Agilent 4352B VCO/PLL Signal Analyzer

GPIB Programming Manual

SERIAL NUMBERS

This manual applies directly to instruments with serial number prefix JP2KE.
For additional important information about serial
numbers, read “Serial Number” in Appendix A.

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Notice

The information contained in this document is subject to change without notice.

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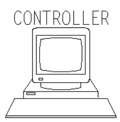
Symbols

General definitions of symbols used on equipment or in manuals:

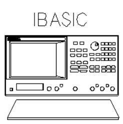
Warning — **Warning** denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

Caution — **Caution** denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result damage to or destruction of part or all of the product.

Note — **Note** denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.



CONTROLLER denotes information for a programmer using an external computer as the system controller.



iBASIC denotes information for a programmer using an analyzer with HP instrument BASIC as the system controller.

Typeface Conventions

Bold	Boldface type is used when a term is defined. For example: **icons** are symbols.
Italics	Italic type is used for emphasis and for titles of manuals and other publications. Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: `copy` *filename* means to type the word `copy`, to type a space, and then to type the name of a file such as `file1`.
`Computer`	Computer font is used for on-screen prompts and messages.
(HARDKEYS)	Labeled keys on the instrument front panel are enclosed in ( ).
SOFTKEYS	Softkeys located to the right of the LCD are enclosed in .

How to Use This Manual

This manual provides an introduction to writing BASIC programs for the 4352B VCO/PLL Signal Analyzer. To reduce the time required for you to learn how to write programs for the analyzer, the examples shown in this guide are supplied on sample disks. You can perform each example sequentially or you can select the examples that apply to your immediate needs and learn those techniques . Use the table of contents and the index to quickly locate these examples. Also, depending upon your experience in writing BASIC programs using GPIB commands, you may want to do one of the following:

1. If you are an experienced programmer and have programmed GPIB systems before, you can scan the examples in this guide to find out how the analyzer can be used in your system. If you have never programmed an instrument similar to the analyzer, you can start at the beginning and do the examples that apply to your application.
2. If you are an experienced programmer, but do not have any knowledge of GPIB commands, review some examples to decide where you need help. See the *GPIB Command Reference* for additional information on GPIB commands.
3. If you are not an experienced programmer and you do not have any knowledge of GPIB commands, see the *GPIB Command Reference* for a list of the documentation that you will need to review before using this guide.
4. Refer to "Documentation Map" on the following page for HP instrument BASIC and the other manuals.

Documentation Map

The following manuals are available for the analyzer:

Function Reference

The Function Reference describes all functions accessed from the front panel keys and softkeys. It also provides information on options and accessories available, specifications, system performance, and conceptual information about the analyzer's features

GPIB Programming Manual

The GPIB Programming Manual describes basic programming methods when remotely controlling the analyzer using the GPIB. It also contains information on the usage of all GPIB commands, the status report mechanism, and the data transfer format.

Manual Supplement for HP instrument BASIC Users Handbook

This supplement describes how HP instrument BASIC works with the analyzer.

HP instrument BASIC Users Handbook

The HP instrument BASIC Users Handbook introduces you to the HP instrument BASIC programming language, provides some helpful hints on getting the most use from it, and provides a general programming reference. It is divided into three books, *HP instrument BASIC Programming Techniques* , *HP instrument BASIC Interface Techniques* , and *HP instrument BASIC Language Reference*.

43521A Operation Manual

This manual provides information on how to use the 43521ADown Converter Unit as well as the features available with it. See also the 4352B Function Reference for how to use the 43521A.

Precautions

Removing Unwanted Components from Signal

The presence of undesired components picked up while the signal passes from the device to the 4352B can result in reduced accuracy in measurement. When connecting a device to the 4352B, take one of the following measures to eliminate these components:

- The 4352B employs the peak detection method to measure RF power. Therefore, the presence of higher harmonics in the signal makes it extremely difficult to correctly measure RF power. If such components may be contained in the signal, insert a low-pass filter into the RF output terminal of the device to eliminate them.
- The output impedance of the DC power and control voltage output terminals at RF can affect output frequency characteristics (particularly, frequency or RF power) of the device. If this is possible, insert a low-pass filter (cutoff frequency between 100 kHz and 1 MHz) into each of the DC power and control voltage output terminals.

How to Avoid Programming Errors When Using PRINT and USING Statements Together

The message "`Numeric image field too small`" may appear if you execute the USING statement included in the PRINT statement. This occurs frequently when an abnormal result is obtained because the target value for the PRINT statement is outside the range specified by the USING statement image.

You can avoid this problem by the following:

- Not using the USING statement,
- Checking the value before executing the PRINT statement and not executing the PRINT statement if this value is outside the range specified with the USING statement image,
- Changing the range specified by the USING statement image so that the value fits within the range, or
- Using the ON ERROR statement to handle errors.

0

Using a Sample Program Disk

A sample program disk is furnished with 4352B. This disk contains the sample programs listed in this manual.

Note If you are going to use HP instrument BASIC, you must first allocate the 4352B's display format to BASIC display by pressing (Display), MORE and HALF INSTR HALF BASIC or ALL BASIC. See the *HP instrument BASIC Users Handbook Supplement* for additional information.

To Check the Files List

The sample programs are saved in ASCII format. To check the files list:

1. Put the program disk into the disk drive and type as follows.

```
CAT
```

2. Press (Return).

```
CAT

FILE NAME  PRO TYPE REC/FILE BYTE/REC   ADDRESS    DATE    TIME

FIG1_3.TXT    ASCII       6      256        34   29-May-96 11:00
FIG2_2.TXT    ASCII       6      256        34   29-May-96 11:00
FIG2_3.TXT    ASCII       6      256        34   29-May-96 11:00
        :
```

Each file name represents the number of the figure shown in this manual. For example, the sample program listed in Figure 4-2 is saved with the file name FIG4_2.TXT.

To Get a Program

To get the program use the `GET` command. For example, to get the sample program `FIG4_2`:

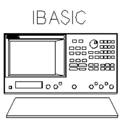
1. Type as follows:

```
GET "FIG4_2.TXT"
```

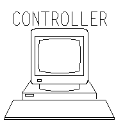
2. Press (Return).

Screen Setup for Sample Program Execution

The statements `INPUT` and `PRINT` used in the sample programs are valid only when the BASIC display is selected. Therefore, you must perform the following setups before you execute a sample program. This will enable you to see the operation of the program and the status of the instrument at the same time.



To use HP instrument BASIC, press (Display), `MORE` and `ALLOCAT'N:HALF INSTR HALF BASIC`.



To use a computer as the system controller, execute the following commands.

```
OUTPUT @4352;"DISA HIHB"
```

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1

Overview of GPIB Remote Control System

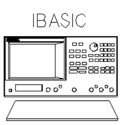
This chapter provides information on how to configure the GPIB remote-control system and the basic use of the GPIB commands. In most of the sample programs shown in this manual, simple GPIB commands are used. For detailed information about each command, see chapters 9 to 11.

What is GPIB?

The General Purpose Interface Bus (GPIB) is used for remote control of the 4352B VCO/PLL Signal Analyzer. GPIB is a standard for interfacing instruments to computers and peripherals. This standard supports worldwide standards IEEE 488.1, IEC-625, IEEE 488.2, and JIS-C1901. The GPIB interface allows the 4352B to be controlled by an external computer. The computer sends commands or instructions to and receives data from the instrument through the GPIB.

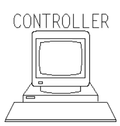
Required Equipment

1. The 4352B and its accessories required to test a specific device under test (DUT).
2. For the GPIB system controller



Using HP instrument BASIC, the 4352B can be used as the system controller.

Or,



An HP 9000 Series 200 or 300 computer or an HP Vectra PC with a measurement co-processor or card (HP 82300 or 82324). The computer must have enough memory to hold BASIC, needed binaries, and at least 64 kilobytes of program space.

BASIC 3.0 or higher operating system and the following binary extensions:

HPIB, GRAPH, IO, KBD, and ERR

A disk drive is required to load BASIC, if no internal disk drive is available. (Depending on the disk drive, a binary such as CS80 may be required.)

3. External Signal Source
4. Peripherals (printer, plotter, and so on) and any GPIB instruments that are required for your application.
5. 10833A/B/C/D GPIB cables to interconnect the computer, the 4352B, and any peripherals.

To Prepare for GPIB Control

1. Connect the 4352B and controller, plus any other instruments and peripherals with GPIB cables.

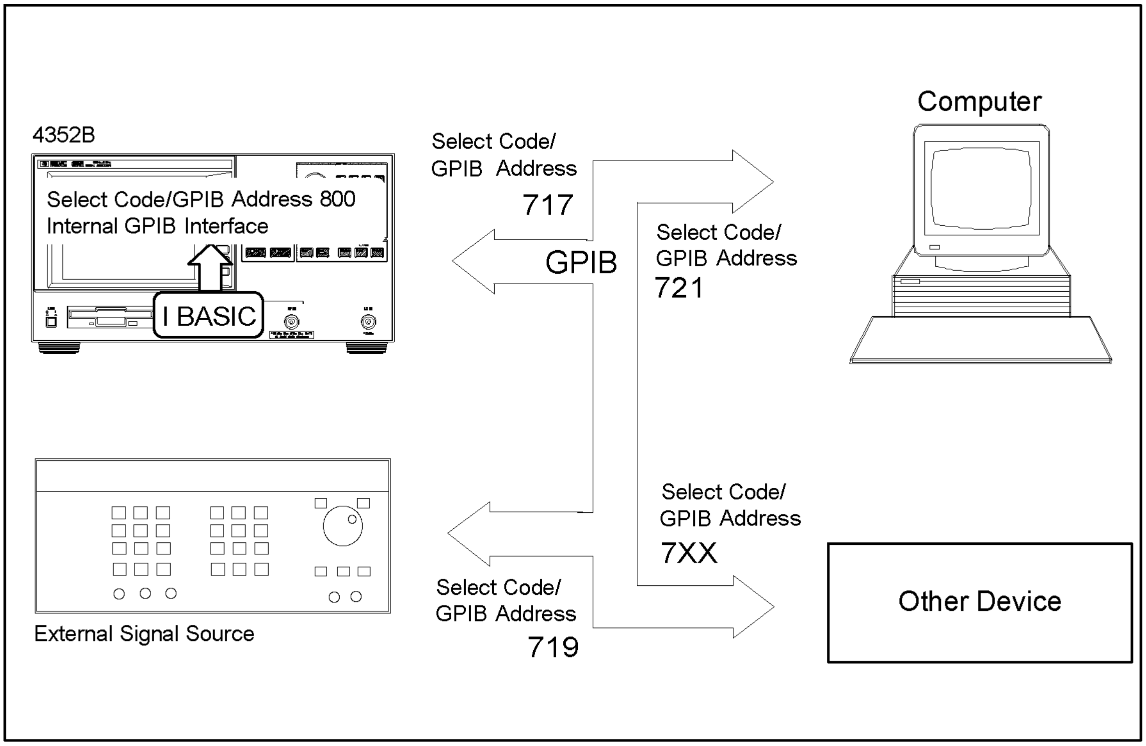
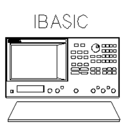


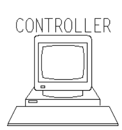
Figure 1-1. System Configuration for GPIB Remote Control

* To set printer or plotter see Chapter 5.

2. Turn on the 4352B.
3. Prepare the system controller.



If you are using only HP instrument BASIC and no external controller, press (Local) SYSTEM CONTROLLER. For details, see *Using HP instrument BASIC with the 4352B*.



If you are using a computer as an external controller,

a. Set the 4352B to addressable only mode.

Press (Local) ADDRESSABLE ONLY.

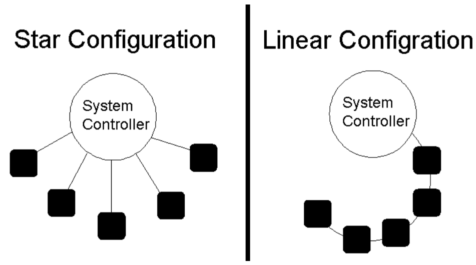
b. Set GPIB address of the 4352B to 17.

Press (Local) SET ADDRESS ADDRESS: 4352 (1) (7) (×1).

c. Turn on the controller. Then load the BASIC operating system and the binary extensions.

How large a system can you configure?

- A maximum of 15 devices can be connected on one bus system.
- The length of cable between one device and another must be less than or equal to four meters. The total length of cable in one bus system must be less than or equal to two meters times the number of devices connected on the bus (the GPIB controller counts as one device). The total length of cable must not exceed 20 meters .
- Star, linear, and combinational cable configurations are allowed. There must be no loop.



- It is recommended that no more than four piggyback connectors be stacked together on one device. Otherwise, the resulting structure could exert enough force on the connector mounting to damage it.

GPIB Commands Introduction

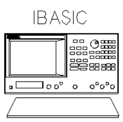
Most of the 4352B's front-panel keys have a corresponding GPIB command. By executing an GPIB command, you can operate the 4352B as if you were pressing the corresponding key.

For example,

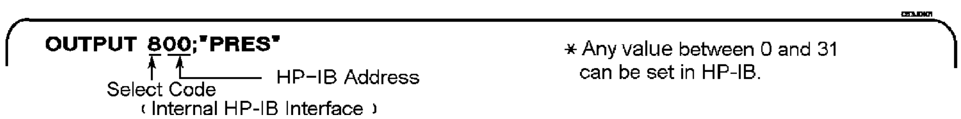
Pressing (Preset) is the same as executing the GPIB command, `PRES`.

To Execute an GPIB Command

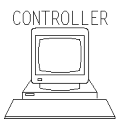
Type the BASIC `OUTPUT` statement, the GPIB select code, the device address, and finally the 4352B's GPIB command. For example, to execute the `PRES` command, type:



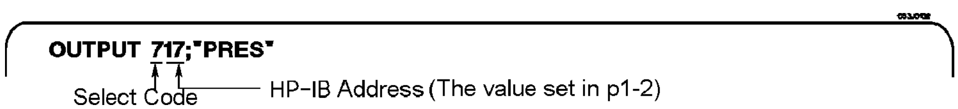
Using HP instrument BASIC



And press (Return). The 4352B goes to the preset state.

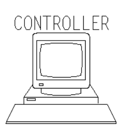


Using an External Controller



And press (Return). The 4352B is set to GPIB remote mode. Then the 4352B goes to the preset state.

What is GPIB remote mode?



Executing an `OUTPUT` statement that is addressed to the 4352B, sets it to the GPIB remote mode. In the remote mode, all the 4352B's front-panel keys are locked out, except (Local). Pressing (Local) puts the 4352B back in local mode. In local mode, all front-panel keys are enabled.

To Program a Basic Measurement

This section describes how to organize the commands into a measurement sequence. Figure 1-2 shows a typical program flow for a measurement.

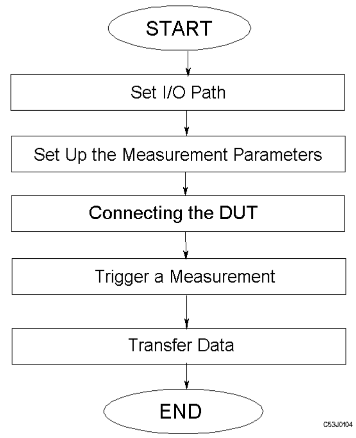
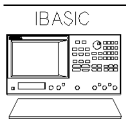


Figure 1-2. Program Flow

The following program performs the measurement flow controlling the 4352B using GPIB.



This manual shows program lists of sample programs for HP instrument BASIC. To use the sample programs on an external controller, change the select code from 8 to 7 and change the GPIB address from 00 to 17 (that is, use 717 instead of 800).

```
100   ! File Name : FIG1_3.TXT
110   !   IBASIC MEASUREMENT SAMPLE PROGRAM
120   !
130   ASSIGN @Hp4352 TO 800 ! IBASIC address
140   !
150   !
160   OUTPUT @Hp4352;"PRES"  ! Preset 4352
170   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
180   OUTPUT @Hp4352;"VT"    ! Select Tester mode
190   !
200   INPUT "DC POWER VOLTAGE (V)",Dc_power
210   INPUT "DC CONTROL VOLTAGE (V)",Dc_ctrl
220   !
230   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
240   OUTPUT @Hp4352;"VCTRL ";Dc_ctrl ! Set DC Control Voltage
250   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
260   OUTPUT @Hp4352;"MEAS POWE" ! Select Power Level Measurement
270   !
280   DISP "CONNECT DEVICE and PRESS CONTINUE."
290   PAUSE
300   DISP
310   !
320   EXECUTE "SING"            ! Measure Power Level
330   Power_data=READIO(8,0)
340   !
350   PRINT "POWER ";Power_data;" (dBm)"
360   !
370   END
```

Figure 1-3. Sample Program: Basic Measurement

Set I/O Path

```
130   ASSIGN @Hp4352 TO 800 ! IBASIC address
```

When an external controller is used, change “800” to “717”.

Set Up the Measurement Parameters

```
160   OUTPUT @Hp4352;"PRES"  ! Preset 4352
170   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
180   OUTPUT @Hp4352;"VT"    ! Select Tester mode
190   !
200   INPUT "DC POWER VOLTAGE (V)",Dc_power
210   INPUT "DC CONTROL VOLTAGE (V)",Dc_ctrl
220   !
230   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
240   OUTPUT @Hp4352;"VCTRL ";Dc_ctrl ! Set DC Control Voltage
250   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
260   OUTPUT @Hp4352;"MEAS POWE" ! Select Power Level Measurement
```

You can execute GPIB commands in the same sequence as key operation. Line 180, for example, works in the same manner as the key operations (Meas) INST TYPE and INST TYPE: VCO TESTER. Also, line 260 works in the same manner as the key operations (Meas) RF POWER.

Generally, the procedure to setup measurement conditions using the instrument is identical to that of the front panel key operations. In lines 230 and 240 (setups of DC power voltage and DC control voltage), you need to specify parameters for GPIB commands. See “To Execute an GPIB Command with a Parameter” for the parameters of the GPIB commands. This is the end of setup. Now you can measure the device.

Connecting a Device

```
280   DISP "CONNECT DEVICE and PRESS CONTINUE."
```

Line 280 prompts the operator to connect a device.

Trigger a Measurement

```
320   EXECUTE "SING"              Single Trigger
```

Line 320 executes a single trigger. See Chapter 2 for the details of trigger control.

Transfer Data

```
330   Power_data=READIO(8,0)
```

The measurement data is transferred to IBASIC. For details about data transfer, see Chapter 4 and the 4352B VCO/PLL Signal Analyzer Manual Supplement for HP instrument BASIC Users Handbook.

Note If you are going to run the program on an external controller, you must make some modifications. See the program described in Chapter 4.

To Execute an GPIB Command with a Parameter

Some GPIB commands require a numeric parameter. For example:

`OUTPUT @Hp4352;"VPOW 4.0"` *Set DC power voltage to* **4 [V]**.

(The space between the command and the numeric parameter is mandatory.) In lines 200 to 240, you enter the parameters and execute the GPIB commands every time you run the program.

```
200   INPUT "DC POWER VOLTAGE (V)",Dc_power
210   INPUT "DC CONTROL VOLTAGE (V)",Dc_ctrl
220   !
230   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
240   OUTPUT @Hp4352;"VCTRL ";Dc_ctrl ! Set DC Control Voltage
```

To set the DC power voltage to 4.0 [V] and the DC control voltage to 2.5 [V], enter each number as follows after each message is displayed.

```
DC POWER VOLTAGE (V)
4 [x1]
DC CONTROL VOLTAGE (V)
2.5 [x1]
```

Query Commands

Most GPIB commands that are used with a numeric parameter can also be used as a query command. For example, when the `VPOW` command is combined with a `?`, it is used as a query command as follows,

```
10 OUTPUT @Hp4352;"VPOW?"
20 ENTER @Hp4352;A
30 PRINT A
```

If you execute the `VPOW?` command, the instrument returns the current DC power voltage. The result of this program will be as follows.

```
4.0
```

Using a Query command enables you to match the program variables with the 4352B's current setup values.

2

Triggering 4352B

This chapter describes how to control the trigger system of the 4352B.

Note

Frequency Transient Measurements can be also triggered using the value trigger function available with the 4352B. See *Value Trigger Function* in Chapter 12 for details.

To trigger a measurement from a controller, the following steps are commonly used:

- Set the trigger source to:

  GPIB, or Free Run (Internal)

  (Because neither External or Manual is valid for triggering from the controller, these sources are not mentioned in this manual.)
- Set the trigger mode to:

  (Hold), Single or Continuous
- Generate the trigger event and the 4352B starts a measurement.

The 4352B trigger system has three states: Idle, Waiting for Trigger, and Measurement.

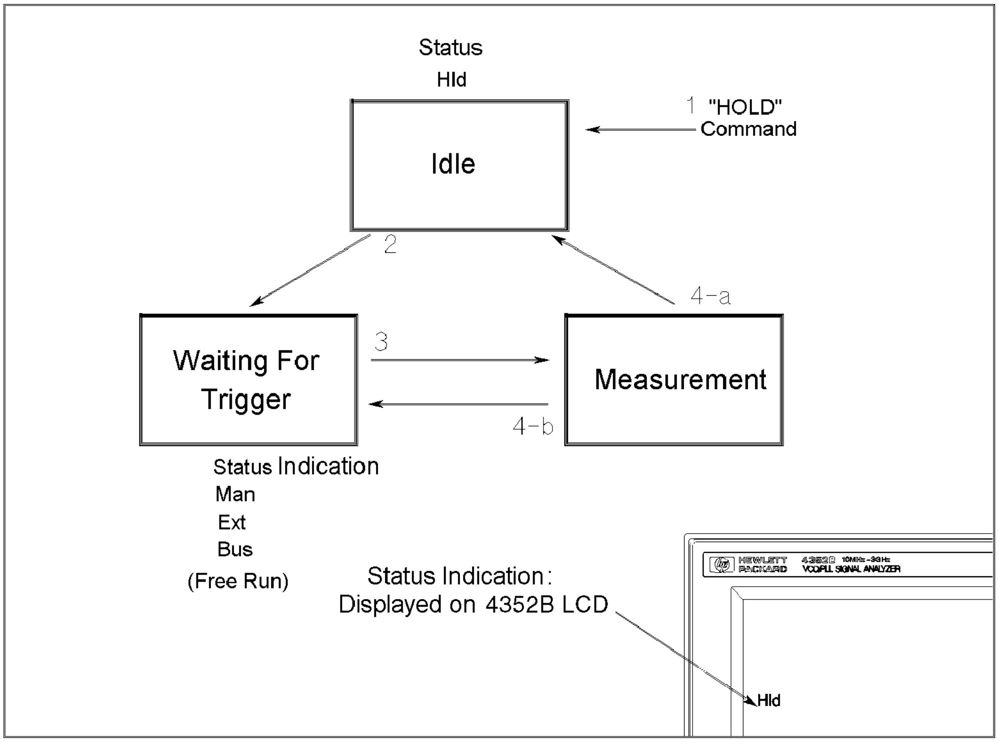


Figure 2-1. Trigger System

In Figure 2-1,

1. After a `HOLD` GPIB command execution, the 4352B returns to the "Idle" state.
2. By selecting the trigger mode with a `SING` or `CONT` GPIB command, the 4352B changes from the "Idle" state to the "Waiting for Trigger" state.
3. At the "Waiting for Trigger" state, a trigger input (corresponding to the trigger source) starts a measurement.

GPIB	`*TRG` command triggers measurements.
Free Run (Internal)	There is no need for a trigger input. The 4352B starts the measurements immediately after a `SING` or `CONT` command is executed.

4. After the measurement is completed, the next state depends on the trigger mode.

Single (`SING`)	Goes to the "Idle" state(4-a).
Continuous (`CONT`)	Goes to the "Waiting for Trigger" state(4-b).

To Measure Continuously

```
100   ! File Name : FIG2_2.TXT
110   !   To Trigger Measurement Continuously
120   !
130   ASSIGN @Hp4352 TO 717  ! When IBASIC is used, change "717" to "800"
140   OUTPUT @Hp4352;"TRGS INT"
150   OUTPUT @Hp4352;"CONT"
160   END
```

Figure 2-2. Sample Program: To Trigger Measurements Continuously

Set Trigger Source

```
140   OUTPUT @Hp4352;"TRGS INT"
```

Set the trigger source to Internal.

Start Continuous Measurement Sweep

```
150   OUTPUT @Hp4352;"CONT"
```

The 4352B changes to the "Waiting for Trigger" state. In this program, the internal trigger source is selected so that the 4352B immediately starts continuous measurements.

What can you do to abort a measurement?

Send the command:

```
OUTPUT @Hp4352;"HOLD"
```

Single measurement

For a single measurement, use one of the following commands:

```
OUTPUT @Hp4352;"SING"
or
EXECUTE "SING"
```

(for **IBASIC** *only)*

To Trigger a Measurement From the Controller

Two methods of triggering a measurement from the controller are shown in Figure 2-3 and Figure 2-4.

```
100   ! File Name : FIG2_3.TXT
110   !   To Trigger Measurement From Controller(1)
120   !
130   ASSIGN @Hp4352 TO 717  ! When IBASIC is used, change "717" to "800"
140   OUTPUT @Hp4352;"TRGS INT"
150   OUTPUT @Hp4352;"SING"
160   END
```

Figure 2-3. Sample Program: To Trigger a Measurement From the Controller (1)

Set Trigger Source

```
140   OUTPUT @Hp4352;"TRGS INT"
```

Set the trigger source to Internal.

Trigger a Measurement

```
150   OUTPUT @Hp4352;"SING"
```

The 4352B changes to the "Waiting for Trigger" state. In this program, the internal source is selected so that the 4352B immediately starts a measurement. After the measurement, the 4352B goes to the "Idle" state.

How can you wait for a measurement to be completed? When you want to return the measurement data to the controller, you must wait for the measurement to be completed. For details, see Chapter 3.

```
100   ! File Name : FIG2_4.TXT
110   !   To Trigger Measurement From Controller(2)
120   !
130   ASSIGN @Hp4352 TO 717  ! When IBASIC is used, change "717" to "800"
140   OUTPUT @Hp4352;"TRGS BUS"
150   OUTPUT @Hp4352;"CONT"
160   OUTPUT @Hp4352;"*OPC?"
170   ENTER @Hp4352;Opc
180   OUTPUT @Hp4352;"*TRG"
190   END
```

Figure 2-4. Sample Program: To Trigger a Measurement From the Controller (2)

Set Trigger Source

```
140   OUTPUT @Hp4352;"TRGS BUS"
```

Set the trigger source to GPIB.

Trigger a Measurement

```
180   OUTPUT @Hp4352;"*TRG"
```

Triggers the 4352B.

Using an External Trigger

```
100 ! File Name : FIG2_5.TXT
110 !   To Trigger Measurement with External Trigger
120 !
130 ASSIGN @Hp4352 TO 717 ! When IBASIC is used, change "717" to "800"
140 OUTPUT @Hp4352;"TRGS EXT"
150 OUTPUT @Hp4352;"TRGP POS"
160 OUTPUT @Hp4352;"CONT"
170 !
180 END
```

Figure 2-5. Sample program: Using an External Trigger

Selecting Trigger Source

```
140 OUTPUT @Hp4352;"TRGS EXT"
```

Selects the external trigger source.

Measurement Trigger

```
160 OUTPUT @Hp4352;"CONT"
```

Allows the 4352B to assume the trigger wait state. Because the external trigger source is selected in this program, continuous measurement starts upon input of a pulse to the external trigger input terminal. You can use an external device such as controller or foot switch as a trigger source.

3

Synchronizing the Controller with 4352B

You can control the 4352B from an external controller to read measurement data and communicate with a handler via GPIB. To do this, it is necessary to synchronize the controller and the 4352B.
For example, The program on the controller must wait until after the measurement ends to transfer measurement data. Also, when it controls the handler via the 4352B, it must wait until the communication with the handler is completed before performing the next measurement.

The following two techniques are available to synchronize the controller and the 4352B:

- Use the `*OPC?` command.

  You can verify the execution completion of the preceding commands by using this command.

- Generate SRQ with the 4352B's status report function.

  The 4352B has a status reporting system to report the status of instrument. The status byte consists of an 8-bit register where each bit represents a specific status condition of the 4352B. For details about the status byte register bit assignment, see Chapter 8 in this manual.

What is an SRQ? An SRQ (Service Request) is an interrupt from the 4352B to the controller. It is generated when a bit of the status byte is set to 1 to report the occurrence of a specific event. Therefore the 4352B can be synchronized with the controller when a specific event, such as sweep end, occurs.

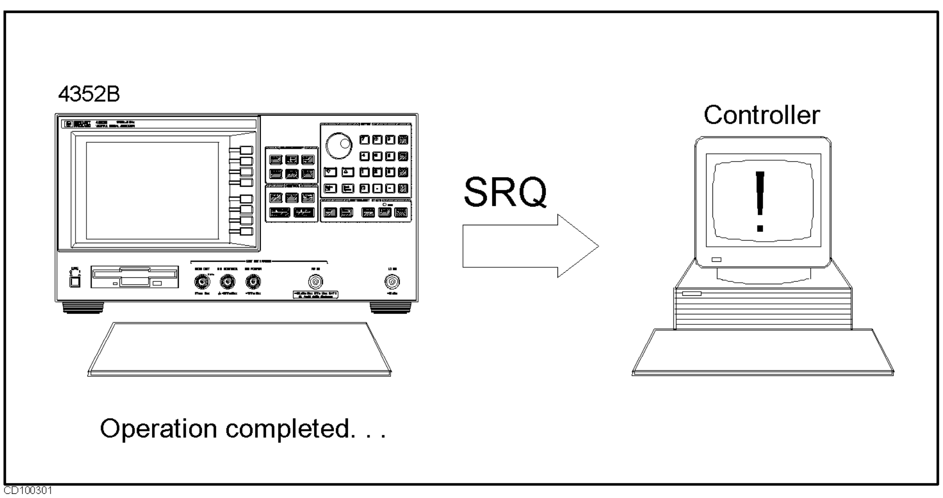


Figure 3-1. SRQ Generation

To Wait For the Preceding Operation to Complete

```
100   ! File Name : FIG3_2.TXT
110   !   To Wait for the Preceding Operation Complete
120   !
130   ASSIGN @Hp4352 TO 800    ! IBASIC address
140   !
150   !  OUTPUT statement to send GPIB command
160   !
170   OUTPUT @Hp4352;"*OPC?"   ! Wait until Operation Completed
180   ENTER @Hp4352;A
190   !
200   !  Next operation
210   !
220   END
```

Figure 3-2. Sample Program: To Wait for the Preceding Operation to Complete

Let Controller Wait For Operation to Complete (OPC)

```
170   OUTPUT @Hp4352;"*OPC?"   !  Wait until Operation Completed
180   ENTER @Hp4352;A
```

In line 180, the controller waits for the next execution until the operations preceding the `*OPC?` command are completed, and then returns `1`.

You cannot use `*OPC?` for the functions listed under SRQ (at the beginning of the chapter) such as synchronizing the program and measurement end. Use the status byte for this purpose.

Waiting for Measurement Completion When Triggering a Measurement From the External Controller

The following program assumes the trigger is being held.

```
100   ! File Name : FIG3_3.TXT
110   !   To Wait for Sweep End Using External Controller
120   !
130   ASSIGN @Hp4352 TO 717     ! 4352 Address
140   CLEAR @Hp4352
150   OUTPUT @Hp4352;"TRGS INT" ! Set trigger to internal
160   OUTPUT @Hp4352;"CLES"     ! Clear Status Registers
170   OUTPUT @Hp4352;"*SRE 4;ESNB 1"
180   OUTPUT @Hp4352;"*OPC?"    ! Wait until operation completed
190   ENTER @Hp4352;Opc
200   !
210   ON INTR 7 GOTO Sweep_end
220   ENABLE INTR 7;2
230   !
240   OUTPUT @Hp4352;"SING"
250 Measuring:GOTO Measuring   ! Wait for interrupt of Sweep End
260 Sweep_end:   !
270   !
280   DISP "MEASUREMENT COMPLETE"
290   END
```

Figure 3-3.
Sample Program:
Wait for Measurement Completion When Triggering a Measurement From the External Controller

Enabling the Measurement Completion Bit

```
160   OUTPUT @Hp4352;"CLES"     ! Clear Status Registers
170   OUTPUT @Hp4352;"*SRE 4;ESNB 1"
```

Line 160 clears all bits of the Status Registers and the Enable Registers. In line 170, the command *SRE 4 sets the Service Request Enable Register to 00000100 (this enables bit 2 of the Status Byte Register). The command ESNB 1 sets the Event Status Enable Register B to 0000000000000001 (this enables bit 0 of the Event Status Register B. See Figure 3-4).

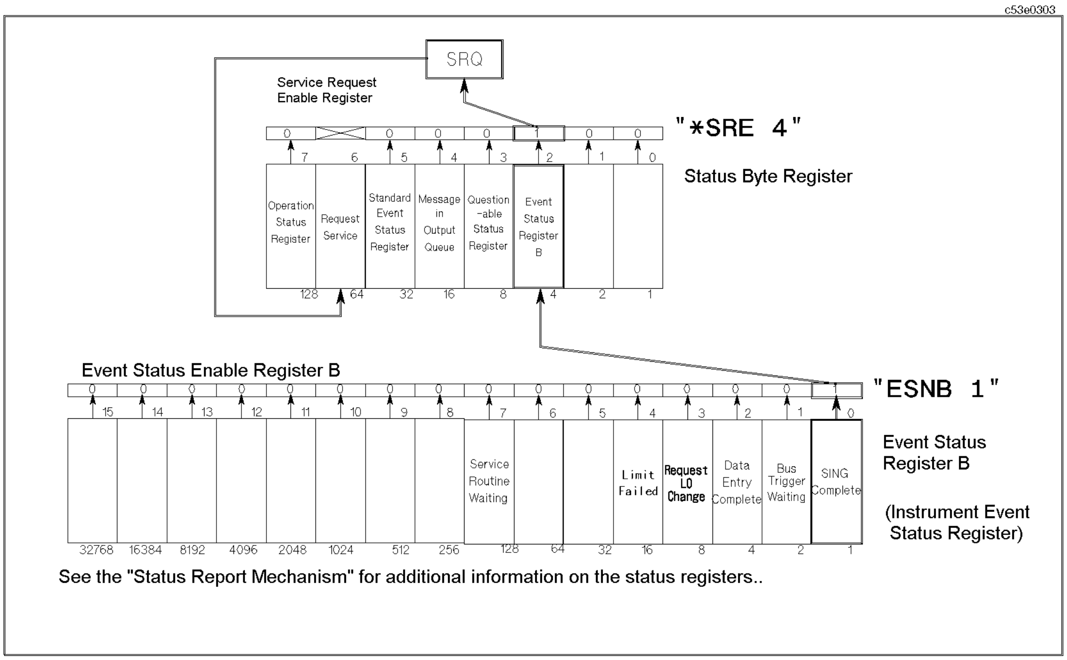


Figure 3-4. Setting the Trigger Completion Bit

The enable register is used to specify an event that will generate an SRQ. The measurement completion is reported as follows: Line 170 sets bit 2 of the Service Request Enable Register(SRE) and bit 0 of the Event Status Enable Register B (ESNB), respectively, to 1. When the single trigger measurement is completed, a corresponding event (bit 0 of the Event Status Register B) is generated. Because bit 0 of the ESNB has already been set to 1, the summary bit of the Event Status Register B, which is bit 2 of the Status Byte Register is be set to 1. At this time, bit 2 of the Service Request Enable Register (SRE) has also been set to 1, and an SRQ is generated. When an SRQ is generated, bit 6 of the Status Byte Register is also set to 1 (see Chapter 8 for additional information).

Enable SRQ Interrupt

```
210   ON INTR 7 GOTO Sweep_end
220   ENABLE INTR 7;2
 :
260 Sweep_end:
```

Line 210 defines a branch. When the SRQ interrupt is generated from the GPIB interface (whose select code is 7), the controller goes to the label `Sweep_end` (Line 260).

Line 220 enables an interrupt from interface 7 (GPIB) when bit 1 (SRQ bit) of the interrupt register of the controller is set by a value of 2.

Wait Until Measurement Is Done

```
250 Measuring:GOTO Measuring   ! Wait for interrupt of Sweep End
```

The controller continues to loop on this line until an SRQ interrupt is generated.

Generate SRQ

On a single trigger end, bit 0 of the Event Status Register B is set to 1, and because bit 2 of the Status Byte Register is also set to 1, an SRQ is generated.

```
250 Measuring:GOTO Measuring       Loop until SRQ interrupt
260 Sweep_end:   !                 At SRQ interrupt, jump to here
```

Once an SRQ is generated, the SRQ interrupt is disabled.

To Report Command Error Occurrence

```
100   ! File Name : FIG3_5.TXT
110   !   To Report Command Error Occurrence
120   !
130   ASSIGN @Hp4352 TO 800  ! IBASIC address
140   !
150   DIM Err$[30]
160   OUTPUT @Hp4352;"CLES"       ! Clear status registers
170   OUTPUT @Hp4352;"*SRE 32 ;*ESE 32"
180   ON INTR 8 GOSUB Err_report  ! When Computer is used, change "8" to "7"
190   ENABLE INTR 8;2             ! When Computer is used, change "8" to "7"
200   !
210   !  OUTPUT statement to send GPIB command
220   !
230   !
240   !
250   GOTO Prog_end
260 Err_report:    !
270   OUTPUT @Hp4352;"OUTPERRO?"   ! Get error message
280   ENTER @Hp4352;Err,Err$       ! Save error NO. and message
290   PRINT "COMMAND ERROR DETECTED"
300   PRINT Err,Err$               ! Print error NO. and message
310     !
320   A=SPOLL(@Hp4352)
330   OUTPUT @Hp4352;"*ESR?"       ! Read status register
340   ENTER @Hp4352;Estat
350   ENABLE INTR 8      ! When Computer is used, change "8" to "7"
360   RETURN
370 Prog_end:   !
380   END
```

Figure 3-5. Sample Program: To Report Command Error Occurrence

For details on SRQ interrupt, see the "Waiting for Measurement Completion When Triggering a Measurement From the External Controller" example.

Enable Error Bit

```
160   OUTPUT @Hp4352;"CLES"        ! Clear status registers
170   OUTPUT @Hp4352;"*SRE 32 ;*ESE 32"
```

Line 160 clears all bits of the Status Registers and Enable Registers.
In line 170, the *SRE 32 command sets the Service Request Enable Register to 00100000 (this enables bit 5 of the Status Byte Register). The *ESE 32 command sets the Event Status Enable Register to 00100000 (this enables bit 5 of the Standard Event Status Register) (see Figure 3-6).

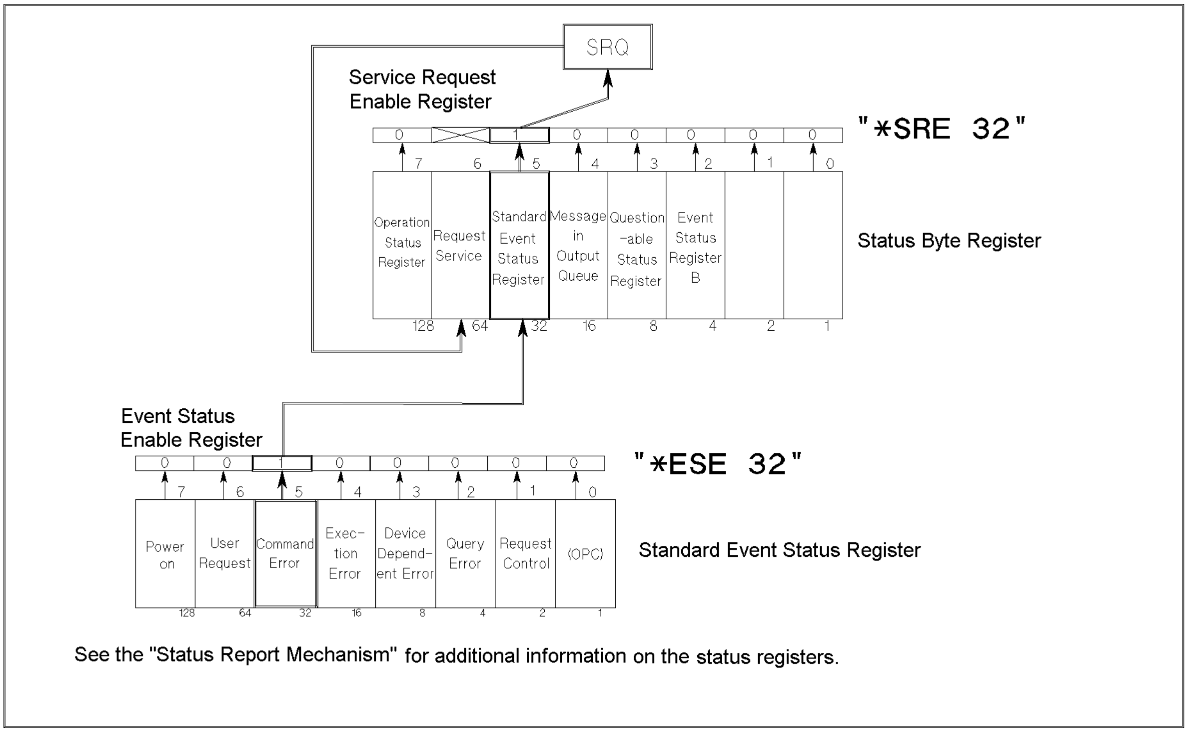


Figure 3-6. Command-Error Bit Enabling

Report Command Error

`180 ON INTR 8 GOSUB Err_report`	*If you are to use an external controller, replace* 8 *with* 7.
`190 ENABLE INTR 8;2`	*The same as the above*
`200 !`	
`210 !`	*Send an GPIB command*
`220 !`	OUTPUT *statement*
`230 !`	
`240 !`	
`250 GOTO Prog_end`	
`260 Err_report: !`	

If an GPIB command error is caused by GPIB commands between lines 190 and 250, the 4352B generates an SRQ and the controller branches to `Err_report`. How to report the error is described below with an example showing what happens when a wrong command in line 210 is executed. When executing this command, the controller branches to `Err_report`. The error number and description can be listed by issuing the commands described in “Output Error”.

`210 OUTPUT @Hp4352;"VPOW "`	*Execute a command to set the DC power voltage with no parameter.*

Output Error

```
270    OUTPUT @Hp4352;"OUTPERRO?"    ! Get error message
280    ENTER @Hp4352;Err,Err$        ! Save error NO. and message
290    PRINT "COMMAND ERROR DETECTED"
300    PRINT Err,Err$                ! Print error NO. and message
```

You can retrieve the error number and description by executing these commands.

The error caused by the wrong command is displayed as follows:

```
COMMAND ERROR DETECTED
-109   "Missing parameter"
```

Return to Execute GPIB command

```
320      A=SPOLL(@Hp4352)
330      OUTPUT @Hp4352;"*ESR?"
340      ENTER @Hp4352;Estat
350      ENABLE INTR 8     ! When the controller is used, replace "8" with "7"
360    RETURN
```

Lines 320 to 360 clear the SRQ before returning to the main routine.

Line 320 reads the 4352B's status byte. The `A=SPOLL(@Hp4352)` statement reads the Status Byte Register of the GPIB address assigned to `@Hp4352` (4352B), and enters the value into variable `A`. If a command error occurs, an SRQ is generated and bit 5 and bit 6 of the Status Byte Register are set to 1 (as a result, the value of the variable `A` is 96). After reading the Status Byte Register with the the `SPOLL` command, SRQ (bit 6 of the Status Byte Register) is cleared.

In line 330 and line 340 the command `*ESR?` reads the value of the Standard Event Status Register. When bit 5 of Standard Event Status Register is set to 1, the value of `Estat` is 32. After reading the Standard Event Status Register with the `*ESR?` command, this register is cleared.

A branch to `Err_report` disables the interrupt. Therefore, SRQ interrupt has to be re-enabled before returning from `Err_report`.

Note See Chapter 8 for other SRQs.

4

Loading Measurement Data into Controller

This chapter describes how to load measurement data into an external controller through GPIB. This chapter covers the following:

- Loading measurement data in tester mode (when the external signal source automatic control function is not used)
  - □ Transferring data in ASCII format
  - □ Transferring data in binary format
- Loading measurement data in analyzer mode (when the external signal source automatic control function is not used)
  - □ Transferring data in ASCII format
  - □ Transferring data in binary format
- Loading measurement data in analyzer mode (when the external signal source automatic control function is used)
  - □ Transferring data in ASCII format
  - □ Transferring data in binary format

In order to make the 4352B measurement and transfer the data using an external controller, you have to consider whether you use the 4352B's external signal source automatic control function or not. When you use this function, the 4352B normally functions as the system controller to control the signal source. Note, some types of measurements do not require external signal source control.

Therefore, there are two ways to transfer measurement data from the 4352B to the external controller:

- When the external signal source need not be controlled during the measurement.
  The external controller functions as the system controller throughout the entire course from measurement to data transfer.
- When the external signal source needs to be controlled during the measurement.
  The controller capability is passed from the external controller to the 4352B during the measurement.

This chapter provides sample programs that can be used in a variety of applications where different combinations of measurement mode, whether to control the external signal source, and transfer formats are included. See the section that best suits your measurement conditions and system configuration.

When transferring measurement data to the external controller and using the external signal source automatic control function in the tester mode, you can basically follow the same methods used in the analyzer mode. See the corresponding program for the analyzer mode for more information.

Data Formats

There are four different types of data formats for transferring data from the 4352B via GPIB.

FORM2 IEEE 32 bit floating point format
FORM3 IEEE 64 bit floating point format
FORM4 ASCII format
FORM5 MS-DOS® personal computer format

The data transfer speed and the number of digits are dependent on the format. Generally, binary data transfer (FORM2, FORM3, or FORM5) is faster than ASCII (FORM4) data transfer.

For details on the data transfer formats, see Appendix C.

Loading Measurement Data in Tester Mode (When the 4352B's External Signal Source Automatic Control Function Is Not Used)

Transferring Data in ASCII Format

Figure 4-1 shows a program that transfers measurement data in ASCII format to an external controller .

```
100   ! File Name : FIG4_1.TXT
110   !   To Get Measurement Data Using ASCII Format
120   !
130   ASSIGN @Hp4352 TO 717  ! 4352 Address
140   !
150   OUTPUT @Hp4352;"PRES"  ! Preset 4352
160   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
170   OUTPUT @Hp4352;"VT"    ! Select Tester mode
180   !
190   INPUT "DC POWER VOLTAGE (V)",Dc_power
200   INPUT "DC CONTROL VOLTAGE (V)",Dc_ctrl
210   !
220   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
230   OUTPUT @Hp4352;"VCTRL ";Dc_ctrl ! Set DC Control Voltage
240   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
250   !
260   OUTPUT @Hp4352;"TRGS INT"   ! Set Trigger to Internal
270   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
280   OUTPUT @Hp4352;"*SRE 4;ESNB 1" !
290   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
300   ENTER @Hp4352;Opc
310   !
320   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
330   !
340   DISP "CONNECT DEVICE and PRESS CONTINUE."
350   PAUSE
360   DISP
370   !
380   ON INTR 7 GOTO Sweep_end
390   ENABLE INTR 7;2
400   OUTPUT @Hp4352;"SING"       ! Measure RF Power level
410   !
420 Measuring:GOTO Measuring
430 Sweep_end:  !
440   !
450   OUTPUT @Hp4352;"FORM4"      ! Set ASCII format
460   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
470   ENTER @Hp4352;Power_data
480   !
490   PRINT "POWER ";Power_data;" (dBm)"
500   !
510   END
```

Figure 4-1.
Sample Program:
Loading Measurement Data in Tester Mode (ASCII Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used)

Setting Tester Mode

```
170   OUTPUT @Hp4352;"VT"    ! Select Tester mode
```

Line 170 selects the Tester mode.

Setting Data Transfer Format

```
450   OUTPUT @Hp4352;"FORM4"      ! Set ASCII format
```

Line 450 tells the 4352B to use the ASCII data transfer format.

Loading Data

```
460   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
470   ENTER @Hp4352;Power_data
```

Lines 460 and 470 load measurement data using the `OUTPDATA?` command.

Transferring Data in Binary Format

Figure 4-2 shows a program that transfers measurement data in a binary format to the external controller.

```
 100   ! File Name : FIG4_2.TXT
 110   !   To Get Measurement Data Using IEEE 64-bit Floating Point Format
 120   !
 130   ASSIGN @Hp4352 TO 717  ! 4352 Address
 140   !
 150   OUTPUT @Hp4352;"PRES"  ! Preset 4352
 160   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
 170   OUTPUT @Hp4352;"VT"    ! Select Tester mode
 180   !
 190   INPUT "DC POWER VOLTAGE (V)",Dc_power
 200   INPUT "DC CONTROL VOLTAGE (V)",Dc_ctrl
 210   !
 220   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
 230   OUTPUT @Hp4352;"VCTRL ";Dc_ctrl ! Set DC Control Voltage
 240   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
 250   !
 260   OUTPUT @Hp4352;"TRGS INT"   ! Set Trigger to Internal
 270   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
 280   OUTPUT @Hp4352;"*SRE 4;ESNB 1" !
 290   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
 300   ENTER @Hp4352;Opc
 310   !
 320   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
 330   !
 340   DISP "CONNECT DEVICE and PRESS CONTINUE."
 350   PAUSE
 360   DISP
 370   !
 380   ON INTR 7 GOTO Sweep_end
 390   ENABLE INTR 7;2
 400   OUTPUT @Hp4352;"SING"       ! Measure RF Power level
 410   !
 420 Measuring:GOTO Measuring
 430 Sweep_end:  !
```

Figure 4-2.
Sample Program:
Loading Measurement Data in Tester Mode (Binary Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 1/2)

```
440   !
450   OUTPUT @Hp4352;"FORM3"      ! Set IEEE 64-BIT Floating Point format
460   ASSIGN @Dt TO 717;FORMAT OFF
470   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
480   ENTER @Dt USING "%,8A";A$
490   ENTER @Dt;Power_data
500   ENTER @Dt USING "%,1A";A$
510   ASSIGN @Dt TO *
520   !
530   PRINT "POWER ";Power_data;" (dBm)"
540   !
550   END
```

Figure 4-3.
Sample Program:
Loading Measurement Data in Tester Mode (Binary Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 2/2)

The flow of this program is the same as that for ASCII data transfer format. You must set the I/O path to FORMAT OFF when using the binary data transfer format.

Setting Tester Mode

```
170   OUTPUT @Hp4352;"VT"    ! Select Tester mode
```

Line 170 selects the Tester mode.

Setting Data Transfer Format

```
450   OUTPUT @Hp4352;"FORM3"      ! Set IEEE 64-BIT Floating Point format
460   ASSIGN @Dt TO 717;FORMAT OFF
```

The data transfer using the `ENTER` statement on FORM3 must be performed without data format. Defining an I/O path with ASCII formatting OFF makes this possible (line 460). This I/O path is valid for the binary data transfer used in the following lines (Loading Data) in the program.

How are data transferred with other binary data formats?

You can use the following data transfer formats, by changing the GPIB command `FORM3` in line 450.

- IEEE 32 bit floating point format — `FORM2`
- MS-DOS® personal computer format — `FORM5`

Loading Data

```
470   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
480   ENTER @Dt USING "%,8A";A$
490   ENTER @Dt;Power_data
500   ENTER @Dt USING "%,1A";A$
```

FORM3 has an eight-byte header to deal with. The first two bytes are the ASCII characters #6. This indicates that a six-byte block data transfer follows, and the next six bytes form an integer specifying the number of bytes in the data block to follow. To load measurement data, the header and a byte of terminator “LF^EOI” must be also read in lines 480 to 500.

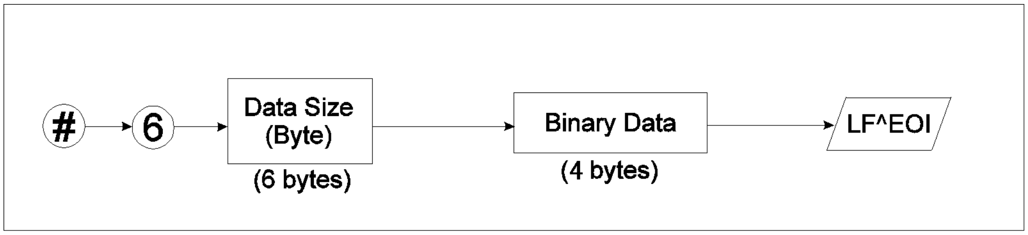


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Figure 4-4. Form 3: Data Transfer Format

Loading Measurement Data in Analyzer Mode (When External Signal Source Automatic Control Function Is Not Used)

Transferring Data in ASCII Format

Figure 4-5 shows a program that transfers measurement data in ASCII data format to the external controller.

```
100   ! File Name : FIG4_5.TXT
110   !   To Get Measurement Data Using ASCII Format
120   !
130   DIM Power_data(1:51)
140   ASSIGN @Hp4352 TO 717  ! 4352 Address
150   !
160   OUTPUT @Hp4352;"PRES"  ! Preset 4352
170   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
180   OUTPUT @Hp4352;"VA"    ! Select Analyzer Mode
190   !
200   INPUT "DC POWER VOLTAGE (V)",Dc_power
210   INPUT "START CONTROL VOLTAGE (V)",Ctrl_start
220   INPUT "STOP CONTROL VOLTAGE (V)",Ctrl_stop
230   !
240   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
250   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
260   OUTPUT @Hp4352;"STAR ";Ctrl_start ! Set DC Control Start Voltage
270   OUTPUT @Hp4352;"STOP ";Ctrl_stop  ! Set DC Control Stop Voltage
280   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
290   OUTPUT @Hp4352;"POIN 51"          ! Set Number of Points to 51
300   !
310   OUTPUT @Hp4352;"TRGS INT"   ! Set Trigger Source to Internal
320   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
330   OUTPUT @Hp4352;"*SRE 4;ESNB 1" !
340   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
350   ENTER @Hp4352;Opc
360   !
370   DISP "CONNECT DEVICE and PRESS CONTINUE."
380   PAUSE
390   DISP
```

Figure 4-5.
Sample Program:
Loading Measurement data in Analyzer Mode (ASCII Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 1/2)

```
400   !
410   ON INTR 7 GOTO Sweep_end
420   ENABLE INTR 7;2
430   OUTPUT @Hp4352;"SING"       ! Measure RF Power level
440   !
450 Measuring:GOTO Measuring
460 Sweep_end:  !
470   !
480   OUTPUT @Hp4352;"FORM4"      ! Set ASCII format
490   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
500   ENTER @Hp4352;Power_data(*)
510   !
520   FOR I=1 TO 51
530    PRINT "POWER ";Power_data(I);" (dBm)"
540   NEXT I
550   !
560   END
```

Sample Program:
Loading Measurement Data in Analyzer Mode (ASCII Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 2/2)

Specifying Array

```
130   DIM Power_data(1:51)
```

Defines the array that is used to store measurement data. The array size must be equal to the specified number of measurement points (line 290).

Specifying Analyzer Mode

```
180   OUTPUT @Hp4352;"VA"    ! Select Analyzer Mode
```

Selects the Analyzer mode.

Setting Data Transfer Format

```
480   OUTPUT @Hp4352;"FORM4"      ! Set ASCII format
```

Line 480 tells the 4352B to use the ASCII data transfer format.

Loading Data

```
490   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
500   ENTER @Hp4352;Power_data(*)
```

Lines 490 and 500 load measurement data array using the `OUTPDATA?` command.

To Load Other Data Use the following GPIB command in place of `'OUTPDATA?'` in line 490 to obtain the memory array. See the *GPIB Command Reference* for more information on this command.

- Memory array `OUTPMEMO?`

Transferring Data in Binary Format

Figure 4-6 shows a program that transfers measurement data in a binary data format to the external controller.

```
100   ! File Name : FIG4_6.TXT
110   !   To Get Measurement Data Using IEEE 64-bit Floating Point Format
120   !
130   DIM Power_data(1:51)
140   ASSIGN @Hp4352 TO 717            ! 4352 Address
150   ASSIGN @Dt TO 717;FORMAT OFF     ! 4352 Address with FORMAT OFF
160   !
170   OUTPUT @Hp4352;"PRES"  ! Preset 4352
180   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
190   OUTPUT @Hp4352;"VA"    ! Select Analyzer Mode
200   !
210   INPUT "DC POWER VOLTAGE (V)",Dc_power
220   INPUT "START CONTROL VOLTAGE (V)",Ctrl_start
230   INPUT "STOP CONTROL VOLTAGE (V)",Ctrl_stop
240   !
250   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
260   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
270   OUTPUT @Hp4352;"STAR ";Ctrl_start ! Set DC Control Start Voltage
280   OUTPUT @Hp4352;"STOP ";Ctrl_stop  ! Set DC Control Stop Voltage
290   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
300   OUTPUT @Hp4352;"POIN 51"          ! Set Number of Points to 51
310   !
320   OUTPUT @Hp4352;"TRGS INT"   ! Set Trigger Source to Internal
330   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
340   OUTPUT @Hp4352;"*SRE 4;ESNB 1" !
350   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
360   ENTER @Hp4352;Opc
370   !
380   DISP "CONNECT DEVICE and PRESS CONTINUE."
390   PAUSE
400   DISP
410   !
420   ON INTR 7 GOTO Sweep_end
430   ENABLE INTR 7;2
440   OUTPUT @Hp4352;"SING"       ! Measure RF Power level
450   !
460 Measuring:GOTO Measuring
470 Sweep_end:  !
```

Figure 4-6.
Sample Program:
Loading Measurement Data in Analyzer Mode (Binary Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 1/2)

```
480   !
490   OUTPUT @Hp4352;"FORM3"      ! Set IEEE 64-BIT format
500   OUTPUT @Hp4352;"OUTPDATA?"  ! Get Measurement data
510   ENTER @Hp4352 USING "#,8A";A$
520   ENTER @Dt;Power_data(*)
530   ENTER @Hp4352 USING "#,A";B$
540   !
550   FOR I=1 TO 51
560    PRINT "POWER ";Power_data(I);" (dBm)"
570   NEXT I
580   !
590   END
```

Figure 4-7.
Sample Program:
Loading Measurement Data in the Analyzer Mode (Binary Format)
(When the 4352B's External Signal Source Automatic Control Function Is Not Used, 2/2)

The flow of this program is the same as that for ASCII data transfer format. You must set the I/O path to FORMAT OFF when using the binary data transfer format.

Specifying Array

```
130   DIM Power_data(1:51)
```

Defines the array that is used to store measurement data. The array size must be equal to the specified number of measurement points (line 300).

Specifying Analyzer Mode

```
190   OUTPUT @Hp4352;"VA"    ! Select Analyzer Mode
```

Selects the Analyzer mode.

Setting Data Transfer Format

```
150   ASSIGN @Dt TO 717;FORMAT OFF      ! 4352 Address with FORMAT OFF
```

```
490   OUTPUT @Hp4352;"FORM3"      ! Set IEEE 64-BIT format
```

As with the Tester mode, defining an I/O path with ASCII formatting OFF (line 150) is required.

How is data transferred with other binary data formats?

You can use the following data transfer formats, by changing the GPIB command FORM3 in line 490.

- IEEE 32 bit floating point format   FORM2
- MS-DOS® personal computer format   FORM5

Loading Measurement Data in Analyzer Mode (When External Signal Source Automatic Control Function Is Used)

Transferring Data in ASCII Format

Figure 4-8 and Figure 4-9 show programs that must pass control from the external controller to the 4352B to transfer measurement data .

The external controller passes the controller capability to the 4352B and receives the measurement data from it after the measurement.
The 4352B controls the measurement and sends the measurement data to the external controller.

```
100   ! File Name : FIG4_8.TXT
110   !   To Get Measurement Data Using ASCII Format
120   !
130   ABORT 7
140   PASS CONTROL 717
150   DIM Power_data(1:51)
160   ASSIGN @Hpib TO 7
170   ENTER @Hpib;Power_data(*)
180   ASSIGN @Hpib TO *
190   !
200   END
```

Figure 4-8.
Sample Program for External Controller:
Loading Measurement Data in the Analyzer Mode (ASCII Format)
(When the 4352B's External Signal Source Automatic Control Function Is Used)

Passing Control

```
140   PASS CONTROL 717
```

Passes the controller capability from the external controller to the 4352B.

Specifying Array

```
150   DIM Power_data(1:51)
```

Defines the array that is used to store measurement data. The array size must be equal to the specified number of measurement points.

Setting up GPIB

```
160   ASSIGN @Hpib TO 7
```

Specifies the select code for the GPIB interface card.

Transferring Data

```
170   ENTER @Hpib;Power_data(*)
```

Loads measurement data from the 4352B into the controller.

```
100   ! File Name : FIG4_9.TXT
110   !   To Get Measurement Data Using ASCII Format
120   !
130   DIM Power_data(1:51)
140   !
150   ASSIGN @Hp4352 TO 800  ! 4352 Address
160   !
170   OUTPUT @Hp4352;"PRES"  ! Preset 4352
180   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
190   OUTPUT @Hp4352;"VA"    ! Select Analyzer mode
200   !
210   INPUT "DC POWER VOLTAGE (V)",Dc_power
220   INPUT "START CONTROL VOLTAGE (V)",Dc_ctrl_1
230   INPUT "STOP CONTROL VOLTAGE (V)",Dc_ctrl_2
240   !
250   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
260   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
270   OUTPUT @Hp4352;"STAR ";Dc_ctrl_1 ! Set DC Start Control Voltage
280   OUTPUT @Hp4352;"STOP ";Dc_ctrl_2 ! Set DC Stop Control Voltage
290   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
300   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
310   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
320   ENTER @Hp4352;Opc
330   !
340   !
350   DISP "CONNECT DEVICE and PRESS CONTINUE."
360   PAUSE
370   DISP
380   !
390   EXECUTE "SING"              ! Measure RF Power level characteristics
400   !
410   OUTPUT @Hp4352;"FORM4"      ! ASCII Format
420   OUTPUT @Hp4352;"OUTPDATA?"
430   ENTER @Hp4352;Power_data(*)
440   ASSIGN @Hp4352 TO *
450   !
460   ASSIGN @Cntlr TO 721        ! Controller Address
470   OUTPUT @Cntlr;Power_data(*)
480   ASSIGN @Cntlr TO *
490   !
500   END
```

Figure 4-9.
Sample Program for the 4352B:
Loading Measurement Data in Analyzer Mode (ASCII Format)
(When the 4352B's External Signal Source Automatic Control Function Is Used)

Specifying Array

```
130   DIM Power_data(1:51)
```

As with the external controller, defines the array that is used to store measurement data.

Specifying Analyzer Mode

```
190   OUTPUT @Hp4352;"VA"    ! Select Analyzer mode
```

Selects the Analyzer mode.

Setting Data Transfer Format

```
410   OUTPUT @Hp4352;"FORM4"      ! ASCII Format
```

Line 410 tells the 4352B to use the ASCII data transfer format.

Loading Data

```
420   OUTPUT @Hp4352;"OUTPDATA?"
```

Loads measurement data array with OUTPDATA? command.

Transferring Data

```
460   ASSIGN @Cntlr TO 721        ! Controller Address
470   OUTPUT @Cntlr;Power_data(*)
```

Transfers measurement data to the external controller.

Transferring Data in Binary Format

Figure 4-10 and Figure 4-11 show the programs for the external controller and the 4352B, respectively.
The program flow is basically the same as that for transferring data in ASCII format (programs in Figure 4-8 and Figure 4-9) except that 'ASCII FORMAT OFF' for I/O path must be specified in both programs and that the 4352B specifies FORM3 as the data transfer format.

```
100   ! File Name : FIG4_10.TXT
110   !   To Get Measurement Data Using IEEE 64-bit Floating Point Format
120   !
130   ABORT 7
140   PASS CONTROL 717
150   !
160   DIM Power_data(1:51)
170   ASSIGN @Dt TO 7;FORMAT OFF
180   ENTER @Dt;Power_data(*)
190   ASSIGN @Dt TO *
200   !
210   END
```

Figure 4-10.
Sample Program for External Controller:
Loading Measurement Data in the Analyzer Mode (IEEE 64-Bit Floating Point Format)
(When the 4352B's External Signal Source Automatic Control Function Is Used)

```
100   ! File Name : FIG4_11.TXT
110   !   To Get Measurement Data Using IEEE 64-bit Floating Point Format
120   !
130   DIM Power_data(1:51)
140   !
150   ASSIGN @Hp4352 TO 800  ! 4352 Address
160   !
170   OUTPUT @Hp4352;"PRES"  ! Preset 4352
180   OUTPUT @Hp4352;"HOLD"  ! Trigger HOLD
190   OUTPUT @Hp4352;"VA"    ! Select Analyzer mode
200   !
210   INPUT "DC POWER VOLTAGE (V)",Dc_power
220   INPUT "START CONTROL VOLTAGE (V)",Dc_ctrl_1
230   INPUT "STOP CONTROL VOLTAGE (V)",Dc_ctrl_2
240   !
250   OUTPUT @Hp4352;"MEAS POWE"  ! Select RF Power Level Measurement
260   OUTPUT @Hp4352;"VPOW ";Dc_power ! Set DC Power Voltage
270   OUTPUT @Hp4352;"STAR ";Dc_ctrl_1 ! Set DC Start Control Voltage
280   OUTPUT @Hp4352;"STOP ";Dc_ctrl_2 ! Set DC Stop Control Voltage
290   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC voltages
300   OUTPUT @Hp4352;"CLES"       ! Clear Status Registers
310   OUTPUT @Hp4352;"*OPC?"      ! Wait until Operation Completed
320   ENTER @Hp4352;Opc
330   !
340   !
350   DISP "CONNECT DEVICE and PRESS CONTINUE."
360   PAUSE
370   DISP
380   !
390   EXECUTE "SING"              ! Measure RF Power level characteristics
400   !
410   ASSIGN @Dt TO 800;FORMAT OFF
420   OUTPUT @Hp4352;"FORM3"      ! IEEE 64-bit Format
430   OUTPUT @Hp4352;"OUTPDATA?"
440   ENTER @Hp4352 USING "#,8A";Header$
450   ENTER @Dt;Power_data(*)
460   ENTER @Hp4352;End$
470   ASSIGN @Dt TO *
480   ASSIGN @Hp4352 TO *
490   !
500   ASSIGN @Cntlr TO 721;FORMAT OFF    ! Controller Address
510   OUTPUT @Cntlr;Power_data(*)
520   ASSIGN @Cntlr TO *
530   !
540   END
```

Figure 4-11.
Sample Program for the 4352B:
Loading Measurement Data in the Analyzer Mode (IEEE 64-Bit Floating Point Format)
(When the 4352B's External Signal Source Automatic Control Function Is Used)

Reading Data Using the Marker Search Function

The program block shown below uses the marker search function to search for the maximum value. You can replace lines 470 onward of the program in Figure 4-5 or lines 480 onward of the program in Figure 4-6 with this program block in order to search for the maximum value on each program.

```
100  OUTPUT @Hp4352;"MKR ON"     ! Set Marker function ON
110  OUTPUT @Hp4352;"SEAM MAX"   ! Search Maximum Level
120  OUTPUT @Hp4352;"OUTPMKR?"   ! Read Marker values
130  ENTER @Hp4352;Power_max,Swp_prm
140  PRINT "Control Voltage ";Swp_prm;" (V)"
150  PRINT "Maximum Power Level ";Power;" (dBm)"
```

Searching for Maximum Value

```
100  OUTPUT @Hp4352;"MKR ON"     ! Set Marker function ON
110  OUTPUT @Hp4352;"SEAM MAX"   ! Search Maximum Level
```

Line 100 turns ON the marker and line 110 moves the marker to the maximum value on the trace.

To Use Other Marker Functions

Commands used to turn ON the sub-marker or Δmarker

`SMKR{1-4} ON`, `DMKR {ON|FIX|TRAC}`

Commands used to move the marker[1]

- Move the marker to the specified X-coordinate — `MKRPRM` *parameter*
- Moves the marker to the specified measurement point. — `MKRP` *parameter*

Commands used to move the sub-marker[1]

- Move the sub-marker to the specified X-coordinate — `SMKRPRM{1-4}` *parameter*
- Move the sub-marker to the specified measurement point — `SMKRP{1-4}` *parameter*

Commands used to move the Δmarker[1]

- Move the Δmarker to the specified X-coordinate — `DMKRPRM` *parameter*
- Move the Δmarker to the specified measurement point — `DMKRVAL` *parameter*

1 Be sure to turn on the desired marker before moving it.

Loading Data

```
120  OUTPUT @Hp4352;"OUTPMKR?"   ! Read Marker values
```

OUTPMKR? returns the marker reading.

Other Marker Readings The following commands can be used to read the marker:

- Marker reading `MKRVAL?`
- X-coordinate `MKRPRM?`
- Measurement point `MKRP?`

The following commands can be used to read the sub-marker:

- Sub-marker reading `SMKRVAL{1-4}?`
- X-coordinate `SMKRPRM{1-4}?`
- Measurement point `SMKRP{1-4}?`

The following commands can be used to read the Δmarker:

- Δmarker reading `DMKRVAL?`
- X-coordinate `DMKRPRM?`

5

Printing the 4352B's Display

This chapter describes how to print the information on the analyzer display using GPIB commands.

To Print Analyzer Display

Printer Preparation

1. Connect a printer using a parallel cable.
2. Turn the printer on.

Execute Print

To print the screen, execute the folowing command.

```
OUTPUT 800;"PRINALL"
```

Set the GPIB address when you execute from an external controller.

To Observe Printing

The HP BASIC program shown below gives an example to detect printing end by using a SRQ interrupt.

```
100   ! FIG5_1. To Observe Printing
110   !
120   ASSIGN @Hp4352 TO 800
130   !
140   OUTPUT @Hp4352;"CLES"
150   OUTPUT @Hp4352;"OSNT 512" !Catch High to Low Transition
160   OUTPUT @Hp4352;"OSPT 0"   !Disable Low to High Transitions
170   OUTPUT @Hp4352;"OSE 512"  !Enable OS Event Reg.
180   OUTPUT @Hp4352;"*SRE 128" !Enable OSR bit
190   ON INTR 8 GOTO La1
200   ENABLE INTR 8;2
210   OUTPUT @Hp4352;"PRINALL"
220   La1:!
230   GOTO La1
240   DISP "PRINT COMPLETE"
250   !
260   END
```

Figure 5-1. Sample Program : To Observe Printing

6

Remote Controlling HP instrument BASIC

This chapter describes how to use both HP instrument BASIC and an external controller together, and also how to pass the active controller capability (with an example using a printer).

To Control GPIB from HP instrument BASIC

The 4352B must be the active controller of the GPIB (select code 7) to control devices on the GPIB, such as an external signal source. Initially, the system controller is the active controller. The active controller can pass the controller capability to the 4352B or other controllers connected via GPIB.

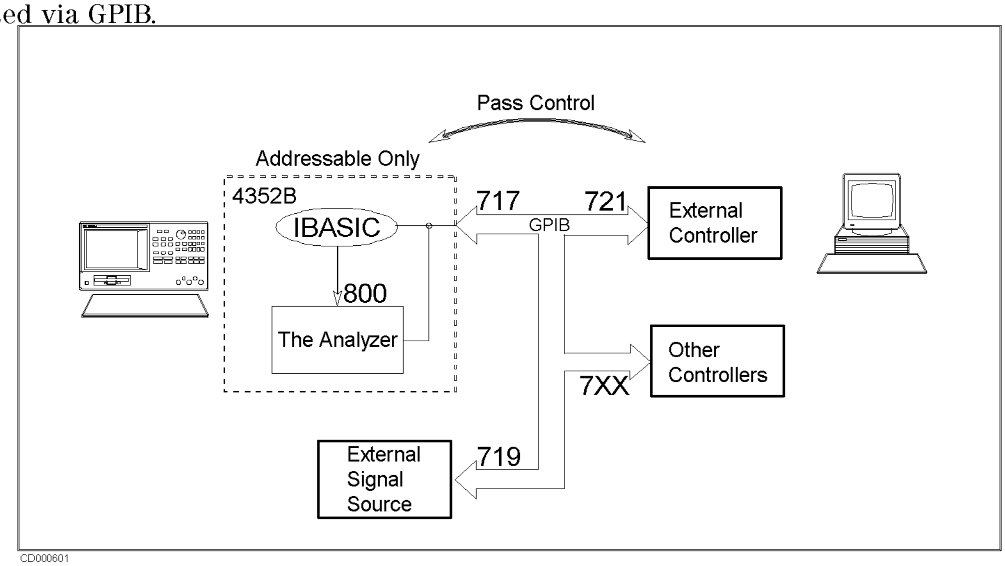


Figure 6-1. Pass Control

What is the active controller?

- The active controller is the controller that currently has the capability to control the devices connected via GPIB. Only one active controller can exist at a time on an GPIB bus. If there are two or more devices that can be a controller on the same bus, the active controller capability can be passed from one controller to another.
- Resetting the GPIB (this operation can be done only by the system controller) causes the active controller capability to be passed back to the system controller.

What is the system controller?

- The controller that acts as the master controller. There can be only one system controller on an GPIB bus. The system controller capability cannot be passed to other controllers via GPIB.
- A controller can be set as either the system controller or a non-system controller. See the controller's manual for details. The 4352B has to be used in either a `SYSTEM CONTROLLER` (system controller) mode or a `ADDRESSABLE ONLY` (non-system controller) mode.

This chapter describes the programs to be used when the external controller is assigned as the system controller and the 4352B is used in `ADDRESSABLE ONLY` mode.

```
100   ! File Name : FIG6_2.TXT
110   !   To Receive Control (on HP instrument BASIC)
120   !
130   PRINTER IS 701          ! Set printer address
140   ON ERROR GOTO Not_active! Wait for pass control
150   Not_active: !
160   PRINT "HELLO WORLD!"
170   !
180   OFF ERROR
190   END
```

Figure 6-2.
Sample Program: To Receive the Active Controller Capability (On HP instrument BASIC)

In order to print out to the printer at address 701 in line 160, the 4352B must receive the active controller capability. Therefore, the program loops back to line 140 to 150 until the capability is passed to the external controller. After it is passed to the 4352B, printing is executed in line 160.

To pass the capability of active controller to HP instrument BASIC:

```
PASS CONTROL 717 [Return]
```

Pass the Capability of Controller (On External Controller)

While the 4352B has the controller capability, it can talk and listen to devices on GPIB bus. Therefore, it can send data to and read replies back from printers and plotters.

Note

Only the system controller can assert the GPIB interface clear line (IFC) and remote enable line (REN). Even when HP instrument BASIC is the active controller, these commands cannot be used.

`ABORT 7`	*assert the interface clear line (IFC)*
`REMOTE 7`	*assert the remote enable line (REN)*

To return the active controller capability to the system controller:

```
PASS CONTROL 721 (Return)
```

Return the Capability of Controller (On HP instrument BASIC)

Or, you can return the controller capability to the system controller by resetting the GPIB as follows:

```
ABORT 7 (Return)
```

Return the Capability of Controller (On External Controller)

To Execute an HP instrument BASIC Command From the External Controller.

Note

The PROGram subsystem commands in the following programs can be used on the external controller.

Combine the `PROG:EXEC` command with a command to be executed on HP instrument BASIC. For example, to execute `EDIT` command,

```
OUTPUT 717;"PROG:EXEC ""EDIT"""
```

Or you can use single quotation marks, instead of the double quotation marks, as follows.

```
OUTPUT 717;"PROG:EXEC 'EDIT'"
```

You have to be careful about the command syntax when executing an HP instrument BASIC command that requires a parameter. For example, to execute the HP instrument BASIC command “`GET "FILENAME"`”, the syntax is as follows.

```
OUTPUT 717;"PROG:EXEC ""GET """"FILENAME"""""""
```

To Run an HP instrument BASIC Program From the External Controller

```
100   ! File Name : FIG6_3.TXT
110   !   To Run IBASIC Program From External Controller
120   !             (On External Controller)
130   !
140   ABORT 7
150   ASSIGN @Hp4352 TO 717
160   OUTPUT @Hp4352;"PROG:DEL:ALL"       ! Delete a program
170   OUTPUT @Hp4352;"PROG:DEF #0"        ! Download a program up to "END"
180   OUTPUT @Hp4352;"10 MSI "":INTERNAL"""
190   OUTPUT @Hp4352;"20 GET ""FIG1_3.TXT"""  !
200   OUTPUT @Hp4352;"30 END"
210   OUTPUT @Hp4352;" " END
220   OUTPUT @Hp4352;"PROG:EXEC ""RUN"""  ! Execute the program
230   END
```

Figure 6-3.
Sample Program: To Run the HP instrument BASIC Program From the External Controller (On the External Controller)

You must insert a floppy disk that contains the program file FIG1_3.TXT into the built-in disk drive of the 4352B before running this sample program. (The furnished sample program disk for HP instrument BASIC also contains FIG1_3.TXT.)

Open the HP instrument BASIC Editor

```
160   OUTPUT @Hp4352;"PROG:DEL:ALL"       ! Delete a program
170   OUTPUT @Hp4352;"PROG:DEF #0"        ! Download a program up to "END"
```

Scratch any program currently existing in the HP instrument BASIC editor and open the editor.

Transfer the HP instrument BASIC Program

```
180   OUTPUT @Hp4352;"10 MSI "":INTERNAL"""
190   OUTPUT @Hp4352;"20 GET ""FIG1_3.TXT"""  !
200   OUTPUT @Hp4352;"30 END"
```

In the HP instrument BASIC editor, the following program is now present:

```
10 MSI ":INTERNAL"
20 GET "FIG1_3.TXT"
30 END
```

Close the HP instrument BASIC Editor

```
210   OUTPUT @Hp4352;" " END
```

Sending the END command to the 4352B closes the editor.

Run the HP instrument BASIC Program

```
220   OUTPUT @Hp4352;"PROG:EXEC ""RUN"""  ! Execute the program
```

Line 220 runs the following program in the HP instrument BASIC editor:

```
10 MSI ":INTERNAL"
20 GET "FIG1_3.TXT"
30 END
```

Line 20 retrieves a program saved in the file FIG1_3.TXT and runs the program.

To Transfer Program to HP instrument BASIC

```
100   ! File Name : FIG6_4.TXT
110   !   To Transfer the Program to IBASIC (on External Controller)
120   !
130   ABORT 7
140   ASSIGN @Hp4352 TO 717
150   INPUT "FILENAME?",File_name$
160   OUTPUT @Hp4352;"PROG:DEL:ALL"  ! Delete a program
170   OUTPUT @Hp4352;"PROG:DEF #0"   ! Download a program up to "END"
180   ASSIGN @File TO File_name$
190   ON ERROR GOTO Done
200   DIM Line$[1024]
210   LOOP
220     Line$=""                     !
230     ENTER @File USING "K";Line$
240     OUTPUT @Hp4352;Line$         ! Transfer the program by each line
250   END LOOP
260 Done:    !
270   OFF ERROR
280   OUTPUT @Hp4352;" " END         ! End edit
290   END
```

Figure 6-4.
Sample Program: To Transfer Program to HP instrument BASIC (on External Controller)

This Program transfers a program file saved in the mass storage device (disk drive) of the external controller to the HP instrument BASIC.
Before you run this program, confirm that the file to be transferred exists on the mass storage device.

Open the HP instrument BASIC Editor

```
160   OUTPUT @Hp4352;"PROG:DEL:ALL"  ! Delete a program
170   OUTPUT @Hp4352;"PROG:DEF #0"   ! Download a program up to "END"
```

Scratch any program that currently exists in the HP instrument BASIC editor and open the editor.

Transfer the Program

```
180   ASSIGN @File TO File_name$
190   ON ERROR GOTO Done
200   DIM Line$[1024]
210   LOOP
220   Line$=""                   !
230   ENTER @File;Line$
240   OUTPUT @Hp4352;Line$       ! Transfer the program by each line
250   END LOOP
```

Transfer the program by line to the 4352B. When all program lines are transferred, the controller exits the loop and goes to line 260.

Close the HP instrument BASIC Editor

```
280   OUTPUT @Hp4352;" " END       ! End edit
```

Sending the 4352B the END command closes the editor.

7

If You Have a Problem

This chapter provides helpful information on how to fix typical problems.

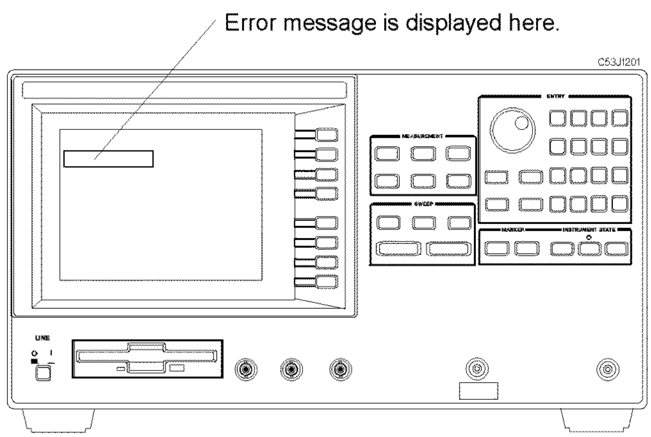
If There Is No Response From an Instrument on the GPIB Bus

□ Check all GPIB addresses and cable connections.

This trouble is usually caused by an incorrect address or a bad or loose GPIB cable in most cases.

If an Error Message is Displayed

□ Check the error message on the 4352B's display.



- If "`GPIB error occurred`" is displayed:
  1. Get the error number and description using the `OUTPERRO?` command. (For information on how to use this command, see the "To Report Command Error Occurrence" in Chapter 3.)
  2. See the appendix "Messages" in this manual.

- If any other message is displayed:

  See the appendix "Messages" in this manual.

If You Cannot Get a File from the Disk

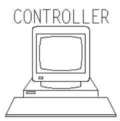
□ Check the floppy disk.

1. Put the disk into the disk drive and type as follows.

```
CAT
```

2. Press (Return).

   If an error message is displayed, the disk is corrupted or the disk format does not match. Use another disk.



If you are using the external controller,

HP BASIC supports the LIF format only, on the other hand, HP instrument BASIC supports both the LIF and the DOS format. Try again using HP instrument BASIC, if there is a possibility that the floppy disk was formatted using the DOS format.

□ Check the mass storage.

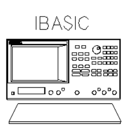
1. Put the floppy disk into the disk drive and type as follows:

```
SYSTEM$("MSI")
```

2. Press (Return).

```
:CS80, 700, 0        ←mass storage volume specifier
```

3. If the mass storage volume does not match your disk drive, use the `MSI` statement to set it to match.



If you are using HP instrument BASIC:

A mass storage volume specifier for the built-in disk drive must be `\:,4` (LIF and DOS). You have to execute `MSI ":INTERNAL"` in advance.

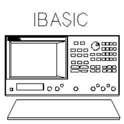
□ Check the file type.

1. Put the floppy disk into the disk drive and type as follows:

```
CAT
```

2. Press Return.

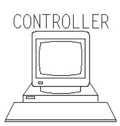
```
CAT

FILE NAME  PRO TYPE REC/FILE BYTE/REC   ADDRESS    DATE    TIME

FIG1_3.TXT    ASCII       6      256        34   29-May-96 11:00
FIG2_2.TXT    PROG        6      256        34   29-May-96 11:00
FIG2_3.TXT    ASCII       6      256        34   29-May-96 11:00
       ⋮
```



If you are using HP instrument BASIC

Only an ASCII type program file can be saved and read.

Use the SAVE/GET commands to save and get ASCII files.



If you are using HP BASIC

- To read ASCII type program, use GET command.

  The ASCII type program file can be saved and read using SAVE/GET commands.

- To read a PROG type program, use LOAD command.

  The PROG type program file can be saved and read using the STORE/LOAD commands.

If the GPIB Command Does Not Work

□ Check the preceding GPIB command.

An GPIB command that requires a long execution time (such as changing format) can affect the next GPIB command execution.

If you execute such commands, insert the following command lines:

```
OUTPUT @Hp4352;"*OPC?"
ENGTER @Hp4352;Dum
```

For details, see “To Wait For the Preceding Operation to Complete” in Chapter 3.

8

The Status Report System

Figure 8-1 shows the overall structure of the Status Report System of the 4352B.

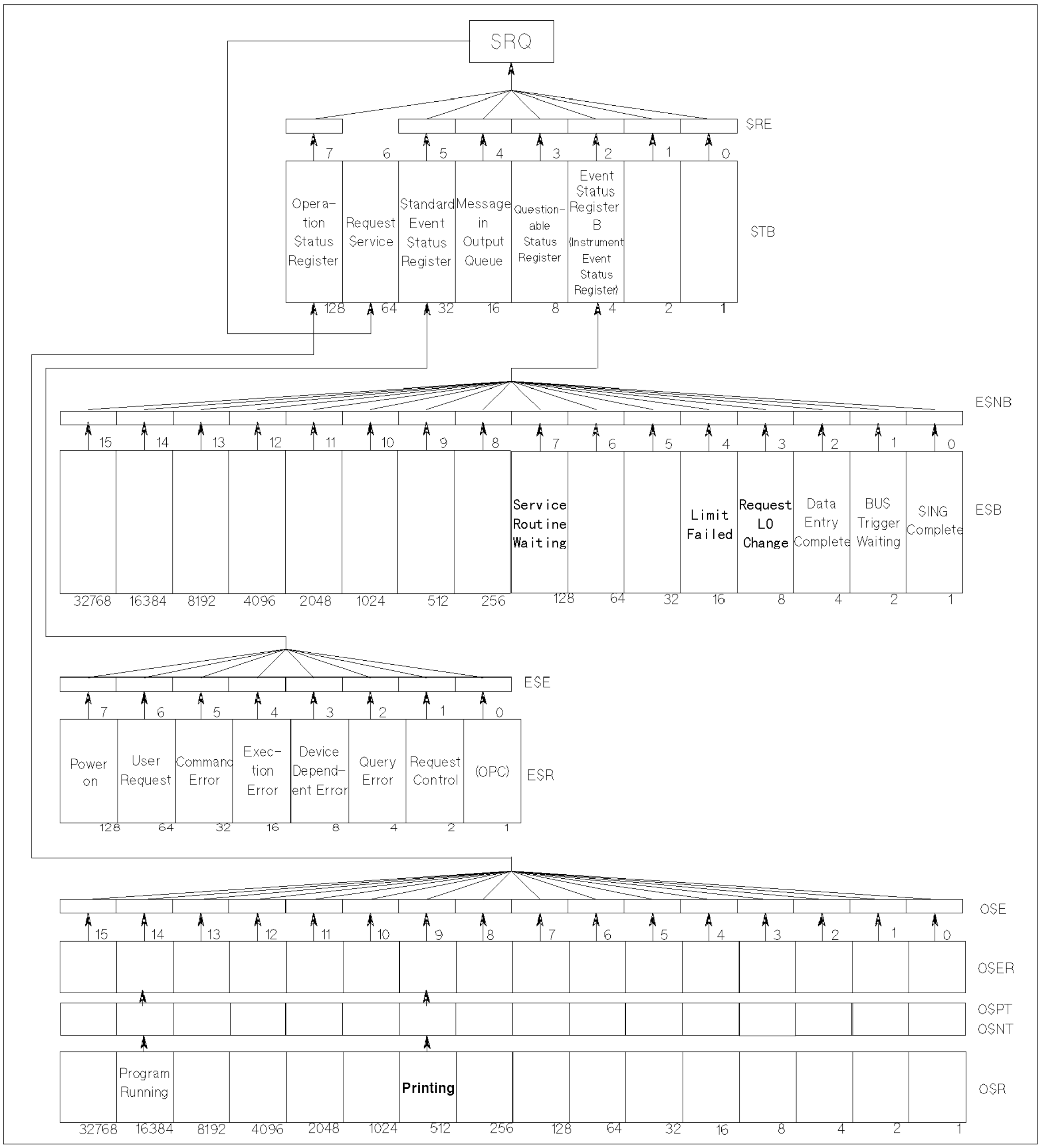


Figure 8-1. The Status Report System

The 4352B has a status report system that reports the status of the 4352B. The Status Byte Register (STB) is an 8 bit register that reports a summary of all the status registers that indicate the current status of the 4352B. Each bit of the status byte reports the status of a specific event in the 4352B. To read the status byte from the external controller, you can use the SPOLL command. This command can directly read the value of the status byte without setting the 4352B to the remote mode. Therefore you can operate the 4352B with its front panel keys even while the controller is reading the status. Bit 6 of the status byte is cleared once you read the status with this command. You can also read the status byte using the *STB? command in remote mode. Reading it with this command does not affect its value. Table 8-1 lists the definition for each bit in the status byte.

Table 8-1. Status Bit Definition of the Status Byte (STB)

Bit Position	Name	Description (When is the bit set to 1 ?)
2	Event Status Register B check Bit	A bit for the Event Status Register B (Instrument Event Status Register) is set to 1.
3	Questionable Status Register Check Bit	The 4352B does not have the event report function to support Questionable Status Register group. This bit is used to maintain consistency with other SCPI-compatible instruments.
4	Bit to check Messages in the Output Queue	A message in the output queue has not been read yet.
5	Standard Event Status Register Check Bit	A bit for the Standard Event Status Register is set to 1.
6	Service Request Bit	A bit of the status byte is set to 1 and a service request (SRQ) is generated.
7	Operation Status Register Check Bit	A bit for the Operation Status Register is set to 1.

For example, to read the content of bit 2 (Event Status Register Check bit) of the status byte, the program should be as follows:

```
10  Stat=SPOLL(717)
20  Stb2=BIT(Stat,2)
30  PRINT Stb2
40  END
```

Figure 8-2. Reading the Status Byte: Example (1)

The program can also be as follows.

```
10  ASSIGN @Hp4352 TO 717
20  OUTPUT @Hp4352;"*STB?"
30  ENTER @Hp4352;Stat
40  Stb2=BIT(Stat,2)
50  PRINT Stb2
60  END
```

Figure 8-3. Reading the Status Byte: Example (2)

The Event Status Register (ESR), Event Status Register B (ESB), and Operational Status Register (OSR) monitor the status of a specific event, and report to the status byte respectively. A status bit of each register is set to 1 when the corresponding event occurs. The status bit is cleared when the register is read with a query command or when CLES or *CLS command is executed.

Table 8-2.
Status Bit Definition of the Standard Event Status Register(ESR)

Bit Position	Name	Description (When is the bit set to 1 ?)
0	Operation Completion Bit (OPC)	A command that has OPC enabled is completed.
1	Control Request Bit	The 4352B is requesting the capability of active controller on GPIB because it was requested to perform an operation that requires the control of a peripheral device.
2	Query Error Bit	1. The 4352B has been specified as Talker when there is no data to transfer in the output queue. 2. Data in the output queue is lost.
3	Device Dependent Error Bit	An error other than the command error, the Query error, the execution error occurred. The error occurred is related to the function unique to the 4352B. (For example, `Set RF ATT 10 dB More`, etc.)
4	Execution Error Bit	1. Data in the program exceeded the entry range specified by the header or the acceptable range for the 4352B. 2. The error is caused not by a program command but by the device status.
5	Command Error Bit	1. An IEEE 488.2 syntax error occurred. The cause may be that the data is in a format the 4352B cannot read or that the data type cannot be accepted by the 4352B. 2. The header of transferred data cannot be read because it does not conform to the specification of the 4352B or to the IEEE 488.2 standard.
6	User Request Bit	The operator pressed a front panel or keyboard key or turned the rotary knob.
7	Power On Bit (Power ON)	The power was turned ON. (You can verify if the power has been accidentally turned OFF.)

Table 8-3.
The Status Bit Definition of Event Status Register B (ESB)(Instrument Event Status Register)

Bit Position	Name	Description (When is the bit set to 1 ?)
0	Single Trigger Completion Bit	Measurement by single trigger is completed. It is cleared when ESB register is read. This bit is only used with the `SING` command.
1	Bus Trigger Wait Bit	The 4352B is set to the GPIB trigger mode and is waiting until it is triggered.
2	Data Entry Completion Bit	The terminator key was pressed.
3	Local Signal Change Request Bit	Changing the frequency of the local signal supplied from the external signal source is requested.
4	Limit Test Failure Bit	Limit test failed.
7	Service Routine Execution Bit	An internal service routine was completed or is waiting for the operator response.

Table 8-4. The status Bit Definition of Operation Status Register (OSR)

Bit Position	Name	Description (When is the bit set to 1 ?)
9	Printing	Data is being transfered to the printer.
14	Program Running Bit (Program running)	HP instrument BASIC is running.

Each status register has a mask register. You can generate the Service Request(SRQ) bit depending on the status of the status bit, by enabling only the specified bits of a mask register. For example, to generate an SRQ when a measurement by single trigger is completed, you have to set the corresponding bit of the mask registers to 1 (bit 0 of the ESNB and bit 2 of the SRE, respectively). These bits correspond to bit 0 of the ESB (single trigger completion bit) and bit 2 of the status byte. This setup creates a way to generate an SRQ from bit 0 of ESB. The sample program is shown below.

```
10  ASSIGN @Hp4352 TO 717
20  !
30  OUTPUT @Hp4352;"CLES"   ! Clear the status register
40  OUTPUT @Hp4352;"ESNB 1" ! The mask register set for
50  !                        ! SING Completion bit of ESB
60  OUTPUT @Hp4352;"*SRE 4" !  The mask register set for
70  !                        ! Event Status Register B bit of STB
80  !
90  ON INTR 7 GOTO End       ! Declaration of SRQ interrupt
100 ENABLE INTR 7;2
110 OUTPUT @Hp4352;"SING"   ! Trigger
120 GOTO 120                 ! Repeat in an n infinite loop
130 !
140 End:                     ! Jump to here from the loop when a single
                               trigger completes.
150 END
```

Figure 8-4. Sample Program: Generating a Service Request (SRQ)

OSPT, OSNT

OSPT (Operation Status Positive Transition Filter)

When you set a 1 to the Positive Transition Filter, a 1 will be written into the corresponding bit of the Operation Status Event Register(OSER) when the bit for the Operation Status Register (OSR) changes from 0 to 1.

The OSR of the 4352B uses only bit 14 to indicate the program execution status. Setting bit 14 of the OSPT will, therefore, write a 1 into bit 14 of the OSER at the start of program, and a 1 is also written into bit 7 of the STB.

OSNT (Operation Status Negative Transition Filter)

When you set a 1 to the Negative Transition Filter, a 1 will be written into the corresponding bit of the Operation Status Event Register(OSER) when the bit for the Operation Status Register (OSR) changes from 1 to 0.

The OSR of the 4352B uses only bit 14 to indicate the program execution status. Setting bit 14 of the OSPT will, therefore, write a 1 into bit 14 of the OSER at the end of the program, and a 1 is also written into bit 7 of the STB.

9

Command Reference for Tester Mode

This chapter describes GPIB commands you can use for measurements in the tester mode. See this chapter for information on functions available with and syntax of each of these commands. Note that some of the commands covered in this chapter are used when you use the 43521A(Down Converter Unit).

Commands given in this chapter are designed for measurements in the tester mode. Commands are listed in alphabetical order.

See the *Function Reference* when you wish to search through command functions or when you need detailed information on each command.

The followings are typeface rules and definitions used in this command reference.

① → **AVER**␣{**OFF**|**0**|**ON**|**1**}

② → Switches the averaging function to ON/OFF. (AVERAGING ON off under Bw/Avg key.)

③ →

Parameter	Description
OFF or 0	Averaging function OFF
ON or 1	Averaging function ON

④ → ■ Query Response

{0|1} <new line> <^END>

⑤ → ■ Example

```
OUTPUT 717;"AVER ON"

OUTPUT 717;"AVER?"
ENTER 717;A
```

①	Command names and required parameters Letters written in bold define a command. You must type the command part exactly as printed without any space in-between. Characters can be either upper case or lower case. If the command to transfer requires a constant, one or more numbers within the defined range, or a character string, input them with a space after a command. (␣ indicates a space.) Characters between brackets, { }, are qualifiers accepted by commands. You do not need symbols such as "|" or "{" between commands and qualifiers when you actually type . For example, {OFF|0|ON|1} indicates that you input either OFF, ON, 0, or 1, and {1-4} indicates that you input a number (1, 2, 3, or 4).
②	This is a description of command. The front panel keys and softkeys that have the same function as the command are described in parentheses. Parentheses are also used for supplemental descriptions.
③	This is a description of parameters for the sample command.
④	This is a Query response format for the sample command.
⑤	Examples (including that of Query case usage) of the sample command.

Note

If a command is invalid in specific measurement items, "ANALYZER TYPE MISMATCH" appears if you attempt to use that command for those items.

Command Reference

AFC␣{OFF|0|ON|1}

Turns the automatic frequency control function ON or OFF. (`AFC on OFF` under (Menu) key.)

Parameter	Description
OFF or 0	Sets the Automatic Frequency Control function OFF.
ON or 1	Sets the Automatic Frequency Control function ON.

AFCITER␣<*numeric*>

Sets the maximum number of times that the measurement and calculation (control voltage setting loop) are repeated. This value is for use with the automatic frequency control function. (`MAX ITERATION` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	1 to 999	

- Query Response

  {*numeric*} <new line><^END>

AFCMAXV␣<*numeric*>

Specifies the DC control voltage upper limit when the automatic frequency control function is used. (`AFC MAX CTRL VOLT` under (Menu) key.)

The value specified with this command is valid when the automatic frequency control function is ON. This value can be specified irrespective of the maximum DC control voltage level specified with MAXVCTRL. Note, also, that with the 4352B the value specified with MAXVCTRL has priority over that specified with this command. Therefore, a voltage level that exceeds the level specified with MAXVCTRL cannot be applied to the device when this command is used.

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001) (Value specified with AFCMINV)≤(Value specified with AFCMAXV) (Value specified with AFCMAXV)≤(Value specified with MAXVCTRL)	V

- Query Response

  {*numeric*} <new line><^END>

AFCMAXV␣<*numeric*>

AFCMINV␣<*numeric*>

Specifies the DC control voltage lower limit. This value is for use with the automatic frequency control function. (`AFC MIN CTRL VOLT` under (Menu) key.)

The value specified with this command is valid when the automatic frequency control function is ON. This value can be specified irrespective of the maximum DC control voltage level specified with `MAXVCTRL`. Note, also, that with the 4352B the value specified with `MAXVCTRL` has priority over that specified with this command. Therefore, a voltage level that exceeds the level specified with `MAXVCTRL` cannot be applied to the device when this command is used.

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001) (Value specified with `AFCMINV`)≤(Value specified with `AFCMAXV`) (Value specified with `AFCMAXV`)≤(Value specified with `MAXVCTRL`)	V

- Query Response

{*numeric*} <new line><^END>

AFCSENS␣<*numeric*>

Specifies the DUT's approximate tuning sensitivity. This value is for use with the automatic frequency control function. (`SENSITIVITY` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−1000000000 to −100 and 100 to 1000000000	Hz/V

- Query Response

{*numeric*} <new line><^END>

AFCTARG␣<*numeric*>

Specifies the target frequency. This value is for use with the automatic frequency control function. (`TARGET` under (Menu).)

Parameter	Range	Unit
<*numeric*>	10E6 to 3E9 (4352B only)	Hz
	Frequency band min to Frequency band max (when 43521A is used)	Hz

- Query Response

{*numeric*} <new line><^END>

AFCTOL␣<*numeric*>

Specifies the allowable difference (frequency resolution) between the target frequency and the actual setting frequency in the automatic frequency control function. (`TOLERANCE` under (Menu).)

Parameter	Range	Unit
<*numeric*>	2000 to 2000000	Hz

■ Query Response

{*numeric*} <new line><^END>

AVER␣{OFF|0|ON|1}

Turns the Averaging function ON or OFF. (`AVERAGING on OFF` under (Bw/Avg) key.)

Parameter	Description
`OFF` or `0`	Averaging function OFF
`ON` or `1`	Averaging function ON

■ Query Response

{0|1} <new line><^END>

AVERFACT␣<*numeric*>

Specifies the averaging factor (number of times for averaging) for the averaging function. (`AVERAGING FACTOR` under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	1 to 999 (when the measurement item sets frequency, power, or DCI)	
	1, 2, 4, . . . , 256 (when the measurement item sets FM Deviation)	
	1, 2, 4, . . . , 4096 (when the measurement item sets C/N)	

■ Query Response

{*numeric*} <new line><^END>

AVERREST

Resets the averaging function to restart the count from the next measurement. (`AVERAGING RESTART` under (Bw/Avg) key. No Query.)

CNBW␣<*numeric*>

Sets the converted noise bandwidth at the C/N Ratio measurement. (NOISE BW under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	1 to 1000000	Hz

- Query Response

{*numeric*} <new line><^END>

CNOFREQ␣<*numeric*>

Sets the offset from the carrier frequency for the noise measurement at the C/N Ratio measurement. (OFFSET FREQ under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	100 to 10000000	Hz

- Query Response

{*numeric*} <new line><^END>

CONT

Sets the trigger mode to the Automatic Continuous mode. In this mode, a measured value is updated at every trigger. (CONTINUOUS under (Trigger) key.)

- Query Response

{0|1} <new line><^END>

CTRLDLY␣<*numeric*>

Sets the wait time required for the DUT response until the DUT's RF output signal is stable after changing the control voltage. (CTRL DELAY under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	10E−3 to 1	sec

- Query Response

{*numeric*} <new line><^END>

CTRLVCAL

Performs DC control voltage calibration. (EXECUTE CTRLV CAL under DC Control key. No Query)

CTRLVCORR␣{OFF|0|ON|1}

Enables or disables the compensation obtained from the DC control voltage calibration. (CTRLV CORR on OFF under DC Control key.)

Parameter	Description
OFF or 0	compensation OFF
ON or 1	compensation ON

- Query Response

  {0|1} <new line><^END>

DATGAIN␣<*numeric*>

Defines the gain value for the data math function. (GAIN under Display key.)

Parameter	Range	Unit
<*numeric*>	−100 to 100 (except 0)	

- Query Response

  {*numeric*} <new line><^END>

DATMEM

Stores the current measurement data into the memory. (DATA→MEMORY under Display key. No Query.)

- Example

```
OUTPUT 717;"DATMEM"
```

DATOVAL␣<*numeric*>

Defines the offset value of a data math function. (OFFSET under Display key.)

Parameter	Range	Unit
<*numeric*>	−15E9 to 15E9	

- Query Response

  {*numeric*} <new line><^END>

DATOVAL␣<*numeric*>

DEFGO

Reverts the gain and offset values to the default values. (gain = 1, offset = 0). This is for use with a data math function. (`DEFAULT GAIN & OFS` under (Display) key. No Query.)

- Example

```
OUTPUT 717;"DEFGO"
```

DEVCAL

Performs the FM Deviation calibration and sets a calibration factor inside the 4352B. Performs this function only once for the same measurement conditions. (`EXECUTE DEV CAL` under (Menu) key. No Query.)

DEVCALF?␣<*numeric*>

Outputs the calibration factor of the FM Deviation. (Query Only.)

- Query Response

{*numeric*} <new line><^END>

DEVCORR␣{OFF|0|ON|1}

Switches the calibration ON/OFF for the FM Deviation measurement values. (`DEV CORR on OFF` under (Menu) key.)

Parameter	Description
OFF or 0	FM Deviation calibration OFF
ON or 1	FM Deviation calibration ON

- Query Response

{0|1} <new line><^END>

DEVRNG␣{DV200KHZ|DV20KHZ|DV2KHZ}

Sets the FM Deviation range. (`FM DEV RNG:200kHz`, `20kHz`, `2kHz` under the (Sense Range) key.)

Parameter	Description
DV200KHZ	Sets the FM Deviation range to 200 kHz (peak value).
DV20KHZ	Sets the FM Deviation range to 20kHz (peak value).
DV2KHZ	Sets the FM Deviation range to 2 kHz (peak value).

- Query Response

{DV200KHZ|DV20KHZ|DV2KHZ} <new line><^END>

DHOLD␣{OFF|MAX|MIN}

Selects the data hold operation. When you change the parameter, the currently held data is reset. (`HOLD: OFF`, `MAX`, or `MIN` under (Display) key.)

Parameter	Description
OFF	Data Hold function OFF
MAX	Maximum data hold
MIN	Minimum data hold

- Query Response

  {OFF|MAX|MIN} <new line><^END>

- Example

```
OUTPUT 717;"DHOLD MAX"

OUTPUT 717;"DHOLD?"
ENTER 717;A$
```

DISP␣{DATA|MEMO|DATM}

Selects the type of measurement value to be displayed. (`DISPLAY: DATA`, `MEMORY`, or `DATA & MEMORY` under (Display) key.)

Parameter	Description
DATA	Current measurement value
MEMO	Memory
DATM	Current measurement value and memory

- Query Response

  {DATA|MEMO|DATM} <new line><^END>

- Example

```
OUTPUT 717;"DISP DATA"
```

DNCONV␣{OFF|0|ON|1}

Turns the downconverter ON or OFF. Set this command to ON to connect the 43521A (downconverter unit) to the 4352B for measurements. (`DOWNCONV on OFF` under (RF/LO) key)

Parameter	Description
OFF or 0	Downconverter is not used
ON or 1	Downconverter is used

- Query Response

  {0|1} <new line><^END>

DTHPF␣{FC50HZ|FC300HZ}

Sets the low frequency cutoff for the FM Deviation detection bandwidth. (HP FILTER:50Hz, 300Hz under (Bw/Avg) key.)

Parameter	Description
FC50HZ	Sets the low frequency cutoff for the FM Deviation detection bandwidth to 50 Hz.
FC300HZ	Sets the low frequency cutoff for the FM Deviation detection bandwidth to 300 Hz.

- Query Response

  {FC50HZ|FC300HZ} <new line><^END>

DTLPF␣{FC3KHZ|FC15KHZ|FC20KHZ}

Sets the high frequency cutoff for the FM Deviation detection bandwidth. (LP FILTER:3kHz, 15kHz, 20kHz under (Bw/Avg) key.)

Parameter	Description
FC3KHZ	Sets the high frequency cutoff for the FM Deviation detection bandwidth to 3 kHz.
FC15KHZ	Sets the high frequency cutoff for the FM Deviation detection bandwidth to 15 kHz.
FC20KHZ	Sets the high frequency cutoff for the FM Deviation detection bandwidth to 20 kHz.

- Query Response

  {FC3KHZ|FC15KHZ|FC20KHZ} <new line><^END>

FBAND␣<*numeric*>

Selects measurement frequency band when you use the 43521A (Down Converter Unit). You can select a desired band when ON is selected for DNCONV␣{OFF|0|ON|1}. You cannot use this command if you do not use the 43521A together with the 4352B. (FREQ BAND [xx-xx] under (Meas))
A total of 6 different frequency bands is available to choose from as shown below.

Band Number<numeric>	Selected Band
1	10MHz to 3GHz
2	2.5GHz to 3.6GHz
3	3.1GHz to 6.6GHz
4	5.4GHz to 9.0GHz
5	2.4GHz to 6.6GHz
6	5.4GHz to 12.6GHz

Parameter	Range	Unit
<*numeric*>	1 to 6	None

- Query Response

{*numeric*} <new line><^END>

FCOUN␣{RES1KHZ|RES64KHZ}

Sets the resolution for the frequency measurement. (FREQ RES: 1 kHz, 64 kHz under (Sense Range) key.)

Parameter	Description
RES1KHZ	Sets the frequency resolution to 1 kHz.
RES64KHZ	Sets the frequency resolution to 64 kHz.

- Query Response

{RES1KHZ|RES64KHZ} <new line><^END>

HOLD

Holds the trigger and cancels the update of measurement value display. (TRIGGER:HOLD under (Trigger) key.)

- Query Response

{0|1} <new line><^END>

Parameter	Description
0	Updating the display (unhold mode)
1	In the Hold mode

INPUDATA␣<*numeric*>

Inputs data to the 4352B and displays data instead of the measurement value. (No Query.)

- Example

```
OUTPUT 717;"INPUDATA ";A
```

LCOMP␣{OFF|0|ON|1}

Turns the measurement cable loss compensation function ON or OFF. It is valid for RF Power Level measurement only. (COMPEN on OFF under (Menu) key.)

Parameter	Description
OFF or 0	Measurement cable loss compensation function OFF
ON or 1	Measurement cable loss compensation function ON

- Query Response

{0|1} <new line><^END>

LOAUTO␣{OFF|ON|0|1}

Turns the automatic control function for the external signal generator (local signal) ON or OFF. (LO CONTROL auto MAN under (RF/LO) key.)

Parameter	Description
OFF or 0	Automatic Control function OFF
ON or 1	Automatic Control function ON

- Query Response

{0|1} <new line><^END>

LOFREQ?

Outputs the frequency (Hz) that must be set to the external signal generator in relation to the current carrier frequency. (Query Only.)

- Query Response

{*numeric*} <new line><^END>

LOSS␣<*numeric*>

Specifies the cable loss at DC (0 Hz) level. It is valid for RF Power Level measurement only. (LOSS under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−20 to +20	dB

- Query Response

{*numeric*} <new line><^END>

LOSWT␣<*numeric*>

Specifies the wait time required for the signal from the external signal generator gets stable after the frequency setup of the external signal generator is completed. (LO SWTCH TIME under (RF/LO) key.)

Parameter	Range	Unit
<*numeric*>	0 to 1	sec

- Query Response

{*numeric*} <new line><^END>

MATH␣{DATA|DPLM|DMNM|DDVM}

Sets the Data Math function. (`DATA MATH: DATA`, `DATA+MEM`, `DATA-MEM`, `DATA/MEM` under (Display) key.)

Parameter	Description
DATA	All Data Math functions are OFF
DPLM	"data" + "memory"
DMNM	"data" − "memory"
DDVM	"data" ÷ "memory"

- Query Response

  {DATA|DPLM|DMNM|DDVM} <new line><^END>

- Example

```
OUTPUT 717;"MATH DATA"
```

MAXVCTRL␣<*numeric*>

Specifies the maximum value for the DC control voltage to protect the DUT from excess voltage. (`MAX CTRL VOLTAGE` under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Query Response

  {*numeric*} <new line><^END>

MEAS␣{POWE|FREQ|CURR|FMDEV|CN}

Selects the measurement item. (`MEAS: RF POWER`, `FREQUENCY`, `DC POWER CURRENT`, `FM DEVIATION`, `C/N` under (Meas) key.)

Parameter	Description
POWE	Selects the RF Power Level measurement.
FREQ	Selects the Frequency measurement.
CURR	Selects the DC Power Current measurement.
FMDEV	Selects the FM Deviation measurement.
CN	Selects the C/N Ratio measurement.

- Query Response

  {POWE|FREQ|CURR|FMDEV|CN} <new line><^END>

MINVCTRL␣<*numeric*>

Specifies the minimum value for the DC control voltage to protect the DUT from excess voltage. (`MIN CTRL VOLTAGE` under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Query Response

  {*numeric*} <new line><^END>

MODAMP␣<*numeric*>

Sets the amplitude of the modulation signal. (`MOD AMPLITUDE` under (Mod) key.)

The frequency of modulation signal is fixed to 1 kHz.

Parameter	Range	Unit
<*numeric*>	0 to 1	V_{rms}

- Query Response

  {*numeric*} <new line><^END>

MODO␣{OFF|0|ON|1}

Turns the modulation signal output ON or OFF. (`MOD OUT on OFF` under (Mod) key.)

Parameter	Description
`OFF` or `0`	Does not output the modulation signal.
`ON` or `1`	Outputs the modulation signal.

- Query Response

  {0|1} <new line><^END>

NATT␣<*numeric*>

Specifies the attenuator for the noise measurement at the C/N measurement. (`NOISE ATTEN` under (Sense Range) key.)

Parameter	Range	Unit
<*numeric*>	0, 10, 20, 30, 40	dB

- Query Response

  {*numeric*} <new line><^END>

NOMFREQ␣<*numeric*>

Type in an approximate sample oscillation frequency (nominal frequency). You can use this command when you use the 43521A Down Converter Unit and the selected frequency band is other than 10 MHz to 3 GHz. Any frequency within the band selected with FREQ <numeric> will be accepted. Make sure that the difference between the actual frequency and your estimation is no more than 200MHz. (FREQ BAND [xx-xx], NOMINAL FREQ under (Meas) key) You cannot use this command if you use the 4352B alone, or if the selected frequency band is 10 MHz to 3 GHz and you use the 43521A together with the 4352B.

Parameter	Range	Unit
<*numeric*>	Frequency band min to Frequency band max (when the 43521A is used and the selected frequency band is other than 10 MHz to 3 GHz)	GHz

- Query Response

  {*numeric*} <new line><^END>

OUTPDATA?

Outputs measurement data. (Query Only.)

- Query Response

  {*numeric*} <new line><^END>

- Example

```
OUTPUT 717;"OUTPDATA?"
ENTER 717;A
```

OUTPMEMO?

Outputs the memory data. (Query Only.)

- Query Response

  {*numeric*}<new line><^END>

- Example

```
OUTPUT 717;"OUTPMEMO?"
ENTER 717;A
```

PARM␣{OFF|0|ON|1}

Switches the measurement setting parameters display ON and OFF. (PARAMS ON off under (Display) key.)

Parameter	Description
OFF or 0	Measurement setting parameters display OFF
ON or 1	Measurement setting parameters display ON

- Query Response

  {0|1} <new line><^END>

PARM⊔{OFF|0|ON|1}

PKCONV⊔{OFF|0|ON|1}

Switches the display unit for the FM Deviation measurement. (PEAK CONV on OFF under (Format) key.)

Parameter	Description
OFF or 0	Selects Hz_{rms} (RMS) for the FM Deviation measurement
ON or 1	Selects Hz (peak value) for the FM Deviation measurement

Note

The 4352B supports only the function to measure the RMS (Hz_{rms}) of the FM Deviation. When the Hz (peak value) is selected, the displayed peak value is just the converted value derived from the RMS (Hz_{rms}).

- Query Response

  {0|1} <new line><^END>

POWUNIT⊔{DBM|DBV|DBUV|W|V}

Selects the unit for displaying measured values in RF power or spectrum measurement. (POWER UNIT:dBm, dBV, dBuV, WATT, VOLT under (Format) key.)

Parameter	Description
DBM	Sets dBm for the RF Power measurement unit.
DBV	Sets dBV for the RF Power measurement unit.
DBUV	Sets dBμV for the RF Power measurement unit.
W	Sets W for the RF Power measurement unit.
V	Sets V for the RF Power measurement unit.

- Query Response

  {DBM|DBV|DBUV|W|V} <new line><^END>

PRES

Presets the 4352B. This presets setups such as the measurement conditions to the default (initial) values. See Appendix D of the *Function Reference* for initial values. The PRES command does not preset HP instrument BASIC. ((Preset) key. No Query.)

REST

Stops the trigger and starts a measurement all over again. (MEASURE RESTART under (Trigger). No Query.)

RFATT␣<*numeric*>

Sets an input attenuator for the 4352B or 43521A (Down Converter Unit). (RF ATTEN under Sense Range key)
Sets an input attenuator for the 4352B when you use the 4352B alone, or when the 43521A is used together with the 4352B and the selected frequency band is 10 MHz to 3 GHz.

Parameter	Range	Unit
<*numeric*>	0, 5, 10, 15, 20, 25	dB

Sets an input attenuator for the 43521A when the selected frequency band is other than 10 MHz to 3 GHz while at the same time you use the 43521A together with the 4352B.

Parameter	Range	Unit
<*numeric*>	0, 5, 10, 15, 20, 25, 30, 35	dB

- Query Response

  {*numeric*} <new line><^END>

SGCMD␣<*Character String*>,<*Divider*>

Allows the 4352B to store the GPIB command to control the external signal generator. When 4 is selected for SG TYPE, the 4352B controls the external signal generator using this command.

<*Character String*> defines the GPIB command of the external signal generator for the frequency setting. The frequency setting value is determined by the 4352B. When this command is used, %f in Hz is used as a variable instead of the frequency setting value. If the GPIB command of the external signal generator must be specified with the engineering unit, use <*Divider*> to fit %f in Hz to the value in the required engineering unit.

- Example

```
OUTPUT 800;"SGCMD 'FREQ %fMHZ',1E6"
```

  If the external signal generator's GPIB command for the frequency setting is FREQ XXXMHz (XXX: Numeric), %f must be entered instead of XXX, and <*Divider*> must be specified to 1E6 for engineering unit conversion from Hz to MHz.

SGTYPE␣{1|2|3|4}

Selects the external signal generator to be used. (SG TYPE under RF/LO key)

Parameter	Description
1	Selects 8664A, 8664B
2	Selects 8657B
3	Selects 8648B, 8648C, E8241A, E8244A, E8251A, E8254A
4	User defined

- Query Response

  {1|2|3|4} <new line><^END>

SGTYPE␣{1|2|3|4}

SIGSRCH

Searches for a carrier signal sent by the DUT. Searching scope is limited to the frequency band selected with FBAND<numeric>. When a carrier is found, the frequency of the carrier will be automatically stored as nominal frequency. (`FREQ BAND [xx-xx]`, `SIGNAL SEARCH` under (Meas) key)

SING

Uses a trigger to perform a single measurement to obtain data, then returns to the hold mode. (`SINGLE` under (Trigger) key. No Query. Executable by `EXECUTE`)

When the single measurement is performed by using `EXECUTE` of Instrument BASIC, the instrument performs a measurement, then returns the control to Instrument BASIC after the measurement. That is, the program holds the execution of next statement until a measurement is completed. This method can be used as an alternative to the monitoring of measurement completion by an SRQ interrupt.

- Example

```
OUTPUT 717;"SING"
EXECUTE "SING"
```

SLOPE␣<*numeric*>

Specifies the slope used to express frequency characteristics for cable loss. It is valid for RF Power measurement only. (`SLOPE` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20	dB/GHz

- Query Response

{*numeric*} <new line><^END>

TRGP␣{POS|NEG}

Sets the polarity of the external trigger to input from the EXT TRIGGER input on the rear panel. (`TRIG PLRTY [POS|NEG]` under (Trigger) key.)

Parameter	Description
POS	The positive trigger (The signal going up from low → high will be the trigger.)
NEG	The negative trigger (The signal going down from high → low will be the trigger.)

- Query Response

{POS|NEG} <new line><^END>

TRGS␣{INT|EXT|BUS|MAN}

Selects the trigger source. (FREE RUN, EXTERNAL, GPIB, MANUAL under (Trigger) key.)

Parameter	Description
INT	Internal trigger
EXT	External trigger from BNC on the rear panel
BUS	GPIB trigger
MAN	Manual trigger

- Query Response

{INT|EXT|BUS|MAN} <new line><^END>

VA

Selects Analyzer mode as the 4352B measurement mode. (INST TYPE: VCO ANALY under (Meas) key.)

VCTRL␣<*numeric*>

Specifies the DC control voltage. (CTRL VOLTAGE under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Query Response

{*numeric*} <new line><^END>

VOUT␣{OFF|0|ON|1}

Turns the DC power and DC control voltages ON or OFF. (OUTPUT on OFF under (DC Control), OUTPUT on OFF under (DC Power) key.)

Parameter	Description
OFF or 0	DC power/control voltage output OFF
ON or 1	DC power/control voltage output ON

- Query Response

{0|1} <new line><^END>

VPOW␣<*numeric*>

Specifies the DC power voltage. (POWER VOLTAGE under (DC Power) key.)

Parameter	Range	Unit
<*numeric*>	0 to 16	V

- Query Response

  {*numeric*} <new line><^END>

10

Command Reference for Analyzer Mode

This chapter describes GPIB commands you can use in the Analyzer mode. See this chapter for information on functions available with and syntax of each of these commands. Note that some of the commands covered in this chapter are used when you use the 43521A(Down Converter Unit).

Commands given in this chapter are designed for measurements in the analyzer mode. Commands are listed in alphabetical order in this chapter.

See the *Function Reference* when you wish to search through command functions or when you need detailed information on each command.

The followings are typeface rules and definitions used in this command reference.

① → **AVER**⊔{**OFF**|**ON**|**0**|**1**}

② → Switches the averaging function to ON/OFF. (AVERAGING ON off under Bw/Avg key)

③ →

Parameter	Description
OFF or 0	Averaging function OFF
ON or 1	Averaging function ON

④ → ■ Query Response
{0|1} <new line> <^END>

⑤ → ■ Example

```
OUTPUT 717;"AVER ON"

OUTPUT 717;"AVER?"
ENTER 717;A
```

①	Command names and required parameters Letters written in bold define a command. You must type the command part exactly as printed without any space in-between. Characters can be either upper case or lower case. If the command to transfer requires a constant, one or more numbers within the defined range, or a character string, input them with a space after a command. (⊔ indicates a space.) Characters between brackets, { }, are qualifiers accepted by commands. You do not need symbols such as "|" or "{" between commands and qualifiers when you actually type . For example, {OFF|0|ON|1} indicates that you input either OFF, ON, 0, or 1, and {1-4} indicates that you input a number (1, 2, 3, or 4).
②	This is a description of command. The front panel keys and softkeys that have the same function as the command are described in parentheses. Parentheses are also used for supplemental descriptions.
③	This is a description of parameters for the sample command.
④	This is a Query response format for the sample command.
⑤	Examples (including that of Query case usage) of the sample command.

Note

If a command is invalid in specific measurement items, "ANALYZER TYPE MISMATCH" appears if you attempt to use that command for those items.

Command Reference

AFC⊔{OFF|0|ON|1}

Turns the automatic frequency control function ON or OFF. This command can be used only in phase noise or spectrum measurements. (`AFC on OFF` under (Menu) key.)

Parameter	Description
`OFF` or 0	Automatic frequency control function OFF
`ON` or 1	Automatic frequency control function ON

AFCITER⊔<*numeric*>

Sets the maximum number of times that the measurement and calculation (control voltage setting loop) are repeated. This value is for use with the automatic frequency control function. This command can be used only in phase noise or spectrum measurements. (`MAX ITERATION` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	1 to 999	

- Response to Query

  {*numeric*} <new line><^END>

AFCMAXV⊔<*numeric*>

Specifies the DC control voltage upper limit when the automatic frequency control function is used. (`AFC MAX CTRL VOLT` under (Menu) key.)

The value specified with this command is valid when the automatic frequency control function is ON. This value can be specified irrespective of the maximum DC control voltage level specified with `MAXVCTRL`. Note, also, that with the 4352B the value specified with `MAXVCTRL` has priority over that specified with this command. Therefore, a voltage level that exceeds the level specified with `MAXVCTRL` cannot be applied to the device when this command is used.

Parameter	Range	Unit
<*numeric*>	0 to 20 (-15 to 35 V with option 001) (Value specified with `AFCMINV`)≤(Value specified with `AFCMAXV`) (Value specified with `AFCMAXV`)≤(Value specified with `MAXVCTRL`)	V

- Response to Query

  {*numeric*} <new line><^END>

AFCMAXV␣<*numeric*>

AFCMINV␣<*numeric*>

Specifies the DC control voltage lower limit. This value is for use with the automatic frequency control function. (AFC MIN CTRL VOLT under (Menu) key.)

The value specified with this command is valid when the automatic frequency control function is ON. This value can be specified irrespective of the maximum DC control voltage level specified with MAXVCTRL. Note, also, that with the 4352B the value specified with MAXVCTRL has priority over that specified with this command. Therefore, a voltage level that exceeds the level specified with MAXVCTRL cannot be applied to the device when this command is used.

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001) (Value specified with AFCMINV)≤(Value specified with AFCMAXV) (Value specified with AFCMAXV)≤(Value specified with MAXVCTRL)	V

- Response to Query

{*numeric*} <new line><^END>

AFCSENS␣<*numeric*>

Specifies the DUT's approximate tuning sensitivity. This value is for use with the automatic frequency control function. This command can be used only in phase noise or spectrum measurements. (SENSITIVITY under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−1000000000 to −100 or 100 to 1000000000	Hz/V

- Response to Query

{*numeric*} <new line><^END>

AFCTARG␣<*numeric*>

Specifies the target frequency. This value is for use with the automatic frequency control function. This command can be used only in phase noise or spectrum measurements. (TARGET under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	10E6 to 3E9 (4352B only)	Hz
	Frequency band min to Frequency band max (4352Bwith 43521A)	Hz

- Response to Query

{*numeric*} <new line><^END>

AFCTOL␣<*numeric*>

Specifies the allowable difference (frequency resolution) between the target frequency and the actual setting frequency in the automatic frequency control function. This command can be used only in phase noise or spectrum measurements. (TOLERANCE under Menu key.)

Parameter	Range	Unit
<*numeric*>	2000 to 2000000	Hz

- Response to Query

{*numeric*} <new line><^END>

AUTO

Displays the trace on the optimum scale. (AUTO SCALE under Display key.)

AVER␣{OFF|0|ON|1}

Turns the trace averaging function ON or OFF. (AVERAGING on OFF under Bw/Avg key.)

Parameter	Description
OFF or 0	Averaging function OFF
ON or 1	Averaging function ON

- Response to Query

{0|1} <new line><^END>

AVERFACT␣<*numeric*>

Specifies the averaging factor (number of times for averaging) for use with the trace averaging function. (AVERAGING FACTOR under Bw/Avg key.)

Parameter	Range	Unit
<*numeric*>	1 to 999	

- Response to Query

{*numeric*} <new line><^END>

AVERREST

Resets the trace averaging function to restart the count from the next measurement. (AVERAGING RESTART under Bw/Avg key. No Query.)

BEEPFAIL␣{OFF|0|ON|1}

Turns the limit fail beeper ON or OFF. Turning this beeper ON when the limit test function is ON allows the beeper to sound each time the limit test result is not acceptable. (BEEP FAIL on OFF under (System) key.)

Parameter	Description
OFF or 0	Limit fail beeper OFF
ON or 1	Limit fail beeper ON

- Response to Query

  {0|1} <new line><^END>

BW␣<*numeric*>

Specifies the resolution bandwidth. You can use this command when you have selected linear sweep for phase noise measurement or when you have selected spectrum measurement. (RES BW under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	1, 3, 10, 30, 100, 300, 1k, 3k (phase noise linear sweep, spectrum)	Hz

- Response to Query

  {*numeric*} <new line><^END>

CARRCENT

Specifies the frequency of the signal at the highest level (carrier) between 10 MHz and 3 GHz as the center value along the X-axis. This command can be used only in spectrum measurements. (CARRIER→CENTER under (Menu) key.)

CARR2CENT

Specifies the frequency twice that of the signal at the highest level (carrier) between 10 MHz and 1.5 GHz as the center value along the X-axis. This command can be used only in spectrum measurements. (2×CARR→CENTER under (Menu) key.)

CARR3CENT

Specifies the frequency three times that of the signal at the highest level (carrier) between 10 MHz and 1.0 GHz as the center value along the X-axis. This command can be used only in spectrum measurements. (3×CARR→CENTER under (Menu) key.)

CARR?

Outputs the carrier frequency measured in phase noise measurements. (Query Only.)

- Response to Query

  {*numeric*} <new line><^END>

CENT␣<*numeric*>

Specifies the sweep center value. You cannot use this command when you have selected linear sweep for phase noise measurement or when you have selected frequency transient measurement. (`CENTER` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	(Sweep stop value + Sweep start value)÷2 (RF power, Frequency/tuning sensitivity)	V
	(Sweep stop value + Sweep start value) ÷2 (phase noise linear sweep, spectrum)	Hz
	Invalid (phase noise log sweep, frequency transient)	

- Response to Query

  {*numeric*} <new line><^END>

CLRSMKRS

Clears the submarker. (`CLEAR SUB MKRS` under (Menu) key.)

CNBW␣<*numeric*>

Specifies the noise bandwidth. This command can be used only in phase noise measurements. (`NOISE BW` under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	1 to 1000000	Hz

- Response to Query

  {*numeric*} <new line><^END>

CNPLL␣{AUTO|WIDE}

Specifies whether to automatically reduce the built-in 2nd PLL bandwidth to 200 Hz if an offset frequency below 5 kHz is specified in phase noise measurements. (`NOISE PLL AUTO wide` under (Bw/Avg) key.)

Parameter	Description
AUTO	Sets the 2nd PLL bandwidth to AUTO.
WIDE	Keeps the 2nd PLL bandwidth WIDE, even if an offset frequency is specified below 5 kHz.

- Response to Query

  {AUTO|WIDE} <new line><^END>

CNPLL␣{AUTO|WIDE}

CONT

Selects the automatic continuous sweep mode. In this mode, the measurement trace is updated for every sweep. (CONTINUOUS under (Trigger) key.)

- Response to Query

  {0|1} <new line><^END>

CTRLDLY␣<*numeric*>

Sets the wait time required for the DUT response until the DUT's RF output signal is stable after changing the control voltage. (CTRL DELAY under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	10E−3 to 1	sec

- Response to Query

  {*numeric*} <new line><^END>

CTRLVCAL

Performs DC control voltage calibration. (EXECUTE CTRLV CAL under (DC Control) key. No Query)

CTRLVCORR␣{OFF|0|ON|1}

Enables or disables the compensation obtained from the DC control voltage calibration. (CTRLV CORR on OFF under (DC Control) key.)

Parameter	Description
OFF or 0	compensation OFF
ON or 1	compensation ON

- Query Response

  {0|1} <new line><^END>

DATGAIN␣<*numeric*>

Defines the gain for use with the data math function. (GAIN under (Display) key.)

Parameter	Range	Unit
<*numeric*>	−100 to 100 (0 not included)	

- Response to Query

  {*numeric*} <new line><^END>

DATLIML

Stores the data trace as the lower limit trace. (DATA—LOWER under (System) key. No Query.)

DATLIMU

Stores the data trace as the upper limit trace. (DATA—UPPER under (System) key. No Query.)

DATMEM

Stores the data trace as the memory trace. (DATA—MEMORY under (Display) key. No Query.)

- Example

```
OUTPUT 717;"DATMEM"
```

DATOVAL␣<*numeric*>

Defines the offset for use with the data math function. (OFFSET under (Display) key.)

Parameter	Range	Unit
<*numeric*>	−15E9 to 15E9	

- Response to Query

{*numeric*} <new line><^END>

DEFGO

Sets the gain and offset values to the default values (gain = 1, offset = 0). This is for use with a data math function. (DEFAULT GAIN & OFS under (Display) key. No Query.)

- Example

```
OUTPUT 717;"DEFGO"
```

DET␣{POS|NEG|SAM}

Selects the detection mode. You can use this command when you have selected linear sweep for phase noise measurement or when you have selected spectrum measurement. (DETECTION [xxx] , DETECTION: POS PEAK , NEG PEAK , or SAMPLE under (Menu) key)

Parameter	Description
POS	Selects the positive peak mode. In this mode, the maximum value in measurement data is found. You can use this mode for spurious measurement.
NEG	Selects the negative peak mode. In this mode, the minimum value in measurement data is found. You can use this mode for spurious measurement.
SAM	Select the sample mode. You can use this mode for noise measurement.

- Response to Query

{POS|NEG|SAM} <new line><^END>

DET␣{POS|NEG|SAM}

DHOLD␣{OFF|MAX|MIN}

Selects the data hold operation. When you change the parameter, the current held data is reset. (HOLD: OFF, MAX, MIN under (Display) key.)

Parameter	Description
OFF	Data hold operation OFF
MAX	Maximum data hold.
MIN	Minimum data hold.

- Response to Query

  {OFF|MAX|MIN} <new line><^END>

- Example

```
OUTPUT 717;"DHOLD MAX"
```

```
OUTPUT 717;"DHOLD?"
ENTER 717;A$
```

DISP␣{DATA|MEMO|DATM}

Selects the trace to be displayed. (DISPLAY: DATA, MEMORY, DATA & MEMORY under (Display) key.)

Parameter	Description
DATA	Currently measured value (data trace)
MEMO	Memory trace
DATM	Data and memory traces

- Response to Query

  {DATA|MEMO|DATM} <new line><^END>

- Example

```
OUTPUT 717;"DISP DATA"
```

DMKR␣{ON|FIX|TRAC|OFF}

Displays the Δ marker where the marker is currently displayed and turns the Δ marker mode ON (ON, FIX, TRAC), or turns the Δ marker off and turns the Δ mode OFF. (ΔMKR, FIXED ΔMKR, TRACKING ΔMKR, ΔMODE OFF under (Menu) key.)

Parameter	Description
ON	Displays the Δ marker where the marker is currently displayed.
FIX	Displays the Δ marker where the marker is currently displayed and keeps the Δ marker fixed at that position.
TRAC	Displays the Δ marker where the marker is currently displayed and turns ON the tracking Δ marker function.
OFF	Turns OFF the Δ marker mode.

- Response to Query

  {ON|FIX|TRAC|OFF} <new line><^END>

- Example

```
OUTPUT 717;"DMKR ON"
```

DMKRPRM␣<*numeric*>

Specifies the Δ marker reading along the X-axis when ON or FIX is selected for DMKR. (ΔMKR SWP PARAM under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	Start value to stop value	Hz (Frequency) dBm (Power)

- Response to Query

  {*numeric*} <new line><^END>

DNCONV␣{OFF|0|ON|1}

Turns the downconverter ON or OFF. Set this command to ON to connect the 43521A (downconverter unit) to the 4352B for measurements. (DOWNCONV on OFF under (RF/LO) key)

Parameter	Description
OFF or 0	Downconverter not connected to 4352B
ON or 1	Downconverter connected to 4352B

- Response to Query

  {0|1} <new line><^END>

DMKRVAL␣<*numeric*>

Specifies the Δ marker reading along the Y-axis when FIX is selected for DMKR. (FIXED ΔMKR VALUE under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−500000 to 500000	

- Response to Query

  {*numeric*} <new line><^END>

EXDATLIML

Replaces the data trace with the lower limit trace.(DATA←LOWER under (System) key. No Query.)

EXDATLIML

EXDATLIMU

Replaces the data trace with the upper limit trace. (DATA↔UPPER under (System) key. No Query.)

FBAND␣<*numeric*>

Selects a frequency band when you use the 43521A (Down Converter Unit) together with the 4352B. Note that you can select a frequency band only when you have selected ON for DNCONV␣{OFF|0|ON|1}. You cannot use this command when you use the 4352B alone. (FREQ BAND [xx-xx] under (Meas))
A total of 6 different frequency bands is available to choose from as shown below.

Band Number<numeric>	Selected Band
1	10MHz to 3GHz
2	2.5GHz to 3.6GHz
3	3.1GHz to 6.6GHz
4	5.4GHz to 9.0GHz
5	2.4GHz to 6.6GHz
6	5.4GHz to 12.6GHz

Parameter	Range	Unit
<*numeric*>	1 to 6	None

- Response to Query

{*numeric*} <new line><^END>

FCOUN␣{RES1KHZ|RES64KHZ}

Specifies the frequency resolution. This command can be used in frequency/tuning sensitivity measurements. (FREQ RES: 1kHz, 64kHz under (Sense Range) key.)

Parameter	Description
RES1KHZ	Specifies 1 kHz as frequency resolution.
RES64KHZ	Specifies 64 kHz as frequency resolution.

- Response to Query

{RES1KHZ|RES64KHZ} <new line><^END>

HOLD

Holds the data trace on the screen, and stops sweep and data input. (SWEEP: HOLD under (Trigger) key.)

- Response to Query

{0|1} <new line><^END>

Parameter	Description
0	Sweep in progress (non-hold mode)
1	Hold mode

INPUDATA␣*<numeric(1)>*,*<numeric(2)>*, ... *<numeric(n)>*

Inputs data to the 4352B trace data array, and displays the data instead of the measurement values. (No Query.)

- Example

```
DIM A(1:201)
OUTPUT 717;"INPUDATA ";A(*)
```

INPULIML␣*<numeric(1)>*,*<numeric(2)>*, ... *<numeric(n)>*

Specifies the lower limit trace. (No Query.)

Parameter	Range	Unit
<numeric>	−500000 to 500000	

- Example

```
DIM A(1:100)
OUTPUT 717;"INPULIML ";A(*)
```

INPULIMU␣*<numeric(1)>*,*<numeric(2)>*, ... *<numeric(n)>*

Specifies the upper limit trace. (No Query.)

Parameter	Range	Unit
<numeric>	−500000 to 500000	

- Example

```
DIM A(1:100)
OUTPUT 717;"INPULIMU ";A(*)
```

INTGNOIS?

Returns noise integration results. Note that you can use this command only when you have selected LINF for SWPT␣{LOGF|LINF} and ON for MEAINOIS{OFF|0|ON|1}.

- Response to Query

{0|1} <new line><^END>

INTGNOIS?

LCOMP␣{OFF|0|ON|1}

Turns the measurement cable loss compensation function ON or OFF. This function is used to compensate for losses on cables. This command can be used in RF power measurements. (`COMPEN on OFF` under (Menu) key.)

Parameter	Description
OFF or 0	Measurement cable loss compensation function OFF
ON or 1	Measurement cable loss compensation function ON

- Response to Query

  {0|1} <new line><^END>

LIMCLEL

Clears the specified upper and lower limit traces. (Resets these traces to $1.0E^{10}$, $-1.0E^{10}$.) (`CLEAR LIMIT` under (System) key. No Query.)

LIMILINE␣{OFF|0|ON|1}

Turns the limit line display ON or OFF. (`LIMIT LINE on OFF` under (System) key.)

Parameter	Description
OFF or 0	Limit line display OFF
ON or 1	Limit line display ON

- Response to Query

  {0|1} <new line><^END>

- Example

```
OUTPUT 717;"LIMILINE ON"
```

LIMISTAT?

Returns limit test results. (`PASS` is returned when measured values on all points are acceptable. `FAIL` is returned if at least a value on one of the points is not acceptable. `Not Done` is returned if the limit test function is OFF.)

- Response to Query

  {−1|(Not Done) 0|(Fail) 1|(Pass)} <new line><^END>

LIMITEST␣{OFF|0|ON|1}

Turns the limit test function ON or OFF. (`LIMIT TEST on OFF` under (System) key.)

Parameter	Description
OFF or 0	Limit test function OFF
ON or 1	Limit test function ON

- Response to Query

  {OFF|ON} <new line><^END>

LIMSECT␣*<Param1>*, *<UpLmt1>*, *<LowLmt1>*, *<Param2>*, *<UpLmt2>*, *<LowLmt2>*

Specifies each of the upper and lower limit traces as a line segment drawn by connecting 2 points (Param1, Param2) along the X-axis. Each limit trace drawn between 2 points undergoes linear interpolation based on the given pairs of upper limits (UpLmt1, UpLmt2) and lower limits (LowLmt1, LowLmt2). (`START: PARAM`, `START: UPPER LIMIT`, `START: STOP LIMIT`, `STOP: PARAM`, `STOP: UPPER LIMIT`, `STOP: LOWER LIMIT` under (System) key.)

Parameter	Description
<Param1>, *<Param2>*	Start value (determined by current measurement item) to stop value

- Example

```
FOR I=1 TO Lmt_n-1
OUTPUT @Hp4352;";LIMSECTN ";
  Lmt_pr(I),Lmt_up(I),Lmt_lw(I),Lmt_pr(I+1),Lmt_up(I+1),Lmt_lw(I+1)
NEXT I
```

Note If Param1 > Param2, the two values are automatically switched.

LIMSECTN␣*<ParamN1>*, *<UpLmt1>*, *<LowLmt1>*, *<ParamN2>*, *<UpLmt2>*, *<LowLmt2>*

This command functions identically to `LIMSECT` except that numbers of 2 sweep point must be specified in place of 2 values along the X-axis.

Parameter	Description
<Param1>, *<Param2>*	1 to specified number of measurement points

Note If Param1 > Param2, the two values are automatically switched.

LOAUTO␣{OFF|0|ON|1}

Turns the automatic control function for external signal generator (local signal) ON or OFF. (LO CONTROL auto MAN under RF/LO key.)

Parameter	Description
OFF or 0	Automatic control function OFF
ON or 1	Automatic control function ON

- Response to Query

{0|1} <new line><^END>

LOFREQ?

Outputs the frequency (Hz) that must be sent to the external signal generator in relation to the current carrier frequency. (Query Only.)

- Response to Query

{*numeric*} <new line><^END>

LOSS␣<*numeric*>

Specifies the cable loss at DC (0 Hz) level. This command can be used in RF power measurements. (LOSS under Menu key.)

Parameter	Range	Unit
<*numeric*>	−20 to +20	dB

- Response to Query

{*numeric*} <new line><^END>

LOSWT␣<*numeric*>

Specifies the wait time required for the signal from the external signal generator to become stable after the frequency setup of the external signal generator is completed. (LO SWTCH TIME under RF/LO key.)

Parameter	Range	Unit
<*numeric*>	0 to 1	sec

- Response to Query

{*numeric*} <new line><^END>

MAXVCTRL␣<*numeric*>

Specifies the maximum DC control voltage level to protect the target device from excess voltage. (MAX CTRL VOLTAGE under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Response to Query

  {*numeric*} <new line><^END>

MEAINOIS␣{OFF|0|ON|1}

Turns noise integration ON or OFF for phase noise measurement. When you select ON, measured noise value will be integrated and displayed. You can use this command for linear sweep. When you select OFF for PARS {OFF|0|ON|1}, measured values on the entire on-screen trace will be integrated. When you select ON for PARS {OFF|0|ON|1}, measured values within the marker search range will be integrated. Select SAM for DET {POS|NEG|SAM} to use this noise integration function. (MARKER, INTG NOISE on OFF under (Menu) key)

Parameter	Description
OFF or 0	Noise integration function OFF
ON or 1	Noise integration function ON

- Response to Query

  {0|1} <new line><^END>

MEAS␣{POWE|FREQ|NOIS|TRAN|SPEC}

Selects a measurement item. (ANALY: RF POWER, FREQUENCY, PHASE NOISE, RF TRANSIENT, SPECTRUM under (Meas) key.)

Parameter	Description
POWE	RF power vs. DC control voltage (Tuning voltage) characteristic measurement.
FREQ	Frequency/tuning sensitivity vs. DC control voltage (Tuning voltage) characteristic measurement.
NOIS	Phase noise vs. offset frequency characteristic measurement.
TRAN	Frequency transient measurement
SPEC	Spectrum measurement

- Response to Query

  {POWE|FREQ|NOIS|TRAN|SPEC} <new line><^END>

MINVCTRL␣<*numeric*>

Specifies the minimum value for the DC control voltage to protect the DUT from excess voltage. (`MIN CTRL VOLTAGE` under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Query Response

  {*numeric*} <new line><^END>

MKR␣{OFF|0|ON|1}

Turns the marker ON (active) or OFF (inactive). When `OFF` is selected, the marker, submarker, and Δ marker are all OFF.

Parameter	Description
`OFF` or 0	Marker function OFF
`ON` or 1	Marker function ON

- Response to Query

  {0|1} <new line><^END>

MKRCENT

Specifies the marker reading as the sweep parameter center value and determines the span with this value at the center. This command cannot be used in phase noise measurements. (`MKR→CENTER` under (Menu) key. No Query.)

MKRCONT␣{OFF|0|ON|1}

Switches between the interpolate and non-interpolate marker modes. (`MKR [ ]` under (Menu) key.)

Parameter	Description
`OFF` or 0	Non-interpolate marker mode
`ON` or 1	Interpolate marker mode

- Response to Query

  {0|1} <new line><^END>

MKRL␣{OFF|0|ON|1}

Turns the marker list function ON or OFF. (`MKR LIST ON off` under (Utility) key.)

Parameter	Description
OFF or 0	Marker list function OFF
ON or 1	Marker list function ON

- Response to Query

{0|1} <new line><^END>

MKRO␣{DATA|MEMO}

Selects whether to use the marker on the data or memory trace. (`MKR ON [DATA]` under (Menu) key.)

Parameter	Description
DATA	Data trace
MEMO	Memory trace

- Response to Query

{DATA|MEMO} <new line><^END>

MKRP␣<*numeric*>

Moves the marker to the specified measurement point.

Parameter	Description
<*numeric*>	1 to specified number of measurement points (NOP)

- Response to Query

{*numeric*} <new line><^END>

MKRPRM␣<*numeric*>

Specifies the value along the X-axis and moves the marker to that position. This command can be used when the marker function is ON.

Parameter	Range	Unit
<*numeric*>	Start value to stop value	Hz(Frequency), dBm(Power)

- Response to Query

{*numeric*} <new line><^END>

MKRPRM␣<*numeric*>

MKRPRM?

Outputs the value along the X-axis of the marker reading.

- Response to Query

  {*numeric*} <new line><^END>

MKRREF

Specifies the absolute value (value that does not affect the Δ marker) of the marker reading as the reference value. (`MKR→REFERENCE` under (Display) key. No Query.)

MKRSTAR

Specifies the value along the X-axis of the marker reading as the sweep parameter start value. This command cannot be used in phase noise measurements. (`MKR→START` under (Menu) key. No Query.)

MKRSTOP

Specifies the value along the X-axis of the marker reading as the sweep parameter stop value. This command cannot be used in phase noise measurements. (`MKR→STOP` under (Menu) key. No Query.)

MKRTHRE

Specifies the value along the Y-axis of the marker reading as the threshold value for peak definition. (`MKR→THRESHOLD` under (Search) key. No Query.)

MKRVAL?

Outputs the value along the Y-axis of the marker reading.

- Response to Query

  {*numeric*} <new line><^END>

- Example

  OUTPUT 717; "MKRVAL?"
  ENTER 717;A

MKRVCTRL

Specifies the value along the X-axis of the marker reading as the control voltage level (tuning voltage level). This command is useful when you wish to determine a control voltage level with the marker in one measurement item for use with other measurement items. This command can be used, for example, in RF power or frequency measurement in which a control voltage is used for the sweep. (`MKR→CTRL VOLT` under (DC CONTROL) key.)

MODAMP␣<*numeric*>

Specifies the value along the Y-axis for a modulated signal. (MOD AMPLITUDE under (Mod) key.)

The frequency of the modulated signal is fixed to 1 kHz.

Parameter	Range	Unit
<*numeric*>	0 to 1	V_{rms}

- Response to Query

{*numeric*} <new line><^END>

MODO␣{OFF|0|ON|1}

Turns the modulated signal output ON or OFF. (MOD OUT on OFF under (Mod) key.)

Parameter	Description
OFF or 0	Does not output modulated signal.
ON or 1	Outputs modulated signal.

- Response to Query

{0|1} <new line><^END>

NATT␣<*numeric*>

Specifies the attenuation for determining noise level. This command can be used only in phase noise measurements. (NOISE ATTEN under (Sense Range) key.)

Parameter	Range	Unit
<*numeric*>	0, 10, 20, 30, 40	dB

- Response to Query

{*numeric*} <new line><^END>

NOMFREQ␣<*numeric*>

Type in an approximate sample oscillation frequency (nominal frequency). You can use this command when you use the 43521A Down Converter Unit and the selected frequency band is other than 10 MHz to 3 GHz. Any frequency within the band selected with FREQ <numeric> will be accepted. Make sure that the difference between the actual frequency and your estimation is no more than 200MHz. (FREQ BAND [xx-xx] , NOMINAL FREQ under (Meas) key) You cannot use this command if you use the 4352B alone, or if the selected frequency band is 10 MHz to 3 GHz and you use the 43521A together with the 4352B.

Parameter	Range	Unit
<*numeric*>	Frequency band min to Frequency band max (4352B alone, or frequency band is other than 10 MHz to 3 GHz)	GHz

NOMFREQ␣<*numeric*>

- Response to Query

  {*numeric*} <new line><^END>

OUTPDATA?

Outputs the data trace. (Query Only.)

- Response to Query

  {*numeric (1)*} {*numeric (2)*} . . . {*numeric (n)*} <new line><^END> (n=Number of measurement points displayed)

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPDATA?"
ENTER 717;A(*)
```

OUTPDATAP?␣<*Integer*>

Outputs the data trace for the specified measurement point. (Query Only.)

Parameter	Description
<*Integer*>	1 to specified number of measurement points (1 is selected if a value equal to or below 0 is specified. If a value greater than the total number of points is specified, this specified value is selected.)

- Response to Query

  {*Integer*} <new line><^END>

- Example

```
OUTPUT 717;"OUTPDATAP? 1"
ENTER 717;A
```

OUTPDMKR?

Outputs both the value along the Y-axis and the value along the X-axis of the Δ marker. (Query Only.)

- Response to Query

  {*numeric (Value along the Y-axis)*} {*numeric (Value along the X-axis)*} <new line><^END>

- Example

```
OUTPUT 717;"OUTPDMKR?"
ENTER 717;A,B
```

OUTPSMKR{1-4}?

Outputs both the value along the Y-axis and the value along the X-axis of the sub-marker. (Query Only.)

- Response to Query

  {*numeric (Value along the Y-axis)*} {*numeric (Value along the X-axis)*} <new line><^END>

OUTPLIML?

Outputs the lower limit trace data. (Query Only.)

- Response to Query

  {*numeric (1)*}{*numeric (2)*} ... {*numeric (n)*}<new line><^END>(n=number of measurement points displayed)

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPLIML?"
ENTER 717;A(*)
```

OUTPLIMRES?

Returns the limit test results for all measurement points. (Query Only.)

- Response to Query

  {−1|(Not Done) 0|(Fail) 1|(Pass)}. . . . {−1|(Not Done) 0|(Fail) 1|(Pass)}<new line><^END>

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPLIMRES?"
ENTER 717;A(*)
```

OUTPLIMU?

Outputs the upper limit trace data. (Query Only.)

- Response to Query

  {*numeric (1)*}{*numeric (2)*} ... {*numeric (n)*}<new line><^END>(n=Number of measurement points displayed)

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPLIMRES?"
ENTER 717;A(*)
```

OUTPMEMO?

Outputs the memory trace data. (Query Only.)

- Response to Query

  {*numeric (1)*}{*numeric (2)*} ... {*numeric (n)*}<new line><^END>(n=Number of measurement points displayed)

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPMEMO?"
ENTER 717;A(*)
```

OUTPMEMOP?␣<*Integer*>

Outputs the memory trace at the specified point. (Query Only.)

Parameter	Description
<*Integer*>	1 to specified number of measurement points (1 is selected if a value equal to or below 0 is specified. If a value greater than the total number of points is specified, this specified value is selected.)

- Response to Query

  {*Integer*}<new line><^END>

- Example

```
OUTPUT 717;"OUTPMEMOP? 1"
ENTER 717;A
```

OUTPMKR?

Outputs both the value along Y-axis and the value along the X-axis of the marker. (Query Only.)

- Response to Query

  {*numeric (Value along the Y-axis)*}{*numeric (Value along the X-axis)*}<new line><^END>

- Example

```
OUTPUT 717;"OUTPMKR?"
ENTER 717;A,B
```

OUTPSWPRM?

Outputs the values along the X-axis (sweep parameter data). (Query Only.)

- Response to Query

  {*numeric (1)*}{*numeric (2)*} ... {*numeric (n)*}<new line><^END>(n=Number of measurement points displayed)

- Example

```
DIM A(1:201)
OUTPUT 717;"OUTPSWPRM?"
ENTER 717;A(*)
```

OUTPSWPRMP?␣<*Integer*>

Outputs the value along the X-axis for the specified point. (Query Only.)

Parameter	Description
<*Integer*>	1 to specified number of measurement points. (1 is selected if a value equal to or below 0 is specified. If a value greater than the total number of points is specified, this specified value is selected.)

- Response to Query

  {*Integer*} <new line><^END>
- Example

```
OUTPUT 717;"OUTPSWPRMP? 1"
ENTER 717;A
```

PARS␣{OFF|0|ON|1}

Turns the partial search for the marker search function ON or OFF. (`PART SRCH on OFF` under (Menu) key.)

Parameter	Description
OFF or 0	Partial search OFF
ON or 1	Partial search ON

- Response to Query

  {OFF|ON} <new line><^END>
- Example

```
OUTPUT 717;"PARS ON"

OUTPUT 717;"PARS?"
ENTER 717;A
```

PKDLTY␣<*numeric*>

Specifies the peak Δ value along the Y-axis for peak definition. (`PEAK DEF: ΔY` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	0 to 5×10^5	

- Response to Query

  {*numeric*} <new line><^END>

PKDLTY␣<*numeric*>

PKTHRE␣{OFF|0|ON|1}

Turns ON or OFF the threshold for peak definition. (THRESHOLD on OFF under (Menu) key.)

Parameter	Description
OFF or 0	Threshold OFF
ON or 1	Threshold ON

- Response to Query

{OFF|ON} <new line><^END>

PKTHVAL␣<*numeric*>

Specifies the threshold for peak definition. (THRESHOLD VALUE under MKR SEARCH (Marker Search Menu) under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−500 to 500	dB
	$-3e^9$ to $3e^9$	Others

- Response to Query

{*numeric*} <new line><^END>

POIN␣<*numeric*>

Specifies the number of measurement points. In spectrum measurement, this command can be used only to query the 4352B for this number, and not to specify it. (NUMBER of POINTS under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	2 to 801 (RF power, Frequency/tuning sensitivity, Frequency transient) A unique preset value is assigned in spectrum measurements. In the phase noise measurement, the parameter takes a unique value based on the value for SPAN.	None

POWUNIT␣{DBM|DBV|DBUV|W|V}

Selects the unit for displaying measured values in RF power or spectrum measurements. (POWER UNIT:dBm, dBV, dBuV, Watt, Volt under (Format) key.)

Parameter	Description
DBM	dBm used for displaying measured values in RF power or spectrum measurements.
DBV	dBV used for displaying measured values in RF power or spectrum measurements.
DBUV	dBμV used for displaying measured values in RF power or spectrum measurements.
W	W used for displaying measured values in RF power or spectrum measurements.
V	V used for displaying measured values in RF power or spectrum measurements.

- Response to Query

  {DBM|DBV|DBUV|W|V} <new line><^END>

PRES

Presets the 4352B. Settings, including measurement conditions, are reset to defaults after presetting. See Appendix D in the *Function Reference* for defaults. (Preset key. No Query.)

∗RST functions similarly to PRES. These commands are designed to change the 4352B settings. Note, however, that some settings are changed differently with one command from another, as shown below. See also "PRES" for more information.

Item	Command	
	∗RST	PRES
4352B settings	Defaults	Defaults
Measurement trigger	Hold mode	Continuous mode
HP IBASIC	Reset[1]	Not changed.

1 Only when the command is executed on the external controller.

PRSMKRS

Turns OFF all markers and clears all marker-related settings. (PRESET MKRS under Menu key. No Query.)

REFP␣<*Integer*>

Specifies the reference line position on the scale graph. (REFERENCE POSITION under SCALE REFERENCE (Scale Menu) under Display key.)

Parameter	Range	Unit
<*Integer*>	0 to 10	Div

REFV␣<*numeric*>

Specifies the value (reference value) at the reference line position. The measurement trace is displayed at a different location on the screen when this value is changed. (REFERENCE VALUE under SCALE REFERENCE (Scale Menu) under Display key.)

Parameter	Range
<*numeric*>	−150 to 30 (RF Power)
	−15GHz to 15GHz (Frequency/Tuning sensitivity, Frequency transient)
	−150 to 30 (Phase noise)
	−150 to 30 (Spectrum)

- Response to Query

  {*numeric*} <new line><^END>

REFV␣<*numeric*>

REST

Stops the trigger and starts a measurement all over again. (MEASURE RESTART under Trigger key. No Query.)

RFATT␣<*numeric*>

Sets an input attenuator for the 4352B or 43521A (Down Converter Unit). (RF ATTEN under Sense Range key)
Sets an input attenuator for the 4352B when you use the 4352B alone, or when the 43521A is used together with the 4352B and the selected frequency band is 10 MHz to 3 GHz.

Parameter	Range	Unit
<*numeric*>	0, 5, 10, 15, 20, 25	dB

Sets an input attenuator for the 43521A when the selected frequency band is other than 10 MHz to 3 GHz while at the same time you use the 43521A together with the 4352B.

Parameter	Range	Unit
<*numeric*>	0, 5, 10, 15, 20, 25, 30, 35	dB

- Response to Query

  {*numeric*} <new line><^END>

SAVLIM␣{OFF|0|ON|1}

Selects whether to store limit traces when saving measurement data. (LIMIT on OFF under Save/Recall key.)

Parameter	Description
OFF or 0	Does not store limit traces.
ON or 1	Stores limit traces.

SCAC␣{OFF|0|ON|1}

Selects whether to use the same scale for the data and memory traces. (D&M SCALE [ ] under Display key. No Query.)

Parameter	Description
OFF or 0	Uses different scales for data and memory traces.
ON or 1	Uses the same trace for data and memory traces.

- Response to Query

  {0|1} <new line><^END>

SCAF␣{DATA|MEMO}

Selects whether to specify the scale for the data or memory trace. (SCALE FOR [ ] under (Display) key.)

- Response to Query

  {DATA|MEMO} <new line><^END>

SCAL␣<*numeric*>

Specifies the value along the Y-axis for one division of the scale graph. (SCALE/DIV under (Display) key.)

Parameter	Range
<*numeric*>	0.1 to 20 (RF power)
	1 kHz to 3 GHz (Frequency)
	1 kHz to 3 GHz (Frequency transient)
	0.1 to 20 (Phase noise/Tuning sensitivity)
	0.1 to 20 (Spectrum)

SEAL

Searches to the left of the marker for the next target value. (SEARCH LEFT under (Menu) key. No Query.)

SEAM␣{PEAK|MAX|MIN|TARG|OFF}

Selects the marker search function. (SEARCH: PEAK, MAX, MIN, TARGET, OFF under (Menu) key.)

Parameter	Description
PEAK	Searches for peak.
MAX	Searches for maximum value.
MIN	Searches for minimum value.
TARG	Searches for target value.
OFF	Search mode OFF

- Response to Query

  {PEAK|MAX|MIN|TARG} <new line><^END>

- Example

```
OUTPUT 717;"SEAM PEAK"

OUTPUT 717;"SEAM?"
ENTER 717;A$
```

SEANPK

Moves the marker to the next peak. (NEXT PEAK under (Menu) key. No Query.)

SEANPKL

Moves the marker leftward to the next peak. (NEXT PEAK LEFT under (Menu) key. No Query.)

SEANPKR

Moves the marker rightward to the next peak. (NEXT PEAK RIGHT under (Menu) key. No Query.)

SEAR

Searches to the right of the marker for the next target value. (SEARCH RIGHT under (Menu) key. No Query.)

SEARSTR

Specifies the range between the marker and the Δ marker as the partial search range. (MKRΔ→SEARCH RNG under (Menu) key. No Query.)

SEARSTRL

Specifies the marker position as the left-hand boundary of the partial search range. (MKR→LEFT RNG under (Menu) key. No Query.)

- Example

```
OUTPUT 717;"SEARSTRL"
```

SEARSTRR

Specifies the marker position as the right-hand boundary of the partial search range. (MKR→RIGHT RNG under (Menu) key. No Query.)

- Example

```
OUTPUT 717;"SEARSTRR"
```

SEATARG␣<*numeric*>

Turns ON the target search function and moves the marker to the specified target point on the trace. (TARGET under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	−500 to 500	dB
	−15E9 to 15E9	Others

- Response to Query

{*numeric*} <new line><^END>

SENSAPER␣<*numeric*>

Specifies the moving average range (aperture) for tuning sensitivity trace. This command can be used in frequency/tuning sensitivity measurements. (SENS APERTURE under Bw/Avg key.)

Parameter	Range	Unit
<*numeric*>	0.1 to 20(% of span)	%

- Response to Query

{*numeric*} <new line><^END>

SENSPOL␣{POS|NEG}

Selects a gradient type (df/dv) for the DUT frequency-control voltage curve. Select POS when the DUT has a characteristic where frequency increases with increase in control voltage. Select NEG when the DUT has a characteristic where frequency decreases with increase in control voltage. (SENS PLRTY POS neg under Sense Range key.)

Parameter	Description
POS	Upward slope to the right
NEG	Downward slope to the right

- Response to Query

{POS|NEG} <new line><^END>

SGCMD␣<*Character String*>,<*Divider*>

Allows the 4352B to store the GPIB command to control the external signal generator. When 4 is selected for SG TYPE, the 4352B controls the external signal generator using this command.

<*Character String*> defines the GPIB command of the external signal generator for the frequency setting. The frequency setting value is determined by the 4352B. When this command is used, %f in Hz is used as a variable instead of the frequency setting value. If the GPIB command of the external signal generator must be specified with the engineering unit, use <*Divider*> to fit %f in Hz to the value in your required engineering unit.

- Example

```
OUTPUT 800;"SGCMD 'FREQ %fMHZ',1E6"
```

If the external signal generator's GPIB command for the frequency setting is FREQ XXXMHz (XXX: Numeric), %f must be entered instead of XXX, and <*Divider*> must be specified as 1E6 for engineering unit conversion from Hz to MHz.

SGTYPE␣{1|2|3|4}

Selects the external signal generator to be used. (SG TYPE under RF/LO key.)

Parameter	Description
1	8664A, 8664B
2	8657B
3	8648B, 8648C, E8241A, E8244A, E8251A, E8254A
4	Signal generator defined with SGCMD

- Response to Query

  {1|2|3|4} <new line><^END>

SING

Uses a trigger to make a single sweeping measurement to obtain data, then returns to the hold mode. (SINGLE under Trigger key. No Query. EXECUTE available)

If EXECUTE (available with Instrument BASIC) is executed, the 4352B sweeps once and returns control to Instrument BASIC after the sweep. That is, the next statement in the program remains unexecuted until the current sweep is complete. This method can be used in place of SRQ interrupt for monitoring the end of sweep.

If this command is executed when ON is selected for TRGOUT, the 4352B changes the logic level of OUTPUT signal lines of the 24-bit I/O port as soon as the sweep starts. This trigger detection output function can be used in frequency transient measurements.

- Example

```
OUTPUT 717;"SING"
EXECUTE "SING"
```

SIGSRCH

Searches for carrier signals from the DUT. Searching scope is limited to the frequency band selected with FBAND<numeric>. When a carrier is found, the carrier frequency will be automatically stored as nominal frequency. (FREQ BAND [xx-xx], SIGNAL SEARCH under Meas key)

SLOPE␣<*numeric*>

Specifies the slope used to express frequency characteristics for cable loss. This command can be used in RF power measurement only. (SLOPE under Menu key.)

Parameter	Range	Unit
<*numeric*>	0 to 20	dB/GHz

- Response to Query

  {*numeric*} <new line><^END>

SMKR{1-4}␣{OFF|0|ON|1}

Selects whether to display the specified sub-marker. (`SUB MKR {1-4}` under (Menu) key.)

Parameter	Description
OFF or 0	Sub-marker OFF
ON or 1	Sub-marker ON

- Response to Query

{0|1} <new line><^END>

SMKRP{1-4}␣<*numeric*>

Moves the sub-marker to the specified measurement point.

Parameter	Description
<*numeric*>	1 to specified number of measurements

- Response to Query

{*numeric*} <new line><^END>

SMKRP{1-4}?

Outputs the number of the measurement point pointed to by the sub-marker.

- Response to Query

{*numeric*} <new line><^END>

SMKRVAL{1-4}?

Outputs the sub-marker reading. (`SUB MKR {1-4}` under (Menu) key. Query Only.)

- Response to Query

{*numeric*} <new line><^END>

SPAN␣<*numeric*>

Specifies the sweep span. You cannot use this command when you have selected log sweep for phase noise measurement. (`SPAN` under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	Sweep stop value-Sweep start value (RF power, frequency/control sensitivity)	V
	Sweep stop value - Sweep start value (linear sweep for phase noise, spectrum)	Hz
	Disabled (log sweep for phase noise)	
	0 to 10s (frequency transient)	s

SPAN␣<*numeric*>

- Response to Query

  {*numeric*} <new line><^END>

STAR␣<*numeric*>

Specifies the sweep start value. (START under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	0 V to Maximum control voltage (RF power, Frequency),	V
	100Hz to 1MHz (10^n, log sweep for phase noise)	Hz
	10Hz to 10.2MHz− Min. span (linear sweep for phase noise)	Hz
	0 to 800ms (frequency transient)	s
	10MHz to 3GHz− Min. span (spectrum, 4352B only)	Hz
	Frequency band min to Frequency band max (spectrum, 4352Bwith 43521A)	Hz

- Response to Query

  {*numeric*} <new line><^END>

STOP␣<*numeric*>

Specifies the sweep stop value. This command cannot be used in frequency transient measurement. (STOP under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	0 V to Maximum control voltage (RF power, Frequency),	V
	100Hz to 1MHz (10^n, low sweep for phase noise)	Hz
	10Hz + Min. span to 10.2MHz (linear sweep for phase noise)	Hz
	10MHz + Min. span to 3GHz (Spectrum, 4352B alone)	Hz
	Frequency band min + Min. span to Frequency band max (Spectrum, 4352B alone)	Hz

- Response to Query

  {*numeric*} <new line><^END>

SWET␣<*numeric*>

Specifies the sweep time. This command can be used in RF power or frequency/tuning sensitivity measurements. (SWEEP TIME under (Menu) key.)

Parameter	Range	Unit
<*numeric*>	Minimum permissible value under 4352B settings to 3600	sec

- Response to Query

  {*numeric*} <new line><^END>

SWPT␣{LOGF|LINF}

Selects a sweep type. You can select log or linear sweep. You can use this command when you phase noise-offset frequency characteristic measurement. You need to select linear sweep for noise integration or spurious measurement. (SWEEP TYPE [LOG FREQ] or SWEEP TYPE [LIN FREQ] under (Menu) key)

Parameter	Description
LOGF	Log sweep
LINF	Linear sweep

- Response to Query

  {LOGF|LINF} <new line><^END>

TRACK␣{OFF|0|ON|1}

Turns the search track function ON or OFF. (SEARCH TRK on OFF under (Menu) key.)

- Response to Query

  {OFF|ON} <new line><^END>

TRGOUT␣{OFF|0|ON|1}

Selects whether to turn the trigger detection output function ON or OFF. This command can be used in frequency transient measurements.

- Response to Query

  {OFF|ON} <new line><^END>

TRGP␣{POS|NEG}

Selects whether to generate a trigger when the measured value exceeds or falls below the pre-specified value. This command can be used for external trigger or in frequency transient measurement (when the value trigger function is ON). (TRIG PLRTY [POS|NEG] under (Trigger) key.)

Parameter	Description
POS	Generates a trigger when the measured value exceeds the preset value.
NEG	Generates a trigger when the measured value falls below the preset value.

TRGP␣{POS|NEG}

TRGS␣{INT|EXT|BUS|MAN|VAL}

Selects the trigger source. (FREE RUN, EXTERNAL, GPIB, MANUAL, VALUE under (Trigger) key.)

Parameter	Description
INT	Internal trigger
EXT	External trigger through BNC on the rear panel
BUS	GPIB trigger
MAN	Manual trigger
VAL	Value trigger (frequency transient measurement only)

■ Response to Query

{INT|EXT|BUS|MAN|VAL} <new line><^END>

TRGVAL␣<*numeric*>

Specifies the value trigger level. (VAL under (Trigger) key.)

Parameter	Range	Unit
<*numeric*>	640 MHz to 3 GHz	Hz

TRMAX␣<*numeric*>

Specifies the maximum frequency of the measurement range for use with frequency transient measurement. (RF TRANS MAX FREQ under (Sense Range) key.)

Parameter	Range	Unit
<*numeric*>	30 MHz to 3 GHz(Resolution: 100 kHz, 4352B alone)	Hz

■ Response to Query

{*numeric*} <new line><^END>

TRMIN␣<*numeric*>

Specifies the minimum frequency of the measurement range for use with frequency transient measurement. You can use this command when you do not use the 43521A together with the 4352B (No softkeys are available.)

Parameter	Range	Unit
<*numeric*>	10 MHz to 3 GHz (Resolution: 100 kHz, 4352B alone)	Hz

■ Response to Query

{*numeric*} <new line><^END>

TRREF␣<*numeric*>

Sets a reference frequency to display frequency transient measurement data. The difference between the specified reference frequency and the measured frequency is displayed, thus ensuring improved frequency resolution. See "Application in the Analyzer Mode (Frequency Transient Measurement)" in Chapter 12 for more information. (RF TRANS REF FREQ under (Sense Range) key.)

Parameter	Range	Unit
<*numeric*>	0 to 3Ghz (4352B alone)	Hz
	0 to Frequency band max (43521A with 43521A)	Hz

- Response to Query

{*numeric*} <new line><^END>

TRSPAN␣{TS2MHZ|TS20MHZ|TSMAX}

Sets a frequency span for frequency transient measurement. You can select one of 2 MHz, 20MHz, and MAX. See MAX xxxxMHz in Chapter 8 and Frequency Transient Measurement in Appendix C of the 4352B's Function Reference. (RF TRANS MENU, FREQ SPAN:2MHz, 20MHz, MAX xxxMHz under (SenseRange))

Parameter	Description
TS2MHZ	Frequency span: 2 MHz
TS20MHZ	Frequency span: 20 MHz
TSMAX	One of the 16 different frequency spans (4352B alone, or 4352B with 43521A and frequency band of 10 MHz to 3 GHz)
	Frequency band: 512 MHz (4352B with 43521A and frequency band other than 10 MHz to 3 GHz)

- Response to Query

{TS2MHZ|TS20MHZ|TSMAX} <new line><^END>

TRTARG␣<numeric>

Sets a target frequency (final frequency) for frequency transient measurement. When you use the 4352B alone, or when the selected frequency band is 10 MHz to 3 GHz while at the same time you use the 43521A together with the 4352B, you cannot specify a target frequency below 100 MHz. Changing this target frequency can cause maximum and minimum measurement frequencies, frequency span, and frequency resolution to change. See "Application in the Analyzer Mode (Frequency Transient Measurement)" in Chapter 12 for more information. (RF TRANS MENU, TARGET FREQ under (SenseRange) key)

Parameter	Range	Unit
<*numeric*>	100 MHz to 3 GHz (4352B alone, or 4352B with 43521A and frequency band of 10 MHz to 3 GHz)	Hz
	Frequency band min to Frequency band max (4352B alone and frequency band is other than 10 MHz to 3 GHz)	Hz

TRTARG␣<numeric>

- Response to Query

  {*numeric*} <new line><^END>

TRTPOS␣<numeric>

Specifies the relationship between target frequency and frequency span by %. The minimum and maximum frequencies in the frequency span are set at 0% and 100%, respectively. You can use this command to specify where to locate the target frequency within the frequency span. You can specify any of 5 through 95% in steps of 5%. See `MAX xxxxMHz` in Chapter 8 of the 4352B's Function Reference and "Application in the Analyzer Mode (Frequency Transient Measurement)" in Chapter 12 for more information. (`RF TRANS MENU`, `TARGET POSITION` under (SenseRange))

Parameter	Range	Unit
<*numeric*>	5,10,15, . . . 95	%

- Response to Query

  {*numeric*} <new line><^END>

VBW␣<*numeric*>

Changes the post detection filter setting to specify a video bandwidth. You can use this command for linear sweep (phase noise-offset frequency characteristic measurement) or for spectrum measurement. You can specify any of 1/1, 1/3, 1/10, 1/30, 1/100, and 1/300 times the resolution bandwidth (`RES BW`) as video bandwidth. Changing the resolution bandwidth can cause the video bandwidth to change automatically. (`VIDEO BW` under (Bw/Avg) key.)

Parameter	Range	Unit
<*numeric*>	3 mHz to 3 kHz(Note, however, that the permissible range varies depending on the RBW selected. See the list below.)	Hz

RBW=1 Hz	3 mHz, 10 mHz, 30 mHz, 100 mHz, 300 mHz, 1 Hz
RBW=3 Hz	10 mHz, 30 mHz, 100 mHz, 300 mHz, 1 Hz, 3 Hz
RBW=10 Hz	30 mHz, 100 mHz, 300 mHz, 1 Hz, 3 Hz, 10 Hz
RBW=30 Hz	100 mHz, 300 mHz, 1 Hz, 3 Hz, 10 Hz, 30 Hz
RBW=100 Hz	300 mHz, 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz
RBW=300 Hz	1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz
RBW=1 kHz	3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz
RBW=1 kHz	3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz
RBW=3 kHz	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz

- Response to Query

  {*numeric*} <new line><^END>

VCTRL␣<*numeric*>

Specifies the DC control voltage level. This command cannot be used in RF power or frequency/tuning sensitivity measurements. (`CTRL VOLTAGE` under (DC Control) key.)

Parameter	Range	Unit
<*numeric*>	0 to 20 (−15 to 35 V with option 001)	V

- Response to Query

  {*numeric*} <new line><^END>

VOUT␣{OFF|0|ON|1}

Turns the DC power and DC control voltages ON or OFF. (`OUTPUT on OFF` under (DC Control) key, `OUTPUT on OFF` under (DC Power) key.)

Parameter	Description
`OFF` or `0`	DC power/control voltages OFF
`ON` or `1`	DC power/control voltages ON

- Response to Query

  {0|1} <new line><^END>

VPOW␣<*numeric*>

Specifies the DC drive voltage. (`POWER VOLTAGE` under (DC Power) key.)

Parameter	Range	Unit
<*numeric*>	0 to 16	V

- Response to Query

  {*numeric*} <new line><^END>

VT

Selects the tester mode for the 4352B measurement mode. (`INST TYPE: VCO TESTER` under (Meas) key.)

11

Command Reference for Commonly Used Commands

This chapter is an GPIB command reference for the 4352B. You can use this chapter when you need information on the function and syntax of commands.
Commands given in this chapter, however, are not related to the measurements in the Tester mode and Analyzer mode.

The command reference in this chapter lists commands in the alphabetical order for each command group.
Note that the following command groups are described in each corresponding section.

Common Commands	See the middle part of this chapter.
Commands Related to IBASIC	See the last part of this chapter.

See the *Function Reference* for referring to a command by its function or for the details of the 4352B's functions.

The followings are typeface rules and definitions used in this command reference.

① → **AVER**␣{**OFF**|**0**|**ON**|**1**}

② → Switches the averaging function on the active channel to ON/OFF. (AVERAGING ON off under Bw/Avg key)

③ →

Parameter	Description
OFF or 0	Averaging function OFF
ON or 1	Averaging function ON

④ → ■ Query Response
{0|1} <new line> <^END>

⑤ → ■ Example

```
OUTPUT 717;"AVER ON"

OUTPUT 717;"AVER?"
ENTER 717;A
```

①	Command names and required parameters Letters written in bold define a command. You must type the command part exactly as printed without any space in-between. Characters can be either upper case or lower case. If the command to transfer requires a constant, one or more numbers within the defined range, or a character string, input them with a space after a command. (␣ indicates a space.) Characters between brackets, { }, are qualifiers accepted by commands. You do not need symbols such as "|" or "{" between commands and qualifiers when you actually type . For example, {OFF|0|ON|1} indicates that you input either OFF, ON, 0, or 1, and {1-4} indicates that you input a number (1, 2, 3, or 4).
②	This is a description of command. The front panel keys and softkeys that have the same function as the command are described in parentheses. Parentheses are also used for supplemental descriptions.
③	This is a description of parameters for the sample command.
④	This is a Query response format for the sample command.
⑤	Examples (including that of Query case usage) of the sample command.

Command Reference

ADDRCONT␣<*numeric*>

Sets the GPIB address the analyzer will use to communicate with the external controller. (`ADDRESS:CONTROLLER` under (Local) key.)

Parameter	Range	Unit
<*numeric*>	0 to 30	

- Query Response

{*numeric*} <new line><^END>

ADDRSG␣<*numeric*>

Sets the GPIB address which the analyzer will use to communicate with the external signal generator. (`ADDRESS:SG` under (Local) key.)

Parameter	Range	Unit
<*numeric*>	0 to 30	

- Query Response

{*numeric*} <new line><^END>

BACI␣<*numeric*>

Sets the intensity of background color for the display. You can set the intensity as percentage of the white level. (`BACKGROUND INTENSITY` under (Display) key.)

Parameter	Range	Unit
<*numeric*>	0 to 100	%

- Query Response

{*numeric*} <new line><^END>

BEEPDONE␣{OFF|0|ON|1}

Sets the beep sound that notifies the completion of operations such as completing a calibration or saving the instrument setup. (`BEEP DONE ON off` under (System) key.)

Parameter	Description
OFF or 0	Operation completion beep OFF
ON or 1	Operation completion beep ON

- Query Response

{0|1} <new line><^END>

BEEPWARN␣{OFF|0|ON|1}

Switches the Alarm Beep function ON and OFF. If you turn this function ON, a beep sounds when a warning message is displayed. (BEEP WARN on OFF under (System) key.)

Parameter	Description
OFF or 0	The alarm beep OFF
ON or 1	The alarm beep ON

- Query Response

  {0|1} <new line><^END>

BLIGHT␣{OFF|0|ON|1}

Sets backlighting the LCD screeen ON or OFF.

Parameter	Description
OFF or 0	Backlighting OFF
ON or 1	Backlighting ON

- Query Response

  {0|1} <new line><^END>

- Equivalent SCPI Command

  :DISPlay:BACKlight␣{OFF|ON|0|1}

CBRI␣<*numeric*>

Adjusts the brightness of changed color. (BRIGHTNESS under (Display) key.)

Parameter	Range	Unit
<*numeric*>	0 to 100	%

- Query Response

  {*numeric*} <new line><^END>

CIN

Assigns the port C signal line (pin #20 to pin #24) in the 24-bit I/O port to the input port.

CHAD␣<*String*>

Change the current directory of a DOS format disk. (Specify the name of the directory to change.) (CHANGE DIRECTORY under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	A directory path name

■ Example

```
OUTPUT 717;"CHAD ""..""" 
```

CLES

Clears the Status Byte Register, the Standard Event Status Register, the Event Status Register B (Instrument Event Status Register), and the Operational Status Register. (No Query.)

■ Common Commands
∗CLS

CLOSE

Returns a file, which has been read/write-enabled using the ROPEN command or WOPEN command, to access-disabled status. If this command is executed before reading process using the READ? command completes, an error occurs.

Generally, this command is used in combination with the ROPEN command and READ? command or the WOPEN command and the WRITE command, as shown in Figure 11-2. (No query)

CLOSE

COLO␣<*parameter*>

Specifies the display information for which you want to change the color. (DATA, MEM, LIMIT LINE PARAMETER, GRATICULE, TEXT, WARNING, IBASIC, PEN 1, PEN 2, PEN 3, PEN 4, PEN 5, PEN 6 under (Display) key.)

Parameter	Description
DATA	Data
MEMO	Memory
PARAM	Limit Line Parameter
GRAT	Graticule and a portion of softkey text
WARN	Warning annotation
IBT	Text statements on the BASIC screen
TEXT	All the non-data text
PEN1	Pen 1
PEN2	Pen 2
PEN3	Pen 3
PEN4	Pen 4
PEN5	Pen 5
PEN6	Pen 6

- Query Response

{DATA|MEMO|PARAM|GRAT|WARN|IBT|TEXT|PEN1|PEN2|PEN3|PEN4| PEN5|PEN6} <new line><^END>

- Example

```
OUTPUT 717;"COLO MEMO"
```

TINT, CBRI, COLOR, and RSCO are the commands related to changing colors. See the corresponding sections for details.

COLOR␣<*numeric*>

Adjusts the degree of whiteness of the color being modified. (COLOR under (Display) key.)

Parameter	Range	Unit
<*numeric*>	0 to 100	%

- Query Response

{*numeric*} <new line><^END>

COPA

Aborts a print in progress. (COPY ABORT under (Copy) key. No Query.)

COPT␣{OFF|0|ON|1}

Switches the printing time and date (the time stamp function) ON and OFF.
(`COPY TIME on OFF` under (Copy) key.)

Parameter	Description
OFF or 0	Time stamp function OFF
ON or 1	Time stamp function ON

- Query Response

  {0|1} <new line><^END>

COUT

Assigns the port C signal lines (pin #20 to Pin #24) in the 24-bit I/O port to the output port.

CRED␣<*String*>

Creates a new directory on a DOS format disk. (`CREATE DIRECTORY` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	A new directory name up to 8 characters (plus an extension up to 3 characters)

- Example

```
OUTPUT 717;"CRED ""DATA"""
```

CWD?

Returns the name of the current directory. (Query only)

- Query Response

  {*string*} <new line><^END>

DAYMYEAR

Changes the date format to "day:month:year". (`DayMonYear` under (System) key.)

- Query Response

  {0|1} <new line><^END>

Parameter	Description
0	"month:day:year" format
1	"day:month:year" format

DEFC

Sets all color setups to the default setups. (`DEFAULT COLORS` under (Display) key. No Query.)

DEFC

DFLT

Returns the printing parameters to their default values. (DEFAULT SETUP under Copy; No query)

The table below lists the default values.

Command	Default value	Unit
DPI	75	dpi
FORMFEED	ON	
LANDSCAPE	OFF	
LMARG	1.0	inch
TMARG	1.0	inch
SKEY	OFF	

- Equivalent SCPI Command

  `:HCOPy:DEFault`

DIN

Assigns the port D signal lines (pin #25 to pin #28) in the 24-bit I/O port to the input port.

DISA␣{ALLI|HIHB|ALLB|BASS}

Selects the assignment mode of the display screen. (ALLOCAT'N: ALL INSTR, HALF INSTR HALF BASIC, ALL BASIC, BASIC STATUS under Display key.)

Parameter	Description
ALLI	Assigns the entire screen to measurements.
HIHB	Assigns the half of the screen to measurements and the other half to HP instrument BASIC.
ALLB	Assigns the entire screen to HP instrument BASIC.
BASS	Displays the status of HP instrument BASIC at the bottom of measurement screen.

- Query Response

  {ALLI|HIHB|ALLB|BASS} <new line><^END>

- Example

```
OUTPUT 717;"DISA HIHB"

OUTPUT 717;"DISA?"
ENTER 717;A$
```

DISF␣{DOS|LIF}

Selects the disk format (LIF or DOS) to be used when initializing a new disk. (FORMAT [ ] under Save/Recall key.)

Parameter	Description
DOS	DOS format
LIF	LIF (Logical Interchange format) format

- Query Response

  {DOS|LIF} <new line><^END>

- Example

```
OUTPUT 717;"DISF DOS"
```

DOUT

Sets the port D signal lines (pin #25 to pin #28) in the 24-bit I/O port to the output port.

DPI␣<*numeric*>

Specifies the printing resolution value for the printer. (DPI under Copy)

Parameter	Range	Unit
<*numeric*>	75 to 600	dpi

- Query Response

  {*numeric*} <new line><^END>

- Equivalent SCPI Command

  `:HCOPy:DRIVer:DPI␣<numeric>`

DSKEY

Disables the front panel key and rotary knob operations. To enable these operations again, send the ENKEY command. (No Query.)

- Example

```
OUTPUT 717;"DSKEY"
```

ENKEY

Enables the front panel and rotary knob operations that were disabled by the DSKEY command. (No Query.)

- Example

```
OUTPUT 717;"ENKEY"
```

ESB?

Outputs the value in the Event Status Register B (Instrument Event Status Register). (Query only.)

- Query Response

{*numeric*} <new line><^END>

ESNB␣<*numeric*>

Sets the bit in the Event Status Register B (Instrument Event Status Register).

Parameter	Range	Unit
<*numeric*>	Contents of the register in decimal: 0 to 32767 ($=2^{15}-1$)	

- Query Response

{*numeric*} <new line><^END>

FILC␣<*character string 1*>,<*character string 2*>,<*character string 3*>,<*character string 4*>

Copies files. (COPY FILE under Save/Recall key. No Query.)

Parameter	Description
<*character string 1*>	Source file name
<*character string 2*>	Source device name (DISK or MEMORY)[1]
<*character string 3*>	Destination file name
<*character string 4*>	Destination device name (DISK or MEMORY)[1]

1 DISK for the internal floppy disk drive; MEMORY for the internal RAM disk memory

- Example

```
OUTPUT 717;"FILC ""DAT1.TXT"",""MEMORY"",""DAT1.TXT"",""DISK"""
```

FNAME?␣<*numeric*>

Returns the file name corresponding to a specified number in the current directory. To each file, a number is assigned from 1 to "the number of the files" in alphabetical order. Use the FNUM? command to verify the number of the files in the current directory. (Query only)

Parameter	Description	Range
<*numeric*>	Specified file No.	1 to "the number of the files in the current directory"

- Query Response

{*string*} <new line><^END>

FNUM?

Returns the number of the files in the current directory. (Query only)

- Query Response

  {*numeric*} <new line><^END>

FORM2

Sets the IEEE 32-bit floating point format to transfer the trace data via GPIB. See Appendix C for details. (No Query.)

FORM3

Sets the IEEE 64-bit floating point format to transfer the trace data via GPIB. See Appendix C for details. (No Query.)

FORM4

Sets the ASCII format to transfer the trace data via GPIB. See Appendix C for details. (No Query.)

FORM5

Sets the MS-DOS® format to transfer the trace data via GPIB. See Appendix C for details. (No Query.)

FORMFEED␣{OFF|0|ON|1}

Sets the printer ON or OFF for delivering printed paper each time printing an entire screen is finished. When the paper orientation is set to Landscape, the setting by this FORMFEED command will not take effect and the printer delivers printed paper screen by screen.

Parameter	Description
OFF or 0	Does not deliver printed paper
ON or 1	Delivers printed paper

- Query Response

  {0|1} <new line><^END>

- Equivalent SCPI Command

  `:HCOPy:DRIVer:FORMFeed␣{OFF|ON|0|1}`

FORMFEED␣{OFF|0|ON|1}

FSIZE?␣<*string*>

Returns the size of a specified file in bytes. If the file does not exist, this command returns -1. (Query only)

Parameter	Description
<*string*>	File name of up to 12 characters including its extension (for the LIF format, up to 10 characters)

- Query Response

  {*numeric*} <new line><^END>

INID

Initializes the floppy disk or the RAM disk memory. (`INITIALIZE DISK` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	`DISK` for a floppy disk for the internal floppy disk drive `MEMORY` for the internal RAM disk memory

- Example

```
OUTPUT 717;":MMEM:INIT ""DISK"",DOS"
```

INP8IO?

Uses the 4-bit parallel input terminal on the I/O port to input data and outputs the data to the computer. (Query Only.)

- Query Response

  {*numeric*} <new line><^END>

INPT?

Returns the pulse input status of INPUT1 of the 24-bit I/O port. (Query Only.)

- Query Response

  {0|1} <new line><^END>

Parameter	Description
0	No pulse input
1	Pulse input[1]

1 Once 1 is returned, the value is reset, 0 will be returned until there is another pulse input.

INTE␣<*numeric*>

Sets the intensity of the display as a percentage of the brightest level. (INTENSITY under Display key.)

Parameter	Range	Unit
<*numeric*>	0 to 100	%

- Query Response

  {*numeric*} <new line><^END>

KEY␣<*numeric*>

Sends key codes correspond to front panel hardkeys and softkeys. This is equivalent to actually pressing a key. See Appendix B for key codes. (No Query.)

Parameter	Description
<*numeric*>	0 to 52

- Query Response

  {*numeric*} <new line><^END>

LANDSCAPE␣{OFF|0|ON|1}

Sets the orientation of paper landscape or not, using ON or OFF. This setting takes effect for priters which support printing paper placed in the landscape orientation. Setting the paper orientation mode will invalidate the setting by the FORMFEED command. (LNDSCAPE under Copy)

Parameter	Description
OFF or 0	The orientation of paper is not set to Landscape. (Thus, Portrait)
ON or 1	The orientation of paper is set to Landscape.

- Query Response

  {0|1} <new line><^END>

- Equivalent SCPI Command

  :HCOPy:DRIVer:LANDScape␣{OFF|ON|0|1}

LANDSCAPE␣{OFF|0|ON|1}

LMARG␣<*numeric*>

Specify the value for the left margin of printed paper. (`LFT MARGIN` under (Copy))

Parameter	Range	Unit
<*numeric*>	0 to 5	inch

- Query Response

  {*numeric*} <new line><^END>
- Equivalent SCPI Command

  `:HCOPy:DRIVer:LEFTMarg:␣`<*numeric*>

MONDYEAR

Changes the date format to "month:day:year". (`DATE MODE:MonDayYear` under (System) key.)

- Query Response

  {0|1} <new line><^END>

Parameter	Description
0	"day:month:year" format
1	"month:day:year" format

NEGL

Sets the I/O signals from/to the 24-bit I/O port as negative logic.

NEXP

Displays the next page of information in a tabular setting. (`NEXT PAGE` under (Copy) key. No Query.)

OPEP

Returns the present measurement setting parameters in a tabular form.
(`OPERATING PARAMETERS` under (Copy) key. No Query.)

OSE␣<*numeric*>

Sets the bit for the Operation Status Enable register.

Parameter	Description
<*numeric*>	Contents of the register in decimal: 0 to 65535 ($=2^{16}-1$)

- Query Response

  {*numeric*} <new line><^END>

OSER?

Outputs the value to which the Operation Status Event register is currently set. (Query Only.)

- Query Response

{*numeric*} <new line><^END>

OSNT␣<*numeric*>

Sets the bit for OSNT (Operation Status Negative Transition Filter). See Chapter 8 for details.

Parameter	Description
<*numeric*>	Contents of the register in decimal: 0 to 65535 ($=2^{16}-1$)

- Query Response

{*numeric*} <new line><^END>

OSPT␣<*numeric*>

Sets the bit for OSPT (Operation Status Positive Transition Filter). See Chapter 8 for details.

Parameter	Description
<*numeric*>	Contents of the register in decimal: 0 to 65535 ($=2^{16}-1$)

- Query Response

{*numeric*} <new line><^END>

OSR?

Outputs the present settings of the Operation Status register. (Query Only.)

- Query Response

{*numeric*} <new line><^END>

OUT1ENVH

Enables the OUTPUT1 signal line (pin #3) of the 24-bit I/O port to go HIGH when a pulse input occurs at the INPUT1 signal line (pin #2) of the 24-bit I/O port.

OUT1ENVL

Enables the OUTPUT1 signal line (pin #3) of the 24-bit I/O port to go LOW when a pulse input occurs at the INPUT1 signal line (pin #2) of the 24-bit I/O port.

OUT1H

Sets the OUTPUT1 signal line (pin #3) of the 24-bit I/O port to HIGH.

OUT1L

Sets the OUTPUT1 signal line (pin #3) of the 24-bit I/O port to LOW.

OUT2ENVH

Enables the OUTPUT2 signal line (pin #4) of the 24-bit I/O port to go HIGH when INPUT1 detects pulse input.

OUT2ENVL

Enables the OUTPUT2 signal line (pin #4) of the 24-bit I/O port to go LOW when a pulse input has occurred at the INPUT1 signal line (pin #2) of the 24-bit I/O port.

OUT2H

Sets the OUTPUT2 signal line (pin #4) of the 24-bit I/O port to HIGH.

OUT2L

Sets the OUTPUT2 signal line (pin #4) of the 24-bit I/O port to LOW.

OUT8IO␣<*numeric*>

Outputs data to the 8-bit parallel output of the I/O port. (No Query.)

Parameter	Description
<*numeric*>	0 to 255

OUTAIO␣<*numeric*>

Outputs decimal data specified as the parameter to port A (8-bit) of the 24-bit I/O port. (No Query.)

Parameter	Description
<*numeric*>	0 to 255

OUTBIO␣<*numeric*>

Outputs decimal data specified as the parameter to port B (8-bit) of the 24-bit I/O port. (No Query.)

Parameter	Description
<*numeric*>	0 to 255

OUTCIO␣<*numeric*>

Outputs decimal data specified as the parameter to port C (4-bit) of the 24-bit I/O port. (No Query.)

You must first use `COUT` to set the port C as the output port before using this command.

Parameter	Description
<*numeric*>	0 to 15

OUTDIO␣<*numeric*>

Outputs decimal data specified as the parameter to port D (4-bit) of the 24-bit I/O port. (No Query.)

You must first use `DOUT` to set the port D as the output port before using this command.

Parameter	Description
<*numeric*>	0 to 15

OUTEIO␣<*numeric*>

Outputs decimal data specified as the parameter to port E (8-bit) of the 24-bit I/O port. (No Query.)

You must first set ports C and D as output ports (using `COUT` and `DOUT`) before using this command.

Parameter	Description
<*numeric*>	0 to 255

OUTFIO␣<*numeric*>

Outputs decimal data specified as the parameter to port F (16-bit) of the 24-bit I/O port. (No Query.)

Parameter	Description
<*numeric*>	0 to 65535

OUTGIO␣<*numeric*>

Outputs decimal data specified as the parameter to port G (20-bit) of the 24-bit I/O port. (No Query.)

You must first use `COUT` to set the port C as the output port before using this command.

Parameter	Description
<*numeric*>	0 to 1048575

OUTHIO␣<*numeric*>

Outputs decimal data specified as the parameter to port H (24-bit) of the 24-bit I/O port. (No Query.)

You must first set ports C and D as output ports (using `COUT` and `DOUT`) before using this command.

Parameter	Description
<*numeric*>	0 to 16777215

OUTHIO␣<*numeric*>

OUTPERRO?

Outputs error messages stored in the Error queue.

- Query Response

  {*numeric (error number)*} {*character string (error message)*} <new line><^END>

- Example

```
OUTPUT 717;"OUTPERRO?"
ENTER 717;A,A$
```

OUTPINPCIO?

Outputs data entered from port C of the 24-bit I/O port (Query only).

Use CIN to specify port C as an input port before using this command.

- Query Response

  {*numeric*} <new line><^END>

OUTPINPDIO?

Outputs data entered from port D of the 24-bit I/O port (Query only).

Use DIN to specify port D as an input port before using this command.

- Query Response

  {*numeric*} <new line><^END>

OUTPINPEIO?

Outputs data entered from port E of the 24-bit I/O port (Query only).

Use CIN and DIN to specify port C and D as an input port before using this command.

- Query Response

  {*numeric*} <new line><^END>

POSL

Sets the I/O signals of the 24-bit I/O port to positive logic.

PREP

Displays the previous page of information in a tabular listing. (PREV PAGE under Copy key. No Query.)

PRIC

Sets the printer so that it prints out in colors at print outs. (COLOR under Copy key.)

- Query Response

{0|1} <new line><^END>

Parameter	Description
0	Monochrome print
1	Color print

PRICFIXE

Sets the printer to print out in the default (initial) color setup. (PRINT COLOR [FIXED] under Copy key.)

- Query Response

{0|1} <new line><^END>

Parameter	Description
0	Variable color (the color setup closest to the display screen's color)
1	Fixed color (the default color setup)

PRICVARI

Sets the printer to print out in the color setup that is as close to the display screen as possible. (PRINT COLOR [VARIABLE] under Copy key.)

- Query Response

{0|1} <new line><^END>

Parameter	Description
0	Fixed color (The default color setup)
1	Variable color (The color setup close to the display screen)

PRINALL

Prints the contents displayed on the screen to the printer as they are. (PRINT [STANDARD] under Copy key. No Query.)

PRIS

Sets the printer so that it prints in black and white. (PRINT STANDARD under (Copy) key.)

- Query Response

  {0|1} <new line><^END>

Parameter	Description
0	Color print
1	Monochrome print

PRSOFT␣{OFF|0|ON|1}

Sets printing the softkeys displayed in the screen ON or OFF. (COPY SKEY under (Copy))

Parameter	Description
OFF or 0	Does not print the soft keys
ON or 1	Print the soft keys

- Query Response

  {0|1} <new line><^END>

- Equivalent SCPI Command

  :HCOPy:DRIVer:SKEY␣{OFF|ON|0|1}

PURG␣<*String*>

Deletes a file. (PURGE FILE under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	File name up to 10 characters including the extension

- Example

```
OUTPUT 717;"PURG ""TEST_S"""
```

READ?

Reads data from a file that has been read-enabled using the `ROPEN` command. The returned data is in the fixed length block format defined in IEEE488.2. The fixed length block format, as shown in Figure 11-1, consists of a header part indicating the data size and an actual data part. In the case of the 4352B, the number of digits to indicate the data size is 6 and the maximum length of the actual data part is 16 Kbytes. If a file contains data greater than 16 Kbytes, execute this command repeatedly to read it. Note that acceptable file formats for this command are the DOS format and the LIF format BDAT type.

Generally, this command is used in combination with the `ROPEN` command and the `CLOSE` command, as shown in Figure 11-2. (Query only)

- Query Response

  {*block*} <new line><^END>

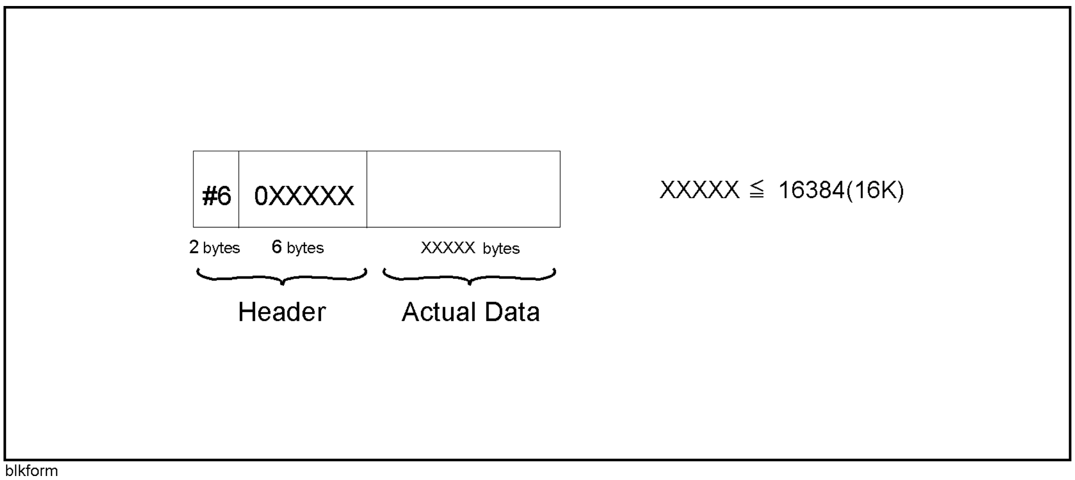


Figure 11-1. Fixed length block format

RECC

Recalls the previously saved color setup from the back-up memory. (`RECALL COLORS` under (Display) key. No Query.)

RECD␣<*String*>

Loads measurement data and instrument setup status from a file. (`file name` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	File name up to 10 characters including the extension

- Example

```
OUTPUT 717;"RECD ""TEST_S"""
```

RECD␣<*String*>

RESAVD␣<*String*>

Updates a file already saved. (`RE-SAVE FILE` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	File name up to 10 characters including the extension

■ Example

```
OUTPUT 717;"RESAVD ""TEST_S"""
```

RESD

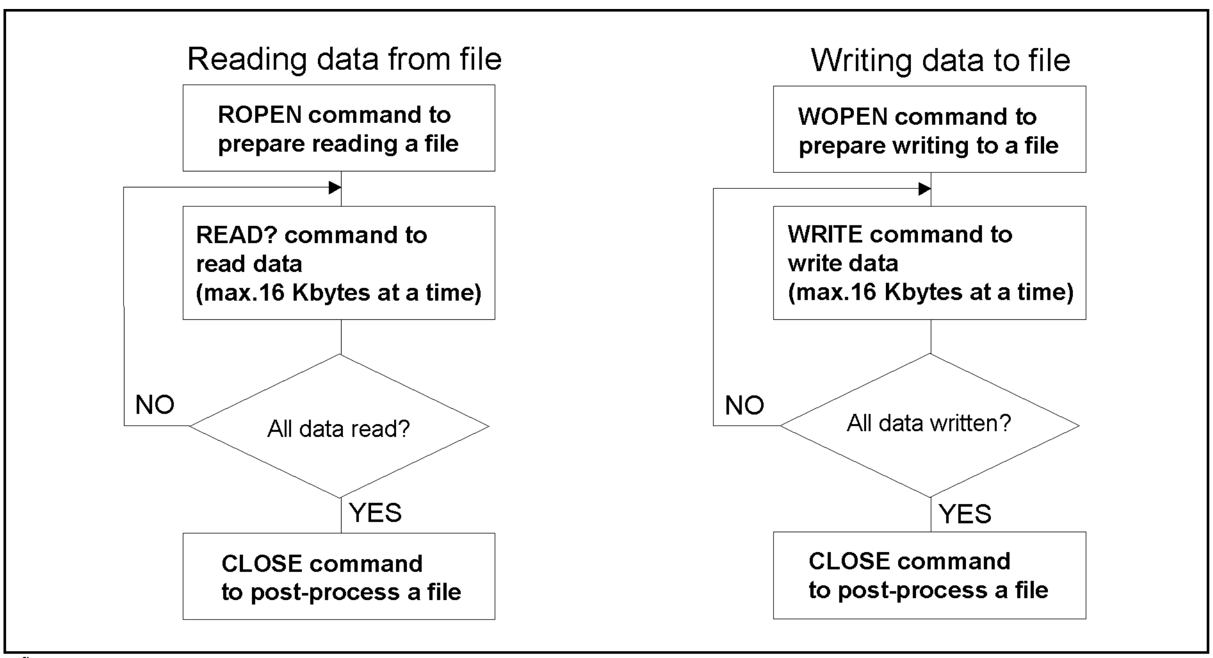
Sets the Measurement Setting Parameter List function OFF and reverts the display screen to a normal measurement screen. (`RESTORE DISPLAY` under (Copy) key. No Query.)

ROPEN␣<*string*>

Makes a specified file read-enabled. If the file does not exist, an error occurs.

Generally, this command is used in combination with the `READ?` command and the `CLOSE` command, as shown in Figure 11-2. (No query)

Parameter	Description
<*string*>	File name of up to 12 characters including its extension (for the LIF format, up to 10 characters)



rwflow

Figure 11-2. Procedure of executing commands to read/write data

RSCO

Sets the color being modified by the `COLO` command to the default setup. (`RESET COLOR` under (Display) key. No Query.)

SAVDASC␣<*String*>

Saves an internal data array, defined by the `SAVDAT` or `SAVMEM` command, in an ASCII formatted file. (`DATA ONLY (ascii)` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	A file name of up to 8 characters

- Example

```
OUTPUT 717;"SAVDASC ""DATA1"""
```

SAVDAT␣{OFF|0|ON|1}

Selects whether or not to save the data arrays. (`DATA ON off` under (Save/Recall) key.)

Parameter	Description
`OFF` or `0`	Do not save the data array.
`ON` or `1`	Saves the data array.

- Query Response

{0|1} <new line><^END>

- Example

```
OUTPUT 717;"SAVDAT ON"
```

SAVDDAT␣<*String*>

Saves an internal data array, defined by the `SAVDAT` or `SAVMEM` command, in a binary file. (`DATA ONLY (binary)` under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	A file name of up to 8 characters

- Example

```
OUTPUT 717;"SAVDDAT ""DATA1"""
```

SAVDDAT␣<*String*>

SAVDSTA␣<*String*>

Saves the setup of the instrument. (STATE under (Save/Recall) key. No Query.)

Parameter	Description
<*String*>	A file name of up to 8 characters

■ Example

```
OUTPUT 717;"SAVDSTA ""STA1"""
```

SAVDSTAC␣<*string*>

Saves the instrument state in the format so that the 4352A can recall. (4352A STATE under (Save/Recall); No Query)

Parameter	Description
<*string*>	File name having maximum 8 characters

SAVDTIF␣<*string*>

Saves the displayed screen in the TIFF format. (GRAPHICS under (Save); No Query)

Parameter	Description
<*string*>	File name having maximum 8 characters

■ Equivalent SCPI Command

:MMEMory:STORe:DINTerchange:TIFF␣<*string (file name)*>

SAVMEM␣{OFF|0|ON|1}

Selects whether or not to save the memory array. (MEM on OFF under (Save/Recall) key.)

Parameter	Description
OFF or 0	Do not save the contents of memory.
ON or 1	Saves the contents of memory.

■ Query Response

{0|1} <new line><^END>

SCRN␣{OFF|0|ON|1}

Switches the LCD screen ON or OFF. (No corresponding softkey command.)

Parameter	Description
OFF or 0	LCD screen OFF
ON or 1	LCD screen ON

- Query Response

  {0|1} <new line><^END>

SETCDATE␣<*numeric (year)*>, <*numeric (month)*>, <*numeric (day)*>

Sets the date of the built-in clock. (ENTER under (System) key.)

Parameter	Description
<*numeric (year)*>	1900 to 2099
<*numeric (month)*>	1 to 12
<*numeric (day)*>	1 to 31

- Query Response

  {*numeric (year)*} {*numeric (month)*} {*numeric (day)*} <new line><^END>

- Example

```
OUTPUT 717;"SETCDATE 1993,1,1"
```

SETCTIME␣<*numeric (hour)*>, <*numeric (minute)*>, <*numeric (second)*>

Sets the time of the built-in clock. (ENTER under (System) key.)

Parameter	Description
<*numeric (hour)*>	0 to 23
<*numeric (minute)*>	0 to 59
<*numeric (second)*>	0 to 59

- Query Response

  {*numeric (hour)*} {*numeric (minute)*} {*numeric (second)*} <new line><^END>

- Example

```
OUTPUT 717;"SETCTIME 10,30,0"
```

SETCTIME␣<*numeric (hour)*>, <*numeric (minute)*>, <*numeric (second)*>

STOD{DISK|MEMO}

Sets the storage device. (STOR DEV [ ] under Save/Recall key. No Query.)

Parameter	Description
STODDISK	Internal floppy disk drive
STODMEMO	Internal RAM disk memory

SVCO

Saves the modified color setup in the back up memory. (SAVE COLORS under Display key. No Query.)

TINT␣<*numeric*>

Adjusts the hue of specified display element. (TINT under Display key.)

Parameter	Range	Unit
<*numeric*>	0 to 100	%

- Query Response

  {*numeric*} <new line><^END>

TITL␣<*string*>

Sends the character string to display in the title area of the display screen. (TITLE under Display key.)

Parameter	Description
<*String*>	Up to 53 characters

- Query Response

  {*String*} <new line><^END>

- Example

```
OUTPUT 717;"TITL ""COMMENT"""

OUTPUT 717;"TITL?"
ENTER 717;A$
```

TMARG␣<*numeric*>

Specify the value for the top margin of printed paper. (TOP MARGIN under (Copy))

Parameter	Range	Unit
<*numeric*>	0 to 5	inch

- Query Response

  {*numeric*} <new line><^END>

- Equivalent SCPI Command

  :HCOPy:DRIVer:TOPMarg␣<*numeric*>

USKEY

Displays the user key labels of the soft keys. The user menu display returns to the ordinary measurement keys when the program ends. (No query; No equivalent SCPI command)

The USKEY command is equivalent to executing the program shown below;

```
OUTPUT @Hp4352;"KEY 47"
OUTPUT @Hp4352;"KEY 0"
OUTPUT @Hp4352;"KEY 6"
```

WOPEN␣<*string*>[,<*numeric*>]

If the specified file exists, this command makes it write-enabled; otherwise, creates a new file and makes it write-enabled. This command takes its arguments in a different way, depending on the file format. For a DOS format file you do not have to specify its file size, for a LIF format file you must. Specify the file size, 0 or greater, so that the file can contain the maximum number of bytes used. Note that only the BDAT type is available as the LIF file format.

The format and size of an existing file cannot be changed. Therefore, if you want to change them, delete the file itself using the PURG command and then create a new file using this command.

This command is used in combination with the WRITE command and the CLOSE commands, as shown in Figure 11-2. (No query)

Parameter	Description
<*string*>	File name of up to 12 characters including its extention (for the LIF format, up to 10 characters)
<*numeric*>	File size (required only for the LIF format)

WOPEN␣<*string*>[,<*numeric*>]

WRITE␣<*block*>

Writes data in a file that has been write-enabled using the `WOPEN` command. Written data must take the fixed length block format (see Figure 11-1) defined in IEEE488.2. The maximum length of data is 16 Kbytes. If data is greater than 16 Kbytes, execute this command repeatedly to write it. (No query)

Generally, this command is used in combination with the `WOPEN` command and the `CLOSE` command, as shown in Figure 11-2. (No query)

Parameter	Description
<*block*>	Data in the fixed length block format

Common Commands

*CLS

Clears the Event Status Register of Error Queue, Status Byte Register, and Operation Status Register, Standard Event Status Register, Event Status Register B (Instrument Event Status Register). (No Query.)

- Example

```
OUTPUT 717;"*CLS"
```

*ESE␣<*numeric*>

Sets the enable bit of Standard Event Status Register.

Parameter	Description
<*numeric*>	0 to 255 (A decimal number describing the setup status of Operational Status Register's enable bit)

- Query Response

{*numeric*} <new line><^END>

- Example

```
OUTPUT 717;"*ESE 1"
```

```
OUTPUT 717;"*ESE?"
ENTER 717;A
```

*ESR?

Returns the contents of Standard Event Status Register. (Query Only.)

- Query Response

{*numeric*} <new line><^END>

- Example

```
OUTPUT 717;"*ESR?"
ENTER 717;A
```

*IDN?

Returns the ID of 4352B.

- Query Response

{*Maker*} {*Model*} {*Serial Number*} {*Firmware Version*} <new line><^END>

- Example

```
OUTPUT 717;"*IDN?"
ENTER 717;A$
```

*IDN?

*OPC

Sets bit 0 of Standard Event Status Register when it completes all pending operations. `*OPC?` query places an ASCII character 1 into the analyzer's output query when all pending operations has been completed.

- Query Response

  {1} <new line><^END>

- Example

```
OUTPUT 717;"*OPC"

OUTPUT 717;"*OPC?"
ENTER 717;A
```

*OPT?

Inquires the installed options. (Query Only.)

- Query Response

  {Parameter} <new line><^END>

Parameter	Description
(Null)	without option
001	option 001 Expand DC Control

- Example

```
OUTPUT 717;"*OPT?"
ENTER 717;A$
```

*PCB␣$<numeric>$

Specifies the address of the controller when you temporarily give control of the GPIB to the 4352B.

Parameter	Description
$<numeric>$	0 ~ 30

- Example

```
OUTPUT 717;"*PCB 0"
```

*RST

Resets the 4352B as follows:

- Returns to the initial settings.
- Sets the trigger to the Hold mode.
- Resets HP instrument BASIC. (Only when executed from the external controller.)

See Appendix D of the *Function Reference* for initial values. (No Query.)

- PRES command is similar to *RST command. The main differences are shown below.

Item	Command	
	*RST	PRES
4352B settings	Defaults	Defaults
Measurement trigger	Hold mode	Continuous mode
HP IBASIC	Reset[1]	Not changed.

1 Only when the command is executed on the external controller.

See PRES command description in chapter 10.

- Example

```
OUTPUT 717;"*RST"
```

*SRE␣<*numeric*>

Sets the enable bits of the Status Byte Register.

Parameter	Description
<*numeric*>	0 to 255 (A decimal number describing the setup status of the Status Byte Register's enable bit)

- Query Response

  {*numeric*} <new line><^END>

- Example

```
OUTPUT 717;"*SRE 1"
```

```
OUTPUT 717;"*SRE?"
ENTER 717;A
```

*SRE␣<*numeric*>

*STB?

Reads the contents of the Status Byte Register according to the status of the Master Summary status bit. (Query Only.)

- Query Response

  {*numeric*} <new line><^END>

- Example

```
OUTPUT 717;"*STB?"
ENTER 717;A
```

*TRG

Triggers the 4352B when the BUS trigger is set to the trigger mode. (No Query.)

- Example

```
OUTPUT 717;"*TRG"
```

*TST?

Performs the internal self test and returns the result. (Query Only.)

- Query Response

  {*numeric*} <new line><^END>

Parameter	Description
0	Pass
1	Fail

- Example

```
OUTPUT 717;"*TST?"
ENTER 717;A
```

*WAI

Holds the 4352B until all the previously sent commands are completed. (No Query.)

- Example

```
OUTPUT 717;"*WAI"
```

Commands Related to Servicing

Note See the *Service Manual* for the details of the following functions.

:DIAG:EREFerence:STATe?

Checks if the external reference frequency source is connected to the EXT REF INPUT connector on the rear panel and returns the result. (Query Only.)

- Query Response

  {0|1} <new line><^END>

Parameter	Description
0	The external reference frequency source is not connected.
1	The external reference frequency source is connected.

- Example

```
OUTPUT 717;":DIAG:EREF:STAT?"
ENTER 717;A
```

:DIAG:INIT:RESult?

Returns the result of the power on test. (Query Only.)

- Query Response

  {“PASS”|“FAIL”} <new line><^END>

- Example

```
OUTPUT 717;":DIAG:INIT:RES?"
ENTER 717;A$
```

Commands Related to HP instrument BASIC

Note Commands for the `PROGram` subsystem are related to HP instrument BASIC. These commands can be used from the external controller only.

:PROGram:CATalog?

Returns all the defined program names of HP instrument BASIC. Because the 4352B's HP instrument BASIC can execute only a single program at a time, this program name will always be "PROG". (Query Only.)

- Query Response

  {"PROG"} <new line><^END>

- Example

```
OUTPUT 717;":PROG:CAT?"
ENTER 717;A$
```

:PROGram[:SELected]:DEFine␣<*block*>

Downloads HP instrument BASIC programs. The DEFine query uploads the program.

Parameter	Description
<*block*>	Block data of a program

<*block*> can be variable length block including the program code lines when downloaded. The first line of <*block*> is a header that specifies the size of the program and has the following 2 formats.

`#0` Allows the `OUTPUT` statement to send program lines until END is specified in the `OUTPUT` statement.

`#NMM.... M` Specifies the program size.

`N` indicates the number of digits to specify the program size.
`M.... M` indicates the program size in byte count (`N` digits).

Each program line must be terminated by <CR> or <CR> <LF>. When the size of <*block*> exceeds the available memory size, the program lines are saved up to the point of memory overflow.

In the response to the DEFine query, the selected program and its size will be returned. The selected program must be either in the "PAUSed" or "STOPped" status for the program to be loaded. The <*block*> is uploaded as definite length arbitrary block response data. The program size is returned in the first line as the header, then the program lines are returned.

- Query Response

  {*block*} <new line><^END>

■ Example

```
OUTPUT 717;":PROG:DEF #0"
OUTPUT 717;"10 PRINT ""HELLO!"""
OUTPUT 717;"20 END"
OUTPUT 717;" " END

DIM A$[100000]
OUTPUT 717;":PROG:DEF?"
ENTER 717 USING "%,2A";HEAD$  !    Reads the header.
B=VAL(HEAD$[2])               !
FOR I=1 TO B                  !
  ENTER 717 USING "%,A";HEAD$ !
NEXT I                        !
ENTER 717 USING "-K";A$       !    Reads the program.
```

:PROGram[:SELected]:DELete[:SELected]

Deletes a program in the 4352B's HP instrument BASIC editor. (No Query.)

■ Example

```
OUTPUT 717;":PROG:DEL"
```

:PROGram[:SELected]:DELete:ALL

Deletes a program in the 4352B's HP instrument BASIC editor. (No Query.)

■ Example

```
OUTPUT 717;":PROG:DEL:ALL"
```

:PROGram[:SELected]:EXECute␣<*string*>

Executes the specified program command. The EXECute command can be used only when a program is in either the "PAUSed" or "STOPped" status. (No Query.)

Parameter	Description
<*string*>	A executable command

■ Example

```
OUTPUT 717;":PROG:EXEC ""STEP"""
```

:PROGram[:SELected]:MALLocate␣{<*numeric*>|DEFault}

This command is not supported by 4352B's HP instrument BASIC.

:PROGram[:SELected]:NAME␣<*string*>

This command is not supported by 4352B's HP instrument BASIC.

:PROGram[:SELected]:NAME␣<*string*>

:PROGram[:SELected]:NUMBer␣<*string*>,<*numeric (1)*>[,<*numeric (2)*>[, ... [,<*numeric (n)*>]

Specifies a number to a numeric variable or to a numeric array in a program on 4352B's HP instrument BASIC or inquires the setting of a numeric variable or a numeric array.

Parameter	Description
<*string*>	Variables in a program (a character or a character string)
<*numeric*>	A number to be set to the variables (To be separated by commas when there is more than one.)

- Query Response

  {*numeric (1)*} [{*numeric (2)*} [... [{*numeric (n)*}] <new line><^END> (n=the number of elements in the array)

- Example

```
OUTPUT 717;":PROG:NUMB A,1"

OUTPUT 717;":PROG:NUMB? A"
ENTER 717;B
```

:PROGram[:SELected]:STATe␣{RUN|PAUSe|STOP|CONTinue}

Sets or inquires the status of the program on 4352B's HP instrument BASIC editor. The following table defines the affect of setting the state to the specified state from each of the possible current states.

Set Status	Current Status		
	RUN	PAUSE	STOP
RUN	Error (−221)	RUN	RUN
CONT	Error (−221)	RUN	Error (−221)
PAUSE	PAUSE	PAUSE	STOP
STOP	STOP	STOP	STOP

- Query Response

  {"RUN"|"PAUS"|"STOP"|"CONT"} <new line><^END>

- Example

```
OUTPUT 717;":PROG:STAT ""STOP"""

OUTPUT 717;":PROG:STAT?"
ENTER 717;A$
```

:PROGram[:SELected]:STRing␣*<string (variable name)>*,*<string (set value 1)>*[,*<string (set value 2)>*[, ... [,*<string (set value n)>*

Sets or inquires for a character string to a string variable or to a string array in the program on 4352B's HP instrument BASIC editor.

Caution This command can only handle a character string of up to 255 characters. If you specify a character string exceeding 255 characters to the command, the 4352B's function is not guaranteed.

Parameter	Description
<string (variable name)>	Variable names in a program (a character or a character string).
<string (set value)>	A number to be set to the character string (use commas when there is more than one).

- Query Response

  {*string (1)*} [{*string (2)*} [... [{*string (n)*] (n = the number of elements in an array) <new line><^END>

- Example

```
OUTPUT 717;":PROG:STR A,""HELLO"""

OUTPUT 717;":PROG:STR? A"
ENTER 717;B$
```

:PROGram[:SELected]:WAIT

Causes no further commands or queries to be executed until the defined program exits from the RUN state. That is, the program is either stopped or paused. (Query inquires the status.)

- Query Response

  {1} <new line><^END>

  1 is returned when a program is in the "STOP" or "PAUS" status.

- Example

```
OUTPUT 717;":PROG:WAIT"

OUTPUT 717;":PROG:WAIT?"
ENTER 717;A
```

Note The following `EXPLicit` command functions in the same manner as the command using the above `SELected`. The `EXPLicit` command is a command to provide compatibility with other SCPI compatible devices. Therefore, you do not necessarily need to use the `EXPLicit` command .

:PROGram:EXPLicit:DEFine⊔“PROG”,*<string>*

See “:PROGram[:SELected]:DEFine⊔*<block>*”.

:PROGram:EXPLicit:DELete⊔“PROG”

See “:PROGram[:SELected]:DELete[:SELected]”.

:PROGram:EXPLicit:EXECute⊔“PROG”,*<string>*

See “:PROGram[:SELected]:EXECute⊔*<string>*”.

:PROGram:EXPLicit:MALLocate⊔“PROG”,{*<numeric>*|DEFault}

See “:PROGram[:SELected]:MALLocate⊔{*<numeric>*|DEFault}”.

:PROGram:EXPLicit:NUMBer⊔“PROG”,*<string>* [,*<numeric>*]

See “:PROGram[:SELected]:NUMBer⊔*<string>*,*<numeric (1)>*[,*<numeric (2)>*[, . . . [,*<numeric (n)>*]”.

:PROGram:EXPLicit:STATe⊔“PROG”,{RUN|PAUSe|STOP|CONTinue}

See “:PROGram[:SELected]:STATe⊔{RUN|PAUSe|STOP|CONTinue}”.

:PROGram:EXPLicit:STRing⊔“PROG”,*<string(variable name)>*[,*<string (set value)>*]

See “:PROGram[:SELected]:STRing⊔*<string (variable name)>*,*<string (set value 1)>*[,*<string (set value 2)>*[, . . . [,*<string (set value n)>*”.

:PROGram:EXPLicit:WAIT “PROG”

See “:PROGram[:SELected]:WAIT”.

12

Application Programming

This chapter describes useful programs for the following operations and measurements available with the 4352B. This chapter also includes transient measurement sample programs using the 43521A Down Converter Unit in the analyzer mode at a frequency beyond 3GHz.

- Controlling the External Signal Source
  - When the 4352B's External Signal Source Automatic Control function is used.
  - When the 4352B's External Signal Source Automatic Control function is not used.
- Controlling the 4352B from the external controller (when the 4352B's External Signal Source Automatic Control function is used)
- Handshaking between the 4352B and the handler via the 24-bit I/O interface
  - When the 4352B's External Signal Source Automatic Control function is used.
  - When the 4352B's External Signal Source Automatic Control function is not used.
- Applications in the Tester Mode
  - Automatic measurement of all the 4352B's measurement parameters
  - FM Modulation sensitivity deviation measurement controlling modulation signal level
- Applications in the Analyzer Mode
  - PLL 3rd harmonic measurement
  - Frequency transient measurement (including high frequency measurement using the 43521A)
  - Limit testing
  - Post-tuning drift characteristics measurement
  - Automatic measurement of all the 4352B's measurement parameters
- File transfer function
  - File transfer from the 4352B to the external controller
  - File transfer from the external controller to the 4352B
  - Listing of the files in the current directory of the 4352B

Controlling the External Signal Source with the 4352B (When the 4352B's External Signal Source Automatic Control Function is Used)

This program measures and displays the C/N ratio at two control (tuning) voltages (1V and 4V) in the tester mode. The external signal source frequency is controlled by the 4352B.

This program assumes that the 4352B is set as the system controller or active controller. Because the external signal source is directly controlled by the 4352B, there is no need to control the external signal source in the program.

Lines 160 to 250 are the main part of this program. This part measures the C/N ratio at two tuning voltages and displays the result on the LCD.

Lines 300 to 510 are a subroutine to set up the 4352B. Line 370 selects the tester mode. Lines 410 to 430 set the external signal source's automatic control function to ON.

Lines 560 to 600 define a function `Meas` that is used to perform a measurement and return the result.

```
100   ! File Name : FIG12_1.TXT
110   !   IBASIC SAMPLE PROGRAM for AUTOMATIC LOCAL CONTROL ON
120   !
130   ASSIGN @Hp4352 TO 800 ! Assign IBASIC Address
140   !
150   GOSUB Setup
160   LOOP
170     DISP "CONNECT DEVICE and PRESS CONTINUE."
180     PAUSE
190     DISP
200     FOR I=1 TO 2
210      OUTPUT @Hp4352;"VCTRL ";V_ctrl(I)   ! Set DC Control Voltage
220      Cn_data(I)=FNMeas                   ! C/N MEASUREMENT
230      PRINT USING "10A,2D.2D,4A,5X,10A,4D.D,6A";
          "Control V ";V_ctrl(I);" (V)";"CN ratio ";Cn_data(I);" (dBc)"
240     NEXT I
250   END LOOP
260   !
270   STOP
280   !
290   !
300 Setup:  !
310   Sg_wait_time=.1  ! second
320   V_ctrl(1)=1      ! volt
330   V_ctrl(2)=4      ! volt
340   !
350   OUTPUT @Hp4352;"PRES"                ! Preset 4352
360   OUTPUT @Hp4352;"HOLD"                ! Trigger HOLD
370   OUTPUT @Hp4352;"VT"                  ! Select Tester mode
380   OUTPUT @Hp4352;"VPOW 4"              ! Set DC Power Voltage to 4 V
390   OUTPUT @Hp4352;"VCTRL ";V_ctrl(1)    ! Supply DC Control Voltage
400   OUTPUT @Hp4352;"VOUT ON"             ! Supply DC Voltages
410   OUTPUT @Hp4352;"LOSWT ";Sg_wait_time ! Set LOCAL SG Switch Time
420   OUTPUT @Hp4352;"SGTYPE 1"            ! Select SGTYPE to 1
430   OUTPUT @Hp4352;"LOAUTO ON"           ! LOCAL AUTO CONTROL ON
440   OUTPUT @Hp4352;"MEAS CN"             ! Select CN ratio Measurement
450   OUTPUT @Hp4352;"CNOFREQ 10KHZ"       ! Set Offset Frequency to 10 kHz
460   OUTPUT @Hp4352;"CNBW 1HZ"            ! Set Noise BW to 1 Hz
470   OUTPUT @Hp4352;"AVER ON"             ! Set Averaging ON
480   OUTPUT @Hp4352;"AVERFACT 4"          ! Set Averaging Factor to 4
490   OUTPUT @Hp4352;"*OPC?"               ! Verify Operation Completed
500   ENTER @Hp4352;Opc
510   RETURN
520   !
530   END
```

Sample Program:
Controlling the External Signal Source with the 4352B
(When the 4352B's Automatic Control Function is Used, 1/2)

```
540   !
550   !
560 DEF FNMeas
570   EXECUTE "SING"                    ! Measurement
580   Dat=READIO(8,0)                   ! Get Measurement Data
590   RETURN Dat
600   FNEND
```

Figure 12-1.
Sample Program:
Controlling the External Signal Source with the 4352B
(When the 4352B's Automatic Control Function is Used, 2/2)

Controlling the External Signal Source with the 4352B (When the 4352B's External Signal Source Automatic Control Function is Not Used)

This program measures and displays the C/N ratio at two tuning voltages (1V and 4V) in the tester mode. The external signal source frequency is controlled not by the 4352B's automatic control function but by this program.

Note

We recommend that you use the 4352B's automatic control function unless your test system has restrictions on the use of this function.

Usually, controlling of the external signal source is required for the following cases.

a. When the device's output frequency changed in the change of tuning voltage or power voltage.

b. When one of the following changes is made:

- When Automatic Frequency Control function (AFC) is set to ON.
- When the AFC target frequency is changed while the AFC is turned ON.

c. When the device's output frequency is changed for some other reasons (such as change of the environment temperature)

Note that you do not have to control the external signal source when measuring the following because the external signal source output is not required for these measurements:

- Tester Mode
  - RF power level
  - DC power consumption current
  - Frequency measurement with 64 kHz resolution
- Analyzer Mode
  - RF power - DC tuning voltage characteristic
  - Frequency/frequency tuning sensitivity - DC tuning voltage characteristic, with 64 kHz resolution
  - Frequency transient measurement in the direct mode

This sample program corresponds to case "a." in the above. This program assumes that the frequency is measured with 1 kHz resolution.

This program also assumes that the 4352B is set as the system controller or active controller. The external signal source's GPIB address is specified in the program (line 140), because the external signal source must be controlled via GPIB.

Lines 170 to 280 are the main part of this program. This part measures the C/N ratio at two tuning voltages and displays the results on the LCD. Line 230 checks the frequency of the external signal source every time the tuning voltage changes, and if the frequency must be changed, it is changed to the proper frequency.
Line 240 selects the C/N ratio measurement at every measurement. This is because the frequency measurement is selected in the subroutine "Local_check" called from line 230 that checks the external signal source frequency.

Lines 330 to 550 are a subroutine to set up the 4352B. Line 380 sets the external signal source's automatic control function to OFF. Line 410 selects the tester mode. Lines 450 to 470 set up the external signal source.

Lines 580 to 700 are the subroutine "Local_check" to control the external signal source frequency.
The frequency of the external signal source is checked as follows:

1. Select the frequency measurement with 64 kHz resolution and measure the frequency.
2. Query the 4352B the information on the frequency of the external signal source to be set (`Lo_freq`).
3. Compare `Lo_freq` and the current frequency of the external signal source (`Lo_freq_pre`).
4. If they are different, change the external signal source frequency to the value of `Lo_freq` and replace that of `Lo_freq_pre` with `Lo_freq`.
5. Set the frequency measurement resolution back to 1 kHz.
6. Wait until the frequency change of the external signal source is completed.

Lines 750 to 790 define a function `Meas` to make a measurement and return the result.

```
100   ! File Name : FIG12_2.TXT
110   !   IBASIC SAMPLE PROGRAM for LOCAL AUTO CONTROL OFF
120   !
130   ASSIGN @Hp4352 TO 800 ! Assign IBASIC Address
140   ASSIGN @Hp8664 TO 719 ! Assign Signal Generator's GPIB Address
150   !
160   GOSUB Setup
170   LOOP
180     DISP "CONNECT DEVICE and PRESS CONTINUE."
190     PAUSE
200     DISP
210     FOR I=1 TO 2
220      OUTPUT @Hp4352;"VCTRL ";V_ctrl(I)
230      GOSUB Local_check            ! CHECK LOCAL FREQUENCY
240      OUTPUT @Hp4352;"MEAS CN"     ! Set Measurement Item to C/N
250      Cn_data(I)=FNMeas            ! C/N MEASUREMENT
260      PRINT USING "10A,2D.2D,4A,5X,10A,4D.D,6A";
          "Control V ";V_ctrl(I);" (V)";"CN ratio ";Cn_data(I);" (dBc)"
270     NEXT I
280   END LOOP
290   !
300   STOP
310   !
320   !
330 Setup:  !
340   Sg_wait_time=.1        ! second
350   V_ctrl(1)=1            ! Volt
360   V_ctrl(2)=4            ! Volt
370   !
380   OUTPUT @Hp4352;"LOAUTO OFF"     ! Manual SG Control
390   OUTPUT @Hp4352;"PRES"           ! Preset 4352
400   OUTPUT @Hp4352;"HOLD"           ! Trigger HOLD
410   OUTPUT @Hp4352;"VT"             ! Select Tester mode
420   OUTPUT @Hp4352;"VPOW 4"         ! Set DC Power Voltage to 4 V
430   OUTPUT @Hp4352;"VCTRL ";V_ctrl(1) ! Supply DC Control Voltage
440   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC Voltages
450   OUTPUT @Hp8664;"*RST"           ! SG Preset
460   OUTPUT @Hp8664;"AMPL:STAT ON"   ! Set SG's Output ON
470   OUTPUT @Hp8664;"AMPL 10DBM"     ! Set SG's Output Level
480   OUTPUT @Hp4352;"MEAS CN"        ! Select CN ratio Measurement
490   OUTPUT @Hp4352;"CNOFREQ 10KHZ"  ! Set Offset Frequency to 10 kHz
500   OUTPUT @Hp4352;"CNBW 1HZ"       ! Set Noise BW to 1 Hz
510   OUTPUT @Hp4352;"AVER ON"        ! Set Averaging ON
520   OUTPUT @Hp4352;"AVERFACT 4"     ! Set Averaging Factor to 4
530   OUTPUT @Hp4352;"*OPC?"          ! Verify Operation Completed
540   ENTER @Hp4352;Opc
550   RETURN
```

Sample Program:
Controlling the External Signal Source with the 4352B
(When the 4352B's Automatic Control Function is Not Used, 1/2)

```
560   !
570   !
580 Local_check:!
590   OUTPUT @Hp4352;"MEAS FREQ"      ! Set Measurement item to Frequency
600   OUTPUT @Hp4352;"FCOUN RES64KHZ" ! Set Frequency Resolution to 64 kHz
610   EXECUTE "SING"
620   OUTPUT @Hp4352;"LOFREQ?"        ! Check Local Frequency to be set
630   ENTER @Hp4352;Lo_freq
640   IF Lo_freqLo_freq_pre THEN
650   OUTPUT @Hp8664;"FREQ ";Lo_freq;"HZ" ! Set Local Frequency to SG
660    Lo_freq_pre=Lo_freq
670   END IF
680   OUTPUT @Hp4352;"FCOUN RES1KHZ"  ! Set Frequency Resolution to 1 kHz
690   WAIT Sg_wait_time
700   RETURN
710   !
720   END
730   !
740   !
750  DEF FNMeas
760    EXECUTE "SING"                 ! Measurement
770    Dat=READIO(8,0)                ! Get Measurement Data
780    RETURN Dat
790    FNEND
```

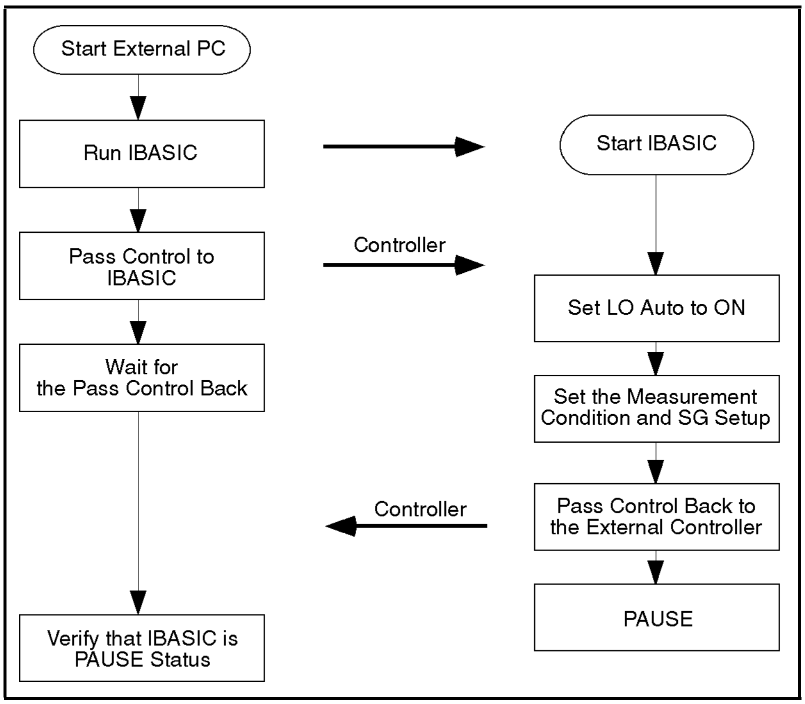
Figure 12-2.
Sample Program:
Controlling the External Signal Source with the 4352B
(When the 4352B's Automatic Control Function is Not Used, 2/2)

Controlling the 4352B from the External Controller

These sample programs are used to measure the device's frequency and C/N ratio in the tester mode with a combination of the 4352B and an external controller. In this case, the external controller controls the 4352B to set up the measurement conditions, make the measurements, and get the measurement results.
These operations are performed by passing control from the external controller to the 4352B.

Setting Measurement Conditions

The following figure describes the process flow:



Controlling the 4352B from the External Controller (Measurement Condition Setup)

External Controller's Side

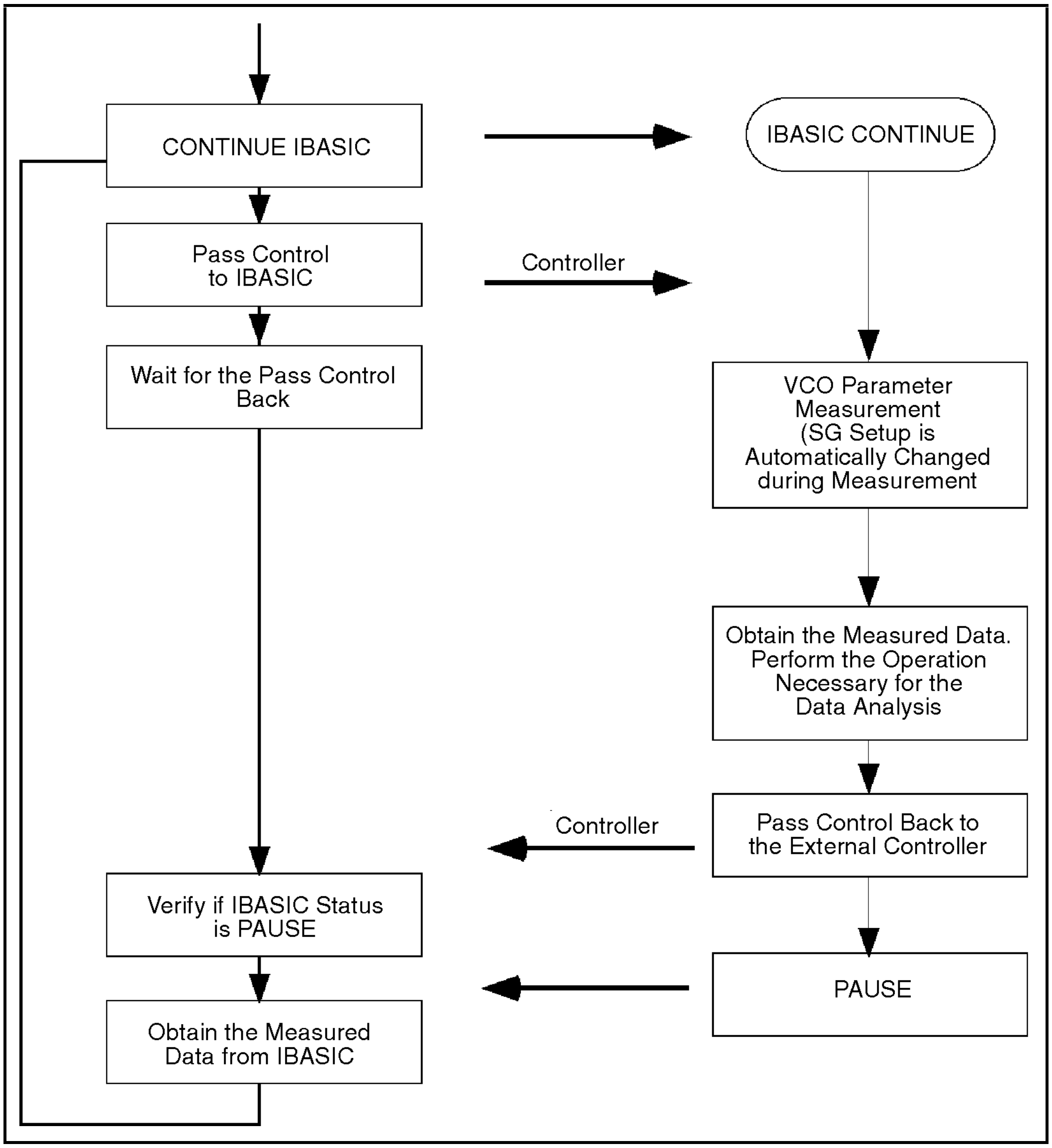
Line 220 runs the 4352B's IBASIC program, and line 240 passes the active controller capability to the 4352B. After that, the external controller waits for the control to be passed back from the 4352B, and then checks that the 4352B's IBASIC program has paused.

4352B's Side

The IBASIC program is run by the external controller. Line 160 sets up the 4352B. Lines 340 to 360 set up the external signal source and set the external signal source automatic control function to ON. When the setup is complete, the 4352B passes the controller capability back to the external controller (line 170) and the program pauses (line 190).

Measurements, Analysis, and Data Transfer

The following figure shows the process flow chart:



Controlling the 4352B from the External Controller (Measurements, Analysis, and Data Transfer)

External Controller's Side

The loop from lines 280 to 420 repeats the following operations:

Line 320 continues the 4352B's program every time the device connection is completed.

Line 340 passes the controller capability to the 4352B.

Line 350 waits for the pass control back from the 4352B which is performed after the measurement completed.

Line 360 checks if the 4352B's IBASIC program pauses.

The measurement result is obtained by querying the 4352B (lines 370 to 400).

4352B's Side

The 4352B's IBASIC program is continued by the external controller, and makes a measurement (line 200). When the measurement is completed, the controller capability is passed back to the external controller (line 210) and the IBASIC program pauses (line 190).

```
100   ! File Name : FIG12_4.TXT
110   !   EXTERNAL CONTROLLER SAMPLE PROGRAM for Controlling 4352
120   !
130   ABORT 7
140   ASSIGN @Hp4352 TO 717
150   !
160   OUTPUT @Hp4352;"OSNT 16384;OSPT 0"
170   OUTPUT @Hp4352;"OSE 16384;*SRE 128"
180   A=SPOLL(@Hp4352)
190   OUTPUT @Hp4352;"OSER?"
200   ENTER @Hp4352;Oser
210   !
220   OUTPUT @Hp4352;"PROG:STAT RUN"
230   WAIT .01
240   PASS CONTROL @Hp4352
250   GOSUB Wait_ctrl_back
260   GOSUB Verify_pause
270   !
280   LOOP
290     DISP "CONNECT DEVICE and PRESS CONTINUE."
300     PAUSE
310     DISP "MEASURING..."
320     OUTPUT @Hp4352;"PROG:STAT CONT"
330     WAIT .01
340     PASS CONTROL @Hp4352
350     GOSUB Wait_ctrl_back
360     GOSUB Verify_pause
370     OUTPUT @Hp4352;"PROG:NUMB? Fr"
380     ENTER @Hp4352;Fr
390     OUTPUT @Hp4352;"PROG:NUMB? Cn"
400     ENTER @Hp4352;Cn
410     PRINT USING "10A,4D.3D,6A,3X,4A,3D.D,6A";
         "FREQUENCY ";Fr/1.E+6;" (MHz)";"C/N ";Cn;" (dBc)"
420   END LOOP
430   !
440   STOP
450   !
460   !
470 Wait_ctrl_back:  !
480   REPEAT
490     STATUS 7,3;Reg3
500   UNTIL BIT(Reg3,6)
510   RETURN
```

Sample Program:
Controlling the 4352B from the External Controller
(External Controller's Side, 1/2)

```
520   !
530   !
540 Verify_pause:  !
550   ON INTR 7 GOTO Verified
560   ENABLE INTR 7;2
570 Waiting:GOTO Waiting
580 Verified: !
590   OFF INTR
600   A=SPOLL(@Hp4352)
610   OUTPUT @Hp4352;"OSER?"
620   ENTER @Hp4352;Oser
630   ENABLE INTR 7
640   RETURN
650   !
660   !
670   END
```

Figure 12-3.
Sample Program:
Controlling the 4352B from the External Controller
(External Controller's Side, 2/2)

```
100 ! File Name : FIG12_6.TXT
110 !   IBASIC SAMPLE PROGRAM for Using with External Controller
120 !
130 ASSIGN @Hp4352 TO 800          ! Assign IBASIC Address
140 Ext_pc=721           ! 721 is External Controller's GPIB Address
150 !
160 GOSUB Setup
170 PASS CONTROL Ext_pc
180 LOOP
190   PAUSE
200   GOSUB Measurement
210   PASS CONTROL Ext_pc
220 END LOOP
230 !
240 STOP
250 !
260 !
270 Setup:!
280 OUTPUT @Hp4352;"PRES"          ! Preset 4352
290 OUTPUT @Hp4352;"HOLD"          ! Trigger HOLD
300 OUTPUT @Hp4352;"VT"            ! Select Tester mode
310 OUTPUT @Hp4352;"VPOW 4"        ! Set DC Power Voltage to 4 V
320 OUTPUT @Hp4352;"VCTRL 1"       ! Set DC Control Voltage to 1 V
330 OUTPUT @Hp4352;"VOUT ON"       ! Supply DC Voltages
340 OUTPUT @Hp4352;"LOSWT 0.1"     ! Set LOCAL SG Wait Time to 0.1 second
350 OUTPUT @Hp4352;"SGTYPE 1"      ! Select SG TYPE 1
360 OUTPUT @Hp4352;"LOAUTO ON"     ! Automatic Local SG Control
370 OUTPUT @Hp4352;"MEAS FREQ"     ! Set Measurement Item to Frequency
380 OUTPUT @Hp4352;"FCOUN RES1KHZ" ! Frequency Measurement
                                     with 1 kHz Resolution
390 OUTPUT @Hp4352;"MEAS CN"       ! Set CN ratio Measurement
400 OUTPUT @Hp4352;"CNOFREQ 10KHZ" ! Set Offset Frequency to 10 kHz
410 OUTPUT @Hp4352;"CNBW 1HZ"      ! Set Noise BW to 1 Hz
420 OUTPUT @Hp4352;"AVERFACT 4"    ! Set Averaging Factor to 4
430 OUTPUT @Hp4352;"AVER ON"       ! Set Averaging ON
440 OUTPUT @Hp4352;"*OPC?"         ! Verify Operation Completed
450 ENTER @Hp4352;Opc
460 RETURN
```

Sample Program:
Controlling the 4352B from the External Controller (4352B's Side, 1/2)

```
470 !
480 !
490 Measurement:!
500  OUTPUT @Hp4352;"MEAS FREQ"
510  Fr=FNMeas       ! Frequency Measurement
520  OUTPUT @Hp4352;"MEAS CN"
530  Cn=FNMeas       ! C/N Measurement
540  RETURN
550 !
560 END
570 !
580 !
590 DEF FNMeas
600   EXECUTE "SING"  ! Measurement
610   Dat=READIO(8,0) ! Get Measurement Data
620   RETURN Dat
630 FNEND
```

Figure 12-4.
Sample Program:
Controlling the 4352B from the External Controller
(4352B's Side, 2/2)

Transferring Data in Analyzer Mode

Here is the program required to use the programs shown in Figure 12-3 through Figure 12-4 for making measurements in the analyzer mode.

There are two differences between transferring data in the tester and analyzer modes.

- In the analyzer mode, the array is used to save and transfer measurement data.
- In the analyzer mode, the data transfer format is more significant because of more measurement data to be transferred.

Change the programs, in Figure 12-5 and Figure 12-6 for ASCII data transfer format, or Figure 12-7 and Figure 12-8 for IEEE 64-bit floating point data transfer format.

```
100   ! File Name : FIG12_8.TXT
110   !   To Get Trace Data Using ASCII Format
120   !
130   ABORT 7
140   PASS CONTROL 717      ! 4352 Address
150   !
160   DIM Dat(1:201)
170   ASSIGN @Hpib TO 7     ! GPIB Card Number
180   ENTER @Hpib;Dat(*)    ! Get Trace Data
190   ASSIGN @Hpib TO *
200   !
210   END
```

Figure 12-5.
Sample Program:
Data Transfer in Analyzer Mode (ASCII Format)
External Controller Side

```
100 ! File Name : FIG12_9.TXT
110 !   To Transfer Data Trace from 4352 to External Controller
        Using ASCII Format
120 !
130 DIM Dat(1:201)
140 !
150 ASSIGN @Hp4352 TO 8
160 OUTPUT @Hp4352;"FORM4"        ! ASCII Format
170 OUTPUT @Hp4352;"OUTPDATA?"    ! Get Data Trace Data
180 ENTER @Hp4352;Dat(*)
190 ASSIGN @Hp4352 TO *
200 !
210 ASSIGN @Cntlr TO 721          ! External Controller Address
220 OUTPUT @Cntlr;Dat(*)
230 ASSIGN @Cntlr TO *
240 !
250 END
```

Figure 12-6.
Sample Program:
Data Transfer in Analyzer Mode (ASCII Format)
4352B Side

```
100   ! File Name : FIG12_10.TXT
110   !   To Get Trace Data Using IEEE 64-bit Floating Point Format
120   !
130   ABORT 7
140   PASS CONTROL 717            ! 4352 Address
150   !
160   DIM Dat(1:201)
170   ASSIGN @Dt TO 7;FORMAT OFF   ! GPIB Card Number
180   ENTER @Dt;Dat(*)            ! Get Trace Data
190   ASSIGN @Dt TO *
200   !
210   END
```

Figure 12-7.
Sample Program:
Data Transfer in Analyzer Mode (Binary Format)
External Controller Side

```
100   ! File Name : FIG12_11.TXT
110   !   To Transfer Data Trace from 4352 to External Controller
          Using IEEE 64-bit Floating Point Format
120   !
130   DIM Dat(1:201)
140   !
150   ASSIGN @Hp4352 TO 8
160   ASSIGN @Dt TO 8;FORMAT OFF
170   OUTPUT @Hp4352;"FORM3"            ! IEEE 64-Bit Format
180   OUTPUT @Hp4352;"OUTPDATA?"        ! Get Data Trace Data
190   ENTER @Hp4352 USING "#,8A";Header$
200   ENTER @Dt;Dat(*)
210   ENTER @Hp4352;End$
220   ASSIGN @Dt TO *
230   ASSIGN @Hp4352 TO *
240   !
250   ASSIGN @Cntlr TO 721;FORMAT OFF    ! External Controller Address
260   OUTPUT @Cntlr;Dat(*)
270   ASSIGN @Cntlr TO *
280   !
290   END
```

Figure 12-8.
Sample Program:
Data Transfer in Analyzer Mode (Binary Format)
4352B Side

Controlling the Handler via the 24-bit I/O interface (When the 4352B's External Signal Source Automatic Control Function is Used)

These programs control the 4352B and the handler using the external controller. The handshake between the 4352B and the handler is accomplished via the 24-bit I/O port on the rear panel of the 4352B.

One of these sample programs shows how to control 24-bit I/O port with GPIB commands or HP instrument BASIC commands. Because the HP instrument BASIC commands `READIO` and `WRITEIO` can directly control the 24-bit I/O port without GPIB, the handshake is faster than that with GPIB commands.

See Appendix D for general functions of the 24-bit I/O port.

Figure 12-9 shows an overview of the system configuration.

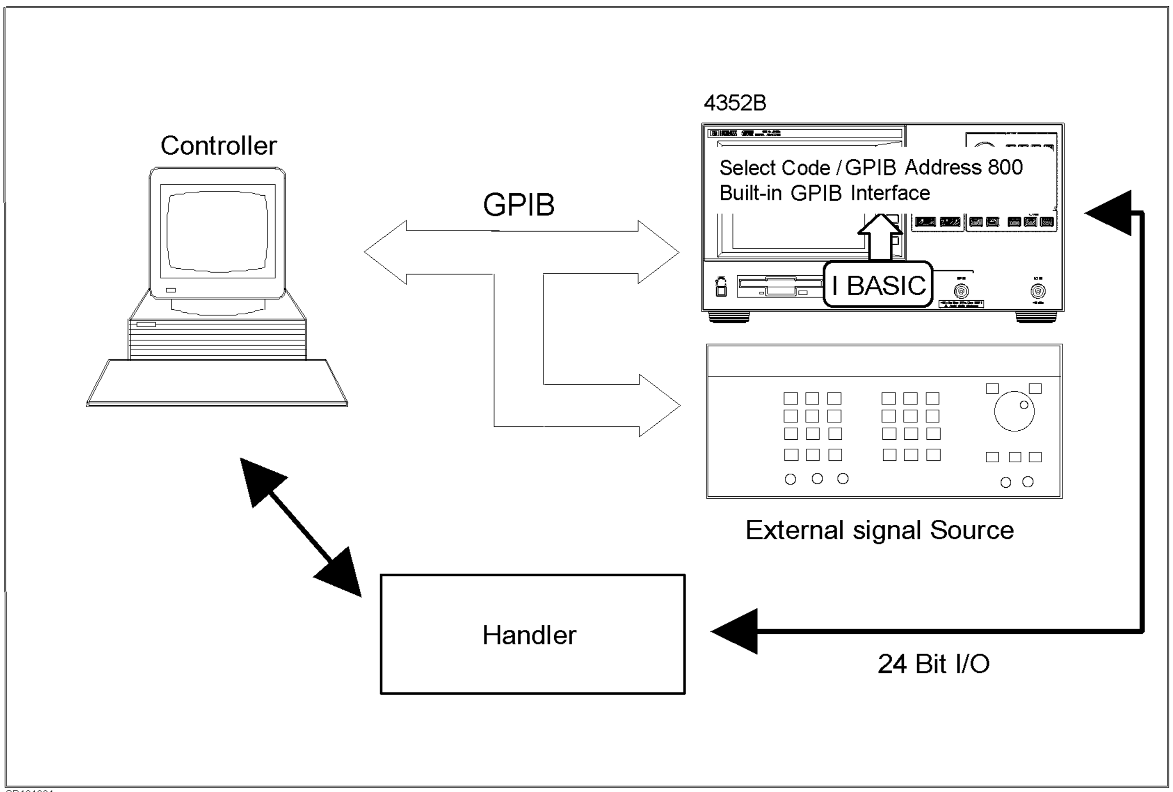


Figure 12-9. The System Configuration with the Handler

The Overview of the Program

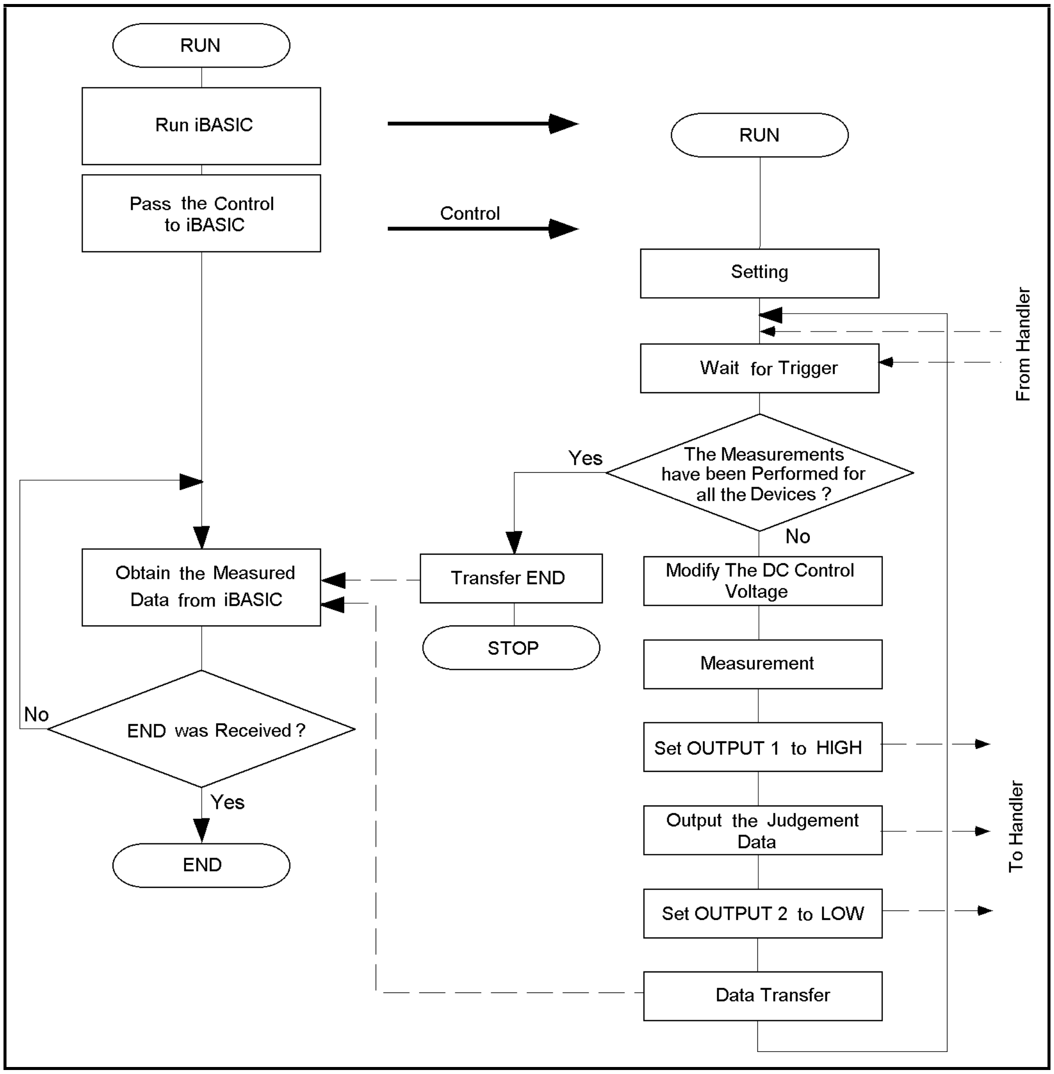


Figure 12-10.
Controlling the Handler with both the IBASIC program and the External Controller

Figure 12-10 shows the flow chart for the sample programs.
Once the 4352B receives the controller capability, it handshakes with the external controller via GPIB and with the handler via the 24-bit I/O port.
The `READIO` and `WRITEIO` commands are used to synchronize with the handler, which eventually improves the total processing speed.

Programs such as "Controlling the 4352B from the External Controller" require that control be passed between the 4352B and the external controller. However, you do not have to pass the controller capability back to the external controller once it is passed to the 4352B.

External Controller's Side

The external controller runs the 4352B's IBASIC program (line 180), and passes the controller capability to the 4352B (line 200). Then, it continues to obtain measurement results from the 4352B (line 240) until it receives the character string `END` (line 250).

4352B's Side

The IBASIC program is started by the external controller, and then assigns the I/O path of the external controller so that data with a tab code is transferred to the controller (line 140). This assignment makes it easier to handle measurement results from spreadsheet software.

Then, the 4352B is set up (line 160) and the following processes are performed in the measurement loop (lines 170 to 280). The 4352B makes a measurement when a trigger is sent from the handler to INPUT1 (line 180). It then informs the handler of the measurement end (line 240), and also the measurement result (line 250). Next, it notifies the handler of the measurement result output (line 260), and transfers the measurement results to the external controller (line 270, lines 960 to 1020).
The `Judgment` subroutine judges the measurement result (lines 830 to 930) and sends the result to the handler via port A (line 920). After all the devices are measured, the handler sends a signal to the 4352B via port C to inform it that all measurements are completed. The 4352B checks for this at every loop (line 190). When the signal has been sent, the 4352B transfers a character string `END` to the external controller (line 310), and the program stops.

Tips on Programming

If the controller capability has to be passed back to the system controller in your system when there is a problem in the handler, you should design your system in advance so that the problem information is sent directly from the handler to the external controller. Then you can execute the following command on the external controller to forcibly pass control back to the external controller:

```
ABORT 7
```

If you do not need to use an external controller, delete from the sample programs the external controller's side program, the part of the data transfer to the external controller in the 4352B's program, and then set the 4352B as the system controller.

```
100   ! File Name : FIG12_14.TXT
110   !   EXTERNAL CONTROLLER SAMPLE PROGRAM for Controlling 4352
          with Handler
120   !
130   DIM Data$[100]
140   !
150   ABORT 7
160   ASSIGN @Hp4352 TO 717
170   !
180   OUTPUT @Hp4352;"PROG:STAT RUN"
190   WAIT .01
200   PASS CONTROL @Hp4352
210   !
220   ON ERROR GOSUB Err_check
230   LOOP
240     ENTER 7 USING "-K,+";Data$
250   EXIT IF Data$="END"
260     PRINT Data$
270   END LOOP
280   !
290   DISP "END"
300   STOP
310   !
320   !
330 Err_check: !
340   IF ERRN167 THEN
350     DISP ERRM$
360     BEEP
370     PAUSE
380   END IF
390   RETURN
400   !
410   !
420   END
```

Figure 12-11.
Sample Program:
Controlling the Handler via the 24-bit I/O Interface
(When the 4352B's External Signal Source Automatic Control Function is Used, External Controller's Side)

```
100   ! File Name : FIG12_15.TXT
110   !   IBASIC SAMPLE PROGRAM for Communication with Handler via 24-bit I/O
120   !
130   ASSIGN @Hp4352 TO 800    ! Assign IBASIC Address
140   ASSIGN @Ext_pc TO 721;EOL CHR$(9)  ! Assign External Controller's
         Address with TAB code
150   !
160   GOSUB Setup              ! Set up
170   LOOP
180    GOSUB Input_check       ! WAIT for TRIGGER from Handler
190   EXIT IF BIT(READIO(16,2),0)  ! Check Test End by PORT C INPUT
200    FOR I=1 TO 2
210     OUTPUT @Hp4352;"VCTRL ";V_ctrl(I) ! Set Control Voltage
220     GOSUB Measurement       ! Measurement
230    NEXT I
240    OUTPUT @Hp4352;"OUT1H"  ! Inform Handler of Measurement End
250    GOSUB Judgement         ! Judgement
260    OUTPUT @Hp4352;"OUT2L"  ! Inform Handler of judgement End
270    GOSUB Data_transfer     ! Send Measurement Data to External PC
280   END LOOP
290   !
300   DISP "END"
310   OUTPUT @Ext_pc;"END" END
320   !
330   STOP
340   !
350   !
```

Sample Program:
Controlling the Handler via the 24-bit I/O Interface
(When the 4352B's External Signal Source Automatic Control Function is Used, 4352B's Side, 1/3)

```
360   Setup:!
370   V_ctrl(1)=1    ! Volt
380   V_ctrl(2)=4    ! Volt
390   OUTPUT @Hp4352;"PRES"    ! Preset 4352
400   OUTPUT @Hp4352;"HOLD"    ! Trigger HOLD
410   OUTPUT @Hp4352;"VT"      ! Select Tester mode
420   OUTPUT @Hp4352;"VPOW 4"   ! Set DC POWER Voltage to 4 V
430   OUTPUT @Hp4352;"VCTRL ";V_ctrl(1)  ! Set Control Voltage to 1 V
440   OUTPUT @Hp4352;"VOUT ON"   ! Supply DC Voltages
450   OUTPUT @Hp4352;"LOSWT 0.1" ! Set LOCAL SG Switch Time to 0.1 second
460   OUTPUT @Hp4352;"SGTYPE 1"       ! Select SGTYPE 1
470   OUTPUT @Hp4352;"LOAUTO ON"      ! LOCAL AUTO CONTROL ON
480   OUTPUT @Hp4352;"MEAS FREQ"      ! Set Measurement Item to FREQUENCY
490   OUTPUT @Hp4352;"FCOUN RES1KHZ"  ! 1 kHz Resolution
500   OUTPUT @Hp4352;"MEAS CN"        ! Set Measurement Item to C/N
510   OUTPUT @Hp4352;"CNOFREQ 10KHZ"  ! Set Offset Frequency to 10 kHz
520   OUTPUT @Hp4352;"CNBW 1HZ"       ! Set Noise BW to 1 Hz
530   OUTPUT @Hp4352;"AVER ON"        ! Set Averaging ON
540   OUTPUT @Hp4352;"AVERFACT 4"     ! Set Averaging Factor to 4
550   OUTPUT @Hp4352;"NEGL"           ! Negative Logic
560   OUTPUT @Hp4352;"OUT1ENVL"       ! Set OUTPUT 1 to LOW by TRIGGER INPUT
570   OUTPUT @Hp4352;"OUT2ENVH"       ! Set OUTPUT 2 to HIGH by TRIGGER INPUT
580   OUTPUT @Hp4352;"OUT1H"          ! Set OUTPUT 1 to HIGH
590   OUTPUT @Hp4352;"OUT2L"          ! Set OUTPUT 2 to LOW
600   OUTPUT @Hp4352;"*OPC?"          ! Verify Operation Completed
610   ENTER @Hp4352;Opc
620   Test_end=0
630   RETURN
640   !
650   !
660   Input_check:!   Wait for TRIGGER INPUT from Handler
670    REPEAT
680     EXECUTE "INPT?"
690    UNTIL READIO(8,0)
700    RETURN
710   !
720   !
```

Sample Program:
Controlling the Handler via the 24-bit I/O Interface
(When the 4352B's External Signal Source Automatic Control Function is Used, 4352B's Side, 2/3)

```
 730   Measurement:!
 740    OUTPUT @Hp4352;"MEAS POWE"     ! Set Measurement Item to POWER
 750    Power(I)=FNMeas
 760    OUTPUT @Hp4352;"MEAS FREQ"     ! Set Measurement Item to FREQUENCY
 770    Freq(I)=FNMeas
 780    OUTPUT @Hp4352;"MEAS CN"       ! Set Measurement Item to C/N
 790    Cn(I)=FNMeas
 800    RETURN
 810   !
 820   !
 830   Judgement:!
 840    WRITEIO 16,0;0              ! Initialize Judgement Result
 850    Result=0
 860    IF Power(1)<-10 THEN Result=BINIOR(Result,1)
 870    IF Freq(1)<8.E+8 OR Freq(1)>8.7E+8 THEN Result=BINIOR(Result,2)
 880    IF Cn(1)<80 THEN Result=BINIOR(Result,4)
 890    IF Power(2)<-10 THEN Result=BINIOR(Result,8)
 900    IF Freq(2)<8.E+8 OR Freq(2)>8.7E+8 THEN Result=BINIOR(Result,16)
 910    IF Cn(2)<80 THEN Result=BINIOR(Result,32)
 920    WRITEIO 16,0;Result         ! Judgement Result Output via PORT A
 930    RETURN
 940    !
 950    !
 960   Data_transfer:!  Send Measurement Data to External Controller
 970    FOR I=1 TO 2
 980     OUTPUT @Ext_pc USING "2D.2D";Power(I)
 990     OUTPUT @Ext_pc USING "4D.3D";Freq(I)/1.E+6
1000     OUTPUT @Ext_pc USING "4D.D,#";Cn(I) END
1010    NEXT I
1020    RETURN
1030    !
1040    !
1050   END
1060    !
1070    !
1080   DEF FNMeas
1090    EXECUTE "SING"          ! Measurement
1100    Dat=READIO(8,0)         ! Get Measurement Data
1110    RETURN Dat
1120    FNEND
```

Figure 12-12.
Sample Program:
Controlling the Handler via the 24-bit I/O Interface
(When the 4352B's External Signal Source Automatic Control Function is Used, 4352B's Side, 3/3)

Synchronizing with the Handler

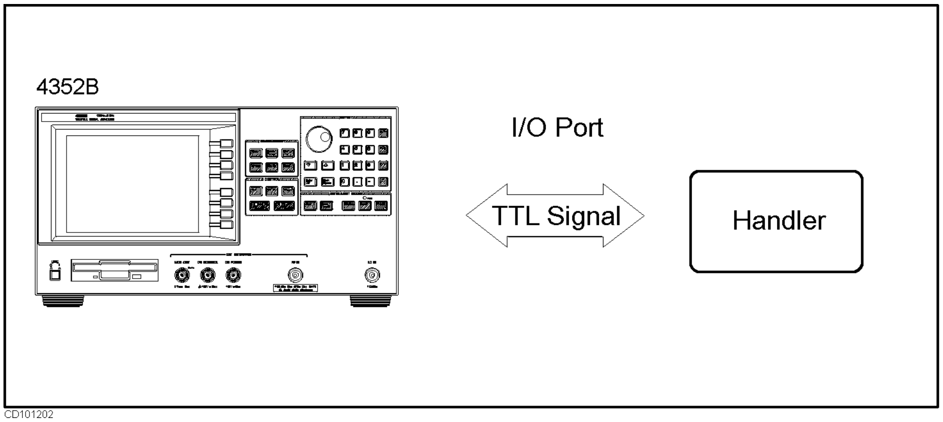


Figure 12-13. Synchronizing with the Handler via the 24-bit I/O port

This program controls the 4352B and the handler to measure the DUTs per lot.

In this case, the 4352B and the handler must be synchronized to perform the following handshakes.

a. The 4352B notifies the handler that a new DUT is ready for measurement.

b. The handler notifies the 4352B that the DUT has been connected to the electrodes of the fixture on the handler.

c. The 4352B notifies the handler of the measurement end.

d. The handler notifies the 4352B of the completion of the measurements of all DUTs in the lot.

In this sample program (for the 4352B side), line 260 corresponds to case "a", subroutine `Input_check` (line 180, lines 660 to 700) corresponds to case "b", line 240 corresponds to case "c", and line 190 corresponds to case "d".

Sending Signals to the Handler

```
920  WRITEIO 16,0;Result         ! Judgment Result Output via PORT A
```

Line 920 sets to 1 the bit (on port A of the 24-bit I/O port) corresponding to the judgment result. This can notify the handler what measurement parameter was failed.

For example, if an RF power measurement value is judged to be less than or equal to −10dBm (line 890), the bit 3 of port A is set to 1 (See the following figure).

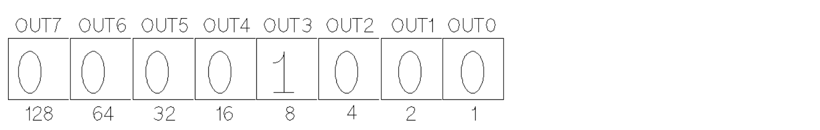


Figure 12-14. An Example of Using the 24-bit I/O Port (port A)

Reading Signals from the Handler

```
180  GOSUB Input_check       ! WAIT for TRIGGER from Handler
190 EXIT IF BIT(READIO(16,2),0)  ! Check Test End by PORT C INPUT

660  REPEAT
670   EXECUTE "INPT?"
680  UNTIL READIO(8,0)
690  RETURN
```

This program assumes that the handler sends a pulse to the signal line INPUT1 when the DUT has been connected to the fixture on the handler.
In the loop in lines 670 to 700, the 4352B waits to perform a measurement until the DUT has been connected to the fixture.

Also, this program assumes that the handler sets bit 0 of port C to 1. Next, it sends a pulse to the INPUT1 after completing the measurement of all the DUTs in a lot.
In line 190, the 4352B judges if all measurements in the lot are completed.

Note

Line 180 is also used as a trigger to execute line 190. This enables you to prevent the 4352B from recognizing the lot end before measuring the last DUT in the lot.

Figure 12-15 is a timing chart for handler control by the 4352B.

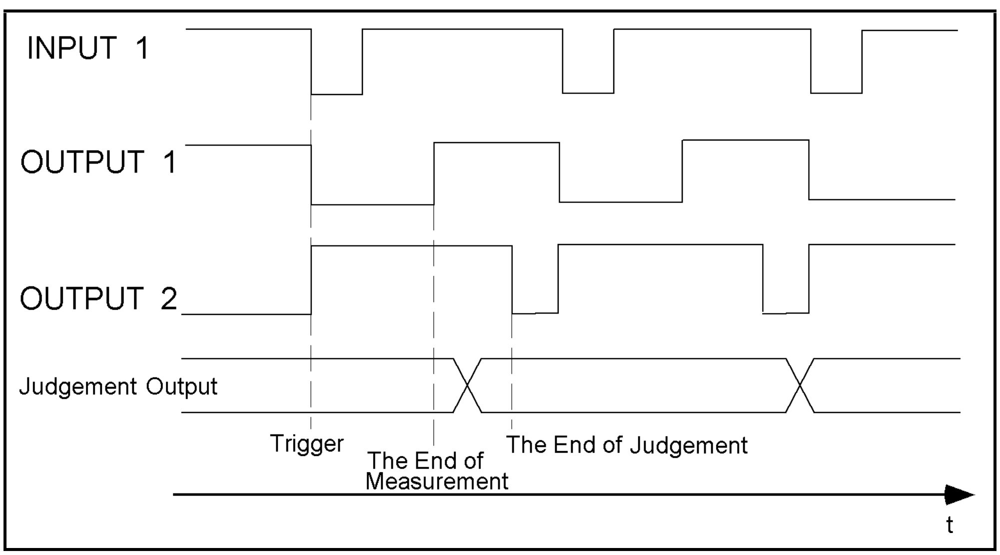


Figure 12-15. The Timing Chart of the Handler Control by the 4352B

Controlling the Handler via the 24-bit I/O Interface (When the 4352B's External Signal Source Automatic Control Function is Not Used)

This program was modified from the 4352B's program in the previous section. It allows the external signal source frequency to be controlled without using the 4352B's External Signal Source Automatic Control function.

Note

We recommend that you use the 4352B's automatic control function unless your test system has restrictions on the use of this function.

Except that the external signal source frequency is controlled by the `Local_check` subroutine (line 230), this program basically functions in the same manner as the program in the previous section.

```
100   ! File Name : FIG12_21.TXT
110   !   IBASIC SAMPLE PROGRAM for Communication with Handler via 24-bit I/O
120   !
130   ASSIGN @Hp4352 TO 800         ! Assign 4352 Address
140   ASSIGN @Hp8664 TO 719         ! Assign Signal Generator's GPIB Address
150   ASSIGN @Ext_pc TO 721;EOL CHR$(9) ! Assign External Controller's GPIB
                                        Address with TAB Code
160   !
170   GOSUB Setup                   ! Set up
180   LOOP
190    GOSUB Input_check          ! WAIT for TRIGGER from Handler
200   EXIT IF BIT(READIO(16,2),0)  ! Check Test End by PORT C INPUT
210    FOR I=1 TO 2
220     OUTPUT @Hp4352;"VCTRL ";V_ctrl(I) ! Set Control Voltage
230     GOSUB Local_check      ! Check Local Frequency
240     GOSUB Measurement      ! Measurement
250    NEXT I
260    OUTPUT @Hp4352;"OUT1H"  ! Inform Measurement End to Handler
270    GOSUB Judgement         ! Judgement
280    OUTPUT @Hp4352;"OUT2L"  ! Inform judgement End to Handler
290    GOSUB Data_transfer     ! Send Measurement Data to External PC
300   END LOOP
310   !
320   DISP "END"
330   OUTPUT @Ext_pc;"END" END
340   !
350   STOP
360   !
370   !
```

Sample Program: Controlling the Handler via the 24-bit I/O Interface (When the 4352B's External Signal Source Automatic Control Function is Not Used, 1/4)

```
380   Setup:!
390   V_ctrl(1)=1    ! Volt
400   V_ctrl(2)=4    ! Volt
410   Sg_wait_time=.1   ! msec
420   OUTPUT @Hp4352;"LOAUTO OFF"   ! LOCAL AUTO CONTROL OFF
430   OUTPUT @Hp4352;"PRES"         ! Preset 4352
440   OUTPUT @Hp4352;"HOLD"         ! Trigger HOLD
450   OUTPUT @Hp4352;"VT"           ! Select Tester mode
460   OUTPUT @Hp4352;"VPOW 4"   ! Set DC POWER Voltage to 4 V
470   OUTPUT @Hp4352;"VCTRL ";V_ctrl(1)  ! Set Control Voltage to 1 V
480   OUTPUT @Hp4352;"VOUT ON"   ! Supply DC Voltages
490   OUTPUT @Hp8664;"*RST"           ! SG Preset
500   OUTPUT @Hp8664;"AMPL:STAT ON"   ! Set SG Output ON
510   OUTPUT @Hp8664;"AMPL 10DBM"     ! Set SG Output to 10 dBm
520   OUTPUT @Hp4352;"MEAS FREQ"      ! Set Measurement Item to FREQUENCY
530   OUTPUT @Hp4352;"FCOUN RES1KHZ"  ! 1 kHz Resolution
540   OUTPUT @Hp4352;"MEAS CN"        ! Set Measurement Item to C/N
550   OUTPUT @Hp4352;"CNOFREQ 10KHZ"  ! Set Offset Frequency to 10 kHz
560   OUTPUT @Hp4352;"CNBW 1HZ"       ! Set Noise BW to 1 Hz
570   OUTPUT @Hp4352;"AVER ON"        ! Set Averaging ON
580   OUTPUT @Hp4352;"AVERFACT 4"     ! Set Averaging Factor to 4
590   OUTPUT @Hp4352;"NEGL"           ! Negative Logic
600   OUTPUT @Hp4352;"OUT1ENVL"       ! Set OUTPUT 1 to LOW by TRIGGER INPUT
610   OUTPUT @Hp4352;"OUT2ENVH"       ! Set OUTPUT 2 to HIGH by TRIGGER INPUT
620   OUTPUT @Hp4352;"OUT1H"          ! Set OUTPUT 1 to HIGH
630   OUTPUT @Hp4352;"OUT2L"          ! Set OUTPUT 2 to LOW
640   OUTPUT @Hp4352;"*OPC?"          ! Verify Operation Completed
650   ENTER @Hp4352;Opc
660   Test_end=0
670   Lo_freq_prev=0
680   RETURN
690   !
700   !
710   Input_check:! Wait for TRIGGER INPUT from Handler
720    REPEAT
730     EXECUTE "INPT?"
740    UNTIL READIO(8,0)
750    RETURN
760   !
770   !
```

Sample Program: Controlling the Handler via the 24-bit I/O Interface (When the 4352B's External Signal Source Automatic Control Function is Not Used, 2/4)

```
 780   Local_check:!
 790     OUTPUT @Hp4352;"MEAS FREQ"      ! Set Measurement item to Frequency
 800     OUTPUT @Hp4352;"FCOUN RES64KHZ" ! Set Frequency Resolution to 64 kHz
 810     EXECUTE "SING"                  ! Measurement
 820     OUTPUT @Hp4352;"LOFREQ?"        ! Check Local Frequency to be set
 830     ENTER @Hp4352;Lo_freq
 840     IF Lo_freqLo_freq_pre THEN
 850     OUTPUT @Hp8664;"FREQ ";Lo_freq;"HZ" ! Set Local Frequency to SG
 860      Lo_freq_pre=Lo_freq
 870     END IF
 880     OUTPUT @Hp4352;"FCOUN RES1KHZ"  ! Set Frequency Resolution to 1 kHz
 890     WAIT Sg_wait_time             ! Wait Frequency Change of SG
 900     RETURN
 910   !
 920   !
 930   Measurement:!
 940    OUTPUT @Hp4352;"MEAS POWE"     ! Set Measurement Item to POWER
 950    Power(I)=FNMeas                ! Measurement
 960    OUTPUT @Hp4352;"MEAS FREQ"     ! Set Measurement Item to FREQUENCY
 970    Freq(I)=FNMeas                 ! Measurement
 980    OUTPUT @Hp4352;"MEAS CN"       ! Set Measurement Item to C/N
 990    Cn(I)=FNMeas                   ! Measurement
1000    RETURN
1010   !
1020   !
1030   Judgement:!
1040    WRITEIO 16,0;0              ! Initialize Judgement Result
1050    Result=0
1060    IF Power(1)<-10 THEN Result=BINIOR(Result,1)
1070    IF Freq(1)<8.E+8 OR Freq(1)>8.7E+8 THEN Result=BINIOR(Result,2)
1080    IF Cn(1)<80 THEN Result=BINIOR(Result,4)
1090    IF Power(2)<-10 THEN Result=BINIOR(Result,8)
1100    IF Freq(2)<8.E+8 OR Freq(2)>8.7E+8 THEN Result=BINIOR(Result,16)
1110    IF Cn(2)<80 THEN Result=BINIOR(Result,32)
1120    WRITEIO 16,0;Result         ! Judgement Result Output via PORT A
1130    RETURN
1140    !
1150    !
```

Sample Program: Controlling the Handler via the 24-bit I/O Interface (When the 4352B's External Signal Source Automatic Control Function is Not Used, 3/4)

```
1160   Data_transfer:     ! Transfer Measurement Data to External Controller
1170    FOR I=1 TO 2
1180     OUTPUT @Ext_pc USING "2D.2D";Power(I)
1190     OUTPUT @Ext_pc USING "4D.3D";Freq(I)/1.E+6
1200     OUTPUT @Ext_pc USING "4D.D,#";Cn(I) END
1210    NEXT I
1220    RETURN
1230    !
1240    !
1250   END
1260    !
1270    !
1280   DEF FNMeas
1290    EXECUTE "SING"         ! Measurement
1300    Dat=READIO(8,0)        ! Get Measurement Data
1310    RETURN Dat
1320    FNEND
```

Figure 12-16.
Sample Program: Controlling the Handler via the 24-bit I/O Interface
(When the 4352B's External Signal Source Automatic Control Function is Not Used, 4/4)

Automatic Measurement of All the 4352B's Measurement Parameters in the Tester Mode

This program measures the frequency at two tuning voltages (1V and 4V) and calculates the tuning sensitivity.
Using the Automatic Frequency Control function, it measures at the target frequency of 830 MHz, frequency, DC tuning voltage, RF power level, DC power consumption current, S/N ratio, FM deviation with modulation signal level of 0.35V, and C/N ratio.

The `Setup` subroutine (lines 260 to 510) sets up the 4352B as follows:
The RF power level, the RF frequency, and the DC power consumption current are measured under the same default condition. In the FM deviation measurement, the modulation signal level is set to 0.35 V_{rms} (line 410). Also, the peak conversion is set to ON so that the measurement value is displayed as the peak value (line 420).
In the C/N ratio measurement, the averaging factor is set to 64, the offset frequency to 60 kHz, and the noise bandwidth to 3 kHz (lines 430 to 470).
To reduce the measurement time, the measurement parameters display function is set to OFF (line 480).

The `Aut_f_cnt_setup` subroutine (line 380, lines 540 to 610) sets up the Automatic Frequency Control function.

The `Measurement` subroutine (line 190, lines 640 to 940) sets the Automatic Frequency Control function to OFF (line 650) and measures the tuning sensitivity (lines 670 to 710). It then sets the Automatic Frequency Control function to ON (line 720), and measures all the above-mentioned measurement parameters (lines 730 to 930).

```
100   ! File Name : FIG12_25.TXT
110   !   IBASIC SAMPLE PROGRAM for Measuring VCO Parameters with
          AUTO FREQUENCY CONTROL function
120   !
130 Main:   !
140    GOSUB Setup
150    LOOP
160      DISP "CONNECT DEVICE and PRESS CONTINUE."
170      PAUSE
180      DISP
190     GOSUB Measurement
200     GOSUB Printing
210   END LOOP
220   !
230   STOP
240   !
250   !
260 Setup:!
270   ASSIGN @Hp4352 TO 800         ! Assign 4352's Address
280   OUTPUT @Hp4352;"PRES"         ! Preset 4352
290   OUTPUT @Hp4352;"HOLD"         ! Trigger HOLD
300   OUTPUT @Hp4352;"VT"           ! Select Tester mode
310   DISP "SETTING UP"
320   !
330   V_ctrl(1)=1  ! Volt
340   V_ctrl(2)=4  ! Volt
350   OUTPUT @Hp4352;"VPOW 4"       ! Set DC Power Voltage to 4 V
360   OUTPUT @Hp4352;"VCTRL ";V_ctrl(1)  ! Set Control Voltage to 1 V
370   OUTPUT @Hp4352;"VOUT ON"       ! Supply DC Voltages
380   GOSUB Aut_f_cnt_setup          ! AUTO FREQUENCY CONTROL FUNCTION Setup
390   OUTPUT @Hp4352;"MEAS FMDEV"    ! Set Measurement Item to FM Deviation
400   S_peak=8000  ! Hz
410   OUTPUT @Hp4352;"MODAMP 0.35"   ! Set Modulation Amplitude to 0.35 V
420   OUTPUT @Hp4352;"PKCONV ON"     ! Set Peak Conversion ON
430   OUTPUT @Hp4352;"MEAS CN"       ! Set Measurement Item to C/N
440   OUTPUT @Hp4352;"AVER ON"       ! Averaging ON
450   OUTPUT @Hp4352;"AVERFACT 64"   ! Set Averaging Factor to 64
460   OUTPUT @Hp4352;"CNOFREQ 60KHZ" ! Set Offset Frequency to 60 kHz
470   OUTPUT @Hp4352;"CNBW 3KHZ"     ! Set Noise Bandwidth to 3 kHz
480   OUTPUT @Hp4352;"PARM OFF"      ! Parameter Display OFF
490   OUTPUT @Hp4352;"*OPC?"         ! Verify Operation Completed
500   ENTER @Hp4352;Opc
510   RETURN
```

Sample Program:
Automatic Measurement of All the 4352B's Measurement Parameters in the Tester Mode (1/3)

```
520   !
530   !
540 Aut_f_cnt_setup:   !
550   Typical_snstvty=12
560   Typical_snstvty=Typical_snstvty*1.E+6   ! MHz/V
570   OUTPUT @Hp4352;"AFCTARG 830MHZ" ! Set Target Frequency to 830 MHz
580   OUTPUT @Hp4352;"AFCTOL 10KHZ"   ! Set Tolerance to 10 kHz
590   OUTPUT @Hp4352;"AFCSENS ";Typical_snstvty  ! Set Sensitivity
          to 12 MHz/V
600   OUTPUT @Hp4352;"MAXVCTRL 5"     ! Set Maximum Voltage to 5 V
610   RETURN
620   !
630   !
640 Measurement:  !
650   OUTPUT @Hp4352;"AFC OFF"       ! AUTO FREQUENCY CONTROL OFF
660   OUTPUT @Hp4352;"MEAS FREQ"     ! Set Measurement Item to Frequency
670   FOR I=1 TO 2
680     OUTPUT @Hp4352;"VCTRL ";V_ctrl(I)  ! Set Control Voltage to 1 V
690     Freq_data(I)=FNMeas          ! Measurement
700   NEXT I
710   Sensitivity=(Freq_data(2)-Freq_data(1))/(V_ctrl(2)-V_ctrl(1))
                                     !  Calculate Sensitivity
720   OUTPUT @Hp4352;"AFC ON"        ! AUTO FREQUENCY CONTROL ON
730   Center_freq=FNMeas             ! Frequency Measurement
740   OUTPUT @Hp4352;"VCTRL?"        ! Verify DC Control Voltage
750   ENTER @Hp4352;Dcv_ctrl_fcent
760   OUTPUT @Hp4352;"MEAS POWE"     ! Set Measurement Item to Power Level
770   Power_data=FNMeas              ! Measurement
780   OUTPUT @Hp4352;"MEAS CURR"     ! Set Measurement Item to
     DC Power Current
790   Current_data=FNMeas            ! Measurement
800   OUTPUT @Hp4352;"MEAS FMDEV"    ! Set Measurement Item to FM Deviation
810   OUTPUT @Hp4352;"DEVRNG DV2KHZ" ! Set Deviation Range to 2 kHz
820   OUTPUT @Hp4352;"AVER ON"       ! Averaging ON
830   OUTPUT @Hp4352;"AVERFACT 4"    ! Set Averaging Factor to 4
840   N_peak=FNMeas                  ! Measurement
850   Sn_ratio=S_peak/N_peak         ! Calculate S/N
860   Sn_ratio_db=20*LGT(Sn_ratio)
870   OUTPUT @Hp4352;"AVER OFF"      ! Averaging OFF
880   OUTPUT @Hp4352;"DEVRNG DV20KHZ" ! Set Deviation Range to 20 kHz
890   OUTPUT @Hp4352;"MODO ON"       ! Modulation Output ON
900   Fm_dev_data=FNMeas             ! Measurement
910   OUTPUT @Hp4352;"MODO OFF"      ! Modulation Output OFF
920   OUTPUT @Hp4352;"MEAS CN"       ! Set Measurement Item to C/N
930   Cn_ratio=FNMeas                ! Measurement
940   RETURN
```

Sample Program:
Automatic Measurement of All the 4352B's Measurement Parameters in the Tester Mode (2/3)

```
 950   !
 960   !
 970 Printing:  !
 980   CLEAR SCREEN
 990   FOR I=1 TO 2
1000    PRINT USING "24A,4D.2D,X,6A";
                    "DC CONTROL VOLTAGE ";V_ctrl(I);" (V)"
1010    PRINT USING "11A,12X,5D.3D,6A";
                    "FREQUENCY ";Freq_data(I)/1.E+6;" (MHz)"
1020   NEXT I
1030   PRINT USING "13A,11X,4D.2D,X,8A";
                   "SENSITIVITY ";Sensitivity/1.E+6;" (MHz/V)"
1040   PRINT USING "19A,4X,5D.3D,6A";
                   "CENTER FREQUENCY ";Center_freq/1.E+6;" (MHz)"
1050   PRINT USING "21A,5X,2D.3D,4A";
                   "CTRL V for CENT FREQ ";Dcv_ctrl_fcent;" (V)"
1060   PRINT USING "10A,15X,3D.2D,X,6A";
                   "RF POWER ";Power_data;" (dBm)"
1070   PRINT USING "12A,12X,4D.2D,X,6A";
                   "DC CURRENT ";Current_data*1000.;" (mA)"
1080   PRINT USING "12A,12X,4D.3D,10A";
                   "FM DEVIATION ";Fm_dev_data/1000;" (kHzpeak) "
1090   PRINT USING "16A,8A,4D.D,2X,6A";
                   "C/N at 60kHzOFS,"," 3kHzNBW";Cn_ratio," (dBc)"
1100   PRINT USING "10A,14X,4D.2D,X,6A";
                   "S/N RATIO ";Sn_ratio_db;" (dB)"
1110   RETURN
1120  !
1130  !
1140  END
1150  !
1160  !
1170  !
1180  DEF FNMeas
1190    EXECUTE "SING"          ! Measurement
1200    Dat=READIO(8,0)         ! Get Measurement Data
1210    RETURN Dat
1220  FNEND
```

Figure 12-17.
Sample Program:
Automatic Measurement of All the 4352B's Measurement Parameters in the Tester Mode (3/3)

FM Modulation Sensitivity Deviation Measurement Controlling Modulation Signal Level

This program measures the device's modulation sensitivity deviation.

The measurement steps are as follows:

1. Control the modulation signal level so that the FM deviation is `Dev0` at the carrier frequency F0. Let this modulation signal level be Vm0.
2. At the modulation signal level Vm0, measure the FM deviation at each of the carrier frequencies, F1 (=F0−delta) and F2 (=F0+delta), by using the Automatic Frequency Control function. Let these deviations be `Dev1` and `Dev2`.
3. Calculate the modulation sensitivity deviation with the equation (`Dev`n-`Dev0`)/`Dev0` (n=1, 2).

The `Setup_env` subroutine (line 150, lines 250 to 320) sets up the 4352B the measurement conditions, and the Automatic Frequency Control function.

The `Setup_fm` subroutine (line 160, lines 530 to 640) specifies the FM deviation `Dev0`, the tuning sensitivity of device (`Sm`), and the allowable FM deviation tolerance required to determine Vm0 (`Dtol`). It also sets up the FM deviation measurement condition.

The `Auto_dev` subroutine (line 170, lines 670 to 850) measures the FM deviation and changes the modulation signal level to obtain an FM deviation closer to `Dev0` using this information. It repeats this procedure until the FM deviation reaches `Dev0`.

The `Measurement` subroutine (line 180, lines 880 to 930) measures the FM deviation at each of the specified carrier frequencies (F1 and F2).

The `Print_result` subroutine (line 190, lines 960 to 1020) calculates the modulation sensitivity deviation and displays the result.

```
100  ! File Name : FIG12_28.TXT
110  !   IBASIC SAMPLE PROGRAM for MODULATION SENSITIVITY MEASUREMENT
120  !
130  ASSIGN @Hp4352 TO 800       ! Assign IBASIC Address
140  !
150  GOSUB Setup_env
160  GOSUB Setup_fm
170  GOSUB Auto_dev
180  GOSUB Measurement
190  GOSUB Print_result
200  !
210  STOP
220  !
230  !
240  !
250 Setup_env:!
260  Vp0=4.          ! Power Voltage (V)
270  Vcmax=4.        ! Maximum Control Voltage (V)
280  Sc=1.5E+7       ! Control Sensitivity (Hz/V)
290  Ftol=50000.     ! Frequency Tolerance (Hz)
300  F0=8.3E+8       ! Center Frequency (Hz)
310  F1=8.2E+8       ! Lower Frequency (Hz)
320  F2=8.4E+8       ! Upper Frequency (Hz)
330                  ! F1<F0<F2
340 !
350  OUTPUT @Hp4352;"PRES"         ! Preset 4352
360  OUTPUT @Hp4352;"HOLD"         ! Trigger HOLD
370  OUTPUT @Hp4352;"VT"           ! Select Tester mode
380  OUTPUT @Hp4352;"VPOW ";Vp0    ! Set DC Power to 4V
390  OUTPUT @Hp4352;"MAXVCTRL ";Vcmax ! Set Max Control Voltage to 4 V
400  OUTPUT @Hp4352;"VOUT ON"      ! Supply DC Voltages
410  OUTPUT @Hp4352;"LOSWT 0.1"    ! Set LOCAL SG Switch Time
420  OUTPUT @Hp4352;"SGTYPE 1"     ! Select SGTYPE 1
430  OUTPUT @Hp4352;"LOAUTO ON"    ! AUTO LOCAL CONTROL ON
440  OUTPUT @Hp4352;"AFCTARG ";F0  ! Set Target Frequency
450  OUTPUT @Hp4352;"AFCTOL ";Ftol ! Set Tolerance
460  OUTPUT @Hp4352;"AFCSENS ";Sc  ! Set Sensitivity (Hz/V)
470  OUTPUT @Hp4352;"AFC ON"       ! AUTO FREQUENCY CONTROL ON
480  OUTPUT @Hp4352;"*OPC?"        ! Verify Operation Completed
490  ENTER @Hp4352;Opc
500  RETURN
```

Sample Program:
FM Modulation Sensitivity Deviation Measurement Controlling Modulation Signal Level (1/3)

```
510  !
520  !
530 Setup_fm:!
540  Dev0=8000.    ! Nominal Deviation (Hz-peak)
550  Sm=21000.     ! Modulation Sensitivity (Hzrms/Vrms)
560  Dtol=50       ! Deviation Tolerance (Hz)
570                ! Dtol > Sm*1mVrms
580  !
590  OUTPUT @Hp4352;"MEAS FMDEV"  ! Set Measurement Item to FM Deviation
600  OUTPUT @Hp4352;"DEVRNG DV20KHZ" ! Set Deviation Range to 20 kHz
610  OUTPUT @Hp4352;"PKCONV ON"   ! PEAK CONVERSION ON
620  OUTPUT @Hp4352;"MODAMP 0"    ! Set Modulation Amplitude to 0 V
630  OUTPUT @Hp4352;"MODO ON"     ! Modulation Output ON
640  RETURN
650  !
660  !
670 Auto_dev:!
680  Lc=0
690  Vm=Dev0/Sm/SQRT(2)           ! Calculate Modulation Signal Amplitude
700  OUTPUT @Hp4352;"MODAMP ";Vm  ! Set Modulation Output to Vm
710  LOOP
720    Dev=FNMeas                 ! Measurement
730    Lc=Lc+1
740  EXIT IF ABS(Dev-Dev0)<Dtol
750  EXIT IF Lc>10
760    Vm=Vm-(Dev-Dev0)/Sm/SQRT(2) ! Calculate Modulation Signal Amplitude
770    OUTPUT @Hp4352;"MODAMP ";Vm ! Set Modulation Output to Vm
780  END LOOP
790  Vm0=Vm
800  Dev0=Dev
810  IF Lc>10 THEN
820    PRINT "Out of Convergence !"
830    STOP
840  END IF
850  RETURN
860  !
870  !
880  Measurement:!
890  OUTPUT @Hp4352;"AFCTARG ";F1  ! Change Target Frequency to F1
900  Dev1=FNMeas                   ! Measurement
910  OUTPUT @Hp4352;"AFCTARG ";F2  ! Change Target Frequency to F2
920  Dev2=FNMeas                   ! Measurement
930  RETURN
940 !
950 !
```

Sample Program:
FM Modulation Sensitivity Deviation Measurement Controlling Modulation Signal Level
(2/3)

```
 960 Print_result:!
 970  PRINT "Deviation of Modulation Sensitivity"
 980  PRINT PROUND(Dev0/1000.,-1);"(kHz) FM-Deviation, ";
                                 F0/1.E+6;"(MHz) referred"
 990  PRINT
1000  PRINT F1/1.E+6;"(MHz) :  ";PROUND((Dev1/Dev0-1)*100,-2);"(%)"
1010  PRINT F2/1.E+6;"(MHz) :  ";PROUND((Dev2/Dev0-1)*100,-2);"(%)"
1020  RETURN
1030  !
1040  END
1050  !
1060  !
1070 DEF FNMeas
1080  EXECUTE "SING"        ! Measurement
1090  Dat=READIO(8,0)       ! Get Measurement Data
1100  RETURN Dat
1110  FNEND
```

Figure 12-18.
Sample Program:
FM Modulation Sensitivity Deviation Measurement Controlling Modulation Signal Level
(3/3)

Application in the Analyzer Mode (PLL 3rd Harmonic Measurement)

This program measures the third harmonic of the PLL output signal. First, it measures the carrier level in a spectrum measurement. Next, it measures the third harmonic level by setting three times the carrier frequency as the center frequency of the sweep. The power levels are checked using the marker. The 4352B functions as the system controller in this program.

Set up the measurement conditions (lines 160 to 220), which include turning the marker function ON (line 220).

Set the carrier frequency as the center of span (line 310), and make the spectrum measurement (line 320). Then, search for the maximum peak with the marker function (line 330) and read the maximum value (lines 340 to 350).

Set three times the carrier frequency as the center of the span (line 380). Again, make a spectrum measurement and read the power level of the third harmonic with the marker search function (lines 390 to 420).

After all the measurements are complete, print the results on the display. The "3rd harmonics" value, printed in line 460, is the power level difference between the carrier and the third harmonic.

```
100   ! File Name : FIG12_31.TXT
110   !   IBASIC SAMPLE PROGRAM to COMPARE Carrier and 3rd Harmonic
120   !
130   DIM Err$[100]
140   ASSIGN @Hp4352 TO 800
150   !
160   OUTPUT @Hp4352;"VA"              ! Select Analyzer Mode
170   OUTPUT @Hp4352;"PRES"            ! Preset 4352
180   OUTPUT @Hp4352;"HOLD"            ! Trigger HOLD
190   OUTPUT @Hp4352;"MEAS SPEC"       ! Spectrum Measurement
200   OUTPUT @Hp4352;"SPAN 100KHZ"     ! Set SPAN 100 kHz
210   OUTPUT @Hp4352;"BW 3KHZ"         ! Set BW 3 kHz
220   OUTPUT @Hp4352;"MKR ON"          ! Set Marker Function ON
230   !
240   DISP "Press Continue"
250   PAUSE
260   DISP
270   !
280   PRINT "Carrier Measurement"
290   OUTPUT @Hp4352;"CLES"        ! Clear Status Register
300   !
310   OUTPUT @Hp4352;"CARRCENT"    ! Set Carrier to Center Frequency
320   EXECUTE "SING"               ! Single Sweep
330   OUTPUT @Hp4352;"SEAM MAX"    ! Search Maximum Level
340   OUTPUT @Hp4352;"OUTPMKR?"    ! Read Carrier Level and Frequency
350   ENTER @Hp4352;Lvl_1st,Frq_1st
360   !
370   PRINT "3rd Harmonic Measurement"
380   OUTPUT @Hp4352;"CARR3CENT"   ! Set 3rd Harmonic to Center Frequency
390   EXECUTE "SING"               ! Single Sweep
400   OUTPUT @Hp4352;"SEAM MAX"    ! Search Maximum Level
410   OUTPUT @Hp4352;"OUTPMKR?"    ! Read 3rd Harmonic Level and Frequency
420   ENTER @Hp4352;Lvl_3rd,Frq_3rd
430   !
440   PRINT "  Carrier Frequency : ";Frq_1st;"[Hz]"
450   PRINT "  Carrier Level     : ";Lvl_1st;"[dBm]"
460   PRINT "  3rd Harmonics     : ";Lvl_3rd-Lvl_1st;"[dBc]"
470   !
480   END
```

Figure 12-19.
Sample Program:
Application in the Analyzer Mode (PLL 3rd Harmonic Measurement)

Application in the Analyzer Mode (Frequency Transient Measurement)

This program measures the PLL frequency transient characteristics. In this section, four programs are provided, each of which uses a different trigger.

Note

The 4352B offers you three ways to measure the PLL oscillation frequency characteristics with respect to time. Select the method that best suits your needs.

Observation time	Method	Reference
10 sec or shorter	Frequency transient measurement	Program given in this section.
10 sec to 1 hour	Post-tuning drift characteristics measurement	Figure 1-3 in *Function Reference*
1 hour or longer	Post-tuning drift characteristics measurement	"Application in the Analyzer Mode (Post-tuning Drift Characteristics Measurement)" in this chapter

Sending Trigger in Frequency Transient Measurement

The purpose of a frequency transient measurement is to evaluate how quick the PLL output frequency changes in response to a request for frequency change. To ensure accuracy in this measurement, the following operations must be performed in as short a time as possible.

- Issuing a request to change output frequency to PLL (sending load signal)
- Measurement start (Triggering)

To meet this requirement, `Trigger Detection Output Function` and `Value Trigger Function` are available with the 4352B.

The figure Figure 12-20 shows an example of connecting a device (PLL) and the 4352B. The load signal input terminal of the PLL is connected to OUTPUT1 of the 24-bit I/O port. A load signal is sent through this port.

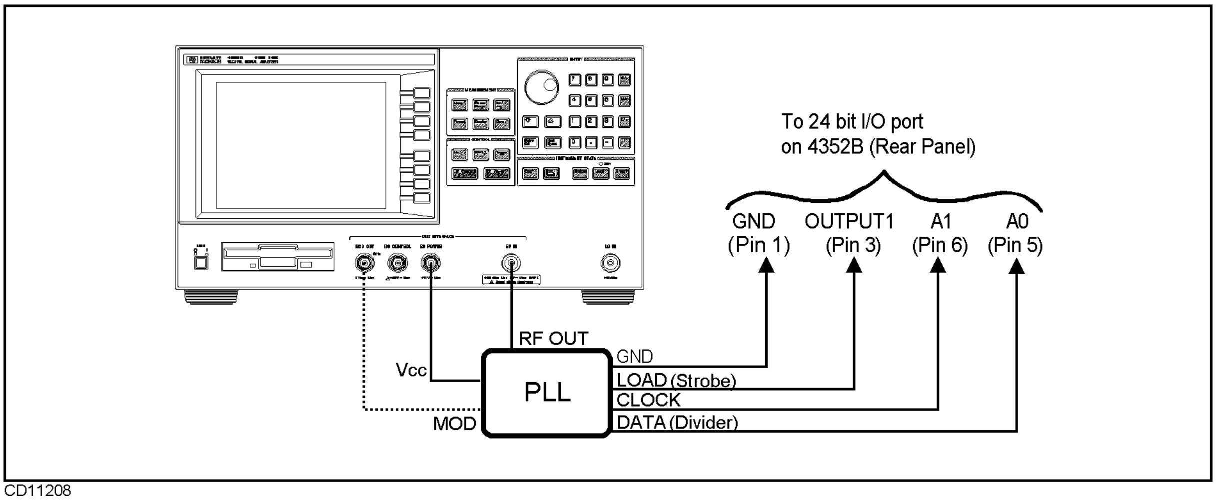


Figure 12-20.

Trigger Detection Output Function

This function sends a load signal to the PLL, synchronizing it with a measurement trigger. When this function is ON, the logic level of the specified OUTPUT signal (OUTPUT1) on the 24-bit I/O port changes in a very short time interval (85μs, typically) after triggering a measurement. This ensures that the load signal is sent immediately to the PLL in response to a measurement trigger.

The logic level of the OUTPUT signal must be set in advance using an GPIB command. For example, using `OUT1ENVH` makes the logic level of the OUTPUT1 signal go HIGH when triggering a measurement.

In addition to `OUT1ENVH`, you can use `OUT1ENVL`, `OUT2ENVH`, and `OUT2ENVL` with the 24-bit I/O port setups, in terms of signal logic level (positive or negative) and the output terminal (OUTPUT1 or OUTPUT2) connected to the PLL load signal input.

Value Trigger Function

This function allows a measurement to be triggered when the PLL output frequency reaches a specified frequency.
When a frequency transient measurement is triggered with this function turned ON, the 4352B, first waits for a measurement trigger, continuing to monitor PLL output frequency f. When the measured frequency (f) reaches a specified valuef_T, the frequency transient measurement is triggered.

You can select in advance whether to use when f exceeds f_T or when f decreases below f_T as the trigger condition.

When you switch f from f_L over to $f_H (f_L < f_H)$, be sure to set f_T at a level slightly higher than that of f_L. This allows a measurement to be initiated immediately after a frequency change request has been sent to the PLL.

Using the Trigger Detection Output Function - 1 (43521A and Serial Data)

Figure 12-24 shows a frequency transient measurement program using the trigger detection output function. Figure 12-21 shows a block diagram of the DUT PLL synthesizer. This PLL requires serial data for initialization word, reference divider, and feedback divider.

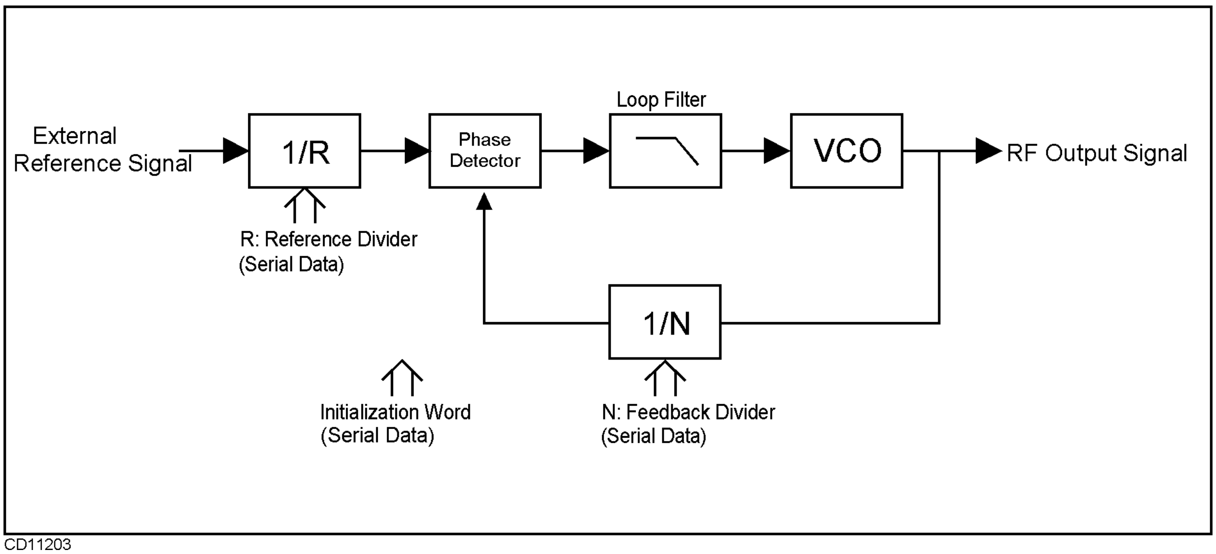
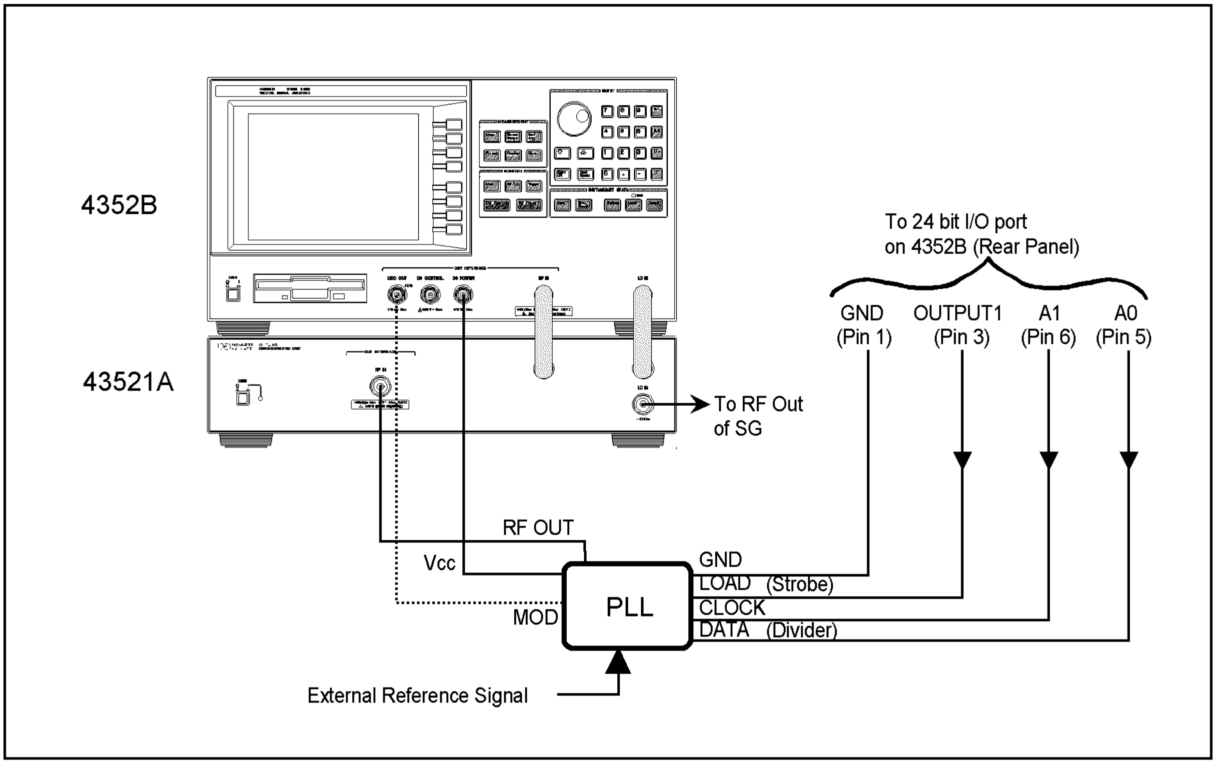


Figure 12-21. DUT PLL Synthesizer Block Diagram (Serial Data)

Figure 12-22 shows the connection of the DUT, the 4352B, and the 43521A Down Converter Unit. Note also that the PLL used in this sample program outputs RF signal at 5.8 GHz, a level of frequency far beyond 3 GHz. Therefore, you need to use the 43521A together with the 4352B. In this example, serial data is sent from the 24-bit I/O port of the 4352B's rear panel to each of the LOAD, CLOCK, and DATA terminals on the DUT PLL.



CD00C02

Figure 12-22. DUT PLL Connection (Serial Data)

This program is intended to measure the transient characteristics of the DUT when its output frequency is changed from 5.8 GHz to 5.85 GHz. Note that the 4352B functions as system controller in this program.
The following describes what each of the blocks is intended to accomplish. The program may need to be changed depending on the type of PLL you use.

Lines 200 to 270: Define Initialization Word

This block specifies the initialization word to be supplied to the PLL. The word is determined based on the DUT PLL specification. The word is then supplied to the PLL by the Send cont: subroutine in line 3410. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits in accordance with your DUT.

Lines 300 to 370: Define Reference Divider

This block specifies the reference divider word to be supplied to the PLL. The word is determined based on the DUT PLL specification. The word is then supplied to the PLL by the Send reference: subroutine in line 3020. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits in accordance with your DUT.

Lines 400 to 490: Define Feedback Divider

Freq(1) and Freq(2) are set respectively at 5.8 GHz and 5.85 GHz. These frequencies represent the start and target (final) frequencies used for frequency transient measurement. Freq(2) is set as target frequency for the 4352B in line 1570. Serial data for PLL, each corresponding to Freq(1) and Freq(2), are assigned to Divider$. The data is supplied to the PLL by the Send_pll_freq subroutine in 3210. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits for Freq(1), Freq(2), and the Feedback Divider in accordance with your DUT.

Lines 700 to 720: Specify Measurement Time

This block specifies the default measurement time. However, line 2200, provided later in the program, allows you to type in a desired measurement time. Therefore, you do not always need to specify it in this block. Measurement time is set at 10 msec in this block.

Lines 800 to 850: Specify DC Power Voltage

This block specifies the 4352B's DC power voltage. The DC Power voltage is set at 5 V in this program. You may need to change it in accordance with your DUT.

Lines 900 to 940: Select Whether to Use the 43521A

This block selects whether to use the 43521A (Down Converter Unit). In this program, a high frequency signal (5.8 GHz) is measured. Therefore, you need to use the 43521A. You do not need to use it if the target frequency is 3 GHz or less. In this case, treat line 930 as an executable statement comment out line 920. Currently, these lines are arranged so that 43521A is used.

Lines 1000 to 1080: Specify SG Type and SG Local Signal Wait Time

This block specifies an SG type number of the external signal source (SG) and local signal wait time. Because the 8664A is used as external signal source in this program, "1" is specified for the SG type number. You need to specify a different number depending on the signal generator. See the (RF/LO) Menu in Chapter 9 of the 4352B Function Reference for more information. "1" and "200 msec" are specified respectively for SG type number and local signal wait time in this block.

Lines 1100 to 1170: Specify Frequency Band When Using the :43521A(Down Converter Unit)

This block sets a frequency band since the 43521A (Down Converter Unit) is used. When you use the 43521A, the upper frequency limit is increased to 12.6 GHz and the entire frequency range is divided into 6 different frequency bands. Therefore, you specify the number indicating the frequency band that includes the target frequency. In this program, approximately 5.8 GHz signal is measured. Therefore, "3" (3.1 GHz to 6.6 GHz) is specified. See FBAND<numeric> in Chapter 9 or 10 for more information. You do not need to specify a band number when you do not use the 43521A. In this case, comment out this entire block.

Lines 1200 to 1240: Specify Positive/Negative Logic for 24-bit I/O

This block specifies whether to use positive or negative logic for the signal output of the 4352B's 24-bit I/O port. Depending on the specification of your PLL, make either line 1220 (POSL) or 1230 (NEGL) an executable statement. In this program, positive logic (POSL) is used.

Lines 1300 to 1340: Select Frequency Transient Measurement

This block selects frequency transient measurement as measurement type. The analyzer mode (VA) is selected. Then, frequency transient measurement (MEAS TRAN) is selected. At the same time, HOLD is selected for trigger so that frequency transient measurement can be triggered by a later block. Measurement is triggered by EXECUTE "SING" in line 2520.

Lines 1400 to 1490: Specify Measurement Frequency Range, Target Frequency, and Target Position

Frequency span, target frequency, and target position are required to determine minimum and maximum measurement frequencies. Because frequency span should cover the entire transient frequency range, transient overshoot is included in addition to the range from start frequency (5.8 GHz) to target frequency (5.85 GHz). This program can automatically select a frequency span in response to the overshoot you enter. Line 1410 calculates the difference between start and target frequencies (Fjump = 50 MHz). Next, the frequency span is calculated by Fspan = Fjump × (1 + Over_shoot) = 50MHz × 2 = 100MHz, assuming that the overshoot is 100% (Over_shoot=1). 100 MHz neither corresponds to <2.E+6 (less than 2 MHz) in line 1490 nor to <2.E+7 (less than 20 MHz) in 1510. Therefore, it corresponds to CASE ELSE in line 1530. Consequently, TSMAX is selected and the frequency span is set at 512 MHz (fixed). Because line 1580 specifies 50% for target position, minimum and maximum frequencies are calculated as follows:

Minimum frequency: 5.85 GHz - (512 MHz × 0.5) = 5.594 GHz
Maximum frequency: 5.85 GHz + (512 MHz × (1 - 0.5)) = 6.106 GHz

In this case, because frequency span is 512 MHz, overshoot is unlikely to exceed the maximum frequency or fall below the minimum frequency. However, if 2 MHz is selected for frequency span due, for example, to a small difference between maximum and minimum frequencies, overshoot may fall outside the range between maximum and minimum frequencies. In this case, assign any value greater than 1 for Over_shoot to provide a wider frequency span. See Figure 12-23 for the relationship between overshoot and, start, and target frequencies.

In line 1570, the 4352B is set at 5.85 GHz (frequency specified in line 480) as target frequency (TRTARG).

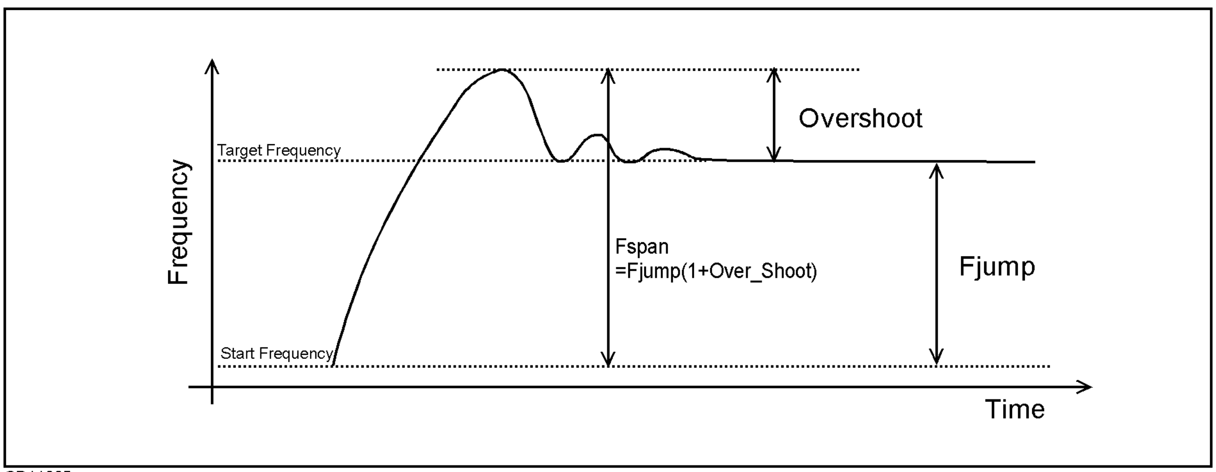


Figure 12-23. Overshoot, and Start and Target Frequencies

Lines 1700 to 1740: Turn ON Trigger Detection Output Function

This block selects internal trigger (TRGS INT) and turns ON the trigger detection output function (TRGOUT ON). OUT1ENVH is used to pull OUTPUT1 (24-bit I/O) high. OUTPUT1 is connected to the PLL Load terminal. (See Figure 12-22.) The PLL loads serial data available at the DATA terminal when the LOAD terminal goes high. It changes the output frequency to the level specified by the serial data. Thus, using OUT1ENVH triggers measurement and allows the PLL to convert the output frequency for transient measurement.

Lines 1900 to 1950: Send Initialization Word and Reference Frequency Divider

This block goes to the subroutine for sending the initialization word and reference divider to the PLL. The initialization word has been defined as serial signal and stored in Cont_word$ in line 250. GOSUB Send_cont goes to line 3410 to send the initialization word to the PLL from port A (pin 5) of the 24-bit I/O port. The reference divider has been defined as serial signal and stored in Ref_Divider$ in line 350. GOSUB Send_reference goes to line 3020 to send this signal from the same port. Comment out lines 1930 and 1940 if you do not need to send any initialization word or reference divider.

Lines 2000 to 2090: Display Measurement Parameters

This block displays measurement parameters. DISA HIHB displays measurement results and measurement parameters respectively at the upper and lower halves of the screen.

- Title (PLL Synthesizer Frequency Transient Measurement)
- Initialization word: Cont_word$
- Reference divider: Ref_divider$
- Start frequency: Freq(1)/1.E+6;"[MHz]"
- Serial signal for start frequency: divider$(1)
- Target frequency (final frequency): Freq(2)/1.E+6;"[MHz]"
- Serial signal for target frequency : divider$(2)

Lines 2200 to 2270: Prompt User to Enter Measurement Time

This block prompts you to enter measurement time [ms]. You can change 10 msec specified in line 700 as necessary. This block displays "Time Span [msec]=? (Default 10 [msec])" on the screen to ask you whether you wish to change the time. The time you enter will be stored in T_span_msec, divided by 1000 for converting the unit into millisecond, and the result of division stored in T_span. Line 2250 displays the new measurement time on the screen while line 2260 sets the 4352B at the new measurement time. Whether you can obtain a proper transient measurement screen depends on your measurement time. In this program, you can return from line 2820 to line 2000 so that you can enter a new measurement time to repeat measurement if your screen is not appropriate.

Lines 2300 to 2370: Lock the PLL to Start Frequency

"Now measuring" appears on the screen.
Freq(1) (5.8 GHz specified as start frequency in line 460) is selected in line 2320. In line 2330, this program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (serial data in line 470) for the start frequency (5.8 GHz) from port A (A0) of the 24-bit I/O port. (Note that this data is not loaded into the PLL at this point.) When OUTPUT1 of the 24-bit I/O port is pulled high in line 2340, the serial data available at port A (A0) is loaded into the PLL, thus causing the PLL to oscillate at the start frequency (5.8 GHz). In line 2350, OUTPUT1 of the 24-bit I/O port is pulled low, thus resetting the PLL's LOAD terminal. Line 2360 waits for the PLL frequency to stabilize at 5.8 GHz.

Lines 2500 to 2530: Lock the PLL to Target Frequency and Trigger Measurement

Freq(2) (5.85 GHz specified as target frequency in line 480) is selected in line 2500. In line 2510, this program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (serial data in line 490) for the target frequency (5.85 GHz) from port A (A0) of the 24-bit I/O port. Note that this data is not loaded into the PLL at this point. Measurement is triggered by EXECUTE "SING". At the same time, OUT1ENVH in line 1630 pulls OUTPUT1 of the 24-bit I/O port high. When OUTPUT1 goes high, serial data available at port A (A0) is loaded into the PLL, thus causing the PLL to start increasing its oscillation frequency to the target frequency (5.85 GHz). Consequently, frequency transient takes place at the same time as start of the measurement.

Lines 2700 to 2720: Auto-scale Measurement Results and Turn ON the Marker

AUTO in line 2700 optimizes scaling for measurement results to be displayed on the screen. Line 2710 displays the marker on the screen. You can use the rotary knob to move the marker as desired to check the reading.

Lines 2800 to 2850: Prompt User to Select Y or N (Whether to Change Measurement Time to Repeat Measurement)

Line 2820 displays "Change Time and Repeat Measurement? (Y/N)" to prompt you to select "Y" or "N." When you enter any character other than "N" (or "n"), the program goes back to line 2000 to repeat measurement. Enter a character other than “N” if you cannot obtain appropriate results due to excessively short or long measurement time. When you enter “N”, the program goes to the subroutine line 5000 to end the program.

Lines 3000 to 3090: Subroutine for Sending Reference Divider

This subroutine sends the reference divider (Ref_divider$ in line 350) from port A of the 24-bit I/O port. Line 3030 pulls OUTPUT1 of the 24-bit I/O port low, thus resetting the PLL’s LOAD signal. Line 3080 sends data in the MSB first. Then, the reference divider (serial data) and a clock signal are sent to the PLL in lines 3100 to 3130. Line 3150 pulls OUTPUT1 of the 24-bit I/O port high, causing the signal to be loaded into the PLL. In 3160, OUTPUT1 is pulled low again, thus resetting the PLL’s LOAD signal. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference*.

Lines 3200 to 3290: Subroutine for Sending Feedback Divider

This subroutine sends the feedback divider from port A of the 24-bit I/O port. Two pieces of serial data whose contents have been specified in lines 460 to 490 are selected respectively in lines 2320 and 2500. These pieces of serial data are sent to the PLL by this subroutine. In line 3220, OUTPUT1 of the 24-bit I/O port is pulled low, thus resetting the PLL’s LOAD signal. Line 3270 sends data in the MSB first. Next, the feedback divider (serial data) and a clock signal are sent to the PLL in lines 3290 to 3320. This program then goes back to line 2520 where EXECUTE “SING” triggers measurement while OUTPUT1 of the 24-bit I/O port is pulled high at the same time, thus the loading feedback divider into the PLL. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 3400 to 3490: Subroutine for Sending the Initialization Word

This subroutine sends the initialization word (Cont_word$ in line 250) from port A of the 24-bit I/O port. In line 3240, OUTPUT1 of the 24-bit I/O port is pulled low, thus resetting the PLL’s LOAD signal. Line 3470 sends data in the MSB first. Next, the initialization word (serial data) and a clock signal are sent to the PLL in lines 3490 to 3520. OUTPUT1 of the 24-bit I/O port is pulled high in line 3540, thus loading the initialization word into the PLL. OUTPUT1 is pulled low again in line 3550, thus resetting the PLL’s LOAD signal. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 5000 to 5040: End the Program

This block turns OFF the DC voltage to end the program.

```
10   ! File Name : FIG12_32.TXT
20   !   IBASIC SAMPLE PROGRAM for Frequency Transient Measurement with
         Trigger Detection Output Function
30    !   (Serial Data Transfer)
40    !
50    ASSIGN @Hp4352 TO 800
60    DISP ""
70    !
80    !################################################################
90    ! Follow the instructions given in comments to modify this
100   ! program to work with your PLL IC. For further information,
110   ! refer to the 4352S GPIB Programming Manual.
120   !----------------------------------------------------------------
130   ! In this program, Control Data are transferred to IC via 24 bit
140   ! I/O port as serial data.  Data are sent via A0(PIN#5), Clock
150   ! via A1(PIN#6), and Strobe (Enable/Load) via OUTPUT 1(PIN#3).
160   !################################################################
170   !
200   !##### If the IC needs to receive the "control word" for
210   !##### initialization, modify these 2 lines below.  If not, comment
220   !##### out the line 1930.  If the LSB should be sent first to IC,
230   !##### modify "Send_cont" sub-troutine.
240   DIM Cont_word$[21]                   ! Length of Control Word Bit
250   Cont_word$="000000000100010010011"     ! MSB <---> LSB
260   Cont_bit_length=LEN(Cont_word$)
270   !
300   !##### The following 2 lines define the "reference divider word."
310   !##### This word may contain the pre-scaler bit for some ICs.
320   !##### Modify the bit length and the content.  If the LSB should be
330   !##### sent first to IC, modify "Send_reference" sub-routine.
340   DIM Ref_divider$[21]          ! Length of Reference Divider Word Bit
350   Ref_divider$="100000000000110010000"   ! MSB <---> LSB
360   Ref_bit_length=LEN(Ref_divider$)
370   !
400   !##### The following 4 lines define the "feedback divider word."
410   !##### First 2 lines are for the start frequency of transient, and
420   !##### the rest are for the target frequency.  Modify the bit
430   !##### length and the content for each.  If the LSB should be sent
440   !##### first to IC, modify "Send_pll_freq" sub-routine.
450   DIM Divider$(1:2)[21]         ! Length of Feedback Divider Word Bit
460   Freq(1)=5.8E+9                       ! Start Frequency [Hz]
470   Divider$(1)="000011100010100100001" ! Feedback Divider. MSB <---> LSB
480   Freq(2)=5.85E+9                      ! Target Frequency [Hz]
490   Divider$(2)="000011100100100001001" ! Feedback Divider. MSB <---> LSB
500   Fb_bit_length=LEN(Divider$(1))
```

Sample Program:
Frequency Transient Measurement Using the Trigger Detection Output Function (Serial Data; 1/5)

```
510   !
700   !##### Initial time span value of the transient measurement.
710   T_span_msec=10                      ! Default Time Span [msec]
720   !
800   !##### Output voltage from 'DC POWER' of 4352B. If the IC
810   !##### needs Vcc supplied by 4352B, change the value "Dc_power".
820   Dc_power=5                          ! DC POWER (PLL Vcc)[V]
830   OUTPUT @Hp4352;"VPOW  ";Dc_power    ! Set DC POWER voltage
840   OUTPUT @Hp4352;"VOUT ON"            ! Set DC Output on
850   !
900   !##### When 43521A is not used, comment out the first line
910   !##### below and uncomment (remove "!" from) the second line.
920   OUTPUT @Hp4352;"DNCONV ON"          ! when 43521A used
930   !OUTPUT @Hp4352;"DNCONV OFF"        ! when 43521A not used
940   !
1000  !##### These 4 lines set Local SG Type and the switching wait time.
1010  !##### Change the Sg_type and Sg_wait values to match the SG used.
1020  Sg_type=1                           ! "1" for 866XA/B
1030  OUTPUT @Hp4352;"SGTYPE ";Sg_type    ! Set SG Type
1040  Sg_wait=.2                          ! Local SG wait time [sec]
1050  OUTPUT @Hp4352;"LOSWT ";Sg_wait     ! Set Local SG wait time
1060  OUTPUT @Hp4352;"LOAUTO ON"          ! Automatic Local SG Control
1070  WAIT 3                              ! Wait for SG Initialization
1080  !
1100  !##### The following 2 lines define the frequency range of HP
1110  !##### 4352S.  When 43521A is not used, comment out these 2
1120  !##### lines. Change F_band value according to the frequency
1130  !##### range and the SG's max frequency (Refer to the 4352S
1140  !##### GPIB Programming Manual.)
1150  F_band=3                            ! "3" for 3.1GHz - 6.6GHz
1160  OUTPUT @Hp4352;"FBAND ";F_band      ! Set Frequency Range
1170  !
1200  !##### If the IC's data input is negative logic, comment out the
1210  !##### first line below and uncomment the second line.
1220  OUTPUT @Hp4352;"POSL"             ! Set 24 bit I/O Positive Logic
1230  !OUTPUT @Hp4352;"NEGL"            ! Set 24 bit I/O Negative Logic
1240  !
1300  !------------------------------------ Frequency Transient Measurement
1310  OUTPUT @Hp4352;"VA"                 ! Select Analyzer mode
1320  OUTPUT @Hp4352;"MEAS TRAN"  ! Select Frequency Transient Measurement
1330  OUTPUT @Hp4352;"HOLD"               ! Hold Measurement Trigger
1340  !
1400  !---------------------------------------- Setting Frequency Span
1410  Fjump=ABS(Freq(1)-Freq(2))         ! Frequency Jump
```

Sample Program:
Frequency Transient Measurement Using the Trigger Detection Output Function (Serial Data; 2/5)

```
1420  !
1430  !##### If the frequency transient overshoot is too large, try a value
1440  !##### larger than 1.
1450  Over_shoot=1                    ! Overshoot Ratio on Frequency Jump
1460  Fspan=Fjump*(1+Over_shoot)            ! Jump + Overshoot
1470  !
1480  SELECT Fspan
1490  CASE <2.E+6
1500    OUTPUT @Hp4352;"TRSPAN TS2MHZ"      ! Set Frequency Span 2[MHz]
1510  CASE <2.E+7
1520    OUTPUT @Hp4352;"TRSPAN TS20MHZ"     ! Set Frequency Span 20[MHz]
1530  CASE ELSE
1540    OUTPUT @Hp4352;"TRSPAN TSMAX"        ! Set Frequency Span "MAX"
1550  END SELECT
1560  !
1570  OUTPUT @Hp4352;"TRTARG ";Freq(2)       ! Set Target Frequency
1580  OUTPUT @Hp4352;"TRTPOS 50"   ! Set Target Position 50% of Freq Span
1590  !
1700  !----------------------- Trigger Detection Output Function Setting
1710  OUTPUT @Hp4352;"TRGS INT"             ! Internal Trigger
1720  OUTPUT @Hp4352;"TRGOUT ON"          ! Set Trigger Detection Output
 function On
1730  OUTPUT @Hp4352;"OUT1ENVH"         ! Set OUTPUT 1 to HIGH by Trigger
1740  !
1900 !--------------------------- Send Control Word and Reference Divider
1910  !##### If the "control word" is not needed for initializing
1920  !##### the IC, comment out the line below.
1930  GOSUB Send_cont                        ! Send Control Word
1940  GOSUB Send_reference                   ! Send Reference Divider
1950  !
2000 Measurement:!
2010  !---------------------------------------- Display Parameters
2020  OUTPUT @Hp4352;"DISA HIHB"             ! Set Disp Allocation Half
      Inst / Half IBASIC
2030  CLEAR SCREEN
2040  PRINT "PLL Synthesizer Frequency Transient Measurement"
2050  PRINT
2060  PRINT "Control Word      :";Cont_word$
2070  PRINT "Reference Divider :";Ref_divider$
2080  PRINT
2090  PRINT "Start Frequency   :";Freq(1)/1.E+6;"[MHz]"
2100  PRINT "Feedback Divider  :";Divider$(1)
2110  PRINT "Target Frequency  :";Freq(2)/1.E+6;"[MHz]"
2120  PRINT "Feedback Divider  :";Divider$(2)
```

Sample Program:
Frequency Transient Measurement Using the Trigger Detection Output Function (Serial Data; 3/5)

```
2130  PRINT
2140 !
2200 !-------------------------------- Input Time Span
2210  BEEP
2220  DISP "Time Span [msec]=? (Defalut";T_span_msec;"[msec])";
2230  INPUT "",T_span_msec
2240  T_span=T_span_msec/1000.
2250  PRINT "Time Span        :";T_span_msec;"[msec]"
2260  OUTPUT @Hp4352;"SPAN ";T_span         ! Set Time Span
2270  !
2300  !------------------------ Transient from Start Freq. to Target Freq.
2310  DISP "Now measuring..."
2320  Freq_index=1                          ! for Start Frequency
2330  GOSUB Send_pll_freq                   ! Send Divider for Start Freq.
2340  OUTPUT @Hp4352;"OUT1H"                ! Send Strobe via OUTPUT 1
2350  OUTPUT @Hp4352;"OUT1L"                ! Reset Strobe (OUTPUT 1)
2360  WAIT .1                               ! Wait for settling
2370  !
2500  Freq_index=2                          ! for Target Frequency
2510  GOSUB Send_pll_freq                  ! Send Divider for Target Freq.
2520  EXECUTE "SING"               ! Measurement Trigger and send strobe
2530  !
2700  OUTPUT @Hp4352;"AUTO"                 ! Auto Scaling
2710  OUTPUT @Hp4352;"MKR ON"               ! Set Marker ON
2720  !
2800  BEEP
2810  INPUT "Measurement done. One more time? [Y/N; default Y]",Ans$
2820  IF Ans$"n" AND Ans$"N" THEN Measurement
2830  !
2840  GOTO End
2850  !
3000  !------------------------ Sub-routines for Sending Data to PLL IC
3010  !----------------------------- Send Reference Divider Word
3020  Send_reference:!
3030  OUTPUT @Hp4352;"OUT1L"                 ! Reset Strobe (OUTPUT 1)
3040  !
3050  !##### If the LSB should be sent first, uncomment the first
3060  !##### line below, and comment out the second line.
3070  !FOR I=Ref_bit_length TO 1 STEP -1      ! Send Data from LSB
3080  FOR I=1 TO Ref_bit_length              ! Send Data from MSB
3090  !
3100    WRITEIO 16,0;VAL(Ref_divider$[I,I])   ! Send Data via PORT A0
3110    WRITEIO 16,0;VAL(Ref_divider$[I,I])+2 ! Clock Up via PORT A1
3120    WRITEIO 16,0;VAL(Ref_divider$[I,I])   ! Clock Down via PORT A1
3130  NEXT I
```

Sample Program:
Frequency Transient Measurement Using the Trigger Detection Output Function (Serial Data; 4/5)

```
3140  !
3150  OUTPUT @Hp4352;"OUT1H"                  ! Send Strobe via OUTPUT 1
3160  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3170  !
3180  RETURN
3190  !
3200  !-------------------------------- Send Feedback Divider Word
3210 Send_pll_freq:!
3220  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3230  !
3240  !##### If the LSB should be sent first, uncomment the first
3250  !##### line below, and comment out the second line.
3260  !FOR I=Fb_bit_length TO 1 STEP -1       ! Send Data from LSB
3270  FOR I=1 TO Fb_bit_length                ! Send Data from MSB
3280  !
3290   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])  !Send Data via PORT A0
3300   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])+2 !Clock Up via PORT A1
3310   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])  !Clock Down via PORT A1
3320  NEXT I
3330  !
3340  RETURN
3350  !
3400  !---------------------------------------- Send Control Word
3410 Send_cont:!
3420  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3430  !
3440  !##### If the LSB should be sent first, uncomment the first
3450  !##### line below, and comment out the second line.
3460  !FOR I=Cont_bit_length TO 1 STEP -1     ! Send Data from LSB
3470  FOR I=1 TO Cont_bit_length              ! Send Data from MSB
3480  !
3490    WRITEIO 16,0;VAL(Cont_word$[I,I])     ! Send Data via PORT A0
3500    WRITEIO 16,0;VAL(Cont_word$[I,I])+2   ! Clock Up via PORT A1
3510    WRITEIO 16,0;VAL(Cont_word$[I,I])     ! Clock Down via PORT A1
3520  NEXT I
3530  !
3540  OUTPUT @Hp4352;"OUT1H"                  ! Send Strobe via OUTPUT 1
3550  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3560  RETURN
3570  !
5000  !------------------------------------------------- Quit Program
5010 End:  !
5020  OUTPUT @Hp4352;"VOUT OFF"
5030  DISP "Bye."
5040  END
```

Figure 12-24.
Sample Program: Frequency Transient Measurement Using the Trigger Detection Output Function (Serial Data; 5/5)

Using the Trigger Detection Output Function - 2 (Parallel Data)

Figure 12-27 shows a frequency transient measurement program using the trigger detection output function. The DUT PLL used in this program requires parallel data for LOAD signal (feedback divider) to change its output frequency. Figure 12-25 shows a block diagram of this PLL (PLL synthesizer).

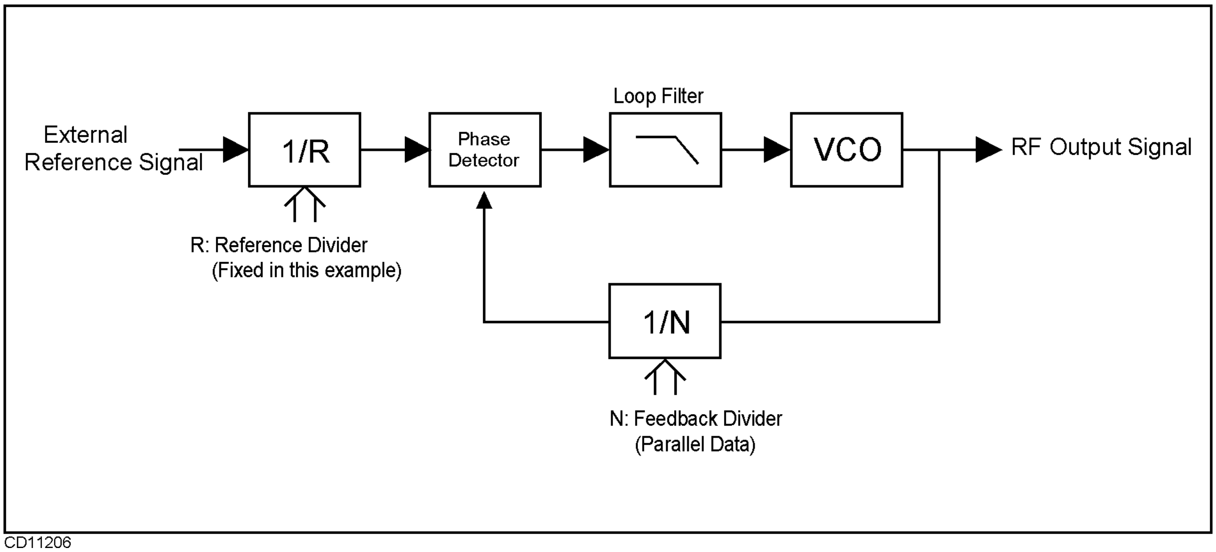


Figure 12-25. Block Diagram of the PLL Synthesizer (Parallel Data)

Figure 12-26 shows the connection of the DUT and the 4352B. RF output signal of the PLL used in this sample program is 180MHz, a level of frequency below 3GHz. Therefore, you do not need to use the 43521A Down Converter Unit together with the 4352B. In this program, parallel data is sent to each of the PLL's LOAD and DATA terminals from the 24-bit I/O port of the 4352B's rear panel.

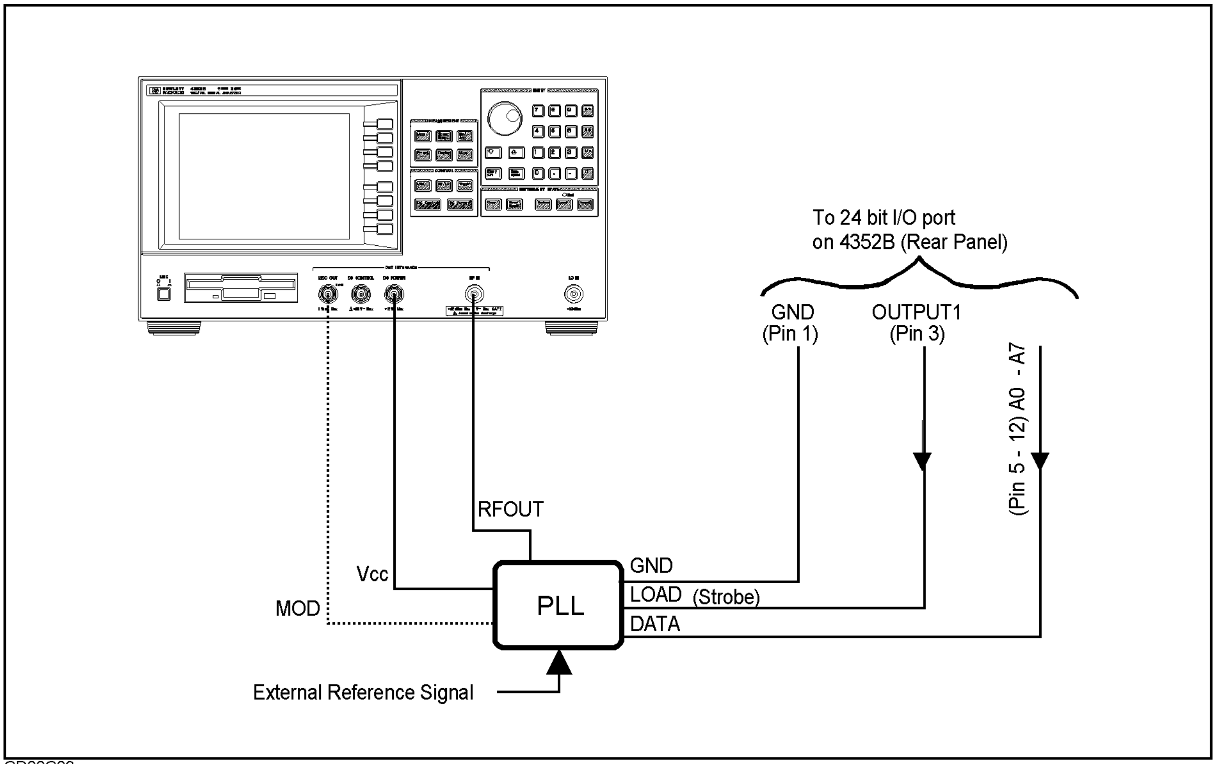


Figure 12-26. Connection of DUT PLL (Parallel Data)

This program is intended to measure characteristics of the DUT when its output frequency is changed from 180 MHz to 180.8 MHz. Note that the 4352B functions as system controller in this program.
The following describes what each of the blocks is intended to accomplish. The program may need to be changed depending on the type of PLL you use.

Lines 400 to 480: Define Feedback Divider

Freq(1) and Freq(2) are set respectively at 180 MHz and 180.8 MHz. These frequencies represent the start and target (final) frequencies used for frequency transient measurement. The 4352B is set at Freq(2) as target frequency in line 1570. Parallel data for each of the frequencies to be supplied to the PLL is substituted into Divider$. In the case of this PLL, 180 MHz and 180.8 MHz are represented respectively by 225 and 226. Data is supplied to the PLL by the Send_pll_freq subroutine in line 3210. In this program, 8-bit parallel data is supplied to the PLL. However, you may need to change the number of bits and the contents of these bits for Freq(1), Freq(2), and the feedback divider in accordance with your DUT.

Lines 700 to 720: Specify Default Measurement Time

This block specifies the default measurement time. However, line 2200, provided later in the program, allows you to type in a desired measurement time. Therefore, you do not always need to specify it in this block. Measurement time is set at 10 msec in this program.

Lines 800 to 850: Specify DC Power Voltage

This block specifies the 4352B's DC power voltage. The DC power voltage is set at 12 V in this program. You may need to change it in accordance with your DUT.

Lines 900 to 940: Select Whether to Use the 43521A

This block selects whether to use the 43521A (Down Converter Unit). The DUT PLL used in this program outputs a low frequency signal (180 MHz). Therefore, you do not need to use the 43521A. You need to use it if the PLL outputs a signal beyond 3 GHz. In this case, you must treat line 920 as an executable statement while at the same time commenting out line 930.

Lines 1000 to 1080: Specify SG Type and SG Local Signal Wait Time

This block specifies an external signal source (SG) type number and local signal wait time. Because we assume that the 8664A is used as external signal source, "1" is specified for SG type number. You need to specify a different number depending on the signal generator type. See the (RF/LO) Menu in Chapter 9 of the 4352B Function Reference for more information. "1" and "200 msec" are specified respectively for SG type number and local signal wait time in this program.

Lines 1100 to 1170: Specify Frequency Band When Using the 43521A

The 43521A (Down Converter Unit) is not used in this program. Therefore, this block is commented out. When you use the 43521A, you need to specify a frequency band in this block. When you use the 43521A, the upper frequency limit is increased to 12.6 GHz and the entire frequency range is divided into 6 different frequency bands. Therefore, you need to specify a band number that matches the frequency of your target signal. See FBAND<numeric> in Chapter 9 or 10 for more information on frequency band numbers.

Lines 1200 to 1240: Specify Positive/Negative Logic for 24-bit I/O

This block specifies whether to use positive or negative logic for the signal output through the 4352B's 24-bit I/O port. Depending on the specification of your PLL, make either line 1220 (POSL) or 1230 (NEGL) an executable statement. In this program, positive logic (POSL) is used.

Lines 1300 to 1340: Select Frequency Transient Measurement

This block selects frequency transient measurement as measurement type. The analyzer mode (VA) is selected first. Then, frequency transient measurement (MEAS TRAN) is selected. At the same time, HOLD is selected for trigger so that frequency transient measurement can be triggered by a later block. Measurement is triggered by EXECUTE "SING" in line 2520.

Lines 1400 to 1490: Specify Measurement Frequency Range, Target Frequency, and Target Position

Frequency span, target frequency, and target position are required to determine minimum and maximum measurement frequencies. Because frequency span must cover the entire transient frequency range, you must include transient overshoot in addition to the range from start frequency (180 MHz) to target frequency (180.8 MHz). This program can automatically select a frequency span in response to the overshoot you enter. Line 1410 calculates the difference between start and target frequencies (Fjump = 0.8 MHz). Next, the frequency span is calculated by Fspan = Fjump × (1 + Over_shoot) = 0.8MHz × 2 = 1.6 MHz, assuming that the overshoot is 100% (Over_shoot=1). This frequency (1.6 MHz) corresponds to <2.E+6 (less than 2 MHz) in line 1490. Consequently, TRSPAN TS2MHZ is selected and the frequency span is set at 2 MHz. Because line 1580 specifies 50% for target position, minimum and maximum frequencies are calculated as follows:

Minimum frequency: 180.8 MHz - (2 MHz × 0.5) = 179.8 MHz
Maximum frequency: 180.8 MHz + (2 MHz × (1 - 0.5)) = 181.8 MHz

In this case, because the minimum frequency span 2 MHz is selected, overshoot may exceed the maximum frequency or fall below the minimum frequency. If this occurs, assign any value greater than 1 for Over_shoot to provide a wider frequency span. See Figure 12-23 for the relationship between overshoot and, start, and target frequencies.

In line 1570, the 4352B is set at 180.8 MHz (frequency specified in line 460) as target frequency (TRTARG).

Lines 1700 to 1740: Turn ON Trigger Detection Output Function

This block selects internal trigger (TRGS INT) and turns ON the trigger detection output function (TRGOUT ON). OUT1ENVH is used to pull OUTPUT1 (24-bit I/O) high. OUTPUT1 is connected to the PLL Load terminal. (See Figure 12-22.) The PLL loads serial data available at the DATA terminal when the LOAD terminal goes high. It changes the signal frequency to the level specified by the serial data. Thus, using OUT1ENVH triggers measurement and allows the PLL to convert the signal frequency for transient measurement.

Lines 2000 to 2090: Display Measurement Parameters

This block displays measurement parameters. DISA HIHB displays measurement results and measurement parameters respectively at the upper and lower halves of the screen.

- Title (PLL Synthesizer Frequency Transient Measurement)
- Initialization word: Cont_word$
- Reference divider: Ref_divider$
- Start frequency: Freq(1)/1.E+6;"[MHz]"
- Parallel signal for start frequency: divider$(1)
- Target frequency (final frequency): Freq(2)/1.E+6;"[MHz]"
- Parallel signal for target frequency : divider$(2)

Lines 2200 to 2270: Prompt User to Enter Measurement Time

This block prompts you to enter measurement time [ms]. You can change 10 msec specified in line 700 as necessary. This block displays "Time Span [msec]=? (Default 10 [msec])" on the screen to ask you whether you wish to change the time. The time you enter will be stored in T_span_msec, divided by 1000 for converting the unit into millisecond, and the result of division stored in T_span. Line 2250 displays the new measurement time on the screen while line 2260 sets the 4352B at the new measurement time. Whether you can obtain a proper transient measurement screen depends on your measurement time. In this program, you can return from line 2820 to line 2000 so that you can enter a new measurement time to repeat measurement if your screen is not appropriate.

Lines 2300 to 2380: Lock the PLL to Start Frequency

"Now measuring" appears on the screen.
Freq(1) (180 MHz specified as start frequency in line 440) is selected in line 2320. In line 2340, this program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (parallel data "225" in line 450) for the start frequency (180 KHz) from port A (A0 to A7) of the 24-bit I/O port. (Note that this data is not loaded into the PLL at this point.) When OUTPUT1 of the 24-bit I/O port is pulled high in line 2340, the parallel data available at A0 to A7 is loaded into the PLL, thus causing the PLL to oscillate at the start frequency (180 MHz). In line 2360, OUTPUT1 of the 24-bit I/O port is pulled low, thus resetting the PLL's LOAD terminal. Line 2370 waits for the PLL frequency to stabilize at 180 MHz.

Lines 2500 to 2530: Lock the PLL to Target Frequency and Trigger Measurement

Freq(2) (180.6 MHz specified as target frequency in line 460) is selected in line 2500. In line 2510, the program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (parallel data ("226") in line 490) for the target frequency (180.8 MHz) from port A (A0 to A7) of the 24-bit I/O port. Note that this data is not loaded into the PLL at this point. Measurement is triggered by EXECUTE "SING". At the same time, OUT1ENVH in line 1630 pulls OUTPUT1 of the 24-bit I/O port high. When OUTPUT1 goes high, serial data available at port A (A0 to A7) is loaded into the PLL, thus causing the PLL to start increasing its oscillation frequency to the target frequency (180.8 MHz). Consequently, frequency transient takes place at the same time as start of the measurement.

Lines 2700 to 2720: Auto-scale Measurement Results and Turn ON the Marker

AUTO in line 2700 optimizes scaling for measurement results to be displayed on the screen. Line 2710 displays the marker on the screen. You can use the rotary knob to move the marker as desired to check the reading.

Lines 2800 to 2850: Prompt User to Select Y or N (Whether to Change Measurement Time to Repeat Measurement)

Line 2820 displays “Change Time and Repeat Measurement? (Y/N)” to prompt you to select “Y” or “N.” When you enter any character other than “N” (or “n”), the program goes back to line 2000 to repeat measurement. Enter a character other than “N” if you cannot obtain appropriate results due to excessively short or long measurement time. When you enter “N”, the program goes to the subroutine line 5000 to end the program.

Lines 3200 to 3260 Subroutine for Sending Feedback Divider

This subroutine sends the feedback divider from port A of the 24-bit I/O port. Two pieces of parallel data whose contents have been specified in lines 440 to 470 are selected respectively in lines 2320 and 2500. These pieces of parallel data are sent to the PLL by this subroutine. In line 3220, OUTPUT1 of the 24-bit I/Ois pulled low, thus resetting the PLL’s LOAD signal. Line 3230 sends the feedback divider (parallel data) to the PLL. The program goes back to line 2520 where EXECUTE “SING” triggers measurement while OUTPUT1 of the 24-bit I/O port is pulled high at the same time, thus loading the feedback divider into the PLL. Note that 8-bit parallel signal is sent to the PLL in this program. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 5000 to 5040: End the Program

This block turns OFF the DC voltage to end the program.

```
10    ! File Name : FIG12_33.TXT
20    !   IBASIC SAMPLE PROGRAM for Frequency Transient Measurement with
 Trigger Detection Output Function
30    !   (Parallel Data Transfer)
40    !
50    ASSIGN @Hp4352 TO 800
60    DISP ""
70    !
80    !################################################################
90    ! Follow the instructions given in comments to modify this
100   ! program to work with your PLL IC. For further information,
110   ! refer to 4352S GPIB Programming Manual.
120   !----------------------------------------------------------------
130   ! In this program, Control Data are transferred to IC via 24 bit
140   ! I/O port as parallel data.  Data are sent via A0 - A7 (PIN#5-12)
150   ! and Strobe (Enable/Load) via OUTPUT 1(PIN#3).
160   !################################################################
170   !
400   !##### The following 4 lines define the "feedback divider" to
410   !##### send to IC's frequency of transient, and the rest are for
420   !##### the target frequency.  Change the frequency and the
430   !##### divider value for each.
440   Freq(1)=1.8E+8                         ! Start Frequency [Hz]
450   Divider(1)=225                         ! Feedback Divider
460   Freq(2)=1.808E+8                        ! Target Frequency [Hz]
470   Divider(2)=226                         ! Feedback Divider
480  !
700   !##### Initial time span value of the transient measurement.
710   T_span_msec=10                         ! Default Time Span [msec]
720   !
800   !##### Output voltage from 'DC POWER' of 4352B. If the IC
810   !##### needs Vcc supplied by 4352B, change the value "Dc_power".
820   Dc_power=12                            ! DC POWER (PLL Vcc)[V]
830   OUTPUT @Hp4352;"VPOW  ";Dc_power       ! Set DC POWER voltage
840   OUTPUT @Hp4352;"VOUT ON"               ! Set DC Output on
850   !
900   !##### When 43521A is used, uncomment  (remove "!" from) the
910   !##### first line below and comment out the second line.
920   !OUTPUT @Hp4352;"DNCONV ON"            ! when 43521A used
930   OUTPUT @Hp4352;"DNCONV OFF"            ! when 43521A not used
```

Sample Program:
Transient Measurement Using the Trigger Detection Output Function (Parallel; 1/4)

```
940   !
1000  !##### These 4 lines set Local SG Type and the switching wait time.
1010  !##### Change the Sg_type and Sg_wait values to match the SG used.
1020  Sg_type=1                              ! "1" for 866XA/B
1030  OUTPUT @Hp4352;"SGTYPE ";Sg_type       ! Set SG Type
1040  Sg_wait=.2                             ! Local SG wait time [sec]
1050  OUTPUT @Hp4352;"LOSWT ";Sg_wait        ! Set Local SG wait time
1060  OUTPUT @Hp4352;"LOAUTO ON"             ! Automatic Local SG Control
1070  WAIT 1                                 ! Wait for SG Initialization
1080  !
1100  !##### The following  2 lines define the frequency range of HP
1110  !##### 4352S.  When 43521A is used, uncomment these 2 lines, and
1120  !##### change F_band value according to the frequency range and
1130  !##### the SG's max frequency.  (Refer to the 4352S GPIB
1140  !##### Programming Manual.)
1150  !F_band=3                                ! "3" for 3.1GHz - 6.6GHz
1160  !OUTPUT @Hp4352;"FBAND ";F_band          ! Set Frequency Range
1170  !
1200  !##### If the IC's data input is negative logic, comment out the
1210  !##### first line below and uncomment the second line.
1220  OUTPUT @Hp4352;"POSL"              ! Set 24 bit I/O Positive Logic
1230  !OUTPUT @Hp4352;"NEGL"             ! Set 24 bit I/O Negative Logic
1240  !
1300  !------------------------ Frequency Transient Measurement Setting
1310  OUTPUT @Hp4352;"VA"                    ! Select Analyzer mode
1320  OUTPUT @Hp4352;"MEAS TRAN" ! Select Frequency Transient Measurement
1330  OUTPUT @Hp4352;"HOLD"                  ! Hold Measurement Trigger
1340  !
1400  !------------------------------------- Setting Frequency Span
1410  Fjump=ABS(Freq(1)-Freq(2))            ! Frequency Jump
1420  !
1430  !##### If the freq transient overshoot is too large, try a value
1440  !##### larger than 1.
1450  Over_shoot=1                  ! Overshoot Ratio on Frequency Jump
1460  Fspan=Fjump*(1+Over_shoot)            ! Jump + Overshoot
```

Sample Program:
Transient Measurement Using the Trigger Detection Output Function (Parallel; 2/4)

```
1470  !
1480  SELECT Fspan
1490  CASE <2.E+6
1500    OUTPUT @Hp4352;"TRSPAN TS2MHZ"      ! Set Frequency Span 2[MHz]
1510  CASE <2.E+7
1520    OUTPUT @Hp4352;"TRSPAN TS20MHZ"     ! Set Frequency Span 20[MHz]
1530  CASE ELSE
1540    OUTPUT @Hp4352;"TRSPAN TSMAX"       ! Set Frequency Span "MAX"
1550  END SELECT
1560  !
1570  OUTPUT @Hp4352;"TRTARG ";Freq(2)      ! Set Target Frequency
1580  OUTPUT @Hp4352;"TRTPOS 50" ! Set Target Position 50% of Freq Span700
1590  !
1700  !------------------------ Trigger Detection Output Function Setting
1710  OUTPUT @Hp4352;"TRGS INT"             ! Internal Trigger
1720  OUTPUT @Hp4352;"TRGOUT ON"            ! Set Trigger Detection Output
 function On
1730  OUTPUT @Hp4352;"OUT1ENVH"          ! Set OUTPUT 1 to HIGH by Trigger
1740  !
2000 Measurement:!
2010  !---------------------------------------- Display Parameters
2020  OUTPUT @Hp4352;"DISA HIHB"             ! Set Disp Allocation Half
 Inst / Half IBASIC
2030  CLEAR SCREEN
2040  PRINT "PLL Synthesizer Frequency Transient Measurement"
2050  PRINT
2090  PRINT "Start Frequency   :";Freq(1)/1.E+6;"[MHz]"
2100  PRINT "Feedback Divider  :";Divider(1)
2110  PRINT
2120  PRINT "Target Frequency  :";Freq(2)/1.E+6;"[MHz]"
2130  PRINT "Feedback Divider  :";Divider(2)
2140  PRINT
2150  !
2200  !---------------------------------- Input Time Span
2210  BEEP
2220  DISP "Time Span [msec]=? (Defalut";T_span_msec;"[msec])";
2230  INPUT "",T_span_msec
2240  T_span=T_span_msec/1000.
2250  PRINT "Time Span         :";T_span_msec;"[msec]"
2260  OUTPUT @Hp4352;"SPAN ";T_span          ! Set Time Span
```

Sample Program:
Transient Measurement Using the Trigger Detection Output Function (Parallel; 3/4)

```
2270  !
2300  !------------------------- Transient from Start Freq. to Target Freq.
2310  DISP "Now measuring..."
2320  Freq_index=1                            ! for Start Frequency
2340  GOSUB Send_pll_freq                     ! Send Divider for Start Freq.
2350  OUTPUT @Hp4352;"OUT1H"                  ! Send Strobe via OUTPUT 1
2360  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
2370  WAIT .1                                 ! Wait for settling
2380  !
2500  Freq_index=2                            ! for Target Frequency
2510  GOSUB Send_pll_freq                     ! Send Divider for Target Freq.
2520  EXECUTE "SING"                  ! Measurement Trigger and send strobe
2530  !
2700  OUTPUT @Hp4352;"AUTO"                   ! Auto Scaling
2710  OUTPUT @Hp4352;"MKR ON"                 ! Set Marker ON
2720  !
2800  BEEP
2810  INPUT "Measurement done. One more time? [Y/N; default Y]",Ans$
2820  IF Ans$"n" AND Ans$"N" THEN Measurement
2830  !
2840  GOTO End
2850  !
3000  !------------------------- Sub-routines for Sending Data to PLL IC
3200  !-------------------------------- Send Feedback Divider Word
3210 Send_pll_freq:!
3220  OUTPUT @Hp4352;"OUT1L"                   ! Reset Strobe (OUTPUT 1)
3230  WRITEIO 16,0;Divider(Freq_index)         ! Send Data via PORT A0 - A7
3240  !
3250  RETURN
3260  !
5000  !---------------------------------------------- Quit Program
5010 End:  !
5020  OUTPUT @Hp4352;"VOUT OFF"                ! Set Voltage Output Off
5030  DISP "Bye."
5040  END
```

Figure 12-27.
Sample Program:
Transient Measurement Using the Trigger Detection Output Function (Parallel; 4/4)

Using the Value Trigger Function - 1 (43521A and Serial Data)

Figure 12-28 shows a frequency transient measurement program using the value trigger function. In this program, the same PLL as that for “Using the Trigger Detection Output Function - 1 (43521A and Serial Data)” is used. See the above-mentioned section for information on the PLL block diagram and its connection. This PLL requires serial data for initialization and frequency division ratio signals. This program is intended to measure the transient characteristics of the DUT when its output frequency is changed from 5.8 GHz to 5.85 GHz. The 4352B functions as system controller in this program.
The following describes what each of the blocks is intended to accomplish. The program may need to be changed depending on the type of PLL you use.

Lines 200 to 270: Define Initialization Word

This block specifies the initialization word to be supplied to the PLL. The word is determined based on the DUT PLL specification. The word thus determined is supplied to the PLL by the Send cont: subroutine in line 3410. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits in accordance with your DUT.

Lines 300 to 370: Define Reference Divider

This block specifies the reference divider word to be supplied to the PLL. The word is determined based on the DUT PLL specification. The word is then supplied to the PLL by the Send reference: subroutine in line 3020. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits in accordance with your DUT.

Lines 400 to 490: Define Feedback Divider

Freq(1) and Freq(2) are set respectively at 5.8 GHz and 5.85 GHz. These frequencies represent the start and target (final) frequencies used for frequency transient measurement. Freq(2) is set as target frequency for the 4352B in line 1570. Serial data for PLL, each corresponding to Freq(1) and Freq(2), are assigned to Divider$. The data is supplied to the PLL by the Send_pll_freq subroutine in 3210. 21-bit serial data is used in this program. You may need to change the number of bits and the contents of these bits for Freq(1), Freq(2), and the feedback divider in accordance with your DUT.

Lines 600 to 630: Specify Trigger Frequency

The value trigger function is used in this program. This function is designed so that frequency transient is generated first and then measurement is triggered immeadately after a change in PLL output frequency is detected. In this block, the frequency at which measurement is to be triggered is stored in Trig_freq. Start and final frequencies are 5.8 GHz and 5.85 GHz, respectively. Because PLL output frequency increases, trigger frequency is set at 5.801 GHz, a frequency slightly higher than start frequency, thus ensuring that the 4352B detects change in frequency as quickly as possible. This allows the 4352B to trigger measurement when PLL output frequency reaches 5.801 GHz.

Lines 700 to 720: Specify Default Measurement Time

This block specifies the default measurement time. However, line 2200, provided later in the program, allows you to type in a desired measurement time. Therefore, you do not always need to specify it in this block. Measurement time is set at 10 msec in this block.

Lines 800 to 850: Specify DC Power Voltage

This block specifies the 4352B’s DC power voltage. The DC power voltage is set at 5 V in this program. You may need to change it in accordance with your DUT.

Lines 900 to 940: Select Whether to Use the 43521A

This block selects whether to use the 43521A (Down Converter Unit). In this program, a high frequency signal (5.8 GHz) is measured. Therefore, you need to use the 43521A. You do not need to use it if the target frequency is 3 GHz or less. In this case, treat line 930 as an executable statement and comment out line 920.

Lines 1000 to 1080: Specify SG Type and SG Local Signal Wait Time

This block specifies an SG type number of the external signal source (SG) and local signal wait time. Because the 8664A is used as external signal source in this program, "1" is specified for the SG type number. You need to specify a different number depending on the signal generator. See the (RF/LO) Menu in Chapter 9 of the 4352B Function Reference for more information. "1" and "200 msec" are specified respectively for SG type number and local signal wait time in this block.

Lines 1100 to 1170: Specify Frequency Band When Using the 43521A

This block sets a frequency band since the 43521A (Down Converter Unit) is used. When you use the 43521A, the upper frequency limit is increased to 12.6 GHz and the entire frequency range is divided into 6 different frequency bands. Therefore, you specify the number indicating the frequency band that includes the target frequency. In this program, approximately 5.8 GHz signal is measured. Therefore, "3" (3.1 GHz to 6.6 GHz) is specified. See FBAND<numeric> in Chapter 9 or 10 for more information. You do not need to specify a band number when you do not use the 43521A. In this case, comment out this entire block.

Lines 1200 to 1250: Specify Positive/Negative Logic for 24-bit I/O

This block specifies whether to use positive or negative logic for the signal output of the 4352B's 24-bit I/O port. Depending on the specification of your PLL, make either line 1220 (POSL) or 1230 (NEGL) an executable statement. In this program, positive logic (POSL) is used.

Lines 1300 to 1340: Select Frequency Transient Measurement

This block selects frequency transient measurement as measurement type. The analyzer mode (VA) is selected. Then, frequency transient measurement (MEAS TRAN) is selected. At the same time, HOLD is selected for trigger so that frequency transient measurement can be triggered by a later block. Because the value trigger function is used in this program, measurement is triggered when the PLL output frequency reaches the trigger frequency after line 2620 has been executed.The 4352B triggers measurement immediately before line 2630.

Lines 1400 to 1490: Specify Measurement Frequency Range, Target Frequency, and Target Position

Frequency span, target frequency, and target position are required to determine minimum and maximum measurement frequencies. Because frequency span should cover the entire transient frequency range, transient overshoot is included in addition to the range from start frequency (5.8 GHz) to target frequency (5.85 GHz). This program can automatically select a frequency span in response to the overshoot you enter. Line 1410 calculates the difference between start and target frequencies (Fjump = 50 MHz). Next, the frequency span is calculated by Fspan = Fjump × (1 + Over_shoot) = 50MHz × 2 = 100MHz, assuming that the overshoot is 100% (Over_shoot=1). 100 MHz neither corresponds to <2.E+6 (less than 2 MHz) in line 1490 nor to <2.E+7 (less than 20 MHz) in 1510. Therefore, it corresponds to CASE ELSE in line 1530. Consequently, TSMAX is selected and the frequency span is set at 512 MHz (fixed). Because line 1580 specifies 50% for target position, minimum and maximum frequencies are calculated as follows:

Minimum frequency: 5.85 GHz - (512 MHz × 0.5) = 5.594 GHz
Maximum frequency: 5.85 GHz + (512 MHz × (1 - 0.5)) = 6.106 GHz

In this case, because frequency span is 512 MHz, overshoot is unlikely to exceed the maximum frequency or fall below the minimum frequency. However, if 2 MHz is selected for frequency span due, for example, to a small difference between maximum and minimum frequencies, overshoot may fall outside the range between maximum and minimum frequencies. In this case, assign any value greater than 1 for Over_shoot to provide a wider frequency span. See Figure 12-23 for the relationship between overshoot and, start, and target frequencies.

In line 1570, the 4352B is set at 5.85 GHz (frequency specified in line 480) as target frequency (TRTARG).

Lines 1700 to 1790: Turn ON Value Trigger Function

This block turns ON the value trigger function by selecting TRGS VAL. Also, this block sets the 4352B at the trigger frequency (5.801 GHz stored in Trig_freq in line 620) in line 1720. Lines 1740 select the trigger polarity. Line 1740 calculates the difference between start and target frequencies. Positive logic (TRGP POS) is selected when target frequency is larger than start frequency while negative logic (TRGP NEG) is selected when target frequency is smaller.

Lines 1900 to 1950: Send Initialization Word and Reference Frequency Divider

This block goes to the subroutine for sending the initialization word and reference divider to the PLL. The initialization word has been defined as serial signal and stored in Cont_word$ in line 250. GOSUB Send_cont goes to line 3410 to send the initialization word to the PLL from port A of the 24-bit I/O port. The reference divider has been defined as serial signal and stored in Ref_Divider$ in line 350. GOSUB Send_reference goes to line 3020 to send this signal from the same port. Comment out lines 1930 and 1940 if you do not need to send any initialization word or reference divider.

Lines 2000 to 2090: Display Measurement Parameters

This block displays measurement parameters. DISA HIHB displays measurement results and measurement parameters respectively at the upper and lower halves of the screen.

- Title (PLL Synthesizer Frequency Transient Measurement)
- Initialization word: Cont_word$
- Reference divider: Ref_divider$
- Start frequency: Freq(1)/1.E+6;“[MHz]”
- Serial signal for start frequency: divider$(1)
- Target frequency (final frequency): Freq(2)/1.E+6;“[MHz]”
- Serial signal for target frequency : divider$(2)

Lines 2200 to 2270: Prompt User to Enter Measurement Time

This block prompts you to enter measurement time [ms]. You can change 10 msec specified in line 700 as necessary. This block displays “Time Span [msec]=? (Default 10 [msec])” on the screen to ask you whether you wish to change the time. The time you enter will be stored in T_span_msec, divided by 1000 for converting the unit into millisecond, and the result of division stored in T_span. Line 2250 displays the new measurement time on the screen while line 2260 sets the 4352B at the new measurement time. Whether you can obtain a proper transient measurement screen depends on your measurement time. In this program, you can return from line 2820 to line 2000 so that you can enter a new measurement time to repeat measurement if your screen is not appropriate.

Lines 2300 to 2360: Lock the PLL to Start Frequency

“Now measuring” appears on the screen.

Freq(1) (5.8 GHz specified as start frequency in line 460) is selected in line 2320. In line 2330, the program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (serial data in line 470) for the start frequency (5.8 GHz) from port A

(A0) of the 24-bit I/O port so that this signal can be loaded into the PLL. This causes the PLL to oscillate at the start frequency (5.8 GHz). Line 2360 waits for the PLL frequency to stabilize at 5.8 GHz.

Lines 2400 to 2430: Clear Status Byte

The last block checks the contents of the status byte register to determine whether measurement is complete. This block clears this register to allow the last block to make this decision.

Lines 2600 to 2640: Wait for Measurement to Be Triggered/Lock the PLL to Target Frequency

In line 2600, OUTPUT@HP4352;"SING" switches the 4352B in the value trigger standby state. This allows measurement to be automatically triggered when the PLL output frequency reaches the trigger frequency (5.801 GHz). In line 2610, Freq(2) (5.85 GHz specified as target frequency in line 480) is selected. In line 2620, the program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (serial data in line 490) for the target frequency (5.85 GHz) from port A (A0) of the 24-bit I/O port so that this data can be loaded into the PLL. At this time, the PLL starts increasing its oscillation frequency to the target frequency (5.85 GHz). Measurement is triggered when the PLL output frequency reaches the target frequency. In line 2630, the program goes to the Meas_end subroutine. This subroutine monitors the progress of measurement. When it determines that measurement is complete, the program goes to the next block.

Lines 2700 to 2720: Auto-scale Measurement Results and Turn ON the Marker

AUTO in line 2700 optimizes scaling for measurement results to be displayed on the screen. Line 2710 displays the marker on the screen. You can use the rotary knob to move the marker as desired to check the reading.

Lines 2800 to 2850: Prompt User to Select Y or N (Whether to Change Measurement Time to Repeat Measurement)

Line 2820 displays "Change Time and Repeat Measurement? (Y/N)" to prompt you to select "Y" or "N." When you enter any character other than "N" (or "n"), the program goes back to line 2000 to repeat measurement. Enter a character other than "N" if you cannot obtain appropriate results due to excessively short or long measurement time. When you enter "N", the program goes to the subroutine line 5000 to end the program.

Lines 3000 to 3090: Subroutine for Sending Reference Divider

This subroutine sends the reference divider (Ref_divider$ in line 350) from port A of the 24-bit I/O port. Line 3030 pulls OUTPUT1 of the 24-bit I/O port low, thus resetting the PLL's LOAD signal. Line 3080 sends data in the MSB first. Then, the reference divider (serial data) and a clock signal are sent to the PLL in lines 3100 to 3130. Line 3150 pulls OUTPUT1 of the 24-bit I/O port high, causing the signal to be loaded into the PLL. In 3160, OUTPUT1 is pulled low again, thus resetting the PLL's LOAD signal. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference*.

Lines 3200 to 3290: Subroutine for Sending Feedback Divider

This subroutine sends the feedback divider from port A of the 24-bit I/O port. Two pieces of serial data whose contents have been specified in lines 460 to 490 are selected respectively in lines 2320 and 2610. These pieces of serial data are sent to the PLL by this subroutine. In line 3220, OUTPUT1 of the 24-bit I/Ois pulled low, thus resetting the PLL's LOAD signal. Line 3270 displays data in the MSB first. Next, the feedback divider (serial data) and a clock signal are sent to the PLL in lines 3290 to 3320. In line 3340, OUTPUT1 of the 24-bit I/O port is pulled high, thus the loading feedback divider into the PLL. OUTPUT1 is pulled low again in line 3350 to reset the PLL's LOAD signal. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 3400 to 3490: Subroutine for Sending the Initialization Word

This subroutine sends the initialization word (Cont_word$ in line 250) from port A of the 24-bit I/O port. In line 3240, OUTPUT1 of the 24-bit I/O port is pulled low, thus resetting the PLL's LOAD signal. Line 3470 displays data in the MSB first. Next, the initialization word (serial data) and a clock signal are sent to the PLL in lines 3490 to 3520. OUTPUT1 of the 24-bit I/O port is pulled high in line 3540, thus loading the initialization word into the PLL. OUTPUT1 is pulled low again in line 3550, thus resetting the PLL's LOAD signal. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 4000 to 4070: Subroutine for Detecting End of Measurement

This subroutine monitors the contents of the event status register to determine whether measurement is complete, then goes to the next block when measurement is complete.

Lines 5000 to 5040: End the Program

This block turns OFF the DC voltage to end the program.

```
10    ! File Name : FIG12_34.TXT
20    !   IBASIC SAMPLE PROGRAM for Frequency Transient Measurement
 with Value Trigger Function
30    !   (Serial Data Transfer)
40    !
50    ASSIGN @Hp4352 TO 800
60    DISP ""
70    !
80    !################################################################
90    ! Follow the instructions given in comments to modify this
100   ! program to work with your PLL IC. For further information,
110   ! refer to 4352S GPIB Programming Manual.
120   !----------------------------------------------------------------
130   ! In this program, Control Data are transferred to IC via 24 bit
140   ! I/O port as serial data.  Data are sent via A0(PIN#5), Clock
150   ! via A1(PIN#6), and Strobe (Enable/Load) via OUTPUT 1(PIN#3).
160   !################################################################
170   !
200   !##### If the IC needs to receive the "control word" for
210   !##### initialization, modify these 2 lines below.  If not, comment
220   !##### out the line 1930.  If the LSB should be sent first to IC,
230   !##### modify "Send_cont" sub-routine.
240   DIM Cont_word$[21]                     ! Length of Control Word Bits
250   Cont_word$="000000000100010010011"     ! MSB <---> LSB
260   Cont_bit_length=LEN(Cont_word$)
270   !
300   !##### The following 2 lines define the "reference divider word."
310   !##### This word may contain the pre-scaler bit for some ICs.
320   !##### Modify the bit length and the content.  If the LSB should be
330   !##### sent first to IC, modify "Send_reference" sub-routine.
340   DIM Ref_divider$[21]          ! Length of Reference Divider Word Bits
350   Ref_divider$="100000000000110010000"   ! MSB <---> LSB
360   Ref_bit_length=LEN(Ref_divider$)
370   !
400   !##### The following 4 lines define the "feedback divider word."
410   !##### First 2 lines are for the start frequency of transient, and
420   !##### the rest are for the target frequency.  Modify the bit
430   !##### length and the content for each.  If the LSB should be sent
440   !##### first to IC, modify "Send_pll_freq" sub-routine.
450   DIM Divider$(1:2)[21]          ! Length of Feedback Divider Word Bits
460   Freq(1)=5.8E+9                         ! Start Frequency [Hz]
470   Divider$(1)="000011100010100100001"  ! Feedback Divider. MSB <---> LSB
480   Freq(2)=5.85E+9                        ! Target Frequency [Hz]
490   Divider$(2)="000011100100100001001"  ! Feedback Divider. MSB <---> LSB
500   Fb_bit_length=LEN(Divider$(1))
```

Sample Program: Using the Value Trigger Function - 1 (Serial Data; 1/6)

```
510   !
600   !##### The next line defines the trigger threshold frequency.
610   !##### Change the value for appropriate measurement trigger.
620   Trig_freq=5.801E+9
630   !
700   !##### Initial time span value of the transient measurement.
710   T_span_msec=10                        ! Default Time Span [msec]
720   !
800   !##### Output voltage from 'DC POWER' of 4352B. If the IC
810   !##### needs Vcc supplied by 4352B, change the value "Dc_power".
820   Dc_power=5                            ! DC POWER (PLL Vcc)[V]
830   OUTPUT @Hp4352;"VPOW  ";Dc_power      ! Set DC POWER voltage
840   OUTPUT @Hp4352;"VOUT ON"              ! Set DC Output on
850   !
900   !##### When 43521A is not used, comment out the first line
910   !##### below and uncomment the second line.
920   OUTPUT @Hp4352;"DNCONV ON"            ! when 43521A used
930   !OUTPUT @Hp4352;"DNCONV OFF"          ! when 43521A not used
940   !
1000  !##### These 4 lines set Local SG Type and the switching wait time.
1010  !##### Change the Sg_type and Sg_wait values to match the SG used.
1020  Sg_type=1                             ! "1" for 866XA/B
1030  OUTPUT @Hp4352;"SGTYPE ";Sg_type      ! Set SG Type
1040  Sg_wait=.2                            ! Local SG wait time [sec]
1050  OUTPUT @Hp4352;"LOSWT ";Sg_wait       ! Set Local SG wait time
1060  OUTPUT @Hp4352;"LOAUTO ON"            ! Automatic Local SG Control
1070  WAIT 1                                ! Wait for SG Initialization
1080  !
1100  !##### The following 2 lines define the frequency range of HP
1110  !##### 4352S.  When 43521A is not used, comment out these 2
1120  !##### lines. Change F_band value according to the frequency
1130  !##### range and the SG's max frequency (Refer to the 4352S
1140  !##### GPIB Programming Manual.)
1150  F_band=3                              ! "3" for 3.1GHz - 6.6GHz
1160  OUTPUT @Hp4352;"FBAND ";F_band        ! Set Frequency Range
1170  !
1200  !##### If the IC's data input is negative logic, comment out
1210  !##### (remove "!" from)  the first line below and uncomment the
1220  !##### second line.
1230  OUTPUT @Hp4352;"POSL"              ! Set 24 bit I/O Positive Logic
1240  !OUTPUT @Hp4352;"NEGL"             ! Set 24 bit I/O Positive Logic
1250  !
```

Sample Program: Using the Value Trigger Function - 1 (Serial Data; 2/6)

```
1300  !------------------------- Frequency Transient Measurement Setting
1310  OUTPUT @Hp4352;"VA"                  ! Select Analyzer mode
1320  OUTPUT @Hp4352;"MEAS TRAN"   ! Select Frequency Transient Measurement
1330  OUTPUT @Hp4352;"HOLD"                ! Hold Measurement Trigger
1340  !
1400  !------------------------------------ Setting Frequency Span
1410  Fjump=ABS(Freq(1)-Freq(2))         ! Frequency Jump
1420  !
1430  !##### If the frequency transient overshoot is too large, try a value
1440  !##### larger than 1.
1450  Over_shoot=1                 ! Overshoot Ratio on Frequency Jump
1460  Fspan=Fjump*(1+Over_shoot)         ! Jump + Overshoot
1470  !
1480  SELECT Fspan
1490  CASE <2.E+6
1500    OUTPUT @Hp4352;"TRSPAN TS2MHZ"      ! Set Frequency Span 2[MHz]
1510  CASE <2.E+7
1520    OUTPUT @Hp4352;"TRSPAN TS20MHZ"     ! Set Frequency Span 20[MHz]
1530  CASE ELSE
1540    OUTPUT @Hp4352;"TRSPAN TSMAX"        ! Set Frequency Span "MAX"
1550  END SELECT
1560  !
1570  OUTPUT @Hp4352;"TRTARG ";Freq(2)       ! Set Target Frequency
1580  OUTPUT @Hp4352;"TRTPOS 50"     ! Set Target Position 50% of Freq Span
1590  !
1700  !----------------------------------- Value Trigger Setting
1710  OUTPUT @Hp4352;"TRGS VAL"              ! Set Value Trigge
1720  OUTPUT @Hp4352;"TRGVAL ";Trig_freq      ! Set Trigger Frequency
1730  !
1740  IF Freq(2)>Freq(1) THEN
1750    OUTPUT @Hp4352;"TRGP POS"          ! Set Trigger Porality Positive
1760  ELSE
1770    OUTPUT @Hp4352;"TRGP NEG"          ! Set Trigger Porality Negative
1780  END IF
1790  !
1900  !---------------------- Send Control Word and Reference Divider
1910  !##### If the 'control word' is not needed for initializing
1920  !##### the IC, comment out the line below.
1930  GOSUB Send_cont                      ! Send Control Word
1940  GOSUB Send_reference                 ! Send Reference Divider
```

Sample Program: Using the Value Trigger Function - 1 (Serial Data; 3/6)

```
1950  !
2000 Measurement:!
2010  !---------------------------------------- Display Parameters
2020  OUTPUT @Hp4352;"DISA HIHB"             ! Set Disp Allocation Half
 Inst / Half IBASIC
2030  CLEAR SCREEN
2040  PRINT "PLL Synthesizer Frequency Transient Measurement"
2050  PRINT
2060  PRINT "Control Word      :";Cont_word$
2070  PRINT "Reference Divider :";Ref_divider$
2080  PRINT
2090  PRINT "Start Frequency   :";Freq(1)/1.E+6;"[MHz]"
2100  PRINT "Feedback Divider  :";Divider$(1)
2110  PRINT "Target Frequency  :";Freq(2)/1.E+6;"[MHz]"
2120  PRINT "Feedback Divider  :";Divider$(2)
2130  PRINT
2140  PRINT "Trigger Frequency :";Trig_freq/1.E+6;"[MHz]"
2150  !
2200  !--------------------------------- Input Time Span
2210  BEEP
2220  DISP "Time Span [msec]=? (Defalut";T_span_msec;"[msec])";
2230  INPUT "",T_span_msec
2240  T_span=T_span_msec/1000.
2250  PRINT "Time Span         :";T_span_msec;"[msec]"
2260  OUTPUT @Hp4352;"SPAN ";T_span          ! Set Time Span
2270  !
2300  !---------------------- Transient from Start Freq. to Target Freq.
2310  DISP "Now measuring..."
2320  Freq_index=1                          ! for Start Frequency
2340  GOSUB Send_pll_freq                   ! Send Divider for Start Freq.
2350  WAIT .1                               ! Wait for settling
2360  !
2400  OUTPUT @Hp4352;"CLES"
2410  OUTPUT @Hp4352;"*OPC?"
2420  ENTER @Hp4352;Opc
2430  !
2600  OUTPUT @Hp4352;"SING"                 ! Measurement Trigger
2610  Freq_index=2                          ! for Target Frequency
2620  GOSUB Send_pll_freq                   ! Send Divider for Target Freq.
2630  GOSUB Meas_end
2640  !
```

Sample Program: Using the Value Trigger Function - 1 (Serial Data; 4/6)

```
2700  OUTPUT @Hp4352;"AUTO"
2710  OUTPUT @Hp4352;"MKR ON"                ! Set Marker ON
2720  !
2800  BEEP
2810  INPUT "Measurement done. One more time? [Y/N; default Y]",Ans$
2820  IF Ans$"n" AND Ans$"N" THEN Measurement
2830  !
2840  GOTO End
2850  !
3000  !------------------------ Sub-routines for Sending Data to PLL IC
3010  !----------------------------- Send Reference Divider Word
3020 Send_reference:!
3030  OUTPUT @Hp4352;"OUT1L"                 ! Reset Strobe (OUTPUT 1)
3040  !
3050  !##### If the LSB should be sent first, uncomment the first
3060  !##### line below, and comment out the second line.
3070  !FOR I=Ref_bit_length TO 1 STEP -1      ! Send Data from LSB
3080  FOR I=1 TO Ref_bit_length              ! Send Data from MSB
3090  !
3100    WRITEIO 16,0;VAL(Ref_divider$[I,I])   ! Send Data via PORT A0
3110    WRITEIO 16,0;VAL(Ref_divider$[I,I])+2 ! Clock Up via PORT A1
3120    WRITEIO 16,0;VAL(Ref_divider$[I,I])   ! Clock Down via PORT A1
3130  NEXT I
3140  !
3150  OUTPUT @Hp4352;"OUT1H"                 ! Send Strobe via OUTPUT 1
3160  OUTPUT @Hp4352;"OUT1L"                 ! Reset Strobe (OUTPUT 1)
3170  !
3180  RETURN
3190  !
3200  !------------------------------- Send Feedback Divider Word
3210 Send_pll_freq:!
3220  OUTPUT @Hp4352;"OUT1L"                 ! Reset Strobe (OUTPUT 1)
3230  !
3240  !##### If the LSB should be sent first, uncomment the first
3250  !##### line below, and comment out the second line.
3260  !FOR I=Fb_bit_length TO 1 STEP -1       ! Send Data from LSB
3270  FOR I=1 TO Fb_bit_length               ! Send Data from MSB
3280  !
3290   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])   ! Send Data via PORT A0
3300   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])+2 ! Clock Up via PORT A1
3310   WRITEIO 16,0;VAL(Divider$(Freq_index)[I,I])   ! Clock Down via PORT A1
3320  NEXT I
```

Sample Program: Using the Value Trigger Function - 1 (Serial Data; 5/6)

```
3330  !
3340  OUTPUT @Hp4352;"OUT1H"                  ! Send Strobe via OUTPUT 1
3350  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3360  !
3370  RETURN
3380  !
3400  !---------------------------------------- Send Control Word
3410 Send_cont:!
3420  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3430  !
3440  !##### If the LSB should be sent first, uncomment the first
3450  !##### line below, and comment out the second line.
3460  !FOR I=Cont_bit_length TO 1 STEP -1     ! Send Data from LSB
3470  FOR I=1 TO Cont_bit_length              ! Send Data from MSB
3480  !
3490    WRITEIO 16,0;VAL(Cont_word$[I,I])     ! Send Data via PORT A0
3500    WRITEIO 16,0;VAL(Cont_word$[I,I])+2   ! Clock Up via PORT A1
3510    WRITEIO 16,0;VAL(Cont_word$[I,I])     ! Clock Down via PORT A1
3520  NEXT I
3530  !
3540  OUTPUT @Hp4352;"OUT1H"                  ! Send Strobe via OUTPUT 1
3550  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3560  RETURN
3570  !
4000  !--------------------------------------- Detect End of Measurement
4010 Meas_end: !
4020  REPEAT
4030    OUTPUT @Hp4352;"ESB?"
4040    ENTER @Hp4352;Esb
4050  UNTIL BIT(Esb,0)
4060  RETURN
4070  !
5000  !--------------------------------------------- Quit Program
5010 End:  !
5020  OUTPUT @Hp4352;"VOUT OFF"
5030  DISP "Bye."
5040  END
```

Figure 12-28. Sample Program: Using the Value Trigger Function - 1 (Serial Data; 6/6)

Using the Value Trigger Function -2 (Parallel Data)

Figure 12-29 shows a frequency transient measurement program using the value trigger function. In this program, the same PLL as that for “Using the Trigger Detection Output Function - 2 (Parallel Data)” is used. See the above-mentioned section for information on the PLL block diagram and its connection. This PLL requires serial data for divider words. This program is intended to measure the transient characteristics of the DUT when its output frequency is changed from 5.8 GHz to 5.85 GHz when it is instructed to do so. The 4352B functions as system controller in this program.

The following describes what each of the blocks is intended to accomplish. The program may need to be changed depending on the type of PLL you use.

Lines 400 to 480: Define Feedback Divider

Freq(1) and Freq(2) are set respectively at 180 MHz and 180.8 MHz. These frequencies represent the start and target (final) frequencies used for frequency transient measurement. The 4352B is set at Freq(2) as target frequency in line 1570. Parallel data for each of the frequencies to be supplied to the PLL is substituted into Divider$. In the case of this PLL, 180 MHz and 180.8 MHz are represented respectively by 225 and 226. Data is supplied to the PLL by the Send_pll_freq subroutine in line 3210. In this program, 8-bit parallel data is supplied to the PLL. You may need to change the number of bits and the contents of these bits for Freq(1), Freq(2), and the Feedback Divider in accordance with your DUT.

Lines 600 to 630: Specify Trigger Frequency

The value trigger function is used in this program. This function is designed so that frequency transient is generated first and then measurement is triggered immeadately after a change in PLL output frequency is detected. In this block, the frequency at which measurement is to be triggered is stored in Trig_freq. Start and final frequencies are 5.8 GHz and 5.85 GHz, respectively. Because PLL output frequency increases, trigger frequency is set at 5.801 GHz, a frequency slightly higher than start frequency, thus ensuring that the 4352B detects change in frequency as quickly as possible. This allows the 4352B to trigger measurement when PLL output frequency reaches 5.801 GHz.

Lines 700 to 720: Specify Measurement Time

This block specifies the default measurement time. However, line 2200, provided later in the program, allows you to type in a desired measurement time. Therefore, you do not always need to specify it in this block. Measurement time is set at 10 msec in this block.

Lines 800 to 850: Specify DC Power Voltage

This block specifies the 4352B's DC power voltage. The DC power voltage is set at 5 V in this program. You may need to change it in accordance with your DUT.

Lines 900 to 940: Select Whether to Use the 43521A

This block selects whether to use the 43521A (Down Converter Unit). The PLL used in this program outputs a low frequency signal (180 MHz). Therefore, you do not need to use the 43521A. You need to use it if the PLL outputs a signal beyond 3 GHz. In this case, treat line 920 as an executable statement and comment out line 930.

Lines 1000 to 1080: Specify SG Type and SG Local Signal Wait Time

This block specifies an SG type number of the external signal source (SG) and local signal wait time. Because the 8664A is used as external signal source in this program, "1" is specified for SG type number. You need to specify a different number depending on the signal generator. See the (RF/LO) Menu in Chapter 9 of the 4352B Function Reference for more information. "1" and "200 msec" are specified respectively for SG type number and local signal wait time in this block.

Lines 1100 to 1170: Specify Frequency Band When Using the 43521A

The 43521A (Down Converter Unit) is not used in this program. Therefore, this block is commented out. When you use the 43521A, you need to specify a frequency band in this block. When you use the 43521A, the upper frequency limit is increased to 12.6 GHz and the entire frequency range is divided into 6 different frequency bands. Therefore, you specify the number indicating the frequency band that includes the target frequency. See FBAND<numeric> in Chapter 9 or 10 for more information on frequency band numbers.

Lines 1200 to 1240: Specify Positive/Negative Logic for 24-bit I/O

This block specifies whether to use positive or negative logic for the signal output of the 4352B's 24-bit I/O port. Depending on the specification of your PLL, make either line 1220 (POSL) or 1230 (NEGL) an executable statement. In this program, positive logic (POSL) is used.

Lines 1300 to 1340: Select Frequency Transient Measurement

This block selects frequency transient measurement as measurement type. The analyzer mode (VA) is selected. Then, frequency transient measurement (MEAS TRAN) is selected. At the same time, HOLD is selected for trigger so that frequency transient measurement can be triggered by a later block. Because the value trigger function is used in this program, measurement is triggered when the PLL output frequency reaches the trigger frequency after line 2620 has been executed.

Lines 1400 to 1490: Specify Measurement Frequency Range, Target Frequency, and Target Position

Frequency span, target frequency, and target position are required to determine minimum and maximum measurement frequencies. Because frequency span should cover the entire transient frequency range, transient overshoot is included in addition to the range from start frequency (180 MHz) to target frequency (180.8 MHz). This program can automatically select a frequency span in response to the overshoot you enter. Line 1410 calculates the difference between start and target frequencies (Fjump = 0.8 MHz). Next, the frequency span is calculated by Fspan = Fjump × (1 + Over_shoot) = 0.8MHz × 2 = 1.6 MHz, assuming that the overshoot is 100% (Over_shoot=1). This frequency (1.6 MHz) corresponds to <2.E+6 (less than 2 MHz) in line 1490. Consequently, TRSPAN TS2MHZ is selected and the frequency span is set at 2 MHz. Because line 1580 specifies 50% for target position, minimum and maximum frequencies are calculated as follows:

Minimum frequency: 180.8 MHz - (2 MHz × 0.5) = 179.8 MHz
Maximum frequency: 180.8 MHz + (2 MHz × (1 - 0.5)) = 181.8 MHz

In this case, because the minimum frequency span 2 MHz is selected, overshoot may exceed the maximum frequency or fall below the minimum frequency. If this occurs, assign any value greater than 1 for Over_shoot to provide a wider frequency span. See Figure 12-23 for the relationship between overshoot and, start, and target frequencies.
In line 1570, the 4352B is set at 180.8 MHz (frequency specified in line 460) as target frequency (TRTARG).

Lines 1700 to 1790: Turn ON Value Trigger Function

This block turns ON the value trigger function by selecting TRGS VAL. Also, this block sets the 4352B at the trigger frequency (5.801 GHz stored in Trig_freq in line 620) in line 1720. Lines 1740 onward automatically select the trigger polarity. Line 1740 calculates the difference between start and target frequencies. Positive logic (TRGP POS) is selected when target frequency is larger than start frequency while negative logic (TRGP NEG) is selected when target frequency is smaller.

Lines 2000 to 2090: Display Measurement Parameters

This block displays measurement parameters. DISA HIHB displays measurement results and measurement parameters respectively at the upper and lower halves of the screen.

- Title (PLL Synthesizer Frequency Transient Measurement)
- Initialization word: Cont_word$
- Reference divider: Ref_divider$
- Start frequency: Freq(1)/1.E+6;"[MHz]"
- Serial signal for start frequency: divider$(1)
- Target frequency (final frequency): Freq(2)/1.E+6;"[MHz]"
- Serial signal for target frequency : divider$(2)

Lines 2200 to 2270: Prompt User to Enter Measurement Time

This block prompts you to enter measurement time [ms]. You can change 10 msec specified in line 700 as necessary. This block displays "Time Span [msec]=? (Default 10 [msec])" on the screen to ask you whether you wish to change the time. The time you enter will be stored in T_span_msec, divided by 1000 for converting the unit into millisecond, and the result of division stored in T_span. Line 2250 displays the new measurement time on the screen while line 2260 sets the 4352B at the new measurement time. Whether you can obtain a proper transient measurement screen depends on your measurement time. In this program, you can return from line 2820 to line 2000 so that you can enter a new measurement time to repeat measurement if your screen is not appropriate.

Lines 2300 to 2360: Lock the PLL to Start Frequency

"Now measuring" appears on the screen.
Freq(1) (180 MHz specified as start frequency in line 440) is selected in line 2320. In line 2340, the program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (parallel data ("225") in line 450) for the start frequency (180 KHz) from port A (A0 to A7) of the 24-bit I/O port so that this signal can be loaded into the PLL. This allows the PLL to oscillate at the start frequency (180 MHz). Line 2350 waits for the PLL frequency to stabilize at 180 MHz.

Lines 2400 to 2430: Clear Status Byte

The last block checks the contents of the status byte register to determine whether measurement is complete. This block clears this register to allow the last block to make this decision.

Lines 2600 to 2640: Wait for Measurement to Be Triggered/Lock the PLL to Target Frequency

In line 2600, OUTPUT@HP4352;"SING" switches the 4352B in the value trigger standby state. This allows measurement to be automatically triggered when the PLL output frequency reaches the trigger frequency (180.1 MHz). In line 2610, Freq(2) (180.8 MHz specified as target frequency in line 460) is selected. In line 2620, the program goes to the Send_pll_freq subroutine (line 3210). This subroutine sends the feedback divider (parallel data ("226") in line 470) for the target frequency from port A (A0 to A7) of the 24-bit I/O port so that this data can be loaded into the PLL. At this time, the PLL starts increasing its oscillation frequency to the target frequency (180.8 MHz). Measurement is triggered when the PLL output frequency reaches 180.1 MHz. In line 2630, the program goes to the Meas_end subroutine. This subroutine monitors the progress of measurement. When it determines that measurement is complete, the program goes to the next block.

Lines 2700 to 2720: Auto-scale Measurement Results and Turn ON the Marker

AUTO in line 2700 optimizes scaling for measurement results to be displayed on the screen. Line 2710 displays the marker on the screen. You can use the rotary knob to move the marker as desired to check the reading.

Lines 2800 to 2850: Prompt User to Select Y or N (Whether to Change Measurement Time to Repeat Measurement)

Line 2820 displays "Change Time and Repeat Measurement? (Y/N)" to prompt you to select "Y" or "N." When you enter any character other than "N" (or "n"), the program goes back to line 2000 to repeat measurement. Enter a character other than "N" if you cannot obtain appropriate results due to excessively short or long measurement time. When you enter "N", the program goes to the subroutine line 5000 to end the program.

Lines 3200 to 3290 Subroutine for Sending Feedback Divider

This subroutine sends the feedback divider from port A of the 24-bit I/O port. Two pieces of parallel data whose contents have been specified in lines 440 to 470 are selected respectively in lines 2320 and 2610. These pieces of parallel data are sent to the PLL by this subroutine. In line 3250, OUTPUT1 of the 24-bit I/O is pulled high, thus loading the parallel data into the PLL. The PLL starts outputting a signal whose frequency corresponds to the new division ratio signal. In line 3260, OUTPUT1 is pulled low again to reset the PLL's LOAD signal. Note that 8-bit parallel signal is sent to the PLL in this program. See Appendix C "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" supplied with the 4352B *Function Reference* for more information.

Lines 4000 to 4070: Subroutine for Detecting End of Measurement

This subroutine monitors the contents of the event status register to determine whether measurement is complete, then goes to the next block when measurement is complete.

Lines 5000 to 5040: End the Program

This block turns OFF the DC voltage to end the program.

```
10    ! File Name : FIG12_35.TXT
20    !   IBASIC SAMPLE PROGRAM for Frequency Transient Measurement with
 Value Trigger Function
30    !   (Parallel Data Transfer)
40    !
50    ASSIGN @Hp4352 TO 800
60    DISP ""
70    !
80    !################################################################
90    ! Follow the instructions given in comments to modify this
100   ! program to work with your PLL IC. For further information,
110   ! refer to 4352S GPIB Programming Manual.
120   !----------------------------------------------------------------
130   ! In this program, Control Data are transferred to IC via 24 bit
140   ! I/O port as parallel data.  Data are sent via A0 - A7 (PIN#5-12)
150   ! and Strobe (Enable/Load) via OUTPUT 1(PIN#3).
160   !################################################################
170   !
400   !##### The following 4 lines define the "feedback divider" to
410   !##### send to IC's frequency of transient, and the rest are for
420   !##### the target frequency.  Change the frequency and the
430   !##### divider value for each.
440   Freq(1)=1.8E+8                       ! Start Frequency [Hz]
450   Divider(1)=225                       ! Feedback Divider
460   Freq(2)=1.808E+8                     ! Target Frequency [Hz]
470   Divider(2)=226                       ! Feedback Divider
480   !
600   !##### The next line defines the trigger threshold frequency.
610   !##### Change the value for appropriate measurement trigger.
620   Trig_freq=1.801E+8
630   !
700   !##### Initial time span value of the transient measurement.
710   T_span_msec=10                       ! Default Time Span [msec]
720   !
800   !##### Output voltage from 'DC POWER' of 4352B. If the IC
810   !##### needs Vcc supplied by 4352B, change the value "Dc_power".
820   Dc_power=12                          ! DC POWER (PLL Vcc)[V]
830   OUTPUT @Hp4352;"VPOW  ";Dc_power     ! Set DC POWER voltage
840   OUTPUT @Hp4352;"VOUT ON"             ! Set DC Output on
850   !
900   !##### When 43521A is used, uncomment the first line below
910   !##### and comment out the second line.
920   !OUTPUT @Hp4352;"DNCONV ON"          ! when 43521A used
930   OUTPUT @Hp4352;"DNCONV OFF"          ! when 43521A not used
```

Sample Program: Using the Value Trigger Function - 2 (Parallel Data; 1/4)

```
940   !
1000  !##### These 4 lines set Local SG Type and the switching wait time.
1010  !##### Change the Sg_type and Sg_wait values to match the SG used.
1020  Sg_type=1                              ! "1" for 866XA/B
1030  OUTPUT @Hp4352;"SGTYPE ";Sg_type       ! Set SG Type
1040  Sg_wait=.2                             ! Local SG wait time [sec]
1050  OUTPUT @Hp4352;"LOSWT ";Sg_wait        ! Set Local SG wait time
1060  OUTPUT @Hp4352;"LOAUTO ON"             ! Automatic Local SG Control
1070  WAIT 1                                 ! Wait for SG Initialization
1080  !
1100  !##### The following  2 lines define the frequency range of HP
1110  !##### 4352S.  When 43521A is used uncomment these 2 lines, and
1120  !##### modify F_band value according to the frequency range
1130  !##### and the SG's max frequency.  (Refer to the 4352S
1140  !##### GPIB Programming Manual.)
1150  !F_band=3                                ! "3" for 3.1GHz - 6.6GHz
1160  !OUTPUT @Hp4352;"FBAND ";F_band          ! Set Frequency Range
1170  !
1200  !##### If the IC's data input is negative logic, comment out the
1210  !##### first line below and uncomment the second line.
1220  OUTPUT @Hp4352;"POSL"                ! Set 24 bit I/O Positive Logic
1230  !OUTPUT @Hp4352;"NEGL"               ! Set 24 bit I/O Negative Logic
1240  !
1300  !--------------------------- Frequency Transient Measurement Setting
1310  OUTPUT @Hp4352;"VA"                    ! Select Analyzer mode
1320  OUTPUT @Hp4352;"MEAS TRAN"  ! Select Frequency Transient Measurement
1330  OUTPUT @Hp4352;"HOLD"                  ! Hold Measurement Trigger
1340  !
1400  !------------------------------------- Setting Frequency Span
1410  Fjump=ABS(Freq(1)-Freq(2))            ! Frequency Jump
1420  !
1430  !##### If the frequency transient overshoot is too large, try a value
1440  !##### larger than 1.
1450  Over_shoot=1                    ! Overshoot Ratio on Frequency Jump
1460  Fspan=Fjump*(1+Over_shoot)            ! Jump + Overshoot
1470  !
1480  SELECT Fspan
1490  CASE <2.E+6
1500    OUTPUT @Hp4352;"TRSPAN TS2MHZ"      ! Set Frequency Span 2[MHz]
1510  CASE <2.E+7
1520    OUTPUT @Hp4352;"TRSPAN TS20MHZ"     ! Set Frequency Span 20[MHz]
1530  CASE ELSE
1540    OUTPUT @Hp4352;"TRSPAN TSMAX"       ! Set Frequency Span "MAX"
1550  END SELECT
```

Sample Program: Using the Value Trigger Function - 2 (Parallel Data; 2/4)

```
1560  !
1570  OUTPUT @Hp4352;"TRTARG ";Freq(2)      ! Set Target Frequency
1580  OUTPUT @Hp4352;"TRTPOS 50"            ! Set Target Position 50% of
 Freq Span700  !
1590  !
1700  !------------------------------------ Value Trigger Setting
1710  OUTPUT @Hp4352;"TRGS VAL"              ! Set Value Trigger
1720  OUTPUT @Hp4352;"TRGVAL ";Trig_freq      ! Set Trigger Frequency
1730  !
1740  IF Freq(2)>Freq(1) THEN
1750    OUTPUT @Hp4352;"TRGP POS"          ! Set Trigger Porality Positive
1760  ELSE
1770    OUTPUT @Hp4352;"TRGP NEG"          ! Set Trigger Porality Negative
1780  END IF
1790  !
2000 Measurement:!
2010  !---------------------------------------- Display Parameters
2020  OUTPUT @Hp4352;"DISA HIHB"             ! Set Disp Allocation Half
 Inst / Half IBASIC
2030  CLEAR SCREEN
2040  PRINT "PLL Synthesizer Frequency Transient Measurement"
2050  PRINT
2090  PRINT "Start Frequency   :";Freq(1)/1.E+6;"[MHz]"
2100  PRINT "Feedback Divider  :";Divider(1)
2110  PRINT
2120  PRINT "Target Frequency  :";Freq(2)/1.E+6;"[MHz]"
2130  PRINT "Feedback Divider  :";Divider(2)
2140  PRINT
2150  PRINT "Trigger Frequency :";Trig_freq/1.E+6;"[MHz]"
2160  !
2200  !--------------------------------- Input Time Span
2210  BEEP
2220  DISP "Time Span [msec]=? (Defalut";T_span_msec;"[msec])";
2230  INPUT "",T_span_msec
2240  T_span=T_span_msec/1000.
2250  PRINT "Time Span         :";T_span_msec;"[msec]"
2260  OUTPUT @Hp4352;"SPAN ";T_span          ! Set Time Span
2270  !
2300  !------------------------ Transient from Start Freq. to Target Freq.
2310  DISP "Now measuring..."
2320  Freq_index=1                           ! for Start Frequency
2340  GOSUB Send_pll_freq                    ! Send Divider for Start Freq.
2350  WAIT .1                                ! Wait for settling
```

Sample Program: Using the Value Trigger Function - 2 (Parallel Data; 3/4)

```
2360  !
2400  OUTPUT @Hp4352;"CLES"
2410  OUTPUT @Hp4352;"*OPC?"
2420  ENTER @Hp4352;Opc
2430  !
2600  OUTPUT @Hp4352;"SING"                 ! Measurement Trigger
2610  Freq_index=2                          ! for Target Frequency
2620  GOSUB Send_pll_freq                   ! Send Divider for Target Freq.
2630  GOSUB Meas_end
2640  !
2700  OUTPUT @Hp4352;"AUTO"
2710  OUTPUT @Hp4352;"MKR ON"                 ! Set Marker ON
2720  !
2800  BEEP
2810  INPUT "Measurement done. One more time? [Y/N; default Y]",Ans$
2820  IF Ans$"n" AND Ans$"N" THEN Measurement
2830  !
2840  GOTO End
2850  !
3000  !----------------------------------------------------- Sub-routines
3200  !------------------------------- Send Feedback Divider Word
3210 Send_pll_freq:!
3220  OUTPUT @Hp4352;"OUT1L"                  ! Reset Strobe (OUTPUT 1)
3230  WRITEIO 16,0;Divider(Freq_index)        ! Send Data via PORT A0 - A7
3240  !
3250  OUTPUT @Hp4352;"OUT1H"                 ! Send Strobe via OUTPUT 1
3260  OUTPUT @Hp4352;"OUT1L"                 ! Reset Strobe (OUTPUT 1)
3270  !
3280  RETURN
3290  !
4000  !--------------------------------- Detect End of Measurement
4010 Meas_end:!
4020  REPEAT
4030    OUTPUT @Hp4352;"ESB?"
4040    ENTER @Hp4352;Esb
4050  UNTIL BIT(Esb,0)
4060  RETURN
4070  !
5000  !-------------------------------------------- Quit Program
5010 End:  !
5020  OUTPUT @Hp4352;"VOUT OFF"               ! Set Voltage Output Off
5030  DISP "Bye."
5040  END
```

Figure 12-29. Sample Program: Using the Value Trigger Function - 2 (Parallel Data; 4/4)

Application in the Analyzer Mode (Limit Testing)

Setting Limit Lines

This program sets the limit lines for the 4352B. In this program, RF power characteristics vs. DC control (tuning) voltage measurement is selected as a measurement parameter, and the 4352B functions as the system controller.

The number of points used to trace limit lines using straight lines is defined (line 130). The upper and lower limits are defined with these points (lines 160 to 190), and the data is saved into arrays `Lmt_up(*)` and `Lmt_lw(*)`, respectively (line 200).

Displays the limit lines, turns ON the limit test function, and clears the current limit lines (lines 340 to 360).

Both the upper and lower limit line data is transferred to the 4352B using a binary format (lines 390 to 440).

```
100 ! File Name : FIG12_36.TXT
110 !   IBASIC SAMPLE PROGRAM to Set Limit Lines
120 !
130 Point=10                             ! Number of Points
140 !
150 DIM Lmt_up(1:10),Lmt_lw(1:10)
160 DATA +1.0, +1.2, +1.4, +1.6, +1.8   ! Upper Limit Line Data
170 DATA +2.0, +2.0, +2.0, +2.0, +1.5
180 DATA -1.0, -1.2, -1.4, -1.6, -1.8   ! Lower Limit Line Data
190 DATA -2.0, -2.0, -2.0, -2.0, -1.5
200 READ Lmt_up(*),Lmt_lw(*)
210 !
220 ASSIGN @Hp4352 TO 800               ! Assign 4352's Address
230 ASSIGN @Dt TO 800;FORMAT OFF        ! Assign 4352's Address
       (Format Off)
240 !
250 OUTPUT @Hp4352;"PRES"               ! Preset 4352
260 OUTPUT @Hp4352;"HOLD"               ! Trigger HOLD
270 OUTPUT @Hp4352;"VA"                 ! Select Analyzer Mode
280 OUTPUT @Hp4352;"MEAS POWE"          ! Select RF Power Measurement
290 OUTPUT @Hp4352;"POIN ";Point        ! Set Number of Points
300 OUTPUT @Hp4352;"SCAL 0.5"           ! Set SCALE/DIV to 0.5 dB
310 OUTPUT @Hp4352;"*OPC?"              ! Verify Operation Completed
320 ENTER @Hp4352;Opc
330 !
340 OUTPUT @Hp4352;"LIMILINE ON"        ! Set Limit Line ON
350 OUTPUT @Hp4352;"LIMITEST ON"        ! Set Limit Test ON
360 OUTPUT @Hp4352;"LIMCLEL"            ! Clear Current Limit Lines
370 !
380 OUTPUT @Hp4352;"FORM3"                  ! Set IEEE 64-BIT Floating Point
                                              format
390 OUTPUT @Hp4352;"INPULIMU #6";           !
400 OUTPUT @Hp4352 USING "ZZZZZZ,#";Point*8 ! Data Size :
                                                  Number of Points * 8 bytes
410 OUTPUT @Dt;Lmt_up(*),END                ! Send Upper Limit Data
420 OUTPUT @Hp4352;"INPULIML #6";           !
430 OUTPUT @Hp4352 USING "ZZZZZZ,#";Point*8 ! Data Size :
                                                  Number of Points * 8 bytes
440 OUTPUT @Dt;Lmt_lw(*),END                ! Send Lower Limit Data
450 !
460 END
```

Figure 12-30.
Sample Program:
Application in the Analyzer Mode (Setting Limit Lines)

Limit Testing

This program sets the limit lines for the 4352B to perform limit testing. Phase noise is selected as a measurement item. Limit lines are defined by a specific offset frequency and a combination of the corresponding upper and lower phase noise limits. (If an offset frequency is not defined, the upper and lower limits obtained through linear interpolation are used.) In this program, the 4352B functions as the system controller.

The number of points used to trace limit lines using straight lines is defined (line 130). The combination of an offset frequency, and upper and lower limits are defined for each point (lines 150 to 200). They are stored as the value of the X-coordinates, and upper and lower limit traces into arrays `Lmt_pr(*)`, `Lmt_up(*)`, and `Lmt_lw(*)`, respectively (lines 240 to 260).

Displays the limit lines, turns ON the limit test function, and clears the current limit lines (lines 410 to 430).

The limit line data is transferred to the 4352B (lines 460 to 480).

Makes a measurement (line 570), and the limit test result is queried (lines 590 to 600). Either `TEST FAILED` or `TEST PASSED` is displayed on the 4352B's LCD in accordance with the result (lines 610 to 660).

```
100 ! File Name : FIG12_37.TXT
110 !   IBASIC SAMPLE PROGRAM for Limit Line Testing
120 !
130 DATA 6                          ! Number of Limit Line Data
140 !
150 DATA 1E3,    -65, -200          ! Limit Line Data
160 DATA 10E3,   -65, -200          ! Offset Frequency, Upper Limit,
      Lower Limit
170 DATA 10E3,   -80, -200
180 DATA 100E3, -110, -200
190 DATA 1E6,   -130, -200
200 DATA 10E6,  -130, -200
210 !
220 DIM Lmt_pr(1:6),Lmt_up(1:6),Lmt_lw(1:6)
230 READ Lmt_n
240 FOR I=1 TO Lmt_n
250   READ Lmt_pr(I),Lmt_up(I),Lmt_lw(I)
260 NEXT I
270 !
280 ASSIGN @Hp4352 TO 800           ! Assign 4352's Address
290 OUTPUT @Hp4352;"PRES"           ! Preset 4352
300 OUTPUT @Hp4352;"HOLD"           ! Trigger HOLD
310 OUTPUT @Hp4352;"SGTYPE 1"       ! Select SG TYPE 1
320 OUTPUT @Hp4352;"LOSWT 0.1"      ! Set LOCAL SG Wait Time to 0.1 second
330 OUTPUT @Hp4352;"LOAUTO ON"      ! Automatic Local SG Control
340 OUTPUT @Hp4352;"VA"             ! Select Analyzer Mode
350 OUTPUT @Hp4352;"MEAS NOIS"      ! Select Phase Noise Measurement
360 OUTPUT @Hp4352;"VPOW 4"         ! Set DC Power Voltage to 4 V
370 OUTPUT @Hp4352;"VCTRL 2"        ! Set DC Control Voltage to 2 V
380 OUTPUT @Hp4352;"VOUT ON"        ! Supply DC Voltages
390 OUTPUT @Hp4352;"REFV -60"       ! Set Scale Reference Value to -60 dBc
400 !
410 OUTPUT @Hp4352;"LIMILINE ON"    ! Set Limit Line ON
420 OUTPUT @Hp4352;"LIMITEST ON"    ! Set Limit Test ON
430 OUTPUT @Hp4352;"LIMCLEL"        ! Clear Current Limit Lines
440 !
450 !  Create Limit Lines
460 FOR I=1 TO Lmt_n-1
470   OUTPUT @Hp4352;";LIMSECT ";Lmt_pr(I),Lmt_up(I),Lmt_lw(I),
        Lmt_pr(I+1),Lmt_up(I+1),Lmt_lw(I+1)
480 NEXT I
490 !
500 OUTPUT @Hp4352;"*OPC?"          ! Verify Operation Completed
510 ENTER @Hp4352;Opc
520 !
```

Sample Program:
Application in the Analyzer Mode (Limit Testing; 1/2)

```
530 DISP "CONNECT DEVICE and PRESS CONTINUE."
540 PAUSE
550 DISP
560 !
570 EXECUTE "SING"                    ! Measurement
580 !
590 OUTPUT @Hp4352;";LIMISTAT?"       ! Read Limit Test Result
600 ENTER @Hp4352;Limistat
610 SELECT Limistat
620 CASE 0
630    DISP "TEST FAILED"
640 CASE 1
650    DISP "TEST PASSED"
660 END SELECT
670 !
680 END
```

Figure 12-31.
Sample Program:
Application in the Analyzer Mode (Limit Testing; 2/2)

Application in the Analyzer Mode (Post-tuning Drift Characteristics Measurement)

This program repeats the device output frequency measurement at the specified DC power and tuning voltages during a specified time of more than 1 hour. It then displays the changes in this frequency over time.

Note

Be sure to use this program when you want to observe changes in the frequency for more than an hour. If you only need to observe the changes for a shorter time than an hour, select the appropriate measurement method based on the information given in "Application in the Analyzer Mode (Frequency Transient Measurement)".

In this program, the 4352B is first set to the tester mode to repeat the frequency measurement at constant intervals. Measurement results at each point are stored into arrays so that the entire result can be saved as a data trace. When the measurement is complete, the 4352B is set to the analyzer mode. The data trace thus obtained is displayed on the frequency transient measurement screen using time as the X-axis.

Enter the measurement time `Stop_time` (line 190). The measurement time interval `Pnt_time` at each point is calculated based on the observation time, the 4352B's measurement resolution of 12.5μs, its maximum number of measurement points of 801 (line 200), and `Stop_time` is re-defined (line 210). `Time_scale` is calculated to adjust the X-coordinates (time) scale of the measurement results on the frequency transient display (line 220).

Lines 440 to 500 are a measurement loop. Measurement are repeated at each elapsed time of `Pnt_time` after the measurement start (lines 460 to 470). Measurement results are stored into the array (line 490).

When measurements for all points are completed, the 4352B is set to the analyzer mode (line 520) and the frequency transient is selected for the measurement item (line 530). The X-coordinates scale is adjusted using `Time_scale`, and the characteristic of frequency changes over time is displayed on the LCD.
When you read information on the time elapse using the marker after completion of measurement, multiply the marker reading by the value displayed as `TIME SCALE :`.

```
100 ! File Name : FIG12_39.TXT
110 !   IBASIC SAMPLE PROGRAM for Post Tuning Drift Measurement
120 !
130 INTEGER I
140 DIM Dat(1:801)                 ! Data Trace Array
150 Point=801                      ! Fixed Number of Points
160 ASSIGN @Hp4352 TO 800          ! Assign 4352'S Address
170 ASSIGN @Dt TO 800;FORMAT OFF   ! Assign 4352'S Address (Format Off)
180 !
190 INPUT "STOP TIME [sec] ( >=25sec )",Stop_time          ! Enter Stop Time
200 Pnt_time=PROUND(Stop_time/(Poin-1)/1.25E-6,0)*1.25E-6  ! Measurement Time
                                                             per point
210 Stop_time=Pnt_time*(Poin-1)                            ! Round Stop Time
220 Time_scale=10^(INT(LGT(Stop_time/10))+1)               ! Calculate Time
         Scale
230 !
240 OUTPUT @Hp4352;"PRES"          ! Preset 4352
250 OUTPUT @Hp4352;"HOLD"          ! Trigger HOLD
260 OUTPUT @Hp4352;"SGTYPE 1"      ! Select SG TYPE 1
270 OUTPUT @Hp4352;"LOSWT 0.1"     ! Set LOCAL SG Wait Time to 0.1 second
280 OUTPUT @Hp4352;"LOAUTO ON"     ! Automatic Local SG Control
290 OUTPUT @Hp4352;"FORM3"         ! Set IEEE 64-BIT Floating Point format
300 OUTPUT @Hp4352;"VT"            ! Select Tester Mode
310 OUTPUT @Hp4352;"MEAS FREQ"     ! Select Frequency Measurement
320 OUTPUT @Hp4352;"PARM OFF"      ! Set Parameter Display Off
330 OUTPUT @Hp4352;"*OPC?"         ! Verify Operation Completed
340 ENTER @Hp4352;Opc
350 !
360 DISP "CONNECT DEVICE and PRESS CONTINUE"
370 PAUSE
380 DISP "MEASUREMENT"
390 !
400 OUTPUT @Hp4352;"VPOW 4"        ! Set DC Power Voltage to 4 V
410 OUTPUT @Hp4352;"VCTRL 2"       ! Set DC Control Voltage to 2 V
420 OUTPUT @Hp4352;"VOUT ON"       ! Supply DC Voltages
430 !
440 Start_time=TIMEDATE
450 FOR I=1 TO Point
460   WHILE TIMEDATE-Start_time<Pnt_time*(I-1)    ! Wait for Next Measurement
                                                    Point
470   END WHILE
480   EXECUTE "SING"                              ! Single Sweep
490   Dat(I)=READIO(8,0)                          ! Get Measurement Data
500 NEXT I
```

Sample Program:
Application in the Analyzer Mode (Post-tuning Drift Characteristic Measurement; 1/2)

```
510 !
520 OUTPUT @Hp4352;"VA"                        ! Select Analyzer Mode
530 OUTPUT @Hp4352;"MEAS TRAN"                 ! Select Frequency
                                                 Transient Measurement
540 OUTPUT @Hp4352;"SPAN ";Stop_time/Time_scale   ! Set Span
550 OUTPUT @Hp4352;"INPUDATA #6006408";        ! Send Trace Data
560 OUTPUT @Dt;Dat(*),END
570 OUTPUT @Hp4352;"AUTO"                      ! AUTO SCALE
580 !
590 CLEAR SCREEN
600 PRINT "TIME SCALE : ";Time_scale   ! Print Time Scale
610 !
620 END
```

Figure 12-32.
Sample Program:
Application in the Analyzer Mode (Post-tuning Drift Characteristic Measurement; 2/2)

Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters)

This program automatically makes the following measurements:

- RF power vs. DC control (tuning) voltage characteristic.
- Frequency vs. DC control (tuning) voltage characteristic and Tuning sensitivity.
- Phase noise.
- Spectrum (Carrier and Third Harmonics).

There are two programs. It is assumed that both the program for the external controller assigned as system controller (Figure 12-33) and the program for the 4352B (Figure 12-34 is stored in the disk drive of the external controller. The program for the 4352B is downloaded from the controller to the 4352B and is executed. Measurement data is transferred from the 4352B to the controller in binary format every time a measurement is complete.

After the program has been downloaded to the 4352B, the controller capability is passed from the controller to the 4352B. The controller capability is not passed back to the controller.

Note When making automatic measurements with only the 4352B's IBASIC program (not using an external controller), you have to comment out or delete the lines 960, 1050, 1160, and 1360 in the 4352B's IBASIC program as they are used to send measurement results to the controller.

External Controller Side

Define the number of measurement points and arrays used to store the measurement result for each parameter (lines 130 to 160). Specify the 4352B address and the select code for the GPIB interface card (lines 180 to 190) (at this time, the I/O path format is set to OFF for the binary transfer (line 190)). Next, the external controller obtains the controller capability and stops execution of any program on the 4352B (lines 210 to 220).

The `Download` subroutine (lines 240 and 470 to 610) downloads the program from the measurement program file (`FIG12_43.TXT`) to the 4352B and runs it (line 250). The 4352B is set to local mode immediately before the external controller passes the controller capability. This is because the 4352B needs to accept key entries of the number of measurement points during program execution.

Lines 290 to 410 are a loop to read measurement results. The X-coordinates and measurement values for each measurement are transferred from the 4352B.

4352B Side

As with the external controller, the number of measurement points and arrays to be stored the measurement results for each parameter are defined, and the 4352B and controller addresses are specified (lines 130 to 200).

Measurement conditions are specified in the `Setup` subroutine (lines 220, 340 to 520). In this subroutine, settings common to all measurement parameters are specified first (lines 350 to 450). Then, settings unique to each parameter are specified (lines 460 to 490).

Lines 230 to 310 are a measurement loop. After each measurement, the result is read by the `Get_result` subroutine (for example, lines 940 to 950 for RF power measurement) and sent to the external controller (for example, line 960 for RF power measurement).

The `Get_result` subroutine (lines 1410 to 1450) queries the 4352B using a query command passed through `cmd$` (which is a pass parameter of CALL statements), and stores the result into the array `Dat(*)`.

```
100 ! File Name : FIG12_41.TXT
110 !   IBASIC SAMPLE PROGRAM for AUTO MEASUREMENT on ANALYZER MODE
        (External Controller Side)
120 !
130 INTEGER N_powe,N_freq,N_pnos
140 DIM Swp_powe(1:802),Dat_powe(1:802)
150 DIM Swp_freq(1:802),Dat_freq(1:802),Dat_sens(1:802)
160 DIM Swp_pnos(1:802),Dat_pnos(1:802)
170 !
180 ASSIGN @Hp4352 TO 717                ! Assign 4352's Address
190 ASSIGN @Dt TO 7;FORMAT OFF           ! Assign GPIB Card Number
                                           (FORMAT OFF)
200 !
210 ABORT 7                              ! Retrieve Active Controller
                                           Capability
220 OUTPUT @Hp4352;"PROG:STAT STOP"      ! Stop IBASIC Program
230 WAIT 1                               ! Wait for IBASIC Program to Stop
240 CALL Download(@Hp4352,"fig12_43.txt") ! Send IBASIC Program to 4352
250 OUTPUT @Hp4352;"PROG:STAT RUN"       ! RUN IBASIC Program
260 LOCAL @Hp4352                        ! Set 4352 to LOCAL State
270 PASS CONTROL @Hp4352                 ! Pass Active Controller Capability
                                           to 4352
280 !
290 LOOP
300     ! Get RF Power Measurement Result
310     ENTER @Dt;N_powe,Swp_powe(*),Dat_powe(*)
320     !
330     ! Get Frequency Measurement Result
340     ENTER @Dt;N_freq,Swp_freq(*),Dat_freq(*),Dat_sens(*)
350     !
360     ! Get Phase Noise Measurement Result
370     ENTER @Dt;N_pnos,Swp_pnos(*),Dat_pnos(*)
380     !
390     ! Get Spectrum Measurement Result
400     ENTER @Dt;Frq_1st,Frq_3rd,Lvl_1st,Lvl_3rd
410 END LOOP
420 !
430 END
```

Sample Program:
Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters - External Controller Side; 1/2)

```
440 !
450 !********************************************************
460 !
470 Download: SUB Download(@Hp4352,File$)
480     DIM Line$[1024]
490     OUTPUT @Hp4352;"HOLD"
500     OUTPUT @Hp4352;"PROG:DEL:ALL"
510     OUTPUT @Hp4352;"PROG:DEF #0"
520     ASSIGN @File TO File$
530     ON END @File GOTO End_of_file
540     LOOP
550         ENTER @File USING "K";Line$
560         OUTPUT @Hp4352;Line$
570     END LOOP
580 End_of_file: !
590     OUTPUT @Hp4352;" " END
600     ASSIGN @File TO *
610 SUBEND
```

Figure 12-33.
Sample Program:
Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters - External Controller Side; 2/2)

```
100 ! File Name : FIG12_43.TXT
110 !   IBASIC SAMPLE PROGRAM for AUTO MEASUREMENT on ANALYZER MODE
                                                     (IBASIC Side)
120 !
130 INTEGER N_powe,N_freq,N_pnos
140 DIM Swp_powe(1:802),Dat_powe(1:802)
150 DIM Swp_freq(1:802),Dat_freq(1:802),Dat_sens(1:802)
160 DIM Swp_pnos(1:802),Dat_pnos(1:802)
170 !
180 ASSIGN @Hp4352 TO 800             ! Assign 4352's Address
190 ASSIGN @Dt TO 800;FORMAT OFF      ! Assign 4352's Address
      (FORMAT OFF)
200 ASSIGN @Ext_pc TO 721;FORMAT OFF  ! Assign External Controller's Address
210 !
220 GOSUB Setup                       ! Measurement Setup
230 LOOP
240   DISP "CONNECT DEVICE and PRESS CONTINUE."
250   PAUSE
260   DISP
270   GOSUB Rf_power                  ! RF Power Measurement
280   GOSUB Frequency                 ! Frequency/Tuning Sensitivity
                                        Measurement
290   GOSUB Phase_noise               ! Phase Noise Measurement
300   GOSUB Spectrum                  ! Spectrum Measurement
310 END LOOP
320 STOP
330 !
340 Setup:!
350   OUTPUT @Hp4352;"PRES"           ! Preset 4352
360   OUTPUT @Hp4352;"HOLD"           ! Trigger HOLD
370   OUTPUT @Hp4352;"SGTYPE 1"       ! Select SG TYPE 1
380   OUTPUT @Hp4352;"LOSWT 0.1"      ! Set LOCAL SG Wait Time to 0.1 second
390   OUTPUT @Hp4352;"LOAUTO ON"      ! Automatic Local SG Control
400   OUTPUT @Hp4352;"VA"             ! Select Analyzer Mode
410   OUTPUT @Hp4352;"MAXVCTRL 5"     ! Set Maximum Control Voltage to 5V
420   OUTPUT @Hp4352;"VPOW 4"         ! Set DC Power Voltage to 4 V
430   OUTPUT @Hp4352;"VOUT ON"        ! Supply DC Voltages
440   OUTPUT @Hp4352;"RFATT 5"        ! Set RF Attenuator to 5 dB
450   OUTPUT @Hp4352;"FORM3"          ! Set IEEE 64-BIT Floating Point format
460   GOSUB Rf_power_setup            ! RF Power Measurement Setup
470   GOSUB Frequency_setup           ! Frequency Measurement Setup
480   GOSUB Phs_noise_setup           ! Phase Noise Measurement Setup
490   GOSUB Spectrum_setup            ! Spectrum Measurement Setup
500   OUTPUT @Hp4352;"*OPC?"          ! Verify Operation Completed
510   ENTER @Hp4352;Opc
520 RETURN
```

Sample Program: Application in the Analyzer Mode
(Automatic Measurement of All the 4352B's Measurement Parameters - 4352B Side; 1/4)

```
530 !
540 Rf_power_setup:!
550   OUTPUT @Hp4352;"MEAS POWE"      ! Select RF Power Measurement
560   OUTPUT @Hp4352;"STAR 1"         ! Set Start DC Control Voltage to 1V
570   OUTPUT @Hp4352;"STOP 4"         ! Set Stop DC Control Voltage to 4V
580   OUTPUT @Hp4352;"POIN?"          ! Read Number of Points
590   ENTER @Hp4352;N_powe
600 RETURN
610 !
620 Frequency_setup:!
630   OUTPUT @Hp4352;"MEAS FREQ"      ! Select Frequency Measurement
640   OUTPUT @Hp4352;"SENSPOL POS"    ! Set Sensitivity Polarity to Positive
650   OUTPUT @Hp4352;"STAR 1"         ! Set Start DC Control Voltage to 1V
660   OUTPUT @Hp4352;"STOP 4"         ! Set Stop DC Control Voltage to 4V
670   OUTPUT @Hp4352;"POIN?"          ! Read Number of Points
680   ENTER @Hp4352;N_freq
690 RETURN
700 !
710 Phs_noise_setup:!
720   OUTPUT @Hp4352;"MEAS NOIS"      ! Select Phase Noise Measurement
730   Target_freq=830E6               ! AFC Target Frequency = 830 MHz
740   OUTPUT @Hp4352;"STAR 100"       ! Set Start Offset Frequency to 100 Hz
750   OUTPUT @Hp4352;"STOP 10E6"      ! Set Stop Offset Frequency to 10 MHz
760   OUTPUT @Hp4352;"NATT 10DB"      ! Set Noise Attenuator to 10 dB
770   OUTPUT @Hp4352;"AFCTOL 2E3"     ! Set AFC Tolerance to 2 kHz
780   OUTPUT @Hp4352;"POIN?"          ! Read Number of Points
790   ENTER @Hp4352;N_pnos
800 RETURN
810 !
820 Spectrum_setup:!
830   OUTPUT @Hp4352;"MEAS SPEC"      ! Select Spectrum Measurement
840   Target_freq=830E6               ! AFC Target Frequency = 830 MHz
850   OUTPUT @Hp4352;"SPAN 100E3"     ! Set Span to 100 kHz
860   OUTPUT @Hp4352;"BW 1KHZ"        ! Set RBW to 1 kHz
870   OUTPUT @Hp4352;"AFCTOL 2E3"     ! Set AFC Tolerance to 2 kHz
880 RETURN
```

Sample Program:
Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters - 4352B Side; 2/4)

```
 890 !
 900 !
 910 Rf_power:!
 920   OUTPUT @Hp4352;"MEAS POWE"      ! RF Power Measurement
 930   EXECUTE "SING"                  ! Single Sweep
 940   CALL Get_result(@Hp4352,@Dt,"OUTPSWPRM?",Swp_powe(*))     ! Read Sweep
                                                                  Parameters
 950   CALL Get_result(@Hp4352,@Dt,"OUTPDATA?",Dat_powe(*))      ! Read Data
                                                                 Trace Data
 960   OUTPUT @Ext_pc;N_powe,Swp_powe(*),Dat_powe(*)             ! Send Result
                                                       to External Controller
 970 RETURN
 980 !
 990 Frequency:!
1000   OUTPUT @Hp4352;"MEAS FREQ"      ! Frequency Measurement
1010   EXECUTE "SING"                  ! Single Sweep
1020   CALL Get_result(@Hp4352,@Dt,"OUTPSWPRM?",Swp_freq(*))     ! Read Sweep
                                                                  Parameters
1030   CALL Get_result(@Hp4352,@Dt,"OUTPDATA?",Dat_freq(*))      ! Read Data
                                                     Trace Data (Frequency)
1040   CALL Get_result(@Hp4352,@Dt,"OUTPMEMO?",Dat_sens(*))      ! Read Memory
                                              Trace Data (Tuning sensitivity)
1050   OUTPUT @Ext_pc;N_freq,Swp_freq(*),Dat_freq(*),Dat_sens(*) ! Send Result
                                                       to External Controller
1060 RETURN
1070 !
1080 Phase_noise:!
1090   OUTPUT @Hp4352;"MEAS NOIS"       ! Select Phase Noise Measurement
1100   OUTPUT @Hp4352;"AFC ON"          ! Set AFC ON
1110   OUTPUT @Hp4352;"AFCTARG ";Target_freq  ! Set AFC Target Frequency
1120   EXECUTE "SING"                   ! Single Sweep
1130   OUTPUT @Hp4352;"AFC OFF"         ! Set AFC OFF
1140   CALL Get_result(@Hp4352,@Dt,"OUTPSWPRM?",Swp_pnos(*))     ! Read Sweep
                                                                  Parameters
1150   CALL Get_result(@Hp4352,@Dt,"OUTPDATA?",Dat_pnos(*))      ! Read Trace
                                                                        Data
1160   OUTPUT @Ext_pc;N_pnos,Swp_pnos(*),Dat_pnos(*)             ! Send Result
                                                       to External Controller
1170 RETURN
```

Sample Program:
Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters - 4352B Side; 3/4)

```
1180 !
1190 Spectrum:!
1200   OUTPUT @Hp4352;"MEAS SPEC"                   ! Select Spectrum
                                                      Measurement
1210   OUTPUT @Hp4352;"MKR ON"                      ! Set Marker function
                                                      ON
1220   OUTPUT @Hp4352;"AFC ON"                      ! Set AFC ON
1230   OUTPUT @Hp4352;"AFCTARG ";Target_freq        ! Set AFC Target
                                                      Frequency
1240   EXECUTE "SING"                               ! Single Sweep
1250   OUTPUT @Hp4352;"CARRCENT"                    ! Set Carrier to
                                                      Center Frequency
1260   EXECUTE "SING"                               ! Single Sweep
1270   OUTPUT @Hp4352;"SEAM MAX"                    ! Search Maximum Level
1280   OUTPUT @Hp4352;"OUTPMKR?"                    ! Read Marker Value
1290   ENTER @Hp4352;Lvl_1st,Frq_1st
1300   OUTPUT @Hp4352;"CARR3CENT"                   ! Set 3rd Harmonic to
                                                      Center Frequency
1310   EXECUTE "SING"                               ! Single Sweep
1320   OUTPUT @Hp4352;"SEAM MAX"                    ! Search Maximum Level
1330   OUTPUT @Hp4352;"OUTPMKR?"                    ! Read Marker Value
1340   ENTER @Hp4352;Lvl_3rd,Frq_3rd
1350   OUTPUT @Hp4352;"AFC OFF"                     ! Set AFC OFF
1360   OUTPUT @Ext_pc;Frq_1st,Frq_3rd,Lvl_1st,Lvl_3rd   ! Send Result to
                                                      External Controller
1370 RETURN
1380 !
1390 END
1400 !
1410 SUB Get_result(@Hp4352,@Dt,Cmd$,Dat(*))
1420   OUTPUT @Hp4352;Cmd$                          ! Send GPIB Command
                                                      of Data Output
1430   ENTER @Hp4352 USING "%,8A";Head$             ! Read Header String
1440   ENTER @Dt;Dat(*)                             ! Read Binary Data
1450 SUBEND
```

Figure 12-34.
Sample Program:
Application in the Analyzer Mode (Automatic Measurement of All the 4352B's Measurement Parameters - 4352B Side; 4/4)

File Transfer Function

This section describes how to use the file transfer function, showing you a sample program.

The file transfer function uses the external controller to transfer files between the selected storage device of this instrument (memory disk or diskette) and an external storage device (such as hard disk). This function allows you to:

- Directly access data you want to use on the external controller.

  For example, you can transfer the file of an instrument screen to the external controller, print it on a printer connected to the external controller, and paste it onto a file in a word processor running on the external controller.

- Use external storage devices, which have larger capacity compared to the memory disk or a diskette.

  For example, if there are a great number of measurement conditions which require calibration, the amount of the setting data becomes extremely large, including calibration data. In this case, it is impractical to store all of these settings on the memory disk or a single diskette at a time. However, you can realize this functionality by transferring them to the external controller and then storing them on an external storage device.

- Perform remote measurement using the external controller with a few GPIB commands for basic measurement. You do not have to memorize further details (such as GPIB commands used for detailed settings).

  Preparation:

  Use the keys on the front panel to establish the setting required for your measurement. Store it on the storage device of the 4352B, then transfer the file to the external controller, and store it on an external storage device. Repeat this procedure for all of the settings required for your measurement.

  Measurement:

  Choose a necessary setting file from those stored and transfer it to the 4352B using the external controller. Then, recall the file to set the 4352B for the measurement and perform the measurement using the GPIB commands.

The storage device of the 4352B allows you to handle files listed below in the DOS format or the LIF format. For DOS format files, both binary files and ASCII files can be transferred. For LIF format files, only binary files can be transferred.

- Binary files
  - Instrument settings and internal data array (STATE)
  - Internal data arrays (DATA ONLY binary)
  - Graphic images (GRAPHICS)
- ASCII files
  - Internal data arrays (DATA ONLY ascii)
  - HP instrument BASIC programs

File Transfer from 4352B to External Controller

This program transfers a specified file in the current directory of the 4352B to the current directory of the storage device connected to the external controller, giving a file name you desire.

When executed, this program first prompts you to enter a source file name, as shown below. Enter the name of a file you want to transfer.

```
ENTER SOURCE FILE NAME ON INSTRUMENT ?
```

Then, the program prompts you to enter a destination file name as shown below(in this example, SAMPLE.STA has been entered as the source file name). Enter the file name you want to give on the storage device. Note that a file with the same name will be overwritten, if it already exists.

```
ENTER SOURCE FILE NAME ON INSTRUMENT ?        SAMPLE.STA
ENTER DESTINATION FILE NAME ON CONTROLLER ?
```

```
100  ! File Name : FIG12_47.TXT
110  !   File transfer (Instrument -> Controller)
120  !
130  DIM Src_file$[50],Dst_file$[50]
140  ASSIGN @Hp4352 TO 717
150  OUTPUT @Hp4352;"*rst"
160  !
170  PRINT "  ENTER SOURCE FILE NAME ON INSTRUMENT ?        ";
180  INPUT Src_file$
190  PRINT Src_file$
200  !
210  PRINT "  ENTER DESTINATION FILE NAME ON CONTROLLER ?  ";
220  INPUT Dst_file$
230  PRINT Dst_file$
240  !
250  Copy_from_instr(@Hp4352,Src_file$,Dst_file$)
260  !
270  END
280  !
290  !  copy_from_instrument
300  !
310  SUB Copy_from_instr(@Hp4352,Src_file$,Dst_file$)
320      DIM Len$[6],Img$[32],Dmy$[2]
330      !
340      ON ERROR GOTO Skip_purge
350      PURGE Dst_file$
360 Skip_purge:  OFF ERROR
370      CREATE Dst_file$,1
```

Sample Program: File Transfer from 4352B to External Controller (1/2)

```
380      ASSIGN @Dst_file TO Dst_file$
390      !
400      CLEAR @Hp4352
410      OUTPUT @Hp4352;"CLES"
420      OUTPUT @Hp4352;"ROPEN """;Src_file$;""""
430      IF FNCheck_error(@Hp4352,"<CPFI: ropen>")=-1 THEN SUBEXIT
440      !
450      LOOP
460          OUTPUT @Hp4352;"READ?"
470          ENTER @Hp4352 USING "#,2A";Dmy$
480          ENTER @Hp4352 USING "#,6A";Len$
490          Block_size=VAL(Len$)
500          !
510          IF Block_size=0 THEN
520              ENTER @Hp4352 USING "%,A";Dmy$
530              ASSIGN @Dst_file TO *
540              OUTPUT @Hp4352;"CLOSE"
550              SUBEXIT
560          END IF
570          !
580          ALLOCATE Dat$[Block_size]
590          Img$="#,"&VAL$(Block_size)&"A"
600          ENTER @Hp4352 USING Img$;Dat$
610          ENTER @Hp4352 USING "%,A";Dmy$
620          OUTPUT @Dst_file USING Img$;Dat$
630          DEALLOCATE Dat$
640          !
650          IF FNCheck_error(@Hp4352,"<CPFI: read>")=-1 THEN SUBEXIT
660      END LOOP
670  SUBEND
680  !
690  !  Instrument Error Check
700  !
710  DEF FNCheck_error(@Hp4352,Str$)
720      DIM Err$[64]
730      OUTPUT @Hp4352;"OUTPERRO?"
740      ENTER @Hp4352;Err$
750      IF Err$"+0,""No error""" THEN
760          PRINT "ERROR: ";Str$;"   ";Err$
770          RETURN -1
780      ELSE
790          RETURN 0
800      END IF
810  FNEND
```

Figure 12-35. Sample Program: File Transfer from 4352B to External Controller (2/2)

Lines 170 to 230 accept the entry of the source file name and the destination file name.
Line 250 calls the subprogram to transfer a file from the 4352B to the external controller.
Lines 340 to 380 prepare for writing to the destination file.
Lines 400 to 430 prepare for reading the source file to the external controller.
Line 460 executes the query command to read data.
Lines 470 to 490 read the part indicating the length of the fixed length block data (see Figure 11-1) to obtain the length of the data to be transferred.

Lines 510 to 560 check the data length. If the data length is 0, the transfer process is terminated.
Depending on the data length obtained in lines 590 to 610, the program adjusts the format and reads the data part.
Line 620 writes the data to the destination file.
The maximum length of data transferred at a time is 16 Kbytes. Therefore, if the size of the source file is greater than 16 Kbytes, the transfer routine, lines 460 to 650, is repeated until transferring all of the data is completed.
Lines 710 to 810 provide a function to check that no error has occurred in the 4352B.

File Transfer from External Controller to 4352B

This program transfers a specified file in the current directory of the storage device connected to the external controller to the current directory of the selected storage device of the 4352B, giving a file name you desire.

This program, when executed, first prompts you to enter a source file name, as shown below. Enter the name of a file you want to transfer.

```
ENTER SOURCE FILE NAME ON CONTROLLER ?
```

Next, the program prompts you to enter the size of the source file as shown below (in this example, SAMPLE.STA has been entered as the source file name). Enter the size correctly in bytes.

```
ENTER SOURCE FILE NAME ON INSTRUMENT ?        SAMPLE.STA
ENTER SOURCE FILE SIZE ?
```

Then, the program prompts you to enter the destination file name, as shown below (in this example, the size of SAMPLE.STA is 12288 bytes). Enter the file name you want to give on the destination storage device. Note that a file with the same name will be overwritten, if it already exists.

```
ENTER SOURCE FILE NAME ON INSTRUMENT ?        SAMPLE.STA
ENTER SOURCE FILE SIZE ?                      12288
ENTER DESTINATION FILE NAME ON CONTROLLER ?
```

```
100 ! File Name : FIG12_48.TXT
110 !   File transfer (Controller -> Instrument)
120 !
130 DIM Src_file$[50],Dst_file$[50]
140 ASSIGN @Hp4352 TO 717
150 OUTPUT @Hp4352;"*rst"
160 !
170 PRINT "  ENTER SOURCE FILE NAME ON CONTROLLER ?        ";
180 INPUT Src_file$
190 PRINT Src_file$
200 !
210 PRINT "  ENTER SOURCE FILE SIZE ?                      ";
220 INPUT Src_size
230 PRINT Src_size
240 !
250 PRINT "  ENTER DESTINATION FILE NAME ON INSTRUMENT ?   ";
260 INPUT Dst_file$
270 PRINT Dst_file$
280 !
290 Copy_to_instr(@Hp4352,Src_file$,Src_size,Dst_file$)
300 !
310 END
320 !
330 !  copy_to_instrument
340 !
350 SUB Copy_to_instr(@Hp4352,Src_file$,Src_size,Dst_file$)
360     DIM Img$[32]
370     Max_bsize=16384
380     !
390     ASSIGN @Src_file TO Src_file$
400     !
410     CLEAR @Hp4352
420     OUTPUT @Hp4352;"CLES"
430     OUTPUT @Hp4352;"WOPEN """;Dst_file$;""""
440     IF FNCheck_error(@Hp4352," <CPTI: wopen>")=-1 THEN SUBEXIT
450     Xfr_done=0
460     !
470     LOOP
480         SELECT (Src_size-Xfr_done)
490             CASE >Max_bsize
500                 Block_size=Max_bsize
510             CASE 0
520                 ASSIGN @Src_file TO *
530                 OUTPUT @Hp4352;"CLOSE"
540                 SUBEXIT
550             CASE ELSE
560                 Block_size=(Src_size-Xfr_done)
```

Sample Program: File Transfer from External Controller to 4352B (1/2)

```
570         END SELECT
580         Xfr_done=Xfr_done+Block_size
590         !
600         ALLOCATE Dat$[Block_size]
610         !
620         Img$="#,"&VAL$(Block_size)&"A"
630         ENTER @Src_file USING Img$;Dat$
640         !
650         Img$="8A,ZZZZZZ,"&VAL$(Block_size)&"A"
660         OUTPUT @Hp4352 USING Img$;"WRITE #6",Block_size,Dat$,END
670         DEALLOCATE Dat$
680         IF FNCheck_error(@Hp4352," <CPTI: write>")=-1 THEN SUBEXIT
690     END LOOP
700 SUBEND
710 !
720 !  Instrument Error Check
730 !
740 DEF FNCheck_error(@Hp4352,Str$)
750     DIM Err$[64]
760     OUTPUT @Hp4352;"OUTPERRO?"
770     ENTER @Hp4352;Err$
780     IF Err$"+0,""No error""" THEN
790         PRINT "ERROR: ";Str$;"   ";Err$
800         RETURN -1
810     ELSE
820         RETURN 0
830     END IF
840 FNEND
```

Figure 12-36. Sample Program: File Transfer from External Controller to 4352B (2/2)

Lines 170 to 270 accept the entry of the source file name and its size and the destination file name.
Line 290 calls the subprogram to transfer a file from the external controller to the 4352B.
Lines 430 to 440 prepare for writing the file to the destination storage device.
Lines 480 to 570 calculate the length of the data that has not been transferred based on the source file size previously entered and the length of the data that has been already transferred. If the length of the remaining data does not exceed 16 Kbytes, it is set as the transfer data length; otherwise, 16 Kbytes is set as the transfer data length. Note that, if the length of the data not transferred is 0 at this time, the transfer process is terminated.
Lines 620 to 630 read data, whose amount is specified by the transfer data length, from the source file.
Lines 650 to 660 write data to the destination file in the fixed length block format (see Figure 11-1).
The maximum length of data transferred at a time is 16 Kbytes. Therefore, if the size of the source file is greater than 16 Kbytes, the transfer routine, lines 480 to 680, is repeated until transferring all of the data is completed.
Lines 740 to 840 provide a function to check that no error has occurred in the 4352B.

Note To transfer a file from the external storage device to the 4352B, you must check the file size (number of bytes) in advance .

Displaying List of Files in Current Directory

This program displays the list of the files in the current directory.

```
100  ! File Name : FIG12_49.TXT
110  !   File list
120  !
130  ASSIGN @Hp4352 TO 717
140  OUTPUT @Hp4352;"*rst"
150  !
160  Dir_instr(@Hp4352)
170  !
180  END
190  !
200  !  Dir_instr
210  !
220  SUB Dir_instr(@Hp4352)
230      DIM Stor_dev$[5],Curr_dir$[50],File_name$[13]
240      !
250      OUTPUT @Hp4352;"STODMEMO?"
260      ENTER @Hp4352;A
270      IF A=1 THEN
280        Stor_dev$="MEMO"
290      ELSE
300        Stor_dev$="DISK"
310      END IF
320      OUTPUT @Hp4352;"CWD?"
330      ENTER @Hp4352;Curr_dir$
340      PRINT "["&Stor_dev$&"]: "&Curr_dir$
350      PRINT "Size[byte]    File Name"
360      PRINT "------------------------"
370      OUTPUT @Hp4352;"FNUM?"
380      ENTER @Hp4352;File_count
390      IF File_count>=1 THEN
400          FOR I=1 TO File_count
410              OUTPUT @Hp4352;"FNAME? ";I
420              ENTER @Hp4352;File_name$
430              OUTPUT @Hp4352;"FSIZE? """&File_name$&""""
440              ENTER @Hp4352;File_size
450              PRINT USING "XX,DDDDDD,XXXX,K";File_size,File_name$
460          NEXT I
470      END IF
480  SUBEND
```

Figure 12-37. Sample Program: Displaying List of Files in Current Directory of 4352B

Line 160 calls the subprogram to display the list of the files in the current directory.
Lines 250 to 340 check the storage device currently selected and its current directory name, and then display the result.
Lines 370 to 380 check the number of the files in the current directory.
If there are any files in the current directory, lines 390 to 470 check the name and size of every file and display them.

The following is the output result of the program, assuming that the selected storage device is the memory disk and the current directory, \TEST, contains 2 files, FILE1.STA (size: 24576 bytes) and FILE2.TIF (size: 16384 bytes) and 1 directory, DIR1. For size of a directory, -1 is displayed. To view the list of the files in DIR1, use the `CHAD` command to change the current directory to DIR1 and then execute this program again.

```
[MEMO]: \TEST
Size[byte]    File Name
------------------------
      -1    ..\
      -1    DIR1\
   24576    FILE1.STA
   16384    FILE2.TIF
```

A

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the 4352B than the current printing date of this manual. The information in this manual applies directly to the 4352B if its serial number prefix is the same as that listed on the title page of this manual.

Manual Changes

See Table A-1 and Table A-2, and adapt this manual to your 4352A, based on all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing date of this manual may be different from the information documented in this manual. The manual change information for later instrument versions will be documented in a manual changes supplement that will be shipped with that instrument. If your the 4352B's serial number is not listed in the title page of this manual, Table A-1 and Table A-2, it may be documented in a *yellow MANUAL CHANGES* supplement.

Turn ON the line switch or execute an GPIB command `*IDN?` to confirm the firmware version. See the *GPIB Command Reference* manual for information on the `*IDN?` command. Refer to "Serial Number" for the detail of serial numbers and conforming manuals.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
JP1KE	Change 2

Table A-2. Manual Changes by Firmware Version

Version	Make Manual Changes
REV 1.00	Change 1
REV 1.02	Change 2

Serial Number

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (see Figure A-1) attached to the rear panel. The first five characteristics are the serial prefix and the last five digits are the suffix.

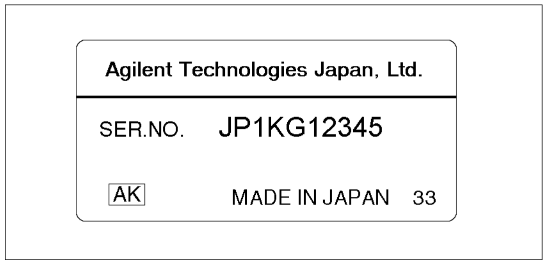


Figure A-1. serial number plate

Change 1

The firmware revision 1.00 does not support the following commands. Please delete the descriptions about these commands in this manual.

```
CLOSE
CWD?
FNAME?
FNUM?
FSIZE?
READ?
ROPEN
WOPEN
WRITE
```

Change 2

The firmware revision 1.02 or later does not support the following commands. Please delete the descriptions about these commands in this manual.

```
DET {POS|NEG|SAM}

DNCONV {OFF|0|ON|1}

FBAND <numeric>

INTEGNOIS?

MEAINOIS {OFF|0|ON|1}

NOMFREQ <numeric>

SIGSRCH

SWPT {LOGF|LINF}

TRSPAN {TS2MHZ|TS20MHZ|TSMAX}

TRTARG <numeric>

TRTPOS <numeric>
```

B

Key Codes

Figure B-1 lists the key codes for the front panel keys. You can use one of these key codes as a parameter of the GPIB command KEY.

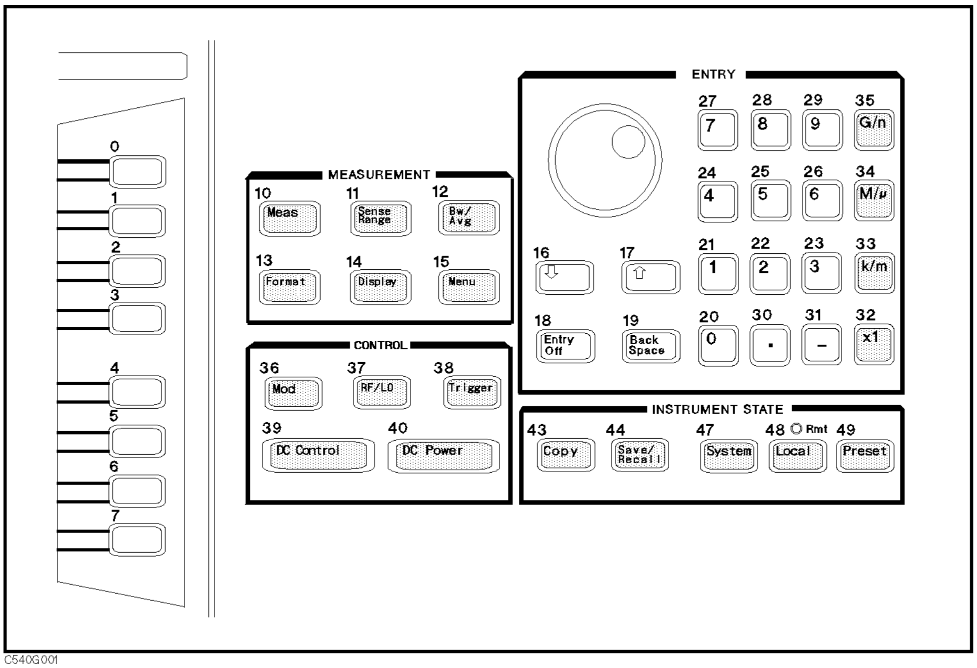


Figure B-1. Key Codes

Data Formats

Data Formats

There are four different types of data formats used to transfer data from the 4352B via GPIB. You must consider the data format not only at data transfer, but also when making the data array declaration of either real or integer because this format determines the type of data to be transferred.

- Form 2

  Form 2 is IEEE 32-bit floating point format. This format expresses a number in four bytes. Figure C-1 shows the data transfer format of Form 2 in the Tester mode.

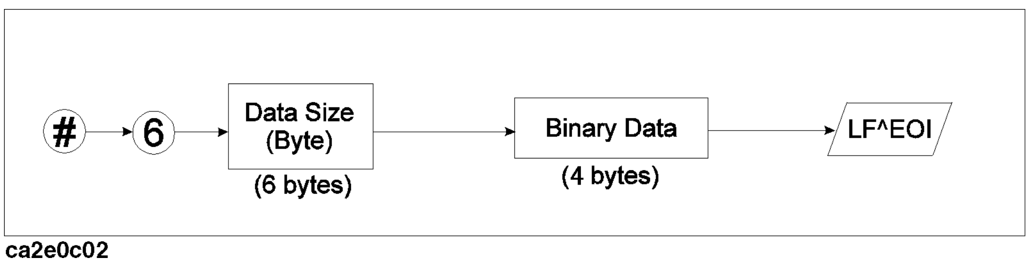


Figure C-1. The Data Transfer Format for Form 2 (Tester mode)

  When the Analyzer mode is selected, data is transferred as a data trace in sequences of 4-byte data. For example, the data length for 201 measurement values will be 804 bytes . Figure C-2 shows the data transfer format of Form 2 in the Analyzer mode.

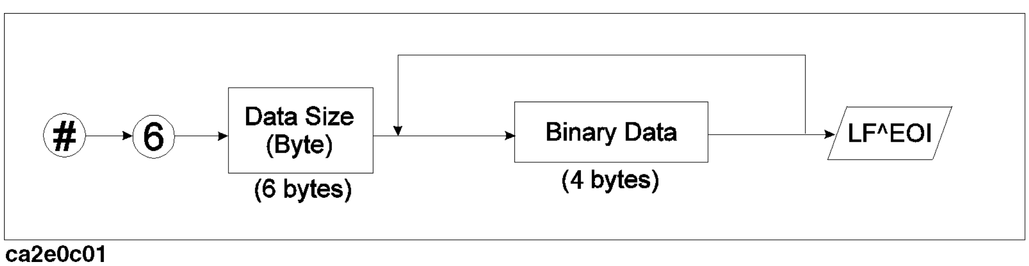
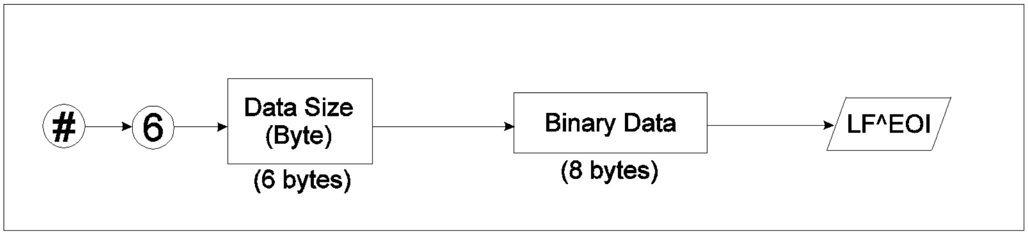


Figure C-2. The Data Transfer Format for Form 2 (Analyzer mode)

- Form 3

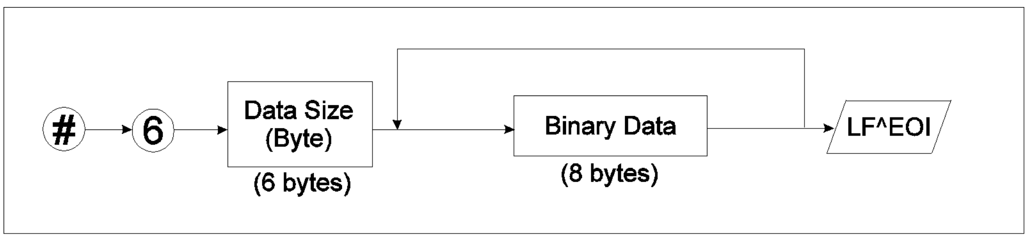
  Form 3 is IEEE 64-bit floating point format. This format represents a number in 8 bytes . You do not have to reformat data if you use Form 3, because the HP 9000 series computers processes data in the IEEE 64-bit floating point format. Figure C-3 shows the data transfer format of Form 3 in the Tester mode.



ca2e0c04

Figure C-3. The Data Transfer Format for Form 3 (Tester mode)

When the Analyzer mode is selected, the data trace is transferred in a similar manner to Form 2, except it is transferred in sequences of 8-byte data. For example, the data length for 201 measurement values will be 1,608 bytes. Figure C-4 shows the data transfer format of Form 3 in the Analyzer mode.



ca2e0c03

Figure C-4. The Data Transfer Format for Form 3 (Analyzer mode)

- Form 4

  Form 4 is the ASCII data transfer format. This format expresses a number in a 24-characters string. This character string contains digits for numbers, a sign, and a decimal point.

- Form 5

  Form 5 is the MS-DOS® personal computer format. In this format, the bytes in IEEE 32-bit floating point format are reversed. Form 5 also has a 4-byte header that indicates the order of the data. With Form 5, you do not have to reformat data if you use it with an IBM PC or a compatible PC running MS-DOS®.

D

I/O Port Function Specifications

The 4352B's rear panel provides two parallel I/O ports, a 24-bit parallel I/O port that enables a 24-bit output or an 8-bit input at maximum, and a 12-bit parallel I/O port that enables 8-bit output and 4-bit input.

These I/O ports enable the handshake between the 4352B and an external controller such as a PC or an external device such as handlers used in production line testing.

To control these I/O ports, you must use either GPIB commands or some special IBASIC commands.

IBASIC

If you use the HP instrument BASIC commands `READIO` and `WRITEIO`, you can control the I/O port without GPIB commands. Also, the execution speed will be faster than when using the GPIB commands.

This appendix explains the following items:

- The 24-bit I/O port
  - The I/O port
  - The control signal line
  - The I/O pin definition
  - The basic I/O circuit
  - IBASIC commands for I/O port control
  - GPIB commands for I/O port control
- The 12-bit I/O port
  - The I/O pin definition
  - IBASIC commands for I/O port control
  - GPIB commands for I/O port control

The 24-bit I/O Port

The 4352B's 24-bit I/O port has four independent parallel ports for data input or output, and several control signal and power lines. All signals are TTL level. The data I/O port consists of 2 pairs of 8-bit output ports and 2 pairs of 4-bit two-ways ports. If you use these ports together, you can use them as a 24-bit output port or as an 8-bit input port at maximum. The I/O signal is initialized to use negative logic, but it can be set to use positive logic using an GPIB command. The control signal lines consist of measurement completion output, PASS/FAIL output of limit testing results, control signal outputs for handshaking, and so on.

Note

A 36-pin cable (part number: 04278-61650) is available if you cannot connect the device directly to the connectors of the 24-bit I/O port interface on the rear panel. This cable enables a 1m cable extension of this interface.

I/O Port

The 4352B's 24-bit I/O port has following 2 pairs of output ports and 2 pairs of input/output ports.

- Output only ports
  - A port: 8-bit
  - B port: 8-bit

  The signal is TTL level and is a latched output.
- Two ways ports
  - C port: 4-bit
  - D port: 4-bit

  Both ports C and D are set as input ports when the 4352B is turned on. These ports can be used as output ports by using the GPIB commands `COUT` or `DOUT`. The signal is TTL level and is a latched output. (Related GPIB commands: `OUTCIO`, `OUTDIO`, `OUTPINPCIO?`, `OUTPINPDIO?`)

  Using GPIB commands, you can combine these ports for use as the following ports (in addition to the above 4 ports).
- The input/output port
  - E port: 8-bit (C port + D port)
- The output only ports
  - F port: 16-bit (A port + B port)
  - G port: 20-bit (A port + B port + C port)
  - H port: 24-bit (A port + B port + C port + D port)

Control Signal Lines

The I/O ports include 10 types of output signal lines and one input signal line. These control signals are TTL-compatible (excluding the power supply line). Each of them are described below.

Port C or Port D Status Output Signal

These signals are used to report the direction setting (input or output) of port C or D to external devices. Each of these signals is set to LOW respectively when port C or D is assigned as an input port. It is set to HIGH respectively when port C or D is defined as an output port. (Related GPIB commands: `CIN`, `COUNT`, `DIN`, and `DOUT`.)

WRITE STROBE Output Signal

When data is output to any output port, a negative pulse is output to the WRITE STROBE output. This negative output pulse notifies an external device of data output to the parallel I/O port. The pulse width is 10 μs (typical). Figure D-1 shows the timing chart for the WRITE STROBE output and data output.

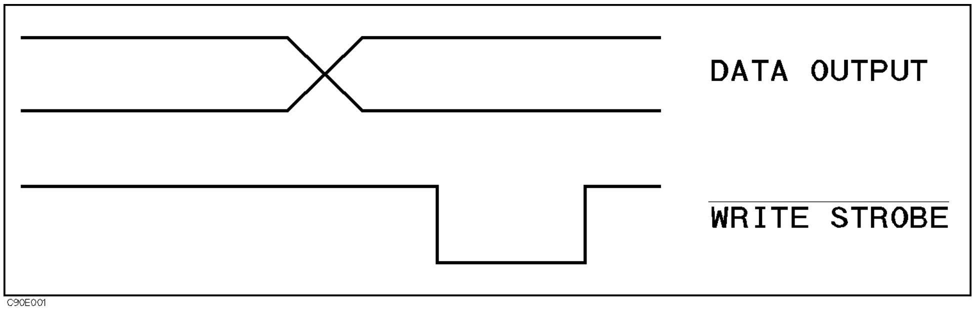


Figure D-1. Write Strobe Signal Timing Chart

INPUT1 Input Signal

When a negative pulse is input to INPUT1, OUTPUT1 and OUTPUT2 are set to LOW or HIGH. The time interval is 200 ns (typical). An GPIB command is used to determine whether LOW or HIGH is to be set. The pulse width of the signal input to INPUT1 must be 1 μs or more. (Related GPIB commands: `OUT1ENVH`, `OUT1ENVL`, `OUT2ENVH`, `OUT2ENVL`, and `TRGOUT`.)

OUTPUT1 or OUTPUT2 Output Signal

This signal (a latch output signal) can be set to LOW or HIGH by inputting a negative pulse to INPUT1 or using an GPIB command. (Related GPIB commands: `OUT1H`, `OUT1L`, `OUT2H` and `OUT2L`.)

Note

You can change the logic level of an OUTPUT signal by synchronizing it with a measurement trigger, when you turn ON the trigger detection output function using the GPIB command `TRGOUT ON`. This function is used only in frequency transient measurements to send a load signal to a device immediately after a triggering measurement. The time interval between the measurement trigger and the logic level change is 85 μs (typical).

PASS/FAIL Output

Outputs a HIGH (positive logic) or LOW (negative logic) signal when the limit test passed, and a LOW (positive logic) or HIGH (negative logic) when the limit test failed. This is valid when the limit test function is set to ON.

WRITE STROBE Output for the PASS/FAIL Output

Outputs a negative pulse when a limit test result has been output through the PASS/FAIL output line. The output signal informs an external device of the limit test result being output through the PASS/FAIL output. The pulse width is 10 μs (typical).

SWEEP END Output

When the 4352B completes a measurement in the Tester mode or a sweep in the Analyzer mode, a negative pulse is output. When measurements are repeated with a continuous trigger, the pulse is output at every measurement or sweep end. The pulse width is 20 μs (typical).

24-bit I/O port

+5V Output

A +5V output can be provided to an external device. The maximum current supplied is 100 mA. This line does not have a fuse. When excessive current flows, the 4352B's protection circuit automatically shuts down its internal power supply circuits. If you remove the cause of the excessive current, the 4352B's power will be turned on but the 4352B's setups are reset to the default settings.

Figure D-2 shows the overview of I/O ports and control signal lines.

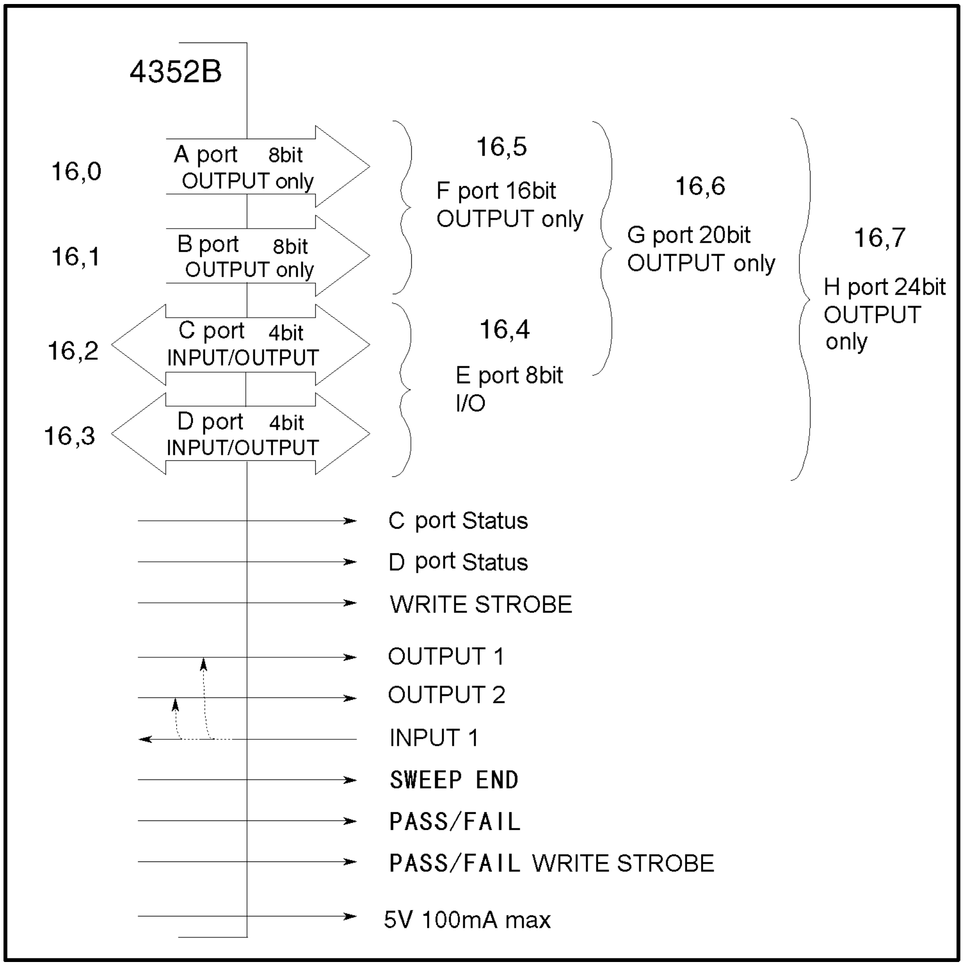


Figure D-2. The Overview of 24-bit I/O Ports

Pin Assignment

Figure D-3 shows the pin numbers. Table D-1 shows the signal lines assigned to the pin numbers.

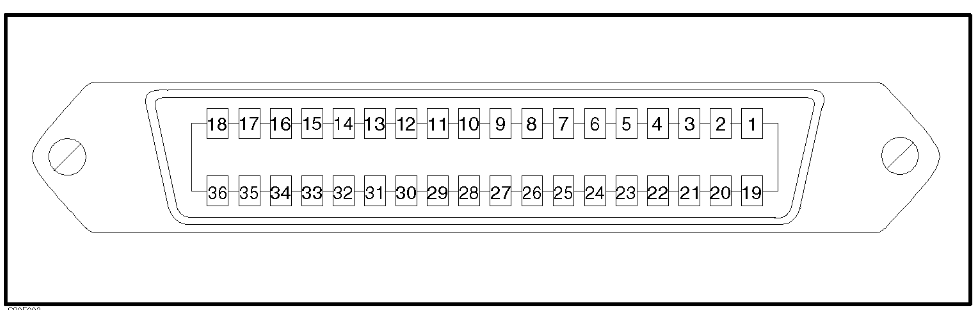


Figure D-3. 24-bit I/O port Connector Pin Number

24-bit I/O port

Table D-1. Assignment of Signals to Pins (Standard)

Pin No.	Signal Name	Signal Standard
1	GND	0 V
2	INPUT1	TTL level, Pulse input (Width: $\geq$1 μs)
3	OUTPUT1	TTL level, Latch output
4	OUTPUT2	TTL level, Latch output
5	Output port A0	TTL level, Latch output
6	Output port A1	TTL level, Latch output
7	Output port A2	TTL level, Latch output
8	Output port A3	TTL level, Latch output
9	Output port A4	TTL level, Latch output
10	Output port A5	TTL level, Latch output
11	Output port A6	TTL level, Latch output
12	Output port A7	TTL level, Latch output
13	Output port B0	TTL level, Latch output
14	Output port B1	TTL level, Latch output
15	Output port B2	TTL level, Latch output
16	Output port B3	TTL level, Latch output
17	Output port B4	TTL level, Latch output
18	Output port B5	TTL level, Latch output
19	Output port B6	TTL level, Latch output
20	Output port B7	TTL level, Latch output
21	Input/output port C0	TTL level, Latch output
22	Input/output port C1	TTL level, Latch output
23	Input/output port C2	TTL level, Latch output
24	Input/output port C3	TTL level, Latch output
25	Input/output port D0	TTL level, Latch output
26	Input/output port D1	TTL level, Latch output
27	Input/output port D2	TTL level, Latch output
28	Input/output port D3	TTL level, Latch output
29	Port C status	TTL level, Input mode: Low, Output mode: High
30	Port D status	TTL level, Input mode: Low, Output mode: High
31	WRITE STROBE signal	TTL level, Negative logic, Pulse output (Width: $\geq$10 μs Typical)
32	+5 V pull-up	
33	SWEEP END signal	TTL level, Negative logic, Pulse output (Width: $\geq$20μs Typical)
34	+5 V	+5 V, 100 mA max.
35	PASS/FAIL signal	TTL level, PASS: HIGH, FAIL: LOW, Latch output
36	PASS/FAIL WRITE STROBE signal	TTL level, Negative Logic, Pulse output (Width: 10 μs; Typical)

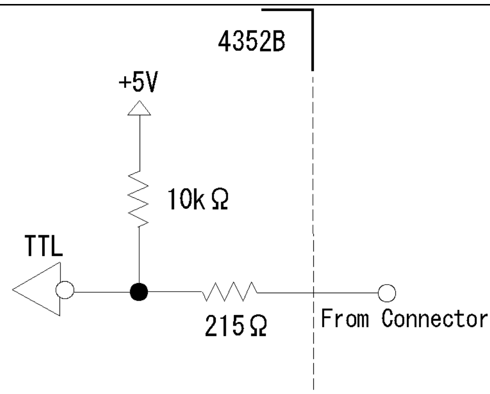
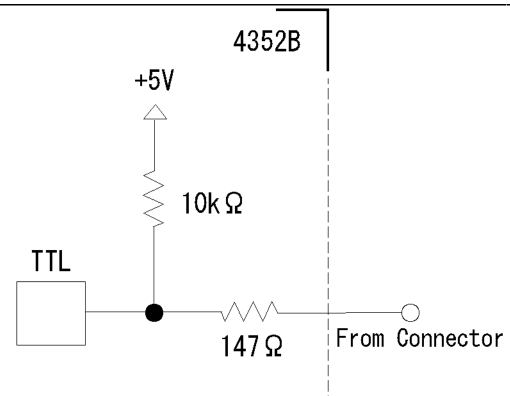
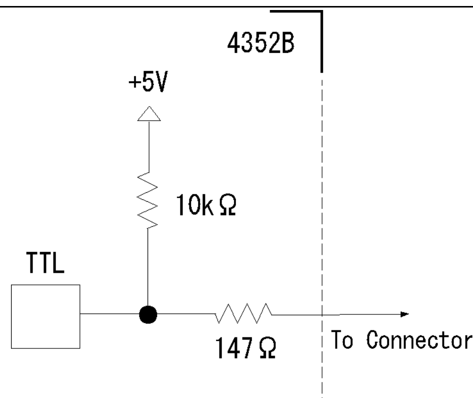
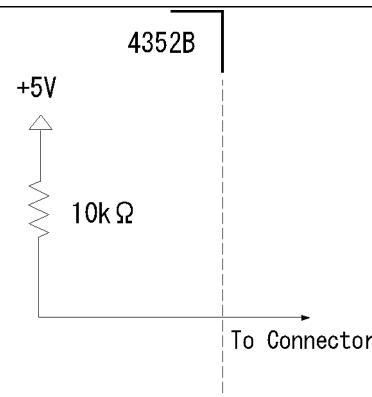
Power-ON Default

The 24-bit I/O port is set to the following defaults at power-on. (These settings do not change when Preset is pressed.)

Logic type	Negative logic
WRITE STROBE signal	HIGH
SWEEP END signal	HIGH
Port A	Negative 0 ⟶ HIGH
Port B	Negative 0 ⟶ HIGH
Port C	Input
Port D	Input
OUTPUT1	HIGH, pulled HIGH by the falling edge of INPUT1 (OUT1ENVH)
OUTPUT2	HIGH, pulled HIGH by the falling edge of INPUT1 (OUT2ENVH)
PASS/FAIL signal	(Negative) ⟶ HIGH

Basic I/O circuit

Table D-2. 24-bit I/O Port, Basic I/O Circuit

<table>
<tr><td rowspan="2">Basic circuit</td><td colspan="2">Input port</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>I/O pin</td><td>INPUT1</td><td>Port C, D (input)[1]</td></tr>
<tr><td rowspan="2">Basic circuit</td><td>Output port</td><td>Others</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>I/O pins</td><td>OUTPUT1, 2
port A[1], B[1], C(output)[1], D(output)[1]
Write strobe signal
SWEEP END signal
Port C status, Port D status</td><td>+5V pullup</td></tr>
</table>

1 Common to all bits

IBASIC Commands for 24-bit I/O Port Control

IBASIC commands related to 24-bit I/O port are described in the following paragraphs.

Data Output

The following commands output data to the corresponding ports (A to H). If you use C, D, E, F, G, or H port as the output port, you must use the GPIB command `COUT` and/or `DOUT` to set the C and/or D port as an output port.

- `WRITEIO 16,0;` Output 8-bit data to port A.
- `WRITEIO 16,1;` Output 8-bit data to port B.
- `WRITEIO 16,2;` Output 4-bit data to port C.
- `WRITEIO 16,3;` Output 4-bit data to port D.

- `WRITEIO 16,4;` Output 8-bit data to port E.
- `WRITEIO 16,5;` Output 16-bit data to port F.
- `WRITEIO 16,6;` Output 20-bit data to port G.
- `WRITEIO 16,7;` Output 24-bit data to port H.

Data Input

The following commands read data sent from an external device to an input port (C to E) and return the value to an HP IBASIC program. If you use the port as an input port, the port must be defined as an input port using the GPIB commands `CIN` and/or `DIN`.

- `READIO(16,2)` Reads 4-bit data from port C and returns the value.
- `READIO(16,3)` Reads 4-bit data from port D and returns the value.
- `READIO(16,4)` Reads 4-bit data from port E and returns the value.

GPIB commands for 24-bit I/O port control

The GPIB commands related to the parallel I/O ports are summarized below.

Data Output

The following commands output data to ports (A to H). If you use C, D, E, F, G or H port as the output port, you must use the GPIB command `COUT` and/or `DOUT` to set the C, D port to output port.

- `OUTAIO` Outputs 8-bit data to port A.
- `OUTBIO` Outputs 8-bit data to port B.
- `OUTCIO` Outputs 4-bit data to port C.
- `OUTDIO` Outputs 4-bit data to port D.
- `OUTEIO` Outputs 8-bit data to port E.
- `OUTFIO` Outputs 16-bit data to port F.
- `OUTGIO` Outputs 20-bit data to port G.
- `OUTHIO` Outputs 24-bit data to port H.

Data Input

The following commands read data sent from an external device to an input port (C to E) and return the value to the GPIB. If you use the port as an input port, the port must be defined as an input port using the GPIB command `CIN` and/or `DIN`.

- `OUTPINPCIO?` Reads 4-bit data from port C and returns its value to the GPIB.
- `OUTPINPDIO?` Reads 4-bit data from port D and returns its value to the GPIB.
- `OUTPINPEIO?` Reads 8-bit data from port E and returns its value to the GPIB.

Setting Input/Output Directions of Ports C and D

The following commands set the input/output directions of ports C and D. When the power is turned ON, ports C and D are defined as input ports. (Preset) does not affect the setup. This setting is saved to an instrument state file using the Save function.

- `CIN` Defines port C as an input port.
- `COUT` Defines port C as an output port.
- `DIN` Defines port D as an input port.
- `DOUT` Defines port D as an output port.

Positive or Negative Logic Setting

You can set the logic level of the following ports and signal to negative or positive using the following GPIB command NEGL or POSL. When the power is turned ON, negative logic is set. (Preset) does not affect this setup. This setup is saved to an instrument state file using the Save function.

- Output ports A to H
- Input ports C and D
- PASS/FAIL signal

- NEGL Sets negative logic.
- POSL Sets positive logic.

OUTPUT1 and OUTPUT2 Level Setting Commands

The following commands set the logic level of OUTPUT1 and OUTPUT2.

- OUT1H Sets OUTPUT1 to HIGH.
- OUT1L Sets OUTPUT1 to LOW.
- OUT2H Sets OUTPUT2 to HIGH.
- OUT2L Sets OUTPUT2 to LOW.

Note You can use one of the above commands in frequency transient measurements to set a load signal through OUTPUT1 or OUTPUT2 to OFF before sending frequency change data to the device.

Commands for Setting OUTPUT1 and OUTPUT2 for Using INPUT1 or SINGLE Trigger in Frequency Transient Measurements

The logic level of OUTPUT1 or OUTPUT2 can be set to HIGH or LOW when one of the following two events occurs. When the 4352B is turned ON or both OUTPUT1 and OUTPUT2 are pulled high. (Preset) does not affect this setup. This setup can be saved to the 4352B state file using the save function.

- Pulse is input to INPUT1
- In frequency transient measurements, the measurement is triggered after the GPIB command TRGOUT ON has been sent.

- OUT1ENVH Pulls OUTPUT1 HIGH by one of the above events.
- OUT1ENVL Pulls OUTPUT1 LOW by one of the above events.
- OUT2ENVH Pulls OUTPUT2 HIGH by one of the above events.
- OUT2ENVL Pulls OUTPUT2 LOW by one of the above events.

Checking Input to INPUT1

This command checks whether a pulse has been input to INPUT1. Send this command after a pulse has been input to INPUT1 and the return value will be “1”. If no pulse has been input, it will be “0”. Once “1” is read by this command, it will be reset to “0” until the next pulse is input.

- INPT? Checks if a pulse has been sent to INPUT1.

12-bit I/O port

The 4352B's 12-bit I/O port consists of an 8-bit output, a 4-bit input, and three ground terminals. This I/O port also uses TTL level operation.

I/O Pins

Figure D-4 shows the I/O pins.

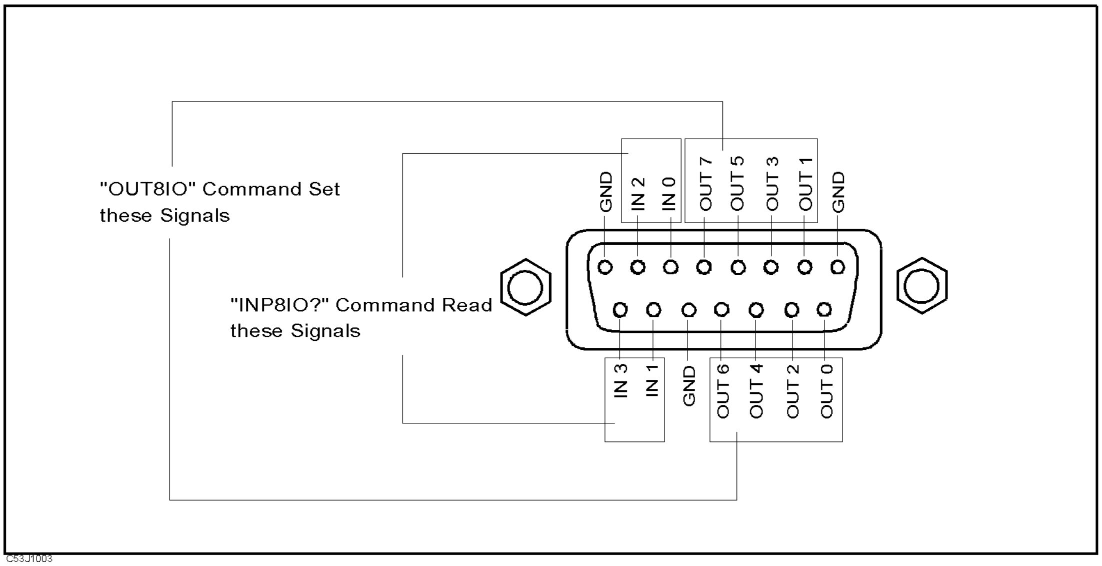


Figure D-4. The I/O Port Pin

The signals assigned to each pin are described below:

OUT 0 through 7 Signal lines used to output signals to an external device. They are controlled by the command, `WRITEIO` or `OUT8IO` as described below. Once one of these commands is executed, the signal is latched until one of them is executed again.

IN 0 through 4 Signal lines used to read an input signal from an external device. They are controlled by the command `READIO` or `INP8IO` as described below.

IBASIC Commands for the 12-bit I/O Port Control

IBASIC commands related to the 12-bit I/O port are defined as follows:

- `WRITEIO 15,0;` Outputs 8-bit data through lines OUT 0 to OUT 7. The OUT 0 signal is the LSB (least significant bit) and the OUT 7 signal is the MSB (most significant bit).
- `READIO(15,0)` Inputs 4-bit data through lines from IN 0 to IN 3 to the 4352B's memory and returns the data to an IBASIC program. The IN 0 signal is the LSB and the IN 3 signal is the MSB.

GPIB Commands for the 12-bit I/O Port Control

The GPIB commands related to the parallel I/O ports are described below:

- `OUT8IO` Outputs 8-bit data through lines OUT 0 to OUT 7. The OUT 0 signal is the LSB (least significant bit), and the OUT 7 signal is the MSB (most significant bit).
- `INP8IO?` Inputs 4-bit data through lines from IN 0 to IN 3 to the 4352B's memory and returns the data to a control device such as an external controller IBASIC program.

Error Message

This section lists the error messages that are displayed on the 4352B display or transmitted by the instrument over GPIB. Each error message is accompanied by an explanation, and suggestions are provided to help in solving the problem. Where applicable, references are provided to the related chapter of the appropriate manual.

When displayed, error messages are preceded with the word "`CAUTION:`." That part of the error message has been omitted here for the sake or brevity. Some messages without the "`CAUTION:`" are for information only, and do not indicate an error condition. The messages are listed first in alphabetical order because the displayed messages do not contain the message number. The messages are then listed in numerical order to make them easier to find if they are read over the GPIB.

In addition to error messages, The 4352B's status is indicated by status notations in the left margin of the display. Examples are $*$, `Cor`, and `P↓`. Sometimes these appear together with error messages. A complete listing of status notations and their meanings is provided in Chater 2 in *4352B Function Reference*.

Errors with a negative number are errors that occurred when the 4352B was being controlled with GPIB commands over the GPIB.

Error Messages in Alphabetical Order

45 1st IF Out Of Range

The 4352B's 1st IF frequency is outside of the proper range.

Possible problems and the corrective action are shown below:

- The frequency of the external signal generator is not correct.
  The 4352B has not performed automatic control of the external signal generator via GPIB (LO CONTROL MAN and/or ADDRESSABLE ONLY is selected). Verify the frequency of the external signal generator.
- The actual time required for the stabilization of the output frequency from the external signal generator after changing the output frequency exceeds the specified wait time in LOCAL SWTCH TIME.

  Press (RF/LO), LOCAL SWTCH TIME, and the entry keys to increase the 4352B's wait time.
- The DUT output frequency fluctuated largely in a very short time (several hundred kHz in several tens of ms)
  Verify the DUT's frequency stability.
- The automatic frequency control function was ON and the target frequency was 50 MHz or less.
  Set the acceptable frequency deviation to 4% or less of the target frequency.

81 2nd PLL Unlocked

The 4352B's internal 2nd PLL cannot be locked. If this message is displayed during a C/N ratio measurement or a phase noise measurement, the following problems and the corrective action are shown below.

- The DUT's noise level is too large, or a large level spurious component exists in the measurement range.
  Verify the spectrum of the DUT's output signal.
- The DUT's output signal is being modulated in frequency.

  Press (Mod), MOD OUT on OFF to stop the frequency modulation.
- In the case of a DUT with an oscillation frequency of 100 MHz or less, a large harmonics component is included in the output signal (effect of TTL output, etc.).

  Insert a low-pass filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the harmonics component.

If this message is displayed any time other than during a C/N measurement, adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

70 A/D Overload

The input level to the 4352B's internal A/D converter is too large.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

71 **A/D Overload in Downconverter Unit**

An overflow occurred in the A/D converter of the 43521A (Down Converter Unit). If this error occurs often, the 43521A may be at fault and need repair. Contact our service office or the company from which you purchased this instrument.

48 **AFC Out Of Loop**

The automatic frequency control function could not follow the fluctuation in the measurement condition, and did not converge on the target frequency.

Possible problems and the corrective action are shown below:

- The tuning sensitivity is improperly set.
  Press (Menu), AUTO FREQ CONTROL , SENSITIVITY , and the entry keys to specify a proper tuning sensitivity (the unit is [Hz/V]).
- The maximum value of the control voltage is too small.
  Press (Menu), AUTO FREQ CONTROL , MAX CTRL VOLTAGE , and the entry keys to specify a maximum value larger than the current setting. *Be careful not to set a value that exceeds the DUT's maximum acceptable value.*
- The math/measurement repeat count is too low.
  Press (Menu), AUTO FREQ CONTROL , MAX ITERATION , and the entry keys to specify a value larger than the current setting.
- An effect of the high value capacitor included with the DUT's power voltage (V_{cc}) terminal.
  Press (Menu), AUTO FREQ CONTROL , CTRL DELAY , and the entry keys to specify a value larger than the current setting.

102 **ANALYZER TYPE MISMATCH**

Indicates an invalid function was selected in the present measurement item. Change the measurement item, or select a different function.

13 **BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. Wait until the battery is re-charged (approximately 10 minutes after turning the 4352B on).

−160 **Block data error**

The 4352B detected an invalid syntax in a block data element.

−168 **Block data not allowed**

A legal block data element was encountered but was not allowed by the 4352B at this point in parsing.

51 **Calibration Aborted**

The FM deviation calibration in progress was aborted. This was probably caused by changing the measurement parameters during the FM deviation calibration.

Perform the FM deviation calibration again.

Error Messages (Alphabetical Order)

100 CAN'T CHANGE- ANOTHER CONTROLLER ON BUS

The 4352B cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See the *4352B Programming Guide*.

144 CAN'T CHANGE NUMBER OF POINTS

The number of points in the spectrum measurement cannot be changed manually, except in zero span.

132 CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS

If you attempt to save graphics when a print is in progress, this error message is displayed.

Wait until the print is completed, then save the graphics again.

63 Can't Use 12-Bit I/O Port

This message appears if you execute an IBASIC or GPIB command to operate the 12-Bit I/O Port with `DOWNCONV ON off` set to ON. If `DOWNCONV ON off` is set to ON, the 12-Bit I/O Port is connected to the 43521A. Therefore, you cannot use this kind of commands.

−281 Cannot create program

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

54 Carrier Overload

The carrier level in a C/N ratio measurement or a phase noise measurement is too large.

The 4352B RF IN connector's input level is too large. Verify the input level to the 4352B RF IN connector.

−140 Character data error

This error, as well as errors −141 through −148, are generated when analyzing the syntax of a character data element. This error message might be displayed if the 4352B detects an unknown problem.

−148 Character data not allowed

A legal character data element was encountered where prohibited by the 4352B.

−144 Character data too long

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

−100 Command error

This is a generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

−110 Command header error

An error was detected in the header. This error message might be displayed if the 4352B detects an unknown problem related to errors −111 through −119.

64 **Command Ignored - Invalid Freq Band**

This message appears if you execute the TRMIN or TRMAX GPIB command when DOWNCONV ON off is set to ON and a frequency band other than 10 MHz to 3 GHz (high frequency band) is selected. The command is ignored. The TRMIN and TRMAX commands are available only in the following cases:

- When you use the 4352B alone (not connecting it to the 43521A)
- When you connect the 4352B and the 43521A (Down Converter Unit), set DOWNCONV ON off to ON, and set the frequency band to 10 MHz to 3 GHz.

62 **Correction Data Lost in Downconverter Unit**

The correction data in the EEPROM of the 43521A (Down Converter Unit) is lost. You cannot use the product. Repair the faulty hardware.

−230 **Data corrupt or stale**

Possibly invalid data. New reading started but not completed since last access.

−225 **Data out of memory**

The 4352B has insufficient memory to perform the requested operation.

−222 **Data out of range**

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the 4352B (see IEEE 488.2, 11.5.1.1.5).

−231 **Data questionable**

Indicates that the measurement accuracy is suspect.

−104 **Data type error**

The parser recognized a data element that is not allowed. For example, a numeric or string data was expected but block data was encountered.

77 **DC Control Current Overload**

The current through the DC CONTROL connector is too large (20 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's control current is too large.
  Verify that the DUT is correctly connected to the 4352B RF IN connector.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal.
  This is a transient error. Press (DC Control), CTRL DELAY, and the entry keys to set a sufficiently large value for elimination of this transient error.

52 **DC Output On Required in AFC**

The automatic frequency control function was set on, however, the power or control voltage is not being applied to the DUT.

Verify that the power/control voltages output is set to ON on the LCD information (the measurement setting parameter display or the status notations). If the power/control voltage output is turned to OFF, press (DC Power) or (DC Control), and OUTPUT ON off.

Error Messages (Alphabetical Order)

76 **DC Power Current Overload**

The current through the DC POWER connector is too large (50 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's power current is too large.
  Verify that the DUT is correctly connected to the 4352B.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal. This is a transient error. Wait until the DC POWER voltage is stabilized, then perform the measurement.

135 **DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use a different extension name.

−200 **Execution error**

This is the generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

−123 **Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

44 **F-V Input Overflow**

The input frequency to the 4352B's F-V converter is too high.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

43 **F-V Input Underflow**

The input frequency to the 4352B's F-V converter is too low.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

83 **FAN Stopped in Downconverter Unit**

The fan in the 43521A (Down Converter Unit) is stopped. Using it without repair causes the temperature inside the 43521A to increase abnormally, which may result in fatal damage.
It needs repair. Contact our service office or the company from which you purchased this instrument.

−257 **File Name Error**

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

53 **FM Deviation Range Overload**

The DUT's FM deviation is out of the measurement range.

Press (Sense Range), FM DEV RANGE, and select a measurement range larger than the current setting. (FM deviations over 200 kHz cannot be measured.)

−105 **GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

−240 **Hardware error**

Indicates that a legal program command or query could not be executed because of a hardware problem in the 4352B. Definition of what constitutes a hard ware problem is completely device-specific. This error message might be displayed if the 4352B detects an unknown problem related to errors −241 through −249.

−241 **Hardware missing**

A legal program command or query could not be executed because of missing 4352B hardware. For example, an option was not installed.

−111 **Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus `*SRE4` is an error.

−114 **Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

−224 **Illegal parameter value**

Used where exact value, from a list of possibilities, was expected.

−282 **Illegal program name**

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

−283 **Illegal variable name**

An attempt was made to reference a nonexistent variable in a program.

−213 **Init ignored**

A request for a measurement initiation was ignored as another measurement was already in progress.

159 **INSUFFICIENT Memory**

If a lot of tasks are executed at the same time, memory might be insufficient for a while. (For example, running HP instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are requested at the same time.) Wait until finishing some tasks then execute the next task.

40 **Insufficient RF Level**

The input level to the 4352B RF IN connector is too low (less than −20 dBm).

Verify that the DUT is correctly connected to the 4352B. Also, verify that the power/control voltage output is turned ON on the LCD information (the measurement setting parameter display or the status notations). If it is OFF, press (DC Power) or (DC Control), and press `OUTPUT ON off`.

This message is also displayed if a positive DC voltage component (TTL output, etc.) is included in the DUT's output signal. In this case, insert a high-pass filter to sufficiently eliminate the positive DC voltage component.

−161 **Invalid block data**

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an `END` message was received before the length was satisfied.

−101 **Invalid character**

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (`SING&`).

−141 **Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

−121 **Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a "9" in octal data.

171 **INVALID DATE**

The date entered to set the real time clock is invalid. Re-enter the correct date.

50 **Invalid Dev Cal**

The correction coefficient of the FM deviation calibration is not proper.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

130 **INVALID FILE NAME**

The file name for the RECALL, PURGE, or RE-SAVE function must have a "`_D`" or "`_S`" extension for LIF format.

−103 **Invalid separator**

The parser was expecting a separator and encountered an illegal character (semicolon (;), comma (,), etc.).

−151 **Invalid string data**

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an `END` message was received before the terminal quote character.

−131 **Invalid suffix**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the 4352B.

133 **LIF-DOS COPY NOT ALLOWED**

Indicates that you tried to copy a file between the different formatted disks.

For example, if you try to copy a file between the RAM disk and the flexible disk when the format of the RAM disk is different from the format of the flexible disk, this message is displayed.

−250 **Mass Storage Error**

Indicates that a mass storage error occurred. This error message might be displayed if the 4352B detects an unknown problem related to error −257.

−311 **Memory error**

An error was detected in the 4352B's memory.

−109 **Missing parameter**

Fewer parameters were received than required for the header.

116 **NO ACTIVE MARKER**

Indicates that the Marker→ function was executed when no marker is activated. Press (Menu) MARKER to activate a marker.

111 **NO DATA TRACE**

Indicates that MKR ON [DATA] was pressed when no data trace is displayed.

137 **NO DATA TRACE DISPLAYED**

Indicates that SCALE FOR [DATA] was pressed when no data trace is displayed.

65 **No Downconverter RF Output; Do Signal Search**

This message appears when RF OUT of the 43521A (Down Converter Unit) outputs no signal because the frequency setting of the external signal source is inappropriate. Set a correct nominal frequency ((Meas), FREQ BAND [xx-xx] , NOMINAL FREQ), or execute the signal search ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)) to set the nominal frequency to the 4352B. The oscillation frequency of the external signal source is adjusted properly.

61 **No Downconverter Unit Connected**

This message appears in the following cases.

- When you try to set DOWNCONV on OFF to ON with the 43521A (Down Converter Unit) disconnected.
- When you try to set DOWNCONV on OFF to ON with the 43521A turned off.
- When you turn off the 43521A with DOWNCONV ON off set to ON.
- When you recall the setting to use the 43521A with DOWNCONV on OFF set to OFF.

Connect the 43521A correctly, and turn on the power. Notice that, if DOWNCONV on OFF is OFF, you cannot recall the setting to use the 43521A.

118 **NO FIXED DELTA MARKER**

The fixed Δmarker was not turned on. Be sure to turn the fixed Δmarker on before using `FIXED ΔMKR VALUE` or `FIXED ΔMKR AUX VALUE`.

114 **NO MARKER DELTA - RANGE NOT SET**

Indicates that `MKRΔ→SEARCH RNG` was selected when the Δmarker is not turned on.

113 **NO MARKER DELTA - SPAN NOT SET**

Indicates that `MKRΔ→SPAN` was selected when the Δmarker is not displayed.

112 **NO MEMORY TRACE**

Indicates that `MKR ON [MEMORY]` was selected when no memory trace is displayed.

138 **NO MEMORY TRACE DISPLAYED**

Indicates that `SCALE FOR [MEMORY]` was selected when no memory trace is displayed.

66 **No Signal Found**

This message appears when the carrier signal cannot be found out in the signal search function ((Meas), `FREQ BAND [xx-xx]`, `SIGNAL SEARCH`)). The frequency of the carrier signal may not be within the specified frequency band ((Meas), `FREQ BAND [xx-xxGHz]`). Check again to see if the specified range of the frequency band matches with the carrier signal frequency. Generally, if the DUT does not generate the carrier signal, the error message, CAUTION: Insufficient RF Level, appears first. As shown in this example, if another error message has been displayed already, this error message does not appear even if you execute the signal search.

131 **NO STATE/DATA FILES ON DISK**

There are no files with extensions ("_D" or "_S" for LIF format, or "STA" or ".DTA" for DOS format) on the flexible disk.

134 **NO STATE/DATA FILES ON MEMORY**

There are no files with extensions ("_D" or "_S" for LIF format, or ".STA" or ".DTA" for DOS format) in the RAM disk memory.

30 **NO VALID MEMORY STORED**

Indicates that you tried to display memory trace/data when there was no measurement data stored in memory.

0 **(No error)**

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the *CLS command.

55 **Noise Overload**

The noise level during a C/N ratio measurement or a phase noise measurement is too large.

This is caused by either the DUT's noise level being too large or by the DUT's spurious component being too large in the measurement range. Verify the spectrum of the DUT's output signal.

91 **NOT ENOUGH DATA**

The amount of data sent to the 4352B is less than that expected when the data transfer format is binary.

−120 **Numeric data error**

This error, as well as errors −121 through −129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This error message might be displayed if the 4352B detects an unknown problem.

−128 **Numeric data not allowed**

A legal numeric data element was received, but the 4352B does not accept it in this position for a header.

−220 **Parameter error**

Indicates that a program data element related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to −221 through −229.

−108 **Parameter not allowed**

More parameters were received than expected for the header. For example, the `*SRE` command only accepts one parameter, so receiving `*SRE 4,16` is not allowed.

75 **POWER FAILED ON *nnn***

Serious error. Contact your nearest Agilent Technologies office. One or more power supply failed. where *nnn* is one of `−5 V`, `−15 V`, `+5 V`, `+15 V`, `+65 V`, and `PostRegHot`. It shows which power line failed. When this error occurs, the system halts so an external controller cannot read this error using GPIB.

22 **PRINTER:not on, not connected, out of paper**

The printer does not respond to control. Verify power to the printer, and check the interface connection between the analyzer and the printer.

−284 **Program currently running**

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

−280 **Program error**

Indicates that a downloaded program-related execution error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −281 through −289.

Error Messages (Alphabetical Order)

−112 **Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

−286 **Program runtime error**

A program runtime error of the HP instrument BASIC has occurred. To get more specific error information, use the `ERRM$` or `ERRN` command (HP instrument BASIC).

−285 **Program syntax error**

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

−350 **Queue overflow**

A specific code entered into the queue instead of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

−400 **Query error**

This is the generic query error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

−410 **Query INTERRUPTED**

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by `DAB` or `GET` before a response was completely sent.

−420 **Query UNTERMINATED**

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the 4352B was addressed to talk and an incomplete program message was received by the controller.

129 **RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the 4352B to be PRESET.

49 **RF Freq Out Of Range**

The DUT's output frequency is not within the measurement range of the 4352B (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Down Converter Unit).).

Verify the DUT's output frequency.

58 **RF Input Over Trans Max Freq**

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was beyond the highest possible measurement frequency.

Note, however, that "`RF Input Under Trans Min Freq`" (message No.: 57) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press Sense Range, MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

57 RF Input Under Trans Min Freq

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was below the lowest possible measurement frequency.

Note, however, that "RF Input Under Trans Max Freq" (message No.: 58) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press Sense Range, MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

78 RF Level Overload

The input level to the 4352B RF IN connector is too high (+20 dBm or more).

Verify the input level to the 4352B RF IN connector. Also, this message is displayed if a negative DC voltage component is included in the DUT's output signal during RF Power Level measurement. In this case, insert a filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the DC voltage component.

Caution Continuously applying excessive input to the 4352B will cause failures.

128 SAVE ERROR

A serious error occurred when the file was being saved.

For example, this is displayed when the disk surface is physically damaged.

27 SG:not on, not connect, wrong address

Indicates that the external signal generator did not respond when the 4352B tried to control the external signal generator via GPIB.

Verify the external signal generator is turned ON, the GPIB cable connection is proper, the GPIB address setting for the external signal generator is proper, etc.

−330 Self-test failed

The self test failed. Either contact our service office, or see the *Service Manual*.

47 Set Noise ATT 10 dB More

Press Sense Range, NOISE ATTN, and the entry keys to set a value 10 dB higher than the current setting.

Error Messages (Alphabetical Order)

41 Set RF ATT 5 dB Less

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB lower than the current setting.

42 Set RF ATT 5 dB More

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB higher than the current setting.

−221 Settings conflict

A legal program data element was parsed but could not be executed due to the current device state (See IEEE 488.2, 6.4.5.3, and 11.5.1.1.5.).

−150 String data error

This error, as well as errors −151 and −158, are generated when analyzing the syntax of a string data element. This error message might be displayed if the 4352B detects an unknown problem.

−158 String data not allowed

A string data element was encountered but was not allowed by the 4352B at this point in parsing.

−130 Suffix error

This error, as well as errors −131 through −139, are generated when parsing a suffix. This error message might be displayed if the 4352B detects an unknown problem.

−138 Suffix not allowed

A suffix was encountered after a numeric element that does not allow suffixes.

−134 Suffix too long

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

−102 Syntax error

An unrecognized command or data type was encountered. For example, a string was received when the 4352B was not expecting to receive a string.

−310 System error

Some error, termed "system error" by the 4352B, has occurred.

59 Target Freq Out Of Range

Indicates the 2nd or 3rd harmonic target frequency is not within the 4352B measurement range (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Down Converter Unit).)) when 2xCARR → CENTER or 3 x CARR → CENTER is selected in spectrum measurements.

At this time, the previous measurement conditions still remain (any of the sweep parameters (start, stop, center, or span values) are not changed).

Check the DUT's output frequency.

82 Thermometer Out Of Range

The 4352B's internal thermometer reading is out of the proper range.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

−124 Too many digits

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

−223 Too much data

A legal program data element of block, expression, or string type was received that contained more data than the 4352B could handle due to memory or related device-specific requirements.

−210 Trigger error

A trigger related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −211 through −219.

−211 Trigger ignored

A GET, `*TRG`, or triggering signal was received and recognized by the 4352B but was ignored because of the 4352B timing considerations. For example, the 4352B was not ready to respond.

−113 Undefined header

The header is syntactically correct, but it is undefined for the 4352B. For example, `*XYZ` is not defined for the 4352B.

160 WRONG I/O PORT DIRECTION

The direction setting for the I/O port (input or output) is incorrect.

Verify that a signal from an external instrument is being sent to an input port, and a signal from an output port is being sent to an external instrument.

79 X-tal PLL Unlocked (40 MHz)

The 4352B's internal PLL cannot be locked.

Verify the reference frequency input to the EXT REF input connector on the 4352B rear panel is 10 MHz ± 100 Hz.

80 X-tal PLL Unlocked (85.6 MHz)

The 4352B's internal PLL cannot be locked.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

Error Messages in Numerical Order

Note The positive number error messages are listed first, and then negative number error messages are listed.

0 **(No error)**

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the *CLS command.

13 **BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. Wait until the battery is re-charged (approximately 10 minutes after turning the 4352B on).

22 **PRINTER:not on, not connected, out of paper**

The printer does not respond to control. Verify power to the printer, and check the interface connection between the analyzer and the printer.

27 **SG:not on, not connect, wrong address**

Indicates that the external signal generator did not respond when the 4352B tried to control the external signal generator via GPIB.

Verify the external signal generator is turned ON, the GPIB cable connection is proper, the GPIB address setting for the external signal generator is proper, etc.

30 **NO VALID MEMORY STORED**

Indicates that you tried to display the memory trace/data when there was no measurement data stored in memory.

Note Messages with error numbers 40~82 are related to measurement.

40 **Insufficient RF Level**

The input level to the 4352B RF IN connector is too low (less than −20 dBm).

Verify that the DUT is correctly connected to the 4352B. Also, verify that the power/control voltage output is turned ON on the LCD information (the measurement setting parameter display or the status notations). If it is turned OFF, press [DC Power] or [DC Control], and press OUTPUT ON off.

Also, this message is displayed if a positive DC voltage component (TTL output, etc.) is included in the DUT's output signal. In this case, insert a high-pass filter to sufficiently eliminate the positive DC voltage component.

41 **Set RF ATT 5 dB Less**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB lower than the current setting.

42 **Set RF ATT 5 dB More**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB higher than the current setting.

43 **F-V Input Underflow**

The input frequency to the 4352B's F-V converter is too low.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

44 **F-V Input Overflow**

The input frequency to the 4352B's F-V converter is too high.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

45 **1st IF Out Of Range**

The 4352B's 1st IF frequency is outside of the proper range.

Possible problems and the corrective action are shown below:

- The frequency of the external signal generator is not correct.
  The 4352B has not performed automatic control of the external signal generator via GPIB (LO CONTROL MAN and/or ADDRESSABLE ONLY is selected). Verify the frequency of the external signal generator.
- The actual time required for the stabilization of the output frequency from the external signal generator after changing the output frequency exceeds the specified wait time in LOCAL SWTCH TIME.

  Press (RF/LO), LOCAL SWTCH TIME, and the entry keys to increase the 4352B's wait time.
- The DUT output frequency fluctuated largely in a very short time (several hundred kHz in several tens of ms)
  Verify the DUT's frequency stability.
- The automatic frequency control function was ON and the target frequency was 50 MHz or less.
  Set the acceptable frequency deviation to 4% or less of the target frequency.

47 **Set Noise ATT 10 dB More**

Press (Sense Range), NOISE ATTN, and the entry keys to set a value 10 dB higher than the current setting.

48 **AFC Out Of Loop**

The automatic frequency control function could not follow the fluctuation in the measurement condition, and did not converge on the target frequency.

Possible causes and countermeasures are shown below:

- The tuning sensitivity is improperly set.
  Press (Menu), AUTO FREQ CONTROL , SENSITIVITY , and the entry keys to specify a proper tuning sensitivity (the unit is [Hz/V]).
- The maximum value of the control voltage is too small.
  Press (Menu), AUTO FREQ CONTROL , MAX CTRL VOLTAGE , and the entry keys to specify a maximum value larger than the current setting. *Be careful not to set a value that exceeds the DUT's maximum acceptable value.*
- The math/measurement repeat count is too low.
  Press (Menu), AUTO FREQ CONTROL , MAX ITERATION , and the entry keys to specify a value larger than the current setting.
- An effect of the high value capacitor included with the DUT's power voltage (V_{cc}) terminal.
  Press (Menu), AUTO FREQ CONTROL , CTRL DELAY , and the entry keys to specify a value larger than the current setting.

49 RF Freq Out Of Range

The DUT's output frequency is not within the measurement range of the 4352B (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Down Converter Unit).).

Verify the DUT's output frequency.

50 Invalid Dev Cal

The correction coefficient of the FM deviation calibration is not proper.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

51 Calibration Aborted

The FM deviation calibration in progress was aborted. This is probably caused by changing the measurement parameters during the FM deviation calibration.

Perform the FM deviation calibration again.

52 DC Output On Required in AFC

The automatic frequency control function was set on, however, power or control voltage is not being applied to the DUT.

Verify that the power/control voltages output is set to ON on the LCD information (the measurement setting parameter display or the status notations). If the power/control voltage output is turned OFF, press (DC Power) or (DC Control), and OUTPUT ON off .

53 FM Deviation Range Overload

The DUT's FM deviation is out of the measurement range.

Press (Sense Range), FM DEV RANGE , and select a measurement range larger than the current setting. (FM deviation over 200 kHz cannot be measured.)

54 Carrier Overload

The carrier level in a C/N ratio measurement or a phase noise measurement is too large.

The 4352B RF IN connector's input level is too large. Verify the input level to the 4352B RF IN connector.

55 Noise Overload

The noise level during a C/N ratio measurement or a phase noise measurement is too large.

This is caused by either the DUT's noise level being too large or by the DUT's spurious component being too large in the measurement range. Verify the spectrum of the DUT's output signal.

57 RF Input Under Trans Min Freq

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was below the lowest possible measurement frequency.

Note, however, that "`RF Input Under Trans Max Freq`" (message No.: 58) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), `MAX TRANS FREQ` or `MIN TRANS FREQ`, and the entry keys to change the detection bandwidth, if required.

58 RF Input Over Trans Max Freq

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was beyond the highest possible measurement frequency.

Note, however, that "`RF Input Under Trans Min Freq`" (message No.: 57) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), `MAX TRANS FREQ` or `MIN TRANS FREQ`, and the entry keys to change the detection bandwidth, if required.

59 Target Freq Out Of Range

Indicates the 2nd or 3rd harmonic target frequency is not within the 4352B measurement range (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Down Converter Unit).)) when `2xCARR → CENTER` or `3 x CARR → CENTER` is selected in spectrum measurements.

At this time, the previous measurement conditions still remain (any of the sweep parameters (start, stop, center, or span values) are not changed).

Check the DUT's output frequency.

Error Messages (Numerical Order)

61 No Downconverter Unit Connected

This message appears in the following cases.

- When you try to set DOWNCONV on OFF to ON with the 43521A (Down Converter Unit) disconnected.
- When you try to set DOWNCONV on OFF to ON with the 43521A turned off.
- When you turn off the 43521A with DOWNCONV ON off set to ON.
- When you recall the setting to use the 43521A with DOWNCONV on OFF set to OFF.

Connect the 43521A correctly, and turn on the power. Notice that, if DOWNCONV on OFF is OFF, you cannot recall the setting to use the 43521A.

62 Correction Data Lost in Downconverter Unit

The correction data in the EEPROM of the 43521A (Down Converter Unit) is lost. You cannot use the product. Repair the faulty hardware.

63 Can't Use 12-Bit I/O Port

This message appears if you execute an IBASIC or GPIB command to operate the 12-Bit I/O Port with DOWNCONV ON off set to ON. If DOWNCONV ON off is set to ON, the 12-Bit I/O Port is connected to the 43521A. Therefore, you cannot use this kind of commands.

64 Command Ignored - Invalid Freq Band

This message appears if you execute the TRMIN or TRMAX GPIB command when DOWNCONV ON off is set to ON and a frequency band other than 10 MHz to 3 GHz (high frequency band) is selected. The command is ignored. The TRMIN and TRMAX commands are available only in the following cases:

- When you use the 4352B alone (not connecting it to the 43521A)
- When you connect the 4352B and the 43521A (Down Converter Unit), set DOWNCONV ON off to ON, and set the frequency band to 10 MHz to 3 GHz.

65 No Downconverter RF Output; Do Signal Search

This message appears when RF OUT of the 43521A (Down Converter Unit) outputs no signal because the frequency setting of the external signal source is inappropriate. Set a correct nominal frequency ((Meas), FREQ BAND [xx-xx] , NOMINAL FREQ), or execute the signal search ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)) to set the nominal frequency to the 4352B. The oscillation frequency of the external signal source is adjusted properly.

66 No Signal Found

This message appears when the carrier signal cannot be found out in the signal search function ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)). The frequency of the carrier signal may not be within the specified frequency band ((Meas), FREQ BAND [xx-xxGHz]). Check again to see if the specified range of the frequency band matches with the carrier signal frequency. Generally, if the DUT does not generate the carrier signal, the error message, CAUTION: Insufficient RF Level, appears first. As shown in this example, if another error message has been displayed already, this error message does not appear even if you execute the signal search.

70 A/D Overload

The input level to the 4352B's internal A/D converter is too large.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

71 A/D Overload in Downconverter Unit

An overflow occurred in the A/D converter of the 43521A (Down Converter Unit). If this error occurs often, the 43521A may be at fault and need repair. Contact our service office or the company from which you purchased this instrument.

75 POWER FAILED ON *nnn*

Serious error. Contact your nearest Agilent Technologies office. One or more power supply failed. where *nnn* is one of `−5 V`, `−15 V`, `+5 V`, `+15 V`, `+65 V`, and `PostRegHot`. It shows which power line failed. When this error occurs, the system halts so an external controller cannot read this error using GPIB.

76 DC Power Current Overload

The current through the DC POWER connector is too large (50 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's power current is too large.
  Verify that the DUT is correctly connected to the 4352B.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal.
  This is a transient error. Wait until the DC POWER voltage is stabilized, then perform the measurement.

77 DC Control Current Overload

The current through the DC CONTROL connector is too large (20 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's control current is too large.
  Verify that the DUT is correctly connected to the 4352B RF IN connector.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal.
  This is a transient error. Press [DC Control], `CTRL DELAY`, and the entry keys to set a sufficiently large value for elimination of this transient error.

78 RF Level Overload

The input level to the 4352B RF IN connector is too high (+20 dBm or more).

Verify the input level to the 4352B RF IN connector. Also, this message is displayed if a negative DC voltage component is included in the DUT's output signal during RF Power Level measurement. In this case, insert a filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the DC voltage component.

Caution Continuously applying excessive input to the 4352B will cause failures.

79 **X-tal PLL Unlocked (40 MHz)**

The 4352B's internal PLL cannot be locked.

Verify the reference frequency input to the EXT REF input connector on the 4352B rear panel is 10 MHz ± 100 Hz.

80 **X-tal PLL Unlocked (85.6 MHz)**

The 4352B's internal PLL cannot be locked.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

81 **2nd PLL Unlocked**

The 4352B's internal 2nd PLL cannot be locked. If this message is displayed during a C/N ratio measurement or a phase noise measurement, the following problems and the corrective action are shown below.

- The DUT's noise level is too large, or a large level spurious component exists in the measurement range.
  Verify the spectrum of the DUT's output signal.
- The DUT's output signal is being modulated in frequency.
  Press (Mod), MOD OUT on OFF to stop the frequency modulation.
- In the case of a DUT with an oscillation frequency of 100 MHz or less, a large harmonics component is included in the output signal (effect of TTL output, etc.).

  Insert a low-pass filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the harmonics component.

If this message is displayed any time other than during a C/N measurement, adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

82 **Thermometer Out Of Range**

The 4352B's internal thermometer reading is out of the proper range.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

90 **TOO MUCH DATA**

The amount of binary data, sent to this instrument in the FORM2, FORM3, or FORM5 data transfer format, is too much. Or, the number of data items exceeds the number of display points.

91 **NOT ENOUGH DATA**

The amount of data sent to the 4352B is less than that expected when the data transfer format is binary.

100 **CAN'T CHANGE- ANOTHER CONTROLLER ON BUS**

The 4352B cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See the *4352B Programming Guide*.

102 **ANALYZER TYPE MISMATCH**

Indicates the invalid function was selected in the present measurement item. Change the measurement item, or select the different function.

111 **NO DATA TRACE**

Indicates that MKR ON [DATA] was pressed when no data trace is displayed.

112 **NO MEMORY TRACE**

Indicates that MKR ON [MEMORY] was selected when no memory trace is displayed.

113 **NO MARKER DELTA - SPAN NOT SET**

Indicates that MKRΔ→SPAN was selected when the Δmarker is not displayed.

114 **NO MARKER DELTA - RANGE NOT SET**

Indicates that MKRΔ→SEARCH RNG was selected when the Δmarker is not turned on.

116 **NO ACTIVE MARKER**

Indicates that the Marker→ function was executed when no marker is activated. Press (Menu) MARKER to activate a marker.

118 **NO FIXED DELTA MARKER**

The fixed Δmarker was not turned on. Be sure to turn the fixed Δmarker on before using FIXED ΔMKR VALUE or FIXED ΔMKR AUX VALUE.

128 **SAVE ERROR**

A serious error occurred when the file was being saved.

For example, this message is displayed when the disk surface is physically damaged.

129 **RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the 4352B to be PRESET.

130 **INVALID FILE NAME**

The file name for the RECALL, PURGE, or RE-SAVE function must have a "_D" or "_S" extension for LIF format.

131 **NO STATE/DATA FILES ON DISK**

There are no files with extensions ("_D" or "_S" for LIF format, or "STA" or ".DTA" for DOS format) on the flexible disk.

132 **CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS**

If you attempt to save graphics when a print is in progress, this error message is displayed.

Wait until print is completed, then save the graphics again.

133 **LIF-DOS COPY NOT ALLOWED**

Indicates that you tried to copy a file between different formatted disks.

For example, if you try to copy a file between the RAM disk and the flexible disk when the format of the RAM disk is different from the format of the flexible disk, this message is displayed.

134 **NO STATE/DATA FILES ON MEMORY**

There are no files with extensions ("_D" or "_S" for LIF format, or ".STA" or ".DTA" for DOS format) in the RAM disk memory.

135 **DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use a different extension name.

137 **NO DATA TRACE DISPLAYED**

Indicates that SCALE FOR [DATA] was pressed when no data trace is displayed.

138 **NO MEMORY TRACE DISPLAYED**

Indicates that SCALE FOR [MEMORY] was selected when no memory trace is displayed.

144 **CAN'T CHANGE NUMBER OF POINTS**

The number of points in the spectrum measurement cannot be to change manually, except in zero span.

159 **INSUFFICIENT Memory**

If a lot of tasks are executed at the same time, memory might be insufficient for a while. (For example, running HP instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are requested at the same time.) Wait until finishing some tasks then execute the next task.

160 **WRONG I/O PORT DIRECTION**

The direction setting for the I/O port (input or output) is incorrect.

Verify that a signal from an external instrument is being sent to an input port, and a signal from an output port is being sent to an external instrument.

171 **INVALID DATE**

The date entered to set the real time clock is invalid. Re-enter the correct date.

Note The messages with negative numbers shown below are for errors that occur when the 4352B is being controlled with GPIB commands over the GPIB.

−100 **Command error**

This is a generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

−101 **Invalid character**

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (`SING&`).

−102 **Syntax error**

An unrecognized command or data type was encountered. For example, a string was received when the 4352B was not expecting to receive a string.

−103 **Invalid separator**

The parser was expecting a separator and encountered an illegal character (semicolon (;), comma (,), etc.).

−104 **Data type error**

The parser recognized a data element that is not allowed. For example, a numeric or string data was expected but block data was encountered.

−105 **GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

−108 **Parameter not allowed**

More parameters were received than expected for the header. For example, the `*SRE` command only accepts one parameter, so receiving `*SRE 4,16` is not allowed.

−109 **Missing parameter**

Fewer parameters were received than required for the header.

−110 **Command header error**

An error was detected in the header. This error message might be displayed if the 4352B detects an unknown problem related to errors −111 through −119.

−111 **Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus `*SRE4` is an error.

−112 **Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

−113 **Undefined header**

The header is syntactically correct, but it is undefined for the 4352B. For example, `*XYZ` is not defined for the 4352B.

Error Messages (Numerical Order)

−114 **Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

−120 **Numeric data error**

This error, as well as errors −121 through −129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This error message might be displayed if the 4352B detects an unknown problem.

−121 **Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a “9” in octal data.

−123 **Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

−124 **Too many digits**

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

−128 **Numeric data not allowed**

A legal numeric data element was received, but the 4352B does not accept it in this position for a header.

−130 **Suffix error**

This error, as well as errors −131 through −139, are generated when parsing a suffix. This error message might be displayed if the 4352B detects an unknown problem.

−131 **Invalid suffix**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the 4352B.

−134 **Suffix too long**

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

−138 **Suffix not allowed**

A suffix was encountered after a numeric element that does not allow suffixes.

−140 **Character data error**

This error, as well as errors −141 through −148, are generated when analyzing the syntax of a character data element. This error message might be displayed if the 4352B detects an unknown problem.

−141 **Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

−144 Character data too long

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

−148 Character data not allowed

A legal character data element was encountered where prohibited by the 4352B.

−150 String data error

This error, as well as errors −151 and −158, are generated when analyzing the syntax of a string data element. This error message might be displayed if the 4352B detects an unknown problem.

−151 Invalid string data

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an `END` message was received before the terminal quote character.

−158 String data not allowed

A string data element was encountered but was not allowed by the 4352B at this point in parsing.

−160 Block data error

The 4352B detected the invalid syntax of a block data element.

−161 Invalid block data

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an `END` message was received before the length was satisfied.

−168 Block data not allowed

A legal block data element was encountered but was not allowed by the 4352B at this point in parsing.

−200 Execution error

This is the generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

−210 Trigger error

A trigger related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −211 through −219.

−211 Trigger ignored

A GET, `*TRG`, or triggering signal was received and recognized by the 4352B but was ignored because of the 4352B timing considerations. For example, the 4352B was not ready to respond.

−213 Init ignored

A request for a measurement initiation was ignored as another measurement was already in progress.

−220 **Parameter error**

Indicates that a program data element related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to −221 through −229.

−221 **Settings conflict**

A legal program data element was parsed but could not be executed due to the current device state (See IEEE 488.2, 6.4.5.3, and 11.5.1.1.5.).

−222 **Data out of range**

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the 4352B (see IEEE 488.2, 11.5.1.1.5).

−223 **Too much data**

A legal program data element of block, expression, or string type was received that contained more data than the 4352B could handle due to memory or related device-specific requirements.

−224 **Illegal parameter value**

Used where exact value, from a list of possibilities, was expected.

−225 **Data out of memory**

The 4352B has insufficient memory to perform the requested operation.

−230 **Data corrupt or stale**

Possibly invalid data. New reading started but not completed since last access.

−231 **Data questionable**

Indicates that the measurement accuracy is suspect.

−240 **Hardware error**

Indicates that a legal program command or query could not be executed because of a hardware problem in the 4352B. Definition of what constitutes a hard ware problem is completely device-specific. This error message might be displayed if the 4352B detects an unknown problem related to errors −241 through −249.

−241 **Hardware missing**

A legal program command or query could not be executed because of missing 4352B hardware. For example, an option was not installed.

−250 **Mass Storage Error**

Indicates that a mass storage error occurred. This error message might be displayed if the 4352B detects an unknown problem related to error −257.

−257 **File Name Error**

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

−280 **Program error**

Indicates that a downloaded program-related execution error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −281 through −289.

−281 **Cannot create program**

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

−282 **Illegal program name**

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

−283 **Illegal variable name**

An attempt was made to reference a nonexistent variable in a program.

−284 **Program currently running**

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

−285 **Program syntax error**

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

−286 **Program runtime error**

A program runtime error of the HP instrument BASIC has occurred. To get more specific error information, use the `ERRM$` or `ERRN` command (HP instrument BASIC).

−310 **System error**

Some error, termed "system error" by the 4352B, has occurred.

−311 **Memory error**

An error was detected in the 4352B's memory.

−330 **Self-test failed**

The self test failed. Either contact our service office, or see the *Service Manual*.

−350 **Queue overflow**

A specific code entered into the queue instead of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

−400 **Query error**

This is the generic query error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

−410 Query INTERRUPTED

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by DAB or GET before a response was completely sent.

−420 Query UNTERMINATED

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the 4352B was addressed to talk and an incomplete program message was received by the controller.

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