Instructions

Tektronix

TDS 400 and TDS 400A Field Upgrades: 040-1571-01, TDS4F2F, TDS4F13 & TDS4F5P

063-1496-05

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Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service 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. To avoid electric shock, do not touch exposed connections.

WARNING. *Dangerous shock hazards may be exposed when the oscilloscope cabinet is removed. Before proceeding, ensure the POWER switch is in the OFF position, then disconnect the oscilloscope from the power source. Installation of this kit should only be attempted by qualified service personnel.*

CAUTION. *Many components within this oscilloscope are extremely susceptible to static-discharge damage. Service the oscilloscope only in a static-free environment and always wear a grounded wrist and foot strap. Observe standard handling precautions for static-sensitive devices while installing this update.*

NOTE. *These instructions assume a familiarity with the TDS 400 and TDS 400A Digitizing Oscilloscopes. If additional disassembly or assembly details are required, refer to the Removal and Installation Procedures section of the service manual.*

Introduction

These instructions provide Tektronix-authorized TDS 400 and TDS 400A service sites with the necessary information to install these field upgrade kits. These kits are not to be installed by the customer without written permission from Tektronix. Certain materials within this kit are not to be released outside of Tektronix.

The oscilloscope, with upgrades installed, is to be returned to the customer with the manuals that are included in the kit. A complete set of disks accompany every field upgrade kit ordered. The customers are not to receive this instruction sheet, any firmware, or the Options Key disks that accompany the upgrade kit. These disks are for the sole use of the Tektronix service technician who is responsible for installation of these kits. These disks may be used by the local service site to service this product, or they are to be destroyed.

The enclosed Options Key disk will activate all oscilloscope options the hardware supports. You are authorized to enable only those options specifically ordered by the customer or those shown on the option/serial number label on the rear of the oscilloscope, or those physically present in the oscilloscope. Carefully read and understand the license agreement which comes with the Options Key disk. The license agreements are legal agreements between you and Tektronix, Inc., and the software is protected by United States Copyright laws and international treaty provisions.

The following instructions support all of the upgrade kits. They are written in a modular format. This format allows the service technician to install only those upgrades required by selecting the applicable instructions.

Kit Descriptions and Contents

Table 1 lists the field upgrade kits available for upgrading TDS 400 and TDS 400A oscilloscopes to include the field-installable options. The contents of each field upgrade kit are shown in Table 2.

Table 1: Kit Descriptions

Kit	040-1571-01	TDS4F2F	TDS4F13	TDS4F5P
Features				
Oscilloscope	TDS 400	TDS 400 TDS 400A	TDS 400 TDS 400A	TDS 400 TDS 400A
Version 2.1 or Greater Firmware	✓			
Advanced DSP Math Functions		✓		
RS-232/Centronics Port			✓	
Printer Pack				✓

✓ **Indicates features included in kit.**

Table 2: Kit Contents

Kit	040-1571-01	TDS4F2F	TDS4F13	TDS4F5P
Contents				
Instruction Sheet	✓	✓	✓	
TDS 400 Firmware Disk	✓			
Options Key Disk(s)	✓	✓	✓	
Instruction Manual (Option 13)[1]			✓	
Instruction Manual (Option 2F)[1]		✓		
Instruction Manual (Option 3P)[1]				✓
Programmer Manual[1]	✓			
Performance Verification Manual[1]	✓			
Rear Panel[1]	✓			
Options Label	✓	✓		
Circuit Board Assembly[1]			✓	
Printer Pack[1]				✓
Label	✓			

✓ **Indicates features included in kit.**

[1] **Indicates portions of upgrade kit to be sent to the customer**

NOTE. *Option 3P Printer Pack, packaged as received, is to be shipped to the customer. Option 3P is a customer installed option and is shipped with instructions for installation.*

Upgrade Installation Sequence

It is recommended that the following sequence be used when installing the field upgrades.

1. Install the hardware.
2. Install the firmware.
3. Install the options.
4. Perform a signal path compensation.

Separate sections follow describing the steps required to perform the upgrade.

Hardware Installation

This section describes the steps necessary to install the RS-232/Centronics interface circuit board.

When installing the 040-1571-XX kit, only the rear panel is replaced. Follow steps 1 through 3 of *Rear Panel and Cabinet Removal*, page 5 of this section, and steps 1 through 3 of *Replace Cabinet and Rear Panel* on page 8 of this section. It is not necessary to remove the cabinet when replacing only the rear panel.

When installing TDS4F2F the only hardware change required is replacement of the Options label on the rear panel.

Rear Panel and Cabinet Removal

Equipment Required: One screwdriver with a size T-15 Torx® tip.

1. Install the front cover. Set the oscilloscope face down with the front cover on the work surface and the bottom facing up (see Figure 1).
2. Unplug the power cord from its receptacle at the rear panel.
3. Using the screwdriver with size T-15 Torx® tip, remove the four screws (number 2 in Figure 1) securing the rear panel (number 1) to the oscilloscope. Lift off the rear panel. Note installed options marked on rear panel for later reassembly. Discard rear panel.

NOTE. *Existing rear panel is replaced by the new rear panel included in this kit. All installed options must be marked on the new rear panel Options label.*

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4. Remove the single T-15 Torx® screw at the left side of the oscilloscope (number 4).
5. Grasp the two handle hubs and pull them outward as if to rotate the handle.
6. While holding the handle hubs pulled out, lift the cabinet (number 3) upwards to slide it off the oscilloscope. Take care not to bind or snag the cabinet on the internal cabling of the oscilloscope as you remove it.

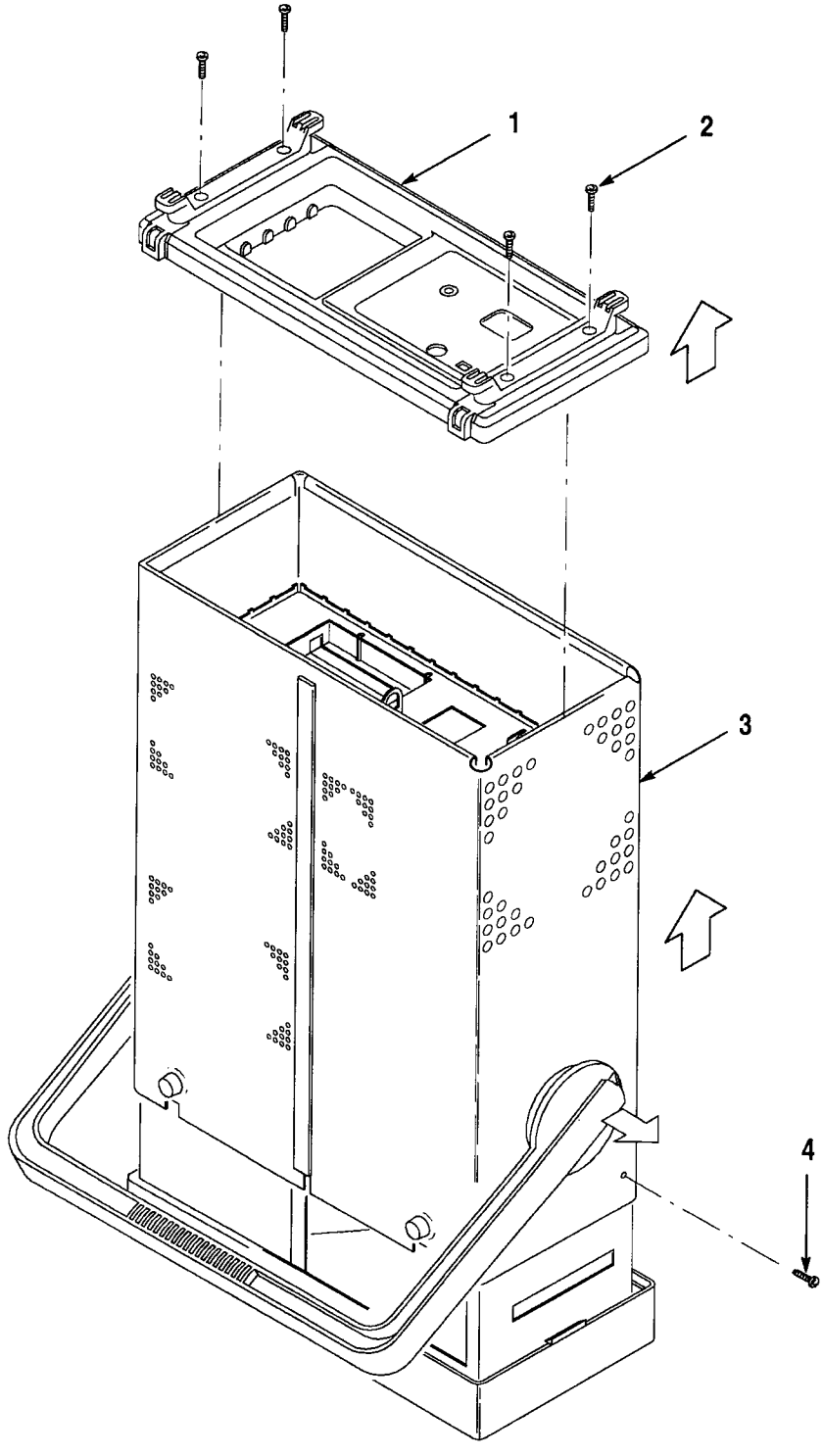

Figure 1: Oscilloscope Rear Panel and Cabinet Removal

Blank Plate Removal (Option 13 Only)

Equipment Required: One screwdriver with a size T-15 Torx® tip.

1. Remove the three board supports (number 4 in Figure 2) by depressing the snap lock at the bottom end of the board support and tilting it outwards. The tabbed top end slips out of a notch in the top rail.
2. Using the screwdriver with size T-15 Torx® tip, remove the two screws on the back and the two screws on the side (numbers 1 and 2).
3. Remove the two blank plates near the top of the oscilloscope.

Circuit Board Assembly Installation (Option 13 Only)

Equipment Required: One screwdriver with a size T-15 Torx® tip and one torque driver set at 8 inch-lbs (9.2 cm-kg) torque.

1. Slide circuit board assembly (number 3 in Figure 2) into the chassis. Make sure the circuit board firmly plugs into J1 of the backplane assembly.
2. Perform steps 1 and 2 of *Blank Plate Removal* in reverse order. Tighten all four screws with torque driver.

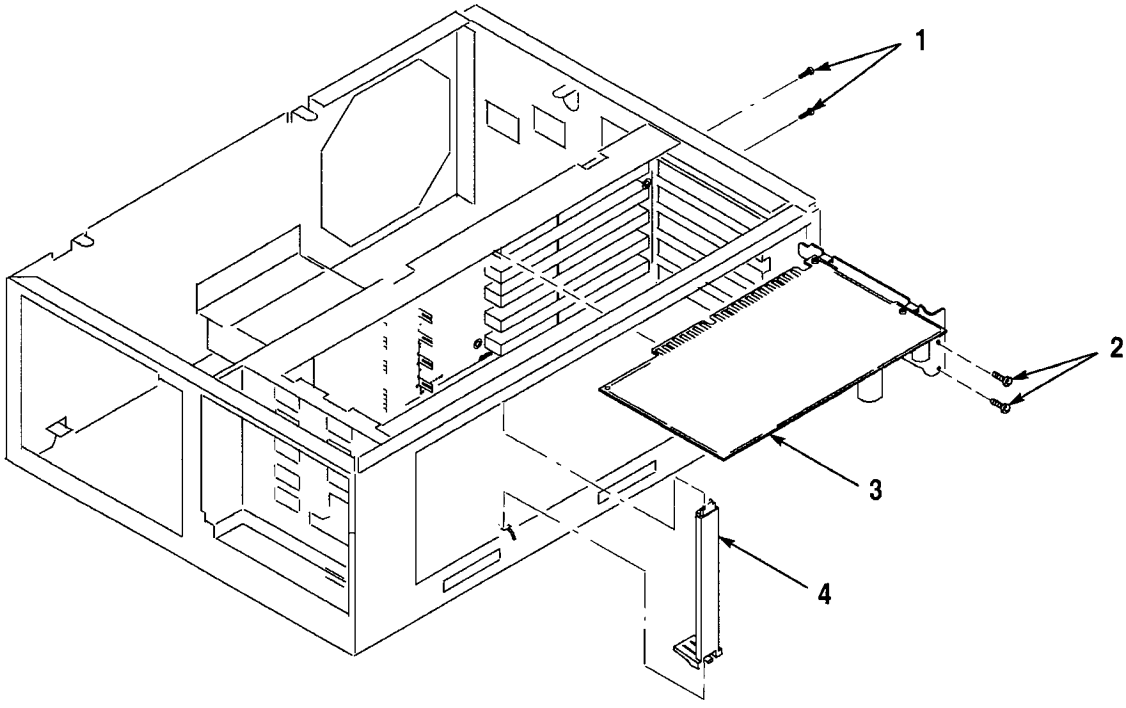

Figure 2: A23 Option 13 Assembly Installation

Replace Cabinet and Rear Panel

Equipment Required: One screwdriver with a size T-15 Torx® tip and one torque driver set at 8 inch-lbs (9.2 cm-kg) torque.

1. Perform step 1 of the *Rear Panel and Cabinet Removal* procedure on page 5.
2. Perform in reverse order steps 2 through 6 of the *Rear Panel and Cabinet Removal* procedure on page 5. Tighten all five screws with torque driver.
3. Mark all installed options on Options label, located on new rear panel, with a black permanent marker. Make sure all previously installed options are also included.

Load Firmware

For the TDS 400: Version 2.1, or greater, firmware must be installed and the RS-232/Centronics option enabled before diagnostics can be performed on the RS-232/Centronics Hardcopy Interface. Proceed to *Firmware Installation* on page 11, then *Options Installation* on page 15. Once completed, the following *Diagnostics* can be performed.

For the TDS 400A: Option 13 must be enabled before diagnostics can be performed. Proceed to *Firmware Installation*, on page 11, and then *Options Installation* on page 15. Once completed, you can perform the following *Diagnostics*.

Diagnostics

The oscilloscope has two levels of internal diagnostics: short confidence and extended. The oscilloscope automatically executes the short set at power on. If the hardcopy feature fails the short diagnostic routine, use the following procedure to execute the extended diagnostics.

Executing Extended Diagnostics Routine

Prerequisites: Power on the oscilloscope and allow a 20 minute warm-up before doing this procedure.

1. Press **SHIFT UTILITY** → **System** (main) → **Diag/Err** (pop-up) → **Area** (main) → **All** (pop-up) → **Execute** (main) → **OK Confirm Run Test** (side).

   The internal diagnostics routine checks oscilloscope functions, but does not check printer function. When finished, the oscilloscope displays an on-screen report of any failed modules, features, or interfaces.

2. If the hardcopy feature fails diagnostics, verify all cables are securely seated and have not been damaged.

3. If the hardcopy feature continues to fail diagnostics, order a replacement RS-232/Centronics circuit board (see the *Parts List* on page 9) then follow the *Hardware Installation* procedure beginning on page 5.

4. To produce a hard copy refer to *Operating Information* in the TDS Family Option 13 Instruction Manual.

Option 13 Replaceable Parts

Fig & Index No.	Part Number	Qty	Name & Description
3-1	671-2756-XX	1 ea	CIRCUIT BD ASSY:RS232/CENTRONICS
3-2	174–2612–XX	1 ea	CA ASSY,SP,ELEC:LOW PROFILE,RS232
3-3	407–4238–XX	1 ea	BRACKET,CKT BD:
3-4	348–1279–XX	1 ea	GASKET,EMI:VIDEO (OUT),SST
3-5	348–1350–XX	1 ea	GASKET,EMI:25 PIN D,CENTRONICS
3-6	214–3903–XX	4 ea	SCREW,JACK:4–40 X 0.312 L,HEX HD
3-7	174–3013–XX	1 ea	CA ASSY,SP,ELEC:CENTRONICS
3-8	213–0882–XX	2 ea	SCREW,TPG,TR:6–32 X 0.437 TAP-TITE,PNH,STL
			STANDARD ACCESSORIES
	070–8567–XX	1 ea	MANUAL,TECH:INSTRUCTION

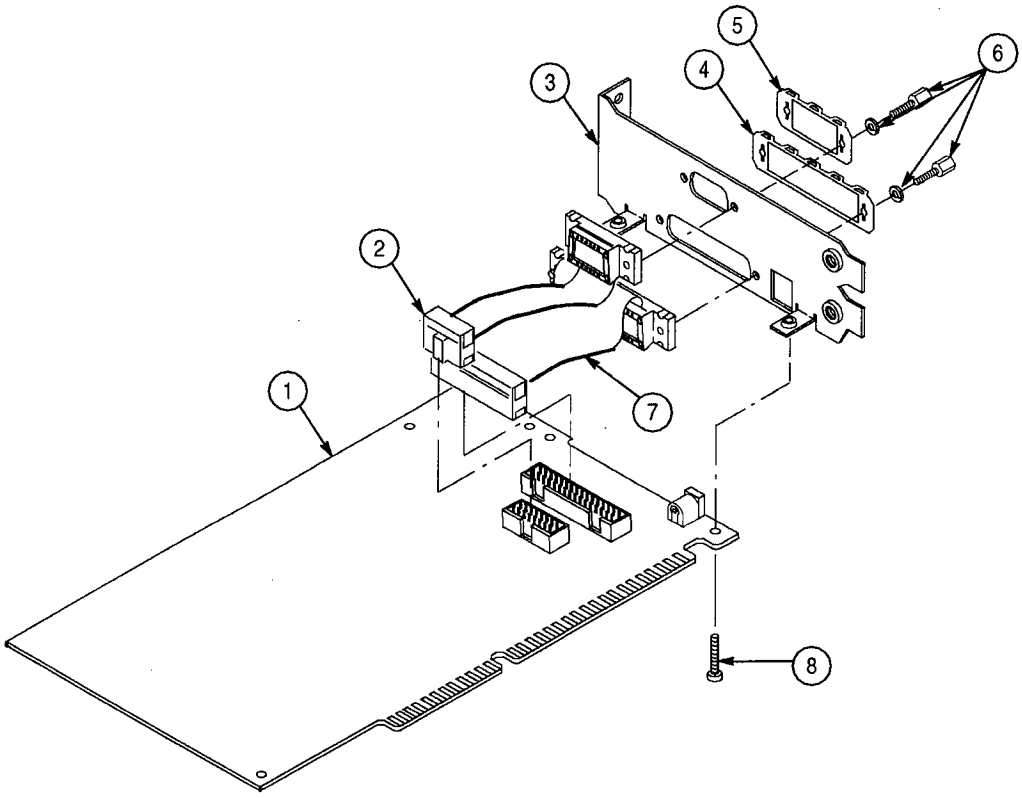

Figure 3: RS-232/Centronics Hardcopy Interface Replaceable Parts

Firmware Installation (TDS 400 Only)

The firmware disks received with this field upgrade kit are the latest versions available. Firmware may be downloaded into the oscilloscope directly from the firmware floppy disk, Tektronix part number 063-1130-XX, or from the hard disk in the computer. It is most efficient to install the firmware onto the computer hard disk, and then download the firmware from the hard disk into the oscilloscope.

This process downloads the base code of the oscilloscope with all options disabled. Options supported by the firmware are enabled by using an external software program. This procedure is described in the *Options Installation* on page 15.

NOTE. *For TDS 400 oscilloscopes with serial numbers B020000 and below use firmware version 2.5.5 and Options Key disk version 2.5.5 (063-1130-XX and 063-1132-XX [TDS 420 and TDS 460]).*

Installation on Hard Disk

Equipment Required: IBM PC or equivalent.

1. Insert the new firmware disk into the floppy disk drive.
2. Move to the floppy drive containing the disk (A:).
3. From the DOS prompt enter:

   `hdinstal <space><drive>:\<oscilloscope type.firmware>`

   Press **Return**.

Example: `hdinstal c:\400fw.21`

Loading Firmware

Equipment Required: IBM PC or equivalent.

NOTE. *To load new firmware the NVRAM protect switch MUST be set to the unprotected position while the TDS oscilloscope power is OFF. Changing the position of the NVRAM protect switch with the oscilloscope running, may cause the NVRAM to be mis-programmed.*

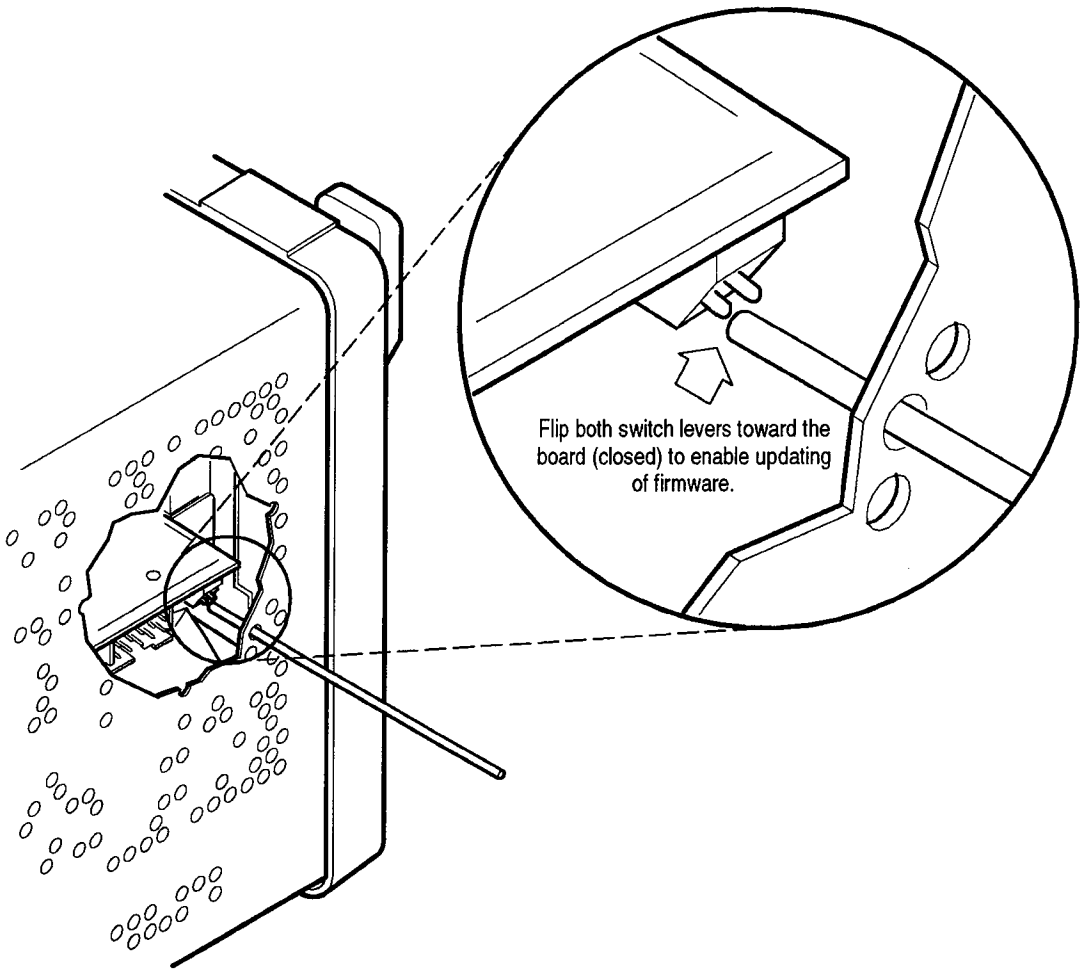

Figure 4: Accessing the Protection Switch

1. Turn oscilloscope power OFF.
2. Set Protection switch to the *unprotected* position. See Figure 4 and the following *NOTE.*

NOTE. *You must set both switches of the Protection switch to the unprotected position before updating the firmware. Figure 4 shows how to set the switch. After loading the firmware, be sure you set both switches back to the protected position and cycle power.*

3. Turn oscilloscope power ON.
4. To load oscilloscope firmware, move to the disk and directory containing the firmware and enter:

   ```
   loadfw
   ```

   Press **Return.**

   This starts the program execution.
5. Highlight the **Firmware** window and press **Return**.
6. Highlight the **Load TDS4XX Vx.x** window and press **Return**. A series of blue screens will indicate activity and give an indication of how close the program is to completion. When the process is complete, the program will return to the main menu and display the message, **Flash memory is write enabled.**
7. Set the Protection switch to the *protected* position. The message **Flash memory is not write enabled** will be displayed.
8. Select **Quit** and exit the program. Firmware loading is now complete.
9. Turn oscilloscope power OFF.

NOTE. *If options are to be installed, omit Step 10, and proceed to Options Installation on page 15. Return to step 11 once options have been installed.*

10. Remove the protective backing from the kit identification label and place it on a clean, dry area to the side of the GPIB and VGA connectors, opposite the Options label located on the oscilloscope rear panel. This label indicates that the kit has been installed.

NOTE. *Installation of V2.1, or greater, firmware in a TDS 400 oscilloscope does not require recalibration. Performing Signal-Path Compensation uses the calibration data already present in the TDS 400.*

11. Turn oscilloscope power ON. The first time the oscilloscope executes power-up diagnostics, a diagnostics status menu appears indicating a cal initialization failure. This is normal. Allow a 20 minute warm-up before performing the next step.

12. Press **SHIFT UTILITY** → **System** (main) → **Cal** (pop-up) → **Signal Path** (main) → **OK Compensate Signal Paths**(side).

When signal-path compensation has completed, the oscilloscope is in the same state of calibration as before the loading of the new firmware.

Options Installation

The Options Key disks and enabling options features are authorized for use only by Tektronix personnel or personnel who have written permission from Tektronix to perform this function. Contact Beaverton Service Support for additional information regarding this policy.

The enclosed Options Key disks will enable all oscilloscope options the hardware supports. You are authorized to enable only those options specifically ordered by the customer, or those shown on the option/serial number label on the rear of the oscilloscope, or physically present in the oscilloscope. Carefully read and understand the license agreement which comes with the Options Key disks. The license agreements are legal agreements between you and Tektronix, Inc., and the software is protected by United States Copyright laws and international treaty provisions.

The options supported by firmware are enabled and/or disabled by use of an external software program. The program is located on the Options Key disk. The program may be executed from either the floppy disk or from the hard disk.

NOTE. *For TDS 400 oscilloscopes with serial numbers B020000 and below use firmware version 2.5.5 and Options Key disk version 2.5.5 (063-1130-XX and 063-1132-XX [TDS 420 and TDS 460] or 063-2038-XX [TDS 410] respectively). For the TDS 400A use Options Key disk 063-2123-XX.*

Installation on Hard Disk

Equipment Required: IBM PC or equivalent.

1. Insert the Options Key disk into the floppy disk drive.
2. Move to the floppy drive containing the disk (A:).
3. From the DOS prompt enter:

   `hdinstal <space><drive>:\<oscilloscope type.option>`

   Press **Return.**

Example: `hdinstal c:\400opt.21`

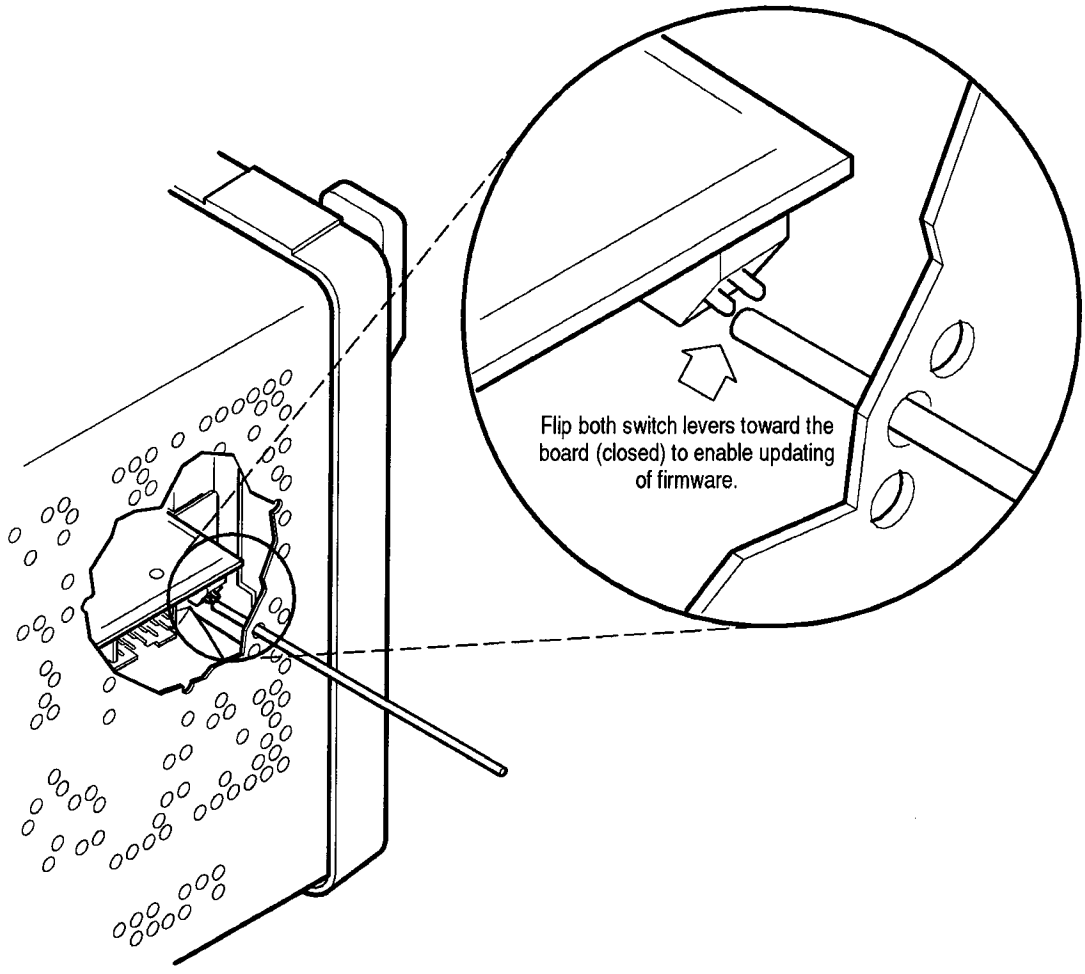

Figure 5: Accessing the Protection Switch

Loading Software

Equipment Required: IBM PC or equivalent.

NOTE. *To enable options the NVRAM protect switch MUST be set to the unprotected position while the oscilloscope power is OFF. Changing the position of the NVRAM protect switch with the oscilloscope running may cause the NVRAM to be mis-programmed.*

1. Turn oscilloscope power OFF.
2. Set Protection switch to the *unprotected* position. See Figure 5 and the following *NOTE*.

NOTE. *You must set both switches of the Protection switch to the unprotected position before updating the firmware. Figure 5 shows how to set the switch. After loading the firmware, be sure you set both switches back to the protected position and cycle power.*

3. Turn oscilloscope power ON.

Enable Options

Equipment Required: IBM PC or equivalent.

1. To enable options, move to the disk and directory containing the firmware.
2. Newer software to enable options uses a DOS command line style interface. Older software to enable options uses pull-down menus. If you have the older software, skip to step 9.
3. To install newer firmware for options type, `setopt` and press **Return**.

NOTE. *This program determines which options are installed in the oscilloscope (RS-232/Centronics, Extended Memory, and File System). If an option is not installed, the program will not display the status of that option.*

4. In response to the `Enable?` question for each option, type `Y` if you want to enable the firmware for that option or `N` is you do not want to enable firmware for that option.
5. When the program completes execution it should display `(A)ccept or (C)hange?` Type `A`.
6. When the program completes execution it should display `(A)bort or (C)ontinue?`
7. Set the Protection switch to the *Protected* position. See Figure 5.
8. Type `C`. Skip to step 14.
9. To enable or disable oscilloscope options, move to the disk and directory containing the firmware. On the PC:

   Type `loadopt`

   Press **RETURN**.

   This starts the program.

10. In the PC, highlight the **Options** window and press **Return**

11. Highlight the **Set Option Status** window and press **Return**.

The program will return the status of each option (enabled or disabled) and ask the user if status of the option should be changed.

NOTE. *This program determines which options are installed in the oscilloscope (RS-232/Centronics, Extended Memory, and File System). If an option is not installed, the program will not display the status of that option.*

12. To exit, highlight **Quit**, press **Return**, highlight **Exit**, press **Return**.

13. Set the Protection switch to the *Protected* position. See Figure 5.

14. Turn oscilloscope power OFF.

15. Remove the protective backing from the kit identification label and place it on a clean, dry area to the side of the GPIB and VGA connectors, opposite the Options label located on the oscilloscope rear panel. This label indicates that the kit has been installed.