

Service Manual



DPO4000 Series Digital Phosphor Oscilloscopes 071-1844-00

This document applies to firmware version 1.00 and above.

Warning

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

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- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty 16

Tektronix warrants that the product will be free from defects in materials and workmanship for a period of three (3) years from the date of original purchase from an authorized Tektronix distributor. If the product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Batteries are excluded from this warranty. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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

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

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

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

Connect and Disconnect Properly. 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.

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

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

Connect the probe reference lead to earth ground only.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

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.



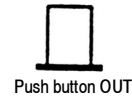
CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.

Symbols and 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.

The following symbols may appear on the product:



Service Safety Summary

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

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

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

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

To avoid electric shock, do not touch exposed connections.

Environmental Considerations

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

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

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



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

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

Restriction of Hazardous Substances

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

Preface

This Service manual provides information to troubleshoot, disassemble, and replace parts on the DPO4000 Series Digital Phosphor Oscilloscopes.

Manual Conventions

This manual uses certain conventions that you should become familiar with before attempting service.

Modules Throughout this manual, any replaceable component, assembly, or part is referred to by the term *module*. A module is composed of electrical and mechanical assemblies, circuit cards, interconnecting cables, and user-accessible controls.

Replaceable Parts This manual refers to any field-replaceable assembly or mechanical part specifically by its name or generically as a replaceable part. In general, a replaceable part is any circuit board or assembly, such as the hard disk drive, or a mechanical part, such as the I/O port connectors, that is listed in the replaceable parts list.

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

Related Documentation

To read about	Use these documents
Installation and Operation	<i>DPO4000 Series Digital Phosphor Oscilloscopes User Manual</i> (available in 11 languages)
Specifications and Performance	<i>DPO4000 Technical Reference</i> (PDF only)
Programmer Commands	<i>DPO4000 Programmer Manual</i> (PDF only)
Analysis and Connectivity Tools	<i>Getting Started with OpenChoice™ Solutions Manual</i>
Installing and testing applications modules	<i>DPO4000 Series Application Modules Installation Instructions Manual</i>



Operating Information

Operating Information

For information on installing and operating your DPO4000 Series Digital Phosphor Oscilloscope, please refer to the *DPO4000 Series Digital Phosphor Oscilloscopes User Manual*. This manual is available on the Web at www.tektronix.com.



Theory of Operation

Theory of Operation

This chapter describes the electrical operation of the oscilloscope to the module level. Figure 2-1 shows the oscilloscope module interconnections.

Block Diagrams

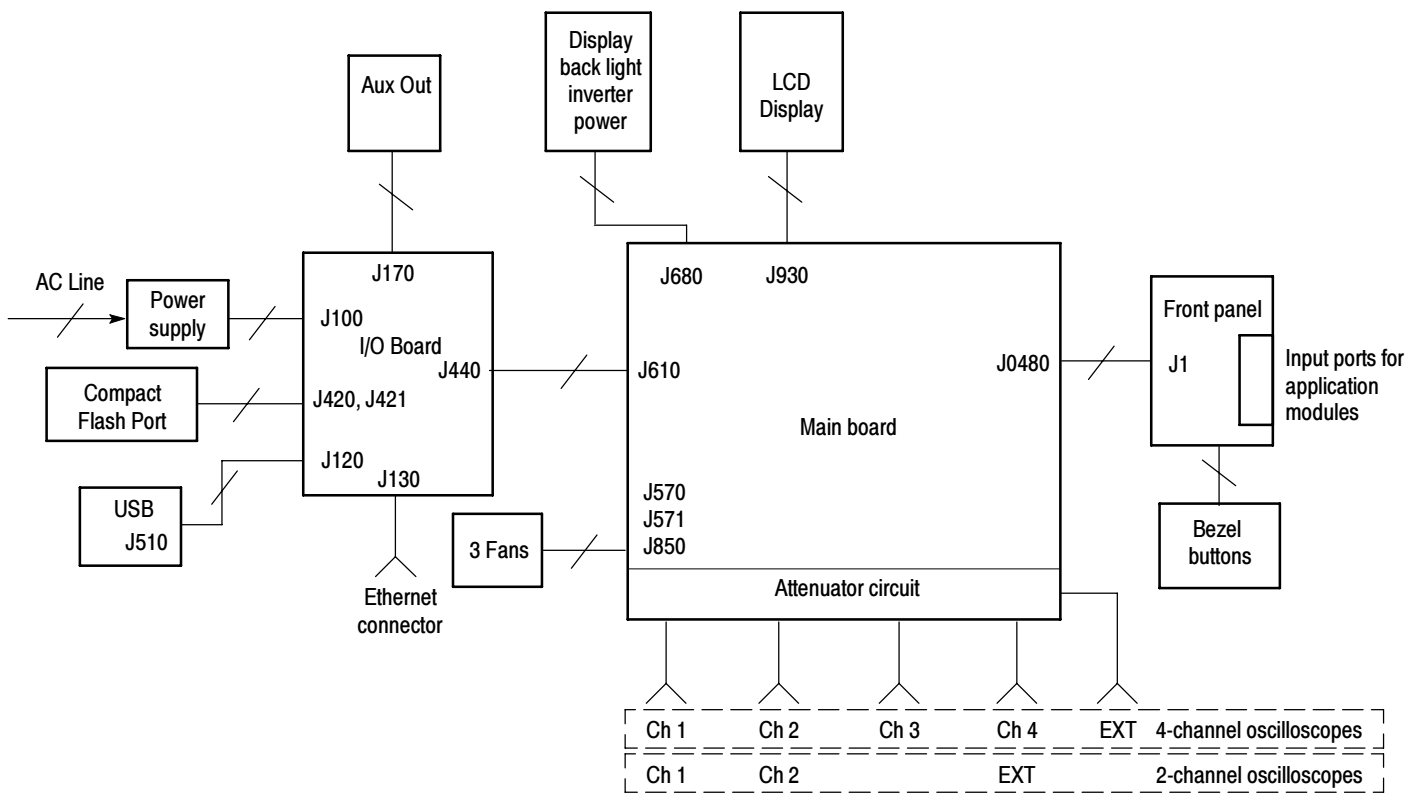


Figure 2-1: DPO4000 series block diagram

Power Supply

The power supply converts AC line voltage to +12V to power all internal circuits.

I/O Board

The I/O board contains USB ports, Compact Flash port, an Ethernet connector, TekLink, XGA Video, and a Trigger Out port.

Main Board

The main board module contains the following functions:

Acquisition System

The acquisition system begins with the analog signal path and ends with a digitized signal in memory. The signal enters a channel input, and then passes through an attenuator and preamplifier. The analog signal from each preamplifier goes through a digitizer, a time base controller, and then into acquisition memory. The analog signal from each preamplifier is also distributed to a trigger circuit.

Trigger System

The trigger system processes the analog signals from the preamplifiers and sends trigger information to the time base controller. Advanced trigger functions are enabled only when the appropriate application modules and supporting software are installed.

Display System

The display system combines live waveform data from acquisition memory with menus and text and stores this information in display memory. It then uses this data to refresh the XGA display module (LCD).

Processor System The processor system contains a 440EP Power PC microprocessor that controls the entire instrument. The processor system also contains FLASH ROM, system RAM, and interfaces to USB ports and a Compact flash slot.

Power Converter The power converter receives +12V from the main power supply and generates voltages for the analog and digital circuitry on the main board.

Front-Panel Board

The front-panel board contains a microprocessor that reads the front-panel buttons and controls, and then sends this information to the processor system on the main board. The front-panel board also generates the probe compensation output signal and provides an interface to the application modules.



Adjustment Procedures

Adjustment Procedures

This chapter contains the factory adjustment procedures for the DPO4000 series oscilloscopes. Only qualified personnel should perform adjustment procedures. Read the *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

NOTE. *The voltage references inside the oscilloscope are very stable over time and should not require routine adjustment. Before performing any procedure in this chapter, do the Performance Verification procedures to check whether the oscilloscope meets specifications. See the DPO4000 Technical Reference.*

Successful completion of this adjustment procedure automatically updates the instrument Calibration Due date and time. (Completion of the Performance Verification procedure does not update the instrument Calibration Due date and time.)

Required Equipment

The following equipment, or a suitable equivalent, is required to complete these procedures.

Description	Minimum requirements	Example
DC voltage source	50 mV to 70 V, $\pm 0.1\%$ amplitude accuracy	Wavetek 9500 Oscilloscope Calibrator with one 9510 Output Module
Sine Generator	1 GHz	Wavetek 9500 with 9530 output modules
Edge Generator	1 kHz with < 50 ps ch-ch skew	
50 Ω BNC cable	BNC male to BNC male, ≈ 10 in (25 cm) long	Tektronix part number 012-0208-00
Adjustment tool	Non conducting shaft with diameter ≤ 2.5 mm (≤ 0.1 in)	Tektronix part number 003-1433-00

Overview of the Adjustment Process

Before performing adjustment procedures, you must warm up the oscilloscope at least ten minutes in an ambient temperature between 20 °C and 30 °C. Adjustments performed before warm-up or outside this temperature range may result in poor performance.

The factory adjustment procedure consists of a series of steps; as you move through these steps, the oscilloscope display provides instructions that describe the specific input signal requirements for each step. If the the oscilloscope passes the step, it moves on to the next step. If the oscilloscope fails, you can repeat the step or choose to abort the procedure.

NOTE. *Do not turn any knobs or push any front-panel buttons other than the Next Step or Previous Step buttons during the adjustment procedure. Doing so will cause the oscilloscope to abort the adjustment procedure. The oscilloscope uses the previous calibration constants if the adjustment procedure is aborted.*

The screen does not display the actual oscilloscope settings (such as channel input impedance or vertical and horizontal settings) during the adjustment procedure. The oscilloscope automatically sets the instrument settings, but these settings may not read out correctly on the display.

During some steps, the instrument may appear to be idle for several minutes while it is processing information internally.

If the oscilloscope completes all steps in the procedure successfully, a “Pass” message is displayed and the new calibration constants take effect. If the oscilloscope does not pass the procedure, the oscilloscope reverts to the previous calibration settings.

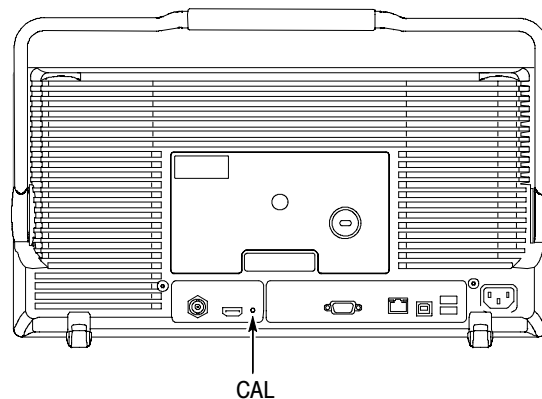
Factory Adjustment Procedure

To perform the factory adjustment procedure, do these steps:

1. Connect the oscilloscope to an AC power source.

NOTE. You must connect the oscilloscope and the test equipment to the same AC power circuit. Connect the oscilloscope and test instruments to a common power strip if you are unsure of the AC power circuit distribution. Connecting the oscilloscope and test instruments to separate AC power circuits can result in offset voltages between the equipment, which can invalidate the adjustment procedure.

2. Locate the hole in the rear panel that provides access to the CAL switch on the rear panel.



3. Insert the adjustment tool into the CAL switch hole. Use the tool to push and hold the CAL switch in while you power on the oscilloscope. Release the switch when the oscilloscope shows the power-on message with the oscilloscope graticule in the background.
4. Push the **Default Setup** button.

NOTE. Do not skip the recall Default Setup step. You must recall the factory settings in order to correctly start the factory adjustment procedure.

5. Push the **MENU OFF** button.
6. Push the **UTILITY** button.
7. Push the **System Config** lower bezel button repeatedly to select **Calibration**.

8. Push the **Factory** lower bezel button.
9. Push the **OK Do Factory Calibration** side bezel button to start the adjustment process.
10. Connect signals from the DC voltage source as instructed by the oscilloscope display. After you connect the correct signal, push the **OK Do Next Step** side bezel button to continue the process.

NOTE. *The oscilloscope adjusts itself automatically using the reference signal from the DC voltage source. You do not need to make any adjustments.*

*If you make an error, such as connecting the wrong input signal, you can repeat the last step by pushing the **Return to Previous Screen** side bezel button.*

11. Continue with the adjustment process until it is complete. You can abort the process at any time by pushing the **MENU OFF** button.
12. Do the performance verification tests to verify that the adjustment procedure has correctly calibrated the oscilloscope. (See the *DPO4000 Technical Reference*.) Incorrect use of calibration equipment can cause the oscilloscope to pass the adjustment procedure but fail performance verification.



Maintenance

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the oscilloscope as well as repackaging instructions if you need to return the oscilloscope to Tektronix for service.

Preventing ESD

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



CAUTION. *Static discharge can damage any semiconductor component in this oscilloscope.*

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

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

Inspection and Cleaning

Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent oscilloscope malfunction and enhance its reliability.

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

How often you do maintenance depends on the severity of the environment in which the oscilloscope is used. A proper time to perform preventive maintenance is just before oscilloscope adjustment.

General Care

The cabinet helps keep dust out of the oscilloscope and should normally be in place when operating the oscilloscope.

Flat Panel Display Cleaning

The display is a soft plastic display and must be treated with care during cleaning.



CAUTION. *Improper cleaning agents or methods can damage the flat panel display.*

Avoid using abrasive cleaners or commercial glass cleaners to clean the display surface.

Avoid spraying liquids directly on the display surface.

Avoid scrubbing the display with excessive force.

Clean the flat panel display surface by gently rubbing the display with a clean-room wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation).

Interior Cleaning

Use a dry, low-velocity stream of air to clean the interior of the chassis. Use a soft-bristle, non-static-producing 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.



WARNING. *To avoid injury, power down the instrument and disconnect it from line voltage before performing any procedure that follows.*

Exterior Cleaning

Clean the exterior surfaces of the chassis 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 chassis that may damage the chassis.

Clean the On/Standby switch using a dampened cleaning towel. Do not spray or wet the switch directly.



CAUTION. Avoid the use of chemical cleaning agents, which might damage the plastics used in this oscilloscope. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Lubrication. There is no periodic lubrication required for this oscilloscope.

Exterior Inspection

Inspect the outside of the oscilloscope for damage, wear, and missing parts, using Table 4-1 as a guide. Immediately repair defects that could cause personal injury or lead to further damage to the oscilloscope.

Table 4-1: External inspection check list

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

If the display is very dirty, moisten the wipe with distilled water or a 75% isopropyl alcohol solution and gently rub the display surface. Avoid using excess force or you may damage the plastic display surface.



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

Interior Inspection

To access the inside of the oscilloscope for inspection and cleaning, refer to the *Removal Procedures* in this section.

Inspect the internal portions of the oscilloscope for damage and wear, using Table 4-2 as a guide. Repair any defects immediately.

If any circuit board is repaired or replaced, check Table 4-2 to see if it is necessary to adjust the oscilloscope.



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

Table 4-2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove and replace damaged circuit board.
Resistors	Burned, cracked, broken, blistered condition.	Remove and replace damaged circuit board.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove and replace damaged circuit board.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

Cleaning Procedure — Interior. To clean the oscilloscope interior, do the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in isopropyl alcohol (75% solution) and rinsed with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

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

If steps 1 and 2 do not remove all the dust or dirt, the oscilloscope may be spray washed using a solution of 75% isopropyl alcohol by doing the following steps:

1. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal Procedures*).
2. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
3. Use hot (120 °F to 140 °F) deionized water to thoroughly rinse them.
4. Dry all parts with low-pressure, deionized air.
5. Dry all components and assemblies in an oven or drying compartment using low-temperature (125 °F to 150 °F) circulating air.

Overview of Removal Procedures

Refer to Figures 4-1 and 4-2 for the location of modules that you are removing or installing. If you are disassembling the instrument for cleaning, refer to the *Inspection and Cleaning* procedure on page 4-1 for instructions.

List of Modules

The *Mechanical Parts List* chapter provides a list of all replaceable modules. Any replaceable component, assembly, or part is referred to by the term module.



WARNING. Only qualified personnel should perform service procedures. Before doing this or any other procedure in this manual, read the General Safety Summary and Service Safety Summary located at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to electrical components, read Preventing ESD on page 4-1.

Tools Required

You will need the following tools to remove and replace all the modules in the instrument.

- Torque-limiting screwdriver, 12 in · lb (1.3 N · m) range with TORX T-15 tips. (If you are using a magnetic screwdriver with interchangeable bits, the T-15 bit must be a long bit, at least 5 cm (2 in) overall length.)
- Screwdriver with $\frac{1}{8}$ inch flat blade
- Phillips screwdrivers with P0 and P2 tips
- $\frac{3}{16}$ inch nut driver
- Needle-nose pliers

Trim, Cabinet, and Module Removal

Use the following tables to remove the trim, cabinet, and internal modules.



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

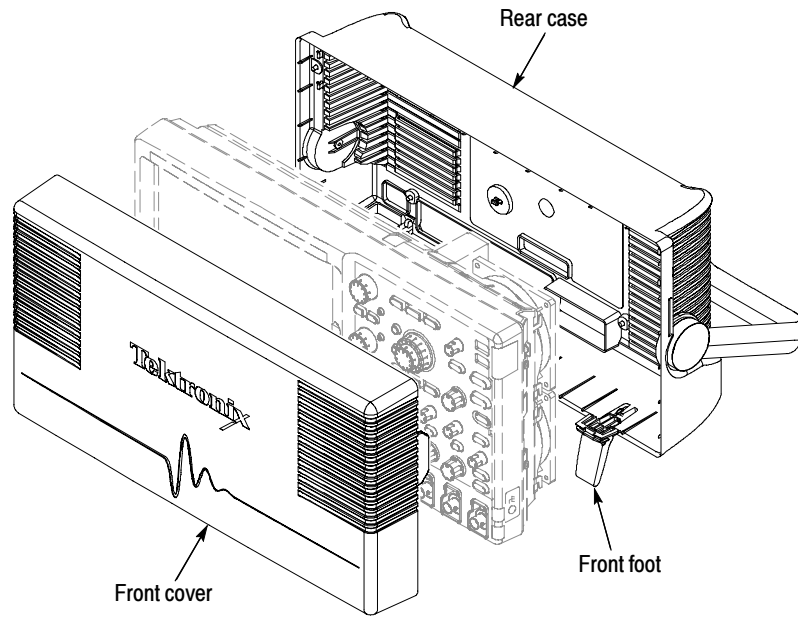


Figure 4-1: Locator for trim and cabinet removal

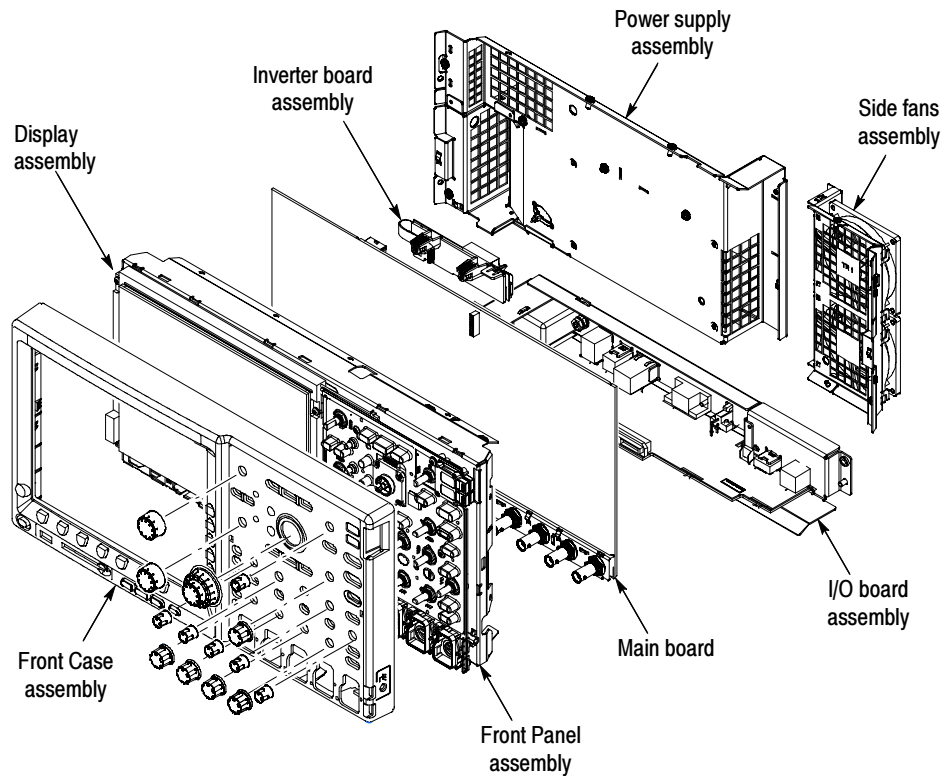


Figure 4-2: Locator for internal modules

Removal Procedures

These procedures assume you have access to the module that you are removing. Refer to the exploded drawings on pages 5-4 through 5-12 and to Figures 4-1 and 4-2, on pages 4-7 and 4-8 to determine which trim and or modules to remove.



CAUTION. When removing or installing the keypad, make sure you do not touch the switch contacts with your fingers. The oils in your fingers will degrade or damage the switch contacts. To help prevent damage to the keypad use cotton gloves when removing or installing the keyboard pad.



CAUTION. To avoid damage to the front panel Standby/On switch assembly, do not set the Display module assembly on a work surface. Sliding the oscilloscope over the edge of the work surface could break off the On/Standby switch assembly.

Rear Case

Follow these steps to remove the rear case. Use a TORX T-15 screwdriver tip. See Figure 5-1 on page 5-4.

1. Remove the 4 screws from the back and sides of the rear case.
2. Grasp the case and pull outwards to remove it.

Power Supply Module

Follow these steps to remove the power supply module. You need to have previously removed the rear case. Use a TORX T-15 screwdriver tip. See Figure 5-4 on page 5-10.

1. Remove the 7 screws that secure the power supply module to the chassis.
2. Disconnect the power supply fan and connectors from the I/O board and the main board.
3. Lift the power supply module off the chassis.

Power Supply Fan. Follow these steps to remove the power supply fan assembly. You need to have previously removed the rear case and power supply assembly. Use a TORX T-15 and a P2 screwdriver tip. See Figure 5-4 on page 5-10.

1. Remove the 5 screws that attach the power supply cover.
2. Lift the power supply cover off.
3. Use the P2 screwdriver tip and remove the 2 screws that attach the fan to the cover.

Power Supply. Follow these steps to remove the power supply. You need to have previously removed the rear case and power supply assembly. Use a TORX T-15 screwdriver tip. See Figure 5-4 on page 5-10.

1. Remove the 5 screws that attach the power supply cover.
2. Lift the power supply cover off.
3. Remove the 4 screws that attach the power supply to the power supply bracket.

I/O Board Follow these steps to remove the I/O board. You need to have previously removed the rear case and power supply module. Use TORX T-15 screwdriver tip. See Figure 5-4 on page 5-10.

1. Remove the 5 screws that hold the I/O board to the chassis.
2. Lift straight up to remove.

Main Fans Follow these steps to remove the side fan assembly. You need to have previously removed the rear case, power supply assembly, and I/O board. Use a TORX T-15 screwdriver tip. See Figure 5-5 on page 5-12.

1. Remove the 6 screws that hold the side fans to the chassis.
2. Disconnect the two fan connectors from the main board.
3. Slide the fan assembly out and away from the chassis.

Main Board Follow these steps to remove the main board. You need to have previously removed the rear case, power supply, I/O board, and side fans. Use a TORX T-15 screwdriver tip. See Figure 5-5 on page 5-12.

1. Disconnect the display cable from the main board.
2. Disconnect the backlight cable from the inverter board.
3. Remove 13 screws from the main board that connect it to the chassis.
4. Lift the main board up to remove.

Inverter board. Follow these steps to remove the inverter board from the main board. You must have previously removed the main board. Use a TORX T-15 screwdriver tip. See Figure 5-5 on page 5-12.

1. Disconnect the inverter board cable from the main board.
2. Remove the inverter board from the plastic bracket.
3. Remove the 2 screws that hold the inverter board bracket to the main board.
4. Remove the inverter board bracket from the main board.

Front Case Assembly

Follow these steps to remove the front case assembly. You must have previously removed the Rear Case Assembly. See Figure 5-2 on page 5-6.

1. Pull off 14 knobs (2 large, 5 medium, 6 small, and 1 rotary).
2. Remove the front case by pulling back the board snaps and lifting the lower right corner of the front case.
3. Place the oscilloscope face up on a soft surface (such as an anti-static mat), with the bottom facing you.
4. Disconnect the bezel button flex circuit by gently pulling the flex circuit out of the connector.

Display

Follow these steps to remove the display module. You need to have previously removed the rear case, power supply assembly, I/O board, and front case assembly. Use a TORX T-15 screwdriver tip. See Figure 5-2 on page 5-6.

1. Disconnect the display power cable from the main board and the backlight cable from the inverter board.
2. Remove the 4 screws that hold the display to the front chassis.
3. Gently lift the display up and off of the chassis.



CAUTION. *Be careful when removing and reinstalling the Display module cables. If the connectors have bent pins or are installed incorrectly; the Display may be destroyed.*

Front Panel

Follow these steps to remove the front panel module. You need to have previously removed the front case assembly. Use a TORX T-15 screwdriver tip. See Figure 5-2 on page 5-6.

1. Remove the 9 screws holding the front panel board to the chassis.
2. Lift the front panel board off of the chassis.

Troubleshooting

This section contains information and procedures to help you isolate a defective module in a DPO4000 series oscilloscope.



WARNING. *Before doing this or any other procedure in this manual, read the General Safety Summary and Service Safety Summary found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to electrical components, read Preventing ESD on page 4-1.*

Adjustment After Repair

If you replace the main board, you must adjust the instrument after repair. Refer *Adjustment Procedures* beginning on page 3-1 for information about adjustment.

Required Tools and Equipment

You need the following equipment to troubleshoot the instrument.

Tools and Equipment	Example
DMM	3.5 or greater digit DMM

Troubleshooting Procedure

Figures 4-3 through 4-5 are troubleshooting procedure flowcharts. Use them to troubleshoot an instrument failure. Begin with Figure 4-3.

NOTE. Before performing the troubleshooting procedure, remove the instrument cabinet (see page 4-9).

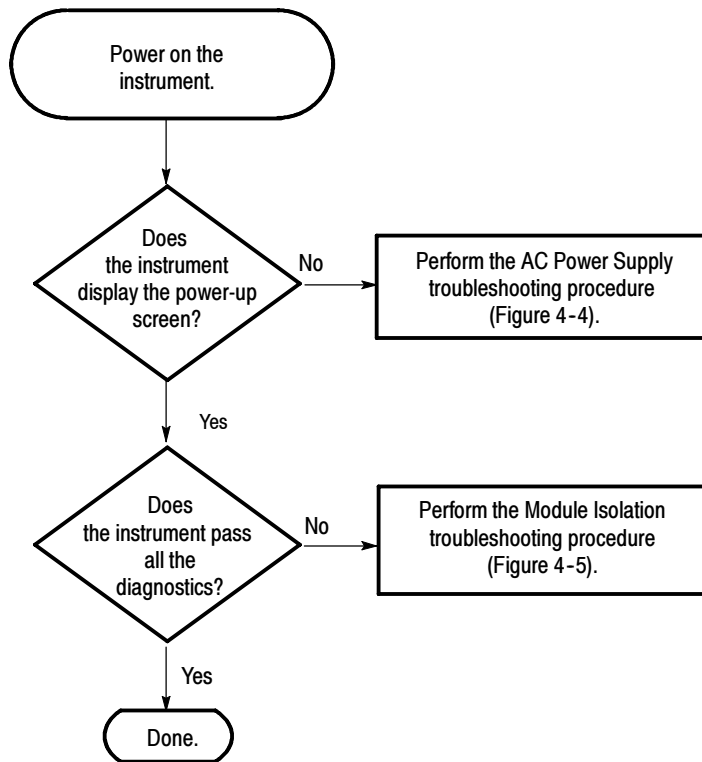


Figure 4-3: Primary troubleshooting procedure

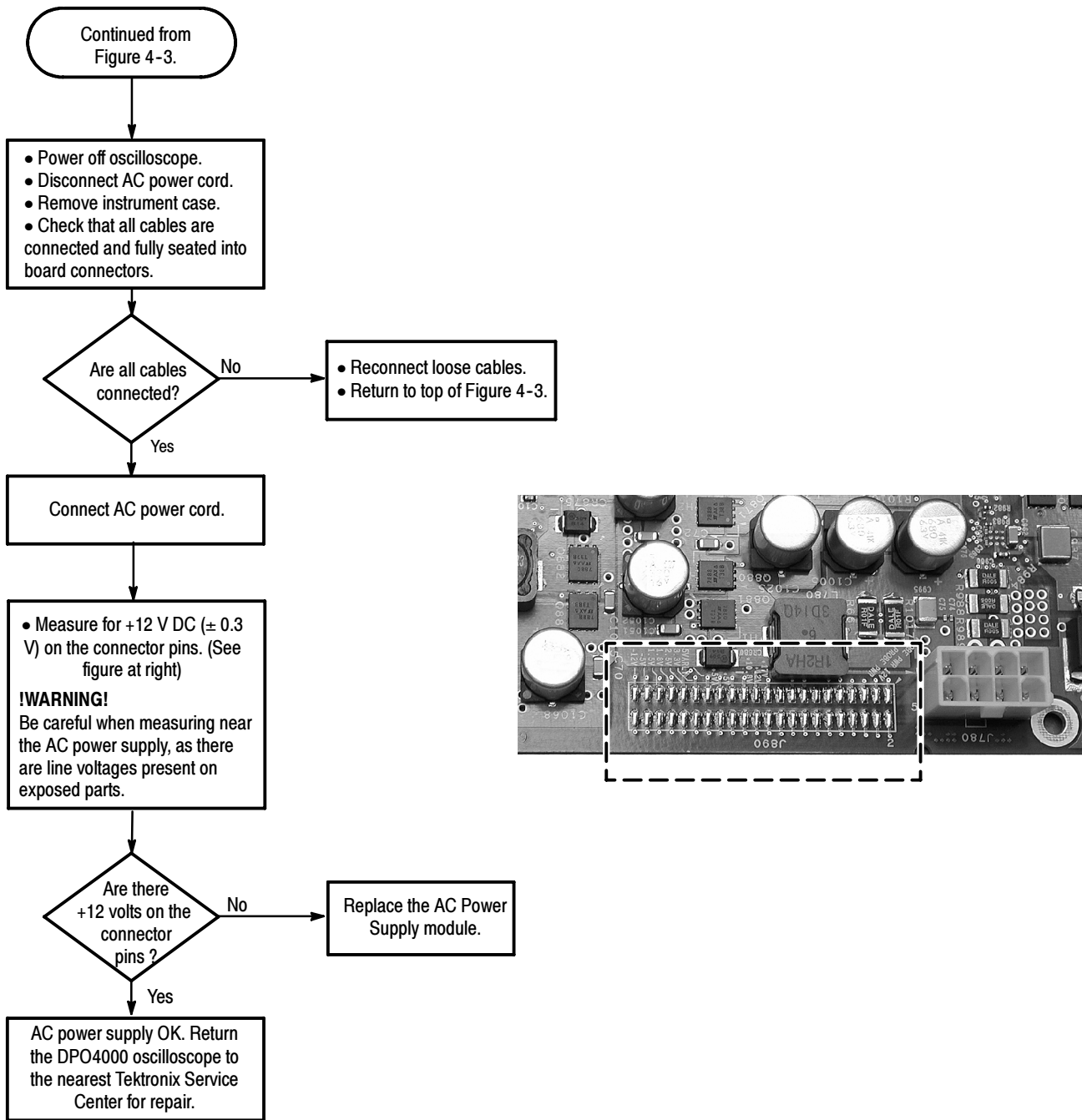
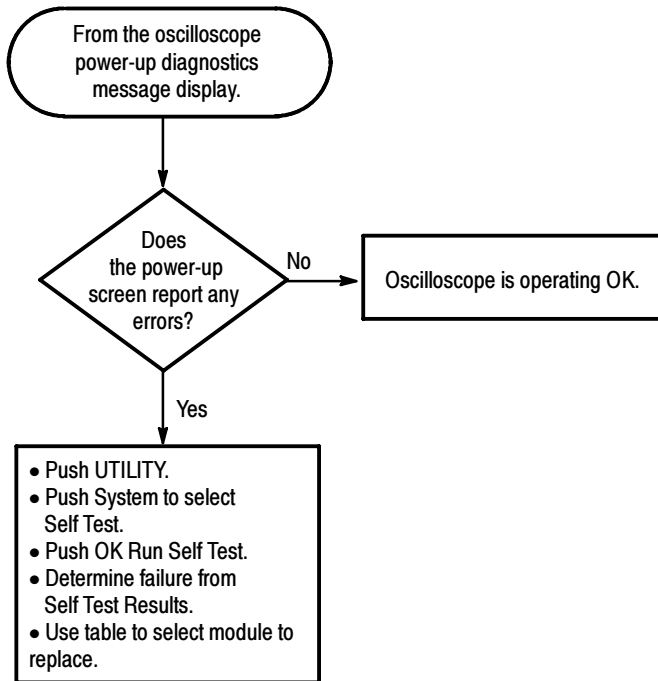


Figure 4- 4: AC power supply troubleshooting procedure



Failed Test	Most Likely Cause
Acquisition	Main board
CPU	Main board
Display	Main board
Front Panel	Front Panel (or Main board)
I/O	Comm module (or Main board)
ROM	Main board
App Modules	Front Panel (or App Keys)

Figure 4-5: Module isolation troubleshooting procedure

Unpacking and Repacking Instructions

This section contains the information needed to unpack the oscilloscope and repack it for shipment or storage.

Unpacking

The oscilloscope and its standard accessories are carefully packed at the factory in a shipping carton. If, upon receipt, damage to the shipping carton is evident, notify the shipper. Tektronix, Inc. is not responsible for damage caused during shipping.

If you have not already done so, carefully remove the oscilloscope and its accessories from the shipping carton and inspect them for damage. Save the shipping carton for repacking or storage.

Repacking

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds (125 kg) and with an inside dimension at least six inches (15.25 cm) greater than the instrument dimensions.

If the instrument is being shipped to a Tektronix Service Center, enclose the following information:

- The owner's address
- Name and phone number of a contact person
- Type and serial number of the instrument
- Reason for returning
- A complete description of the service required

Seal the shipping carton with an industrial stapler or strapping tape.

Mark the address of the Tektronix Service Center and also your own return address on the shipping carton in two prominent locations.

Storage

The oscilloscope should be stored in a clean, dry environment. The following environmental characteristics apply for both shipping and storage:

- Temperature range: -20 °C to +60 °C
- Altitude: To 15,000 m

See the *DPO4000 Technical Reference* for a complete listing of the environmental characteristics.



Mechanical Parts List

Mechanical Parts List

This chapter contains a list of the replaceable modules for the DPO4000 series oscilloscope. 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.

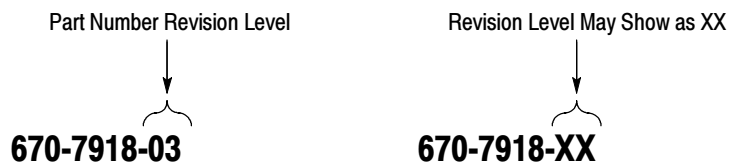
- Part number (see *Part Number Revision Level* below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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 some parts in this manual, you will find the letters XX in place of the revision level number.



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

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

Module Exchange. In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

Module Repair and Return. You may ship your module to us for repair, after which we will return it to you.

New Modules. You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

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

Parts List Column Descriptions

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

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

Mfr. Code to Manufacturer Cross Index

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

Manufacturers cross index

Mfr. code	Manufacturer	Address	City, state, zip code
06383	PANDUIT CORP	17303 RIDGELAND AVE	TINLEY PARK, IL 60477-3048
06915	RICHCO	5825 N TRIPP AVE P.O. BOX 804238	CHICAGO, IL 60646
0B445	ELECTRI-CORD MFG CO INC	312 EAST MAIN STREET	WESTFIELD, PA 16950
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214-4657
0KB05	NORTH STAR NAMEPLATE INC	5750 NE MOORE COURT	HILLSBORO, OR 97124-6474
1WNNW6	ACCRA-FAB INC	23201 E APPLEWAY	LIBERTY LAKE, WA 99019
30817	LAIRD TECHNOLOGIES WORLD HEADQUARTERS	ONE SHIELDING WAY PO BOX 650	DELAWARE WATER GAP, PA 18327-0650
4T165	NEC ELECTRONICS INC	2880 SCOTT BLVD PO BOX 58062	SANTA CLARA, CA 95052-2554
57003	CHOMERICS INC	23839 S. BANNING BLVD	CARSON, CA 90745
7X318	KASO PLASTICS INC	5720-C NE 121ST AVE, STE 110	VANCOUVER, WA 98682
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
80640	ARTESYN TECHNOLOGY POWER CONVERSION	7 ELKIN ST	SOUTH BOSTON, MA 02127-1615
83285	STEWART INC	1200 E 36TH ST-PO BOX 510	CHATTANOOGA, TN 37401-0510
S3109	FELLER U.S. CORPORATION	10B VAN DYKE AVENUE	NEW BRUNSWICK, NJ 08901
TK1373	PATELEC-CEM	10156 TORINO	VAICENTALLO 62/456 ITALY
TK2548	XEROX CORPORATION	7431 EVERGREEN PARKWAY	HILLSBORO, OR 97124
TK6121	TUMBLER CORP	4241 BUSINESS CENTER DR	FREMONT, CA 94538
TK6159	RAD TECHNOLOGIES	2900 NW 229TH AVE	HILLSBORO, OR 97124
TK6253	VOLEX INC	646 CARRIBEAN DR	SUNNYVALE, CA 94089-1108
TK6433	I-SHENG ELECTRIC WIRE & PLASTIC (KUNSHAN) CO LTD.	289 ZING YANG ZHONG RD	TECHNICAL DEVELOPMENT ZONE JIANGSU, CHINA CN
TK6547	SOLETRON MILPITAS INC	1177 GIBRALTAR DRIVE SOLETRON BUILDING 9	MILPITAS, CA 95035
TK6612	HANACO MANUFACTURING COMPANY	3965 SCHAEFER AVENUE	CHINO, CA 91710
TK6619	ACE MOLD (SHANGHAI) COMPANY LTD	318 NORTH ROUND-THE-CITY ROAD	SHANGHAI COMPREHENSIVE INDUSTRIAL DEVELOPMENT ZONE, FENGXIAN SHANGHAI, CN
TK6709	SOLETRON (SHANGHAI)	798 YING LUN RO AD-WALGAOQIAO FTZ	PUDONG, SHANGHAI, CN CN 200131

Exploded Views

Figures 5-1 through 5-5 on the following pages show the module-level exploded views of the DPO4000 series oscilloscope. The adjacent page is the list of components for that exploded view, indexed by the numbers in the figure.

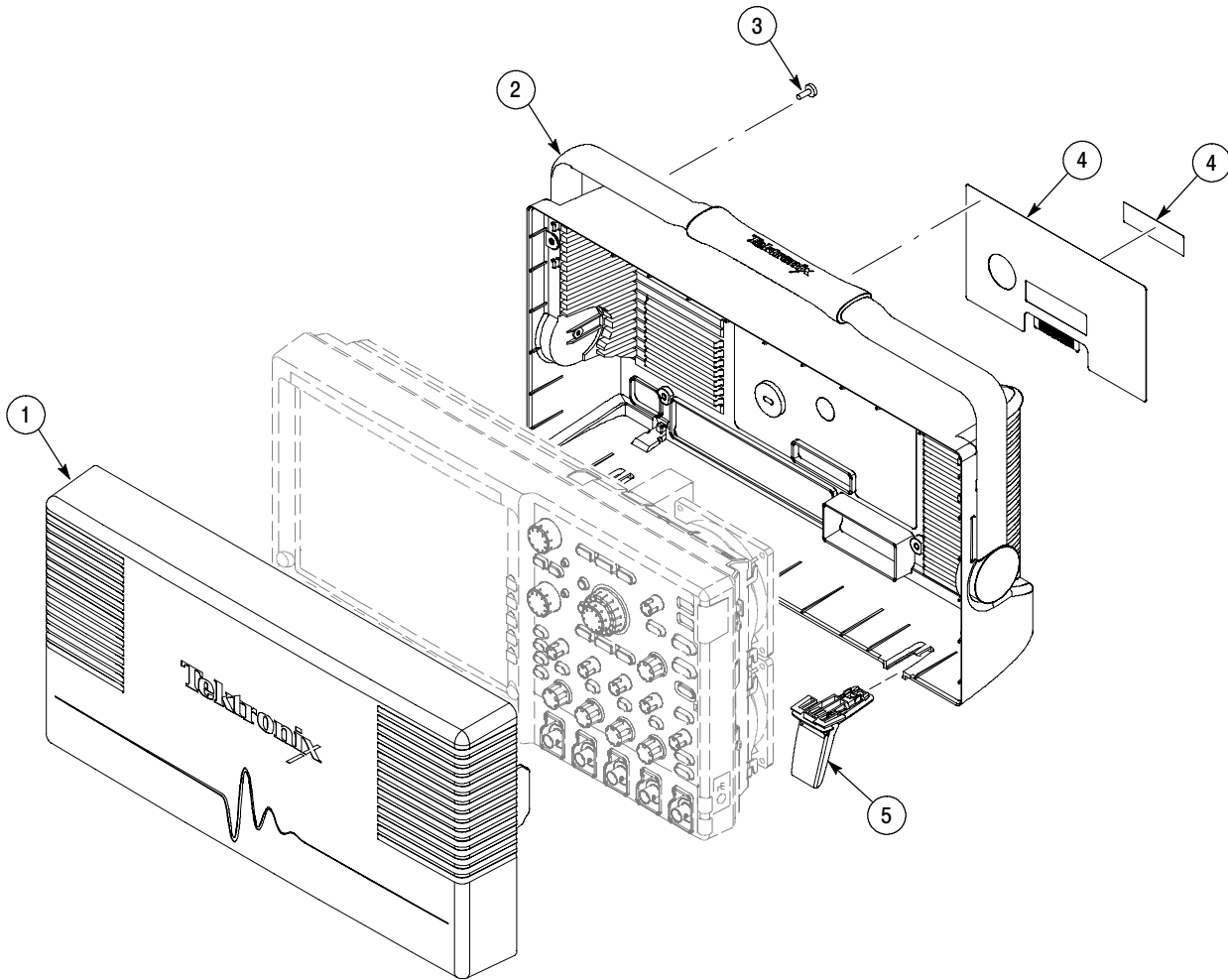


Figure 5- 1: Exploded view, case

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
5-1					Case		
-1	200-4908-00			1	COVER, FRONT, PROTECTIVE	TK6710	200-4908-00
-2	202-0441-00			1	CASE, REAR	80009	202-0441-00
-3	211-1174-00			4	SCREW,MACHINE; W/HEAVY PATCH THREADLOCKING MATERIAL; 6-32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	211-1174-00
-4	335-1186-00			1	MARKER,IDENT;LABEL,REAR PANEL	80009	335-1186-00
-5	348-1798-00			2	FOOT, FRONT	80009	348-1798-00

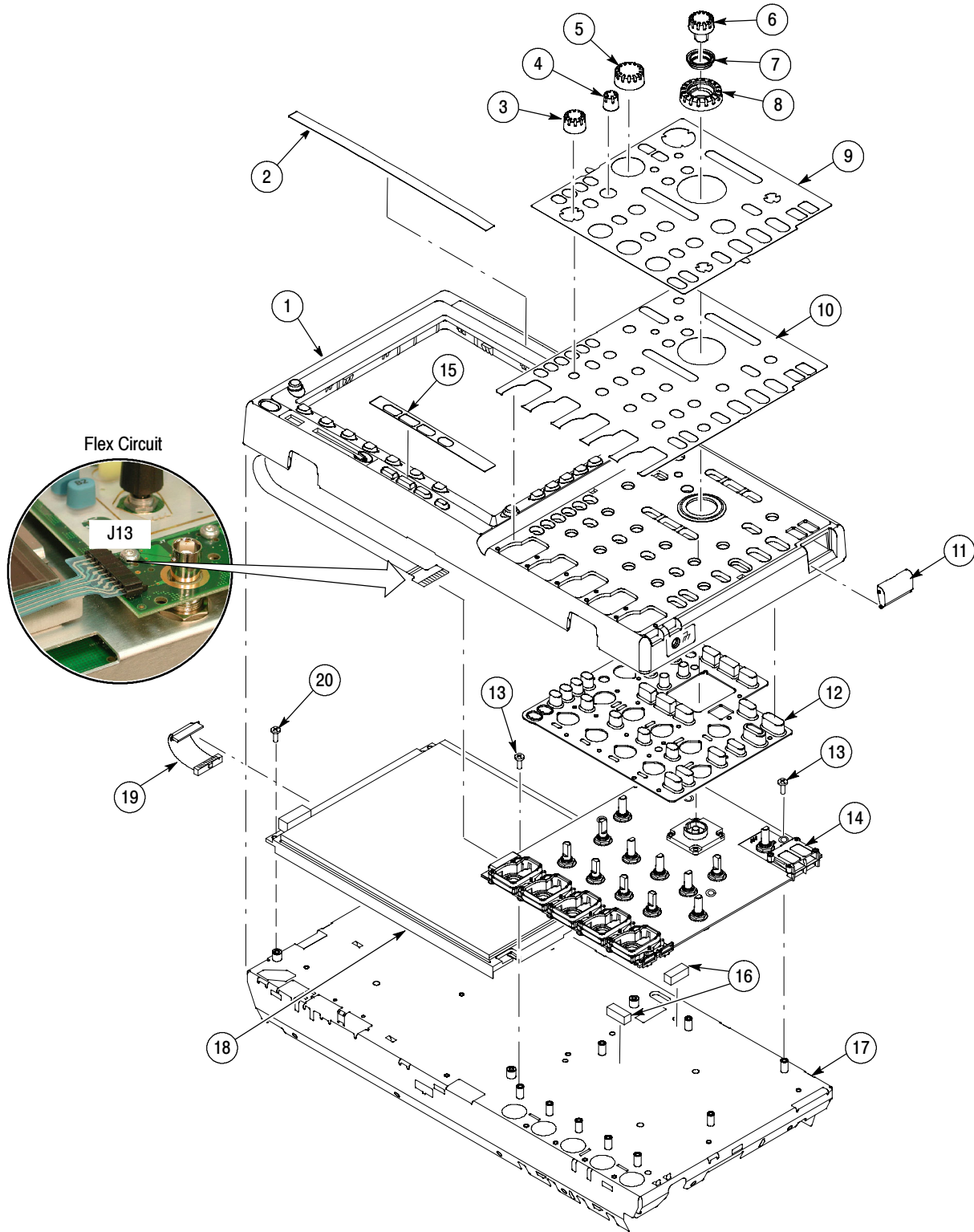


Figure 5-2: Exploded view: front panel and display, 4-channel instruments

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
5-2					Front Panel		
-1	202-0432-00			1	FRONT CASE ASSEMBLY	80009	202-0432-00
-2	335-1187-00			1	LABEL. FRONT PANEL, MODEL DPO4054	80009	335-1187-00
	335-1191-00			1	LABEL. FRONT PANEL, MODEL DPO4104	80009	335-1191-00
	335-1193-00			1	LABEL. FRONT PANEL, MODEL DPO4034	80009	335-1193-00
-3	366-0860-01			5	KNOB, .685 DIA, SOFT TOUCH	80009	366-0860-01
-4	366-0859-01			6	KNOB, .470 DIA, SOFT TOUCH	80009	366-0859-01
-5	366-0861-01			2	KNOB, .925 DIA, SOFT TOUCH	80009	366-0861-01
-6	366-0865-00			1	KNOB, JOG	80009	366-0865-00
-7	358-0883-00			1	BUSHING (JOG SHUTTLE KNOB)	TK2565	358-0883-00
-8	366-0867-00			1	KNOB, SHUTTLE	80009	366-0867-00
-9	335-1467-00			1	LABEL. FRONT PANEL, OVERLAY, RUSSIAN	80009	335-1467-00
	335-1466-00			1	LABEL. FRONT PANEL, OVERLAY, KOREAN	80009	335-1466-00
	335-1465-00			1	LABEL. FRONT PANEL, OVERLAY, STD CHINESE	80009	335-1465-00
	335-1464-00			1	LABEL. FRONT PANEL, OVERLAY, SIM CHINESE	80009	335-1464-00
	335-1463-00			1	LABEL. FRONT PANEL, OVERLAY, PORTUGUESE	80009	335-1463-00
	335-1462-00			1	LABEL. FRONT PANEL, OVERLAY, JAPANESE	80009	335-1462-00
	335-1461-00			1	LABEL. FRONT PANEL, OVERLAY, SPANISH	80009	335-1461-00
	335-1460-00			1	LABEL. FRONT PANEL, OVERLAY, GERMAN	80009	335-1460-00
	335-1459-00			1	LABEL. FRONT PANEL, OVERLAY, ITALIAN	80009	335-1459-00
	335-1458-00			1	LABEL. FRONT PANEL, OVERLAY, FRENCH	80009	335-1458-00
10	335-1183-00			1	LABEL. FRONT PANEL, 4CH	80009	335-1183-00
11	200-4418-00			1	COVER; OPTION KEY DOOR,0.7270 X 1.2250 X 0.310,PC/ABS,FR110,SILVER GRAY	7X318	200-4418-00
12	260-2798-00			1	SWITCH,KEYPAD;ELASTOMERIC FRONT PANEL	80009	260-2798-00
13	211-1174-00			9	SCREW,MACHINE; W/HEAVY PATCH THREADLOCKING MATERIAL; 6-32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	211-1174-00
14	672-6132-01			1	FRONT PANEL BOARD, 4 CH	80009	672-6132-00
15	335-1194-00			1	MARKER, FRONT PANEL, I/O	80009	335-1194-00
16	348-1860-00			2	GASKET, ELEC; CONDUCTIVE URETHANE FOAM	57003	77-03-3150-09600-AP
17	441-2378-00			1	CHASSIS;FRONT; SAFETY CONTROLLED	TK6709	441-2378-00
18	650-4715-00			1	ASSEMBLY, LCD DISPLAY	80009	650-4715-00
19	174-5014-00			1	CABLE ASSY,SP;DISPLAY DATA,FLAT FLEX	80009	174-5014-00
20	211-1174-00			4	SCREW,MACHINE; W/HEAVY PATCH THREADLOCKING MATERIAL; 6-32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	211-1174-00

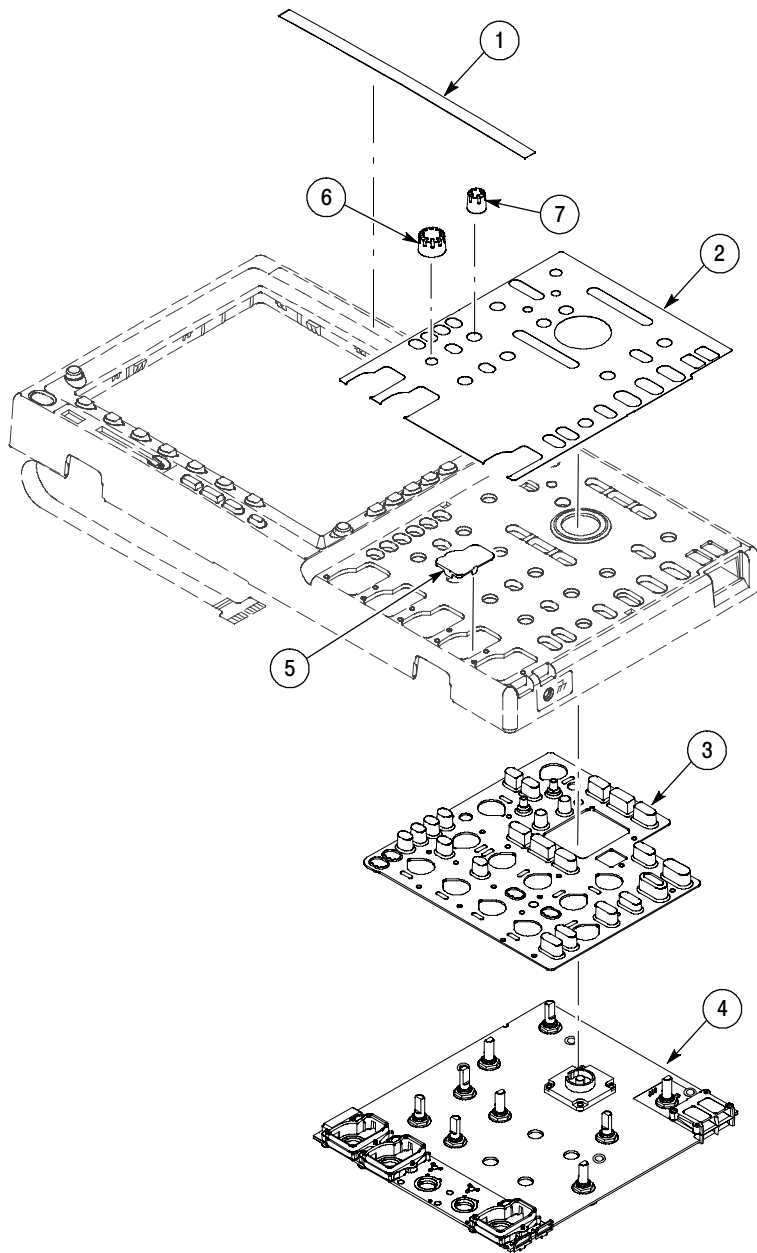


Figure 5-3: Exploded view: front panel 2-channel instruments

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
5-3					Front Panel		
-1	335-1189-00			1	LABEL, FRONT PANEL, MODEL DPO4032	80009	335-1189-00
-2	335-1185-00			1	MARKER,IDENT;LABEL,FRONT PANEL,2CH	80009	335-1185-00
-3	260-2812-00			1	SWITCH,KEYPAD;ELASTOMERIC FRONT PANEL	TK6612	260-2812-00
-4	672-6133-01			1	CIRCUIT BOARD; FRONT PANEL;2 CHANNEL	80009	672-6133-01
-5	200-4906-00			2	COVER;BNC FILLER	TK6433	200-4906-00
-6	366-0860-01			3	KNOB, .685 DIA, SOFT TOUCH	80009	366-0860-01
-7	366-0859-01			4	KNOB, .470 DIA, SOFT TOUCH	80009	366-0859-01

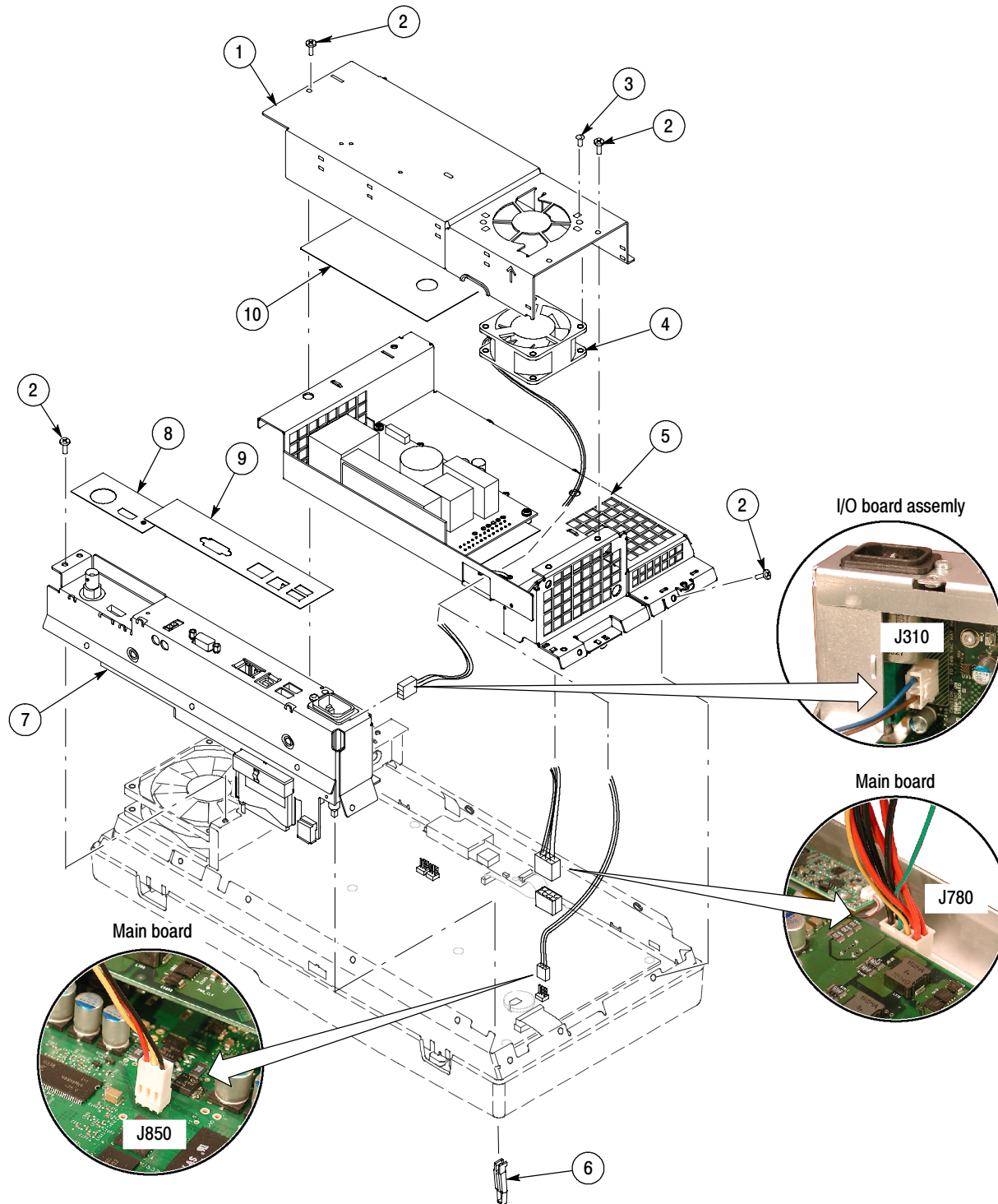


Figure 5-4: Exploded view: power supply and I/O board

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
5-4					Main Board		
-1	407-5019-00			1	BRACKET;POWER SUPPLY COVER	TK6709	407-5019-00
-2	211-0722-00			19	SCREW,MACHINE; 6-32 X 0.250,PNH,STL,CDPL,T-15 TORX	0KB01	211-0722-00
-3	211-1213-00			1	SCREW, METRIC 5 X 10MM, FLATHEAD, STL, ZINC, POSI	0KB01	211-1213-00
-4	119-7223-00			1	FAN,TUBEAXIAL; 12VDC,0.09A,1.4W,19 CFM,4000RPM,31DBA,60MM X 60MM X 25MM,W/7IN LEADS & CONNECTOR,TACH OUT	TK6159	119-7223-00
-5	650-4939-00			1	POWER SUPPLY SUB ASSEMBLY;DOMESTIC	80009	650-4939-00
-6	366-0844-00			1	PUSH BUTTON;POWER; SAFETY CONTROLLED	TK6619	366-0844-00
-7	672-6131-01			1	I/O BOARD	80009	672-6131-01
-8	335-1213-00			1	MARKER,IDENT;LABEL,REAR PANEL,LEFT	80009	335-1213-00
-9	335-1214-00			1	MARKER,IDENT;LABEL,REAR PANEL, RIGHT	80009	335-1214-00
10	337-4378-00			1	SHIELD;INSULATOR,ELECTRICAL	80009	337-4378-00

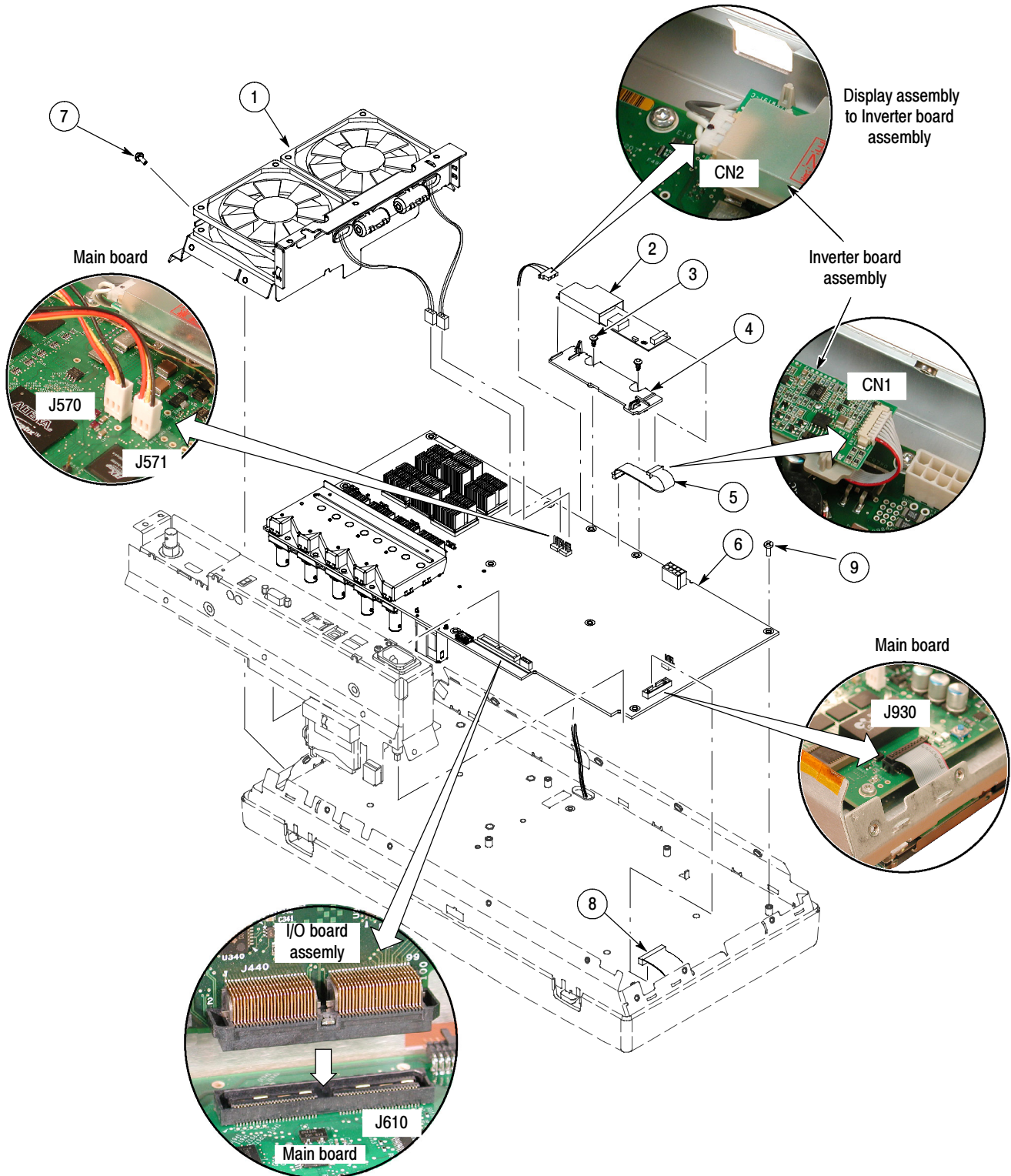


Figure 5-5: Exploded view: mainboard, inverter board, and side fans

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discontinued	Qty	Name & description	Mfr. code	Mfr. part number
5-5					Main Board		
-1	650-4937-00			1	FAN TRAY ASSEMBLY	80009	650-4937-00
-2	119-6806-00			1	POWER SUPPLY; INVERTER,1200VAC NO-LOAD & 600VAC @ 85KOHM LOADED OUTPUT	4T165	104PW191
-3	211-1143-00			2	SCREW,PT; K35-1.57,PAN HEAD,T-15	0KB01	211-1143-00
-4	407-5113-00			1	BRACKET,PCB;BACKLIGHT BOARD	TK6433	407-5113-00
-5	174-5015-00			1	CABLE ASSY,SP;INVERTER POWER,FLAT FLEX	80009	174-5015-00
-6	671-5843-00			1	CIRCUIT BD ASSY; MAIN BOARD, (DPO4104)	TK6547	671-5843-00
	671-5959-00			1	CIRCUIT BD ASSY;350MHZ 4 CHANNEL, (DPO4054)	TK6547	671-5959-00
	671-5960-00			1	CIRCUIT BD ASSY;350MHZ 2 CHANNEL, (DPO4034)	TK6547	671-5960-00
	671-5961-00			1	CKT BD ASSY; 2 CHANNEL, (DPO4032)	TK6547	671-5961-00
-7	211-0722-00			6	SCREW,MACHINE; 6-32 X 0.250,PNH,STL,CDPL,T-15 TORX DR	0KB01	211-0722-00
-8	174-5014-00			1	CABLE ASSY,SP;DISPLAY DATA,FLAT FLEX	80009	174-5014-00
-9	211-1174-00			13	SCREW,MACHINE; W/HEAVY PATCH THREADLOCKING MATERIAL; 6-32 X 0.312 L,PNH,STL CAD PLT,T15		211-1174-00

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
STANDARD ACCESSORIES							
Accessories							
---	161-0104-05			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A3 - AUSTRALIAN)	TK1373	161-0104-05
	161-0104-06			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A1 - EUROPEAN)	S3109	1923
	161-0104-07			1	CA ASSY,PWR:3,1.0MM SQ,240V/10A,2.5 M (OPTION A2 - UNITED KINGDOM)	TK6121	21072WH518.2
	161-0167-00			1	CA ASSY,PWR:3,0.75MM SQ,250V/10A,2.5 M (OPTION A5 - SWITZERLAND)	0B445	161-0167-00
	161-0306-00			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A10 - CHINA)	TK6253	92-2637-250BKH
	161-0066-09			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A11 - INDIA)	TK6121	2171H518.2
	161-0298-00			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A6 - JAPAN)	0B445	161-0298-00
	161-0066-00			1	CABLE ASSY,PWER.:3,18 AWG,92 L (STANDARD CABLE)	S3109	161-0066-00
-----				1	POUCH, PLASTIC:POUCH	TK2582	TK1441 BLACK CORDURA



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