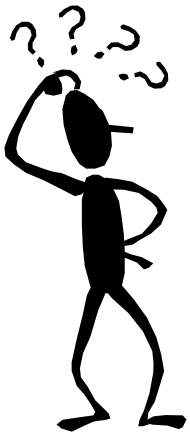

Help - Quick Assistance for SCPI Command Programming

IBASIC Programming with Help Function

HEWLETT PACKARD

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  - Starting IBASIC Editor
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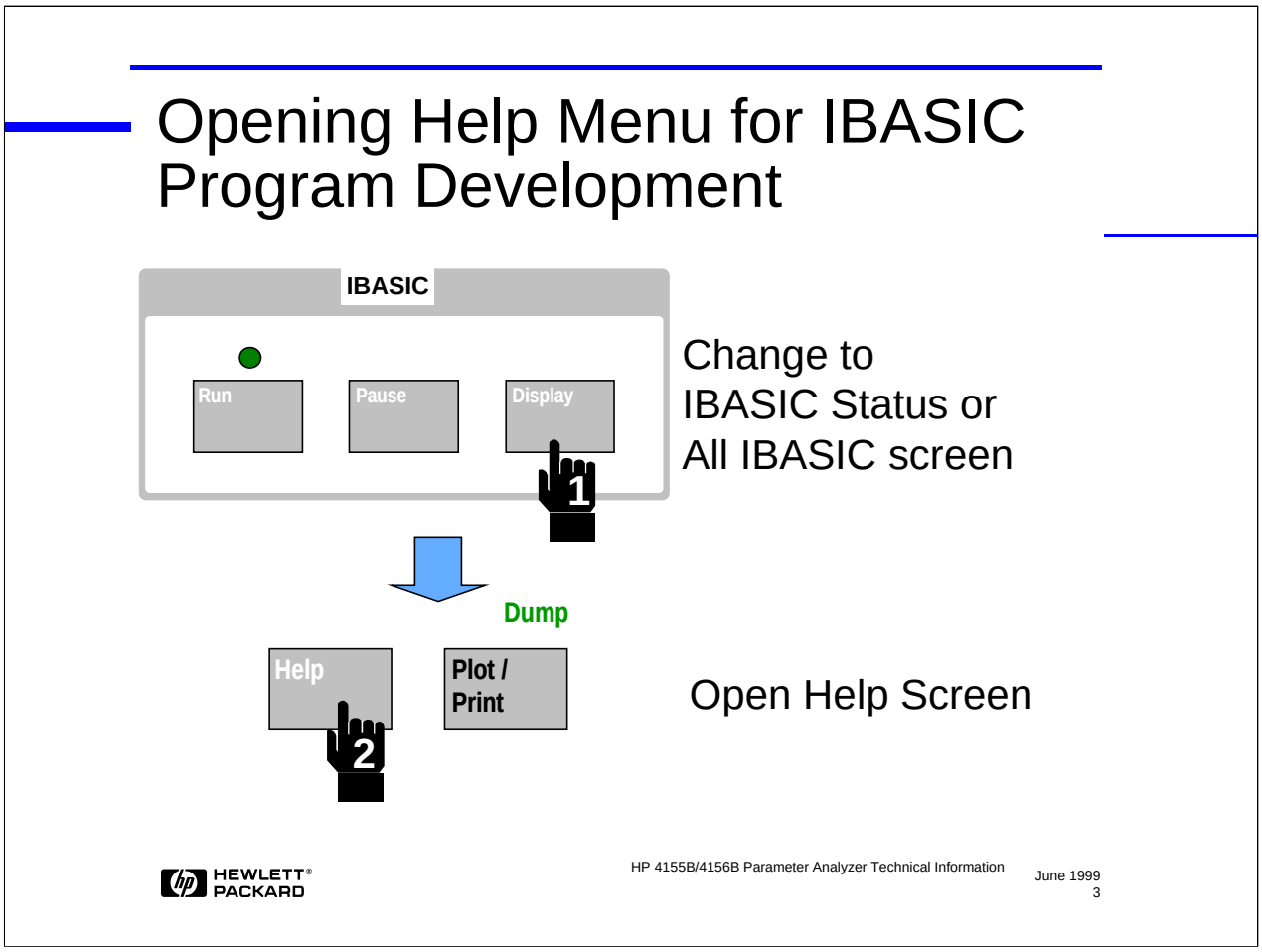
The HP 4155B/4156B has a really nice function to automate tests. It is Instrument BASIC (IBASIC), which is a built-in environment for quick test program development. It is a good tool to configure a compact test system and automate your tests. No external computer is necessary. IBASIC is an easy-to-use and friendly language. It is similar to HP BASIC, which was designed for measurement instrument control. IBASIC is actually a subset of HP BASIC, and many HP BASIC commands are supported by IBASIC. While not 100% compatible, the syntax of both languages is very similar.

Since IBASIC and the HP 4155B/4156B are very versatile, there are many keywords for IBASIC and many commands to control the HP 4155B/4156B. A total of 640 keywords and commands are available. This complexity sometimes makes programming difficult and/or time consuming.

Do you refer to the manuals every time you want to find commands? The HP 4155B/4156B includes a nice built-in help function that provides you with simple hints to develop IBASIC programs. The help function quickly enables you to find desired commands.

This document shows you how to utilize the help function and IBASIC to develop programs using SCPI (Standard Commands for Programmable Instruments) on the HP 4155B/4156B.

Note that this document does not include information on the 4145 syntax commands, HP FLEX commands, and ASP-like programming. Please refer to the HP 4155B/4156B User Training Text for more information.



Opening Help Menu for IBASIC Program Development

The help function is context based. The contents of the help screen depend upon the page opened when you press the "Help" key. To get the help screen for IBASIC program development, you have to change the screen mode by pressing the "Display" key in the IBASIC key group.

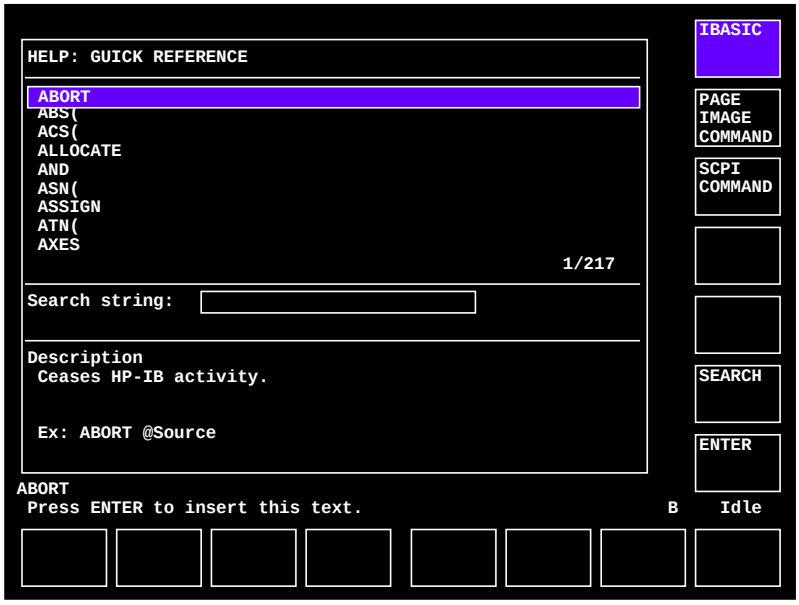
1. Press the "Display" Key. Make sure that you are opening the IBASIC Status screen or All IBASIC screen.

[The IBASIC Status screen has the front panel screen to control the HP 4155B/4156B, but softkeys are for the IBASIC operation. The All IBASIC screen does not have any front panel for control of the HP 4155B/4156B.]

2. Next press the "Help" key. If you opening the help menu for the first time, the help for IBASIC keywords shown on the next page are displayed.

[The help displayed in this manner is called "Quick Reference" help. The Quick Reference includes 3 categories of help. They are: IBASIC keyword, Page Image Command, and SCPI Command help.]

IBASIC Keyword Help



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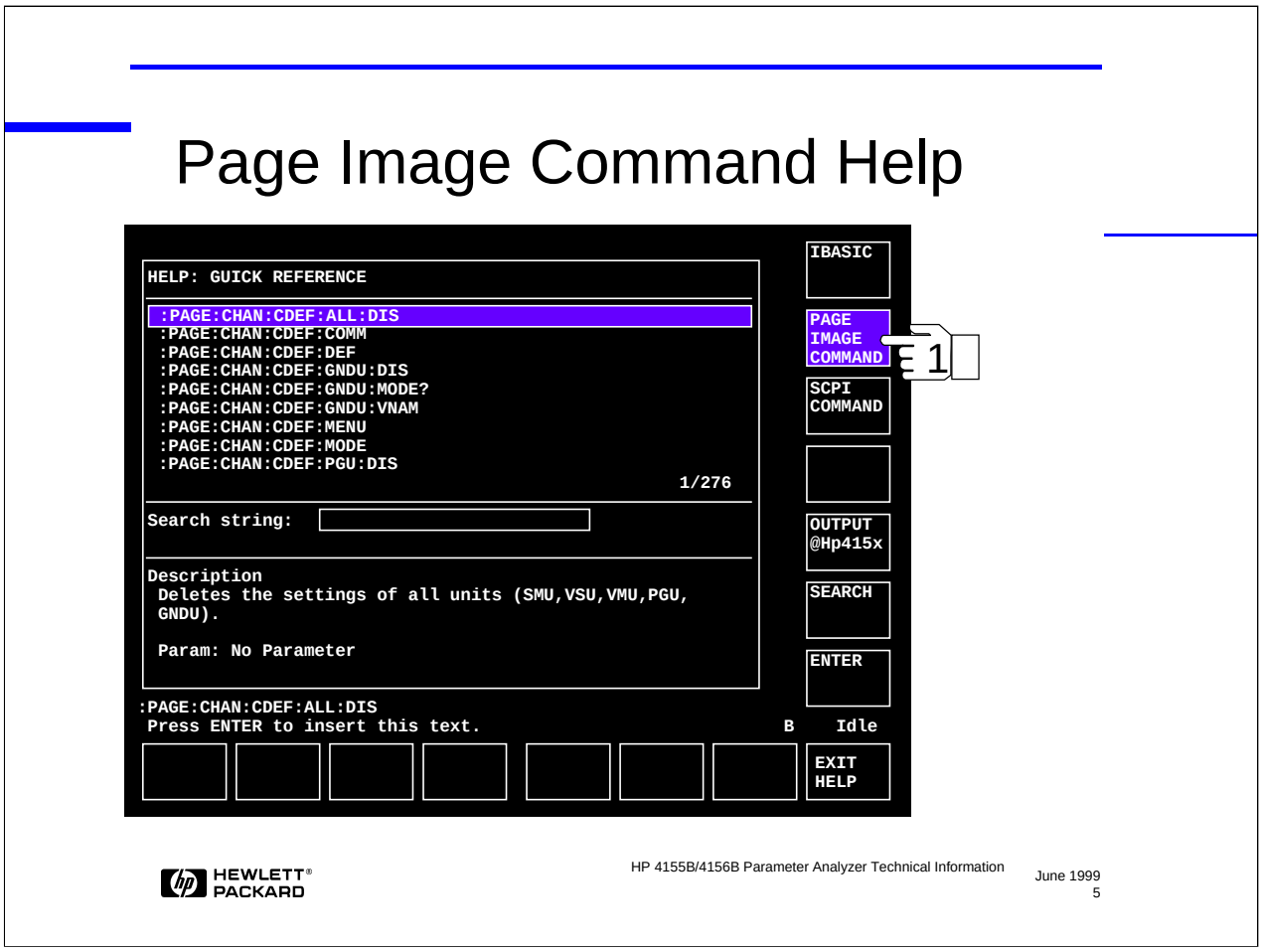
IBASIC keyword Help

The figure above shows the help screen for the IBASIC keywords. There are more than 200 keywords (BASIC commands) supported by HP 4155B/4156B IBASIC. Short descriptions and examples are available for each keyword.

Since the screen space is very limited, the help function does not detail each keyword. However, it is still useful as a quick reference. You can quickly understand the syntax for each keyword by referring to the examples.

Note: The search function does not find a keyword by name, but rather finds specified text in descriptions and/or examples.



Page Image Command Help

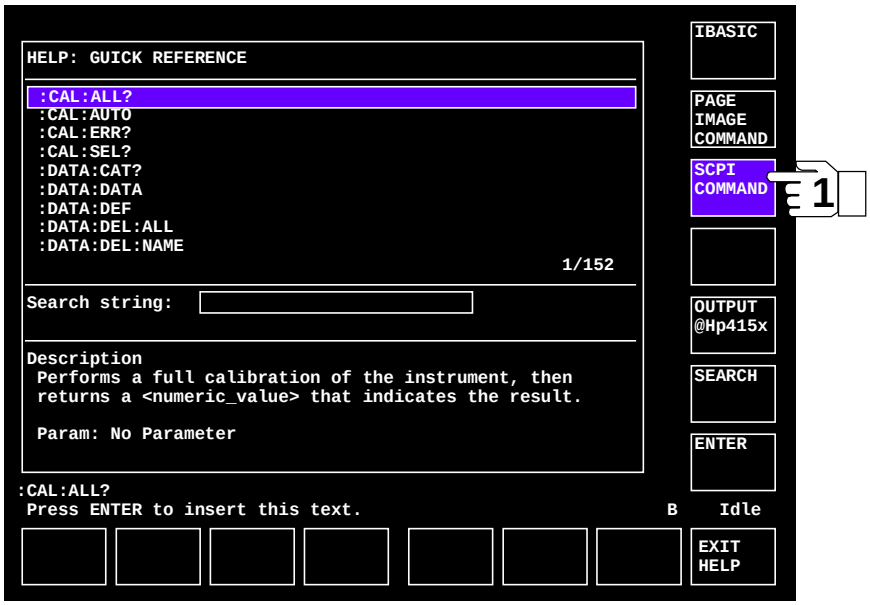
The default command set to control the HP 4155B/4156B is SCPI mode. The SCPI commands can be categorized into two groups. They are Page Image commands and standard SCPI commands. The standard SCPI commands are compatible with other SCPI supported instruments.

The Page Image commands are dedicated commands to control the front panel of the HP 4155B/4156B (following the SCPI hierarchy rules). In general, one Page Image command is used to set one corresponding field in a setup page. In other words, every field on the front panel has an associated Page Image command.

The figure above shows the help screen for the Page Image commands. There are 276 commands.

Note: The Page Image commands and SCPI commands are grouped at the functional level. The Page Image commands preserve the hierarchical nature of the page layout of the HP 4155B/4156B front panel. A path is established from a root page to sublevel page(s), and then to the individual command.

SCPI Command Help



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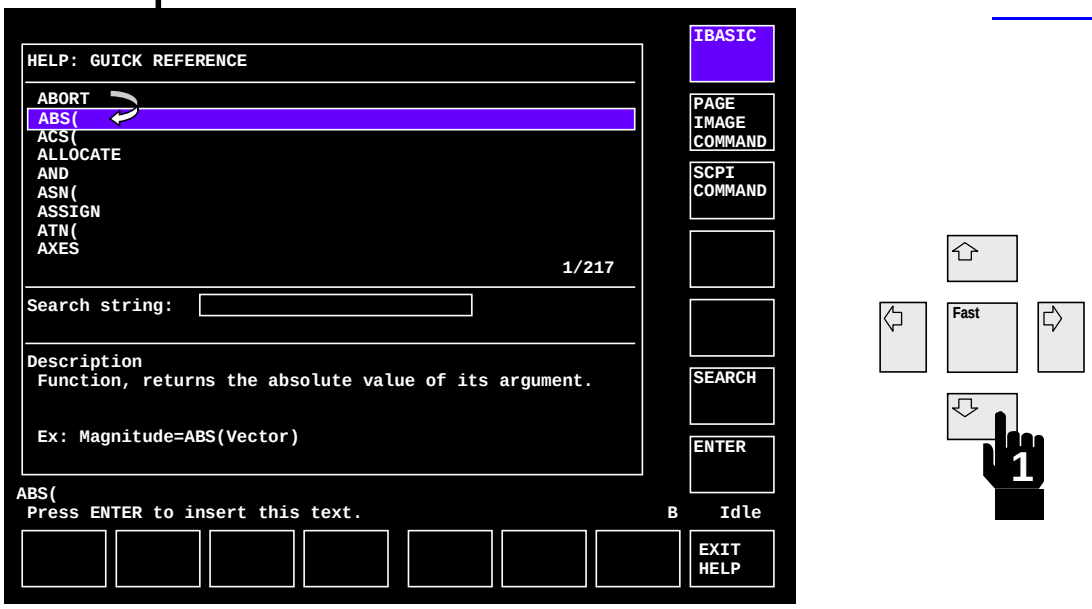
SCPI Command Help

This is the help screen for the SCPI commands. They follow the SCPI standard. For the HP 4155B/4156B, more than 150 commands are supported.

Basic Operation of IBASIC Help - 1



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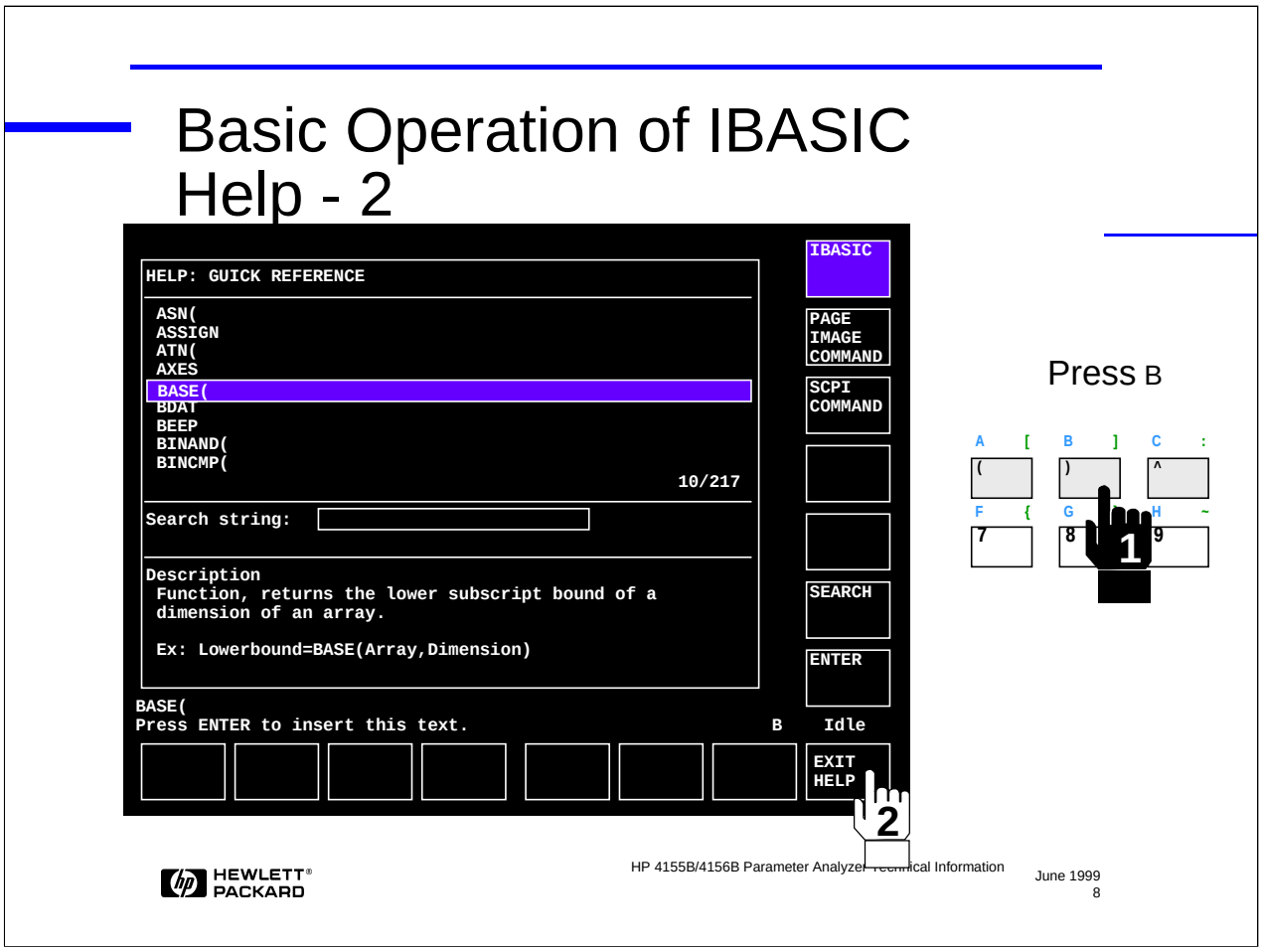
Basic Operation of IBASIC Help - 1

Operation of the IBASIC help (Quick reference) is simple. By using the arrow keys, you can move the field pointer up or down.

Find a desired keyword or command by referring to the description and examples for each keyword.

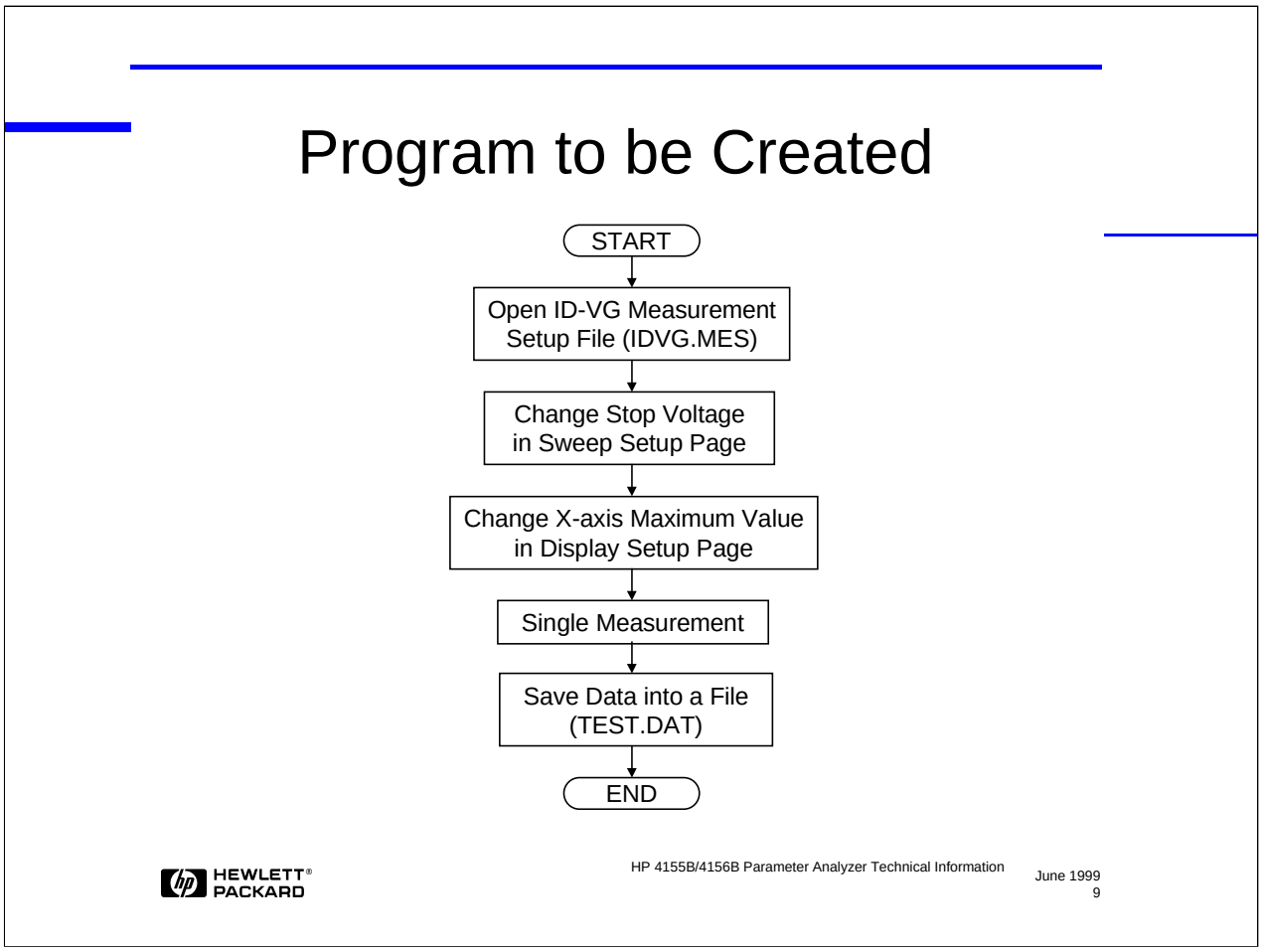


Basic Operation of IBASIC Help - 2

You can jump to a keyword by pressing alphabetic keys.

1. By pressing the “B” key for example, the filed pointer moves to the first keyword starts from character “B” is “BASE”.

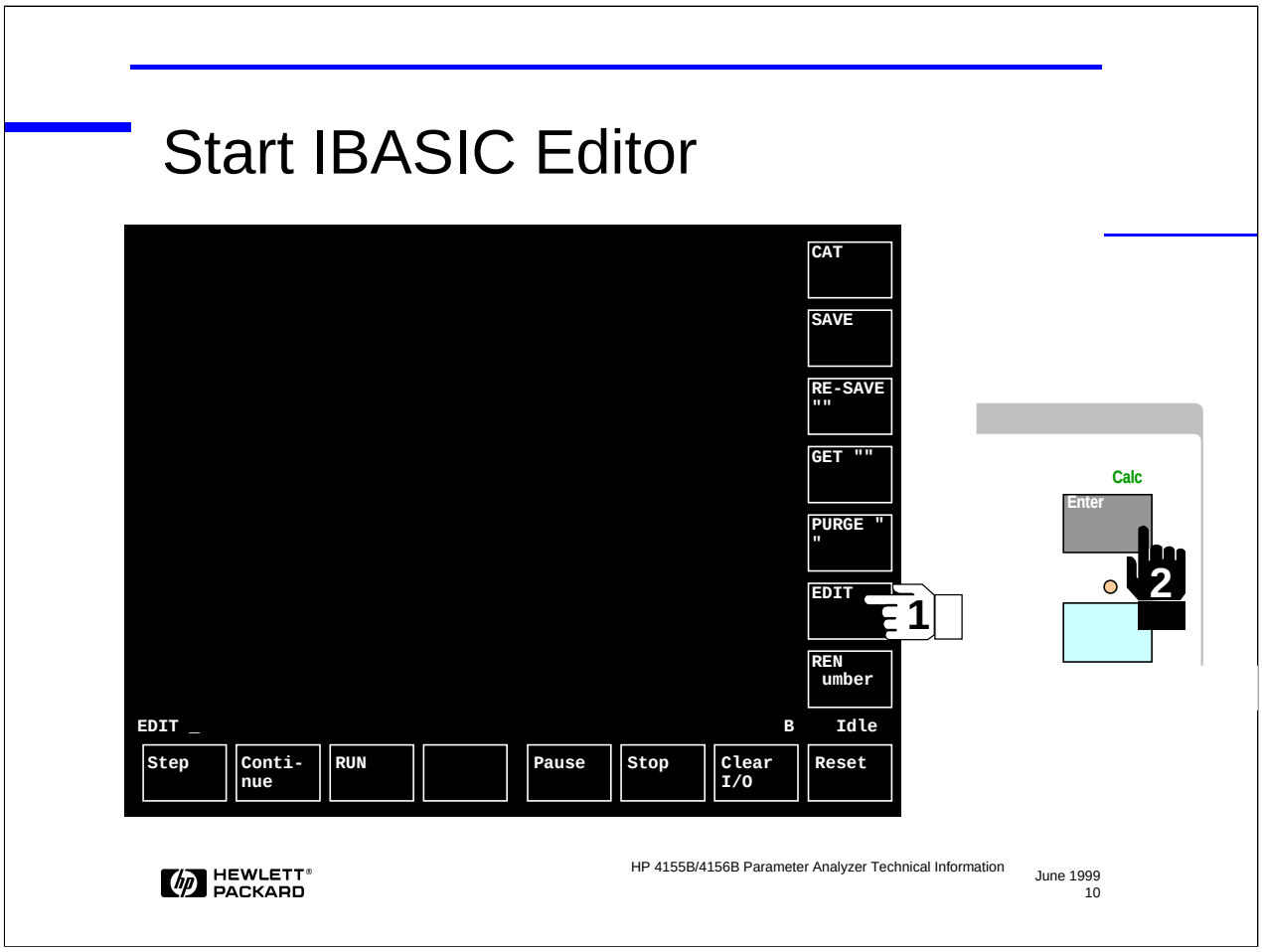
2. You can always exit the help screen by selecting the “EXIT HELP” softkey.



Program to be Created in This Example

This is the flow chart for the program that we will create in the following pages.

This example assumes that a measurement setup file for Drain Current vs Gate Voltage characteristics (Id-Vg) was previously stored into the current mass storage.



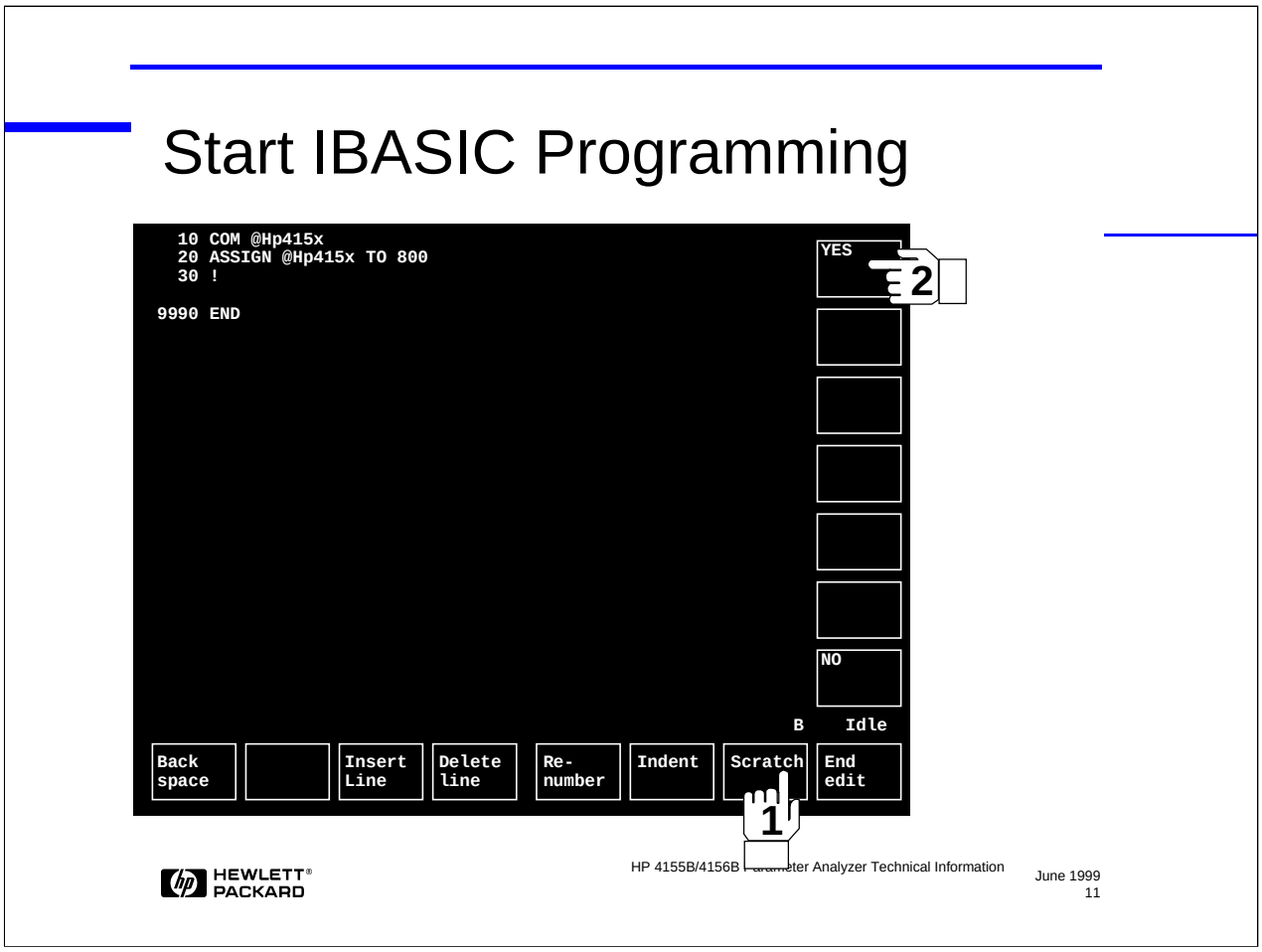
Start IBASIC Editor

Please start the IBASIC Editor.

1. Select the "EDIT" softkey.

2. Press the "Enter" key.

You may type "E", "D", "I" and "T", and hit the return key using the external keyboard.



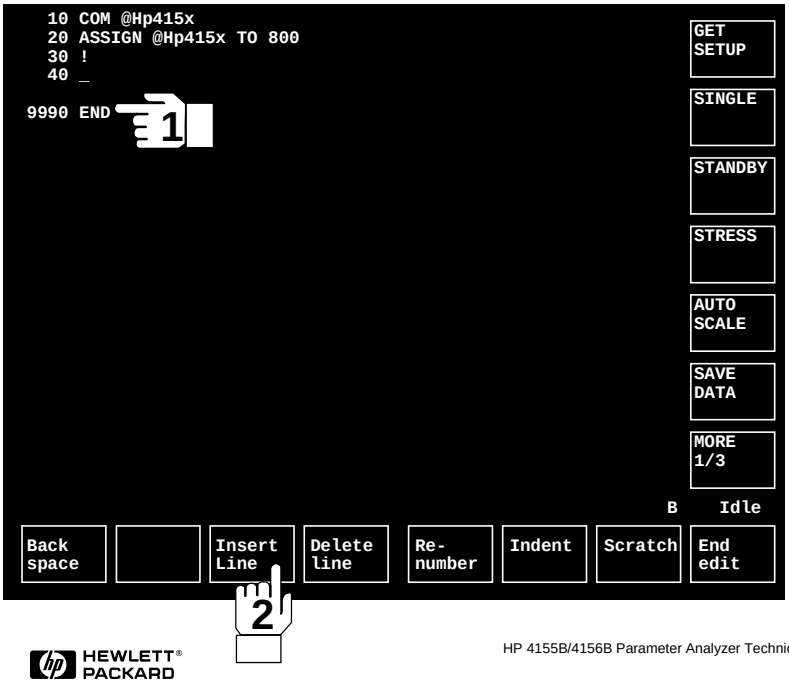
Start IBASIC Programming

While you can start editing now, we recommend using the default program that will make it easy for you to program with the assistance of the help function.

1. Select the "Scratch" softkey.
2. Select the "YES" softkey.

This will open a default program which includes the I/O path assignment for the internal GPIB of HP 4155B/4156B. The GPIB address is 800. This I/O path is used to control the HP 4155B/4156B in the following pages.

Inserting Editing Line



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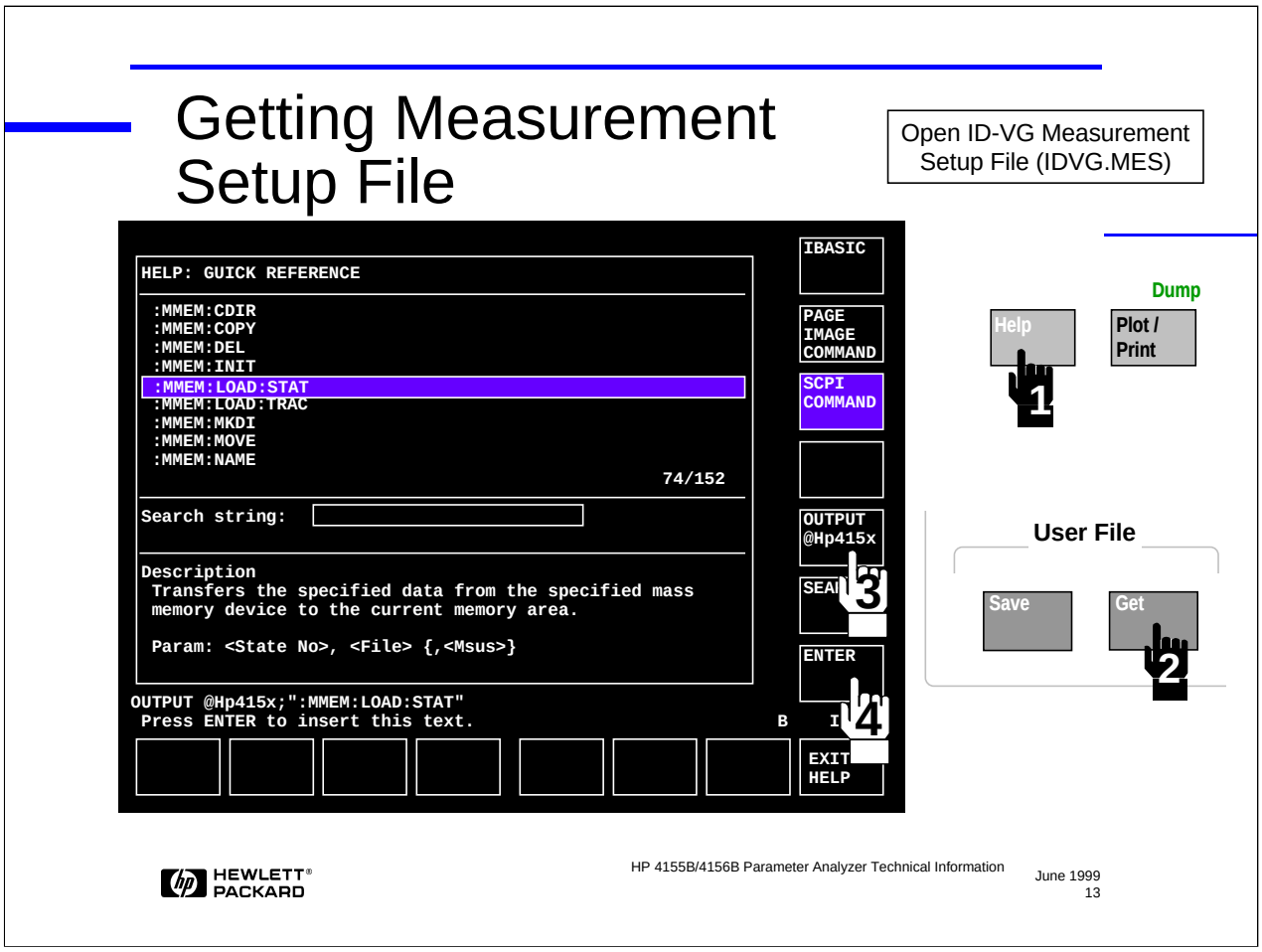
Inserting Editing Line

1. Move the field pointer to line 9990 using the arrow key.
2. Select the "Insert line" softkey.

This will insert line 40 and the field pointer will move to this line. You can now add your program.



Getting Measurement Setup File

Now we can start programming with assistance of the help function. First, we will get the previously saved measurement setup file.

1. Press the "Help" key to open the help screen.

2. Press the “Get” key. The field pointer will move to the corresponding SCPI command. Read the description to confim the command is what you want to use.

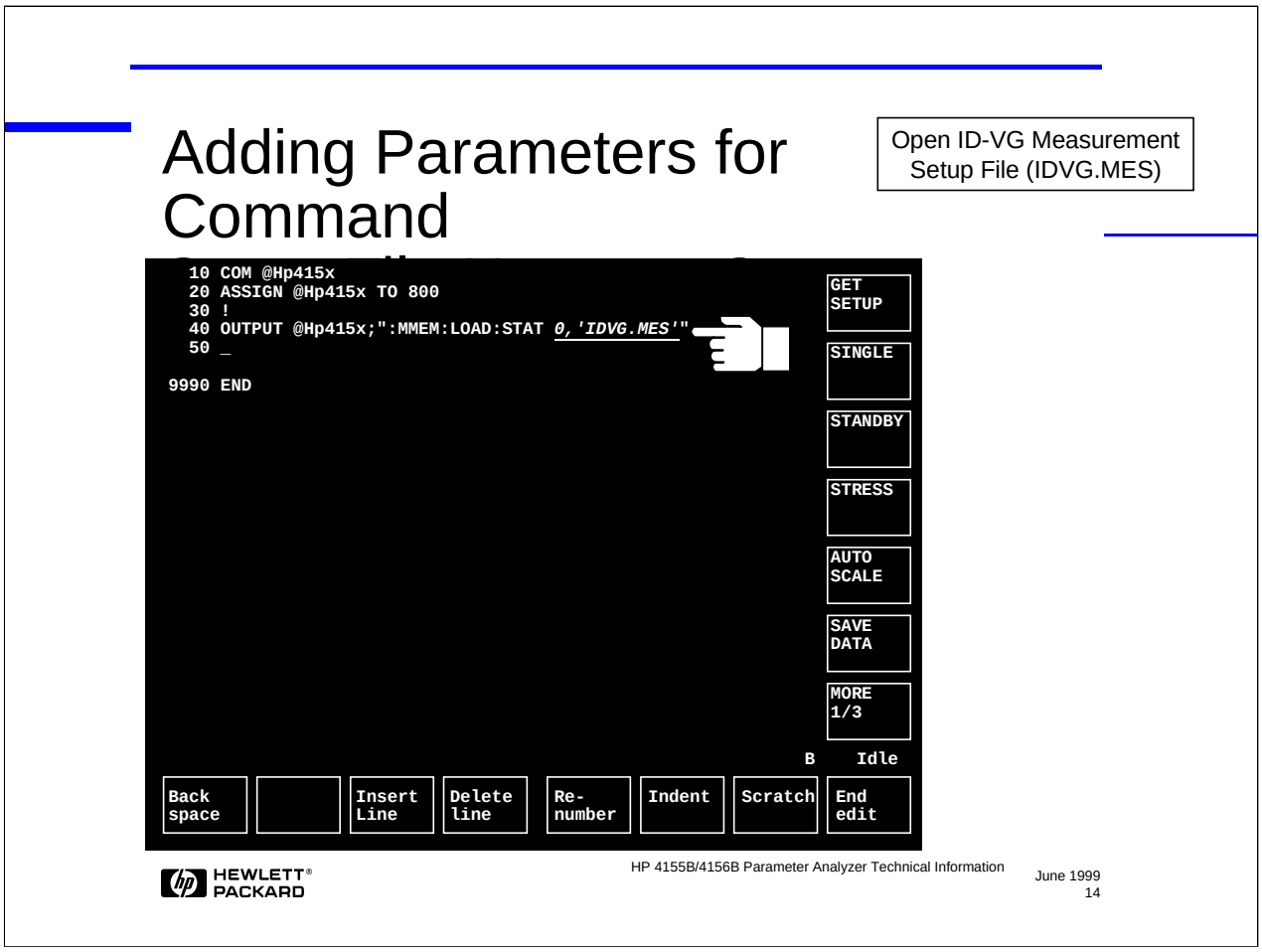
Note that the parameters for the command are:

```
<State No>, <File> {,<Msus>}
```

3. Select the "OUTPUT @Hp415x" softkey.

4. Select the "Enter" softkey.

By performing these operations, the command for the OUTPUT statement is copied to the editing line.



Adding Parameters for Command

Since the command requires some parameters, you need to add them manually. The syntax is:

<State No>, <File> {,<Msus>}*

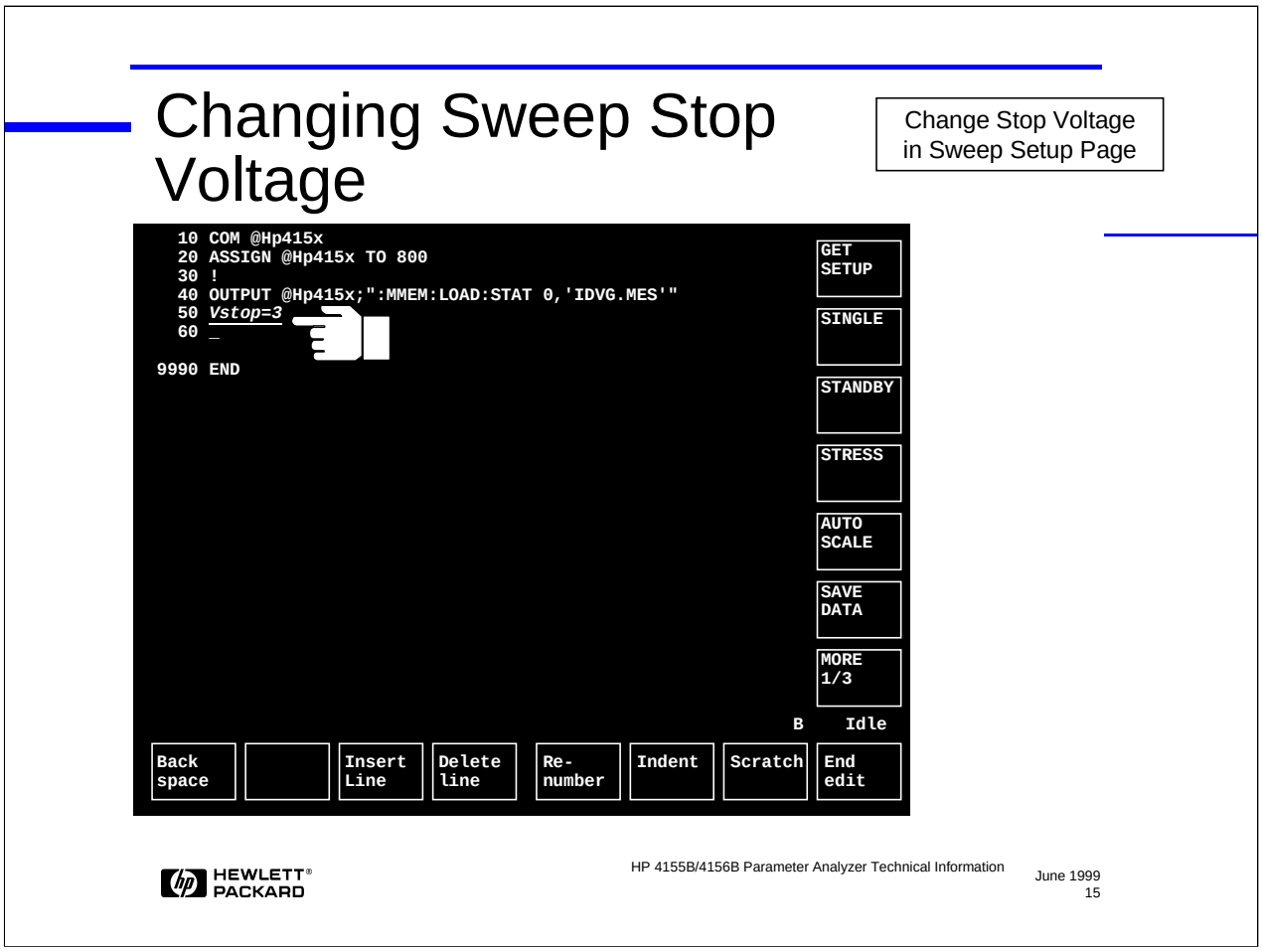
In the file operation of the HP 4155B/4156B , the state number is always **0**. This should be noted for future use.

The file name is 'IDVG.MES' in this example. Put single quotation marks before and after the file name. After adding the state number and file name, press the “Enter” key to fix the editing line.

Note: You do not have to specify a mass storage (Msus) because it is an optional parameter.

* The parameters in { } parenthesis are optional.

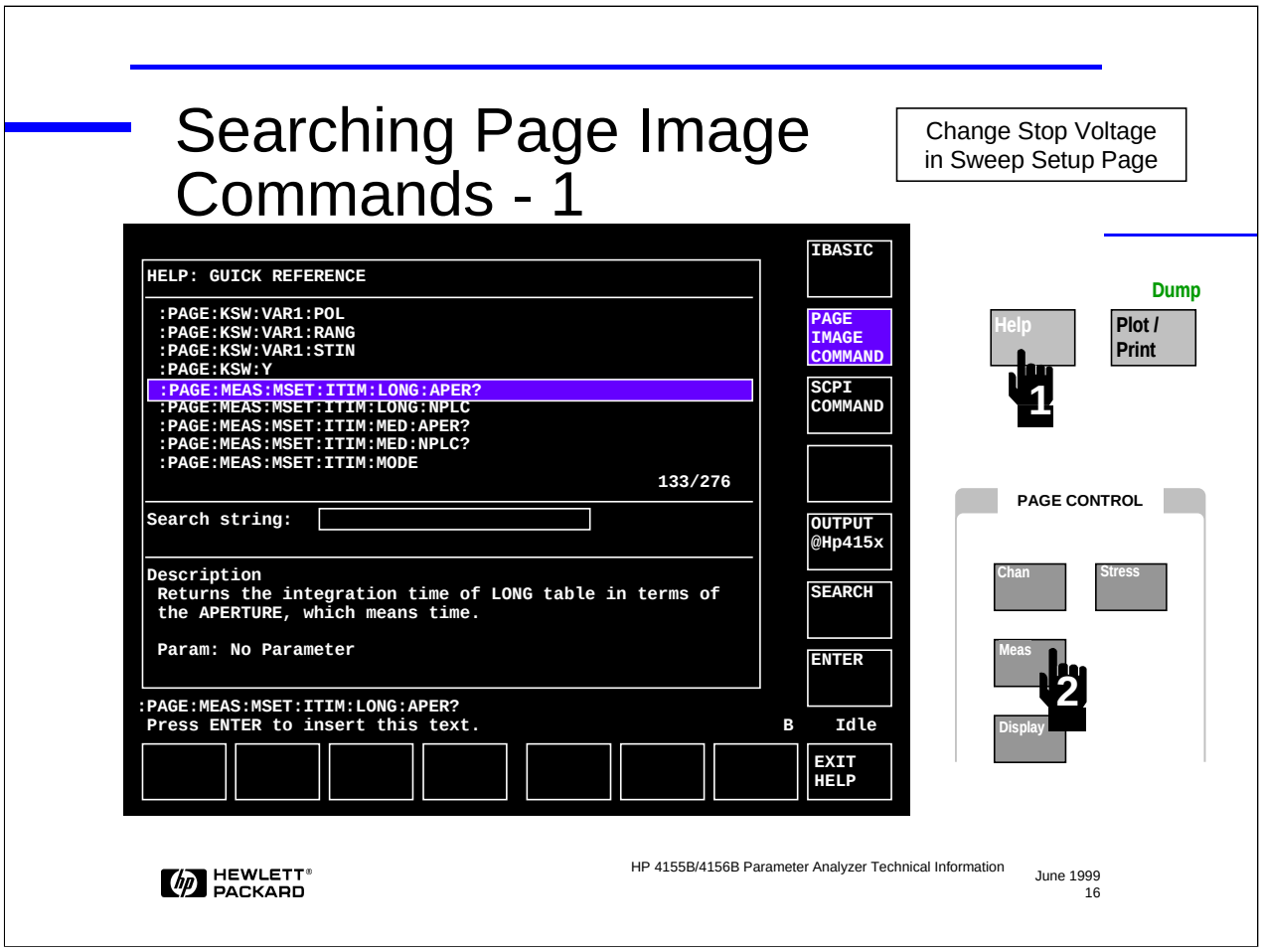
Note that the IBASIC editor is always in the insert mode.



Changing Sweep Stop Voltage

The next step is to change the stop voltage setup in the Sweep Setup page.

In this example, a variable "Vstop" is used to specify the stop voltage. The gate voltage is swept and its stop value is set to **3** V.



Searching Page Image Commands

The next step is to change the stop voltage value in the Sweep Setup page. The following several pages describe how to find the Page Image command to set the stop voltage.

1. Press the "Help" key to open the help screen.

The Page Image commands have a hierarchy and are grouped at corresponding pages and function levels. For example, the first 27 commands listed in the Page Image command help are for the Channel Definition page. The following commands are for the User Function page.

2. Press "Meas" key in the Page Control group. The field pointer moves to the first command, which is to set the Measure Setup page.

Note that the Measure page group includes the following pages (alphabetic order):

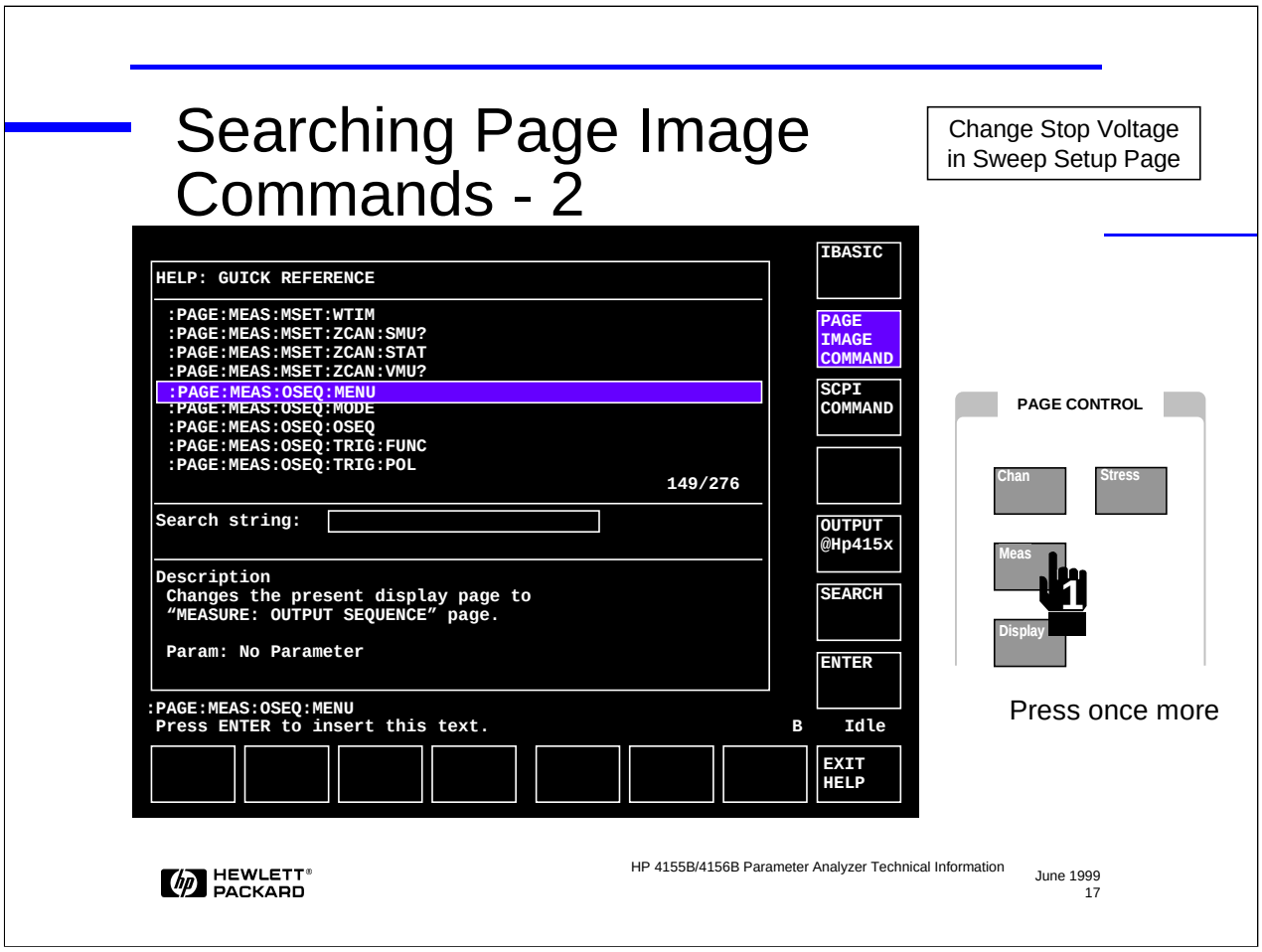
Measure Setup < This page

Output Sequence

PGU Setup

Sampling Setup

Sweep Setup

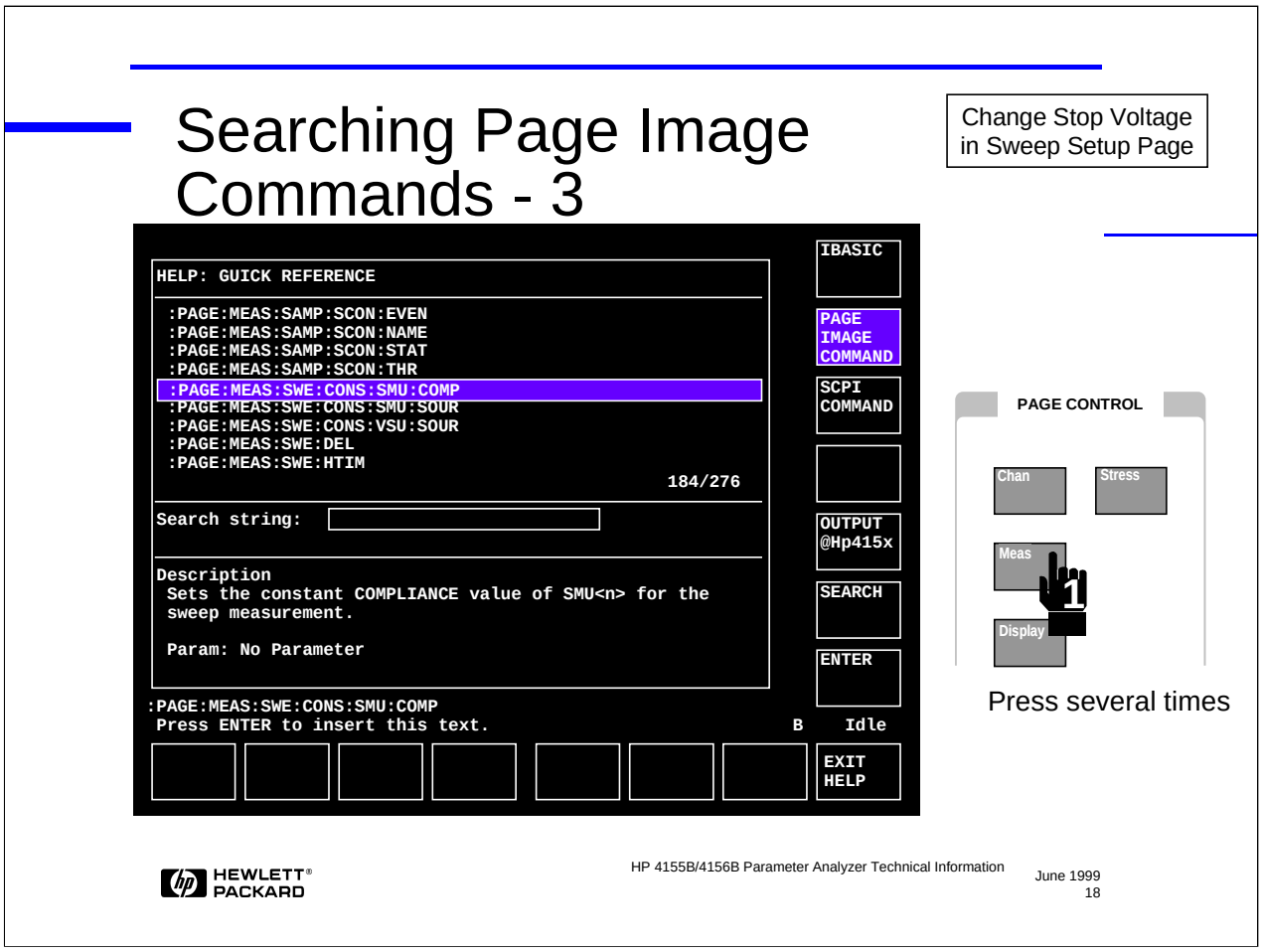


Searching Page Image Commands

1. Press the "Meas" key again. The field pointer moves to the first command, which is for the Output Sequence page control.

Again, the Measure page group includes the following pages (alphabetic order):

Measure Setup
Output Sequence < This page
PGU Setup
Sampling Setup
Sweep Setup



Searching Page Image Commands

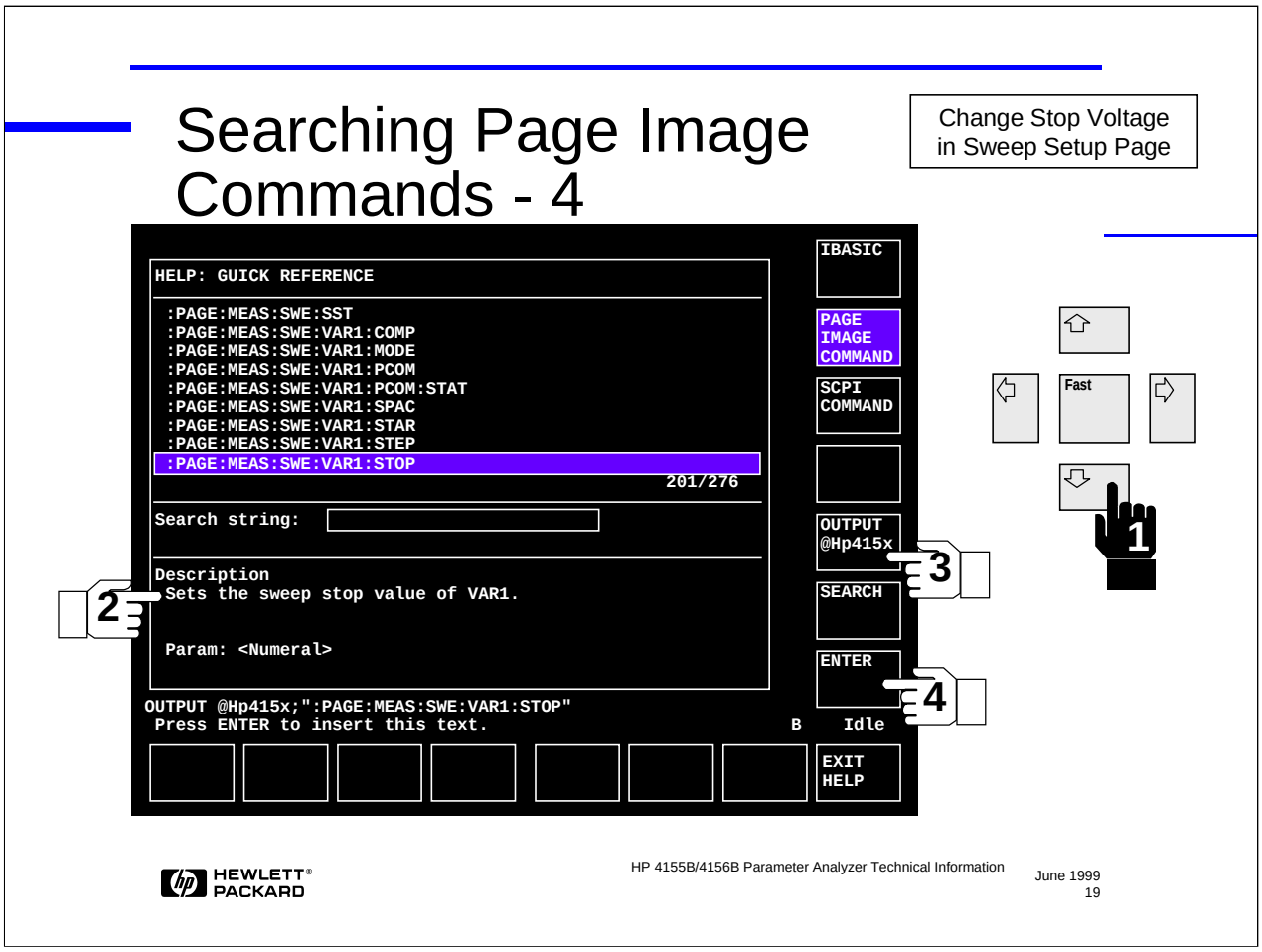
The sweep conditions are set in the Sweep Setup page.

1. Press the "Meas" key several times to open the help menu for the Sweep Setup page.

Measure Setup
Output Sequence
PGU Setup
Sampling Setup
Sweep Setup < This page

The field pointer is located at the first command for the Sweep Setup page.

Now use the arrow keys to find desired Page Image command.



Searching Page Image Commands

1. Use the arrow key to find the Page Image command to set the stop value.
2. Read the description to confim that this command is what you want to use.

Note that the parameter for the command is:

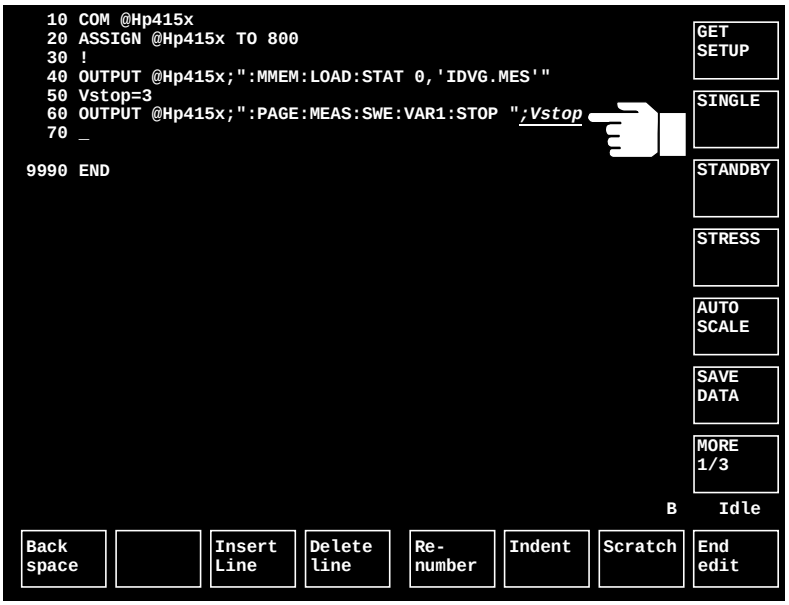
`<Numeral>`

3. Select the "OUTPUT @Hp415x" softkey.
4. Select the "Enter" softkey.

By performing these operations, the command with OUTPUT statement is copied to the editing line.

Adding Parameter for Command Sweep Stop Value

Change Stop Voltage in Sweep Setup Page



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Adding Parameter for Command

Add a numeral parameter for the command to specify the stop voltage in the sweep measurement. Note that you must put a space character between the command and the parameter.

If the Vstop variable is positive value, the command may work without a space. However, if the variable is negative then an error will occur.

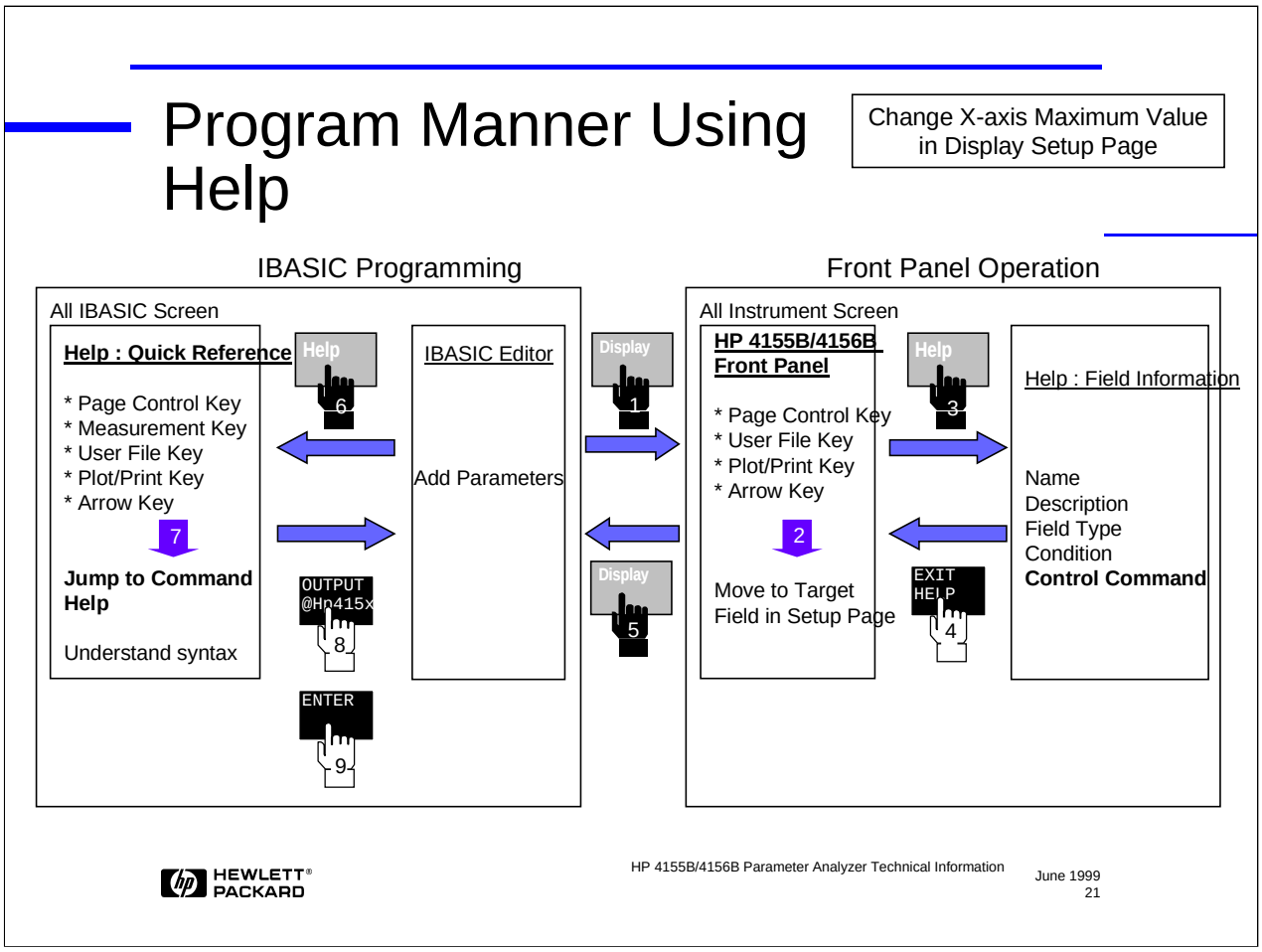
After adding the parameter, press the “Enter” key.

You may specify the stop value without using a variable as follows:

```
50 OUTPUT @Hp415x;":PAGE:MEAS:SWE:VAR1:STOP 3"
```

Note: A space character is needed after the STOP command (and after any other similar command).

The next step is to change the X-axis maximum value in the Display Setup page.



Programming Manner Using Help Function

The next step is to change the X-axis maximum value in the display setup page.

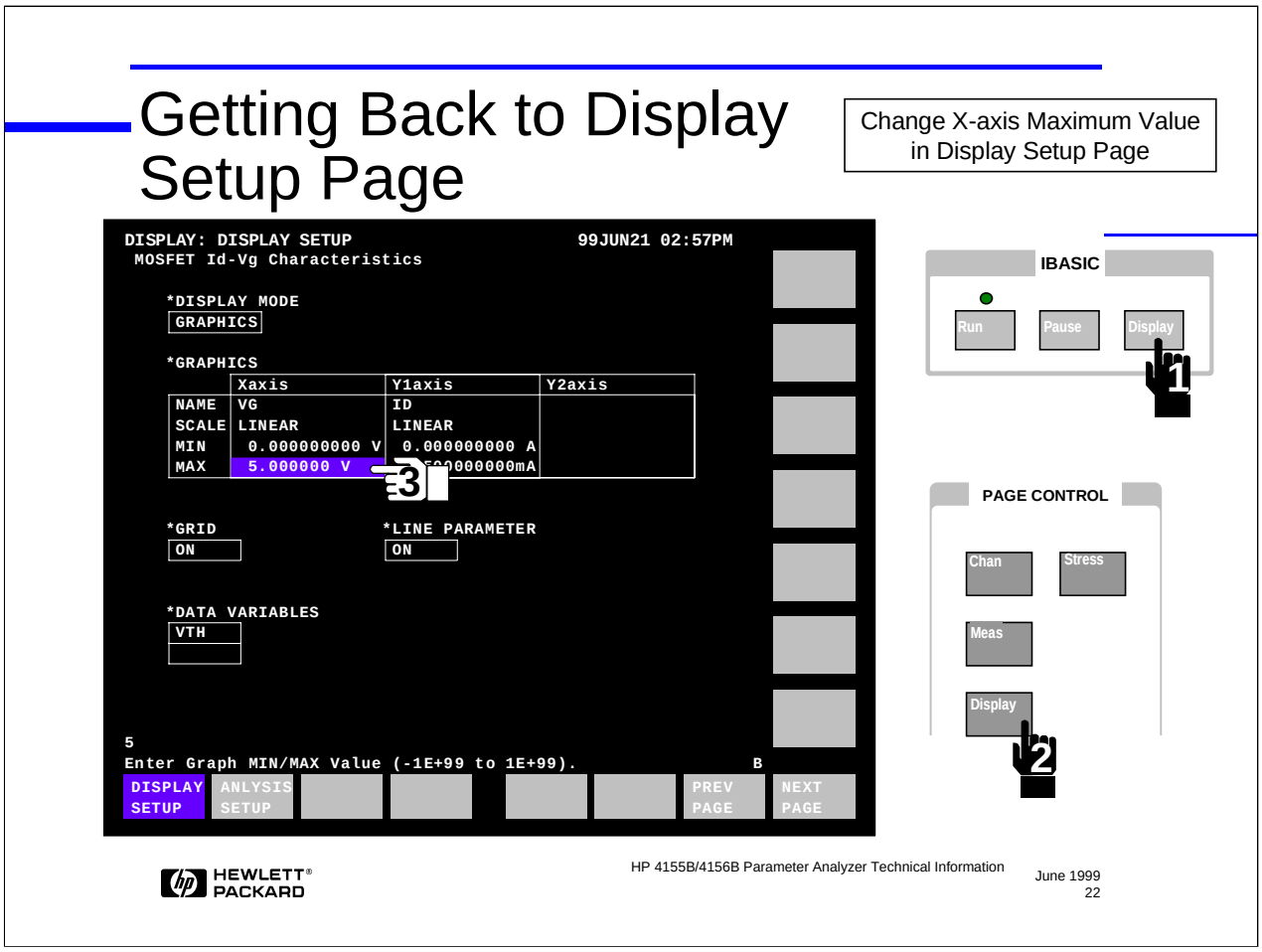
If you can not find a desired Page Image command in the Quick Reference help for IBASIC programming (Left Side of the figure), you can use another help function. It is the help for front panel operation (Right Side). It is called the "Field Information" help.

First, change the All IBASIC screen mode to All Instrument screen mode by pressing the “Display” key. You do not have to exit the editor beforehand. Now you can see the front panel screen.

Open a page and move the field pointer to the field that you want to control.

Press the “Help” key to open the Field Information help. It shows corresponding control command as well as description and other information for the field. This makes it easy to find a single desired command among over 640 commands / keywords. Now you can return to IBASIC programming.

The following several pages show an example of programming in this manner.



Getting Back to the Display Setup Page

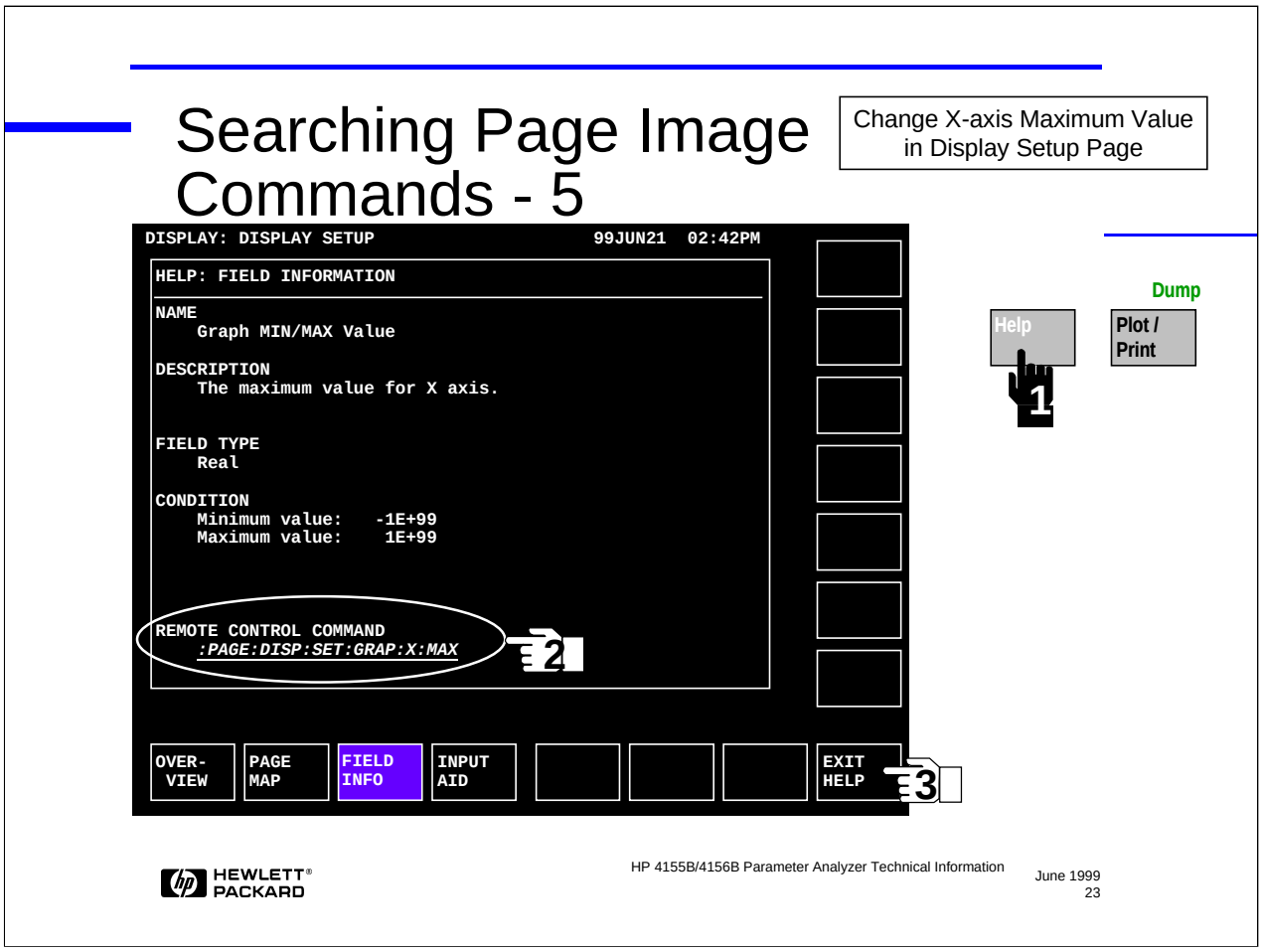
Now we can return to the Display Setup page. You do not have to exit the editor.

1. Press the "Display" key in the IBASIC key group.

2. Press the "Display" key in the PAGE CONTROL key group.

The Display Setup page will be opened.

3. Move the field pointer to the field that you want to control by using a Page Image command. In this example, move to the Maximum field of the the X-axis in the graphics setup.



Searching Page Image Commands

1. Press the "Help" key to open the help screen for field information.

This is the help screen for the field for the maximum value for the X axis. At the bottom of this screen, you can find the Page Image command for this field.

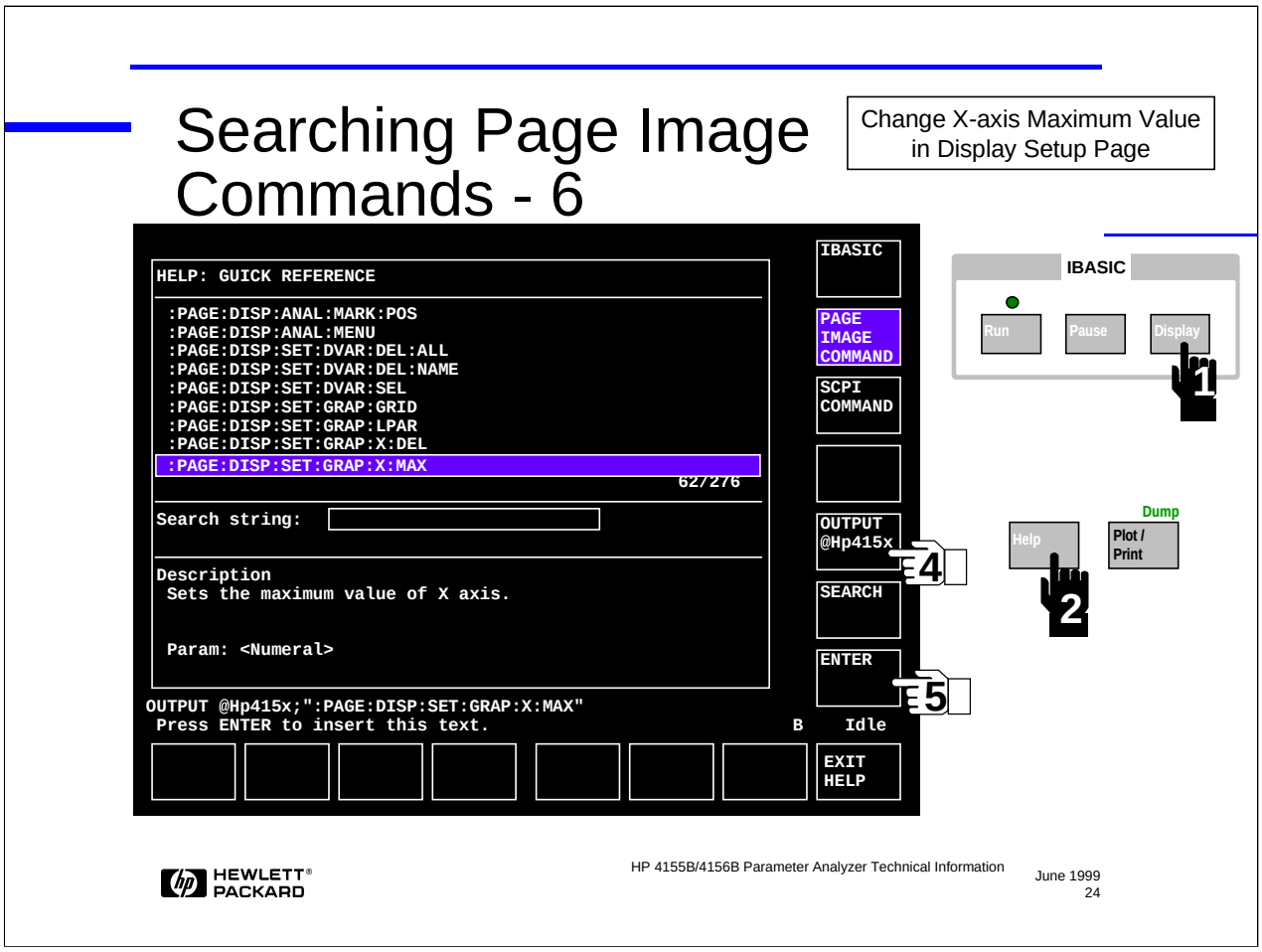
`:PAGE:DISP:SET:GRAP:X:MAX`

2. Make a memorandum of this command.

As for the parameter(s) and example usage, go back to the All IBASIC screen and then refer to the help menu for the Page Image command.

You can find desired page commands in this manner.

3. Exit the help screen.



Searching Page Image Commands

1. Go back to the All IBASIC screen by pressing the "Display" key in the IBASIC key group. You can return to the editor screen.

2. Open the help screen by pressing the "Help" key.

3. Press the "Display" key in the PAGE CONTROL key group twice, and use the arrow key to move the field pointer to the Page Image command that you found in the previous page.

`:PAGE:DISP:SET:GRAP:X:MAX`

Note that the parameter for the command is:

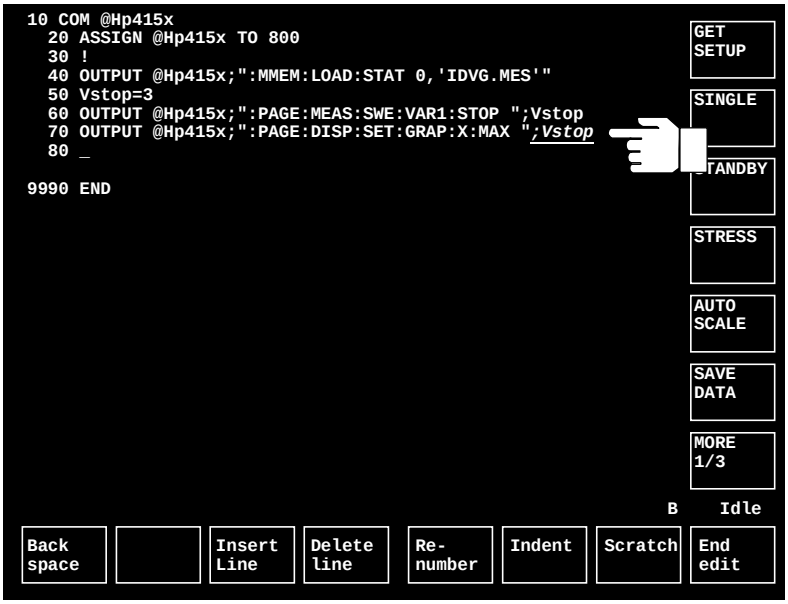
`<Numeral>`

3. Select the "OUTPUT @Hp415x" softkey.

4. Select the "Enter" softkey.

Adding Parameter for X-axis Max Value

Change X-axis Maximum Value in Display Setup Page



Adding Parameter for Command

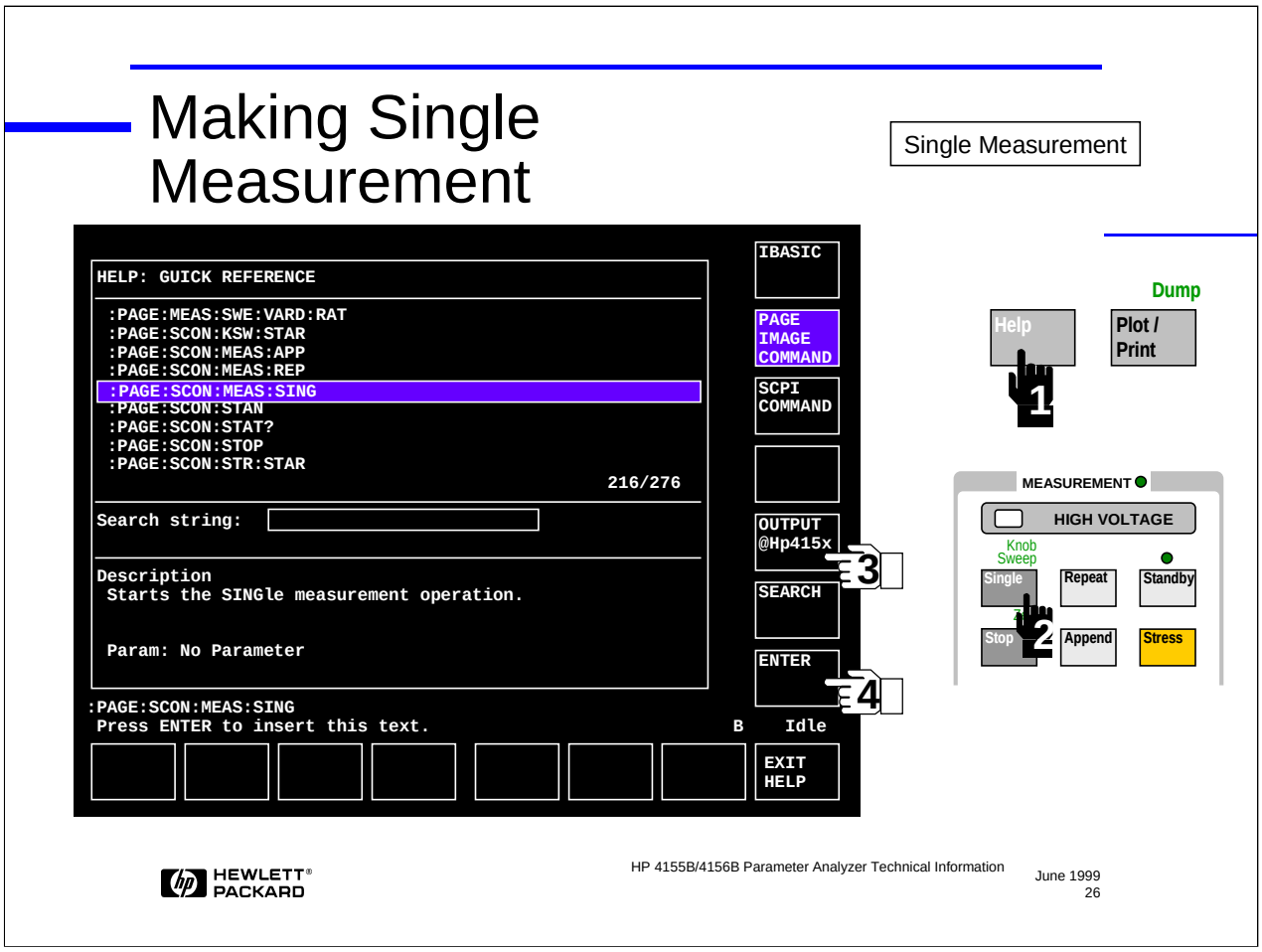
The command to set the X-axis maximum value is copied with the OUTPUT statement to the editing line.

Add a numerical parameter for the command to specify the maximum value for the X-axis in the display setup page.

In this example, the stop voltage value (Vstop) is used as the maximum value for the X-axis.

Please note again that there must be a space character between the command and the parameter.

After adding the parameter, press the “Enter” key.



Making a Single Measurement

The next step is to make a measurement. Search for the command to trigger a single measurement.

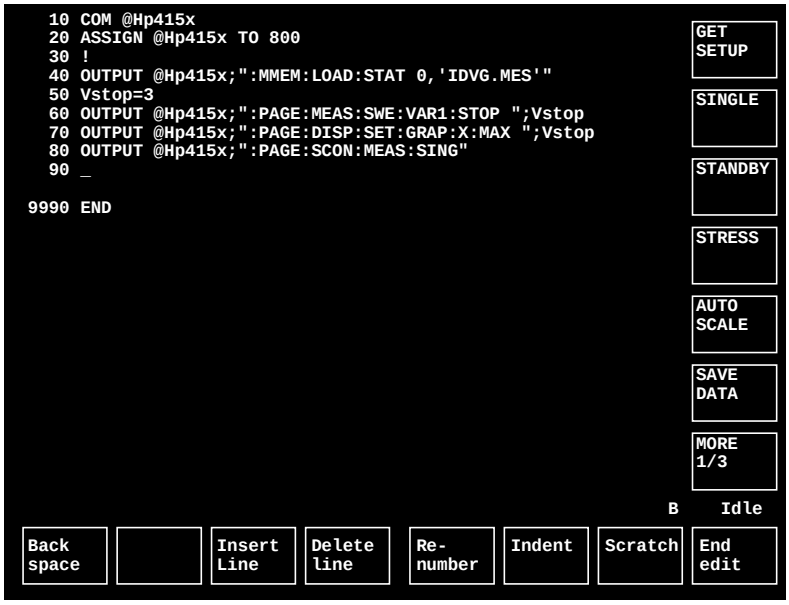
1. Press the "Help" key to open the help screen.
2. Press the "Single" key in the help screen.

The field pointer moves to the corresponding command directly. There is no parameter for this command.

3. Select the "OUTPUT @Hp415x" softkey.
4. Press the "Enter" key.

Editing Program

Single Measurement



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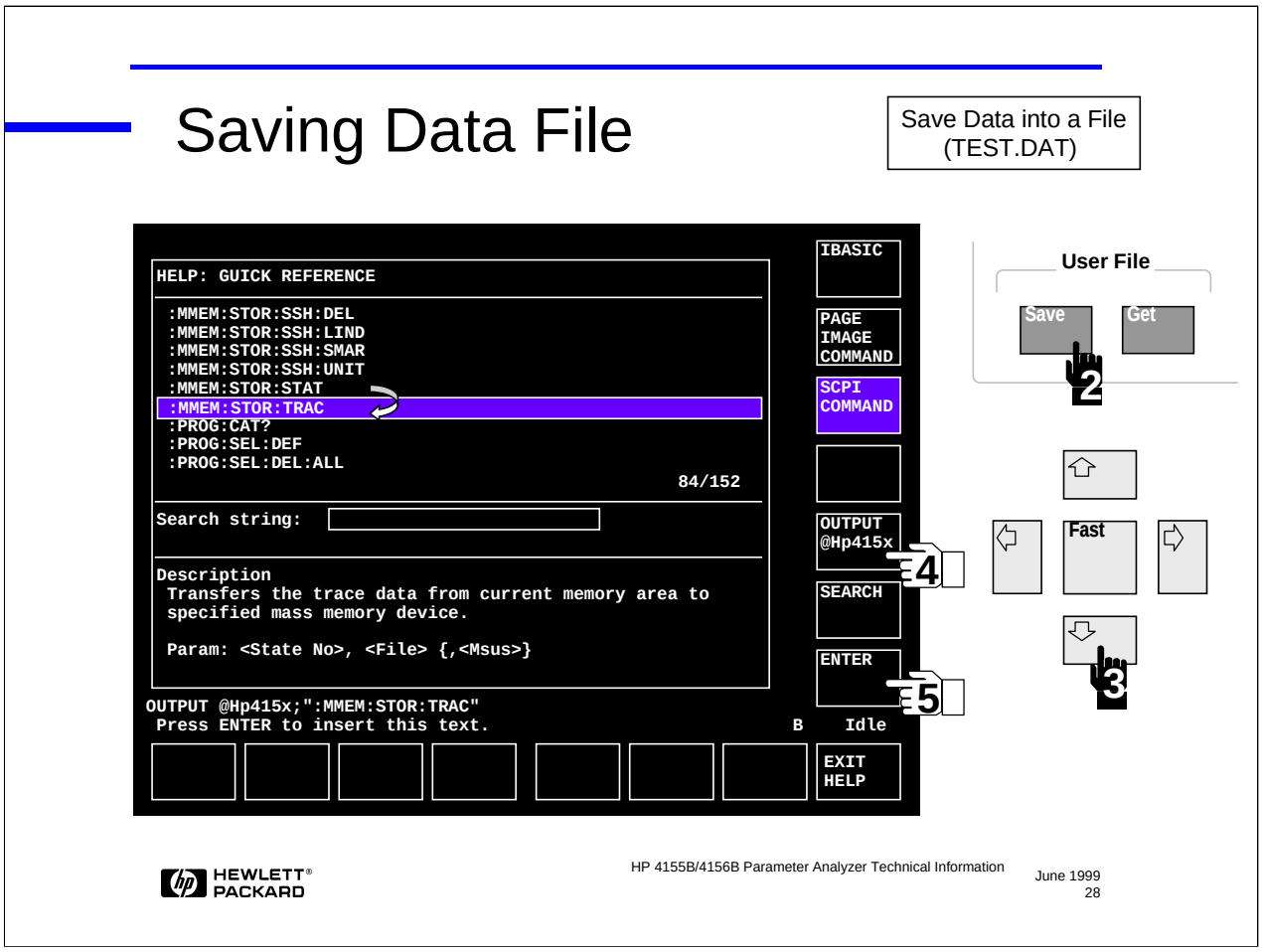
Editing Program

The command to trigger a measurement is copied with the OUTPUT statement to the editing line. Press the “Enter” key to fix the line.



Saving Data File

The next step is to save the data into a file.

1. Press the "Help" key to open the help screen.

2. Press the "Save" key in the User File key group.

3. Use the arrow key to move the field pointer down to the command to save the measured data (trace data).

`:MMEM:STOR:TRAC`

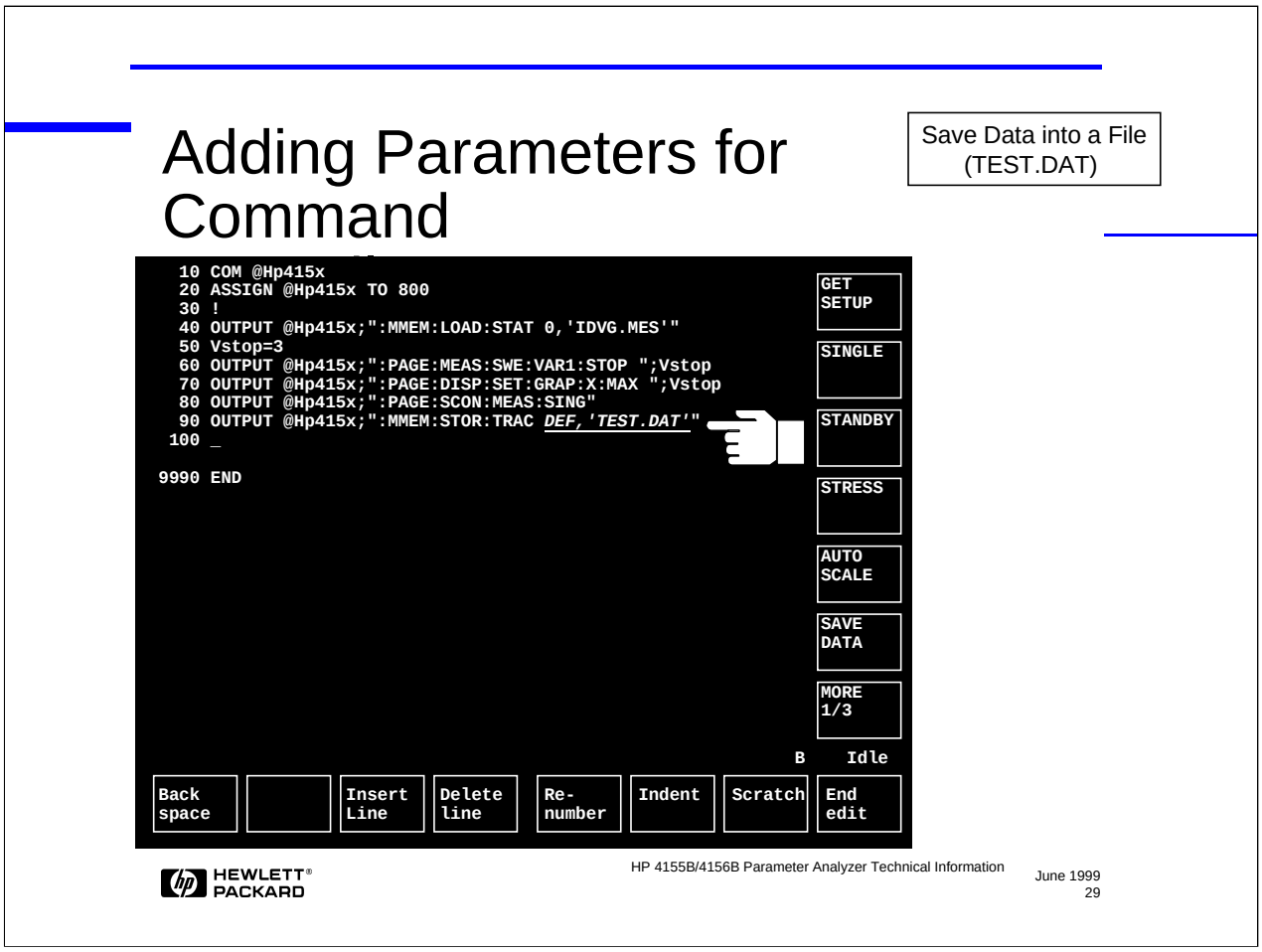
The parameters for this command are:

`<Label>, <File> {,<Msus>}`

Note that there is a similar command whose purpose is to save the measurement setup, stress setup or customize setup file. Do not confuse the two.

4. Select "OUTPUT @Hp415x" softkey.

5. Select "ENTER" softkey.



Adding Parameters for Command

Manually add parameters for the command to save the measurement data (trace data) into a file. The parameters for this command are:

<Label>, <File> {,<Msus>}*

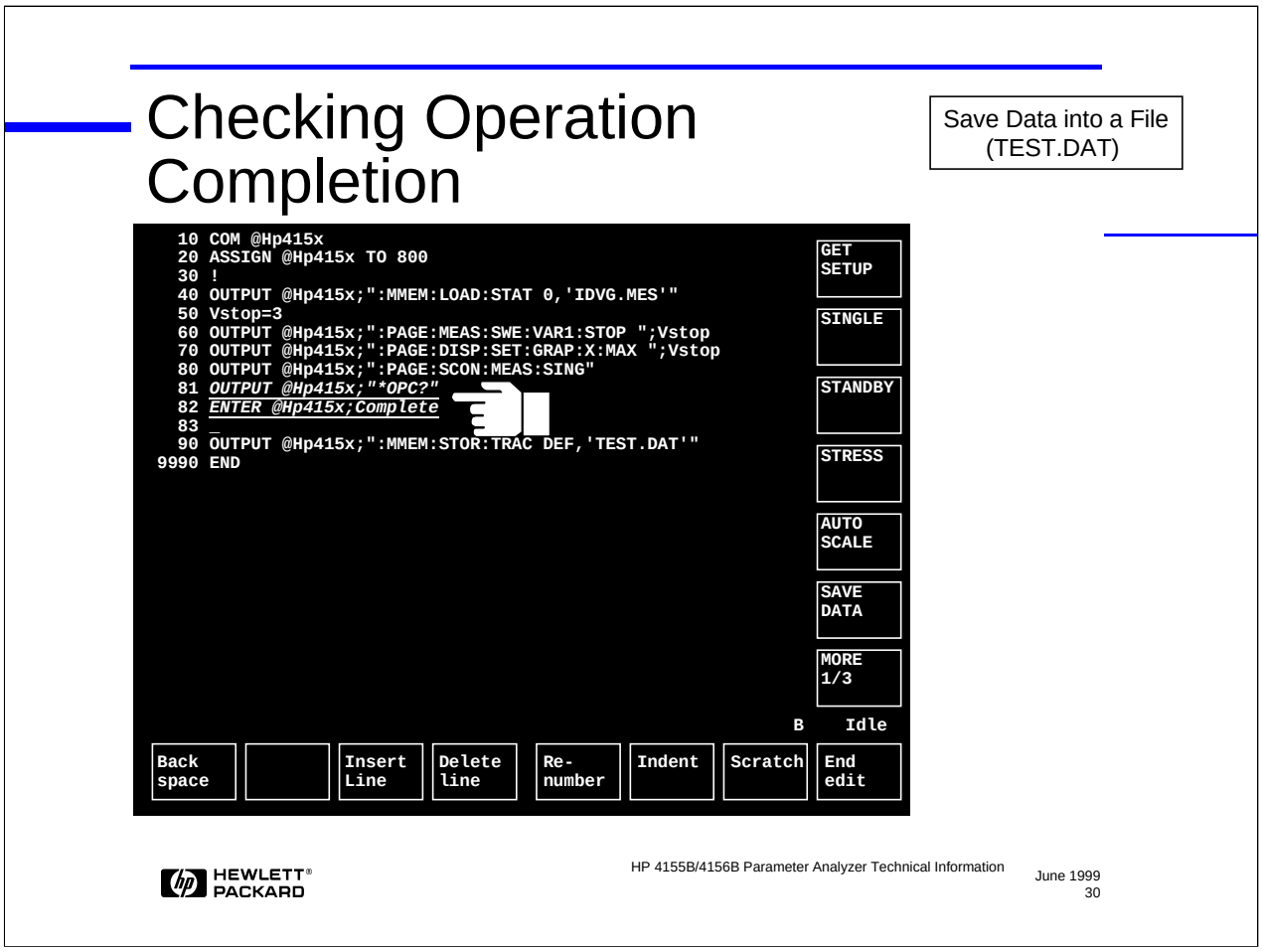
The label for saving trace data is always "DEF" in the HP 4155B/4156B. This should be noted for future use.

The file name is 'TEST.DAT' in this example. Put single quotation marks before and after the file name.

After adding the parameters, press the “Enter” key to fix the editing line.

You do not have to specify a mass storage (Msus) because it is an optional parameter.

* The parameters in { } parenthesis are optional.



Checking Operation Completion

Lines 81 and 82 check operation (single measurement) completion. It is very important to put these lines right after the line that triggers the single measurement. Otherwise, the next command (to save the data) will be sent to the HP 4155B/4156B during the measurement. However, the HP 4155B/4156B will be busy and cannot save the measurement data. In this case an error "145: System busy. Unable to change page when MEAS." will occur.

To avoid this error, insert the lines to check the operation completion.

```
81 OUTPUT @Hp415x;"*OPC?"
82 ENTER @Hp415x;Complete
```

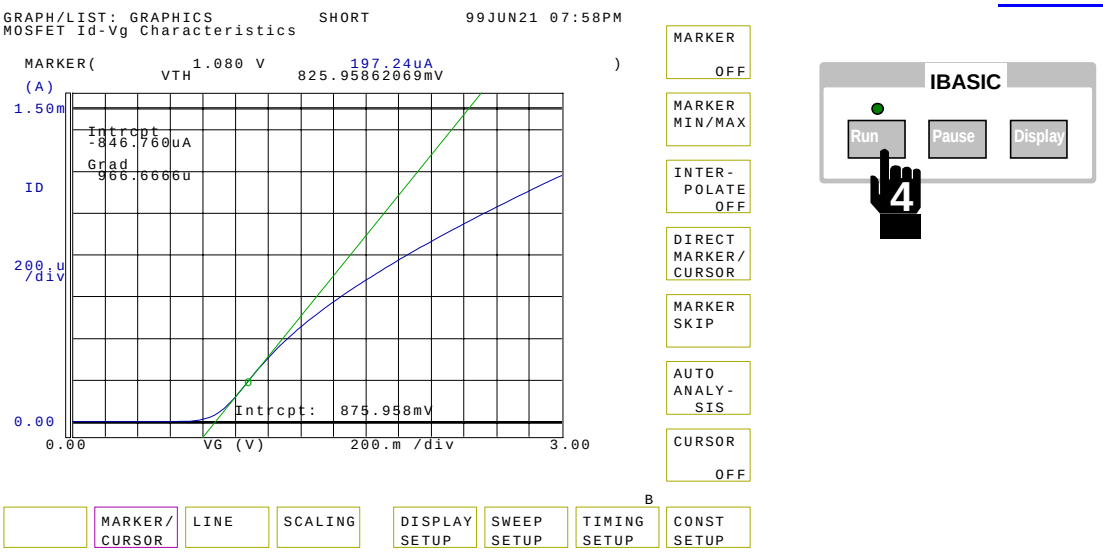
When a single measurement completes, an ASCII character “1” is returned.

Note that these lines should be used with the following commands to avoid error 145:

:PAGE:SCON:XXXX

:HCOP:XXXX

Running Program



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Running Program

Now the program is complete. You can run the program. However, it is recommended to save the program onto a floppy disk first.

1. Select the "End Edit" softkey.
2. Type

   `SAVE "PROG1"`

and press the "Enter" key to save the program as "PROG1".

3. Exit the All IBASIC screen by pressing the "Display" key in the IBASIC key group.

4. Press the "Run" key in the IBASIC key group to start the program.

First, a measurement setup file (IDVG.MES in this example) is loaded and the measurement setup is changed. Next, a single measurement is executed. The figure above shows an example of measurement execution. Finally the measured data is stored into a file (the screen is changed to System: Filer page).

Conclusion: With assistance from the Help function, you can easily and quickly develop test programs!