

Service Manual

Tektronix

TDS 500C, TDS 600B & TDS 700C Digitizing Oscilloscopes

070-9875-01

CE

Warning

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

Table of Contents

General Safety Summary	xi
Service Safety Summary	xiii
Preface	xv
Manual Structure	xv
Manual Conventions	xvi
Related Manuals	xvii
Contacting Tektronix	xviii
Introduction	xix
Service Strategy	xix
Service Offerings	xix
Before You Begin	xxi

Specifications

Specifications	1-1
Product Description	1-1
User Interface	1-2
Signal Acquisition System	1-3
Horizontal System	1-3
Trigger System	1-5
Acquisition Control	1-5
On-Board User Assistance	1-6
Measurement Assistance	1-6
Storage	1-7
I/O	1-7
Display	1-8
Nominal Traits	1-9
Warranted Characteristics	1-17
Typical Characteristics	1-25

Operating Information

Installation	2-1
Supplying Operating Power	2-1
Operating Environment	2-3
Applying and Interrupting Power	2-4
Repackaging Instructions	2-5
Installed Options	2-5
Operating Instructions	2-7
Screen Layout	2-7
Basic Procedures	2-7

Theory of Operation

Theory of Operation	3-1
Logic Conventions	3-1
Module Overview	3-1

Performance Verification Procedures

Performance Verification Procedures	4-1
Input Channels vs. Model	4-2
Conventions	4-2
Brief Procedures	4-5
Self Tests	4-5
Functional Tests	4-7
Performance Tests	4-15
Prerequisites	4-15
Equipment Required	4-16
TDS 600B Test Record	4-19
TDS 500C/700C Test Record	4-23
Signal Acquisition System Checks	4-27
Time Base System Checks	4-43
Trigger System Checks	4-45
Output Signal Checks	4-58
Option 05 Video Trigger Checks	4-67
Sine Wave Generator Leveling Procedure	4-84
Optical Filters Checks (TDS 500C/TDS 700C Only)	4-87

Adjustment Procedures

Adjustment Procedures	5-1
Requirements for Performance	5-1
Usage	5-2
Equipment Required	5-5
Adjustment Instructions	5-6
Probe Adjustment for the P6139A Probe	5-10
Display Assembly Adjustment	5-21

Maintenance

Maintenance	6-1
Related Maintenance Procedures	6-1
Preparation	6-2
Inspection and Cleaning	6-4
Removal and Installation Procedures	6-9
Preparation — Please Read	6-9
Access Procedure	6-15
Procedures for External Modules	6-16
Procedures for Outer-Chassis Modules	6-29
Procedures for Inner-Chassis Modules	6-48
Disassembly for Cleaning	6-54
Troubleshooting	6-59
Diagnostics	6-59

Firmware Updates	6-60
Hard Disk Maintenance	6-61

Options

Options and Accessories	7-1
Options	7-1
Standard Accessories	7-3
Optional Accessories	7-4

Electrical Parts List

Electrical Parts List	8-1
------------------------------------	------------

Diagrams

Diagrams	9-1
Symbols	9-1

Mechanical Parts List

Mechanical Parts List	10-1
Parts Ordering Information	10-1
Using the Replaceable Parts List	10-2

List of Figures

Figure 2-1: Map of Display Functions	2-8
Figure 4-1: Map of display functions	4-3
Figure 4-2: Verifying adjustments and signal-path compensation ..	4-6
Figure 4-3: Universal test hookup for functional tests – TDS 600B shown	4-8
Figure 4-4: Measurement of DC offset accuracy at zero setting	4-29
Figure 4-5: Initial test hookup	4-30
Figure 4-6: Measurement of DC accuracy at maximum offset and position	4-32
Figure 4-7: Initial test hookup	4-34
Figure 4-8: Optional initial test hookup	4-34
Figure 4-9: Measurement of analog bandwidth	4-37
Figure 4-10: Initial test hookup	4-39
Figure 4-11: Measurement of channel delay – TDS 684B shown	4-41
Figure 4-12: Initial test hookup	4-43
Figure 4-13: Measurement of accuracy — Long-term and delay time	4-45
Figure 4-14: Initial test hookup	4-46
Figure 4-15: Measurement of time accuracy for pulse and glitch triggering	4-48
Figure 4-16: Initial test hookup	4-49
Figure 4-17: Measurement of trigger-level accuracy	4-51
Figure 4-18: Initial test hookup	4-54
Figure 4-19: Measurement of trigger sensitivity — 50 MHz results shown on a TDS 684B screen	4-55
Figure 4-20: Initial test hookup	4-58
Figure 4-21: Measurement of main trigger out limits	4-60
Figure 4-22: Initial test hookup	4-62
Figure 4-23: Measurement of probe compensator frequency	4-64
Figure 4-24: Subsequent test hookup	4-65
Figure 4-25: Measurement of probe compensator amplitude	4-66
Figure 4-26: Jitter test hookup	4-68
Figure 4-27: Jitter test displayed waveform – TDS 684B shown	4-69
Figure 4-28: Jitter test when completed – TDS 684B shown	4-70
Figure 4-29: Triggered signal range test – 300 mV	4-72
Figure 4-30: Triggered signal range test – 75 mV	4-73

Figure 4-31: 60 Hz Rejection test hookup	4-74
Figure 4-32: 60 Hz Rejection test setup signal	4-74
Figure 4-33: Subsequent 60 Hz Rejection test hookup	4-75
Figure 4-34: 60 Hz Rejection test result – TDS 684B shown	4-76
Figure 4-35: Line count accuracy test hookup	4-77
Figure 4-36: Line count accuracy test setup waveform – TDS 684B shown	4-78
Figure 4-37: Line count accuracy correct result waveform	4-79
Figure 4-38: Setup for sync duty cycle test	4-81
Figure 4-39: Sync duty cycle test: one-div neg pulse waveform	4-82
Figure 4-40: Sync duty cycle test: critically adjusted pulse	4-83
Figure 4-41: Sine wave generator leveling equipment setup	4-85
Figure 4-42: Equipment setup for maximum amplitude	4-86
Figure 4-43: Reference-receiver performance-verification set up ...	4-89
Figure 4-44: Optical impulse of Ch1 input from OA5022 Optical Attenuator (OIG501 / OIG502 fed into optical attenuator in Step 1)	4-91
Figure 4-45: Optical impulse response for OC-12 SONET Reference Receiver	4-94
Figure 4-46: Optical impulse response for OC-12 SONET Reference Receiver	4-95
Figure 5-1: Accessing the protection switch	5-9
Figure 5-2: Hookup for probe compensation	5-11
Figure 5-3: Performing probe compensation	5-12
Figure 5-4: Proper and improper probe compensation	5-12
Figure 5-5: Exposing the Inner Probe Tip	5-13
Figure 5-6: Initial test hookup	5-14
Figure 5-7: Exposing the probe body	5-16
Figure 5-8: Initial test hookup	5-17
Figure 5-9: Locations of P6139A Probe Adjustments	5-19
Figure 5-10: Adjustments versus front-corner response	5-20
Figure 5-11: Five and Ten Percent Luminance Patches	5-22
Figure 6-1: External modules	6-12
Figure 6-2: Outer-chassis modules	6-13
Figure 6-3: Inner-chassis modules	6-14
Figure 6-4: Knob removal	6-17
Figure 6-5: Line fuse and line cord removal	6-18
Figure 6-6: Rear cover and cabinet removal	6-21

Figure 6-7: Front cover, trim ring, menu buttons, and attenuator panel removal (front cover not shown)	6-22
Figure 6-8: A12 Front-panel assembly removal	6-24
Figure 6-9: Cabinet modules removal	6-27
Figure 6-10: A14 D1 bus and analog-power and digital-power cables removal	6-30
Figure 6-11: Remove circuit board assembly from oscilloscope	6-31
Figure 6-12: Remove circuit board from assembly	6-32
Figure 6-13: Circuit board installed	6-34
Figure 6-14: Circuit board removal	6-35
Figure 6-15: A11 Processor/display removal	6-37
Figure 6-16: Hard disk removal	6-39
Figure 6-17: Board bracket removal	6-40
Figure 6-18: A10 Acquisition board removal	6-43
Figure 6-19: Floppy disk removal	6-45
Figure 6-20: Rear chassis removal	6-47
Figure 6-21: A16 Low voltage power supply removal	6-49
Figure 6-22: Display assembly removal	6-51
Figure 6-23: Display driver board removal	6-52
Figure 6-24: Front subpanel removal	6-54
Figure 6-25: Accessing the protection switch	6-60
Figure 6-26: Primary troubleshooting procedure	6-62
Figure 6-27: Module isolation troubleshooting procedure	6-64
Figure 6-28: A16 Low voltage power supply module isolation troubleshooting procedure	6-65
Figure 6-29: Power supply voltage measurement locations	6-66
Figure 6-30: Color display troubleshooting procedure	6-67
Figure 6-31: Horizontal and vertical sync signals – color display ...	6-68
Figure 6-32: A video signal with white, black, and blanking levels – color display	6-68
Figure 6-33: Processor/acquisition troubleshooting procedure	6-69
Figure 6-34: Processor/front panel troubleshooting procedure	6-70
Figure 6-35: Attenuator/acquisition troubleshooting procedure	6-71
Figure 6-36: A11 DRAM processor/display module	6-72
Figure 6-37: A10 Acquisition module (view of lower right corner) ..	6-73
 Figure 9-1: Interconnections	 9-2
Figure 9-2: Block Diagram	9-4
Figure 10-1: External modules	10-7

Figure 10-2: Outer-chassis modules	10-9
Figure 10-3: Inner-chassis modules	10-11
Figure 10-4: Cables, bottom view	10-13
Figure 10-5: Cables, top view	10-15
Figure 10-6: Floppy disk drive	10-17
Figure 10-7: Accessories	10-19

List of Tables

Table 1-1: Key features of the TDS 500C, 600B and 700C oscilloscopes	1-1
Table 1-2: Record length and divisions per record vs. TDS model ..	1-4
Table 1-3: Nominal traits — Signal acquisition system	1-9
Table 1-4: Nominal traits — Time base system	1-10
Table 1-5: Nominal traits — Triggering system	1-11
Table 1-6: Nominal traits — Display system	1-13
Table 1-7: Nominal traits — GPIB interface, output ports, and power fuse	1-14
Table 1-8: Nominal traits — Data handling and reliability	1-14
Table 1-9: Nominal traits — Mechanical	1-15
Table 1-10: Warranted characteristics — Signal acquisition system	1-18
Table 1-11: Warranted characteristics — Time base system	1-19
Table 1-12: Warranted characteristics — Triggering system	1-20
Table 1-13: Warranted characteristics — Output ports, probe compensator, and power requirements	1-20
Table 1-14: Warranted characteristics — Environmental	1-22
Table 1-15: Certifications and compliances	1-24
Table 1-16: Typical characteristics — Signal acquisition system ...	1-25
Table 1-17: Typical characteristics — Triggering system	1-28
Table 2-1: Power-cord conductor identification	2-2
Table 2-2: Power cord identification	2-2
Table 2-3: Effects of corrupted data	2-4
Table 4-1: Test equipment	4-16
Table 4-2: DC offset accuracy (zero setting)	4-28
Table 4-3: DC Voltage measurement accuracy	4-31
Table 4-4: Analog bandwidth	4-35
Table 4-5: Delay between channels worksheet	4-42
Table 4-6: Available Filters	4-87
Table 4-7: Reference Receiver Filter Options:	4-88
Table 4-8: Option 3C and 4C Specifications	4-88
Table 4-9: Available receivers	4-88
Table 4-10: Bessel Thompson frequency response and reference receiver limits	4-96

Table 5-1: Calibration Tests	5-3
Table 5-2: Adjustments Required for Module Replaced	5-4
Table 5-3: Adjustments and Dependencies	5-4
Table 5-4: Test Equipment, Fixtures, and Supplies	5-5
Table 5-5: GPIB Board Configuration1	5-7
Table 6-1: Relative susceptibility to static-discharge damage	6-3
Table 6-2: External inspection check list	6-5
Table 6-3: Internal Inspection Check List	6-6
Table 6-4: Tools Required for Module Removal	6-11
Table 6-5: Normal supply voltages (measured on J26 and J27 on the A11 DRAM processor/display module)	6-66
Table 6-6: No-load supply voltages (measured on J5 and J6 on the A17 Main LV power Supply module)	6-66
Table 7-1: Options	7-1
Table 7-2: Standard Accessories	7-3
Table 7-3: Optional Accessories	7-4
Table 7-4: Accessory software	7-7