

# 496P SPECTRUM ANALYZER

*Please CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.*

First Printing APR 1981  
Revised APR 1985

**Tektronix**  
COMMITTED TO EXCELLENCE

# PREFACE

## About the 496P Programmable Spectrum Analyzer Manuals

Local control and maintenance of the 496P are described in combined 496/496P manuals. These manuals are: 496/496P Operators, 496/496P Operators Handbook (a small manual that fits in the 496P front cover), and 496/496P Service, Volumes 1 and 2.

Refer to the 496/496P Operators Manual for a full description of 496P functions and front-panel controls. The Operators Manual also contains the full specification of instrument performance.

## About This Programmer's Manual

This Programmer's Manual describes the programmable functions of the 496P and how to use them for remote operation.

Sections 1 and 2 help you get started using the 496P on the GPIB (General Purpose Interface Bus). Programming examples are given here and throughout the manual. Some examples are given for a variety of GPIB controllers, but most are in BASIC as implemented on TEKTRONIX 4050-Series controllers. Comments help you translate if you are using another controller.

Sections 3 through 7 are a reference to the language used to set and read 496P functions and transfer spectrum data acquired by the 496P. Section 3 defines device-dependent message format and execution. Sections 4 through 7 cover the commands and queries by function: front-panel, display data i/o, waveform processing, and system operation.

Section 8 is a how-to-do-it section for making programmable measurements with the 496P.

An appendix helps you understand the GPIB and the IEEE 488 standard on which it is based.

A command summary foldout provides a complete list of remote control messages and features of the 496P.

# TABLE OF CONTENTS

	Page
Preface .....	i
Operators Safety Summary .....	vii
Service Safety Summary .....	ix
<b>Section 1 INTRODUCTION TO GPIB OPERATION</b>	
GPIB Controls and Indicators .....	1-1
RESET TO LOCAL (REMOTE) .....	1-2
ADDRESSED .....	1-2
GPIB Function Readout .....	1-2
Setting the GPIB ADDRESS Switches .....	1-3
Setting the LF or EOI Switch .....	1-5
Syntax Diagrams .....	1-6
Talk/Listen-Only Operation .....	1-7
TALK ONLY, LISTEN ONLY Switches .....	1-7
Data Logging .....	1-8
Restoring Control Settings and the Display .....	1-10
Putting a Counter on the Tape .....	1-11
IEEE 488 Functions .....	1-11
Connecting To a System .....	1-13
<b>Section 2 GETTING STARTED</b>	
Setting Programmable Controls .....	2-1
4050-Series Graphic Systems .....	2-2
Two Other Controllers .....	2-2
In General .....	2-3
Querying Programmable Controls .....	2-3
Listen/Talk Routine .....	2-5
Acquiring Instrument Settings with SET? .....	2-6
Resetting the 496P and Interface Messages .....	2-8
Acquiring a Waveform .....	2-9
4050-Series .....	2-9
TEK SPS BASIC .....	2-10
9825 .....	2-10
Getting Smarter .....	2-10
AutoCal—A Programmable Assist in Calibrating the Front Panel .....	2-12

Qservice-496P Programming manual Sample - Qservice

# TABLE OF CONTENTS (cont)

Section 3	DEVICE-DEPENDENT MESSAGE STRUCTURE AND EXECUTION	Page
	496P Input Messages .....	3-1
	Input Message Format .....	3-2
	Input Buffering and Execution .....	3-2
	Command Format .....	3-3
	Argument Format .....	3-4
	Query Format .....	3-6
	496P Output Messages .....	3-6
	Output Message Format .....	3-6
	Output Message Execution .....	3-6
Section 4	FRONT-PANEL CONTROL	
	Frequency .....	4-2
	FREQ (center frequency) .....	4-3
	TUNE (increment frequency) .....	4-3
	DELFR (delta-frequency) .....	4-4
	FRCAL (frequency cal) .....	4-5
	DEGAUS (degauss tuning coils) .....	4-5
	Frequency Span and Resolution .....	4-6
	SPAN (frequency span/division) .....	4-7
	ZEROSP (zero span mode) .....	4-8
	RESBW (resolution bandwidth) .....	4-9
	ARES (automatic resolution bandwidth) .....	4-10
	PHSLK (phaselock) .....	4-11
	Vertical Display and Reference Level .....	4-12
	VRTDSP (vertical display) .....	4-13
	REFLVL (reference level) .....	4-14
	FINE (fine reference level steps) .....	4-15
	RLMODE (reference level mode) .....	4-16
	MINATT (min RF attenuation) .....	4-17
	MAXPWR (maximum input power) .....	4-18
	PLSTR (pulse stretcher) .....	4-19
	VIDFLT (video filter) .....	4-20
	Sweep Control .....	4-21
	TRIG (triggering) .....	4-22
	SIG SW (single sweep) .....	4-23
	TIME (time/div) .....	4-24
	Digital Storage .....	4-25
	VIEW, BVIEW (A and B memory display) .....	4-26
	SAVEA (save A memory) .....	4-27
	BMINA (B-A memory display) .....	4-28
	MXHLD (max hold) .....	4-29
	CRSOR (peak/average cursor) .....	4-30
	Display Control .....	4-31
	REDOUT, GRAT, CLIP (display control) .....	4-32
	Impedance (Option 07) .....	4-33
	IMPED .....	4-33

# TABLE OF CONTENTS (cont)

Section 5	DISPLAY DATA AND CRT READOUT I/O	Page
	Waveform Transfers .....	5-1
	WFMPRE (waveform preamble) .....	5-2
	CURVE (display curve) .....	5-6
	CRT Readout Transfers .....	5-9
	RDOUT (readout message) .....	5-9
	UPRDO, LORDO (upper or lower readout) .....	5-10
Section 6	WAVEFORM PROCESSING	
	POINT (display data point) .....	6-1
	FIBIG, LFTNXT, RGTNXT (signal search) .....	6-2
	FMAX (find maximum value) .....	6-3
	FMIN (minimum value) .....	6-3
	CENSIG, TOPSIG (center or move signal) .....	6-5
Section 7	SYSTEM COMMANDS AND QUERIES	
	Instrument Parameters .....	7-1
	SET (instrument settings) .....	7-1
	INIT (initialize settings) .....	7-3
	ID (identify) .....	7-4
	Message Execution .....	7-4
	WAIT (wait to execute) .....	7-4
	REPEAT (repeat execution) .....	7-5
	Status and Error Reporting .....	7-6
	EOS (end-of-sweep) .....	7-6
	RQS (request service) .....	7-7
	Status Byte .....	7-8
	Effect of Busy on Device-Dependent Messages .....	7-9
	Effect of Busy on Interface Messages .....	7-9
	ERCNT (error count) .....	7-10
	ERR (error) .....	7-11
	Command Errors .....	7-11
	Execution Errors .....	7-12
	Execution Warnings .....	7-12
	Internal Errors .....	7-13
Section 8	HELPS AND HINTS	
	Data Acquisition .....	8-1
	Synchronizing Controller and 496P .....	8-1
	Synchronizing with the Sweep .....	8-2
	Using the End-of-Sweep SRQ .....	8-4
	INPUT: An SRQ Alternative .....	8-4

# TABLE OF CONTENTS (cont)

	Page
Binary Waveform Transfers .....	8-5
Getting 496P Binary CURVE Output .....	8-5
Sending a Binary CURVE to the 496P .....	8-6
Scaling, Saving, and Graphing Waveform Data .....	8-6
Saving the Scaled Array .....	8-7
Waveform Plotting Made Easy .....	8-7
Multiple Use of Display Buffer for Waveform Processing and I/O .....	8-9
Buffer Data Flow .....	8-9
Order-Dependent Conflicts .....	8-10
Finding Signals with 496P Waveform Processing .....	8-11
Understanding How Waveform Processing Works .....	8-11
Acquiring Data for Waveform Processing .....	8-12
Spectrum Search .....	8-12
Using REPEAT for Signal Tracking and Searches .....	8-13
Tracking a Signal .....	8-13
Spectrum Search Using REPEAT .....	8-14
Messages on the Crt Using RDOUT .....	8-14
What is the Difference Between FREQ and TUNE? .....	8-15
Power-Up Bus Glitches .....	8-16
Comparing the Status Byte and ERR? Response .....	8-16
Execution and Transfer Times .....	8-16
<b>Appendix A IEEE 488 (GPIB) SYSTEM CONCEPTS .....</b>	
Introduction .....	A-1
Mechanical Elements .....	A-1
Electrical Elements .....	A-1
Functional Elements .....	A-2
A Typical GPIB System .....	A-3
Talkers, Listeners, and Controllers .....	A-3
Interface Control Messages .....	A-4
Device-Dependent Messages .....	A-5
Typical GPIB Events When Transferring Data .....	A-5
GPIB Signal Line Definitions .....	A-8
Data Transfer Control Bus .....	A-8
Management Bus .....	A-9
INTERFACE FUNCTIONS AND MESSAGES .....	A-10
Introduction .....	A-10
Remove-Local Function (RL) .....	A-10
Talker and Listener Functions (T/TE and L/LE) .....	A-11
Source and Acceptor Handshake Functions (SH and AH) .....	A-11
Device Clear Function (DC) .....	A-12
Device Trigger Function (DT) .....	A-12
Controller (C), Service Request (SR), and Parallel Poll (PP) .....	A-12
Taking Control (Asynchronous or Synchronous) .....	A-13
Passing Control .....	A-13
Performing a Serial Poll .....	A-13
Performing a Parallel Poll .....	A-14
Programming Summary .....	A-15

# LIST OF ILLUSTRATIONS

Figure No.		Page
	The TEKTRONIX 496P Programmable Spectrum Analyzer .....	x
1-1	GPIB control and indicators on the front panel .....	1-1
1-2	Status of GPIB functions indicated when active .....	1-2
1-3	GPIB ADDRESS switches on the rear panel .....	1-3
1-4	Effect of message terminator switch for input and output .....	1-5
1-5	The TEKTRONIX 4924 and 496P in talk/listen-only system .....	1-6
1-6	Controls used for talk/listen-only data transfers .....	1-8
1-7	The 496P GPIB port on the rear panel .....	1-13
1-8	The 496P can be connected in either a star or linear manner .....	1-14
4-1	Front-Panel Control Commands and Queries .....	4-1
4-2	Front-Panel Control—Frequency commands .....	4-2
4-3	Front-Panel Control—Frequency Span and Resolution commands .....	4-6
4-4	Front-Panel Control—Vertical Display and Reference Level commands .....	4-12
4-5	Front-Panel Control—Sweep Control commands .....	4-21
4-6	Front-Panel Control—Digital Storage commands .....	4-25
4-7	Front-Panel Control—Display Control commands .....	4-31
8-1	Synchronizing controller and 496P for data acquisition .....	8-3
8-2	A simple plot of a spectrum acquired from the 496P .....	8-8
8-3	How multiple use of the display data buffer is controlled .....	8-10
8-4	Quote marks can be used in messages on the 496P crt .....	8-15
A-1	Standard IEEE 488 (GPIB) connector .....	A-2
A-2	A Typical GPIB System .....	A-4
A-3	ASCII & IEEE 488 (GPIB) Code Chart .....	A-6
A-4	An example of data byte traffic on the GPIB .....	A-7
A-5	A typical handshake timing sequence .....	A-8
A-6	496P Front Panel Controls .....	A-15

# LIST OF TABLES

Table No.		Page
1-1	Bus Address .....	1-4
1-2	496P IEEE 488 Interface Functions .....	1-11
8-1	Execution Times .....	8-17
8-2	Transfer Times .....	8-17
A-1	Major GPIB Interface Functions .....	A-3