

Table of Contents

About This Manual	i
Related Documentation	i
Notes on Previous Products	i
Contacting Tektronix	ii
Safety Summary	xix

Getting Started

Introduction	1-1
CSA 803C Description	1-1
Description of Sampling	1-3
Electrical Connections	1-3
Installation	1-7
Operating Environment	1-8
At a Glance	1-9
Front Panel and Sampling Heads	1-9
Rear Panel	1-10
Display and Touch Panel	1-11
Icons	1-12
Knobs, Knob Menu, and Keypad Menu	1-13
Major Menu Buttons	1-14
Waveform Major Menu	1-16
Trigger Major Menu	1-18
Measure Major Menu	1-19
Display Modes Major Menu	1-20
Store/Recall Major Menu	1-21
Utility1 Major Menu	1-23
Enhanced Accuracy Major Menu	1-25
Utility2 Major Menu	1-27

Operating Basics

Overview	2-1
Example 1: Displaying a Trace	2-3
Major Menu Buttons	2-3
The Touch Panel	2-5
Menu Selectors	2-5

Connecting Cables	2-6
Pop-Up Menus	2-8
Autoset	2-9
Autoset Options	2-10
The Knobs	2-12
Icons	2-13
Keypad Pop-Up Menu and Knob Resolution	2-15
Major Menu Knob Assignments	2-17
Example 2: Managing Multiple Traces	2-19
Vectorized Traces	2-21
Adding Another Trace	2-22
Selecting Traces by Touch	2-23
Selecting Traces Using the Trace Status Menu	2-24
Labeling Traces	2-25
Displaying Dual Graticules	2-27
Removing Traces	2-29
Example 3: Defining Complex Traces	2-31
Trace Expressions	2-33
Vertical Adjustment of Complex Traces	2-35
High Precision Traces	2-38
Windows	2-39
Horizontal Reference Point	2-41
Example 4: Using Signal Processing	2-43
Averaging and Enveloping	2-45
Variable Persistence	2-48
Smoothing	2-50
Record Length	2-51
Example 5: Taking Automated Measurements	2-53
Specifying Measurements	2-55
Measurement Parameters and Annotations	2-58
Default Measurement Parameters	2-60
Measurement Modes	2-62
Example 6: Taking Delay Measurements Using Cursors	2-67
The Cursors Major Menu	2-68
Using Split Dot Cursors	2-71
Cursor Accuracy Considerations	2-73
Example 7: Taking Comparison Measurements Using a Reference Trace	2-75
Setting X-Axis Units to Meters, Feet, or Inches	2-76
Using the Reference Value	2-78
Example 8: Comparing Traces to Stored Traces	2-81
Example 9: Creating a Histogram Display	2-85

Example 10: Taking TDR Measurements	2-89
Changing Graticule Units for TDR	2-92
Measuring Distance with TDR	2-93

Reference

Acquisition	3-1
How Traces are Acquired	3-1
Determining the Sample Interval	3-2
Controlling Acquisition	3-3
Clearing Traces	3-5
Audio Feedback	3-7
Autoset	3-9
Undoing an Autoset	3-10
Autoset Options	3-10
Averaging and Enveloping	3-13
Defining an Averaged or Enveloped Trace	3-14
Terminating Averaging or Enveloping	3-15
Record Count	3-15
Limiting Acquisition	3-16
Side Effects of Averaging and Enveloping	3-16
Baseline Correction	3-17
Example	3-17
Calibrator	3-19
Color Display	3-21
Color Selection	3-21
Restoring Colors	3-22
Reassigning Trace Colors	3-23
Setting the Display Intensity	3-23
Constellation Diagrams	3-25
Displaying a Constellation Diagram	3-25
Cursors	3-29
Cursor Operation	3-30
Cursor Examples	3-33
Diagnostics	3-35
Power-On Diagnostics	3-36
Self-Test Diagnostics	3-37
Extended Diagnostics	3-38
Display Intensity	3-41

Display Persistence	3-43
Setting the Persistence Mode	3-44
Enhanced Accuracy	3-49
Control of Automated Calibration	3-50
Calibration Assistance	3-51
Sampling Head Calibrations	3-53
Offset for Sampling Probes	3-60
Eye Diagrams	3-61
Displaying an Eye Diagram	3-61
Fast Fourier Transforms	3-65
Defining an FFT Trace	3-66
Amplitude Resolution	3-68
Frequency Range and Resolution	3-68
Changing Horizontal and Vertical Size	3-69
FFT Scaling	3-70
Aliasing	3-71
Using Cursors to Make Measurements	3-72
FFT Windowing Functions	3-74
GPIB Parameters	3-79
GPIB Connection	3-79
Setting GPIB Parameters	3-80
Graticules	3-83
Managing Graticules and Traces	3-86
Changing Axis Units	3-87
Hardcopy	3-89
Installing the Printer	3-89
Hardcopy Parameters	3-91
Making a Hardcopy	3-95
Terminating A Hardcopy In Progress	3-96
Hardcopy Defaults	3-96
Histograms	3-97
Displaying a Histogram	3-99
Histogram Controls	3-100
The Histogram Readout	3-104
Horizontal Controls	3-105
Setting Horizontal Size and Position	3-106
Pan/Zoom	3-107
Changing the Horizontal Reference Point	3-109

Initialization	3-111
Initializing and Erasing Nonvolatile RAM	3-112
Labeling	3-113
Creating Labels	3-114
Displaying Labels with Traces	3-116
Mask Testing	3-117
Using Predefined Telecommunication Masks	3-119
Creating Masks	3-122
Starting Mask Testing	3-128
Standard Mask Definitions and Requirements	3-131
Measurements	3-135
Setting Up Measurements	3-138
Deleting Measurements	3-140
Topline/Baseline Calculation	3-140
Measurement Mode	3-141
Comparing Measurements to References	3-145
Changing Measurement Parameters	3-147
Measurement Statistics	3-154
Changing Default Parameters	3-155
Power-On	3-157
Installation	3-157
Power-On Sequence	3-159
Warm-Up Period	3-159
Record Length	3-161
RS-232-C Parameters	3-163
RS-232-C Connection	3-163
Setting RS-232-C Parameters	3-164
Sampling Heads	3-167
Installing Sampling Heads	3-168
Sampling Head Front Panel	3-168
Controlling TDR and Smoothing Functions	3-170
Stored Settings	3-173
Storing Settings	3-174
Recalling Stored Settings	3-175
Deleting Stored Settings	3-176
Sequencing Through Stored Settings	3-177
Stored Traces	3-179
Storing Traces	3-180
Recalling Stored Traces	3-181
Deleting Stored Traces	3-182
Displaying Time and Date with Stored Traces	3-183

System Identification	3-185
TDR	3-187
TDR Step Generation	3-187
Example: Taking TDR Measurements	3-190
Example: Differential and Common Mode TDR	3-194
More About TDR Measurements	3-198
Time and Date	3-199
Displaying Time and Date with Stored Traces	3-200
Trace Definition and Management	3-201
Defining New Traces	3-202
Trace Numbers	3-205
Selecting Traces	3-206
Modifying Traces	3-207
Removing Traces	3-208
Trace Scaling	3-210
Triggering	3-211
Vectored Traces	3-215
Vertical Controls	3-217
Setting Vertical Size and Offset	3-218
Windows	3-221
Changing Window Size and Position	3-222
Positioning Window Traces Automatically	3-223
XY Traces	3-227

Appendices

Appendix A: Accessories	A-1
Standard Accessories	A-1
Optional Accessories	A-1
Power Cord Options	A-2
Appendix B: Specifications	B-1
Appendix C: User Service	C-1
Cleaning the Instrument	C-1
Packaging for Shipment	C-2
Appendix D: Algorithms	D-1
Trace Functions	D-1
Software Measurements	D-12
Statistical Measurements	D-23
Hardware Measurements	D-25

Table of Contents

Color Grading	D-27
Appendix E: Messages	E-1
Selected Message Descriptions	E-1

Glossary

Glossary	G-1
----------------	-----

Index

Index	I-1
-------------	-----

List of Figures

Figure 1-1: Front Panel Connectors	1-5
Figure 1-2: Rear Panel Power Connectors and Switches	1-6
Figure 1-3: Rear Panel Printer and Data Connectors	1-6
Figure 2-1: Utility1 Major Menu	2-4
Figure 2-2: Initialize Selector in Utility1 Major Menu	2-5
Figure 2-3: Cable from the CALIBRATOR Output to a Sampling Head Input	2-6
Figure 2-4: Sampling Head Control Panel (SD-24 shown)	2-7
Figure 2-5: The Trigger Major Menu and Source Pop-Up Menu	2-8
Figure 2-6: AUTOSET Button Location	2-9
Figure 2-7: The Instrument Options Pop-Up Menu	2-10
Figure 2-8: The Calibrator Signal After Pressing AUTOSET in Edge Mode	2-11
Figure 2-9: The Knobs and the Knob Menu	2-12
Figure 2-10: Icons	2-14
Figure 2-11: The Knob Menu and Keypad Pop-Up Menu	2-16
Figure 2-12: Connections for Example 2	2-19
Figure 2-13: The Acquired Calibrator Signal	2-20
Figure 2-14: A Vectored Trace Display	2-21
Figure 2-15: Graticule with Two Traces	2-22
Figure 2-16: The Waveform Major Menu with the Knob Menu	2-23
Figure 2-17: The Trace Status Menu	2-24
Figure 2-18: The Labeling Pop-Up Menu	2-26
Figure 2-19: The Graticules Pop-Up Menu	2-27
Figure 2-20: A Dual-Graticule Display	2-28
Figure 2-21: Connections for Example 3	2-31
Figure 2-22: The DefTra Pop-Up Menu	2-34
Figure 2-23: Complex Trace Aberration Caused by Off-Graticule Component	2-36
Figure 2-24: The Chan Sel Selector in the Knob Menu	2-36
Figure 2-25: A Window Trace Display	2-39
Figure 2-26: The Chan Sel Selector in the Knob Menu	2-40
Figure 2-27: Connections for Example 4	2-43
Figure 2-28: A Horizontally and Vertically Expanded Portion of the Calibrator Signal	2-44
Figure 2-29: The Acquire Desc Pop-Up Menu	2-46
Figure 2-30: Averaged and Normal Traces	2-46
Figure 2-31: The Persist/Histograms Pop-Up Menu	2-48
Figure 2-32: The Sampling Head Fnc's Pop-Up Menu	2-51
Figure 2-33: Connections for Example 5	2-53

Figure 2-34: The Measure Major Menu	2-55
Figure 2-35: The Measurements Pop-Up Menu	2-56
Figure 2-36: Measurements of a Trace	2-57
Figure 2-37: The RMS Pop-Up Menu and Annotation Lines	2-59
Figure 2-38: The Default Parameters Pop-Up Menu	2-61
Figure 2-39: The Hardware Measurements Pop-Up Menu	2-64
Figure 2-40: A Jitter Measurement on the Calibrator Signal	2-65
Figure 2-41: Connections for Example 6	2-67
Figure 2-42: The Cursors Major Menu and Cursor Type Pop-Up Menu	2-69
Figure 2-43: Horizontal Bar Cursors Placed Over a Trace	2-70
Figure 2-44: The Cursor Type Pop-Up Menu in Split Dots Mode	2-71
Figure 2-45: Connections for Example 7	2-75
Figure 2-46: The Graticules Pop-Up Menu	2-76
Figure 2-47: The Compare & References Pop-Up Menu	2-78
Figure 2-48: Connections for Example 8	2-81
Figure 2-49: The Store/Recall Major Menu and Store Trace Pop-Up Menu	2-82
Figure 2-50: Connections for Example 9	2-85
Figure 2-51: A Vertical Histogram Display	2-87
Figure 2-52: Connections for Example 10	2-89
Figure 2-53: The Sampling Head Fnc's Pop-Up Menu	2-90
Figure 2-54: TDR Step and Reflection	2-91
Figure 3-1: Acquisition of a Trace	3-1
Figure 3-2: Front Panel Acquisition Lights	3-3
Figure 3-3: The Acquire Desc Pop-up Menu	3-4
Figure 3-4: The Clear Trace Pop-up Menu	3-5
Figure 3-5: The Instrument Options Pop-up Menu	3-7
Figure 3-6: Front Panel Autoset Button	3-9
Figure 3-7: The Instrument Options Pop-up Menu	3-10
Figure 3-8: The Acquire Desc Pop-up Menu	3-15
Figure 3-9: Location of the CALIBRATOR and INTERNAL CLOCK Outputs	3-19
Figure 3-10: The Color Pop-up Menu	3-22
Figure 3-11: Adjusting the Main Position	3-26
Figure 3-12: How the Expanded Waveforms Should Appear	3-27
Figure 3-13: The Display After Selecting the XY Display Mode	3-28
Figure 3-14: The Cursors Major Menu and Cursor Type Pop-up Menu	3-30
Figure 3-15: The Set Zero Pop-up Menu	3-31
Figure 3-16: The Self Test Pop-up Menu in the Utility2 Major Menu ..	3-37
Figure 3-17: The Extended Diagnostic Pop-up Menu in the Utility2 Major Menu	3-38
Figure 3-18: The Top Portion of the Extended Diagnostics Menu ...	3-38
Figure 3-19: The Instrument Options Pop-up Menu	3-41

Figure 3-20: The Persist/Histograms Pop-up Menu	3-43
Figure 3-21: The Color Grad Scale Pop-up Menu	3-46
Figure 3-22: The Enhanced Accuracy Major Menu	3-49
Figure 3-23: The Calibrate All Pop-up Menu	3-51
Figure 3-24: A Typical Calibration Pop-up Menu	3-55
Figure 3-25: Loop Gain Calibration (in Vectored Trace Mode)	3-57
Figure 3-26: An Eye Diagram Display	3-62
Figure 3-27: The DefTra Pop-Up Menu	3-66
Figure 3-28: Location of the FFTmag Icon on the Display	3-67
Figure 3-29: Equations for Frequency Interval and Frequency Range	3-68
Figure 3-30: The Instrument Options Pop-Up Menu	3-70
Figure 3-31: Paired Dots Cursors on an FFT Magnitude Display	3-72
Figure 3-32: Using Split Dots Cursors to Measure FFT Phase	3-73
Figure 3-33: FFT Magnitude Displayed Using Rectangular Window ..	3-75
Figure 3-34: FFT Magnitude Displayed Using Triangular Window ..	3-75
Figure 3-35: FFT Magnitude Displayed Using Blackman Window ..	3-76
Figure 3-36: FFT Magnitude Displayed Using Blackman-Harris Window	3-77
Figure 3-37: FFT Magnitude Displayed Using Hanning Window	3-77
Figure 3-38: FFT Magnitude Displayed Using Hamming Window	3-78
Figure 3-39: GPIB Rear-Panel Connector and Lights	3-79
Figure 3-40: The GPIB/RS232C Pop-up Menu	3-80
Figure 3-41: Graticule with Trace	3-83
Figure 3-42: Dual Graticules with Multiple Traces	3-84
Figure 3-43: The Graticules Pop-up Menu	3-85
Figure 3-44: Printer Connectors on Rear Panel	3-89
Figure 3-45: The Hardcopy Pop-up Menu	3-91
Figure 3-46: Front Panel Hardcopy Button	3-95
Figure 3-47: A Histogram Displayed on an Eye Diagram	3-97
Figure 3-48: The Persist/Histograms Pop-up Menu	3-98
Figure 3-49: Using Stop N Wfms	3-102
Figure 3-50: Histogram Readout Appears Below the Trace Display ..	3-104
Figure 3-51: Horizontal Controls	3-105
Figure 3-52: Horizontal Magnification with Pan/Zoom	3-108
Figure 3-53: The Horizontal Desc Pop-up Menu	3-110
Figure 3-54: The Initialize Verification Pop-up Menu	3-111
Figure 3-55: Labels Displayed with Active Traces	3-113
Figure 3-56: The Labeling Pop-up Menu	3-115
Figure 3-57: Mask Testing on an Eye Diagram	3-117
Figure 3-58: The Standard Masks Pop-up Menu	3-119
Figure 3-59: Page 2 of the SONET/SDH Optical Standards	3-120
Figure 3-60: Pages 2 and 3 of the ITU-T Electrical Standards	3-120
Figure 3-61: The Mask Testing Pop-up Menu	3-122
Figure 3-62: Editing a Mask	3-123

Figure 3-63: Creating a User Mask	3-124
Figure 3-64: How Points are Connected in a User Mask	3-125
Figure 3-65: Mask Count Readout	3-129
Figure 3-66: Using Stop N Wfms	3-130
Figure 3-67: Measure Major Menu	3-138
Figure 3-68: Measurements Pop-up Menu with Frequency and RMS Selected	3-139
Figure 3-69: Compare & References Pop-up Menu	3-146
Figure 3-70: A Typical Individual Measurement Pop-up Menu	3-148
Figure 3-71: Statistics in an Individual Measurement Pop-up Menu ..	3-154
Figure 3-72: Measurements Pop-up Menu with Software Defaults ..	3-156
Figure 3-73: Power Connector, Fuse, and Switches	3-157
Figure 3-74: Front Panel ON/STANDBY Switch	3-157
Figure 3-75: Traces with Record Lengths of 512 (top) and 5120 (bottom)	3-161
Figure 3-76: The Horizontal Desc Pop-up Menu	3-162
Figure 3-77: Location of RS-232-C Connector	3-163
Figure 3-78: The GPIB/RS232C Pop-up Menu	3-164
Figure 3-79: Location of Sampling Head Compartments	3-167
Figure 3-80: Sampling Head Control Panel (SD-24 shown)	3-168
Figure 3-81: The Sampling Head Fnc's Pop-up Menu	3-171
Figure 3-82: The Store Setting Pop-up Menu	3-174
Figure 3-83: The Recall Setting Pop-up Menu	3-175
Figure 3-84: The Delete Setting Pop-up Menu	3-176
Figure 3-85: Front Panel SEQUENCE SETTING Button	3-177
Figure 3-86: The Store Trace Pop-up Menu	3-180
Figure 3-87: The Recall Trace Pop-up Menu	3-181
Figure 3-88: The Delete Trace Pop-up Menu	3-182
Figure 3-89: The Identify Pop-up Menu	3-185
Figure 3-90: Step Generator Simplified Schematic Diagram	3-187
Figure 3-91: Step Generator with a Shorted Output	3-188
Figure 3-92: Step Generation with a $50\ \Omega$ Load	3-188
Figure 3-93: Step Generation with a $50\ \Omega$ Load	3-189
Figure 3-94: Connections for Example	3-190
Figure 3-95: TDR Step and Reflection	3-191
Figure 3-96: The Graticules Pop-up Menu	3-192
Figure 3-97: Single Channel TDR	3-195
Figure 3-98: Channels 1 and 2 TDR	3-196
Figure 3-99: Ensuring Pulses Arrive at the Reference Plane at the Same Time	3-198
Figure 3-100: The Instrument Options Pop-up Menu	3-199
Figure 3-101: The DefTra Pop-up Menu	3-203
Figure 3-102: The Trace Status Menu	3-207
Figure 3-103: The Remove Selector in the Remove/Cir Pop-Up Menu	3-208

Figure 3-104: The Instrument Options Pop-up Menu	3-210
Figure 3-105: The Trigger Major Menu and Source Pop-up Menu ..	3-212
Figure 3-106: The Trigger Major Menu and the Trigger Holdoff Pop-up Menu	3-214
Figure 3-107: Identical 512-Point Traces without Trace Vectoring (top) and with Trace Vectoring (bottom)	3-215
Figure 3-108: The Instrument Options Pop-up Menu	3-216
Figure 3-109: Vertical Controls	3-217
Figure 3-110: A Window Trace Display	3-221
Figure 3-111: The Window Mode Pop-up Menu	3-223
Figure 3-112: An XY Trace	3-227
Figure 3-113: The Horizontal Desc Pop-up Menu	3-228

List of Tables

Table 2-1: Measurement Mode Comparison	2-63
Table 3-1: A Sample Assignment of Colors to Hit Density	3-45
Table 3-2: Time Base Cal Mode Comparison	3-50
Table 3-3: Delay Compensate Comparison	3-50
Table 3-4: Repetition Encodings	3-94
Table 3-5: Hardcopy Defaults	3-96
Table 3-6: ITU-T Electrical Standards Masks	3-131
Table 3-7: SONET/SDH Optical Standards Masks	3-132
Table 3-8: Fibre Channel Standards Masks	3-132
Table 3-9: ANSI T1.102 Electrical Standard Masks	3-133
Table 3-10: Miscellaneous Standards Masks	3-133
Table 3-11: Measurements	3-136
Table 3-12: Measurement Mode Comparison	3-143
Table 3-13: Measurement Parameters	3-149
Table 3-14: Trace Functions	3-204
Table B-1: 11801C Vertical System Specifications	B-1
Table B-2: 11801C Time Base Specifications	B-2
Table B-3: 11801C Input and Output Specifications	B-3
Table B-4: 11801C Trigger Specifications	B-4
Table B-5: 11801C Display Specifications	B-5
Table B-6: 11801C AC Line Power Specifications	B-6
Table B-7: 11801C Environmental Specifications	B-6
Table B-8: 11801C Certifications and Compliances	B-7
Table D-1: Filter Characteristics of FFT Windowing Functions	D-5
Table D-2: Values of icoeff for FFT Windowing Functions	D-16
Table D-3: Values of wcoeff and m for FFT Windowing Functions ...	D-22