



**3 Series MDO
Mixed Domain Oscilloscope
Service Manual**

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Contacting Tektronix

Tektronix, Inc.

14150 SW Karl Braun Drive

P.O. Box 500

Beaverton, OR 97077

USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, see the *Service safety summary* that follows the *General safety summary*.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be used in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

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. Do not use the provided power cord for other products.
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 disable the power cord grounding connection.
Power disconnect	The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.
Connect and disconnect properly	Do not connect or disconnect probes or test leads while they are connected to a voltage source. Use only insulated voltage probes, test leads, and adapters supplied with the product, or indicated by Tektronix to be suitable for the product.
Observe all terminal ratings	To avoid fire or shock hazard, observe all rating and markings on the product. Consult the product manual for further ratings information before making connections to the product. Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory. Use caution when using 1:1 test leads because the probe tip voltage is directly transmitted to the product. Do not float the common terminal.
Do not operate without covers	Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.
Avoid exposed circuitry	Do not touch exposed connections and components when power is present.

Do not operate with suspected failures	<p>If you suspect that there is damage to this product, have it inspected by qualified service personnel.</p> <p>Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.</p> <p>Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.</p> <p>Examine the exterior of the product before you use it. Look for cracks or missing pieces.</p> <p>Use only specified replacement parts.</p>
Do not operate in wet/damp conditions	<p>Be aware that condensation may occur if a unit is moved from a cold to a warm environment.</p>
Do not operate in an explosive atmosphere	
Keep product surfaces clean and dry	<p>Remove the input signals before you clean the product.</p>
Provide proper ventilation	<p>Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.</p> <p>Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.</p>
Provide a safe working environment	<p>Always place the product in a location convenient for viewing the display and indicators.</p> <p>Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.</p> <p>Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.</p> <p>Use care when lifting and carrying the product. This product is provided with a handle or handles for lifting and carrying.</p> <p>Use only the Tektronix rackmount hardware specified for this product.</p>

Probes and test leads

Before connecting probes or test leads, connect the power cord from the power connector to a properly grounded power outlet.

Keep fingers behind the protective barrier, protective finger guard, or tactile indicator on the probes.

Remove all probes, test leads and accessories that are not in use.

Use only correct Measurement Category (CAT), voltage, temperature, altitude, and amperage rated probes, test leads, and adapters for any measurement.

Beware of high voltages	<p>Understand the voltage ratings for the probe you are using and do not exceed those ratings. Two ratings are important to know and understand:</p> <ul style="list-style-type: none"> • The maximum measurement voltage from the probe tip to the probe reference lead • The maximum floating voltage from the probe reference lead to earth ground <p>These two voltage ratings depend on the probe and your application. Refer to the Specifications section of the manual for more information.</p>
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Warning: To prevent electrical shock, do not exceed the maximum measurement or maximum floating voltage for the oscilloscope input BNC connector, probe tip, or probe reference lead.

Connect and disconnect properly	Connect the probe output to the measurement product before connecting the probe to the circuit under test. Connect the probe reference lead to the circuit under test before connecting the probe input. Disconnect the probe input and the probe reference lead from the circuit under test before disconnecting the probe from the measurement product.
Connect and disconnect properly	De-energize the circuit under test before connecting or disconnecting the current probe. Connect the probe reference lead to earth ground only. Do not connect a current probe to any wire that carries voltages or frequencies above the current probe voltage rating.
Inspect the probe and accessories	Before each use, inspect probe and accessories for damage (cuts, tears, or defects in the probe body, accessories, or cable jacket). Do not use if damaged.
Ground-referenced oscilloscope use	Do not float the reference lead of this probe when using with ground-referenced oscilloscopes. The reference lead must be connected to earth potential (0 V).

Risk assessment warnings and information

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock	Do not touch exposed connections.
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 product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.
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.
Verify safety after repair	Always recheck ground continuity and mains dielectric strength after performing a repair.

Terms in the 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



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product:



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal



Chassis Ground



Standby

Preface

This manual contains service information for your instrument.

Read the General and Service safety summaries before servicing the product.

Be sure to read the introductions to all procedures. These introductions provide important information needed to perform the service correctly, safely, and efficiently.

Supported products

This manual contains information that is necessary to service the following products:

- MDO32
- MDO34

Check for a specific product designation in the header at the top of the page, in a heading, table or figure title, or within text. Material that does not have any specific product designation applies to all products in the manual.

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, or a mechanical part, that is listed in the replaceable parts list that can be replaced in the field. See [Replaceable parts](#) on page 23.

Where to find operating information

For information on installing, operating, and networking the instrument, refer to the online help or user manual that was provided with your oscilloscope. You can also find the manual at www.tek.com/manuals, by searching for your product.

Theory of operation

This chapter describes the electrical operation of the oscilloscope to the module level. The block diagram shows the oscilloscope module interconnections.

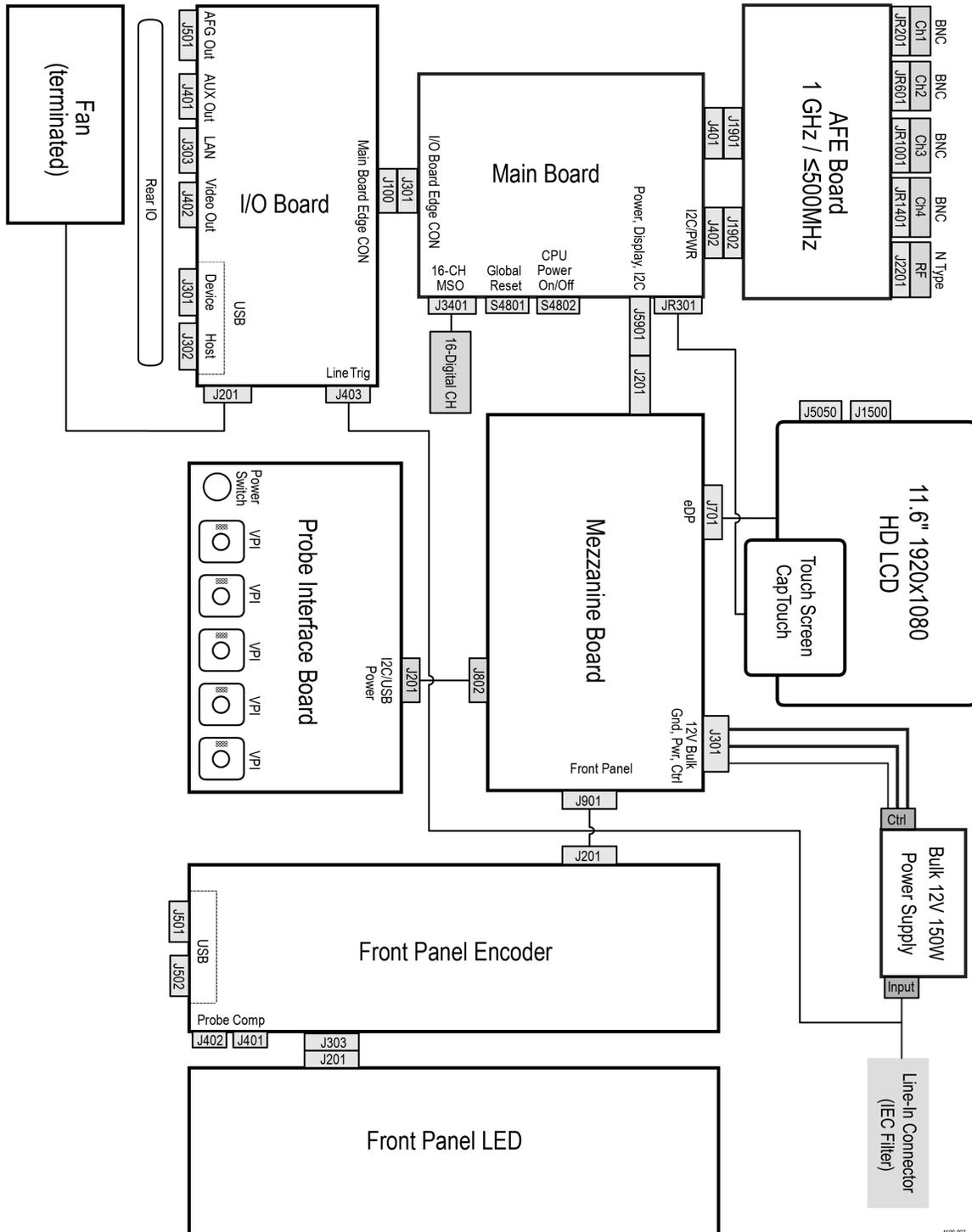


Figure 1: MDO34 block diagram

The only difference between the MDO34 and MDO32 block diagram is the AFE board.

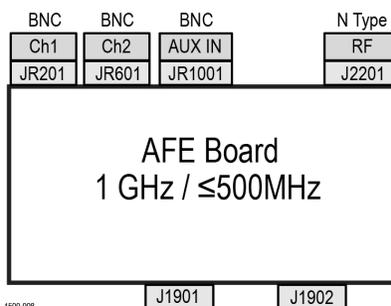


Figure 2: MDO32 AFE board

Power supply

The Power Supply board converts AC line voltage to +12 V to power for all internal circuits.

I/O board

The I/O board contains USB ports, an Ethernet port (LAN), a HDMI port, an AUX OUT BNC connector, and the AFG generator output connector.

Main board and front-end board

The Main and Analog boards contain 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, and then into acquisition memory. The analog signal from each preamplifier is also distributed to a trigger circuit. The digital channels pass through the front of the instrument to the Main board.

Front-end

All of the analog inputs are routed to the Front-end board. The analog channels are amplified and attenuated through the front-end circuitry, and are output to the Main board. The front-end board has a controller that is used as an I/O controller for the front-end board.

Mezzanine

The Mezzanine board converts the +12 V power to some of the other voltages used for the analog and digital circuitry throughout the system.

Front panel and display

The Front Panel board contains digital logic that reads the front-panel buttons and controls and sends this information to the processor system on the Main board. The Front Panel board also generates the probe compensation output signal and provides USB ports on the front panel. The front panel routes the front-end signals from the probe directly to the front-end board.

Adjustment procedures

This chapter contains information about instrument adjustment.

Adjustment

Adjustment and calibration can be performed only by a Tektronix Service Center. See Contacting Tektronix, following the title page in this manual, for information on contacting Tektronix Service Support.

Adjustment interval

The voltage and timing references inside the instrument are very stable over time and do not need routine adjustment.

If the instrument fails the performance tests in the Specifications and Performance Verification manual, adjustment may be required. To download the 3 Series MDO Specification and Performance Verification manual (Tektronix part number 077-1499-XX), go to <http://www.tek.com/product-support>, enter the model number, click GO, and then select the Specification and Performance Verification document to download.

If your organization requires periodic calibration, a general rule is to verify performance and make adjustments (only if needed) every 2000 hours of operation or once a year if the instrument is used infrequently.

Adjustment after repair

After removal and replacement of any module, you must perform the Performance Verification procedures, found in the Specifications and Performance Verification manual (Tektronix part number 077-1499-XX), available to download from the Tektronix web site (www.tek.com/product-support).

If the instrument fails any Performance Verification tests, it must be returned to a Tektronix Service Center for adjustment and calibration.

Maintenance

This section contains information needed to perform periodic and corrective maintenance on the instrument.

Preventing ESD

Before servicing this product, read the *General Safety Summary* and the *Service Safety Summary* at the front of the manual, as well as the following ESD information.



CAUTION: Electrostatic discharge (ESD) can damage any semiconductor component in this instrument.

When performing any service that requires internal access to the instrument, 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.
4. Service static-sensitive modules only at a static-free work station.
5. Do not allow any items capable of generating or holding a static charge on the work station surface.
6. Handle circuit boards by the edges when possible.
7. Do not slide the circuit boards over any surface.
8. 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 describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the instrument. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent instrument malfunction and enhance its reliability.

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

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

Exterior cleaning (other than display)

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 cleaning towel dampened with deionized water. Do not spray or wet the switch itself.



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

Inspection - Exterior. Inspect the outside of the instrument for damage, wear, and missing parts. Immediately repair defects that could cause personal injury or lead to further damage to the instrument.

Table 1: External inspection checklist

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 brush 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

Flat panel display cleaning

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), or an abrasive-free cleaning cloth.

If the display is very dirty, moisten the wipe or cloth with distilled water, a 75% isopropyl alcohol solution, or standard glass cleaner, and gently rub the display surface. Use only enough liquid to dampen the cloth or wipe. Avoid using excess force or you may damage the display surface.



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

- Do not use abrasive cleaners or surface cleaners to clean the display.
- Do not spray liquids directly on the display surface.
- Do not scrub the display with excessive force.



CAUTION: To prevent getting moisture inside the instrument during external cleaning, do not spray any cleaning solutions directly onto the screen or instrument.

Interior cleaning

You can only clean the interior of the rear chassis assembly. To access the rear chassis assembly, see the *Removal and Installation Procedures* topics.

Do not disassemble or clean the front chassis assembly (other than cleaning the front panel display and removing panel knobs). Disassembling the front chassis assembly requires that the instrument be returned to your nearest Tektronix Service Center for calibration.



Warning: To avoid electric shock or damage to the instrument, remove instrument power. Before performing any procedure that follows, power down the instrument and disconnect it from line voltage.

- Blow off dust with dry, low-pressure (approximately 9 psi), deionized air.
- Use a soft-bristle, non-static-producing brush for cleaning around components.
- Remove any remaining dust with a lint-free cloth dampened in isopropyl alcohol (75% solution). (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards).
- If you must use a liquid for minor rear chassis interior cleaning, use a clean-room wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation) dampened with a 75% isopropyl alcohol solution.
- Inspect the internal portions of the instrument for damage and wear. See [Table 2: Internal inspection checklist](#) on page 7. Defects should be repaired immediately.

- If any circuit board is repaired or replaced, you must perform the Performance Verification procedure in the specifications and performance verification manual, which was provided with your instrument. This manual is also available at www.tektronix.com/manuals, by searching for your product name. If the instrument fails the Performance Verification tests, it must be returned to a Tektronix Service Center for repair and calibration.



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

Table 2: Internal inspection checklist

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.	
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Replace defective cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

Lubrication

There is no periodic lubrication required for this instrument.

Returning the instrument for service

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

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

Before returning the instrument for service, contact the Service Center to get an RMA (return material authorization) number, and any return or shipping information you may need.

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

- The RMA number.
- 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 required service.

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

Remove and replace procedures

This section contains procedures for removal and installation of replaceable modules in the instrument. Refer to [Replaceable parts](#) on page 23 for lists and exploded views of replaceable modules.

Any module inside of the chassis that does not have a remove and replace procedure requires that the entire instrument be returned to Tektronix Service Center for service.



Warning: Before performing this or any other procedure in this manual, read the safety summaries found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to the instrument components, read [Preventing ESD](#) on page 5.

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



Note: Read the cleaning procedure before disassembling the instrument for cleaning.

Required equipment

Most assemblies in this instrument can be removed with a T-10 Torx® screwdriver tip.

Table 3: Required equipment for removal and replacement

Item No.	Name	Description
1	Screwdriver handle	Accepts Torx-driver bits
2	T-10 Torx tip	Used for removing instrument screws. Torx-driver bit for T-10 size screw heads
3	Proper antistatic work environment	To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.

Remove feet

Use this procedure to remove and replace bottom feet assemblies or gain access to the rear chassis assembly.

Prerequisite:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.

Steps:

Remove the two flip feet assemblies from the rear chassis using the following steps:

- Remove all cables and the power cord from the rear panel.
- Set the instrument on its back side so the bottom is facing you.
- Flip open both feet assemblies.
- Use a screwdriver with T-10 Torx tip to remove the four screws from each foot assembly.
- Remove the feet assemblies.
- To reinstall, reverse the steps. Use a screwdriver with T-10 Torx tip to secure the eight screws. First insert and tighten the screws that are near the front edge of the instrument, then insert and tighten the screws that are near the rear edge of the instrument. Tighten to 0.65 N·m.



Remove handle

Use this procedure to remove and replace the handle assemblies.

Prerequisite:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.

Steps:

1. Use a screwdriver with T-10 Torx tip to remove two screws from each side of the handle.
2. Disengage the handle from the pins on the couplers and remove the handle.
3. Remove the two couplers.
4. To reinstall, reverse the steps. Use a screwdriver with T-10 Torx tip to secure the screws. Tighten to 0.65 N·m.

Remove rear grill and case

Use this procedure to remove and replace the rear grill and rear case.

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove handle](#).
- [Remove feet](#). See

Steps:

Remove the grill and rear case using the following steps:

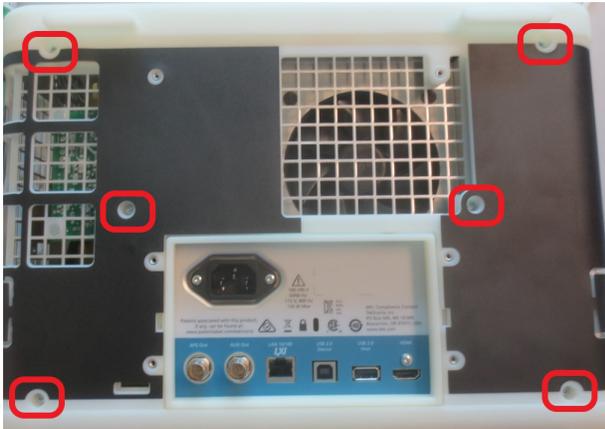
1. Use a screwdriver with T-10 Torx tip to remove the six screws from the back of the rear case.



- Use a screwdriver with T-10 Torx tip to remove the two screws from each side of the rear case.



- Pull the front edges of the grill to remove it from rear case.
- Use a screwdriver with T-10 Torx tip to remove the six screws securing the rear case to the rear chassis.



- Remove handle hub assemblies. See [Remove handle hub assembly](#) to remove the right and left handle hub from the rear chassis.
- Slide the rear case off of the rear chassis.
- To reinstall, reverse the steps. Tighten the six T-10 Torx rear case screws to 0.65 N·m. Tighten the ten T-10 Torx rear grill screws to 0.65 N·m.

Remove handle hub assembly

Use this procedure to remove and replace the handle hubs from the rear chassis.

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- Remove the rear grill. See steps 1 - 3 in [Remove rear grill and case](#).

Steps:

1. Remove four screws from each handle hub using a T-10 Torx bit screwdriver.



2. Remove the right and left handle hub from the rear chassis.
3. To reinstall, reverse the steps. Use a screwdriver with a T-10 Torx tip to tighten the screws to 0.65 N·m.

Remove rear chassis assembly

Use this procedure to remove and replace the rear chassis, to access rear chassis assemblies (power supply, main fan, I/O board).

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove rear grill and case](#)

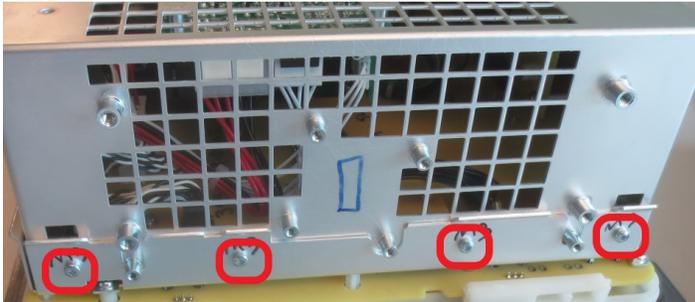
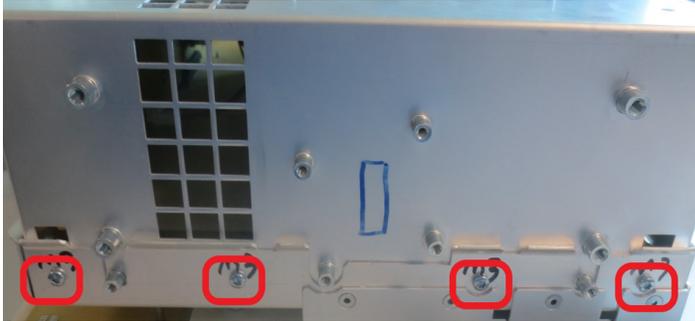
Steps:

Remove the rear chassis assembly from the front chassis assembly using the following steps:

1. Use a screwdriver with a with T-10 Torx tip to remove the 16 screws securing the rear chassis to the front chassis.
 - a. Remove four screws from the top and bottom of the rear chassis.



- b. Remove four screws from the left and right side of the rear chassis.



2. Place the instrument face down on a soft surface or fixture. Place the instrument face down carefully to prevent damage to the knobs.



CAUTION: Place the instrument face down carefully to prevent damage to the knobs.

3. Carefully slide the rear chassis off of the front chassis.
4. To reinstall, reverse the steps. Align the rear chassis assembly with the front chassis, slide in, and use a screwdriver with T-10 Torx tip to install the 16 screws securing the rear chassis to the front chassis. Tighten to 0.65 N·m.

Remove the main fan assembly

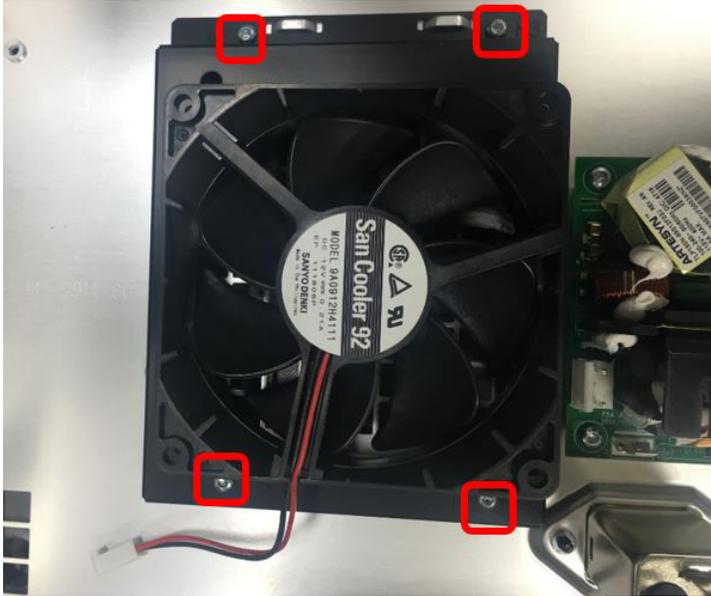
Use this procedure to remove and replace the main fan from the rear chassis.

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove rear chassis assembly](#)

Steps:

1. Use a T-10 Torx screwdriver to remove the four screws from the main fan assembly.



2. Disconnect the main fan cable from the I/O board.



3. Remove the main fan assembly from the rear chassis.
4. To remove the fan from the bracket, carefully pull the fan from each corner of the bracket to disconnect the elastic fan attachments.
5. To reinstall, reverse the steps. Install the fan on the bracket in the correct orientation for the fan power cable. Use a needle nose plier to reinstall the fan elastic attachments on each corner. Tighten the T-10 Torx screws to 0.65 N·m when reinstalling.

Remove the AC line filter

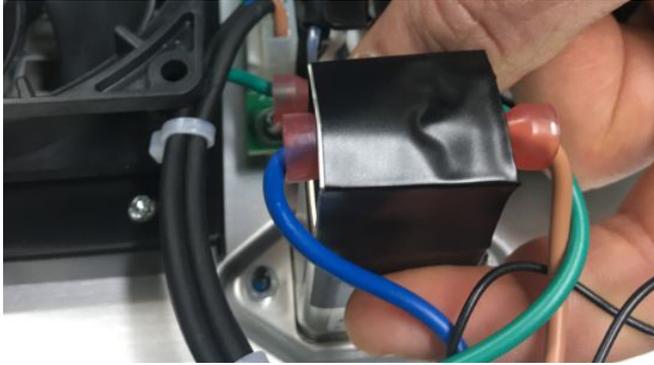
Use this procedure to remove and replace the AC line filter from the rear chassis.

Prerequisites:

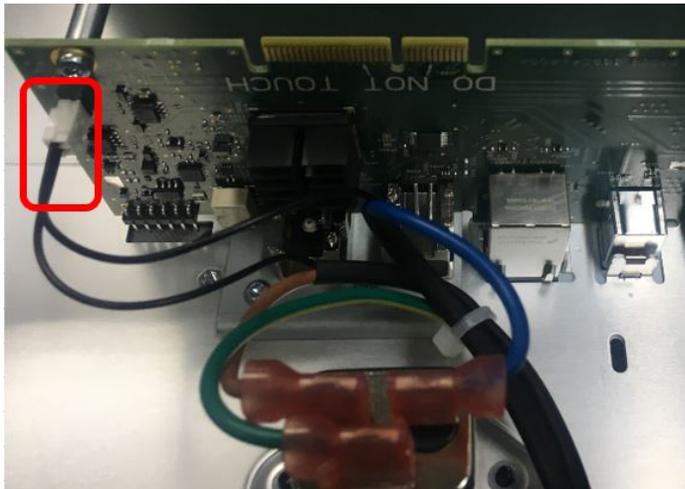
- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove rear chassis assembly.](#)

Steps:

1. Remove the conductive tape (253-0594-XX) from the top of the AC linefilter. Save the conductive tape for reassembly. Only reuse the conductive tape once.



2. Disconnect the line trigger cable from the I/O board.



3. Disconnect the line input cable from the power supply.

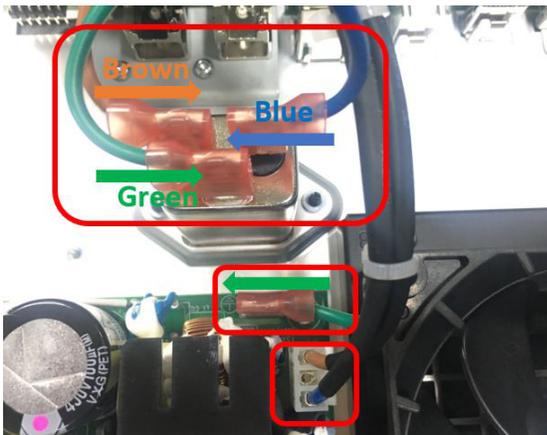


Figure 3: AC line filter cable connections

4. Use a T-10 Torx screwdriver to remove the two screws securing the line filter to the outside of the rear chassis.



5. Remove the line filter and line input cable assembly from the rear chassis.
6. To reinstall, reverse the steps:
 - a. Use a T-10 Torx screwdriver to secure the line filter to the inside of the rear chassis using two screws. Tighten the T-10 Torx screws to 0.65 N·m.
 - b. Connect the line input cable to the power supply.
 - c. Connect the line trigger cable to the I/O board.
 - d. Connect the line trigger cable to the AC line filter (See [#unique_46/unique_46_Connect_42_GUID-E29EB9F0-CB65-4E31-A669-4AD92917F1A2](#)).
 - e. Route the line input cables under the corner of the fan.
 - f. Fold the conductive tape over the top of the AC line filter.

Remove the power supply assembly

Use this procedure to remove and replace the power supply assembly.

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove rear chassis assembly](#)
- [Remove the main fan assembly](#)

Steps:

Use the following steps to remove the power supply assembly from the rear chassis.

1. Disconnect the cables connecting the power supply to the mezzanine board and AC line filter.



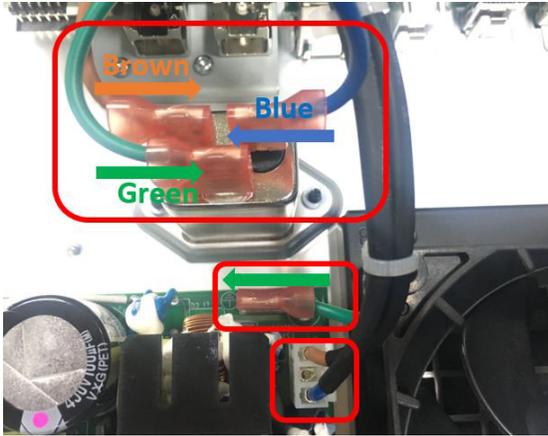
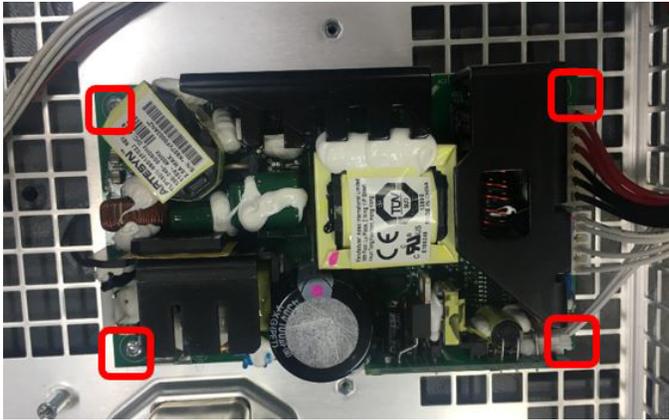
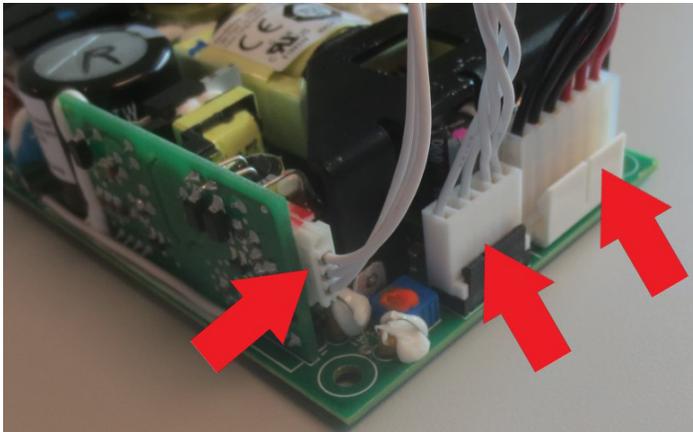


Figure 4: AC line filter cable connections

2. Use a T-10 Torx bit screwdriver to remove the four screws securing the power supply assembly to the chassis. Tighten screws to 0.65 N·m when reinstalling.



3. Remove the power supply assembly from the rear chassis.
4. Disconnect the three power supply cables from the power supply board.



5. To reinstall, reverse the steps. Tighten all T-10 Torx screws to 0.65 N·m when reinstalling. Install new tie down straps (zip ties) if you removed them during disassembly.

Remove the I/O board

Use this procedure to remove and replace the I/O board.

Prerequisites:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.
- [Remove rear chassis assembly](#)

Steps:

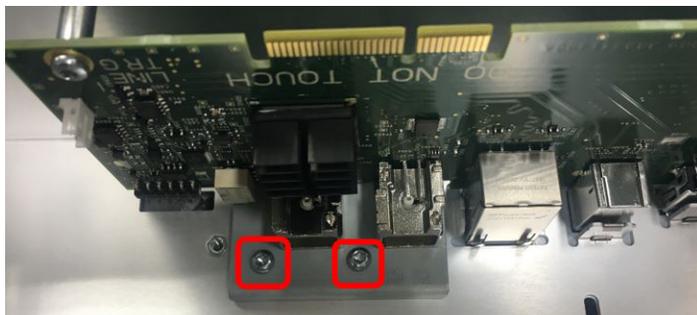
1. Use a T-10 Torx screwdriver to remove the one screw above the HDMI connector on the rear panel.



2. Disconnect the line trigger and fan cable from the I/O board.



3. Use a T-10 Torx screwdriver to remove the two screws above the AFG Out and AUX Out connections.



4. Use a T-10 Torx screwdriver to remove the two screws securing the I/O board to the bottom of the rear chassis.



5. Slide the I/O board out from the rear chassis.
6. To reinstall, reverse the steps. Tighten the T-10 Torx screws to 0.65 N·m when reinstalling.

Remove front-panel knobs

Use this procedure to remove and replace front-panel knob assemblies.

Prerequisite:

- To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.

There are seven knob assemblies that can be removed from the front case.

Steps:

- To remove a knob assembly, pull the knob straight out of the front panel. Finger strength is adequate to pull knobs. Do not use pliers.
- To reinstall a knob, align the knob with the shaft indent and press the knob onto the shaft. Turn the knob to make sure there is a smooth rotation.

Troubleshooting the 3 Series MDO



CAUTION: Before performing this or any other procedure in this manual, read the General Safety Summary and Service Safety Summary found at the beginning of this manual.

To prevent possible injury to service personnel or damage to electrical components, please read information on Preventing ESD. (See [Preventing ESD](#) on page 5.)

This section contains information and procedures designed to help you isolate faults to a module.

This section requires that service personnel have the appropriate skills to work on this instrument.

For assistance, contact your local Tektronix Service Center.

Level of service

This subsection contains information and procedures to help you determine if a faulty power supply is the problem with your instrument. If replacing the power supply does not fix the fault, you will need to return the instrument to a Tektronix Service Center for repair, as no other internal electronic assemblies or modules are user-replaceable.

Check for common problems

Use the following table to help isolate possible failures. The table lists problems and possible causes. The list is not exhaustive, but it may help you eliminate a problem that is quick to fix, such as a loose power cord. For more detailed troubleshooting, see the [Troubleshooting flow chart](#) on page 19.

Table 4: Failure symptoms and possible causes

Symptom	Possible cause(s)
Instrument will not power on	<ul style="list-style-type: none"> Power cord not plugged in Faulty power supply Defective micro-controller assembly
Instrument powers on, but one or more fans will not operate	<ul style="list-style-type: none"> Faulty fan power cable Fan power cable not connected to circuit board Defective fan Faulty power supply One or more defective point of load regulators

Table continued...

Symptom	Possible cause(s)
Flat-panel display blank or has streaks in display	<ul style="list-style-type: none"> Faulty LCD screen or video circuitry.

Equipment required

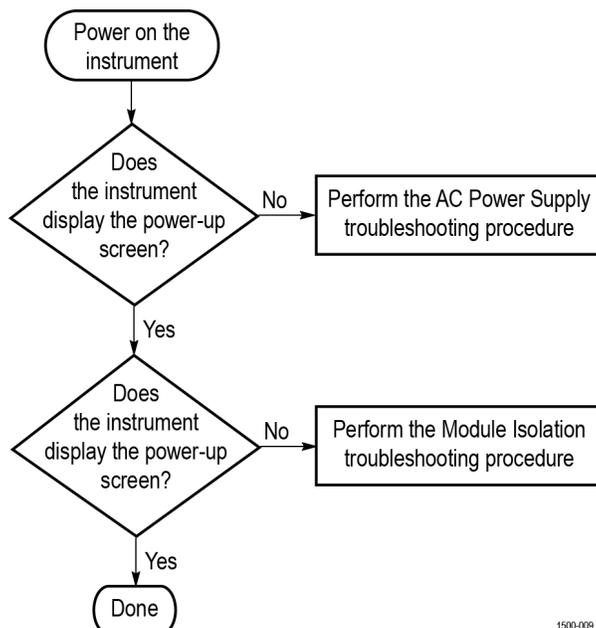
- Digital voltmeter to check power supply voltages.
- An antistatic work environment. To prevent electrostatic damage to components whenever you work on the instrument, wear properly-grounded electrostatic prevention wrist and foot straps, and work in a tested antistatic environment on an antistatic mat.

Test points

Test points on the Main board are shown in the troubleshooting flow chart. The test point voltages are printed on the Main board. The +12 V test point is on the upper right-hand corner of the board.

Troubleshooting flow chart

Follow the troubleshooting flow chart to determine the action for a fault condition.



1500-009

Figure 5: Primary troubleshooting tree

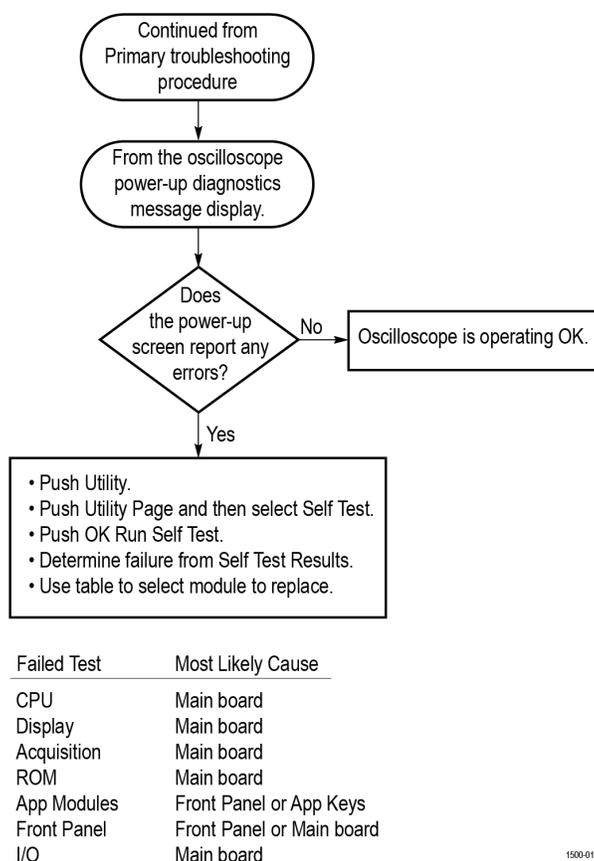


Figure 7: Module isolation troubleshooting procedure

Instrument self tests

The instrument runs self test diagnostics during every power on. The power on self tests ensure that the hardware and software are functionally working. The tests provide limited diagnostic information, and provide no performance information.

If the instrument detects errors during power on, a pop-up message indicates that a failure has occurred. To display the Self test menu and results, select **Utility > Self Test**. Select a test mode and run the self tests. If you continue to get errors on one or more tests, you will need to return the instrument to your nearest Tektronix Service Center for repair.

Software updates

To update the application software:

1. Go to **www.tek.com/product-support**.
2. Enter a model number in the Enter Product or Product Series Name field and click **Go**.
3. Click the **Software** tab.
4. On the oscilloscope, tap **Help > About**.
5. Compare the version number of the installed software to the version on the web:
 - a. If the version number on the oscilloscope is the same as the version on the web, you have the latest version. You do not need to install new software. Exit this procedure.
 - b. If the version number on the oscilloscope is a lower number than the version on the web, you can download and install new software. Continue with the rest of this procedure.
6. Select the highest-numbered version.
7. Click **Download File** to start the download.

8. When done downloading, unzip the downloaded file.
9. Open the file install.txt and follow the instructions in the file.

After power supply module replacement

After removal and replacement of the power supply module, you must perform the Performance Verification procedures, found in the *Specifications and Performance Verification* manual (Tektronix part number 077-1499-XX). Download this manual from the Tektronix Web site (www.tek.com/manuals).

If the instrument fails the Performance Verification tests, it must be returned to a Tektronix Service Center for adjustment.

Replaceable parts

This section contains separate subsections for different product groups. Use the lists in the appropriate section to identify and order replacement parts for your product.

Standard accessories. Standard accessories for these products are listed in your user manual. The user manual is available at www.tek.com/manuals.

Parts ordering information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order:

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Module servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix Service Center or representative for repair assistance.

Module exchange. In some cases, you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-833-9200. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix Web site (www.tek.com) for a list of offices.

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.

Abbreviations

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

Using the replaceable parts list

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

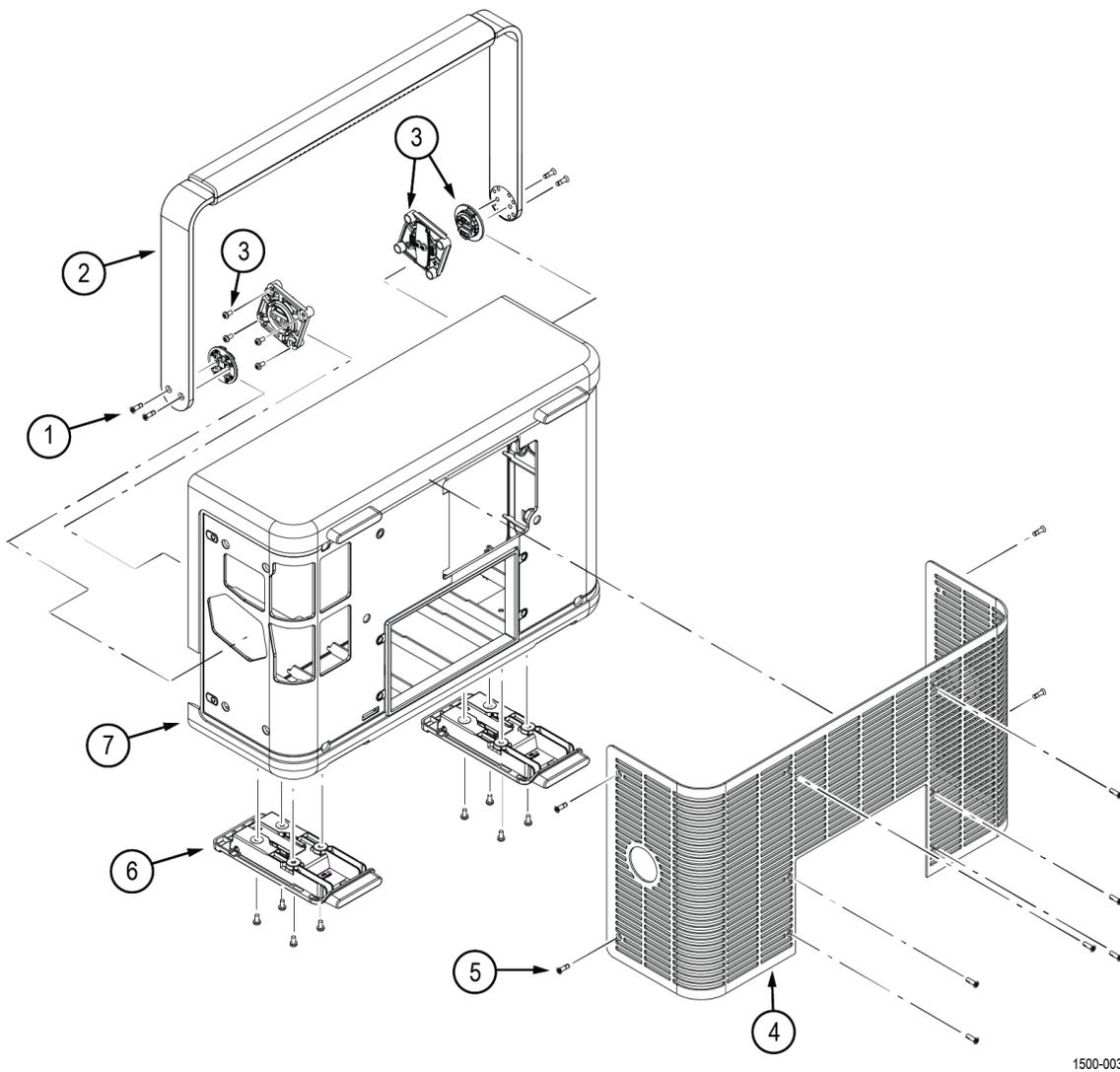
Table 5: Parts list column descriptions

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.

Table continued...

Column	Column name	Description
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 entry 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.

Rear case



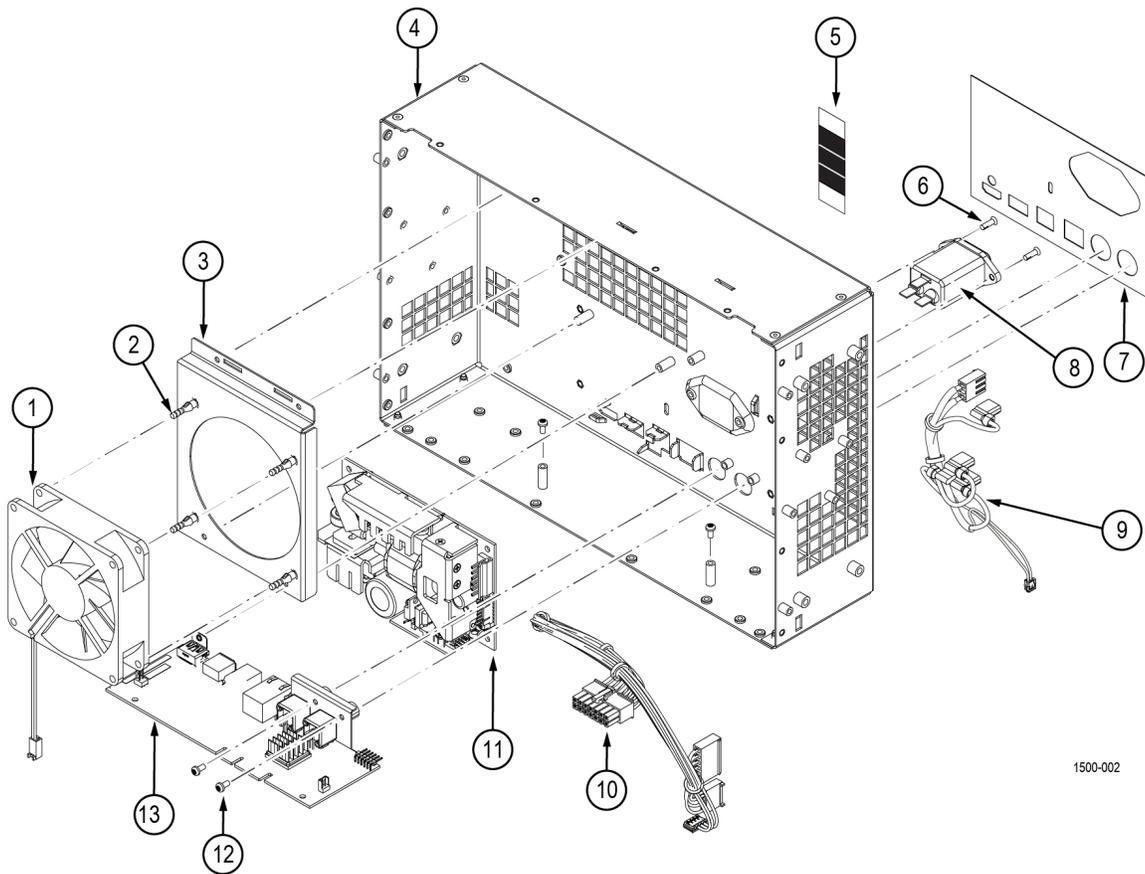
1500-003

Figure 8: Rear case exploded view

Table 6: Rear case

Index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
<i>Figure 8: Rear case exploded view</i> on page 24					
-1	211-1688-XX			4	SCREW, MACHINE, M3X0.5X10, FLAT HEAD 90 DEG, SUS410 NYLOK, TORX T10
-2	065-1060-XX			1	MODULE ASSY:SERVICE REPLACEMENT KIT HANDLE ASSEMBLY
-3	065-1059-XX			1	MODULE ASSY:SERVICE REPLACEMENT KIT HANDLE HUB ASSEMBLY, RIGHT AND LEFT
-4	378-0963-XX			1	GRILLE, COSMETIC, REAR
-5	211-1686-XX			10	SCREW, MACHINE, M3X0.5X10 FLAT HEAD, STL, TORX 10
-6	065-1047-XX			1	MODULE ASSY:SERVICE REPLACEMENT KIT; REAR FLIP FEET; 3 & 4 SERIES (QTY 2 IDENTICAL)
-7	202-0579-XX			1	CASE, REAR, ASSEMBLY. INCLUDES: PLASTIC CASE, PLASTIC TRIM, and WRAP LABELS

Rear chassis



1500-002

Figure 9: Rear chassis exploded view

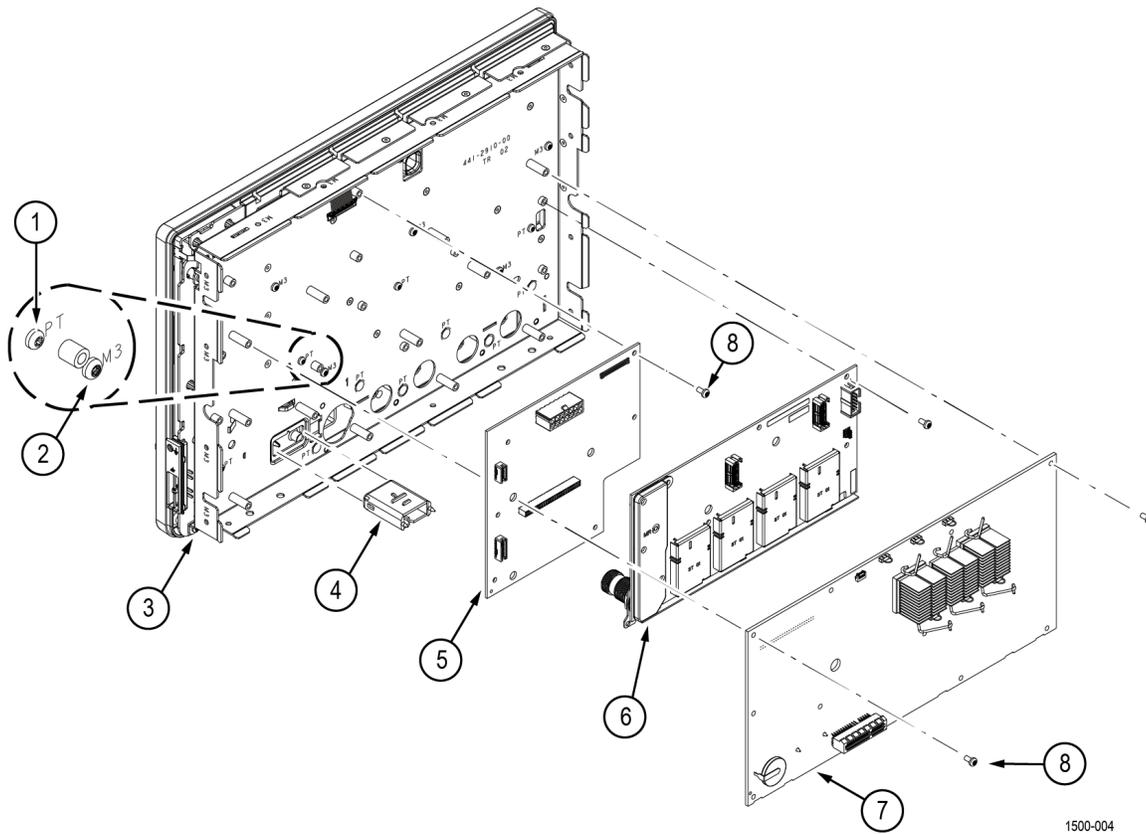
Table 7: Rear chassis

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
<i>Figure 9: Rear chassis exploded view</i> on page 26					
-1	119-8177-XX			1	FAN, TUBEAXIAL; 12 VDC, 0.21 A, 2.52 W, 1.45 M ³ /MIN, 3150 RPM, 33 DBA, 92 MM X 92 MM X 25 MM, SAFETY CONTROLLED
-2	348-2082-XX			4	GROMMET, FAN MOUNT, NOISE DAMPING
-3	407-6149-XX			1	BRACKET, FAN
-4	441-2911-XX			1	CHASSIS, REAR (a new Rear I/O Label needs to be installed when replacing the rear chassis; order separately)

Table continued...

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-5	253-0594-XX			1	TAPE, CONDUCTIVE, LINE FILTER SHIELD If the tape is removed during service, replace it during reassembly. The tape is removed during 119-7086-xx (#8) and 174-6286-xx (#9) replacement.
-6	211-1686-XX			2	SCREW, MACHINE; M3X0.5X10, FLAT HEAD, STL, TORX 10
-7	335-4064-XX			1	LABEL, REAR I/O
-8	119-7086-XX			1	FILTER, EMI; AC LINE CONNECTOR/INPUT FILTER;6.0 A, 120-250 VAC, DC-400 HZ, 2.2 NF CY, 100 NF CX, IEC INPUT, FAST-ON/SOLDER LUG OUTPUT, CHASSIS MOUNT, SAFETY CONTROLLED
-9	174-6286-XX			1	CABLE ASSEMBLY (LINE INPUT), SAFETY CONTROLLED
-10	174-6284-XX			1	CABLE, POWER SUPPLY, OUTPUT
-11	119-8042-XX			1	POWER SUPPLY; AC-DC; 90-264 VAC 45-66 HZ, 100-132 VAC 360-440 HZ IN; +12 V@12 A5, +5 V@1 A, 150 W, OUT; PS_ON#, PWR_GOOD SIGNALS; SAFETY CONTROLLED
-12	211-1584-XX			32	SCREW, MACHINE, M3X0.5X6MM PAN HEAD, TORX T10
-13	878-1624-XX			1	ASSEMBLY, CIRCUIT BOARD, I/O BOARD

Front chassis



1500-004

Figure 10: Front chassis exploded (rear) view

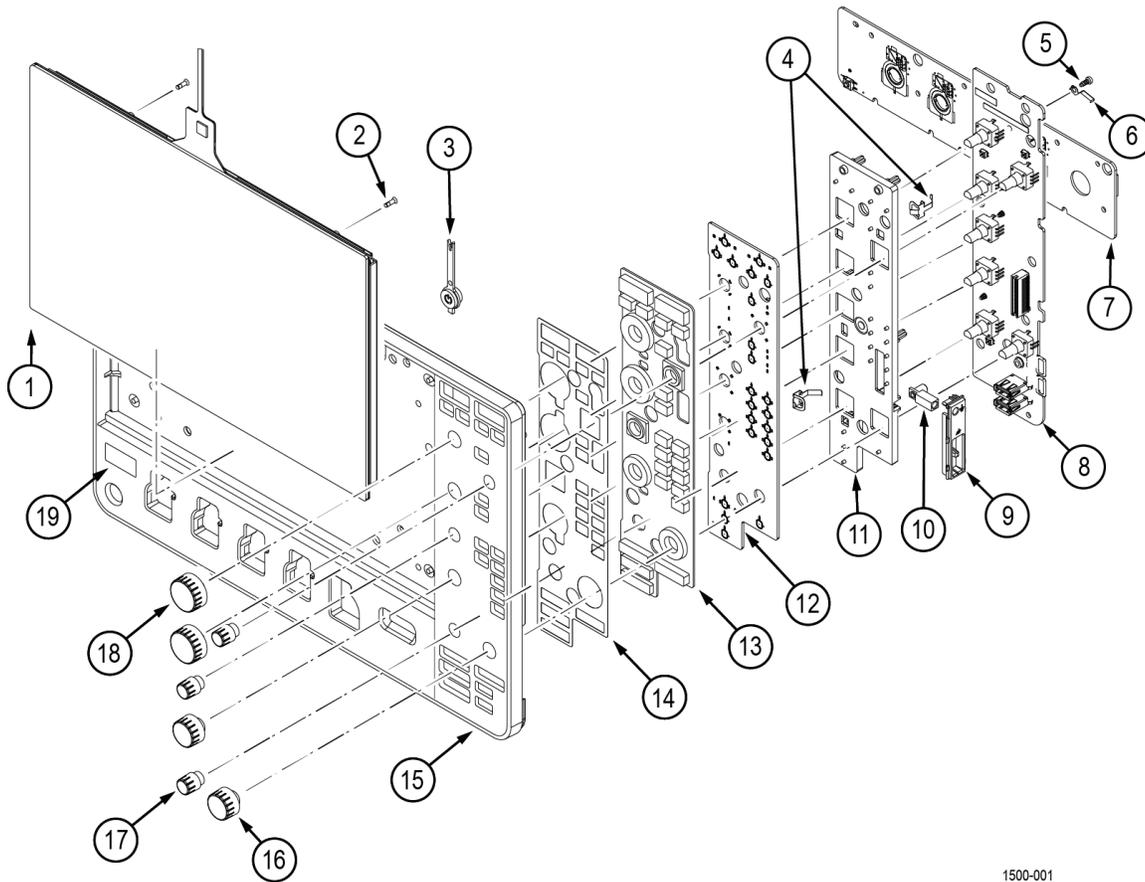
Table 8: Front chassis

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
<i>Figure 10: Front chassis exploded (rear) view</i> on page 28					
-1	211-1585-XX			15	SCREW, DELTA-PT, 3MM X 8MM, T10
-2	211-1584-XX			8	SCREW MACHINE, M3 X 6
-3	441-2910-XX			1	CHASSIS, FRONT, ASSEMBLY Return the instrument to Tektronix for service.
-4	351-1159-XX			1	GUIDE, MSO PROBE, BLACK Return the instrument to Tektronix for service.
-5	878-1623-XX			1	ASSEMBLY, CIRCUIT BOARD, MEZZANINE Return the instrument to Tektronix for service.

Table continued...

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-6	870-1626-XX			1	ASSEMBLY, CIRCUIT BOARD, AFE 1GHZ, 4 CH MODEL, WITH SHIELD 337-4590-XX Return the instrument to Tektronix for service.
	870-1627-XX			1	ASSEMBLY, CIRCUIT BOARD, AFE 1GHZ, 2 CH MODEL, WITH SHIELD 337-4590-XX Return the instrument to Tektronix for service.
	870-1647-XX			1	CIRCUIT BOARD ASSY; AFE BOARD 500MHZ, 2 CH MODEL, WITH SHIELD 337-4590-XX Return the instrument to Tektronix for service.
	870-1648-XX			1	CIRCUIT BOARD ASSY; AFE BOARD 500MHZ, 4 CH MODEL, WITH SHIELD 337-4590-XX Return the instrument to Tektronix for service.
-7	878-1625-XX			1	ASSEMBLY, CIRCUIT BOARD, MAIN BOARD Return the instrument to Tektronix for service.
-8	211-1584-XX			27	SCREW MACHINE, M3 X 6

Front panel and display



1500-001

Figure 11: Front panel and display exploded view



Note: None of the components listed are user-replaceable except for front panel knobs and the front panel label. Return the instrument to your nearest Tektronix Service Center to repair or replace any internal components or assemblies in this diagram.

Table 9: Front panel and display

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
<i>Figure 11: Front panel and display exploded view</i> on page 30					
-1	850-0404-XX			1	ASSEMBLY,DISPLAY / TOUCHSCREEN (INCLUDES DISPLAY + TOUCHSCREEN + BRACKET), SAFETY CONTROLLED Return the instrument to Tektronix for service.
-2	211-1584-XX			5	SCREW, MACHINE, M3X0.5X6MM PAN HEAD, TORX T10
-3	366-0920-XX			1	BUTTON, POWER SWITCH, SAFETY CONTROLLED Return the instrument to Tektronix for service.

Table continued...

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-4	133-0194-XX			2	CONTACT, SPRING FRONTPANEL, LED BOARD TO CHASSIS, INSTALLED ON SPACER
-5	211-1585-XX			3	SCREW, DELTA-PT, 3MM X 8MM, T10
-6	133-0192-XX			3	CONTACT, SPRING FRONT PANEL
-7	878-1622-XX			1	ASSEMBLY, CIRCUIT BOARD, PROBE INTERFACE Return the instrument to Tektronix for service.
-8	878-1620-XX			1	ASSEMBLY, CIRCUIT BOARD, FRONT PANEL ENCODER Return the instrument to Tektronix for service.
-9	380-1331-XX			1	HOUSING, PROBE COMP Return the instrument to Tektronix for service.
-10	131-9410-XX			1	CONNECTOR, RECEPTACLE, GROUND JACK
-11	361-1892-XX			1	SPACER, FRONT PANEL Return the instrument to Tektronix for service.
-12	065-1038-XX			1	MODULE ASSY: SERVICE REPLACEMENT KIT; FRONT PANEL DOME SWITCH ARRAY, AND PCBA, FRONT PANEL-SWITCH/LED, MDO32 AND MDO34 Return the instrument to Tektronix for service.
-13	260-3116-XX			1	EMAT, FRONT PANEL Return the instrument to Tektronix for service.
-14	335-4091-XX			1	LABEL, BLACKOUT, EMAT OVERLAY Return the instrument to Tektronix for service.
-15	065-1043-XX			1	SERVICE REPLACEMENT KIT; 2CH FRONT CASE ASSY, 3 SERIES MDO (PLASTIC AND LABELS) Return the instrument to Tektronix for service.
	065-1044-XX			1	SERVICE REPLACEMENT KIT; 4CH FRONT CASE ASSY, 3 SERIES MDO (PLASTIC AND LABELS) Return the instrument to Tektronix for service.
-16	366-0944-XX			2	KNOB, MEDIUM WITH OVERMOLD
-17	366-0943-XX			3	KNOB, SMALL WITH OVERMOLD

Table continued...

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-18	366-0945-XX			2	KNOB, LARGE WITH OVERMOLD
-19	335-4197-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 4 CHANNEL, 100 MHZ
	335-4198-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 4 CHANNEL, 200 MHZ
	335-4199-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 4 CHANNEL, 350 MHZ
	335-4200-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 4 CHANNEL, 500 MHZ
	335-4201-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 4 CHANNEL, 1GHZ
	335-4192-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 2 CHANNEL, 100 MHZ
	335-4193-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 2 CHANNEL, 200 MHZ
	335-4194-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 2 CHANNEL, 350 MHZ
	335-4195-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 2 CHANNEL, 500 MHZ
	335-4196-XX			1	MARKER, IDENTIFICATION; LABEL MDO, 2 CHANNEL, 1 GHZ