



**TBS2000 Series
Digital Storage Oscilloscopes
Service Manual**



077-1150-00



**TBS2000 Series
Digital Storage Oscilloscopes
Service Manual**

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 before performing service.

www.tek.com

077-1150-00

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

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.

Table of Contents

| | |
|--|------|
| Important safety information | iv |
| General safety summary | iv |
| Service safety summary | vii |
| Terms in this manual | vii |
| Symbols and terms on the product | viii |
| Preface | ix |
| Manual conventions | ix |

Operating information

| | |
|----------------------------|-----|
| Operating information..... | 1-1 |
|----------------------------|-----|

Theory of operation

| | |
|---|-----|
| Theory of operation | 2-1 |
| Power supply | 2-2 |
| Front End assembly (4 channel models) | 2-2 |
| Main board | 2-2 |
| I/O board (4 channel models)..... | 2-3 |
| Front-panel board | 2-3 |

Adjustments

| | |
|-------------------|-----|
| Adjustments | 3-1 |
|-------------------|-----|

Maintenance

| | |
|--|------|
| Maintenance | 4-1 |
| Preventing ESD | 4-1 |
| Inspection and cleaning | 4-1 |
| Module removal..... | 4-5 |
| Troubleshooting..... | 4-5 |
| Troubleshooting procedure | 4-6 |
| Unpacking and repacking instructions | 4-10 |

Replaceable parts list

| | |
|--|-----|
| Replaceable parts list..... | 5-1 |
| Parts ordering information | 5-1 |
| Using the replaceable parts list | 5-2 |
| The replaceable parts list..... | 5-3 |

List of Figures

| | |
|--|-----|
| Figure 2-1: TBS2000 block diagram (2 channel)..... | 2-1 |
| Figure 2-2: TBS2000 block diagram (4 channel)..... | 2-1 |
| Figure 4-1: Primary troubleshooting procedure flowchart..... | 4-7 |
| Figure 4-2: AC Power Supply module troubleshooting..... | 4-8 |
| Figure 4-3: Board isolation troubleshooting flowchart..... | 4-9 |
| Figure 5-1: Four channel models; front half..... | 5-3 |
| Figure 5-2: Four channel models; rear half..... | 5-5 |
| Figure 5-3: Two channel models; front half..... | 5-7 |
| Figure 5-4: Two channel models; rear half..... | 5-9 |

List of Tables

| | |
|--|------|
| Table 4-1: External inspection checklist | 4-3 |
| Table 4-2: Internal inspection checklist..... | 4-4 |
| Table 4-3: Most likely board to replace for failed diagnostics | 4-9 |
| Table 5-1: Four-channel model parts: front panel, display, and front chassis | 5-4 |
| Table 5-2: Four-channel model parts: inputs, main board, power supply, I/O, rear chassis, rear cover | 5-6 |
| Table 5-3: Two channel model parts; front panel, labels, front panel, LCD, chassis | 5-8 |
| Table 5-4: Two channel model parts; power supply, main board, AC connector/filter, rear cover | 5-10 |

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, additional information is provided at the end of this section. (See page vii, *Service 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.

Comply with local and national safety 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.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, make sure 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 ratings 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 apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do not float the common terminal above the rated voltage for that 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. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

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.

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.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Use proper fuse. Use only the fuse type and rating specified for this product.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

Provide proper ventilation. Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

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 finger guards 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. Understand the voltage ratings for the probe you are using and do not exceed those ratings. Two ratings are important to know and understand:

- 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

These two voltage ratings depend on the probe and your application. Refer to the Specifications section of the manual for more information.



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 a current probe.

Connect the probe reference lead to earth ground only.

Do not connect a current probe to any wire that carries voltages 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.

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 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.



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 symbol(s) may appear on the product:



Preface

This service manual provides information that you need to troubleshoot, disassemble, and replace parts on the following Tektronix oscilloscopes:

| Model | Bandwidth | Channels |
|---------|-----------|----------|
| TBS2072 | 70 MHz | 2 |
| TBS2102 | 100 MHz | 2 |
| TBS2074 | 70 MHz | 4 |
| TBS2104 | 100 MHz | 4 |

Manual conventions

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

Modules Throughout this manual, any replaceable component, assembly, or part is referred to by the term *module*.

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 *General Safety Summary*. Information for service procedures appears in both the *General Safety Summary* and the *Service Safety Summary*.

Operating information

Operating information

For information on installing and operating your oscilloscope, refer to the *TBS2000 Series Digital Storage Oscilloscopes User Manual* (Tektronix part number 077-1147-xx English; other languages available), which is downloadable from the Tektronix Web site (www.tek.com/downloads).

Theory of operation

Theory of operation

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

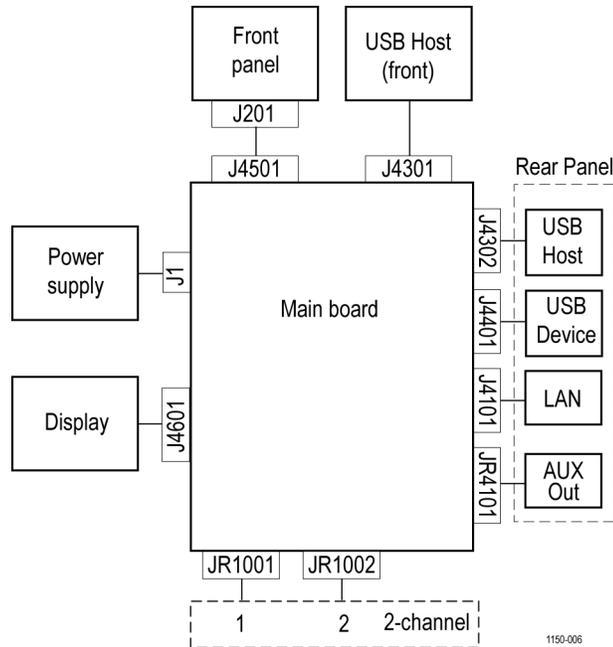


Figure 2-1: TBS2000 block diagram (2 channel)

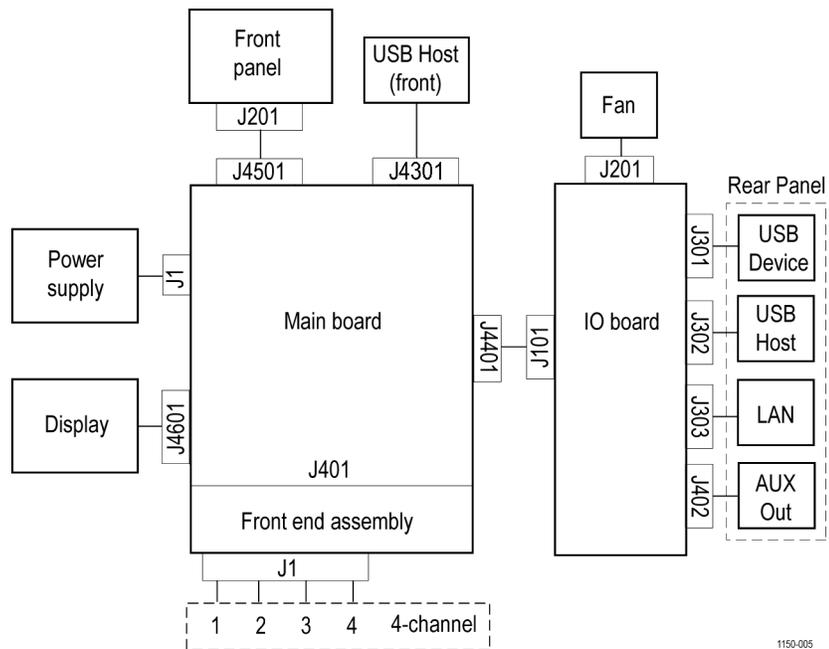


Figure 2-2: TBS2000 block diagram (4 channel)

Power supply

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

Front End assembly (4 channel models)

The Front End assembly begins with the analog signal path and ends with differential mode channel signals which are passed to the Main board. The analog inputs, attenuators, and preamps are contained in this assembly.

Main board

The Main 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. |
| Trigger system | The Trigger system digitizes the analog signals from the preamplifiers and routes the digitized signal to the Trigger circuit. 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 an ARM microprocessor that controls the entire instrument. The processor system also contains FLASH ROM, system RAM, and interfaces to USB ports and the Ethernet port. |
| Power subsystem | The Main board converts the +12 V power to +5 V, -5 V, +3.3 V, +2.5 V, +2 V, +1.8 V, +1.5 V, +1.1 V, 1 V, and 0.75 V, used by circuitry throughout the system. The Front Panel board is powered on at all times when AC power is connected to the unit. |
| I/O ports (2 channel models) | The Main board provides USB ports (Host and Device), an Ethernet port (LAN), and an Aux Out trigger output connections. |

I/O board (4 channel models)

The I/O board provides USB ports (Host and Device), an Ethernet port (LAN), and an Aux Out trigger output connections.

Front-panel board

The Front Panel board contains a microprocessor that reads the front-panel buttons and controls, sends this information to the processor system on the Main board, and controls power to the Main board. The Front Panel board also generates the probe compensation output signal and controls power to the Main board.

Adjustments

Adjustments

There are no customer-performable adjustment procedures (calibrations) for the TBS2000 Series oscilloscopes. Please return the instrument to Tektronix if adjustment is required. Calibrations can only be performed at a Tektronix service center and require the use of traceable test equipment (signal sources and measuring equipment) to verify the performance of the instrument.

To determine if adjustment is required, use the Performance Verification procedure in the *TBS2000 Series Digital Storage Oscilloscopes Specifications and Performance Verification* manual (tektronix part number 077-1148-xx), available at www.tek.com/downloads. Adjustment is also required after instrument repair.

Maintenance

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the oscilloscope, and repackaging instructions for returning the oscilloscope to Tektronix for service.

Preventing ESD

Before servicing this product, read the *General Safety Summary* and the *Service Safety Summary* at the front of the manual, and familiarize yourself with the following electrostatic discharge (ESD) information.



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. Service 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.



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

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).

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.

Exterior cleaning



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

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 might damage the chassis.

Clean the power 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.*

Exterior inspection Inspect the external oscilloscope case, display, and controls for damage, wear, and missing parts, using the following table as a guide. Immediately repair defects that could cause personal injury or lead to further damage to the oscilloscope.

Table 4-1: 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 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. |

Interior inspection To access the inside of the oscilloscope for cleaning and inspection, refer to the exploded view diagrams. (See page 5-1, *Replaceable parts list*.)

Inspect the internal portions of the oscilloscope for damage and wear, using the following table as a guide. Repair any defects immediately.

If any circuit board is repaired or replaced, adjustment is required. (See page 3-1, *Adjustments*.)



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

Table 4-2: 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. | 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. |

Interior cleaning

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.)

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

If there is still dust or dirt on the module, the oscilloscope may be spray washed using a solution of 75% isopropyl alcohol by following these steps:

- a. Spray wash dirty parts with isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
- b. Use hot (120 °F to 140 °F) deionized water to thoroughly rinse them.
- c. Dry all parts with low-pressure, deionized air.
- d. Dry all components and assemblies in an oven or drying compartment using low-temperature (125 °F to 150 °F) circulating air.

Lubrication

There is no periodic lubrication required for this oscilloscope.

Module removal



WARNING. Only qualified personnel should perform service procedures. Before performing 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*. (See page 4-1, *Preventing ESD*.)

To remove an assembly, refer to the exploded view diagrams and parts lists. (See page 5-1, *Replaceable parts list*.)

If you are disassembling the instrument for cleaning, refer to the *Inspection and Cleaning* procedure for instructions. (See page 4-1, *Inspection and cleaning*.)



WARNING. Disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.

Required equipment

You will need Torx drivers with a T-15 and T-10 Torx tip to remove instrument screws.

To remove modules

- To remove any of the instrument modules or assemblies, you must first remove the rear cover and separate the front chassis from the rear chassis.
- To remove the Front Panel board assembly or the front panel case assembly, you must first remove the Main board assembly and the front chassis.
- To remove or install the keypad, do not touch the switch contacts with your fingers. The oils on 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.

Troubleshooting

This section contains information and procedures to help you isolate a defective module in the TBS2000 Series oscilloscopes.



WARNING. 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, and, to prevent possible injury to service personnel or damage to electrical components, read *Preventing ESD*. (See page 4-1, *Preventing ESD*.)

Adjustment after repair Instrument adjustment is required after you replace the Main board (all models) or the Front End assembly (4 channel models). Refer to the *Adjustments* section for information about the adjustment. (See page 3-1, *Adjustments*.)

Required tools and equipment You need the following equipment to troubleshoot the instrument.

| Tools and equipment | Example |
|---------------------|---------------------|
| DMM | 3.5 digits or above |

Troubleshooting procedure

Use the following flowcharts to troubleshoot an instrument failure. Begin with the Primary troubleshooting flowchart.



WARNING. *Before removing the cabinet, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.*



CAUTION. *When you operate the four-channel instrument with the cabinet removed, the system fan will not cool the instrument. You must provide an external fan to cool the interior of the instrument. Failure to do so could cause instrument damage.*

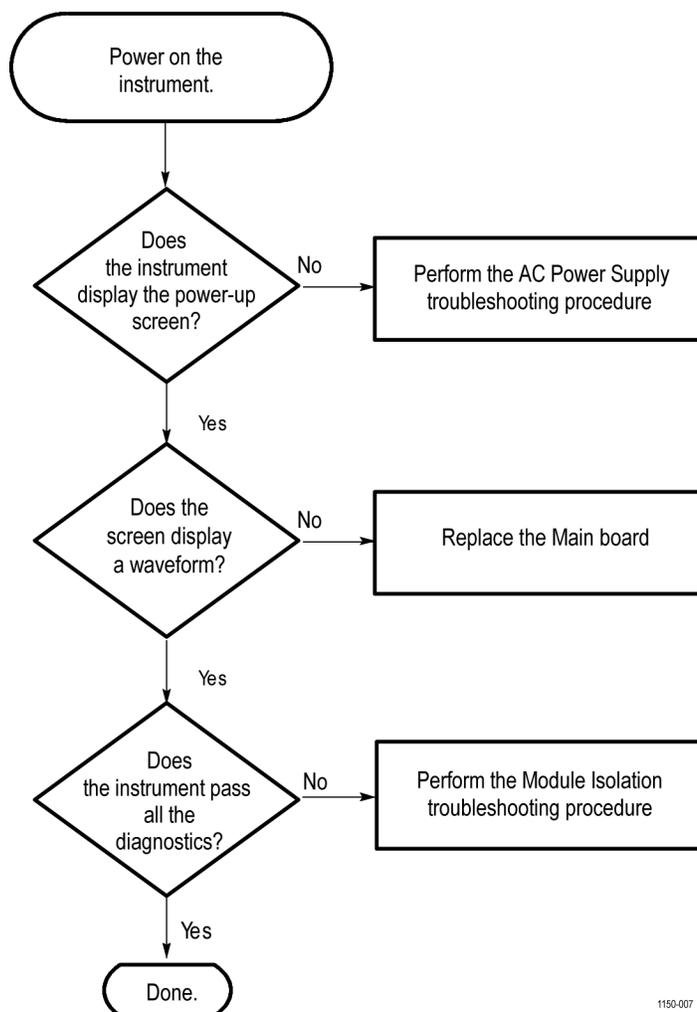
Primary troubleshooting
flowchart

Figure 4-1: Primary troubleshooting procedure flowchart

AC Power Supply module troubleshooting flowchart

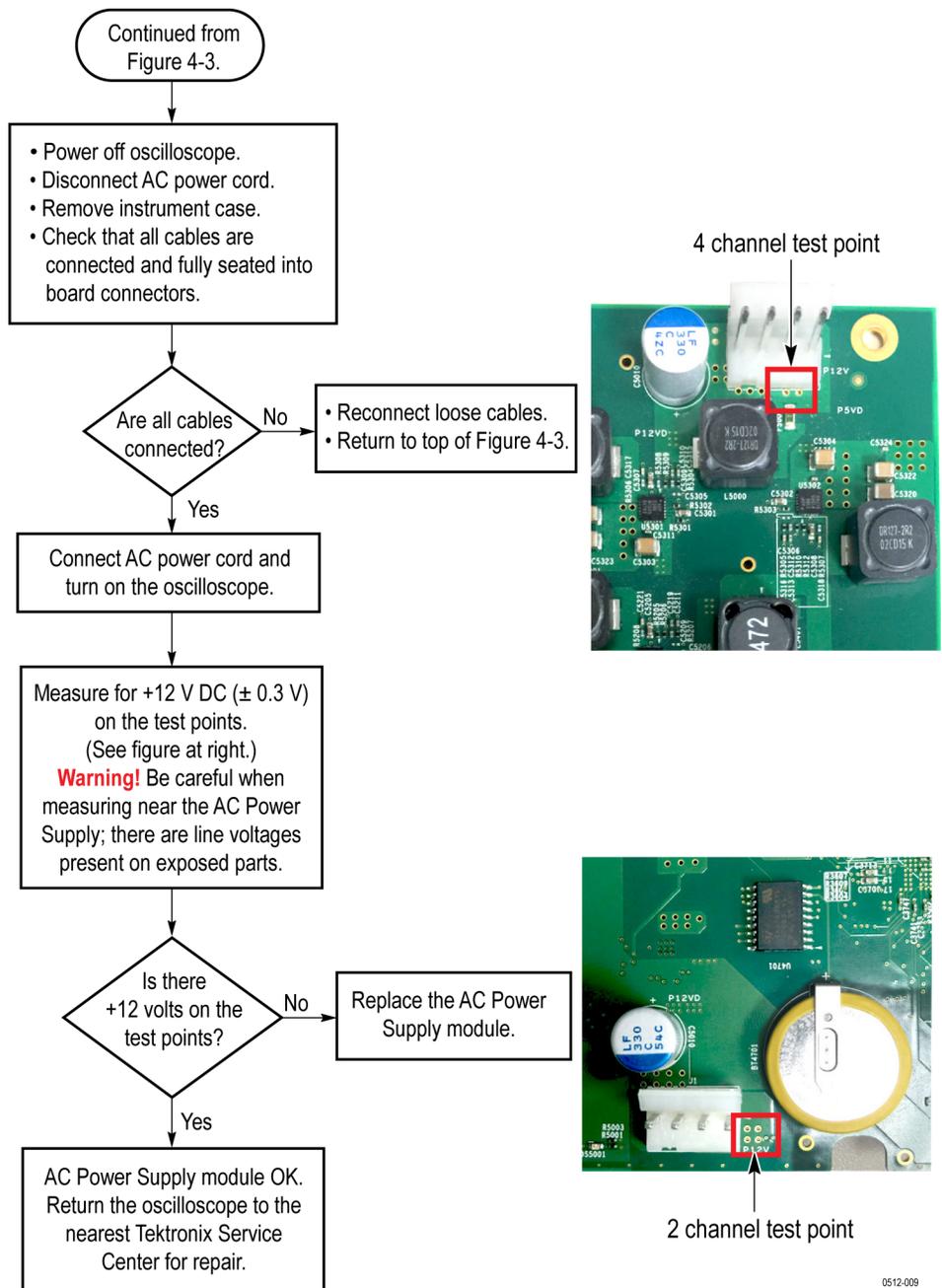
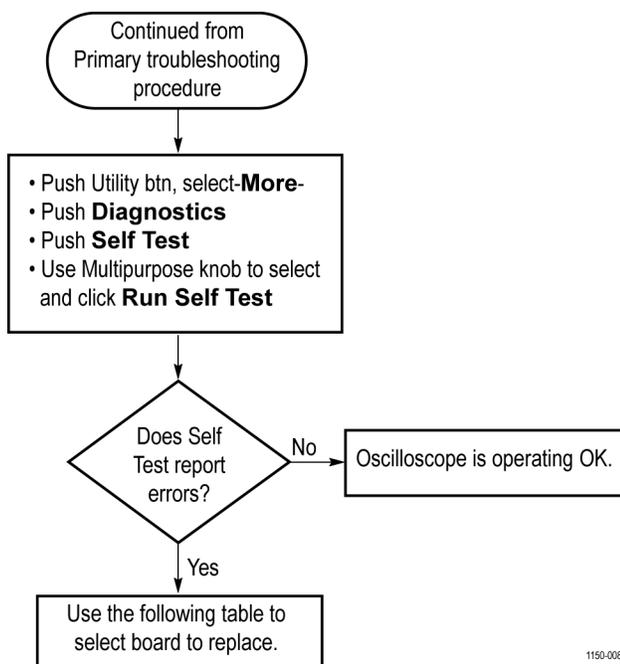


Figure 4-2: AC Power Supply module troubleshooting

NOTE. Images show the power supply cable disconnected from the main board, to better show the test point locations. The power cable from the Power Supply must be connected to the Main board to test the +12 VDC value.

Board isolation troubleshooting flowchart



1150-008

Figure 4-3: Board isolation troubleshooting flowchart

Table 4-3: Most likely board to replace for failed diagnostics

| Failed test | Most likely board |
|--------------------|---|
| CPU | Main |
| Display | Main |
| Acquisition | Main (or Front End board on 4-channel models) |
| ROM | Main |
| Front Panel | Front Panel or Main |
| I/O | Main (or I/O board on 4-channel models) |

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, tell 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. See www.tektronix.com/service to find a service center near you.

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

- Temperature range: -4 °F to +140 °F (-20 °C to +60 °C)
- Altitude: To 39,370 feet (12,000 m)

See the Tektronix *TBS2000 Series Digital Storage Oscilloscopes Specifications and Performance Verification Technical Reference* (Tektronix part number 077-1148-xx) for a complete listing of the environmental specifications.

Replaceable parts list

Replaceable parts list

This chapter contains a list of the replaceable modules for these oscilloscopes. 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:

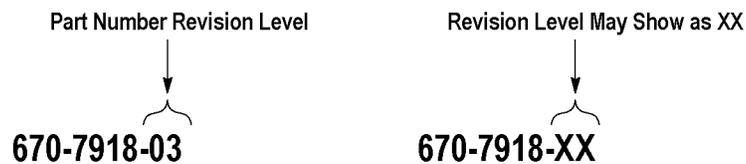
- Part number (see *Part Number Revision Level* below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that is 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 next 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, extension 2.

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 similarly 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.

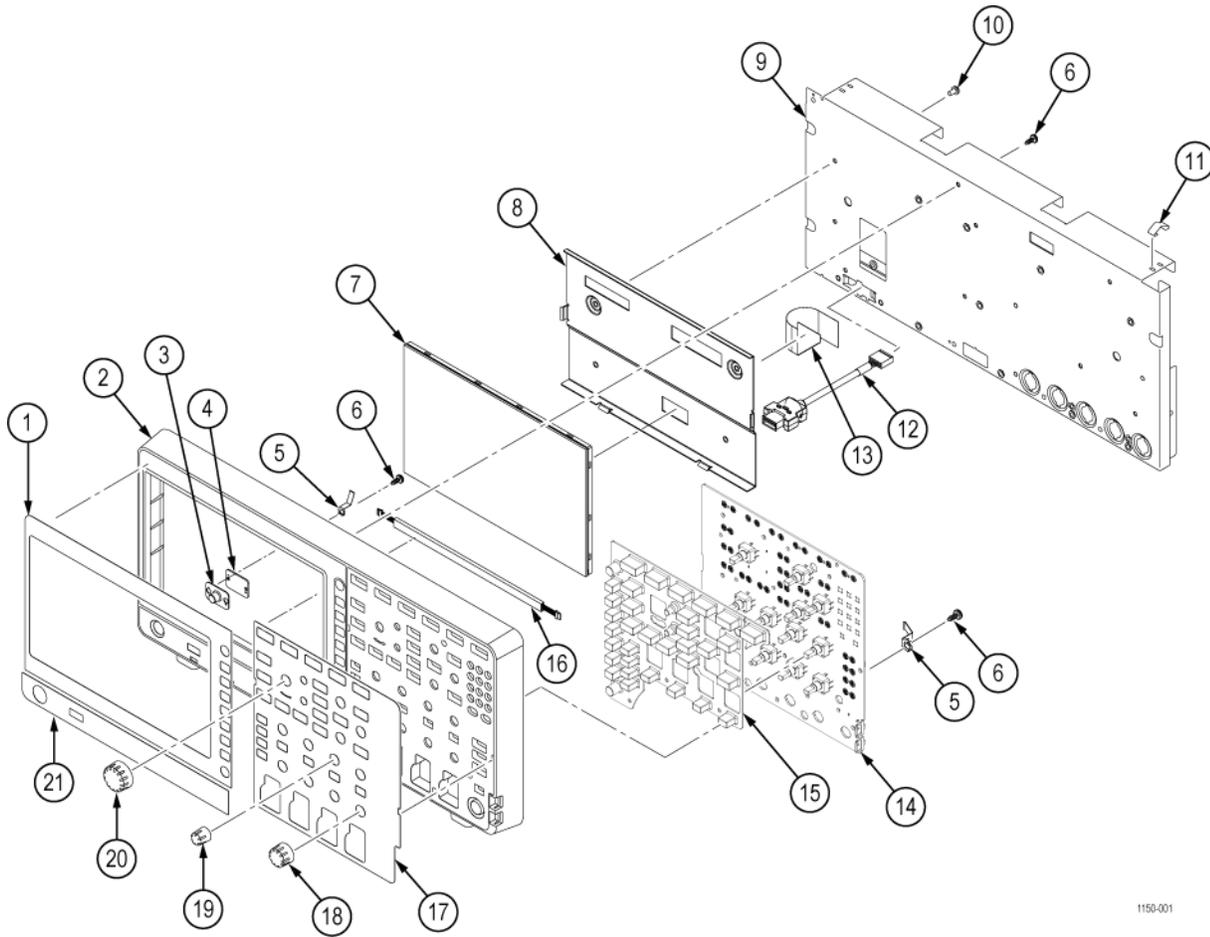
Parts list column descriptions

| Column | Column name | Description |
|---------|-----------------------|--|
| 1 | Figure & Index Number | Items in this section are referenced by figure and index numbers to the exploded view illustrations. |
| 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. |

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

Exploded views The illustrations in this section show the module-level exploded views of the oscilloscopes. Each exploded view is indexed by the numbers in the figure. The table of index numbers and part numbers corresponding to a picture are in the table immediately preceding the illustration.

The replaceable parts list



1150-001

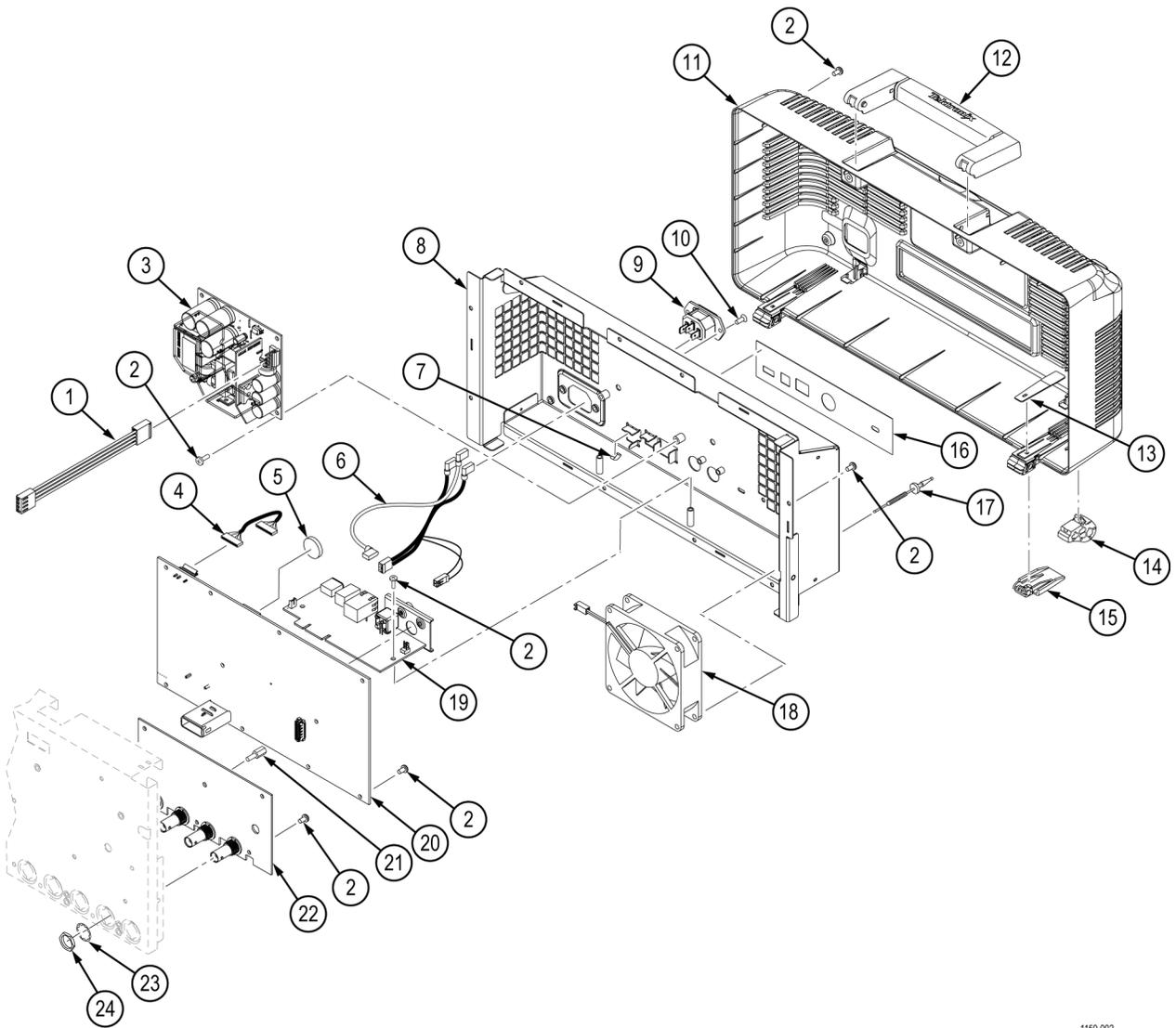
Figure 5-1: Four channel models; front half

Table 5-1: Four-channel model parts: front panel, display, and front chassis

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discount'd | Qty ¹ | Name & description |
|---------------------|-----------------------|----------------------|-----------------------|------------------|--|
| 5-1-1 | 335-3552-xx | | | 1 | LABEL, BLACK FRAME-B4 9 INCH DISPLAY, TBS2074, SAFETY CONTROLLED |
| | 335-3553-xx | | | 1 | LABEL, BLACK FRAME-B4 9 INCH DISPLAY, TBS2104, SAFETY CONTROLLED |
| -2 | 202-0522-xx | | | 1 | FRONT CASE |
| -3 | 260-3035-xx | | | 1 | SWITCH, KEYPAD, ELASTOMERIC POWER; SAFETY CONTROLLED |
| -4 | 878-1179-xx | | | 1 | CIRCUIT BOARD ASSY; POWER SWITCH BOARD |
| -5 | 131-8139-xx | | | 8 | CONTACT, SPRING; FRONT PANEL ELEC |
| -6 | 211-1273-xx | | | 22 ² | SCREW, PT; K35-1.57, PAN HEAD, STL, ZNPL, T-15 |
| -7 | 850-0312-xx | | | 1 | FRAME ASSEMBLY; DISPLAY; TBS2K |
| -8 | 407-5760-xx | | | 1 | BRACKET, DISPLAY MOUNT |
| -9 | 441-2848-xx | | | 1 | CHASSIS, FRONT |
| -10 | 211-1272-xx | | | 43 ² | SCREW, MACHINE; 6-32 X 0.250, PNH, STL, ZNPL, T-15 TORX DR |
| -11 | 131-6643-xx | | | 6 | CONTACT, ELECTRICAL |
| -12 | 174-5411-xx | | | 1 | CABLE EXTENSION, USB-HOST |
| -13 | 174-6623-xx | | | 1 | CABLE, DISPLAY, FFC, 50POS |
| -14 | 878-1172-xx | | | 1 | PCB, FRONT-PANEL |
| -15 | 260-3035-xx | | | 1 | SWITCH, KEYPAD, ASSEMBLY FRONT |
| -16 | 174-6696-xx | | | 1 | CABLE CONNECTION, FRONT-PANEL & POWER SWITCH |
| -17 | 335-3428-xx | | | 1 | MARKER, IDENTIFICATION LABEL, SAFETY CONTROLLED |
| | 335-3728-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, KOREAN |
| | 335-3744-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, FRENCH |
| | 335-3745-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, RUSSIAN |
| | 335-3746-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, ITALIAN |
| | 335-3747-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, GERMAN |
| | 335-3748-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, SPANISH |
| | 335-3749-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, JAPANESE |
| | 335-3750-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, PORTUGUESE |
| | 335-3751-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, SIMPLE CHINESE |
| | 335-3752-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, STANDARD CHINESE |
| -18 | 366-0935-xx | | | 5 | ASSEMBLY, KNOB; .685 DIAMETER |
| -19 | 366-0934-xx | | | 6 | ASSEMBLY, KNOB; .470 DIAMETER |
| -20 | 366-0936-xx | | | 1 | ASSEMBLY, KNOB; .925 DIAMETER |
| -21 | 335-3429-xx | | | 1 | MARKER, IDENTIFICATION LABEL, SAFETY CONTROLLED |

¹ Quantity indicated is for the entire instrument, not necessarily for each image.

² Tightening torque for 211-1272-xx and 211-1273-xx is 0.9 N*M



1150-002

Figure 5-2: Four channel models; rear half

Table 5-2: Four-channel model parts: inputs, main board, power supply, I/O, rear chassis, rear cover

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty ¹ | Name & description |
|---------------------|-----------------------|----------------------|----------------------|------------------|---|
| 5-2-1 | 174-6877-xx | | | 1 | CABLE POWER SUPPLY WITH MAIN BOARD, SAFETY CONTROLLED |
| -2 | 211-1272-xx | | | 43 ² | SCREW, MACHINE; 6-32 X 0.250, PNH, STL, ZNPL, T-15 TORX DR |
| -3 | 119-8488-xx | | | 1 | POWER SUPPLY; AC-DC, INTERNAL; 90-264 VAC 47-63 HZ, 103-127 VAC 360-440 HZ IN; +12V 5A4, 65W OUT; SAFETY CONTROLLED |
| -4 | 174-6699-xx | | | 1 | CABLE CONNECTION, FRONT-PANEL & MAIN BOARD |
| -5 | 146-0148-xx | | | 1 | BATTERY, DRY: 3 VOLT, 150MAH, LITHIUM, LEADED BUTTON CELL, SAFETY CONTROLLED |
| -6 | 174-6286-xx | | | 1 | CABLE ASSEMBLY (LINE INPUT), SAFETY CONTROLLED |
| -7 | 131-6643-xx | | | 2 | CONTACT, ELECTRICAL |
| -8 | 441-2847-xx | | | 1 | CHASSIS; REAR, SAFETY CONTROLLED |
| -9 | 119-7086-xx | | | 1 | FILTER, EMI; AC LINE CONNECTOR/INPUT FILTER; 6.0A, 120-250VAC, DC-400 HZ |
| -10 | 211-0718-xx | | | 2 | SCREW, MACHINE; 6-32 X 0.312, FLH100, STEEL, ZINC FINISH, T-10 TORX DR |
| -11 | 202-0544-xx | | | 1 | CASE, REAR, SAFETY CONTROLLED |
| -12 | 367-0598-xx | | | 1 | HANDLE, CARRYING OVERMOLDED, SAFETY CONTROLLED |
| -13 | 214-5148-xx | | | 2 | SPRING FRONT FOOT |
| -14 | 348-1909-xx | | | 2 | FOOT REAR |
| -15 | 348-2222-xx | | | 2 | FOOT, FRONT CABINET, HINGED |
| -16 | 335-3427-xx | | | 1 | LABEL, IO (REAR) |
| -17 | 348-2082-xx | | | 4 | GROMMET, FAN MOUNT, NOISE DAMPING |
| -18 | 119-8751-xx | | | 1 | FAN, TUBE AXIAL (92MM, DC, ASSEMBLY) |
| -19 | 878-1137-xx | | | 1 | CIRCUIT BOARD (IO BOARD) |
| -20 | 870-1169-xx | | | 1 | CIRCUIT BOARD MAIN BOARD |
| -21 | 129-1693-xx | | | 1 ³ | SCREW, JACK, 433H, 6-32 INTERNAL, 8-32 EXTERNAL |
| -22 | 878-1139-xx | | | 1 | CIRCUIT BOARD ASSY, ANALOG FRONT END BOARD, |
| -23 | 210-1039-xx | | | 4 | WASHER, LOCK INTERNAL TOOTH |
| -24 | 220-0265-xx | | | 4 ⁴ | NUT, PLAIN, HEX; 0.5-28 X 0.625 HEX, BRS, NKL PL |
| -N/A | 119-8771-xx | | | 1 ⁵ | WIFI USB DONGLE FOR TBS |

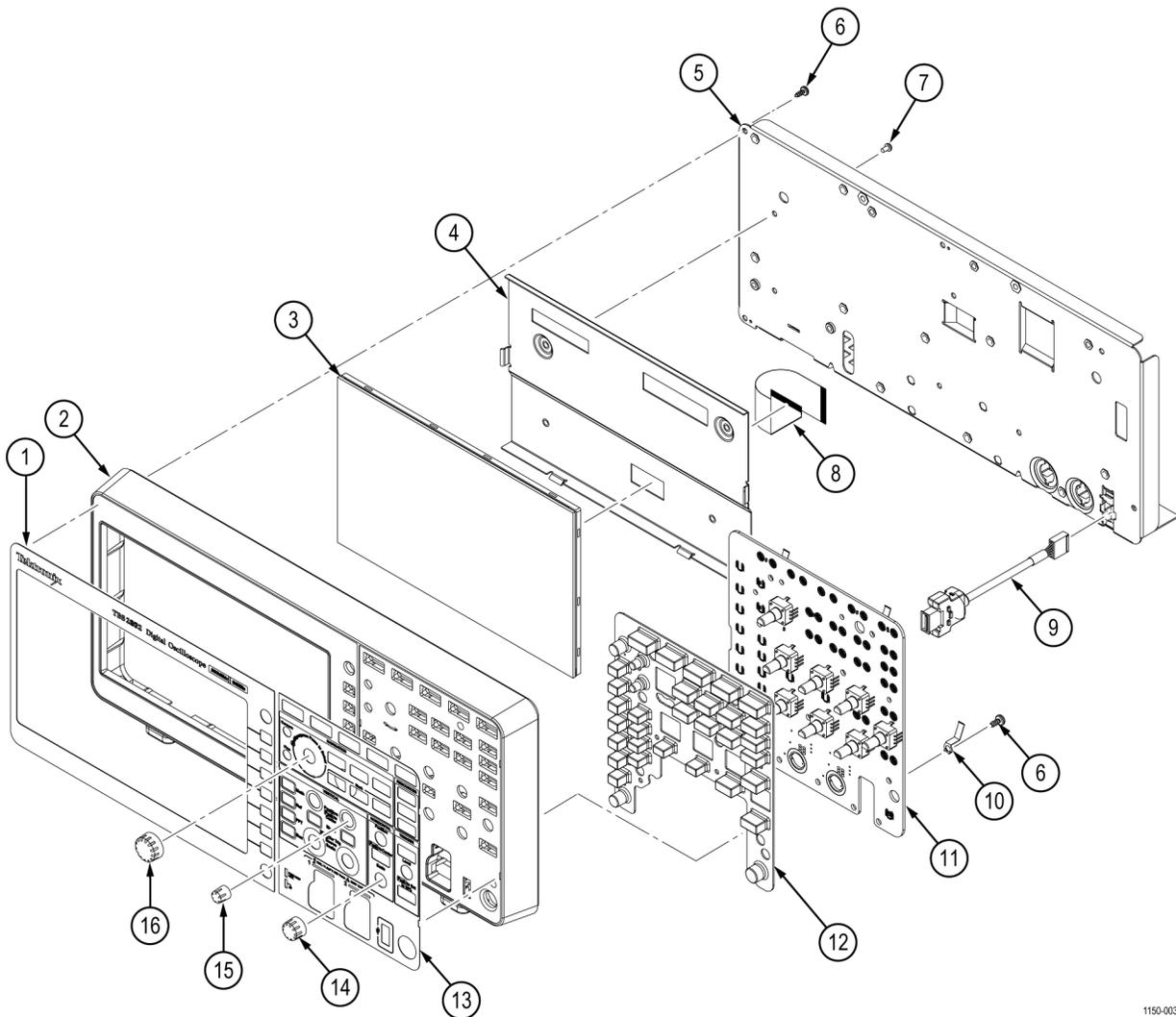
¹ Quantity indicated is for the entire instrument, not necessarily for items in each image.

² Tightening torque for 211-1272-xx and 211-1273-xx is 0.9 N*M.

³ Tightening torque for 129-1693-xx is 1.13 N*M.

⁴ Tightening torque for 220-0265-xx is 4.52N*M, ±0.23 N*M.

⁵ Tektronix option TEKUSBWIFI.



1150-003

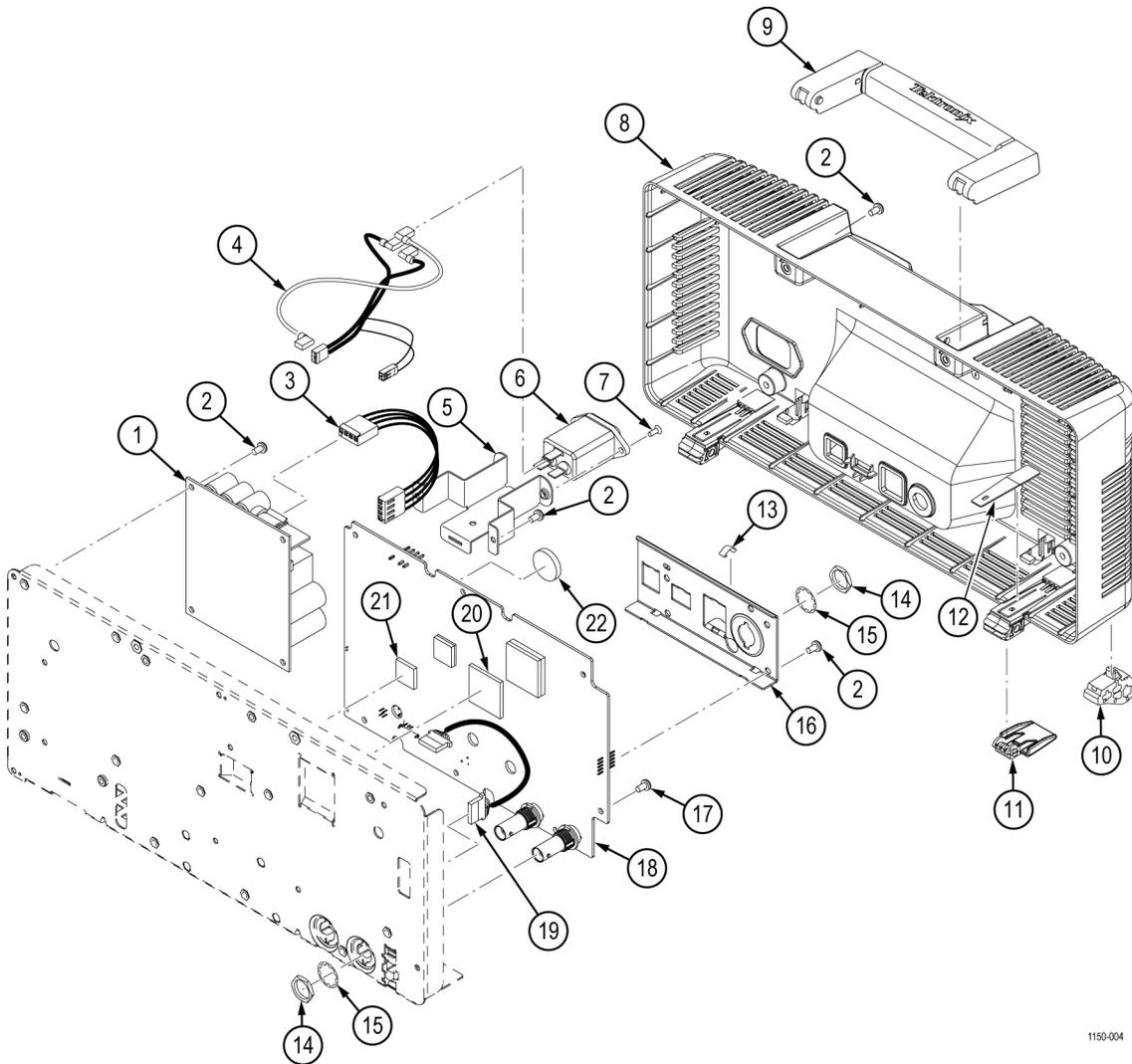
Figure 5-3: Two channel models; front half

Table 5-3: Two channel model parts; front panel, labels, front panel, LCD, chassis

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discount'd | Qty ¹ | Name & description |
|---------------------|-----------------------|----------------------|-----------------------|------------------|--|
| 5-3-1 | 335-3550-xx | | | 1 | LABEL, BLACK FRAME-B2 9 INCH DISPLAY, TBS2102, SAFETY CONTROLLED |
| | 335-3546-xx | | | 1 | LABEL, BLACK FRAME-B2 9 INCH DISPLAY, TBS2072, SAFETY CONTROLLED |
| -2 | 202-0527-xx | | | 1 | B2 FRONT CASE SAFETY CONTROLLED |
| -3 | 850-0312-xx | | | 1 | FRAME ASSEMBLY; DISPLAY; TBS2K |
| -4 | 407-5760-xx | | | 1 | BRACKET, DISPLAY MOUNT |
| -5 | 441-2844-xx | | | 1 | CHASSIS, MAIN, SAFETY CONTROLLED |
| -6 | 211-1273-xx | | | 22 ² | SCREW,PT; K35-1.57, PAN HEAD, STL, ZNPL, T-15 |
| -7 | 211-1272-xx | | | 43 ² | SCREW, MACHINE; 6-32 X 0.250, PNH, STL, ZNPL, T-15 TORX DR |
| -8 | 174-6941-xx | | | 1 | CABLE, DISPLAY, FFC, 50POS |
| -9 | 174-5411-xx | | | 1 | CABLE EXTENSION, USB-HOST |
| -10 | 131-8139-xx | | | 7 | CONTACT, SPRING; FRONT PANEL ELEC |
| -11 | 878-1161-xx | | | 1 | FRONT PANEL B2 BOARD |
| -12 | 260-3038-xx | | | 1 | SWITCH, KEYPAD, ELASTOMERIC FRONT PANEL |
| -13 | 335-3473-xx | | | 1 | MARKER, IDENTIFICATION LABEL FRONT PANEL, 2CH, SA, SAFETY CONTROLLED |
| | 335-3729-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, FRENCH |
| | 335-3730-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, RUSSIAN |
| | 335-3731-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, ITALIAN |
| | 335-3732-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, GERMANY |
| | 335-3733-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, SPANISH |
| | 335-3734-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, JAPANESE |
| | 335-3735-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, PORTUGUESE |
| | 335-3736-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, SIMPLE CHINESE |
| | 335-3737-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, STANDARD CHINESE |
| | 335-3738-xx | | | 1 | MARKER, IDENTIFICATION FRONT PANEL OVERLAY, KOREAN |
| -14 | 366-0935-xx | | | 3 | ASSEMBLY, KNOB; .685 IN DIAMETER |
| -15 | 366-0934-xx | | | 4 | ASSEMBLY, KNOB; .470 IN DIAMETER |
| -16 | 366-0936-xx | | | 1 | ASSEMBLY, KNOB; .925 IN DIAMETER |

¹ Quantity indicated is for the entire instrument, not necessarily for items in each image.

² Tightening torque for 211-1272-xx and 211-1273-xx is 0.9 N*M.



1150-004

Figure 5-4: Two channel models; rear half

Table 5-4: Two channel model parts; power supply, main board, AC connector/filter, rear cover

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty ¹ | Name & description |
|---------------------|-----------------------|----------------------|----------------------|------------------|--|
| 5-4-1 | 1198-488-xx | | | 1 | POWER SUPPLY; AC-DC, INTERNAL; 90-264 VAC 47-63 HZ, 103-127 VAC, 360-440 HZ IN; +12V 5A4, 65W OUT; SAFETY CONTROLLED |
| -2 | 211-1272-xx | | | 43 ² | SCREW, MACHINE; 6-32 X 0.250, PNH, STL, ZNPL, T-15 TORX DR |
| -3 | 174-6877-xx | | | 1 | CABLE POWER SUPPLY WITH MAIN BOARD, SAFETY CONTROLLED |
| -4 | 174-6920-xx | | | 1 | CABLE ASSEMBLY (LINE INPUT), SAFETY CONTROLLED |
| -5 | 407-5916-xx | | | 1 | BRACKET, FILTER, SAFETY CONTROLLED |
| -6 | 119-7086-xx | | | 1 | FILTER, EMI; AC LINE CONNECTOR/INPUT FILTER; 6.0A, 120-250 VAC, DC-400 HZ |
| -7 | 211-0718-xx | | | 2 | SCREW, MACHINE; 6-32 X 0.312, FLH100, STEEL, ZINC FINISH, T-10 TORX DR |
| -8 | 202-0528-xx | | | 1 | CASE, REAR, SAFETY CONTROLLED |
| -9 | 367-0598-xx | | | 1 | HANDLE, CARRYING OVERMOLDED, SAFETY CONTROLLED |
| -10 | 348-1909-xx | | | 2 | FOOT REAR; SAFETY CONTROLLED |
| -11 | 348-2209-xx | | | 2 | FOOT, FRONT CABINET, HINGED, SAFETY CONTROLLED |
| -12 | 214-5148-xx | | | 2 | SPRING FRONT FOOT |
| -13 | 131-6643-xx | | | 4 | CONTACT, ELECTRICAL |
| -14 | 220-0265-xx | | | 3 ³ | NUT, PLAIN, HEX; 0.5-28 X 0.625 HEX, BRS, NKL PL |
| -15 | 210-1039-xx | | | 3 | WASHER, LOCK INTERNAL TOOTH |
| -16 | 407-5915-xx | | | 1 | BRACKET, REAR BNC IN MAIN BOARD |
| -17 | 211-1273-xx | | | 6 | SCREW, PT; K35-1.57, PAN HEAD, STL, ZNPL, T-15 |
| -18 | 870-1175-xx | | | 1 | CIRCUIT BOARD ASSY; MAIN B2 BOARD |
| -19 | 174-6699-xx | | | 1 | CABLE CONNECTION, FRONT- PANEL & MAIN BOARD |
| -20 | 253-0571-xx | | | 1 | THERMAL INTERFACE MATERIAL SQUARE, 27X27MM |
| -21 | 253-0570-xx | | | 1 | THERMAL INTERFACE MATERIAL SQUARE, 15X15MM |
| -22 | 146-0148-xx | | | 1 | BATTERY, DRY: 3 VOLT, 150MAH, LITHIUM, LEADED BUTTON CELL, SAFETY CONTROLLED |
| -N/A | 119-8771-xx | | | 1 ⁴ | WIFI USB DONGLE FOR TBS |

¹ Quantity indicated is for the entire instrument, not necessarily for each image.

² Tightening torque for 211-1272-xx and 211-1273-xx is 0.9 N*M.

³ Tightening torque for 220-0265-xx is 4.52N*M, ±0.23 N*M.

⁴ Tektronix option TEKUSBWIFI.