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Agilent Technologies

HP 4396A Network/Spectrum Analyzer
Performance Test Program (PN: 04396-65001)

Operation Manual

HEWLETT PACKARD

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Contents

Figures

Tables

General Information

Introduction

The HP 4396A Performance Test Program (P/N: 04396-65001) is written in HP BASIC, designed to minimize the test time, and helps eliminate human error while performance testing the HP 4396A Network/Spectrum Analyzer. When executing the program, the computer displays the test instructions, and controls the HP 4396A under test and the related test equipment.

This performance test program has the "Built-in Calibration Data Editor" which edits and stores the standards' calibration data needed in the tests.

Initial Inspection

The Performance Test Program for HP 4396A has been carefully inspected before being shipped from the factory. Verify that the shipping container contains the following:

■ 2 ea. of 3-1/2 inch diskettes

■ Operation Manual (this book)

The diskettes should contain the following. Check the contents of the diskette using your computer CAT command:

Filename	Description
TEST4396A	Main Program
SUBT4396A	Subprogram
CSUBS	Compiled Utilities for BASIC 5.13
CSUBS6	Compiled Utilities for BASIC 6.2 and above
TE_T4396A	Test Equipment Configuration Program

Making Working Copies

Copy the contents of the performance test program diskette to a working diskette or to the hard disk to prevent accidental deletion or destruction of the program files. Use the working diskettes or the hard disk, and store the original diskette in a safe place.

Note	Make an exclusive directory for this program and copy the files of the diskette into the directory when you use a hard disk.

Required Tools

Hardware Requirements

Table 1-1 lists the equipment required for executing the programs.

Table 1-1. Required Equipment

Equipment	Requirements	Recommended Models	Qty.
Computer	No Substitute	HP 9000 series 200 or 300[1] RAM $\geq$ 4 MBytes	1
Operating System	BASIC 5.1 or higher	HP 98616A	1
Flexible Disk Drive	Dual 3-1/2 inch Drive	HP 9122C	1
Printer	HP-IB Printer	HP 2225AJ	1

1 Excluding the HP 9826A

Software Requirements

Table 1-2 lists the required language extensions to be used with the performance test program. If you already have a pre-configured BASIC system, you can verify if it contains all the required binaries by typing LIST BIN.

Table 1-2. Required Language Extensions

Name	Description	Name	Description
CLOCK	Clock	CRTX	CRT Extensions
EDIT	List and Edit	FHPIB	Fast Disc Interface Driver
GRAPHX	Graphics Extensions	IO	I/O
MAT	Matrix Statements	PDEV	Program Development
CRTA	Alpha CRT Driver	CS80	CS80 Disc Driver
ERR	Error Messages	GRAPH	Graphics
HPIB	HPIB Interface Driver	KBD	Keyboard Extensions
MS	Mass Storage		

Test Equipment

Table 1-3 lists the required equipment to perform the performance test.

Table 1-3. Recommended Test Equipment

Equipment Name	Model or HP Part Number	Qty
Frequency Counter	HP 5343A Opt. 001 or HP 5334B Opt.010 or HP 5335A Opt.010[1]	1
Frequency Standard[2]	HP 5061B	1
Spectrum Analyzer	HP 8566A/B	1
Network Analyzer	HP 8753A/B/C	1
Power Meter	HP 436A Opt. 022 or HP 437B or HP 438A	1
Power Sensor	HP 8482A	1
Power Sensor	HP 8481D	1
Function Genarator	HP 3325A	1
Signal Generator[3]	HP 8663A or HP 8642B	2
Step Attenuator[4]	HP 8496A/G Option 001 and H60[5]	1
Step Attenuator[4]	HP 8494A/G Option 001 and H60[6]	1
Attenuator/Switch Driver	HP 11713A[7]	1
50Ω Type-N Calibration Kit	HP 85032B	1
T/R Test Set	HP 85044A	1
50 MHz Low Pass Filter	PN 0955-0306	1
50Ω termination, type-N(m)	HP 909C Opt 012 or part of HP 85032B[8]	3
6 dB Fixed Attenuation, 50 Ω	HP 8491A Opt 006	2
6 dB Fixed Attenuation, 50 Ω, VSWR ≤ 1.015	HP 8491A Opt 006 & Opt H60[9]	2
Two-way Power Splitter	HP 11667A	1
N(m)-N(m) cable, 50 Ω	HP 11500B or part of HP 11851B[10]	4
RF cable kit	HP 11851B	1

1 Option 001 or 010 (optional time base) is not required, when a frequency standard in Table 1-3 is available.

2 Required for testing an analyzer equipped with Option 1D5 (High Stability Frequency Reference).

3 The "HPxxxx_2" type model number is assigned to the "Signal Generator 2", while the nomal "HPxxxx" is used for the "Signal Generator 1". This makes us possible to use two signal generators of the same model.

4 Calibration values at 50 MHz are required in the tests. See the *Calibration Data Required for Step Attenuators* later in this chapter.

5 An HP 8496A/G step attenuator with required low VSWR (≤ 1.02) can be purchased by specifying option H60.

6 An HP 8494A/G step attenuator with required low VSWR (≤ 1.02) can be purchased by specifying option H60.

7 Required when an HP 8494G or HP 8496G step attenuator is used in the tests.

8 The HP 85032B includes a type-N(m) 50 Ω termination.

9 An HP 8491A Opt. 006 fixed attenuator with required low VSWR (≤ 1.015) can be purchased by specifying Opt. H60.

10 The HP 11851B includes three N(m)-N(m) cables of 61 cm and a N(m)-N(m) cable of 88 cm.

Table 1-3. Recommended Test Equipment (continued)

Equipment Name	Model or HP Part Number	Qty
BNC(m)-BNC(m) cable, 61 cm, 50 Ω	PN 8120-1839	1
BNC(m)-BNC(m) cable, 122 cm, 50 Ω	PN 8120-1840	2
BNC(f)-BNC(f) adapter, 50 Ω	PN 1250-0080	1
BNC(f)-SMA(f) adapter, 50 Ω	PN 1250-0562	1
Tee BNC(m)-(f)-(f) adapter, 50 Ω	PN 1250-0781	1
N(m)-N(m) adapter, 50 Ω	PN 1250-1475	1
N(m)-BNC(f) adapter, 50 Ω	PN 1250-1476	1
N(f)-BNC(m) adapter, 50 Ω	PN 1250-1477	1
APC 3.5(m)-APC 3.5(f) adapter, 50 Ω	PN 1250-1866	1
APC 7-N(f) adapter, 50 Ω	HP 11524A or part of HP 85032B[1]	1

1 The HP 85032B includes two APC 7-N(f) adapters.

Calibration Data Required for Step Attenuator

The six performance tests listed below measure the analyzer's performance against a known standard (the attenuation values at a frequency 50 MHz of the HP 8496A/G and HP 8494A/G step attenuators).

3. Non-Sweep Power Linearity Test
4. Power Sweep Linearity Test
10. Magnitude Ratio/Phase Dynamic Accuracy Test
14. Amplitude Fidelity Test
15. Input Attenuator Switching Uncertainty Test
18. IF Gain Switching Uncertainty Test

These tests require the calibrated values of the attenuators listed in Table 1-4 and Table 1-5. Enter these attenuation values (referenced to 0 dB setting) at the beginning of the program with following instructions. See "Built-in Calibration Data Editor" in Chapter 3 for details.

Table 1-4. Calibration Data Required for HP 8496A/G

Frequency	Attenuation	Uncertainty
50 MHz	10 dB	≤ 0.0060 dB
	20 dB	≤ 0.0060 dB
	30 dB	≤ 0.0066 dB
	40 dB	≤ 0.0090 dB
	50 dB	≤ 0.0165 dB
	60 dB	≤ 0.0197 dB
	70 dB	≤ 0.0272 dB

Table 1-5. Calibration Data Required for HP 8494A/G

Frequency	Attenuation	Uncertainty
50 MHz	2 dB	≤ 0.007 dB
	4 dB	≤ 0.007 dB
	6 dB	≤ 0.007 dB
	8 dB	≤ 0.007 dB
	10 dB	≤ 0.007 dB

The calibration uncertainty is the primary source of measurement error in performance tests. The measurement uncertainties listed in the performance test record are valid only when the uncertainty of the step attenuation data satisfies that given in the third column of Table 1-4 and Table 1-5.

The calibration of step attenuators, HP 8496A/G and HP 8494A/G, are available at Hewlett-Packard. For information about the calibration and the available uncertainties, contact your nearest Hewlett-Packard service center.
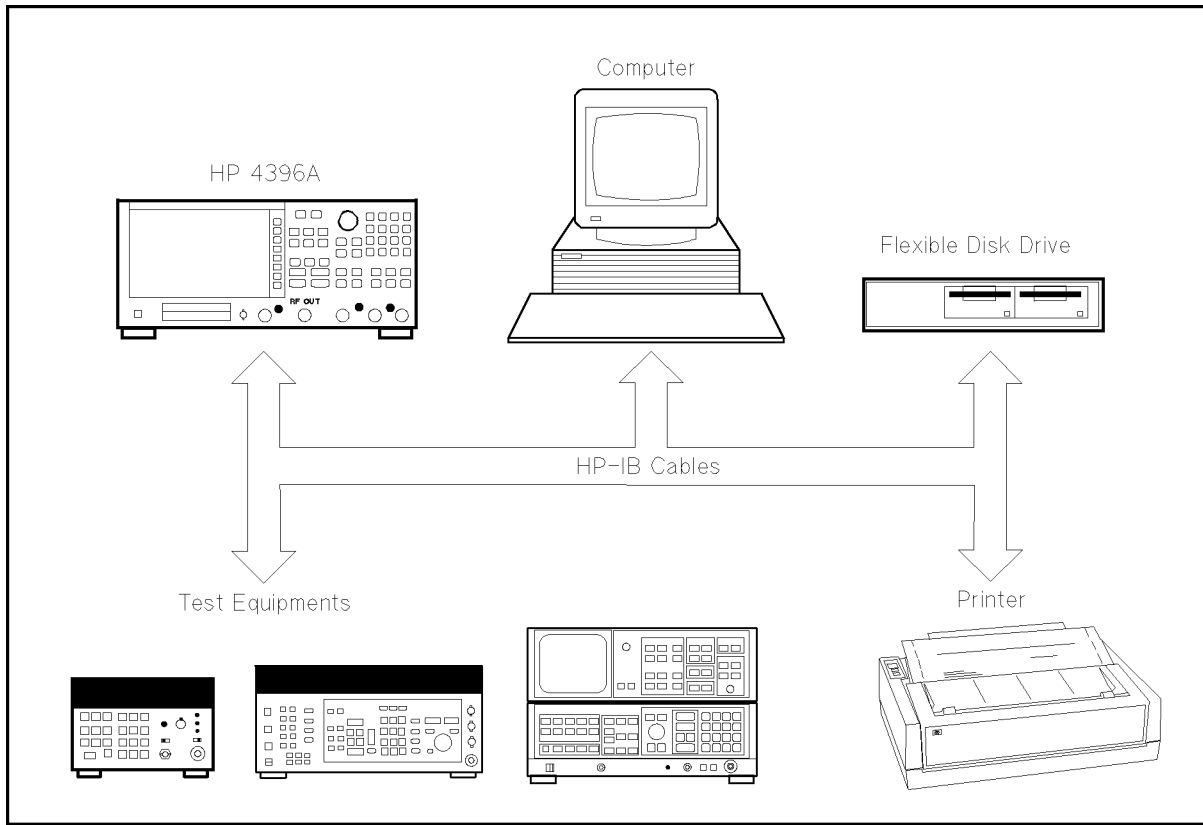
Preparation

Test Equipment Configuration

This procedure is used to select the equipment and to set their HP-IB addresses. When you perform the Performance Test Program at the first time, perform this Equipment Configuration Program to select the equipment and the HP-IB address. After that, only when you want to change the equipment or the HP-IB address, perform this program.

1. Set the MSUS (Mass Strage Unit Specifier) to the working directory or drive using the `MSI` command.

2. Load the Test Equipment Configuration Program, "TE_T4396A" by pressing `LOAD` `"TE_T4396A"` [Return] (or [ENTER]) key.

3. Execute the program by pressing `RUN`, and follow the instructions on the computer's screen.

4. The BDAT files which contain the test equipment configuration information will be created in the working directory / drive.

System Setup

The system setup is shown in Figure 2-1

Figure 2-1. Performance Test Hardware Setup

3

Operation

This chapter describes a program flowchart, and how to operate the program.

Keyboard and Mouse Operation

The menus in "TEST4396A" use a window format. It supports keyboard and mouse operations. The operations are as follows.

■ Keyboard Operation

1. Press (▲)/(▼) cursors until your preference is highlighted.

2. Choose the highlighted item by pressing (Return) or (Select) ((ENTER) or (EXECUTE)).

3. If `QUIT` or `EXIT` is displayed in a menu, select one of these to exit the menu. Otherwise, press (▼) (or (CONTINUE)) key to exit. When you exit menus, the program displays next menu.

Note   Press (?) to access on-screen help information for the selection you have highlighted. Help information appears in a display window.

Press (Return) or (Select) ((ENTER) or (EXECUTE)) to turn off the help screen.

■ Mouse Operation

1. Slide the mouse up or down until your preference is highlighted.

2. Choose the highlighted item by pressing left-hand button on the mouse, or slide the mouse to the right.

3. If `QUIT` or `EXIT` is displayed in a menu, select one of these to exit the menu. Otherwise, slide the mouse to the left to exit. When you exit menus, the program displays next menu.

Note   Press the right-hand mouse button to access on-screen help information for the selection you have highlighted. Help information appears in a display window.

Press the left-hand mouse button to turn off the help screen.

www.valuetronics.com

Program Execution

Perform the following steps to start the performance test program.

Note	In the program, the HP 4396A under test is referred as "UUT".

Note	Perform the Test Equipment Configuration prior to execution. Refer to "Test Equipment Configuration" in Chapter 2.

Main Program Instruction

1. Turn on the computer and bring up the BASIC system. Refer to the Table 1-2 for the required language extensions.

2. Set the Mass Storage Unit Specifier to the drive/directory where the adjustment program exists using the `MSI` command.

3. Load the program, "TEST4396A" by pressing `LOAD "TEST4396A"` (Return) (or (ENTER)).

4. Execute the program by pressing `RUN`.

5. The copyright will be displayed on the computer's screen. Press any key to continue.

6. The UUT configuration window "`UUT: HP4396A`" will be opened. Enter the UUT (the HP 4396A under test) configuration (serial number, HP-IB address, environment, and line frequency), and press (▼) (or (CONTINUE)) key to continue.

7. The program will ask "`Where should Test Reports be printed?`". Select `CRT`, `PRINTER`, or `NO OUTPUT`.

Note	If the performance test record is necessary, then select `PRINTER` and connect a printer which is addressed 701 to the computer by HP-IB cable.

8. The used equipment list will be displayed. Select `CONTINUE` to go to next step, or `PRINT` to print the used equipment list to the printer.

9. The used accessory list will be displayed. Select `CONTINUE` to go to next step, or `PRINT` to print the used accessories list to the printer.

10. The "TEST LIST" menu will be opened. Each test can be selected using (▲)/(▼) cursors and (Return) (or (ENTER)) key, or pressing (▼) (or (CONTINUE)) key to exit the program.

Note	INITIAL SETUP will be performed automatically when you select any other test before performing INITIAL SETUP.

Note	INITIAL SETUP includes the Built-in Calibration Data Editor and the Standard Selection screen. Refer to the next section for instruction of the Built-in Calibration Data Editor.

11. The program will invoke the Calibration Data Editor. Select the calibration standard's serial number to be used in the test among the listed serial numbers.

Built-in Calibration Data Editor

This section provides the instructions for the Built-in Calibration Data Editor.

Built-in Calibration Data Editor Instruction

1. The window "`Enter the CAL FACTOR volume Msvs`" will be opened. Enter the MSVS (Mass Storage Volume Specifier) which the calibration data will be stored in.

Note   The directory must be already exist before executing the performance test program. Create directory first which the calibration data should be stored in.

2. The menu for selecting ADD, EDIT or DELETE the standard will be opened. Select `ADD` for adding the new standard data, `EDIT` for editing an existing standard data, or `DELETE` for deleting an existing standard data.

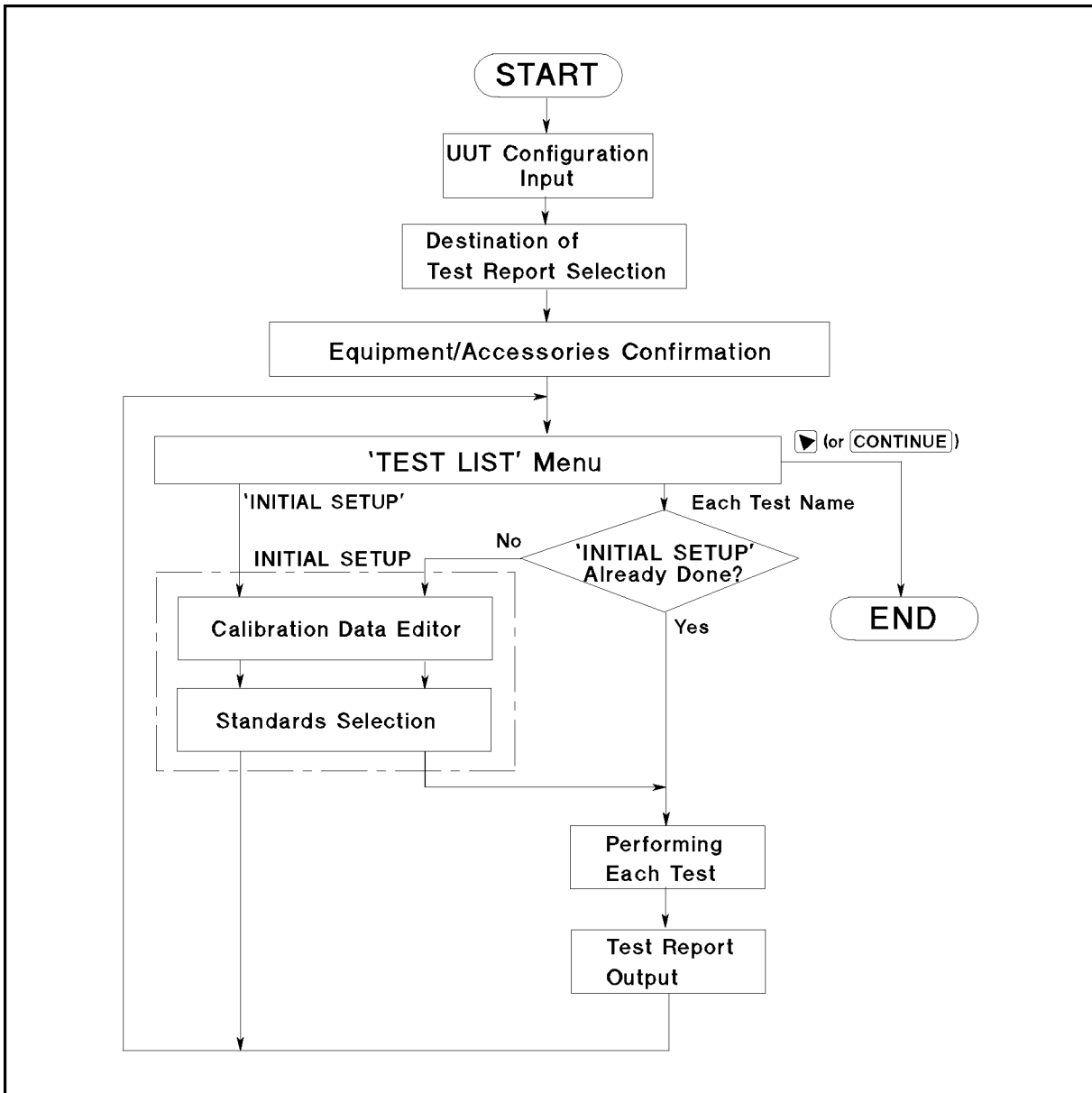**Note**   The `SERIAL NUMBER` field cannot be modified when editing the calibration data.

Program Flow

Figure 3-1 shows the performance test program flowchart. The following information gives a brief explanation for each menu item. Figure 3-2 shows the Built-in calibration data editor flowchart.

Main Program Flowchart

Figure 3-1. Performance Test Program Flowchart

UUT Configuration Input	Input the UUT serial number, HP-IB address, installed options, environment, and line frequency.
Destination of Test Report Selection	Select where the Test Report will be output. The output medium can be selected as CRT, PRINTER, or NO OUTPUT.
Equipment / Accessories Confirmation	Confirm equipment and accessories are correct. If necessary, select PRINT to print out the list. Otherwise, select CONTINUE to continue.
TEST LIST Menu	Each test can be selected by using (▲)/(▼) cursors and (Return) (or (ENTER)) key. If necessary, you can invoke the Built-in Calibration Data Editor by selecting "INITIAL SETUP".
	Press (▼) (or (CONTINUE)) key to quit the program.
Built-in Calibration Data Editor	Input standards' calibration data which are needed to perform the performance test.
Standards Selection	Select the standards' serial numbers used in the performance test. This list must be filled before performing each test.
	Press (▼) (or (CONTINUE)) key to exit this screen.
Performing Each Test	Each test can be selected in the 'TEST LIST' Menu.
Test Report Output	Outputs the Test Report to the medium that was selected at "Destination of Test Report Selection".

Built-in Calibration Data Editor Flowchart
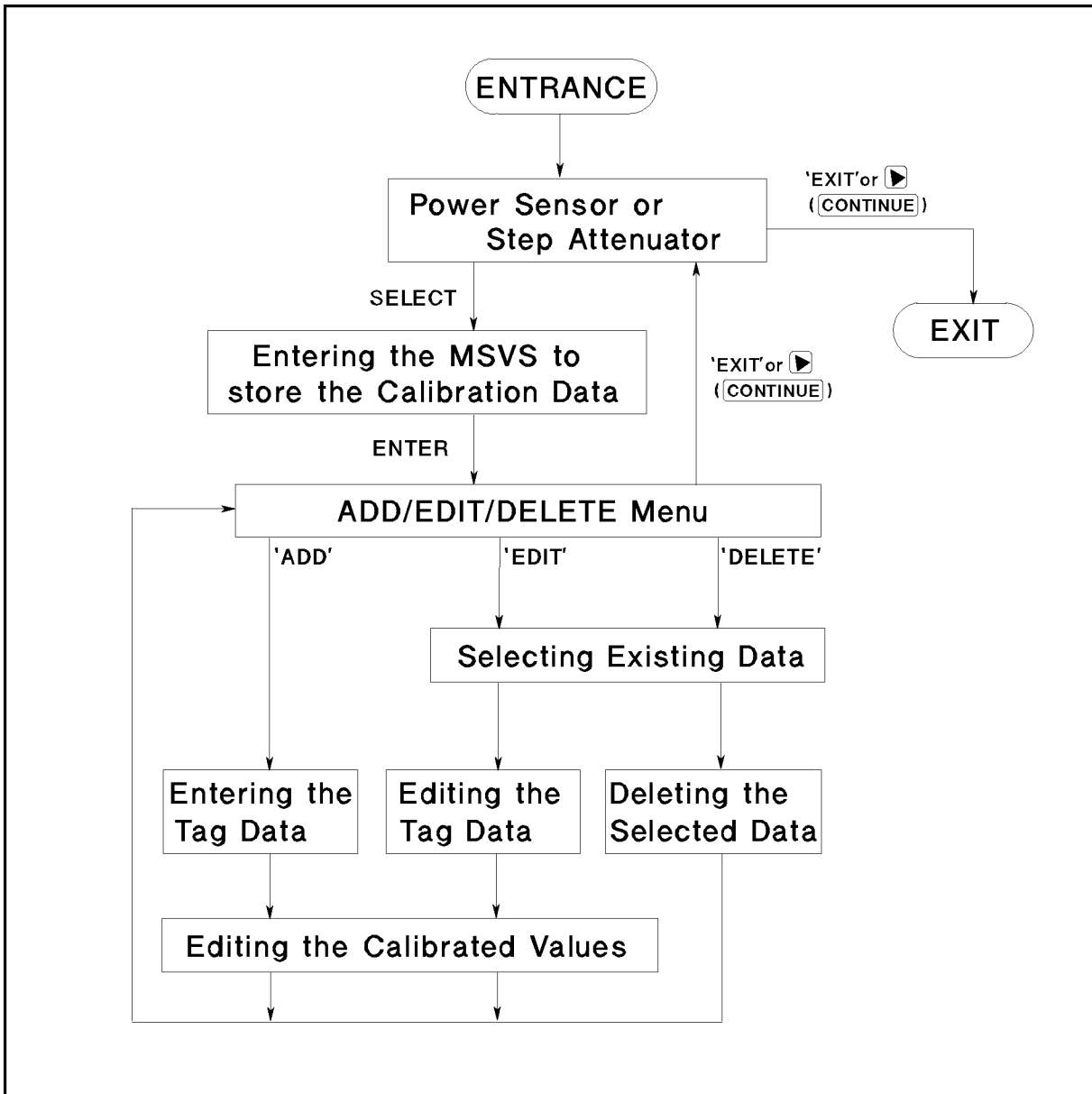
Figure 3-2. Built-in Calibration Data Editor Flowchart

Power Sensor or Step Attenuator	Select POWER SENSOR or STEP ATTENUATOR .
	Selecting EXIT or pressing ⏷ (or (CONTINUE)) key quits the Built-in Calibration Data Editor.
Entering the MSVS to store the Calibration Data	Enter the MSVS (Mass Storage Volume Specifier) which the calibration data will be stored in. For example:

      :CS80,702,1   *Flexible disk based system*
      /CAL_FACTORS:REMOTE   *SRM based system*

Default MSVS is current MSVS.

Press ⏷ (or (CONTINUE)) key to exit this screen.

Add / Edit / Delete Menu	You can select NEW CAL FACTOR FILE to add the new calibration data, or EDIT CAL FACTOR FILE to modify the existing calibration data, or PURGE CAL FACTOR FILE to delete the existing calibration data.
Entering / Editing the Tag Data	Enter / edit the serial number, cal due date, trace number, and press ⏷ (or (CONTINUE)) key to exit this screen.
Existing Data Selection	A list of existing data is displayed. Select one of the data to be edited / deleted using (▲)/(▼) cursors, and press (Return) (or (ENTER)) key to go to next step.
Editing the Calibrated Values	A screen that corresponds to the Calibration Report is displayed. You can select the field that you want to edit by using (▲)/(▼) cursors, and pressing (Return) (or (ENTER)) key to start modify. Each value is adjusted by (▲)/(▼) cursors.
	Press ⏷ (or (CONTINUE)) key to back to previous screen.