequency Electromagnetic Field	No mainframe failures when the mainframe is subjected to a 3 V/m electromagnetic field over the frequency range of 27 MHz to 500 MHz. (IEC 801-3)
Immunity, Fast Transients, Common Mode	No loss of stored data, change to control settings, degradation of performance, or temporary loss of function will occur when the mainframe is subjected to the following transients: (IEC 801-4)
	Port — *Peak Voltage* — *Tr/Th* — *Rep Frequency* Signal & Control — 0.5 kV — 5/50 ns — 5 kHz DC Power — 0.5 kV — 5/50 ns — 5 kHz AC Power — 1.0 kV — 5/50 ns — 5 kHz
Immunity, AC Power Line Transients	No loss of stored data, change to control settings, degradation of performance, or temporary loss of function will occur when the mainframe is subjected to the transients as described below. (IEC 801-5)
	Mode — *Peak Voltage* — *Tr/Th*[1] Common — 2 kV — 1.2/50 μs Differential — 1 kV — 8/20 μs
FCC	The mainframe complies with the radiated and conducted emissions requirements of FCC 47 CFR, Part 15, Subpart B, Class A equipment

[1]Open circuit voltage (short circuit current) transient characteristics.

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Table 4–5: Certifications and compliances (Cont.)

Characteristic	Description
Certifications	UL3111-1 Standard for electrical measuring and test equipment CAN/CSA C22.2 No. 1010.1–Safety requirements for electrical equipment for measurement, control and laboratory use
IEC 1010-1 Characteristics	Installation CAT II (Local-level mains instrument is cord-connected). Pollution Degree 2 (rated for indoor use only). Safety Class I (grounded product). Altitude (maximum operating) 2000 meters Equipment Type: Test and Measuring
Overvoltage Category	Category: Examples of Products in this category: CAT III Distribution-level mains, fixed installation CAT II Local-level mains, appliances, portable equipment CAT I equipment, Signal levels in special equipment or parts of telecommunications, electronics
Pollution Degree 2	Do not operate in environments where conductive pollutants may be present.
Certification Compliance	Altitude (maximum operating) 2000 meters Equipment Type: Test and measuring

Table 4–6: Backplane

Characteristic	Description
Bus Grant/ Interrupt Acknowledge	Solid state, auto-configuring (jumperless)
VXIbus CLK10 Distribution	Full differential

Table 4–7: Mechanical

Characteristic	Description
Overall Dimensions	
Standard Mainframe	
Height (with feet)	14.4 in (36.58 cm)
Width	16.7 in (42.42 cm)

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Table 4–7: Mechanical (Cont.)

Characteristic	Description
Depth	24 in (60.96 cm)
Mainframe with Rackmount	
Height	14.0 in (35.56 cm)
Width	18.9 in (48.01 cm)
Depth	26.4 in (67.06 cm) to 31.4 in (79.76 cm) in 0.5 in (1.27 cm) increments, user selectable
Cable Tray, Option 1U	(See Figure 4–4 for overall mainframe dimensions)
Height	1.75 in (4.45 cm)
Width	16.6 in (42.16 cm)
Depth	18.4 in (46.74 cm)
Weight	
Standard Mainframe	48 lbs (21.8 kg) with no modules installed
Rackmount Option 1R	18 lbs (8.2 kg)
Rackmount Option 2R	20 lbs (9.1 kg)
Cable Tray Option 1U	4 lbs (1.8 kg)
Shipping Weight	
Standard Mainframe	75 lbs (34.1 kg) maximum with no modules installed
Cable Tray Option 1U	8 lbs (3.6 kg)
Rackmount Option 1R or 2R	28 lbs (12.7 kg)
Module Size	13 C-size VXI slots. The mainframe also accepts A-size or B-size modules using the 73A-851 module.
Finish	Tektronix smoke tan and graphite grey paint on an aluminum chassis

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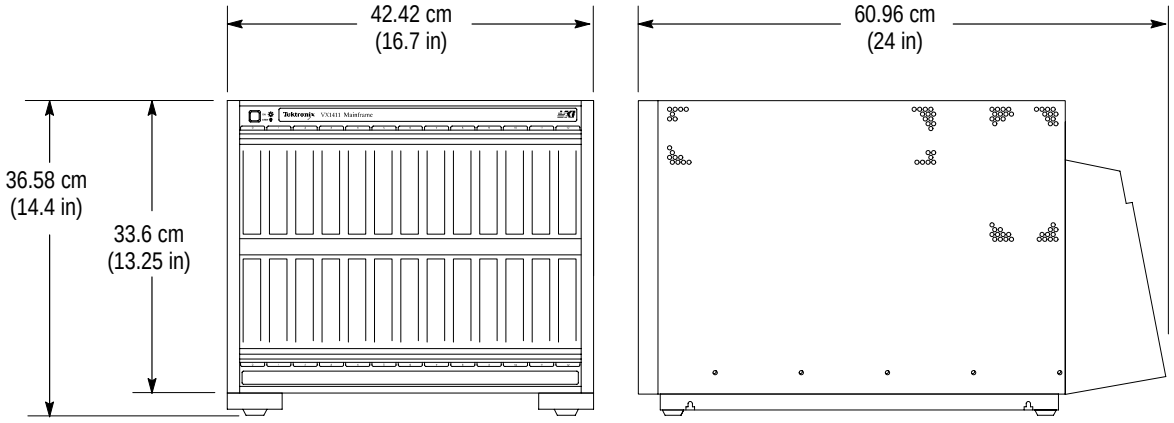


Figure 4–3: Front view and side view of standard VX1411 Mainframe

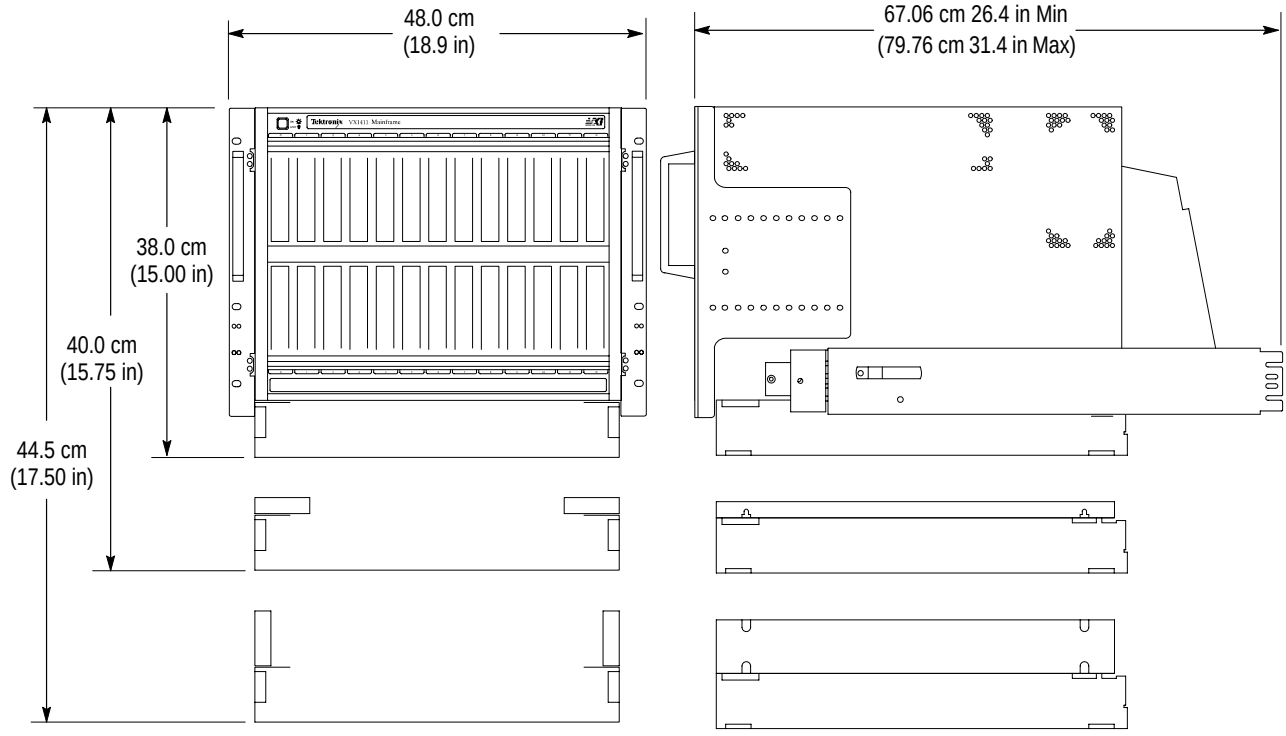


Figure 4–4: Front view and side view of VX1411 Mainframe with Option 1U and rackmount option

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Table 4–8: VXI and VXI*plug&play*

Characteristic	Description
VXI	Fully compatible with VXIbus System Specifications, Rev 1.4
VXI*plug&play*	
Mainframe	VXI*plug&play* compliant with VPP-8

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Performance Verification

Use this chapter to verify that the VX1411 Mainframe operates properly. The checks consist of installing a 73A-850 extender card into slot 0 of the mainframe. Check the power supply voltages with a DMM.

Equipment Required

You will need the following equipment to complete the performance verification checks in this chapter:

- Digital Voltmeter (Tektronix DM250 series digital voltmeter)
- Extender card, 73A-850.

DC Voltage Regulation

The DC voltage regulation can be verified by following the steps listed under *Functional Check* beginning on page 1–22.

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WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all Safety Summaries before performing any service.

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Maintenance

This chapter provides procedures for inspecting and cleaning the VX1411 Mainframe, removing and replacing internal mainframe components, and isolating problems to module levels.

Service Strategy

The service procedures in this manual provide removal and replacement procedures to repair the VX1411 Mainframe to a module level. Instrument level repairs are accomplished by exchanging faulty modules with known-good modules or parts. No component-level repair is provided in this manual.

Preparation

The information in this section is designed for use by qualified service personnel. Read the *Safety Summary* at the front of this manual and *Service Strategy* before attempting any procedures in this chapter. Refer to the *Operating Basics* chapter for information on the location of controls, indicators, and connectors used with the mainframe.



CAUTION. *Many components within the mainframe are susceptible to static-discharge damage. Service the mainframe only in a static-free environment. Observe standard handling precautions for static-sensitive devices while servicing the mainframe. Always wear a grounded wrist strap, or equivalent, while servicing the mainframe.*

Observe the following precautions to avoid damaging the mainframe:

- Do not handle static-sensitive components on boards.
- Transport and store static-sensitive boards in their original containers or on conductive foam. Label any package that contains static-sensitive assemblies.
- Wear a wrist strap attached to the mainframe while handling the boards to discharge the static voltage from your body.

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- Do not allow anything capable of holding or generating a static charge on the work surface.
- Do not slide a board over any surface.
- Avoid handling boards in areas that have a floor or work surface cover that is capable of generating a static charge.

***NOTE**. Always power off the mainframe and disconnect the power cord before cleaning or servicing the mainframe.*

Inspection and Cleaning

The mainframe is inspected mechanically and electrically before shipment. It should be free of marks or scratches and should meet or exceed all electrical specifications. To confirm this, inspect the mainframe for physical damage incurred during transit. Retain the mainframe packaging in case shipment for repair is necessary. If there is damage or deficiency, contact your local Tektronix representative.

Cleaning procedures consist of exterior and interior cleaning of the mainframe and cleaning the fan filter. Periodic cleaning reduces instrument breakdown and increases reliability. Clean the mainframe as needed, based on the operating environment. Refer to your module user documentation for information on cleaning the individual VXIbus modules.

Interior Cleaning

Use a dry, low-velocity stream of air to clean the interior of the mainframe. Use a soft-bristle brush for cleaning around components. If you must use a liquid for minor interior cleaning, use a 75% isopropyl alcohol solution and rinse with deionized water.

Exterior Cleaning

Clean the exterior surfaces of the mainframe with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, use a cloth or swab dipped in a 75% isopropyl alcohol solution. Use a swab to clean narrow spaces around controls and connectors. Do not use abrasive compounds on any part of the mainframe.

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CAUTION. *Avoid getting moisture inside the mainframe during exterior cleaning; use just enough moisture to dampen the cloth or swab.*

Do not wash the front-panel On/Standby switch. Cover the switch while washing the mainframe.

Use only deionized water when cleaning. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.

Do not use chemical cleaning agents; they may damage the mainframe. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Cleaning the Fan Filter

The fan filter easily removes from the rear of the mainframe. The filter slides out of the rear of the mainframe as shown in Figure 6–1.

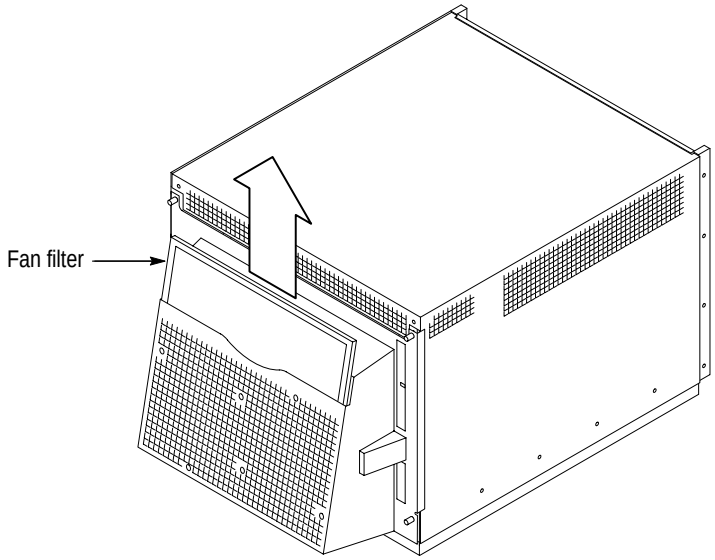


Figure 6–1: Removing the fan filter

Clean the fan filter by vacuuming or blowing air through the filter. Rinse the filter in cool water and dry it before replacing it in the mainframe.

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Removal and Replacement

The following procedures describe how to remove and replace module-level components of the VX1411 Mainframe. Refer to the exploded view illustrations in *Replaceable Parts* for an overview of the assembly and disassembly of the mainframe.



WARNING. *To avoid electric shock, always power off the mainframe and disconnect the power cord before cleaning or servicing the mainframe.*

Tools Required

The following tools are required to disassemble the VX1411 Mainframe to the module level:

- Small flat blade screwdriver
- Diagonal cutters (for removing cable ties)
- Torx screw driver with T-15 and T-20 tips
- Phillips screw driver
- Pozidrive screw driver
- 3/32 inch hex (Allen) wrench

Procedure 1: Removing the Fan Assembly

To remove the fan assembly, refer to Figure 6–3 and Figure 6–4 while performing the following steps:

1. From the back of the mainframe, loosen the five captive screws using a Phillips screw driver (refer to Figure 6–2 for the screw locations).
2. Remove the Chassis Ground screw (if installed).
3. Gently pivot the fan assembly outward from the mainframe far enough to access the fan cables on the right side of the mainframe.
4. Unplug the fan cables and set the fan assembly aside on a clean working surface.
5. Remove the fan filter from the fan assembly if you need to replace one of the fans.
6. To remove the two fans, remove the three 6-32 screws (with a Pozidrive driver) holding each fan to the inside of the fan assembly as shown in Figure 6–4.
7. Remove the cable tie holding the fan cables to the fan.

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NOTE. *When reconnecting the fan cables to the mainframe, verify that you connect the fan cables to their respective connectors. Match the labels on the fan cables to their respective connector on the rear of the mainframe.*

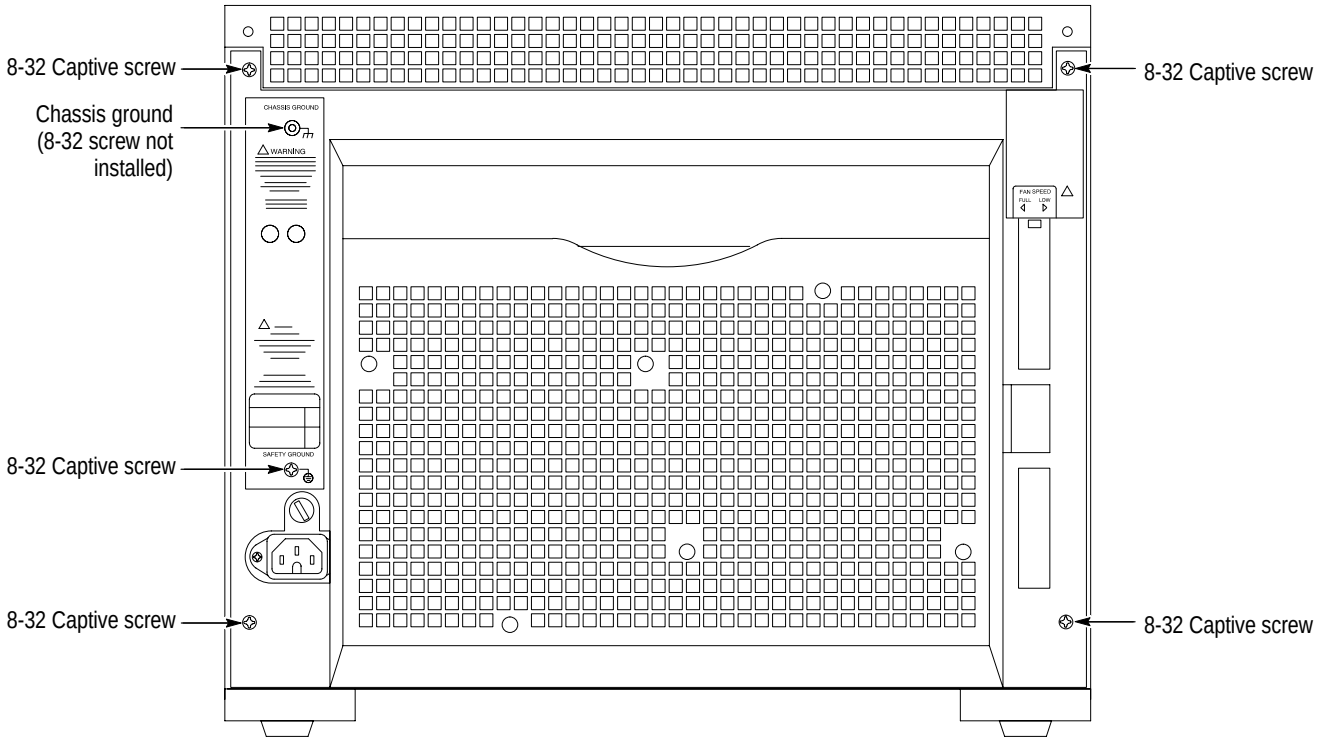


Figure 6–2: Location of fan assembly screws on the rear of the mainframe

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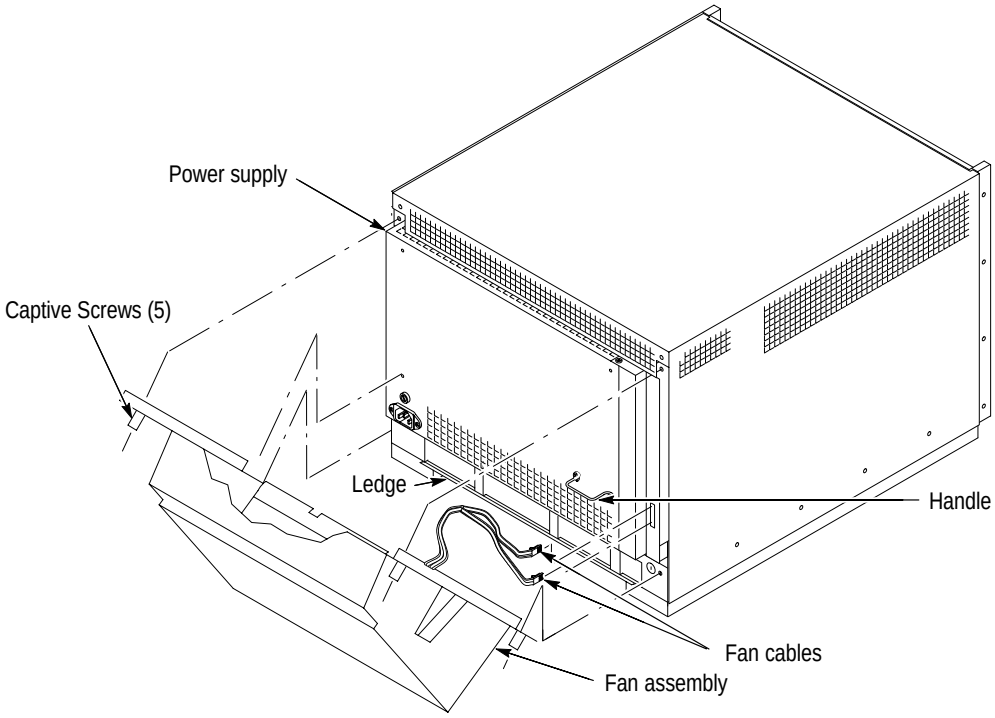


Figure 6–3: Removing the fan assembly

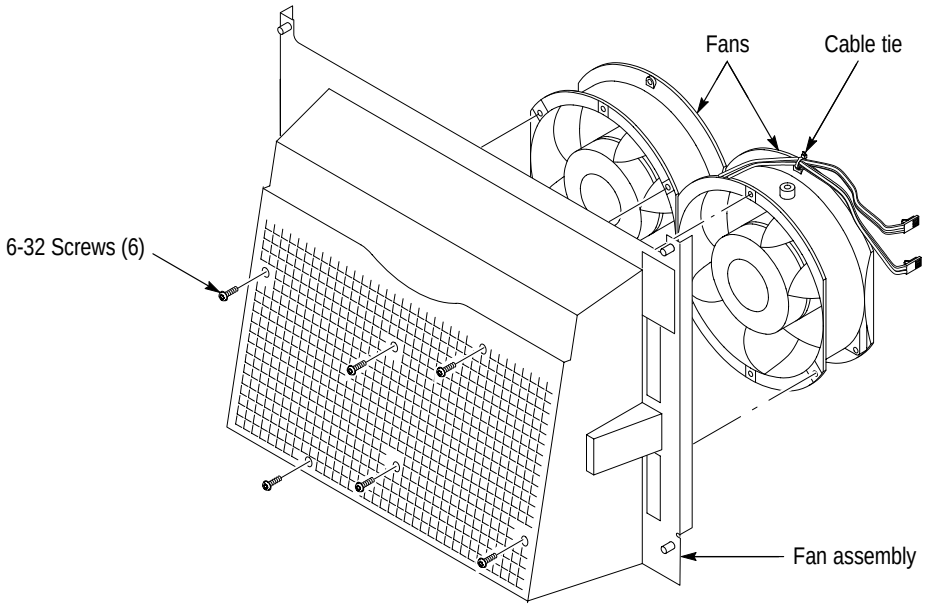


Figure 6–4: Removing the fans

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Procedure 2: Removing the Fan Control Board

To remove the fan control board , perform *Procedure 1: Remove Fan Assembly* and then refer to Figure 6–5 to remove the fan assembly.

Grasp the cable tie loop and pull the fan control board until it comes loose from the backplane. Then slide the board out of the right side of the mainframe.

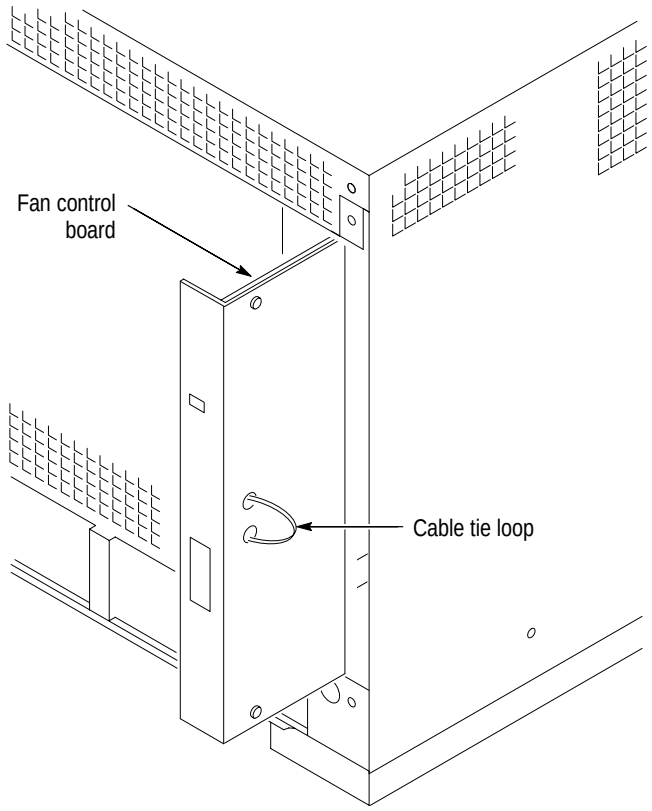


Figure 6–5: Removing the fan control board

Procedure 3: Removing the Power Supply

To remove the power supply from the mainframe, refer to Figure 6–3 and perform steps 1 through 4 of Procedure 1 to remove the fan assembly. Then continue with the following steps:

1. Using the handle on the power supply, firmly pull out the power supply from the rear of the mainframe.
2. Set the power supply assembly on a clean working surface.

NOTE. *Step 3 is necessary only if you intend to replace the Power Supply Interface board. This step is normally not necessary because the Power Supply and the Power Supply Interface board can be replaced as a single unit.*

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3. Refer to Figure 6–6 and remove the Power Supply Interface board from the power supply module as shown.

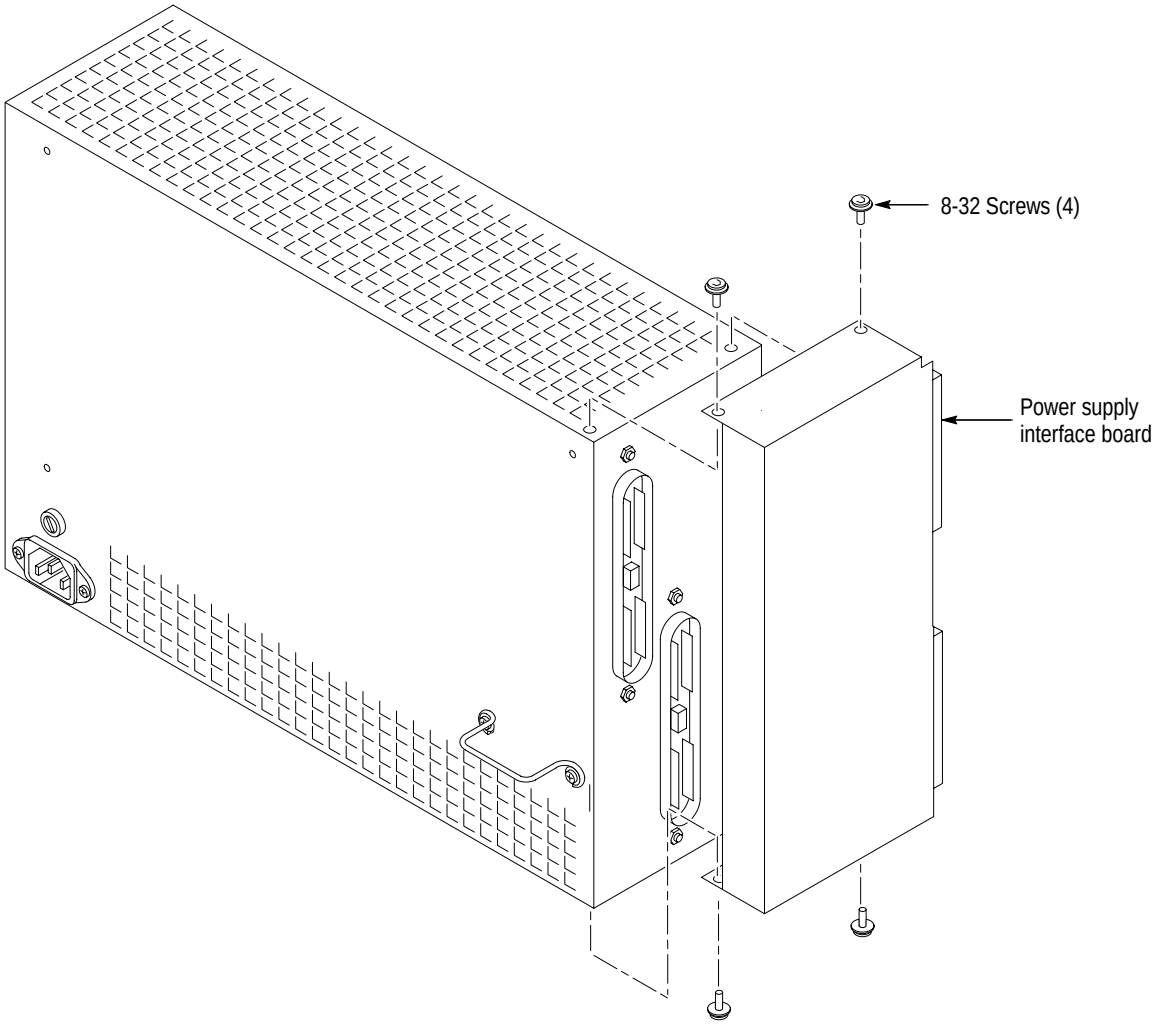


Figure 6–6: Removing the power supply interface board

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Procedure 4: Removing the Card Guides

The card guides at the top and bottom of the mainframe are very similar. The main difference is that the bottom guides (IntelliGuides) include the spring-loaded shutters to redirect air into the mainframe. The procedure for removing both guides is identical. Refer to Figure 6–7 while performing the following steps:

1. Use a small flat blade screw driver to pry up the tab of the card guide at the front of the mainframe being careful not to damage the card guide or the mainframe.
2. Gently pull the card guide forward until it pops out of place.
3. Remove the card guide.

***NOTE**. The bottom card guides (IntelliGuides) are replaced as a unit. The IntelliGuides are not intended to be disassembled.*

To replace a card guide, slide the card guide towards the rear of the mainframe and allow the front of the card guide to snap into place.

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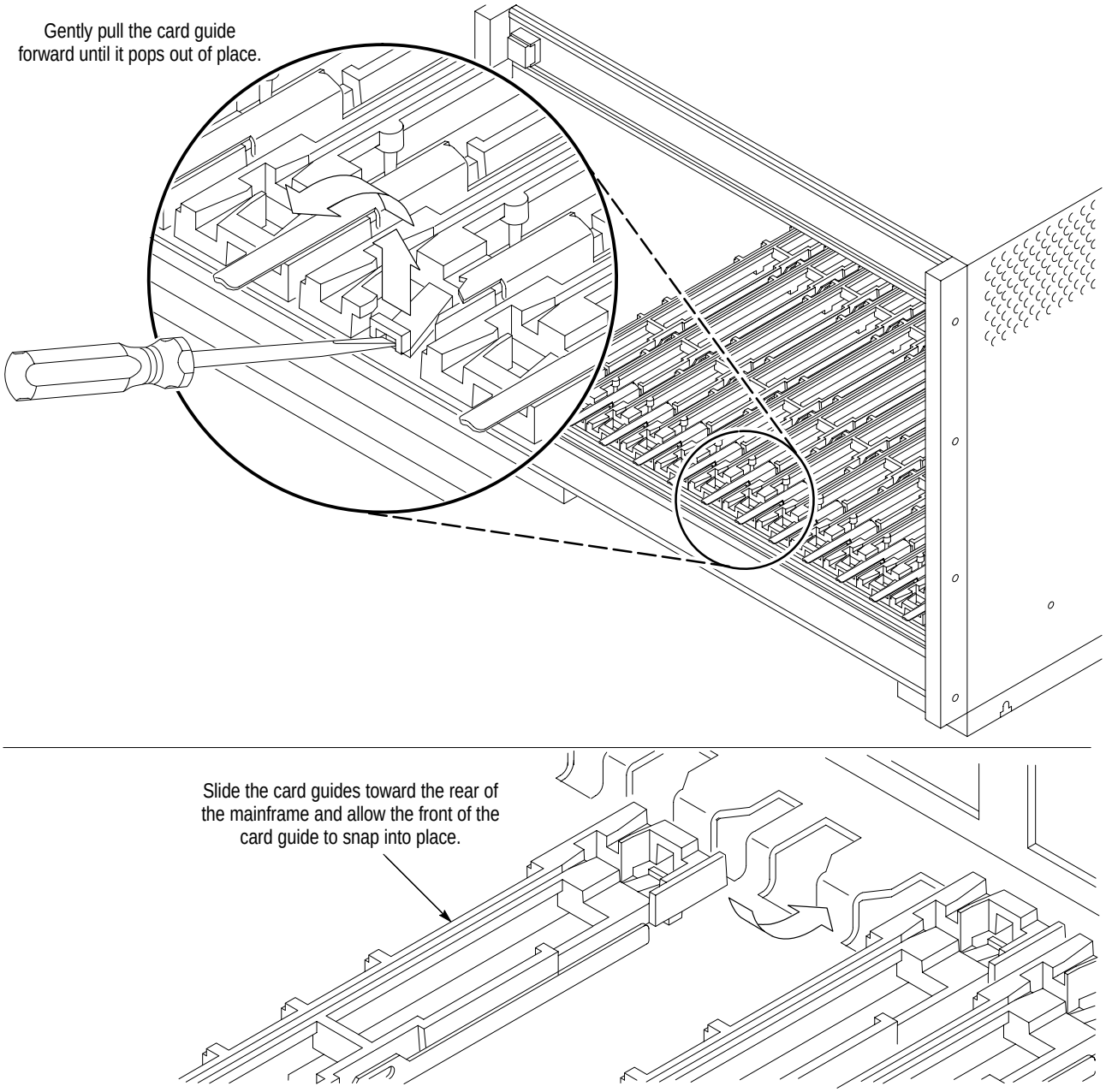


Figure 6–7: Removing the top and bottom card guides

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Procedure 5: Replacing the Top and Bottom Nut Rails

The nut rails at the top and the bottom of the front of the VX1411 Mainframe allow the user to securely install the modules in the mainframe by screwing the top and bottom of the modules to the front of the mainframe. Refer to Figure 6–8 to remove these nut rails.

1. Loosen all module retaining screws (it may be necessary to slide the modules partially out of the mainframe).
2. Remove the 12 screws holding the top cover to the mainframe using a 3/32-inch Allen wrench.
3. Slide the top cover of the mainframe back far enough to expose the hole just inside the top and bottom extrusions.
4. Slide the nut rail out of hole on the side of mainframe.

Replace the nut rail by sliding it back in the side of the mainframe and pushing it into place.

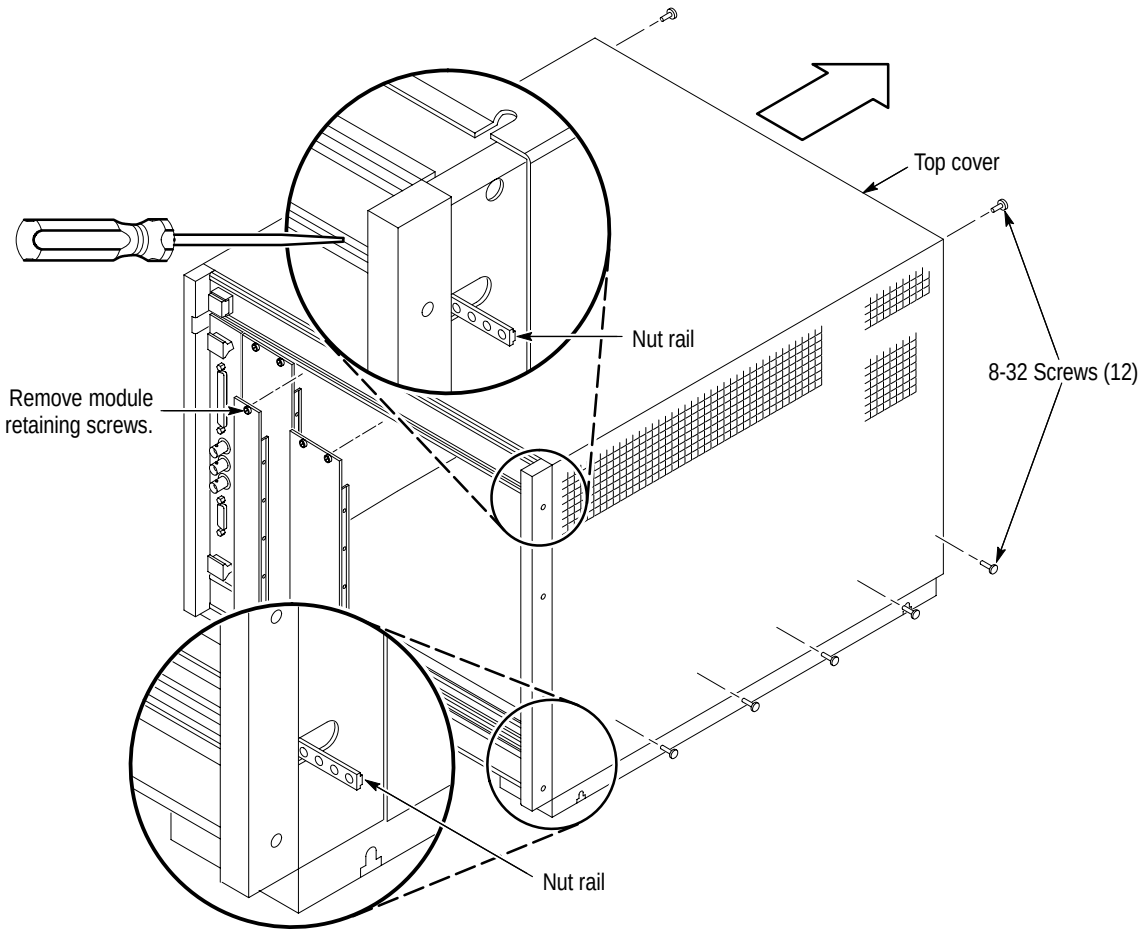


Figure 6–8: Replacing the top and bottom nut rails

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Procedure 6: Remove the Backplane

To remove the backplane, perform Procedures 1, 2, and 3. Refer to Figure 6–9 and then complete the following steps:

1. Remove the top cover of the mainframe (see Figure 6–8 on page 6–11, if necessary).
2. Disconnect the power switch cable at J22 at the top of the backplane.
3. From the rear of the mainframe, remove the five 6-32 screws on the top of the backplane, seven 6-32 screws from the center, and five 6-32 screws from the bottom.
4. After removing all screws from the backplane, remove the backplane from the mainframe by sliding it out of the right side.

Install the backplane by reversing the disassembly procedure.

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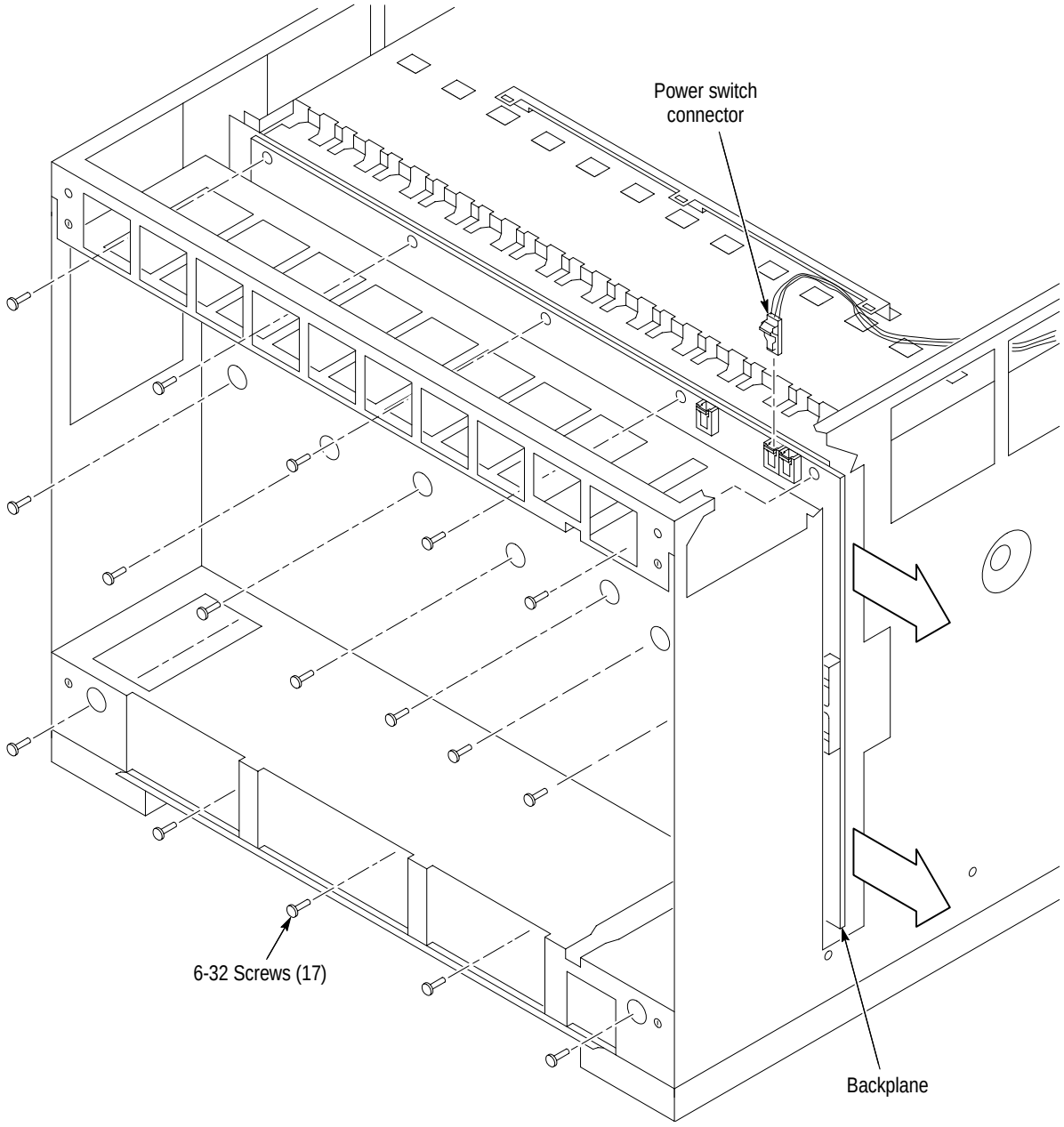


Figure 6–9: Removing the backplane

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Troubleshooting Procedures

The troubleshooting procedures are designed to isolate problems to a module level. No component-level procedures are provided.

Equipment List

The following test equipment is recommended for troubleshooting procedures.

- Digital Voltmeter (Tektronix DM250 series digital voltmeter)
- Oscilloscope, 20 MHz BW, with 10x Probe (Tektronix TDS400A or TDS500A series oscilloscope)

Diagnostic Information

The VX1411 Mainframe does not include diagnostics. The functionality of the mainframe can be verified by following the performance verification procedures as described in *Performance Verification* beginning on page 5–1.

Fuses

The mainframe has two fuses for normal operation, the line fuse and a 5 V fuse on the backplane. The line fuse can be one of two different kinds depending on the operating voltage of the mainframe. Table 6–1 summarizes the different fuses in the mainframe.

Table 6–1: Fuses

Voltage	Rating	Tektronix replacement part number
90 V to 250 V operation	10 A, Fast Blow, 250 V	159-0047-00
207 V to 250 V operation	4 A, Slow Blow, 250 V	159-0397-00
5 V Backplane	4 A, Fast Blow, 250 V	159-0320-00

Fault Isolation

The main focus of the troubleshooting procedures is to isolate problems to one of the major modules within the mainframe. You may find it helpful to refer to the functional block diagram in Figure 6–10 on page 6–17 to isolate problems to one of the modules within the mainframe.

Power Supply Problems. Use the following information to isolate power supply problems to the power supply or to other modules.

- Isolate the problem to either the mainframe or to one of the installed VXIbus Modules. Remove the modules from the mainframe and check that the problem still exists.
- Try isolating the problem to a module by either replacing the module with an known-good module or moving the module to a different slot.

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- Check the fuses in the mainframe and on the backplane.
- Perform the procedures as described in *Performance Verification* beginning on page 5–1 to verify the power supply voltages are present and within the specified limits. If the voltages are not present, replace the power supply. If any of the voltages are not within the specified limits, replace the power supply.

Inadequate Cooling. Cooling problems can be due to one or more of the following problems:

- Verify that the air filter is clean. If not, remove the air filter and clean it.
- One or both fans may not be operating properly. Check that both fans rotate.
- Verify that each fan is properly connected to the fan control board (see Figure 6–3 on page 6–6).
- Check that both fans are working at low and high speeds.
- Verify that all of the IntelliGuides of empty slots within the mainframe are closed when no modules are installed. If necessary replace the faulty assembly.
- Verify that each VXIbus modules have front panel that activates the IntelliGuides (shutters).

Repackaging Instructions

If you need to send the VX1411 Mainframe to a Tektronix field center for repair, attach a tag to the mainframe with the owner name and address, the serial number, and a brief description of the problem(s) encountered or the service required. Always return all accessories so that the entire system can be tested.

When repacking the mainframe for shipment, use the original packaging. If the packaging is unavailable or unfit for use, contact your local Tektronix representative to obtain new packaging.

Theory of Operation

This section provides a brief overview of the theory of operation for the VX1411 Mainframe. Figure 6–10 shows the functional block diagram of the mainframe and the major components.

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The VX1411 Mainframe contains the following major components:

- Power supply
- Backplane
- Fan Control board

Power Supply. The power supply provides all voltages and currents to the mainframe. The power supply connects to the backplane at J1 and J2 through the Power Supply Interface board. The power supply and the Power Supply Interface board can be replaced as a single unit.

Backplane. The backplane (A4) provides all the connections to module slots 0 through 12 in the mainframe. It also has connections to all other circuit boards and modules in the mainframe.

The front panel On/Standby DC switch connects to J22 at the top of the backplane.

The backplane connects to the Power Supply Interface board at J20 and J21. Connector 0J2 supplies power to the fans from the backplane via fan control board.

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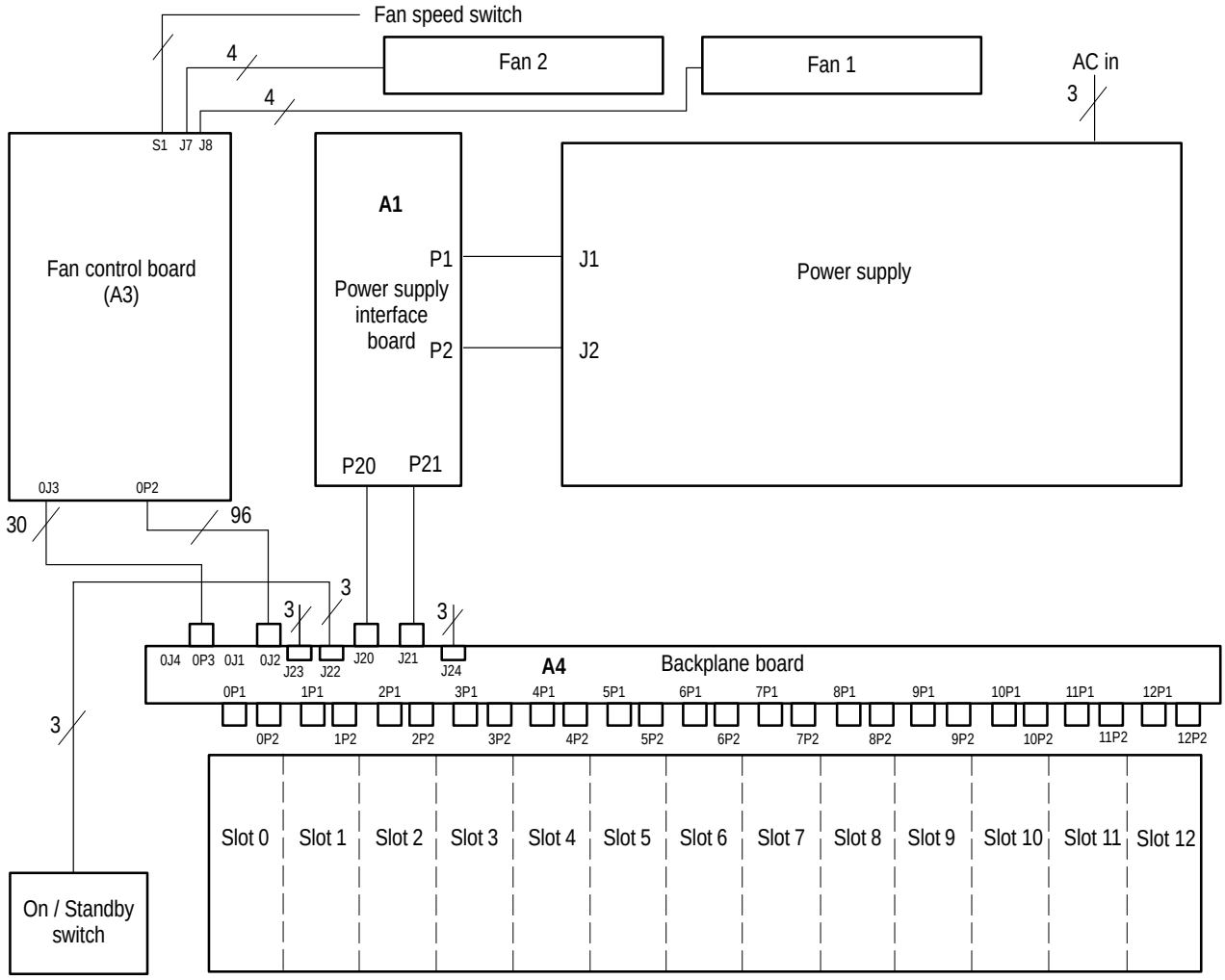


Figure 6–10: Mainframe block diagram

Fan Control Board. The fan control board (A3) controls the speed of the two fans, full or low. The fan control board connects directly to the backplane at 0J3 and 0P2.

The two fans connect to the fan control board at J7 (Fan2) and J8 (Fan1). The Fan Speed switch (S1) selects either low fan speed (LOW) or full speed (FULL).

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Replaceable Parts

This section contains a list of the replaceable modules for the VX1411 Mainframe. 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.

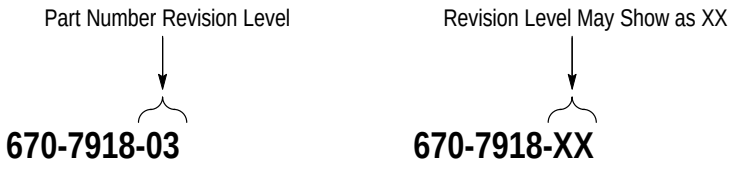
- Part number (see Part Number Revision Level below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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.

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Module Servicing

Modules can be serviced by selecting one of the following two options. Contact your local Tektronix service center or representative for repair assistance.

Module Repair and Return. You may ship your module to Tektronix, Inc. 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.

VX1411 Mainframe Common Replaceable Parts

Table 7–1 provides a quick reference list of parts that you are most likely to replace. The table only provides a summary of information on the parts. For more detailed information refer to the individual parts lists in this chapter.

Table 7–1: VX1411 Mainframe common replaceable parts

Name	Description	Tektronix Part Number
Power Supply Module	Power supply and power supply interface board	020-2116-01
Air Filter	Air filter:Woven Polypropylene, black, 0.125 thick, 2 layer, vinyl,edging	378-2075-00
Fuse	Fuse, cartridge:10A,250V,Fast	159-0047-00
Fuse	Fuse, cartridge:5MM X 20MM,250V,4A, Time Delay High Breaking capacity,ceramic;VDE	159-0397-00
Fuse (Backplane)	Fuse, cartridge:5 X 20MM,4.0A,250V,30 MIN MAX	159-0320-00
Bottom Card Guide with Shutters	Baffle,VXI Slot:0.040 AL,Formed Sheet Metal with Perforations	378-2074-01
Card Guide	Guide:Plastic Guide,ECB,VXI Molded Ckt Bd Guide, VXI Form Factor	351-0962-00
Fan	Fan,DC:48V;TUBEAXIAL,Programmable with Tach Out, 15W,2500 RPM,170 CFM,48DBA,6.75” X 5.9” X 2.0”	119-4801-00

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Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the VX1411 Mainframe. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Table 7–2: Parts list column descriptions

Column	Column name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

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Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK1499	AMLAN INC	97 THORNWOOD RD	STAMFORD CT 06903–2617
TK1547	MOORE ELECTRONICS INC.	19500 SW 90TH CT PO BOX 1030	TUALATIN OR 97062
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2208	NORTHWEST RUBBER EXTRUDERS INC	16748 SW 77TH AVE	PORTLAND OR 97223
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER WA 98601
0B445	ELECTRI–CORD MFG CO INC	312 EAST MAIN ST	WESTFIELD PA 16950
0J9P4	DELTA ENGINEERING & MFG. CO.	19500 SW TETON	TUALATIN, OR 97062
0KB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
06383	PANDUIT CORP	17303 RIDGELAND AVE	TINLEY PARK, IL 60477–3048
06540	NEW HAVEN MFG CORPORATION	AMATOM ELECTRONIC HARDWARE DIV 446 BLAKE ST	NEW HAVEN, CT 06515–1238
06666	GENERAL DEVICES CO INC	1410 S POST RD PO BOX 39100	INDIANAPOLIS IN 46239–9632
22589	ELECTRO–SPACE FABRICATORS INC	300 W HIGH ST PO BOX 67	TOPTON PA 19562–1420
5Y921	COMAIR ROTRON	2675 CUSTOMHOUSE CT	SAN YSIDRO, CA 92073
51506	ACCURATE SCREW MACHINE COMPANY (ASMCO)	19 BALTIMORE STREET	NUTLEY NY 07110–1303
61081	ELECTRONIC SOLUTIONS	6790 FLANDERS DRIVE	SAN DIEGO, CA 92121
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA CA 94952–1152
73893	MICRODOT INC	50631 E RUSSELL SCHMIDT BLVD	MT CLEMENS, MI 48045
74594	COMPONENT RESOURCES INC	BUSSMAN PARTS C/O CASEY LAKEY 14525 SW WALKER ROAD	BEAVERTON, OR 97006
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016–3049
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001
8X345	NORTHWEST SPRING MFG CO	5858 SW WILLOW LANE	LAKE OSWEGO, OR 97035

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					CABINET AND CHASSIS ASSEMBLY		
1–1	212–0193–00			12	SCREW,EXT:8–32 X 0.375 BUTTON HEAD,HEXDRIVE,STAINLESS STEEL,BLACK OXIDE FINISH	0KB01	212–0193–00
–2	200–4206–00			1	COVER:0.050 ALUMINUM,SMOKE TAN	80009	200420600
–3	441–2064–00			1	CHASSIS:VXI MAINFRAME SHEET METAL ASSY	80009	441206400
–4	426–2524–00			2	RAIL,FOOT:ALUM SHEET METAL,SMOKE TAN	80009	426252400
–5	348–0001–00			4	FOOT,CABINET:BLACK RUBBER	TK2208	ORDER BY DESC
–6	212–0193–00			4	SCREW,EXT:8–32 X 0.375 BUTTON HEAD,HEXDRIVE,STAINLESS STEEL,BLACK OXIDE FINISH	0KB01	212–0193–00
–7	212–0158–00			8	SCREW,MACHINE:8–32 X 0.375,PNH,STL,CDPL,T–20	0KB01	ORDER BY DESC
					STANDARD ACCESSORIES		
	070–9602–00			1	MANUAL TECH:INSTRUCTION MANUAL,VX1411	80009	070–9602–00
	161–0213–00			1	CABLE ASSY,PWR,3,16 AWG,2.5 METER,GREY, 13A/250V	0B445	ECM–161–0213–00
	159–0397–00			1	FUSE,CARTRIDGE:5 X 20MM, 4A, 250V, CER	75915	215004
	200–2265–00			1	CAP,FUSEHOLDER:5 X 20MM FUSES	61935	031.1663

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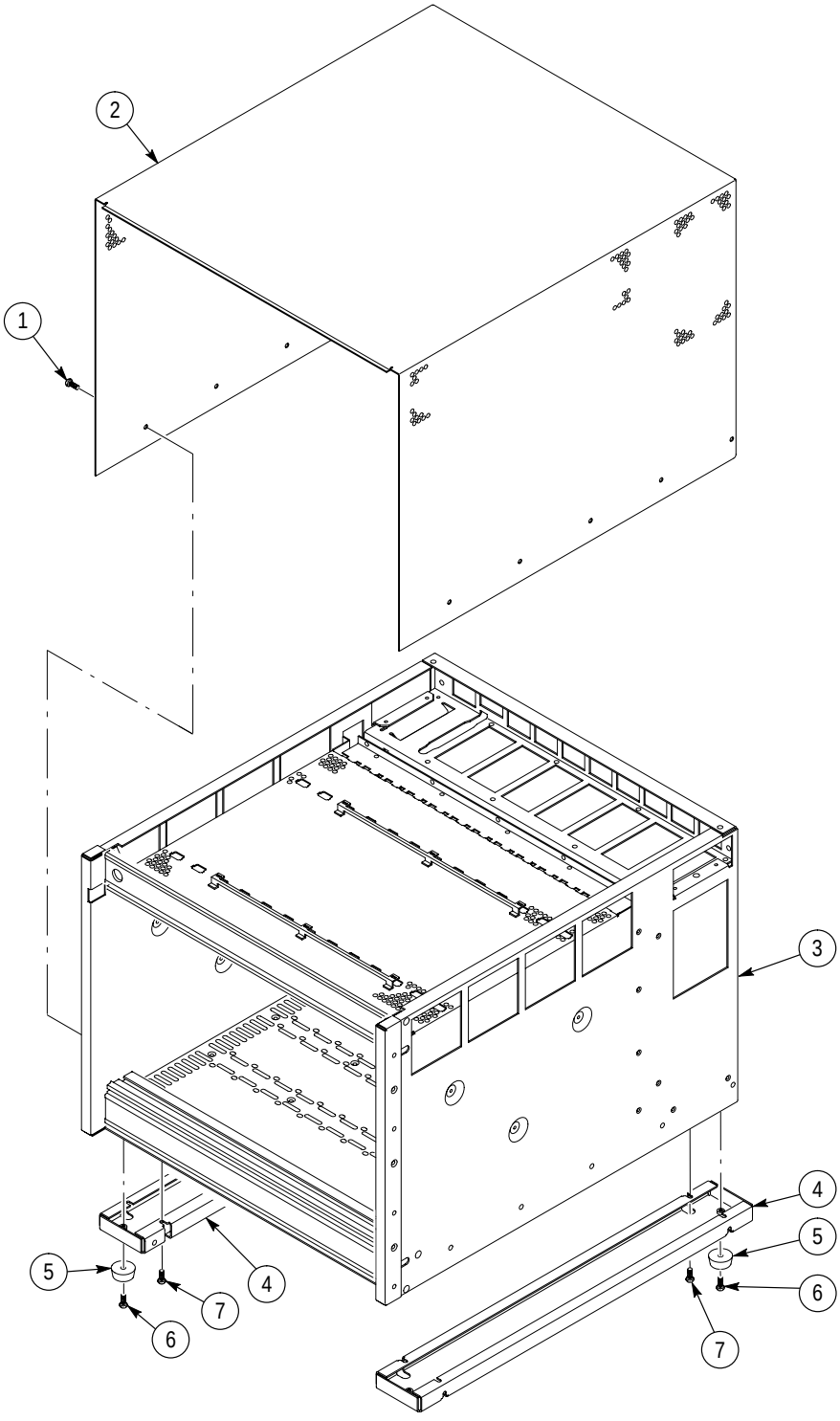


Figure 7–1: Cabinet and Chassis Assembly

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					CIRCUIT BOARD AND CHASSIS PARTS		
2–1	260–2618–00			1	SWITCH,PUSH:SPST;MOM,GOLD CONTACTS,0.4V	TK2469	260-2618-00
–2	386–6947–00			1	EXTRUSION,ASSY:UPPER EXTRUSION ASSY,ASSY OF EXT,LABEL,POWER SWITCH,& NUT BAR	80009	386686500
–3	211–0720–00			17	SCR,ASSEM WSHR:6–32 X 0.500,PNH,STL,CDPL,T–15	0KB01	ORDER BY DESC
–4	118–9142–00			1	BACKPLANE,VXI:13 SLOT,C–SRE,W/ELECTRONIC AUTOMATIC BUS GRANTSENSING	61081	V1213J1J2X–7059
–5	213–0882–00			12	SCREW,TPG,TR:6–233 X 0.437,PNH,STL,CDPL,TYPE TT,T–15	0KB01	ORDER BY DESC
–6	220–0199–01			2	NUT BAR,VXI:VME/VXI NUT BAR,M2.5 THREADS	22589	120 15.580 LENG
–7	386–6867–00			1	EXTRUSION,ASSY:LOWER EXTRUSION ASSY,LABEL,&NUT BAR	80009	386686700
–8	378–2074–01			13	BAFFLE,VXI SLOT:0.040 AL,FORMED SHEET METAL W/PERFORATIONS	80009	378207401
–9	351–0962–00			13	GUIDE:PLASTIC GUIDE,ECB,VXI MOLDED CKT BD GUIDE, VXI FORM FACTOR	80009	351096200
					OPTIONAL ACCESSORIES		
2–10	333–4092–01			1	PANEL,FRONT:DOUBLE WIDE BLANK VXI, EMI GASKET	TK1943	333409201
2–11	333–4092–00			1	PANEL,FRONT:SINGLE WIDE BLANK VXI, EMI GASKET	TK1943	333409200
2–12	333–4169–00			1	PANEL,FRONT:DOUBLE WIDE BLANK, STANDARD	80009	333416900
2–13	333–4170–00			1	PANEL,FRONT:SINGLE WIDE BLANK, STANDARD	80009	333417000

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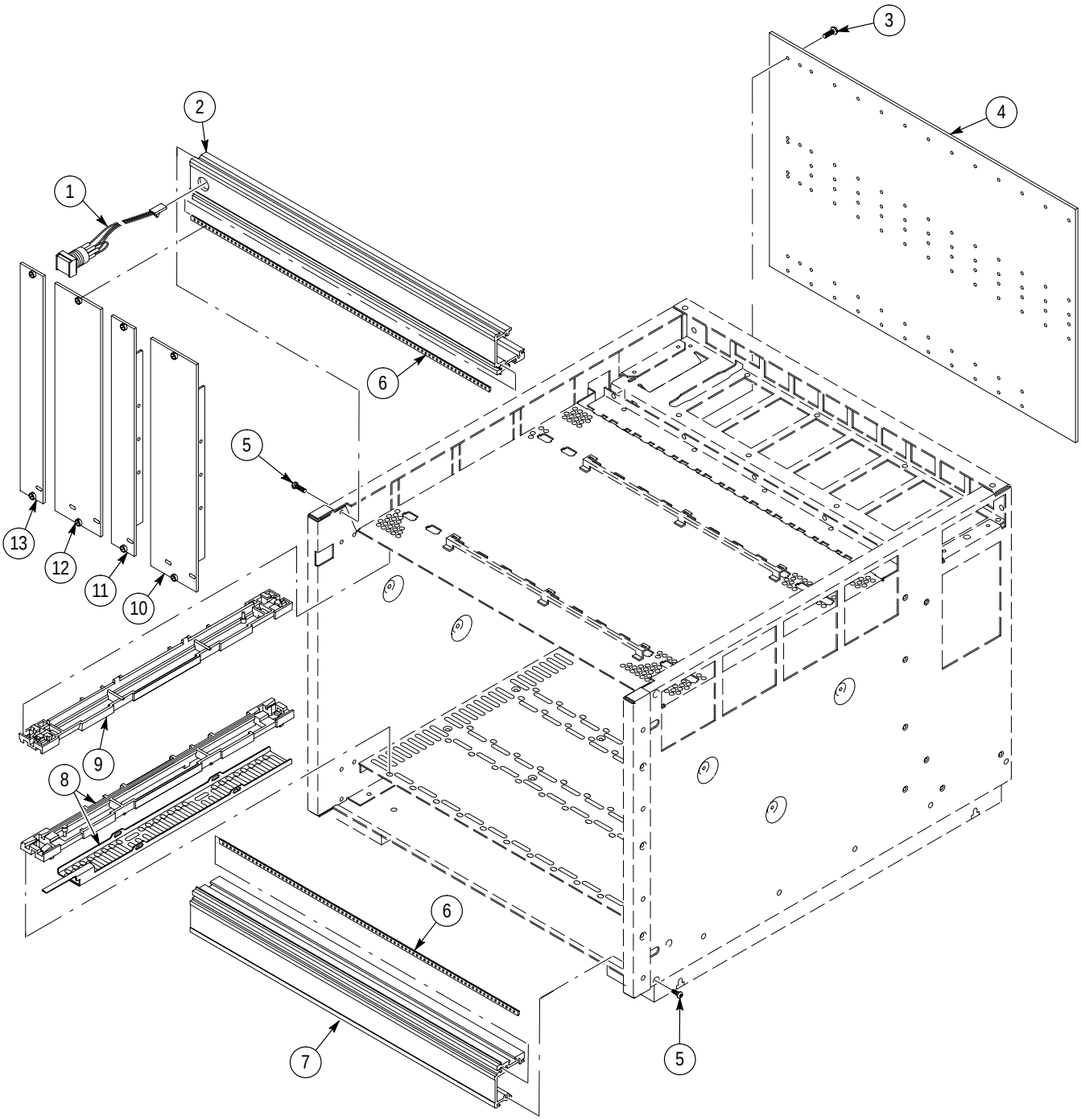


Figure 7–2: Circuit Boards and Chassis Parts

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					POWER SUPPLY AND FAN ASSEMBLY		
3–1	343–0549–00			2	STRAP,TIEDOWN,,E:0.098 W X 4.0 L,ZYTEL	TK1499	HW–047
–2	407–4331–00			1	BRACKET:0.062 ALUM SHEET,MOUNTS MONITOR ECB	80009	407433100
–3	671–3901–00			1	CIRCUIT BD ASSY:FAN CONTROL BOARD	80009	671390100
–4	211–0747–00			4	SCREW,MACHINE:6–32 X 0.188,PNH,STL,CDPL,T–15	0KB01	ORDER BY DESC
–5	020–2116–02			1	COMPONENT KIT:POWER SUPPLY INTERFACE BOARD KIT (KIT CONTAINS ITEMS 6 THROUGH 10 AND 15)	80009	020211602
–6	200–4207–00			1	COVER:0.050 AL,COVER,ECB,PWR SPLY I/F,SHEET METAL, MOUNT PWRSPLY I/F ECB TO PWR SPLY	80009	200420700
–7	212–0158–00			6	SCREW,MACHINE:8–32 X 0.375,PNH,STL,CDPL,T–20	0KB01	ORDER BY DESC
–8	671–3216–01			1	CIRCUIT BD ASSY:POWER SUPPLY INTERFACE	80009	671321601
–9	119–4783–03			1	POWER SUPPLY:VX1411	80009	119478303
–10	367–0466–00			1	HANDLE:WIREFORM,0.125 SST,ELECTRO POLISH, 1 X 2 IN.	80009	367321600
–11	119–4801–00			2	FAN,DC:48V;TUBEAXIAL	5Y921	JQ48R7
–12	380–1088–02			1	HOUSING:0.062 AL,FAN VXI MAINFRAME SHEET METAL MOUNT FANS	80009	380108802
–13	211–0512–00			6	SCREW,MACHINE:6–32 X 0.5,FLH,100 DEG,STL CD PL POZ	73893	ORDER BY DESCRIPTION
–14	378–2075–00			1	AIR FILTER:WOVEN POLYPROPYLENE,BLACK,0.125 THICK, 2 LAYER,VINYL EDGING	80009	378207500
–15	211–0846–00			4	SCREW:SCREW,SHLDR,6–32 X 0.156,HEX SOCKET SHOULDER SCREW,0.156 DIA X 0.125 SHANK	51506	67515–S–12–VT

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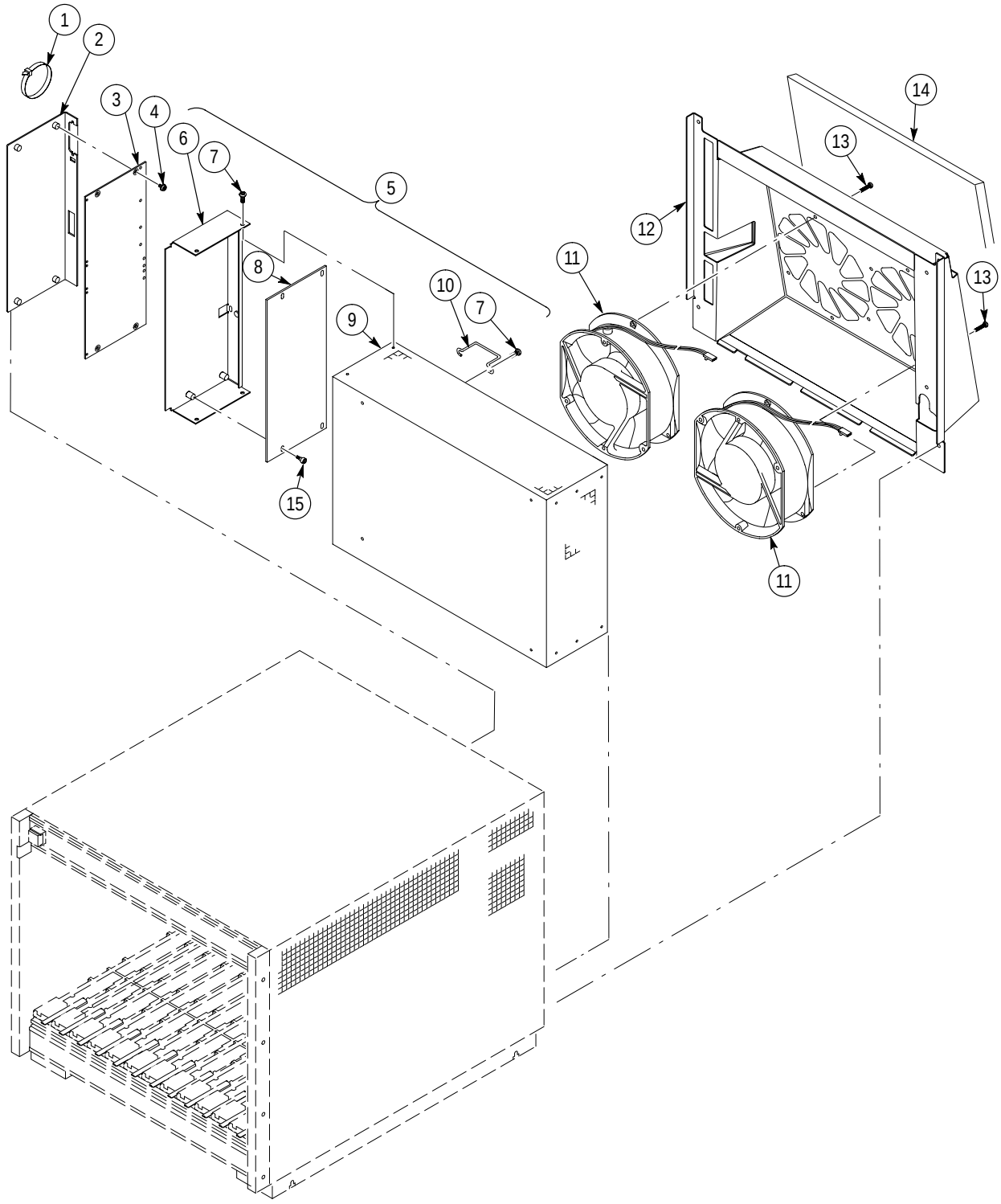


Figure 7–3: Power Supply and Fan Assembly

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					1R RACKMOUNT ASSEMBLY		
4–0	020–2117–00			1	COMPONENT KIT:RACKMOUNT KIT 1R (KIT CONTAINS ITEMS 1 THROUGH 5)	80009	020211700
–1	950–0991–00			2	HANDLE ALUMINUM BLK	80009	950099100
–2	212–0157–00			14	SCREW,MACHINE:8–32 X 0.5,FLH,100 DEG,STL CDPL,TORX	0KB01	ORDER BY DESC
–3	407–4363–00			2	BRACKET:RACKMOUNT,2R	80009	407436300
–4	212–0671–00			4	SCREW,MACHINE:10–32 X 0.625,FLH,100 DEG,STL,CDPL, TORX	0KB01	ORDER BY DESC
–5	351–0800–00			1	GUIDE,SLIDE:CHASSIS TRACK, (PAIR)	06666	CTS–424

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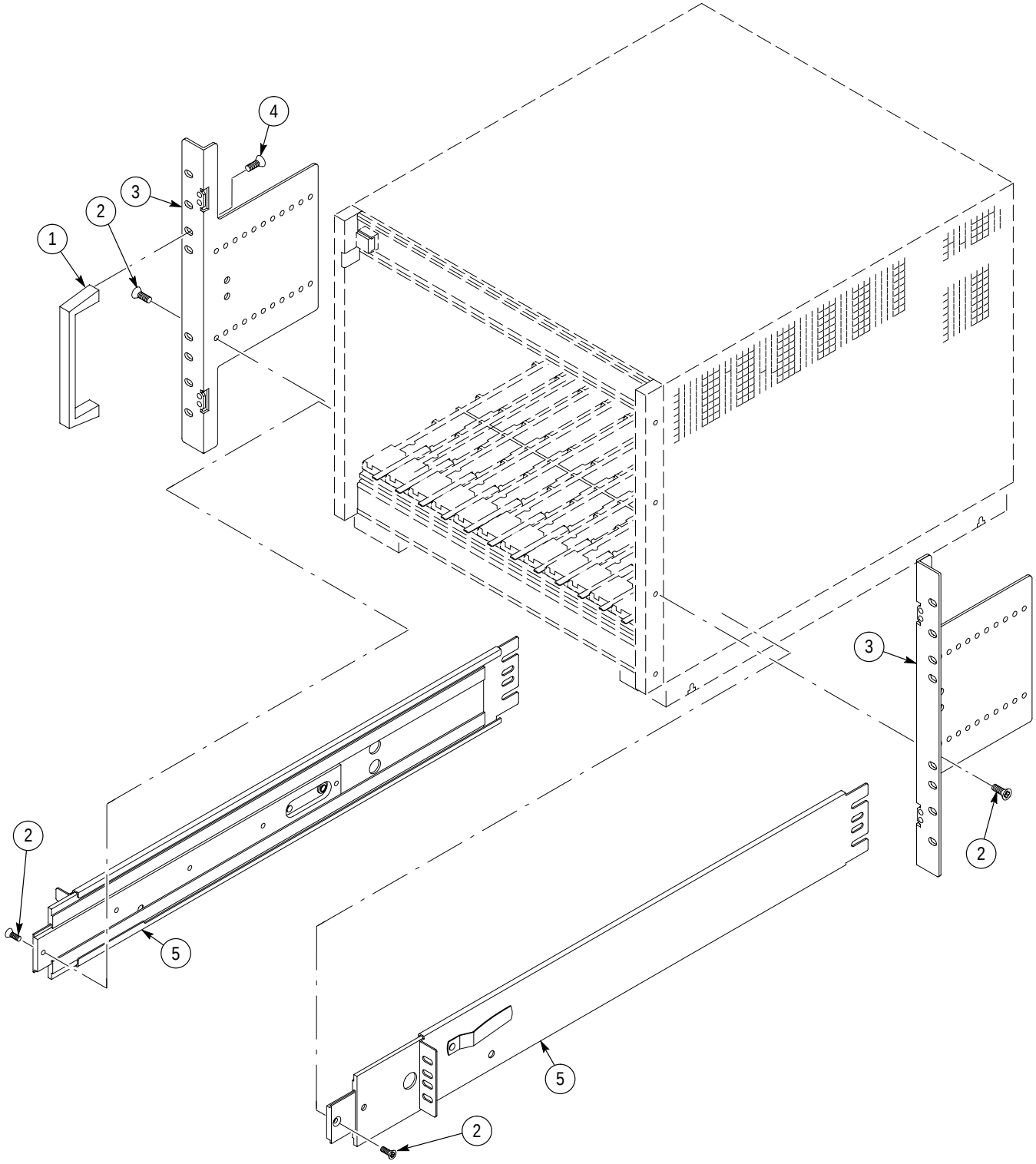


Figure 7–4: 1R Rackmount Assembly

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					2R RACKMOUNT AND DOOR ASSEMBLY		
5–0	020–2118–00			1	COMPONENT KIT:RACKMOUNT KIT 2R (KIT CONTAINS ALL THE FOLLOWING ITEMS EXCLUDING ITEMS 3, 5 & 8)	80009	020211800
–1	950–0991–00			2	HANDLE ALUMINUM BLK	80009	950099100
–2	212–0157–00			14	SCREW,MACHINE:8–32 X 0.5,FLH,100 DEG,STL CD PL	0KB01	ORDER BY DESC
–3	214–4678–00			2	HINGE LIFT OFF, BLACK	80009	214467800
–4	407–4363–00			2	BRACKET:RACKMOUNT,2R	80009	407436300
–5	211–0718–00			8	SCREW,MACHINE:6–32 X 0.312,FLH100 DEG,STL,CD PL,T–10	0KB01	211–0718–00
–6	212–0671–00			4	SCREW,MACHINE:10–32 X 0.625,FLH100 DEG,STL,CD PL, TORX	0KB01	ORDER BY DESC
–7	212–0158–00			2	SCREW,MACHINE:8–32 X 0.375,PNH,STL,CD PL,T–20	0KB01	ORDER BY DESC
–8	200–4243–01			1	DOOR ASSY:LEXAN DOOR,W/LATCH HARDWARE ATTACHED	80009	200424301
–9	351–0800–00			1	GUIDE,SLIDE:CHASSIS TRACK, (PAIR)	06666	CTS–424

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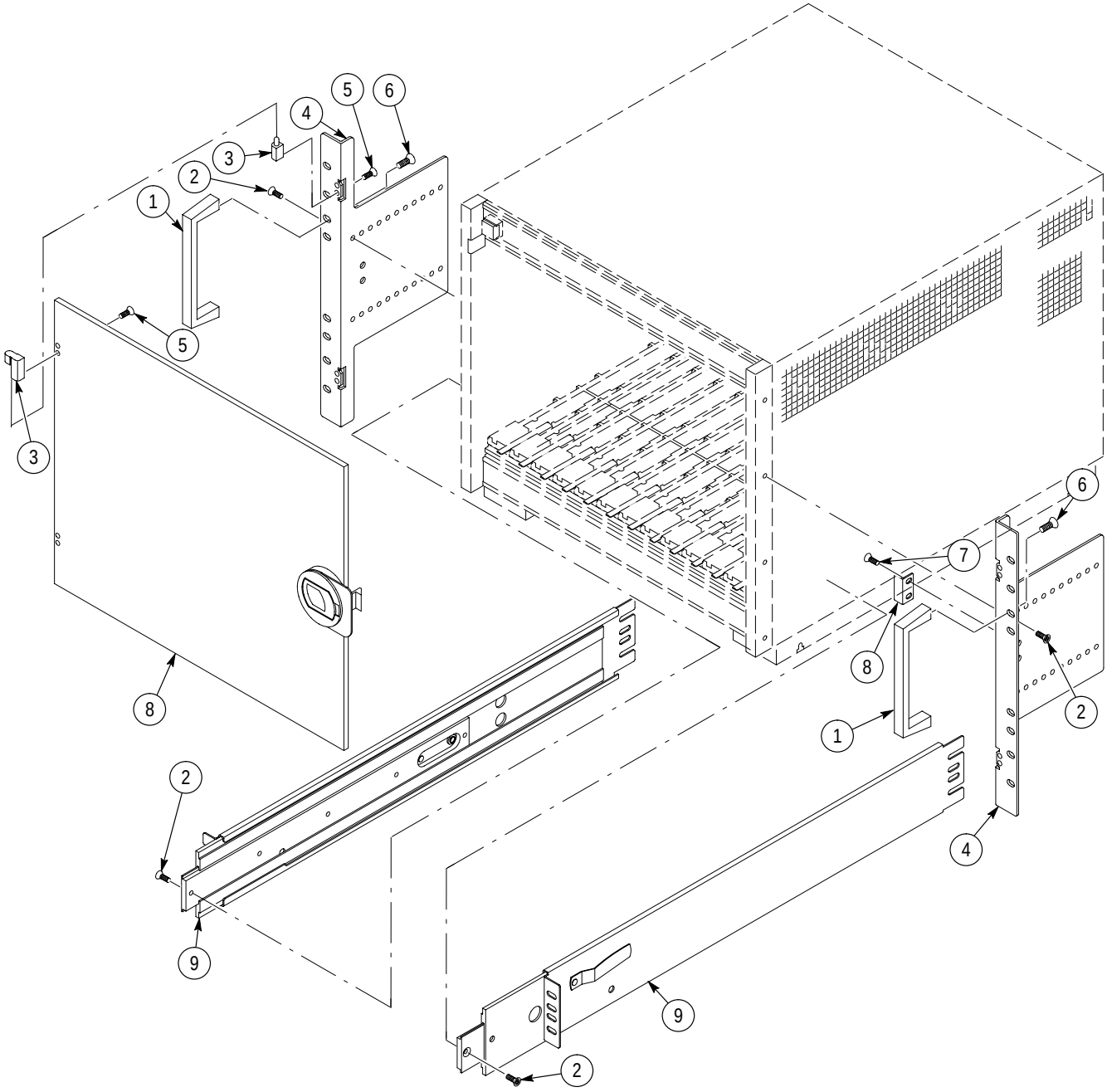


Figure 7–5: 2R Rackmount and Door Assembly

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Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTION 1U CABLE TRAY		
6–0	020–2119–00			1	COMPONENT KIT:CABLE TRAY 1U KIT	80009	020–2119–00
–1	212–0158–00			2	SCREW,MACHINE:8–32 X 0.375,PNH,STL,T–20	0KB01	ORDER BY DESCRIPTION
–2	333–4158–00			1	PANEL,CONN:0.09ALUM	0J9P4	333–4158–00
–3	407–4361–00			1	CABLE TRAY:0.09 ALUMINUM,PAINTED SMOKE TAN	0J9P4	407–4361–00

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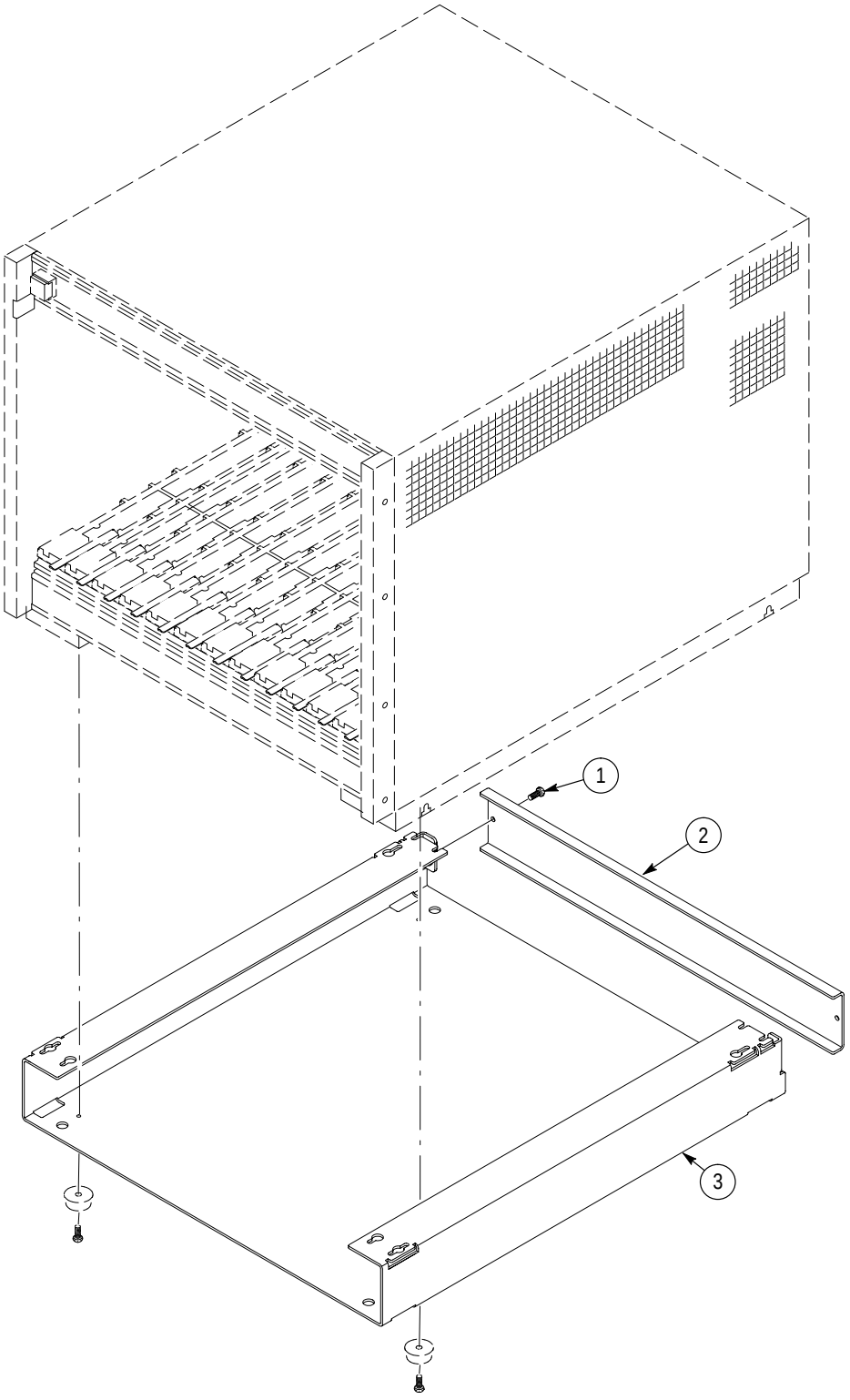


Figure 7–6: Option 1U Cable Tray

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Appendix A: Power Budget Worksheet

Use the Power Budget Worksheet to determine the operating parameters of the VX1411 Mainframe and any installed modules. Enter the steady-state current (I_{MP}) and the dynamic current (I_{MD}) for each module. Add the individual currents to determine the total current needed for each power rail. Calculate the total power for the mainframe.

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Power Requirements

Slot	Module	I_{MP} +5V	I_{MD}	I_{MP} +12V	I_{MD}	I_{MP} −12V	I_{MD}	I_{MP} +24V	I_{MD}	I_{MP} −24V	I_{MD}	I_{MP} −5.2V	I_{MD}	I_{MP} −2V	I_{MD}
0															
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
Total Current of All Modules (I_{MP}, I_{MD})															
VX1411 Current Limit		60A	10A	6A	2A	6A	2A	7A	5A	7A	5A	20A	7A	10A	5A
Individual Current Sums Less Than VX1411 Current Limits?															

Power Calculation (V x total I_{MP})

Total Power < 500W

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Glossary

The terms in this glossary are defined as used in the VXIbus System. Although some of these terms may have different meanings in other systems, it is important to use these definitions in VXIbus applications. Terms which apply only to a particular instrument module are noted. Not all terms appear in every manual.

ACFAIL*

A VMEbus backplane line that is asserted under these conditions: 1) by the mainframe Power Supply when a power failure has occurred (either ac line source or power supply malfunction), or 2) by the front panel ON/STANDBY switch when switched to STANDBY.

A-Size Card

A VXIbus instrument module that is 100.0 × 160 mm × 20.32 mm (3.9 × 6.3 in × 0.8 in), the same size as a VMEbus single-height short module.

Asynchronous Communication

Communications that occur outside the normal "command-response" cycle. Such communications have higher priority than synchronous communication.

Backplane

The printed circuit board that is mounted in a VXIbus mainframe to provide the interface between VXIbus modules and between those modules and the external system.

B-Size Card

A VXIbus instrument module that is 233.4 × 160 mm × 20.32 mm (9.2 × 6.3 in × 0.8 in), the same size as a VMEbus double-height short module.

Bus Arbitration

In the VMEbus interface, a system for resolving contention for service among VMEbus Master devices on the VMEbus.

Bus Timer

A functional module that measures the duration of each data transfer on the Data Transfer Bus (DTB) and terminates the DTB cycle if the duration is excessive. Without the termination capability of this module, a Bus Master attempt to transfer data to or from a non-existent Slave location could result in an infinitely long wait for the Slave response.

Butch Plate

A connector plate that optionally connects to the rear of the cable tray options. The plate can be modified to accept cable connectors thus reducing the number of cables under the VX1411 Mainframe.

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Client
In shared memory protocol (SMP), that half of an SMP channel that does not control the shared memory buffers.

CLK10
A 10 MHz, ±100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to Slots 1–12 on P2. It is distributed to each module slot as a single source, single destination signal with a matched delay of under 8 ns.

CLK100
A 100 MHz, ±100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to Slots 1–12 on P3. It is distributed to each module slot in synchronous with CLK10 as a single source, single destination signal with a maximum system timing skew of 2 ns, and a maximum total delay of 8 ns.

Commander
In the VXIbus interface, a device that controls another device (a servant). A commander may be a servant of another commander.

Command
A directive to a device. There are three types of commands:

In Word Serial Protocol, a 16-bit imperative to a servant from its commander.

In Shared Memory Protocol, a 16-bit imperative from a client to a server, or vice versa.

In a Message, an ASCII-coded, multi-byte directive to any receiving device.

Communication Registers
In word serial protocol, a set of device registers that are accessible to the commander of the device. Such registers are used for inter-device communications, and are required on all VXIbus message-based devices.

Configuration Registers
A set of registers that allow the system to identify a (module) device type, model, manufacturer, address space, and memory requirements. In order to support automatic system and memory configuration, the VXIbus standard specifies that all VXIbus devices have a set of such registers, all accessible from P1 on the VMEbus.

C-Size Card
A VXIbus instrument module that is 340.0 × 233.4 mm × 30.48 mm (13.4 × 9.2 in × 1.2 in).

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Custom Device
A special-purpose VXIbus device that has configuration registers so as to be identified by the system and to allow for definition of future device types to support further levels of compatibility.

Data Transfer Bus
One of four buses on the VMEbus backplane. The Data Transfer Bus allows Bus Masters to direct the transfer of binary data between Masters and Slaves.

Device Specific Protocol
A protocol for communication with a device that is not defined in the VXIbus specification.

D-Size Card
A VXIbus instrument module that is 340.0 × 366.7 mm × 30.48 mm (13.4 × 14.4 in × 1.2 in).

DTB
See Data Transfer Bus.

DTB Arbiter
A functional module that accepts bus requests from Requester modules and grants control of the DTB to one Requester at a time.

DUT
Device Under Test.

ECLTRG
Six single-ended ECL trigger lines (two on P2 and four on P3) that function as inter-module timing resources, and that are bussed across the VXIbus subsystem backplane. Any module, including the Slot 0 module, may drive and receive information from these lines. These lines have an impedance of 50 Ω; the asserted state is logical High.

Embedded Address
An address in a communications protocol in which the destination of the message is included in the message.

ESTST
Extended STart/STop protocol; used to synchronize VXIbus modules.

Extended Self Test
Any self test or diagnostic power-on routine that executes after the initial kernel self test program.

External System Controller
The host computer or other external controller that exerts overall control over VXIbus operations.

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IACK Daisy Chain Driver
The circuit that drives the VMEbus Interrupt Acknowledge daisy chain line that runs continuously through all installed modules or through jumpers across the backplane.

ID-ROM
An NVRAM storage area that provides for non-volatile storage of diagnostic data.

Instrument Module
A plug-in printed circuit board, with associated components and shields, that may be installed in a VXIbus mainframe. An instrument module may contain more than one device. Also, one device may require more than one instrument module.

IntelliGuides
The card guides used in the VX1411 Mainframe. The card guides on the bottom of the mainframe shut off airflow when no modules are installed in the respective slots.

Interface Device
A VXIbus device that provides one or more interfaces to external equipment.

Interrupt Handler
A functional module that detects interrupt requests generated by Interrupters and responds to those requests by requesting status and identity information.

Interrupter
A device capable of asserting VMEbus interrupts and performing the interrupt acknowledge sequence.

IRQ
The Interrupt ReQuest signal, which is the VMEbus interrupt line that is asserted by an Interrupter to signify to the controller that a device on the bus requires service by the controller.

Local Bus
A daisy-chained bus that connects adjacent VXIbus slots.

Local Controller
The instrument module that performs system control and external interface functions for the instrument modules in a VXIbus mainframe or several mainframes. See Resource Manager.

Local Processor
The processor on an instrument module.

Logical Address
The smallest functional unit recognized by a VXIbus system. It is often used to identify a particular module.

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Mainframe
Card Cage. For example, the Tektronix VX1411 Mainframe, an operable housing that includes 13 C-size VXIbus instrument module slots.

Memory Device
A storage element (such as bubble memory, RAM, and ROM) that has configuration registers and memory attributes (such as type and access time).

Message
A series of data bytes that are treated as a single communication, with a well defined terminator and message body.

Message Based Device
A VXIbus device that supports VXI configuration and communication registers. Such devices support the word serial protocol, and possibly other message-based protocols.

MODID Lines
Module/system identity lines.

Physical Address
The address assigned to a backplane slot during an access.

Power Monitor
A device that monitors backplane power and reports fault conditions.

P1
The top-most backplane connector for a given module slot in a vertical mainframe such as the Tektronix VX1411. The left-most backplane connector for a given slot in a horizontal mainframe.

P2
The bottom backplane connector for a given module slot in a vertical C-size mainframe such as the VX1411; or the middle backplane connector for a given module slot in a vertical D-size mainframe.

P3
The bottom backplane connector for a given module slot in a vertical D-size mainframe.

Query
A form of command that allows for inquiry to obtain status or data.

READY Indicator
A green LED indicator that lights when the power-on diagnostic routines have been completed successfully. An internal failure or failure of +5 V power will extinguish this indicator.

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Register Based Device
A VXIbus device that supports VXI register maps, but not high level VXIbus communication protocols; includes devices that are register-based servant elements.

Requester
A functional module that resides on the same module as a Master or Interrupt Handler and requests use of the DTB whenever its Master or Interrupt Handler requires it.

Resource Manager
A VXIbus device that provides configuration management services such as address map configuration, determining system hierarchy, allocating shared system resources, performing system self test diagnostics, and initializing system commanders.

Self Calibration
A routine that verifies the basic calibration of the instrument module circuits, and adjusts this calibration to compensate for short- and long-term variables.

Self Test
A set of routines that determine if the instrument module circuits will perform according to a given set of standards. A self test routine is performed upon power-on.

Servant
A VXIbus message-based device that is controlled by a commander.

Server
A shared memory device that controls the shared memory buffers used in a given Shared Memory Protocol channel.

Shared Memory Protocol
A communications protocol that uses a block of memory that is accessible to both client and server. The memory block operates as a message buffer for communications.

Slot 0 Controller
See Slot 0 Module. Also see Resource Manager.

Slot 0 Module
A VXIbus device that provides the minimum VXIbus slot 0 services to slots 1 through 12 (CLK10 and the module identity lines), but that may provide other services such as CLK100, SYNC100, STARBUS, and trigger control.

SMP
See Shared Memory Protocol.

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STARX
Two (2) bi-directional, 50 Ω, differential ECL lines that provide for inter-module asynchronous communication. These pairs of timed and matched delay lines connect slot 0 and each of slots 1 through 12 in a mainframe. The delay between slots is less than 5 ns, and the lines are well matched for timing skew.

STARY
Two (2) bi-directional, 50 Ω, differential ECL lines that provide for inter-module asynchronous communication. These pairs of timed and matched delay lines connect slot 0 and each of slots 1 through 12 in a mainframe. The delay between slots is less than 5 ns, and the lines are well matched for timing skew.

STST
STart/STop protocol; used to synchronize modules.

SYNC100
A Slot 0 signal that is used to synchronize multiple devices with respect to a given rising edge of CLK100. These signals are individually buffered and matched to less than 2 ns of skew.

Synchronous Communications
A communications system that follows the “command-response” cycle model. In this model, a device issues a command to another device; the second device executes the command; then returns a response. Synchronous commands are executed in the order received.

SYSFAIL*
A signal line on the VMEbus that is used to indicate a failure by a device. The device that fails asserts this line.

System Clock Driver
A functional module that provides a 16 MHz timing signal on the Utility Bus.

System Hierarchy
The tree structure of the commander/servant relationships of all devices in the system at a given time. In the VXIbus structure, each servant has a commander. A commander may also have a commander.

Test Monitor
An executive routine that is responsible for executing the self tests, storing any errors in the ID-ROM, and reporting such errors to the Resource Manager.

Test Program
A program, executed on the system controller, that controls the execution of tests within the test system.

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Test System
A collection of hardware and software modules that operate in concert to test a target DUT.

TTLTRG
Open collector TTL lines used for inter-module timing and communication.

VXIbus Subsystem
One mainframe with modules installed. The installed modules include one module that performs slot 0 functions and a given complement of instrument modules. The subsystem may also include a Resource Manager.

Word Serial Protocol
A VXIbus word oriented, bi-directional, serial protocol for communications between message-based devices (that is, devices that include communication registers in addition to configuration registers).

Word Serial Communications
Inter-device communications using the Word Serial Protocol.

WSP
See Word Serial Protocol.

10-MHz Clock
A 10 MHz, ±100 ppm timing reference. Also see CLK10.

100-MHz Clock
A 100 MHz, ±100 ppm clock synchronized with CLK10. Also see CLK100.

488-To-VXIbus Interface
A message based device that provides for communication between the IEEE-488 bus and VXIbus instrument modules.

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