Errata

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HP References in this Manual

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HP 8791 Model 200

Radar Simulator ID 2.0 Remote Operation Reference

HEWLETT PACKARD

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Introduction

Purpose of This Manual

This manual provides complete descriptions and definitions of all the HP 8791 Model 200 Radar Simulator Instrument-on-a-Disk (RSID) capabilities for remote operation.

Remote operation consists of using an external controller to control the HP Frequency Agile Signal Simulator (HP FASS) system over the Hewlett-Packard Interface Bus (HP-IB). From the external controller, the system is treated as a single instrument, just as the system is controlled as a single instrument using the front panel in local operation.

The information in this manual is intended for the system operator or the test engineer who uses the HP FASS system in remote mode.

Manual Contents

The following information is contained in this manual:

- Chapter 1, "Introduction," provides instructions for using HP FASS with an external controller. Also included are the HP FASS system's talking and listening syntax requirements.
- Chapter 2, "Status Reporting," describes the HP FASS system's status reporting features available over HP-IB, including serial and parallel poll.
- Chapter 3, "HP-IB Command Overview," provides a hierarchical command tree and tables summarizing the HP-IB commands by subsystem. Also included is a flowchart showing a typical programming sequence.

- Chapter 4, "Common Commands," describes the RSID HP-IB commands that are defined by IEEE Standard 488.2. Included in this chapter is the reset command (*RST).
- Chapters 5 through 18 describe each of the subsystems available to RSID over the HP-IB.
- Appendix A, "General HP-IB Information," contains additional information about interface functions and bus commands that are applicable to HP FASS.
- Appendix B, "Front and Rear Panel Features," describes the front and rear panel features of the Smart Interface, the MDS (Modulation Data Source), the ACS (Agile Carrier Synthesizer), and the AUC (Agile Upconverter).
- "Error Messages"
- Index

Assumptions

This manual assumes the system is correctly installed and operating. If this is not true, see the *HP 8791 FASS System Service Manual* for the information required to install or repair the system. Installation procedures are also provided in the *RSID 2.0 Getting Started Guide.*

This manual also assumes you are somewhat familiar with the local operation of the system. See the *Radar Simulator ID Local Operation Reference Manual* for information about local operation.

RSID 2.0 Upgrade

The feature set of RSID 2.0 is almost identical to previous versions of RSID. The main change is that RSID can now be used with SID 2.0 and WGL on the Smart Interface. WGL can be used to create user patterns for RSID and to modify RSID signals.

Note

RSID waveform creation is done using WGL. This means that when you leave WGL to use RSID, the contents of the WGL stack and waveform registers will be altered.

Fixes

RSID 2.0 implements the following fixes:

- FM data is scaled when using an external clock.

  In previous versions of RSID, FM data was not scaled when using an external clock, although the carrier frequency was properly scaled.

- The HP-IB command to enable antenna scan modulation uses the correct sense (0 disables modulation, 1 enables modulation).

  In previous versions of RSID, the HP-IB command to enable antenna scan modulation had its sense reversed.

  :SOUR:AMOD:SCAN:MOD OFF (or 0) enabled modulation.

  :SOUR:AMOD:SCAN:MOD ON (or 1) disabled modulation.

ID Settings

RSID 2.0 will be able to use ID settings from previous versions of RSID. However, RSID 2.0 ID settings cannot be used with previous versions of RSID.

Interfacing HP FASS to a Controller

Interfacing HP FASS to a controller consists of connecting an external controller and setting the HP-IB address for HP FASS.

Connecting an External Controller

A 4-meter HP-IB cable is already attached to the Smart Interface. When you open the rear door of the rack, this cable is coiled on the right side. Cut the tie wraps and put the cable through the hole on either side of the rack. Connect the cable to an external controller.

If the cable has been disconnected, reconnect it to the HP-IB port on the right side of the Smart Interface rear panel. See appendix B for a drawing of the Smart Interface rear panel.

Setting the System HP-IB Address

The system HP-IB address is set from Options menu on the front panel. When the system is shipped from the factory, the HP-IB address is set to 19.

To change the HP-IB address:

1. On the front panel, select the HP-IB Address command from the Options Menu.
2. Enter the new HP-IB address (a number from 0 to 30) in the dialog box and select OK.

The HP-IB addresses of the instruments in the system must be set as follows in order for the system to work:

- AMUC HP-IB address = 14.
- AUC HP-IB address = 15.
- ACS HP-IB address = 16.
- MDS HP-IB address = 17.

The HP-IB address for each instrument is set by a DIP switch on its rear panel.

If you ordered HP FASS without the keyboard, monitor, and mouse, you can set the HP FASS system HP-IB address over the HP-IB with special function 41.1. Note that setting the HP-IB address over the HP-IB is in violation of IEEE Standard 488.1.

To set the address over the HP-IB, send HP FASS the following commands:

```
OUTPUT 719; ":SID:SPEC 41.1, <address>"
WAIT 5
```

where <*address*> is an integer between 0 and 30.

After changing the address over the HP-IB, the system returns to local mode. The WAIT statement ensures that the address change has been executed and the system is ready to accept HP-IB commands at the new address.

The system powers up to the address it was at the last time the system was shutdown. To ensure that the address remains changed the next time the system is powered up, issue the following command before turning off the power.

```
OUTPUT <new address>; ":SID:SHUT"
```

Reset (*RST) has no effect on the HP-IB address.

Initialization

To make sure the bus and all appropriate interfaces are in a known state, begin every program with an initialize statement. For example, to initialize the interface of the system:

```
CLEAR 719
```

To set the system to its default state:

```
OUTPUT 719; "*RST"
```

Note

Refer to your controller manual and programming language reference manual for information on initializing your interface.

The *RST command is discussed in detail in chapter 3, "Common Commands."

Remote Mode

Remote-Only Capabilities

Many system capabilities are available only in remote mode. These capabilities include status reporting, loading data directly into the HP FASS memories from SID, using dynamic data and dynamic sequence modes, and synchronizing two HP FASS systems. Most of these additional capabilities are discussed in chapter 2, "Common Commands," chapter 7, "FASS Subsystem," and chapter 15, "Synchronization Subsystem."

Local Mode versus Remote Mode

In local mode, you are only allowed to enter valid parameters. The front panel displays a message if you try to enter data that is out of range. The front panel also displays any additional parameters that you must enter for a particular function. In remote mode, you must provide a lot of the intelligence that is designed into the front panel. This information is provided in chapter 3, Command Overview, and the flowchart at the beginning of each subsystem (where applicable).

Local-Only Capabilities

Most of the system capabilities that are available in local operation are also available for remote operation. The following capabilities are available only in local operation:

- Storing hardware images, ID settings, and user patterns to a flexible disk in the Smart Interface.
- Pull-down menu commands on the File, Edit, and Window menus.

Accessing local-only capabilities requires a keyboard, monitor, and mouse.

Local-to-Remote Changes

HP FASS always powers up in local mode. HP FASS enters remote mode when it is addressed to listen or when it receives the Remote message.

Examples:

```
OUTPUT 719; "*RST"   addressing HP FASS to listen

REMOTE 719           sending the Remote message
```

Note

Refer to your controller manual and programming language reference manual for information on sending the Remote message.

When HP FASS goes from local to remote control, no settings are changed. If the system has a monitor, the following HP-IB Setup Message is displayed.

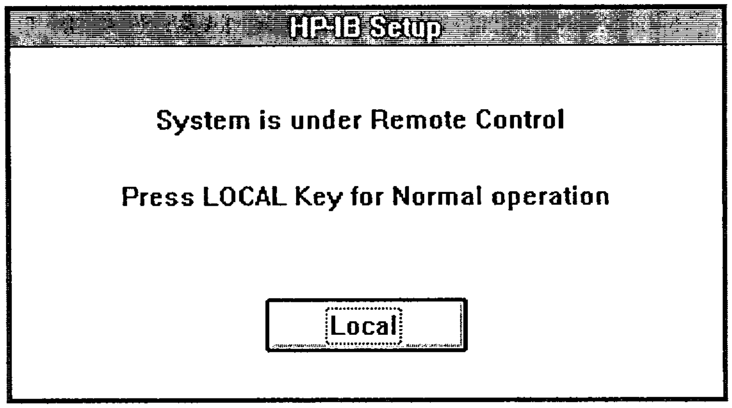


Figure 1-1. HP-IB Setup Message

Remote-to-Local Changes

Selecting LOCAL in the HP-IB Setup Message will return HP FASS to local control, unless HP FASS is in the Local Lockout state. No settings are changed. HP FASS returns to either the RSID Global Edit commands or the SID Control Panel, depending on the last command that was issued to HP FASS in remote mode. If the last command that was issued is a command that is common to all IDs, HP FASS returns to the SID Control Panel. If the last command issued to HP FASS is unique to RSID, HP FASS returns to the RSID Global Edit commands.

Local Lockout

Local Lockout prevents HP FASS from returning to local control from the front panel.

Example of setting Local Lockout:

```
LOCAL LOCKOUT 7
```

Local Lockout out is cleared by sending HP FASS the Local message over the HP-IB.

Example of clearing Local Lockout:

```
LOCAL 7
```

Note

Refer to your controller manual and programming language reference manual for information on sending the Local and Local Lockout messages.

Aborting Lengthy Commands

Under certain conditions, some commands can take a long time to process. You may want to abort a command before it is finished. The following examples show different ways to abort an HP-IB command. The example that has the least impact on the existing system state is listed first. Before using any of the examples, gain control of the controller by pausing the program or clearing the interface. A dedicated key (CLEAR I/O) clears the interface on HP 9000 Series 200 Controllers.

Begin by using the first example, and then use as many as needed to abort the command.

```
ABORT 7    !Minimum change, simply clears the
           !handshake lines. (ABORT message)

CLEAR 719  !The input and output buffers
           !are cleared, the parser is reset, and
           !any pending commands are cleared.
           !(Selective Device Clear message)

CLEAR 7    !The same actions are taken as with
           !CLEAR 719, except to all instruments
           !on interface select code 7.
           !(Device Clear message)

OUTPUT 719; "*RST"
           !HP FASS is reset to a pre-defined state.
```

Messages and Responses

Messages are groups of one or more HP-IB commands sent from a controller to HP FASS. They are sent to HP FASS over the system interface as a sequence of ASCII data messages. These messages are placed on the bus using an OUTPUT command, and passing the device address, program message, and terminator.

Responses are data sent from HP FASS to a controller in response to a query. (A query is a command followed by a question mark. It is used to find out how HP FASS is currently configured.) After receiving a query, HP FASS interrogates the requested function and places the answer in its HP-IB output queue. The output message remains in the queue until it is read or another command is issued. When read, the message is transmitted across the bus to the controller. You read the bus by using an ENTER command and passing the device address.

Note

The actual OUTPUT and ENTER commands you use when programming are dependent on the programming language you are using.

Sending Messages to HP FASS

The system is remotely programmed with HP-IB program commands or queries.

Command Types

A command is part of a valid message sent from a controller to HP FASS. It includes the command mnemonic, and any required parameters and punctuation. RSID HP-IB commands are divided into two types:

- Common Commands
- Subsystem Commands

Common Commands

The common commands are commands defined by IEEE Standard 488.2 and always begin with an asterisk. They are common to all instruments that conform to IEEE Standard 488.2. These commands generally deal with status reporting. See chapter 4, "Common Commands," for a complete description of each command.

Subsystem Commands

Subsystems are groups of commands that are organized into major categories. Each subsystem roughly corresponds to a functional block within HP FASS.

Subsystem commands are hierarchical. A subsystem command consists of two or more program mnemonics, with a colon separating each mnemonic. The colon specifies that the subsequent command is one level down in the hierarchy. (This is also referred to as a command tree.)

The exact mnemonics for subsystem commands are listed in chapters 4 through 18.

Command Parameter Types

Program data is used to convey a variety of types of parameter information related to the command mnemonic.

Decimal Numeric Data

HP FASS recognizes integers, real numbers, and scientific notation.

Examples of decimal numeric data:

```
256           decimal integer
103.45        decimal real
-1.234 E-3    scientific notation
```

If the system receives a number of a precision greater than it can handle, the system rounds the number rather than truncating it. When rounding, the system ignores the sign of the number and rounds up on values greater than or equal to one half and rounds down on values less than one half.

Suffixes. Suffixes, such as MHZ (megahertz) and US (microsecond), are allowed within this format. The suffix expresses the units and multipliers that can be used to interpret the data sent. If a suffix is not specified, HP FASS assumes that data is entered in fundamental units (that is, hertz, seconds, etc.)

Boolean. For commands that toggle on or off, HP FASS accepts either 1 or ON, and either 0 or OFF. Any non-zero numeric value is rounded to 1. When queried, boolean parameters always return 1 or 0, not ON or OFF.

Character Data

Character data is used to convey parameter information as short alpha or alphanumeric strings. Either upper or lower case letters can be used.

Examples of character data:

`:FASS:MEM AM`	`AM is the character data.`
`:TRIG:INIT FRUN`	`FRUN is the character data.`

String Data

String data is any set of 7-bit ASCII characters that is delimited by either the single quote character ' or the double quote character ". All examples in this manual use the single quote character.

Example of string data:

`PURG:FILE 'MYFILE'`	`'MYFILE' is the string data.`

Arbitrary Length Block Data

Arbitrary block data allows data to be transmitted to the system in 8-bit binary data bytes. Block data is particularly useful for sending large quantities of data. The syntax is #0 (a pound sign and a zero) followed by the actual data. Arbitrary length block data is terminated by <NL> and asserting EOI with the last data byte (also referred to as the END message).

Example of arbitrary length block data:

```
ASSIGN @Fmtoff to 719; FORMAT OFF
OUTPUT 719; ":FASS:DATA 'WAVE:(00000)',#0";
OUTPUT @Fmtoff; Mydata(*)
OUTPUT 719 USING "-,K";"",END

Mydata is the indefinite length block data.
```

Message Terminators

Program messages sent to HP FASS must be terminated by either a <NL> (new line or line feed character), EOI (end-or-identify) asserted, or a combination of the two. Asserting EOI sets the EOI control line low on the last byte of the data message. Both EOI and <NL> are required to terminate arbitrary length data.

Syntax Rules

- A blank space is required to separate a command mnemonic from its data.
- Use a comma to separate multiple data parameters in a command.
- Use a semicolon to separate program commands and queries from each other.
- In the command tree, use the last mnemonic in the compound header as a reference point. Then find the last colon above the mnemonic. Any command below that point can be sent within the current message without sending the mnemonics that appear above it.

The following examples are both syntactically correct and both produce the same results.

```
OUTPUT 719; ":SID:IMAG:LOAD; :SID:IMAG:REC 0"
  OUTPUT 719; ":SID:IMAG:LOAD; REC 0"
```

- Never leave a space after a colon.

Receiving Responses From HP FASS

HP FASS generates a response only when instructed to do so by a query.

Note

All results for queries sent in a program message must be read before another program message is sent. Sending another command before reading the result of the query will cause the output buffer to be cleared and the current response to be lost. This will also generate an error message.

Response Data

The format of the response data is determined by its content. The possible formats are numeric, character, string, block, and arbitrary ASCII. All responses are terminated with <NL> (new line or line feed) and EOI (end or identify) asserted with the last byte.

Numeric Response Data

Queries of status registers, system errors, boolean parameters (0 for off, 1 for on), and numeric parameters yield a numeric response. Numeric responses include all integer and floating point numbers in their base 10 representation.

Numeric data is always returned in fundamental units, such as hertz and seconds.

Character Response Data

Character responses are groups of upper-case ASCII letters and the underscore character. Character responses are encountered when querying the value of a command that uses a character data parameter.

String Response Data

String responses can contain any 7-bit ASCII character enclosed by double quote characters.

Indefinite Length Arbitrary Block Response Data

Block responses are used to transfer large blocks of data, such as reading data from the modulation memories. The format for an indefinite length block is #0 followed by 8-bit data bytes. <NL> and EOI end the block of data and also terminate the entire message. HP FASS will not send any more data until it receives another query. (The EOI line asserted while the new line or line feed character is being sent on the bus is often referred to as the END message.)

For most controllers and programming languages, block responses will require special programming to decode the header information and control the data transfer.

Arbitrary ASCII

Arbitrary ASCII responses can be used to send ASCII text as unformatted bytes. The response is terminated by <NL> and EOI.

Multiple Queries

You can send multiple queries to the system in a single program message, but you must also read them back within a single program message. This can be accomplished by either reading them back into a string variable or into multiple numeric variables.

Examples of reading back the result from the query OUTPUT 719; "*ESE?; *SRE?":

```
ENTER 719; A$       string variable

ENTER 719; A,B      multiple numeric variables
```

2

Status Reporting

Introduction

This chapter describes the HP FASS system's status reporting structure. The status reporting features that are available over the HP-IB include the serial and parallel polls. ANSI/IEEE Std 488.2-1987, *Codes, Formats, Protocols and Common Commands*, defines data structures, commands, and common commands for each. Figure 2-1 shows an overview of the status reporting structure.

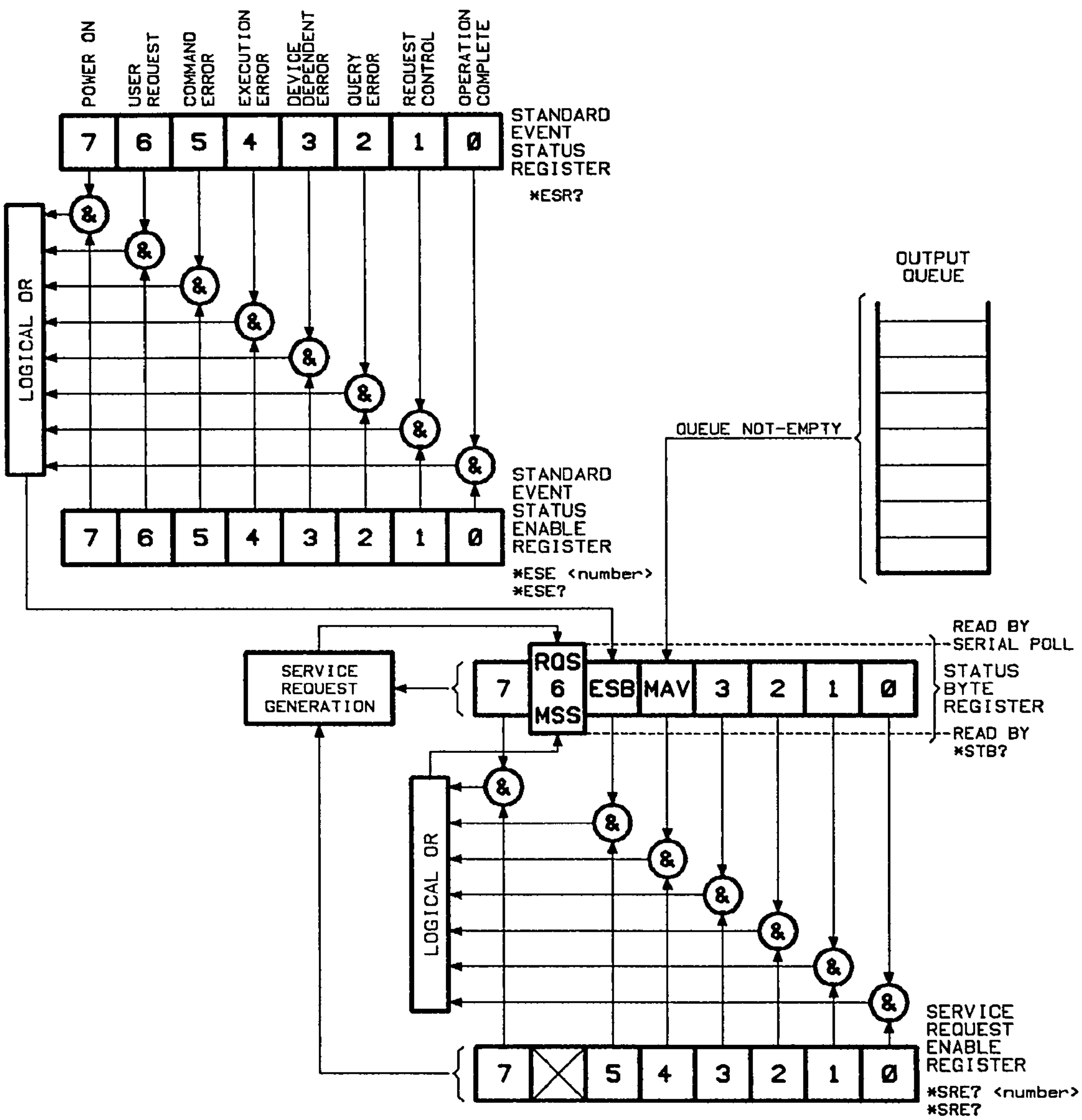


Figure 2-1. Status Reporting Data Structures

Status Byte Structures and Concepts

The bits in the Status Byte act as summary bits for the data structures residing behind them. In the case of the Output Queue, the summary bit is set if the queue is not empty. For registers, the summary bit is set if any enabled bit in the event register is set. The events are enabled by the corresponding event enable register. Events captured by an event register remain set until the register is read or cleared. Registers are read with their associated commands. The *CLS command clears all event registers but does not clear the Output Queue.

Status Byte Summary Bit Definitions

The Status Byte in HP FASS uses bits 4, 5, and 6.

MAV Summary Bit

Bit 4, the MAV (Message Available) summary bit, indicates whether there is a response in the Output Queue. Whenever HP FASS has data available to output, this bit will be set to 1.

ESB Summary Bit

Bit 5, the ESB (Event Summary Bit), indicates whether any of the conditions in the Standard Event Status Register are set and enabled.

The Standard Event Status Register is an 8-bit event register. The bits are defined in the following table.

Table 2-1. Standard Event Status Register

Bit	Name	Description
7	Power On	Indicates that the math accelerator boards in the Smart Interface (SI) have been reconfigured. The math accelerator boards are reconfigured whenever there is an off-to-on transition in the SI power supply or whenever application IDs are changed.
6	User Request	This bit will always be read as a zero.
5	Command Error	Indicates an error in the format or contents of a program message is detected.
4	Execution Error	Indicates the current command cannot be processed due to an out of range parameter or conflicting settings.
3	Device Dependent Error	Indicates HP FASS was unable to complete an operation for device dependent reasons.
2	Query Error	Indicates either an attempt was made to read the Output Queue when it was empty or output data has been lost.
1	Request Control	This bit will always be read as a zero.
0	Operation Complete	Indicates HP FASS has completed any pending operations and is ready to accept new commands. This bit is generated only in response to the *OPC command.

RQS and MSS Summary Bits

Bit 6 has two definitions: RQS (Request Service) and MSS (Master Summary Status). How the bit is defined depends on the method used to access the Status Byte.

The RQS bit indicates whether or not HP FASS is requesting service. This bit is returned during a serial poll. RQS will be set to 0 after being read by a serial poll.

The MSS bit indicates whether or not HP FASS has at least one reason for requesting service. This bit is read by *STB? (Status Byte Query). MSS is not cleared by *STB?.

Serial Poll

HP FASS supports the IEEE Standard 488.1 serial poll feature. Serial poll enables the controller to determine if the system requires service. When a serial poll of the system is performed, the RQS bit is returned on bit 6 of the Status Byte.

The following example shows how to conduct a serial poll of HP FASS.

```
Stat=SPOLL(719)
```

SPOLL is the HP BASIC command for serial poll. This command reads the contents of the HP-IB Status Byte Register into the variable called Stat.

For more information about serial poll, refer to your controller manual.

After the serial poll is completed, the RQS bit in the Status Byte Register will be reset to 0 if it was set. Other bits in the Status Byte Register remain set until the status is cleared with a *CLS command or the system is reset. Even if these bits are not reset, they cannot generate another service request.

Parallel Poll

Parallel poll is a controller initiated operation that is used to obtain information from several devices simultaneously. When a controller initiates a parallel poll, each device returns a status bit via one of the bus data lines (DIO1-8). Device DIO assignments are made by the controller using the PPC (Parallel Poll Configure) bus command. Devices respond either individually, each on a separate DIO line, collectively on a single DIO line, or any combination of these two ways. When responding collectively, the result is a logical AND (True High) or a logical OR (True Low) of the groups of the status bits.

Figure 2-2 shows the parallel poll data structure. The summary bit is sent to the controller in response to a parallel poll. The summary bit is the "ist" (Individual Status) local message.

The Parallel Poll Enable Register determines which events are summarized in the individual status bit. The *PRE (Parallel Poll Enable Register) command is used to write to the enable register and the *PRE? query is used to read the register. The *IST? query is used to read "ist" without doing a parallel poll.

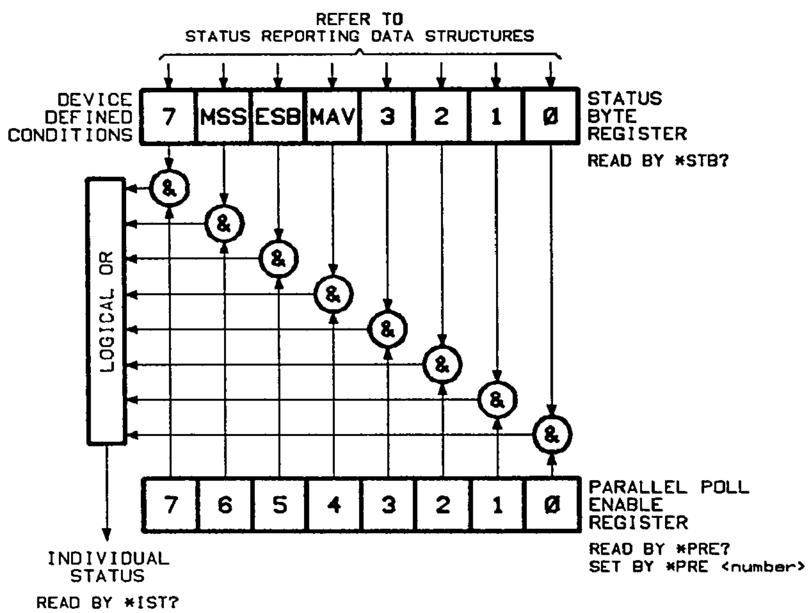


Figure 2-2. Parallel Poll Status Reporting

Polling HP-IB Devices

Parallel poll is the fastest means of gathering device status when several devices are connected to the bus. Each device with this capability can be programmed to respond with one bit of status when parallel polled. This makes it possible to obtain the status of several devices in one operation. If a device responds affirmatively to a parallel poll, more information about its specific status can be acquired by conducting a serial poll of the device.

Configuring Parallel Poll Responses

Certain devices, including HP FASS, can be remotely programmed by a controller to respond to a parallel poll. A device that is currently programmed for a parallel poll responds to the parallel poll by placing its current status on one of the bus data lines (DIO1-8). The response and the data-bit number can be programmed by the PPC (Parallel Poll Configure) bus command. Multiple listeners cannot be specified in this statement. If more than one device is to respond on a single bit, each device must be configured with a separate PPC bus command.

The following example shows how to configure a device to respond to a parallel poll.

```
PPOLL CONFIGURE 719; Mask
```

The value of Mask (any numeric expression can be specified) is first rounded and then used to configure the device's parallel poll response. The least significant 3 bits (bits 0 through 2) of the expression determine which data line the device responds on (place its status on). A value of 0 specifies DIO1; a value of 7 specifies DIO8. Bit 3 specifies the logical sense of the parallel poll response bit. For example, a value of 0 implies that the device's response is 0 when its Status Bit message is affirmative.

The following statement configures HP FASS to respond to a parallel poll by placing a 0 on bit 4 (DIO5) when its status response is affirmative.

```
PPOLL CONFIGURE 719;4
```

Conducting a Parallel Poll

The PPOLL (Parallel Poll) function returns a single byte containing up to 8 Status Bit messages for all devices on the bus capable of responding to the poll. Each bit returned by the function corresponds to the status bit of the devices configured to respond to the parallel poll. The PPOLL function can only be executed by the controller. It is initiated by the simultaneous assertion of ATN and EOI.

The following statement is an example of how a parallel poll is conducted.

```
Response = PPOLL(7) .
```

PPOLL is the HP BASIC command for parallel poll. This command reads the interface select code 7 status bits into the variable called Response.

Disabling Parallel Poll Responses

The PPU (Parallel Poll Unconfigure) bus command gives the controller the capability of disabling the parallel poll response of one or more devices on the bus.

For example, to disable HP FASS from responding to a parallel poll:

```
PPOLL UNCONFIGURE 719
```

To disable all devices on interface select code 7 from responding to a parallel poll:

```
PPOLL UNCONFIGURE 7
```

If no primary address is specified, all bus devices are disabled from responding to a parallel poll. If a primary address is specified, only the specified devices that have the parallel poll configure capability are disabled.

Status Reporting Commands

The following table describes HP-IB commands that are used to perform status reporting functions. See chapter 6, "Common Commands," for an in-depth description of each command.

Table 2-2.
Status Reporting Command Summary

Command	Description
*CLS	Clear Status Byte Register and Standard Event Status Register.
*ESE *number* *ESE?	Set Standard Event Status Enable Register. Read Standard Event Status Enable Register.
*ESR?	Read Standard Event Status Register.
*IST?	Read the individual status bit.
*OPC *OPC?	Set the operation complete bit. Read the status of the operation complete bit.
*PRE *number* *PRE?	Set the Parallel Poll Enable Register. Read the Parallel Poll Enable Register.
*SRE *number* *SRE?	Set the Service Request Enable Register. Read the Service Request Enable Register.
*STB?	Read the Status Byte Register.

3

Command Overview

Introduction

This chapter describes the types of RSID HP-IB commands and their relationship to each other. Tables at the end of this chapter summarize all HP-IB commands available for RSID.

The Command Tree

The command tree (figure 3-1) shows all of the commands in RSID and the relationship of the commands to each other. After a <NL> has been sent to HP FASS, the parser is set to the root of the command tree. (The parser is the component of HP FASS that interprets commands sent to the system and decides what actions should be taken.)

Command Types

The RSID HP-IB programming commands are divided into two types: common commands and subsystem commands.

Common Commands

The common commands are commands defined by IEEE Standard 488.2. These commands control some functions that are common to all devices that conform to this standard. Common commands are not part of any subsystem or command tree.

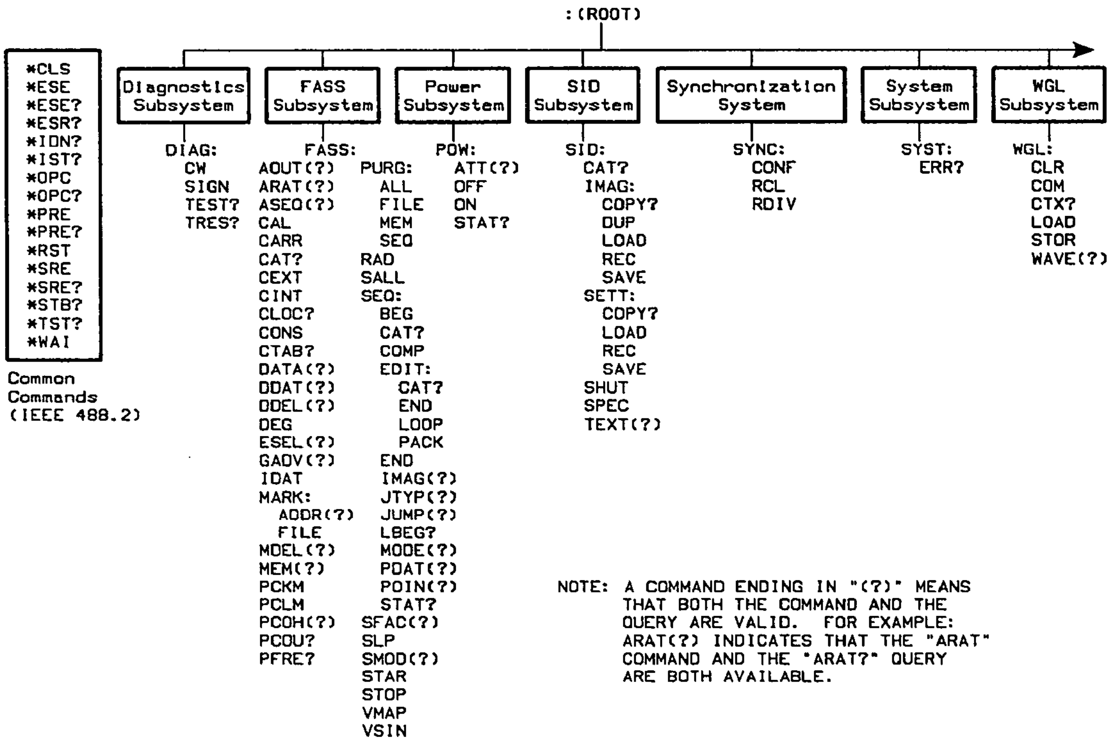


Figure 3-1. RSID Command Tree

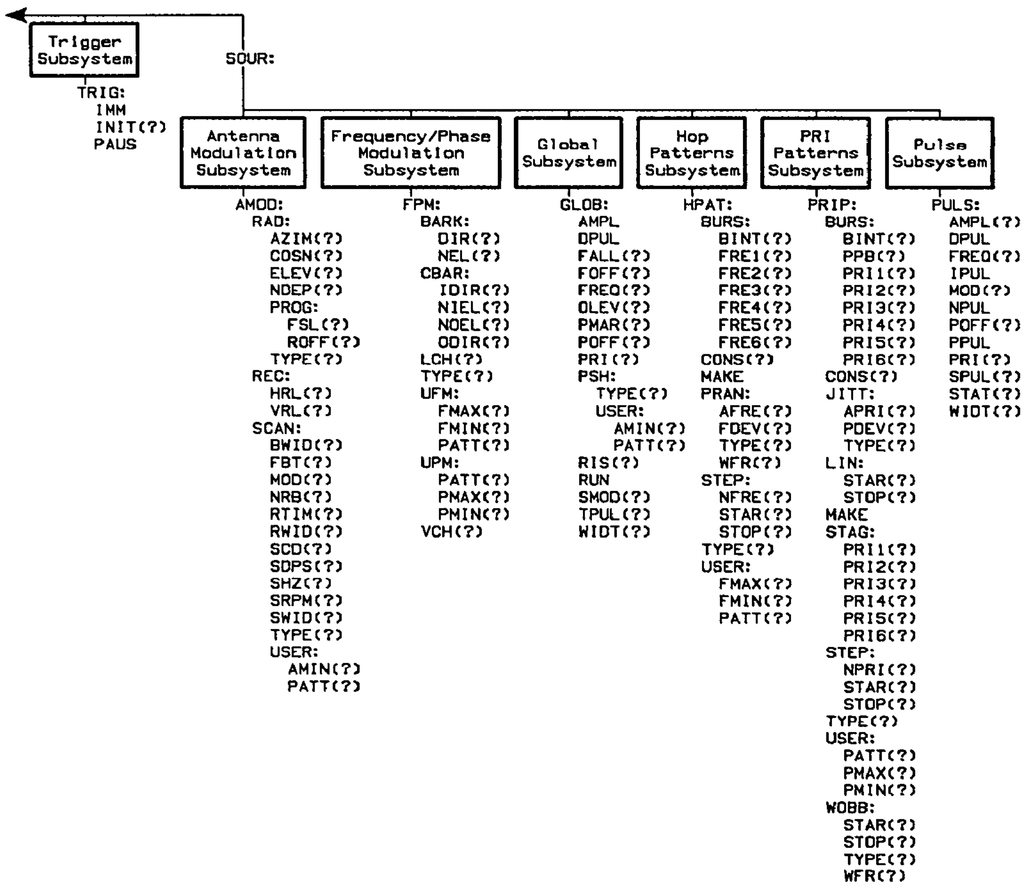


Figure 3-1. RSID Command Tree (continued)

Subsystem Commands

Commands other than common commands are grouped into major categories called subsystems, with each subsystem roughly corresponding to a menu or a functional block within the system. There are 14 subsystems in RSID:

- Antenna Modulation
- Diagnostics
- FASS
- Frequency/Phase Modulation
- Global
- Hop Patterns
- Power
- PRI Patterns
- Pulse
- SID
- Synchronization
- System
- Trigger
- WGL

Subsystem commands use a hierarchy, which is called a command tree. The RSID command tree (see figure 3-1) shows all the commands in RSID and the relationship of the commands to each other.

Six of the 14 subsystems are unique to RSID and eight are available on all IDs. The following subsystems are common to all IDs:

- Diagnostics
- FASS
- Power
- SID
- Synchronization
- System
- Trigger
- WGL

Subsystems that are unique to RSID are structured under the :SOUR mnemonic.

Table 3-1 describes the function of each subsystem.

Table 3-1. Subsystem Summary

Subsystem	Description
Antenna Modulation	Provides commands to define radiation and scan patterns, and to specify vertical and horizontal receiver location. Used with signal models 2 and 5 only.
Diagnostics	Provides commands for diagnostics and system service.
FASS	Provides commands for controlling the system hardware. Allows you to select clock source, perform a level calibration, configure the system for dynamic data and dynamic sequence mode, load data into the modulation memories, create packets and sequences, set the markers, and start and stop the system.
Frequency/Phase Modulation	Provides commands to select frequency and phase modulation (also referred to as intrapulse modulation) for all pulses.
Global	Provides commands to select characteristics that apply to all pulses.
Hop Patterns	Provides commands to create frequency hop patterns that apply to groups of pulses or all pulses.
Power	Provides commands to control the output attenuator.
PRI Patterns	Provides commands to create PRI patterns that apply to groups of pulses or all pulses.
Pulse	Provides commands to select characteristics that apply to individual pulses.
SID	Provides commands to access hardware images, ID settings, user patterns, and special functions. Also provides the command for system shutdown.
Synchronization	Provides commands to synchronize two or more HP FASS systems.
System	Provides a command for reading error messages.
Trigger	Provides commands for selecting and enabling the trigger mode, and pausing and continuing the signal.
WGL	Provides commands that allow HP FASS to be controlled by WGL (Waveform Generation Language).

Programming with RSID

The order in which you send subsystem commands to HP FASS is a matter of personal preference. Subsystems that are common to all IDs can be programmed in any order. Subsystems that are unique to RSID (that is, they are prefaced by mnemonic :SOUR) can be programmed in any order with two exceptions:

1. You must select the signal model before issuing other RSID commands. The signal model determines which commands you can use. See the SMOD command in the Global subsystem for a description of signal models.
2. You must program PRI patterns before hop patterns.

Note

Changing signal models initializes the model parameters to their reset values.

Commands within a subsystem can be order dependent. See the flowchart in the chapter of interest to determine the order in which commands within a subsystem should be issued.

Figure 3-2 shows a typical sequence for programming RSID subsystems. Example 3-1 provides a sample program using this programming sequence.

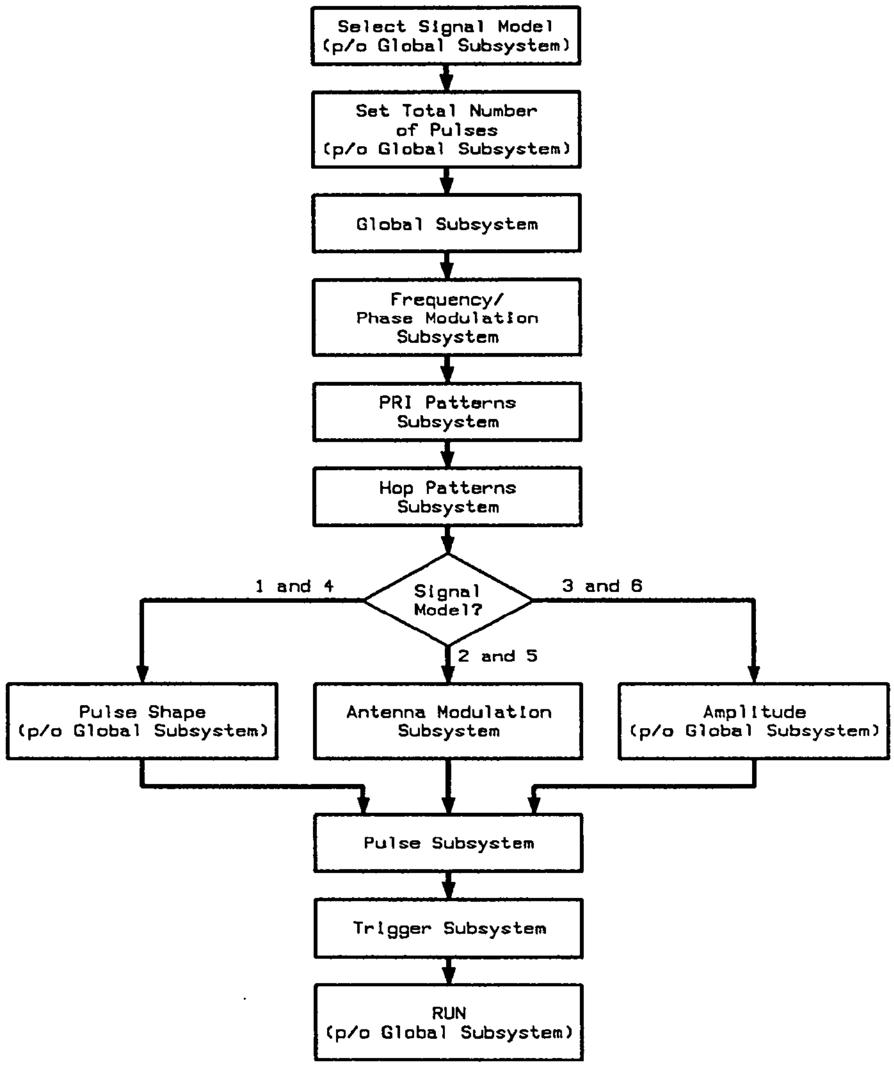


Figure 3-2. Typical RSID Programming Sequence

Example 3-1. Search Radar Program

```
10  ! THIS PROGRAM CREATES A SEARCH RADAR SIGNAL. THE SEARCH
11  ! RADAR'S CARRIER  FREQUENCY IS HOPPED TO HELP PREVENT
12  ! DETECTION.  THE SIGNAL PARAMETERS ARE AS
13  ! FOLLOWS:
14  !   PRI         : 1600 us
15  ! PULSE  WIDTH :    8 us
16  !   HOP PATTERN: STEPPED
17  !         START:    2.000 GHz
18  !         STOP :    2.144 GHz
19  !         STEPS:   18          144 MHz/18 = 8 MHz STEPS
20  !   PULSES/STEP:    6
21  !  ANTENNA SCAN: CIRCULAR
22  !     SCAN RATE:    6 RPM
23  !     RADIATION: PROGRAMMABLE
24  !FIRST SIDELOBE:  -22 dB
25  !       ROLLOFF:   12 dB/OCTAVE
26  !     BEAMWIDTH
27  !            AZ:   11 deg
28  !            EL:   19 deg
29  !      REC LOC.:    0 deg
30  ! THE SIGNAL IS CREATED USING FIGURE 3-2 Typical RSID
31  !  Programming Sequence
32  !
33  DIM Answer$[100]                      ! USED TO READ ERROR
34                                        ! MESSAGES
35  ASSIGN @Fass TO 719                   ! HP FASS HPIB ADDRESS
36  !
37  ON TIMEOUT 7,30 GOTO Notfound         ! ESCAPE
38  !
39  OUTPUT @Fass;"*RST"                   ! KNOWN STARTING POINT
40  GOSUB Check_err
41  !
42  ! SELECT SIGNAL MODEL WITH ANTENNA MODULATION
```

Example 3-1. Search Radar Program (continued)

```
43  OUTPUT @Fass;":SOUR:GLOB:SMOD 2"
44  !
45  ! SET TOTAL NUMBER OF PULSES TO 108.  THIS IS 18 UNIQUE
46  ! FREQUENCIES WITH 6 PULSES AT EACH FREQUENCY.
47  OUTPUT @Fass;":SOUR:GLOB:TPUL 108"
48  !
49  ! SET PRI TO 1600 MICROSECONDS
50  OUTPUT @Fass;":SOUR:GLOB:PRI 1600 US"
51  ! SET PULSE WIDTH TO 8 MICROSECONDS
52  OUTPUT @Fass;":SOUR:GLOB:WIDT 8 US"
53 GOSUB Check_err
54  !
55  ! SET FM OR PM HERE IF NECESSARY
56  !
57  ! CREATE PRI PATTERN HERE IF NECESSARY
58  !
59  !SELECT STEPPED HOP FREQUENCY PATTERN
60  OUTPUT @Fass;":SOUR:HPAT:TYPE STEP"
61  !
62  ! SET START FREQ, STOP FREQ, AND NUMBER OF FREQUENCIES
63  OUTPUT @Fass;":SOUR:HPAT:STEP:STAR 2 GHZ"
64  OUTPUT @Fass;":SOUR:HPAT:STEP:STOP 2.144 GHZ"
65  OUTPUT @Fass;":SOUR:HPAT:STEP:NFRE 18"
66  !
68  ! MAKE HOP PATTERN
69  OUTPUT @Fass;":SOUR:HPAT:MAKE"
70  GOSUB Check_err
71  !
72  ! SELECT CIRCULAR ANTENNA SCAN PATTERN
73  OUTPUT @Fass;":SOUR:AMOD:SCAN:TYPE CIRC"
74  !
75  ! SET SCAN RATE IN RPM
76  OUTPUT @Fass;":SOUR:AMOD:SCAN:SRPM 6"
```

Example 3-1. Search Radar Program (continued)

```
77  !
78  ! SELECT PROGRAMMABLE RADIATION
79  OUTPUT @Fass;":SOUR:AMOD:RAD:TYPE PROG"
80  !
81  ! SET FIRST SIDE LOBE LEVEL AND ROLL-OFF
82  OUTPUT @Fass;":SOUR:AMOD:RAD:PROG:FSL -22 DB"
83  OUTPUT @Fass;":SOUR:AMOD:RAD:PROG:ROFF 12 DB"
84  !
85  ! SET 3 dB AZIMUTH AND ELEVATION
86  OUTPUT @Fass;":SOUR:AMOD:RAD:AZIM 11 DEG"
87  OUTPUT @Fass;":SOUR:AMOD:RAD:ELEV 19 DEG"
88  !
89  ! SET VERTICAL RECEIVER LOCATION
90  OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
91  !
92  GOSUB Check_err
93  !
94  OFF TIMEOUT                          ! CAN TAKE A LONG TIME
95  OUTPUT @Fass;"SOUR:GLOB:RUN;*WAI"    ! CREATE SIGNAL
96  GOSUB Check_err
97  STOP                                 ! END OF PROGRAM
98  !
99  Check_err: ! CHECK FOR ERRORS
100   OUTPUT @Fass;":SYST:ERR?;ERR?;ERR?;ERR?;ERR?"
101   ENTER @Fass;Answer$
102   PRINT
103   PRINT "    Execute Signal: ERR=";Answer$
104   RETURN
105 !
106 Notfound: !
107   PRINT
108   PRINT "IO TIMEOUT OCCURRED"
109 END
```

Syntax Diagrams

At the beginning of each of the following chapters are syntax diagrams showing the proper syntax for each command.

All characters contained in a circle or oblong must be entered exactly as shown. Words or phrases contained in rectangles are names of items used with the command and are described in the accompanying text of each command. Each line can only be entered from one direction as indicated by the arrow on the entry line. Any combination of commands and arguments that can be generated by following the lines in the proper direction is syntactically correct. An argument is optional if there is a path around it. Where there is a rectangle that contains the word "space" a white space must be entered. White space characters are optional in many places, and no attempt has been made to specify every place where an optional white space makes sense.

In addition to the syntax diagram at the beginning of each chapter, the command syntax is shown at the beginning of each command description. The command is shown in computer font. Names of items used with the command are shown in italics. If there are several choices for a required item, they are shown inside a set of curly braces - { }. Optional elements are placed inside square brackets - [ ].

Command Summary Tables

Table 3-2 summarizes common commands available for RSID. Tables 3-3 through 3-16 summarize RSID commands by subsystem.

Table 3-2. Common Command Summary

Command	Description
*CLS	Clears the Status Byte Register and the Standard Event Status Register.
*ESE *number*	Sets the Standard Event Status Enable Register.
*ESE?	Reads the Standard Event Status Enable Register.
*ESR?	Reads the Standard Event Status Register.
*IDN?	Reads the system identification.
*IST?	Reads the individual status bit.
*OPC	Sets the operation complete bit.
*OPC?	Reads the status of the operation complete bit.
*PRE *number*	Sets the Parallel Poll Enable Register.
*PRE?	Reads the Parallel Poll Enable Register.
*RST	Resets the system to a known state.
*SRE *number*	Sets the Service Request Enable Register.
*SRE?	Reads the Service Request Enable Register.
*STB?	Reads the Status Byte Register.
*TST?	Executes an internal self-test and reports the results.
*WAI	Wait to continue.

Table 3-3. Antenna Modulation Subsystem Command Summary

Command	Description
:SOUR:AMOD:RAD:AZIM *angle*	Sets the 3 dB azimuth beamwidth in degrees for a radiation pattern.
:SOUR:AMOD:RAD:AZIM?	Reads the 3 dB azimuth beamwidth in degrees.
:SOUR:AMOD:RAD:COSN *power*	Sets the power of a cosine radiation pattern.
:SOUR:AMOD:RAD:COSN?	Reads the power of a cosine radiation pattern.
:SOUR:AMOD:RAD:ELEV *angle*	Sets the 3 dB elevation beamwidth in degrees for a radiation pattern.
:SOUR:AMOD:RAD:ELEV?	Reads the 3 dB elevation beamwidth in degrees.
:SOUR:AMOD:RAD:NDEP *depth*	Sets the null depth of a radiation pattern.
:SOUR:AMOD:RAD:NDEP?	Reads the radiation pattern null depth in dB.
:SOUR:AMOD:RAD:PROG:FSL *level*	Sets the level of the first sidelobe for a programmable radiation pattern.
:SOUR:AMOD:RAD:PROG:FSL?	Reads the level of first sidelobe for a programmable radiation pattern.
:SOUR:AMOD:RAD:PROG:ROFF *roll_off*	Sets the programmable radiation pattern roll-off in dB per octave.
:SOUR:AMOD:RAD:PROG:ROFF?	Reads the programmable radiation pattern roll-off in dB per octave.
:SOUR:AMOD:RAD:TYPE *BLAC, COSN, HAMM, HANN, PROG, RECT, or TTER*	Selects the radiation pattern type.
:SOUR:AMOD:RAD:TYPE?	Reads the selected radiation pattern type.
:SOUR:AMOD:REC:HRL *location*	Sets the horizontal receiver location in degrees.
:SOUR:AMOD:REC:HRL?	Reads the horizontal receiver location in degrees.

Table 3-3.
Antenna Modulation Subsystem Command Summary (continued)

Command	Description
:SOUR:AMOD:REC:VRL *location*	Sets the vertical receiver location in degrees.
:SOUR:AMOD:REC:VRL?	Reads the vertical receiver location in degrees.
:SOUR:AMOD:SCAN:BWID *angle*	Sets the raster bar width for a raster scan pattern.
:SOUR:AMOD:SCAN:BWID?	Reads the raster bar width for a raster scan pattern.
:SOUR:AMOD:SCAN:FBT *time*	Sets the flyback time for a unidirectional raster or unidirectional sector scan pattern.
:SOUR:AMOD:SCAN:FBT?	Reads the flyback time for a unidirectional raster or unidirectional sector scan pattern.
:SOUR:AMOD:SCAN:MOD *ON or OFF*	Turns antenna scan modulation on or off.
:SOUR:AMOD:SCAN:MOD?	Reads the antenna scan modulation setting.
:SOUR:AMOD:SCAN:NRB *number*	Sets the number of raster bars for a raster scan pattern.
:SOUR:AMOD:SCAN:NRB?	Reads the number of raster bars for a raster scan pattern.
:SOUR:AMOD:SCAN:RTIM *time*	Sets the retrace time for a raster scan pattern.
:SOUR:AMOD:SCAN:RTIM?	Reads the retrace time for a raster scan pattern.
:SOUR:AMOD:SCAN:RWID *width*	Sets the raster width for a raster scan pattern.
:SOUR:AMOD:SCAN:RWID?	Reads the raster width for a raster scan pattern.
:SOUR:AMOD:SCAN:SCD *diameter*	Sets the scanning cone diameter for a conical scan pattern.
:SOUR:AMOD:SCAN:SCD?	Reads the scanning cone diameter for a conical scan pattern.

Table 3-3.
Antenna Modulation Subsystem Command Summary (continued)

Command	Description
:SOUR:AMOD:SCAN:SDPS *rate*	Sets the scan rate in degrees per second for a raster or sector scan pattern.
:SOUR:AMOD:SCAN:SDPS?	Reads the scan rate in degrees per second for a raster or sector scan pattern.
:SOUR:AMOD:SCAN:SHZ *rate*	Sets the scan rate in hertz for a conical or user scan pattern.
:SOUR:AMOD:SCAN:SHZ?	Reads the scan rate in hertz for a conical or user scan pattern.
:SOUR:AMOD:SCAN:SRPM *rate*	Sets the scan rate in revolutions per minute for a circular scan pattern.
:SOUR:AMOD:SCAN:SRPM?	Reads the scan rate in revolutions per minute for a circular scan pattern.
:SOUR:AMOD:SCAN:SWID *width*	Sets the sector width for a sector scan pattern.
:SOUR:AMOD:SCAN:SWID?	Reads the sector width for a sector scan pattern.
:SOUR:AMOD:SCAN:TYPE *BRAS, BSEC, CIRC, CON, URAS, USEC, or USER*	Selects the scan pattern type.
:SOUR:AMOD:SCAN:TYPE?	Reads the selected scan pattern type.
:SOUR:AMOD:SCAN:USER:AMIN *amplitude*	Sets the minimum amplitude relative to the system output level for a user-defined scan pattern.
:SOUR:AMOD:SCAN:USER:AMIN?	Reads the minimum amplitude for a user-defined scan pattern.
:SOUR:AMOD:SCAN:USER:PATT *'name'*	Specifies the name of a user pattern on the removable cartridge to be used for scan pattern.
:SOUR:AMOD:SCAN:USER:PATT?	Reads the name of the user pattern that is being used for the scan pattern.

Table 3-4. Diagnostic Subsystem Command Summary

Command	Description
:DIAG:CW *frequency, level*	Generates a CW signal of a specified frequency (in hertz) and amplitude (in dBm).
:DIAG:SIGN	Generates a test signal to verify whether the system is operating properly.
:DIAG:TEST? *test*	Returns a pass/fail test result for a specified test.
:DIAG:TRES?	Returns text describing the test result from the last test that was specified with the :DIAG:TEST? query.

Table 3-5. FASS Subsystem Command Summary

Command	Description
:FASS:AOUT *ON or OFF*	Enables/disables the DYNAMIC DATA/DYNAMIC SEQUENCE port on the MDS for outputting modulation memory addresses currently being accessed.
:FASS:AOUT?	Returns whether the capability to output modulation memory addresses is on or off.
:FASS:ARAT *divider*	Sets the address rate divider for the active memory.
:FASS:ARAT?	Returns the address rate divider setting for the active memory.
:FASS:ASEQ *ACS, AM, AUC, FLC, FM, GRO, PM, PM2, or PULS*	Advances the selected sequencer from the current packet to the next packet in the sequence.
:FASS:ASEQ?	Returns the packet advance mode for the packet that is currently running.
:FASS:CAL	Generates an internal level accuracy table for self calibration.
:FASS:CARR *address, length, frequency*	Loads constant carrier waveform data into the ACS and AUC fields of frequency memory.
:FASS:CAT?	Returns a catalog of all file names currently defined in active modulation memory.
:FASS:CEXT *frequency*	Sets the clock source to external and specifies the frequency of the external clock.
:FASS:CINT	Sets the clock source to internal.
:FASS:CLOC?	Returns the current clock source and the frequency of the external clock.
:FASS:CONS *address, length, value*	Loads the active modulation memory with a constant value starting at the specified address for the specified length.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:CTAB? *band*	Reads the level calibration factor for the specified frequency index.
:FASS:DATA 'SEQ2', *sequencer_data*	Loads data directly into the active sequencer memory.
:FASS:DATA 'WAVE:(*address*)', *memory_data*	Loads data by address directly into the active modulation memory.
:FASS:DATA 'WAVE:*file_name*', *memory_data*	Loads data by file name directly into the active modulation memory.
:FASS:DATA? *address, length*	Returns the data in the active modulation memory starting at the specified address for the specified length.
:FASS:DDAT *ASYNC or SYNC*	Sets the dynamic data mode for the active modulation memory.
:FASS:DDAT?	Returns the dynamic data mode for the active modulation memory.
:FASS:DDEL *MIN or DYNSEQ*	Selects the active modulation memory's delay mode for dynamic data input.
:FASS:DDEL?	Returns the dynamic data delay mode for the active memory.
:FASS:DEG	Sets the data format of PM or PM2 memory to degrees.
:FASS:ESEL *'EMAR1' or 'EMAR2', 'source'*	Selects which marker will be output through which event marker port for the active memory.
:FASS:ESEL? *'EMAR1' or 'EMAR2'*	Returns the source for the specified port configuration.
:FASS:GADV *INT or EXT*	Selects the source for the group packet advance signal.
:FASS:GADV?	Returns the source for the group packet advance signal.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:IDAT 'WAVE:(*address*)', *memory_data*	Loads data in internal format by address directly into the active modulation memory.
:FASS:IDAT 'WAVE:*file_name*', *memory_data*	Loads data in internal format by file name directly into the active modulation memory.
:FASS:IDAT? *address, length*	Returns the data in the active modulation memory in internal format starting at the specified address for the specified length.
:FASS:MARK:ADDR *address*	Sets the MDS Address Equal marker of the active memory to the specified address.
:FASS:MARK:ADDR?	Returns the address of the MDS Address Equal marker for the active memory.
:FASS:MARK:FILE '*file_name*', *offset*	Sets the MDS Address Equal marker of the active modulation memory to beginning address of a file plus offset.
:FASS:MDEL *delay*	Selects the number of clock delays on the active sequencer memory's marker outputs.
:FASS:MDEL?	Returns the number of clock delays on the active sequencer memory's marker outputs.
:FASS:MEM *ACS, AM, AUC, FLC, FM, PM, PM2, or PULS*	Selects the active memory.
:FASS:MEM?	Returns the name of the active memory.
:FASS:PCKM '*file_name*', *scans, advance_mode, packet_ID_enable*	Defines a packet by using named files in the modulation memory.
:FASS:PCLM *address, scans, advance_mode, packet_ID_enable*	Defines a packet by using addresses of waveforms in the modulation memory.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:PCOH *OFF, FREQ, or FMFREQ* :FASS:PCOH?	Selects the FASS coherence mode. Returns the current setting of the phase coherence mode.
:FASS:PCOU? *sequence_number*	Returns the number of packets and loop packets in the specified sequence of active memory.
:FASS:PFRE?	Returns the number of packets that are free in the active sequencer memory.
:FASS:PURG:ALL	Purges the data in all the modulation memories.
:FASS:PURG:FILE *'file_name'*	Purges the specified file in active memory.
:FASS:PURG:MEM	Purges the contents of the active memory.
:FASS:PURG:SEQ *sequence_number*	Purges the specified sequence in the active sequencer memory.
:FASS:RAD	Sets the data format of PM or PM2 memory to radians.
:FASS:SALL *sequence_number*	Starts all sequencers at the specified sequence number.
:FASS:SEQ:BEG *sequence_number, packet_address*	Establishes the sequence number and sequence address for a sequence to be loaded into active sequencer memory.
:FASS:SEQ:CAT? *sequence_number*	Returns a listing of all the packets and loop packets that define the specified sequence.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:SEQ:COMP	Compresses the data in the active sequencer memory.
:FASS:SEQ:EDIT:CAT? *sequence_number, packet_number*	Returns packet information for the specified sequence for editing purposes.
:FASS:SEQ:EDIT:END *end_flag, sequence_number, packet_number*	Allows editing of the end-of-sequence flag.
:FASS:SEQ:EDIT:LOOP *scans, advance_mode, begin_flag, sequence_number, packet_number*	Allows editing of loop packet parameters.
:FASS:SEQ:EDIT:PACK *address, length, scans, advance_mode, marker_flag, sequence_number, packet_number*	Allows editing of packet parameters.
:FASS:SEQ:END	Specifies the end of the sequence that is currently being defined.
:FASS:SEQ:IMAG *'PACKET' or 'POINTER', sequencer_data* :FASS:SEQ:IMAG? *'PACKET' or 'POINTER'*	Loads an image of the entire packet memory or pointer memory for the active sequencer memory. Returns an image of the entire packet memory or pointer memory for the active sequencer memory.
:FASS:SEQ:JTYP *IMM or EOS* :FASS:SEQ:JTYP?	Selects the jump mode for all the sequences in the active sequencer memory. Returns the jump mode for all the sequences in the active sequencer memory.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:SEQ:JUMP *INT or EXT*	Selects a source for the group jump signal.
:FASS:SEQ:JUMP?	Returns the current source for the group jump signal.
:FASS:SEQ:LBEG?	Returns the value of *sequence_number* in the most recently issued :FASS:SEQ:BEG command.
:FASS:SEQ:MODE *INT, OFF, LOCAL, MASTER, SLAVE, INDIV or EXTADDR*	Sets the active sequencer mode to one of the indicated types of operation.
:FASS:SEQ:MODE?	Returns the active sequencer mode of operation.
:FASS:SEQ:PDAT 'PACKET', *packet_data*	Loads packet data into the active sequencer memory.
:FASS:SEQ:PDAT? *sequence_number*	Returns the contents of the specified sequence.
:FASS:SEQ:POIN *ampm_seq, pm_seq, fm_seq, freq_seq*	Establishes the number of the sequence in the specified sequencer memory that will be executed when the :FASS:STAR command is issued or an external group sequence jump signal is received.
:FASS:SEQ:POIN?	Returns the currently active sequence number for each memory.
:FASS:SEQ:STAT?	Returns whether a sequence jump is pending for the active sequencer memory.

Table 3-5. FASS Subsystem Command Summary (continued)

Command	Description
:FASS:SFAC *1, 2, or 4*	Sets the stretch factor for AM, PM, or PM2 memory.
:FASS:SFAC?	Returns the stretch factor.
:FASS:SLP *scans, advance_mode, beginning_of_sequence*	Creates a loop packet for the current sequence.
:FASS:SMOD *MDL10 or MDL11*	Sets the sequencer model.
:FASS:SMOD?	Returns the sequencer model number.
:FASS:STAR	Starts all sequencers.
:FASS:STOP	Stops all sequencers.
:FASS:VMAP *address, length, min, max, stretch_factor*	Creates a linear ramp in the active memory.
:FASS:VSIN *address, length, start_phase, end_phase, scale, offset, stretch_factor*	Creates a sine wave in the active memory.

Table 3-6.
Frequency/Phase Modulation Subsystem Command Summary

Command	Description
:SOUR:FPM:BARK:DIR *FORW or REV*	Specifies the Barker code direction.
:SOUR:FPM:BARK:DIR?	Reads the Barker code direction.
:SOUR:FPM:BARK:NEL *elements*	Sets the number of elements in a Barker code.
:SOUR:FPM:BARK:NEL?	Reads the number of elements in a Barker code.
:SOUR:FPM:CBAR:IDIR *FORW or REV*	Specifies the direction of inner elements in a compound Barker code.
:SOUR:FPM:CBAR:IDIR?	Reads the direction of inner elements in a compound Barker code.
:SOUR:FPM:CBAR:NIEL *elements*	Sets the number of inner elements in a compound Barker code.
:SOUR:FPM:CBAR:NIEL?	Reads the number of inner elements in a compound Barker code.
:SOUR:FPM:CBAR:NOEL *elements*	Sets the number of outer elements in a compound Barker code.
:SOUR:FPM:CBAR:NOEL?	Reads the number of outer elements in a compound Barker code.
:SOUR:FPM:CBAR:ODIR *FORW or REV*	Specifies the direction of outer elements in a compound Barker code.
:SOUR:FPM:CBAR:ODIR?	Reads the direction of outer elements in a compound Barker code.
:SOUR:FPM:LCH *frequency*	Sets the linear chirp frequency deviation.
:SOUR:FPM:LCH?	Reads the linear chirp frequency deviation.
:SOUR:FPM:TYPE *BARK, CBAR, CW, LCH, RPH, UFM, UPM, or VCH*	Selects the frequency or phase modulation type.
:SOUR:FPM:TYPE?	Reads selected frequency or phase modulation type.

Table 3-6.
Frequency/Phase Modulation Subsystem Command Summary
(continued)

Command	Description
:SOUR:FPM:UFM:FMAX *frequency*	Sets the maximum frequency deviation for a user-defined FM pattern.
:SOUR:FPM:UFM:FMAX?	Reads the maximum frequency deviation for a user-defined FM pattern.
:SOUR:FPM:UFM:FMIN *frequency*	Sets the minimum frequency deviation for a user-defined FM pattern.
:SOUR:FPM:UFM:FMIN?	Reads the minimum frequency deviation for a user-defined FM pattern.
:SOUR:FPM:UFM:PATT '*name*'	Specifies the name of a user pattern on the removable cartridge to be used for the FM pattern.
:SOUR:FPM:UFM:PATT?	Reads name of user pattern being used for the FM pattern.
:SOUR:FPM:UPM:PATT '*name*'	Specifies the name of a user pattern on the removable cartridge to be used for the phase modulation pattern.
:SOUR:FPM:UPM:PATT?	Reads name of the user pattern being used for phase modulation.
:SOUR:FPM:UPM:PMAX *phase*	Sets the maximum phase for a user- defined PM pattern.
:SOUR:FPM:UPM:PMAX?	Reads the maximum phase for a user-defined PM pattern.
:SOUR:FPM:UPM:PMIN *phase*	Sets the minimum phase for a user- defined PM pattern.
:SOUR:FPM:UPM:PMIN?	Reads the minimum phase for a user-defined PM pattern.
:SOUR:FPM:VCH *frequency*	Sets the V Chirp frequency deviation.
:SOUR:FPM:VCH?	Reads the V Chirp frequency deviation.

Table 3-7. Global Subsystem Command Summary

Command	Description
:SOUR:GLOB:AMPL *amplitude*	Sets the amplitude of all pulses relative to the output level. For signal models 3 and 6 only.
:SOUR:GLOB:DPUL *pulse_number*	Deletes all pulses starting with the specified pulse to the end of the pulse train.
:SOUR:GLOB:FALL *time*	Sets the fall time for all pulses for signal models 1 and 4. Pulse shape must be either exponential or trapezoidal.
:SOUR:GLOB:FALL?	Reads the global fall time for signal models 1 and 4.
:SOUR:GLOB:FOFF *offset*	Sets the frequency offset for all pulses.
:SOUR:GLOB:FOFF?	Reads the global frequency offset.
:SOUR:GLOB:FREQ *frequency*	Sets the carrier frequency for all pulses.
:SOUR:GLOB:FREQ?	Reads the global carrier frequency.
:SOUR:GLOB:OLEV *level*	Sets the output level for the system.
:SOUR:GLOB:OLEV?	Reads the output level for the system.
:SOUR:GLOB:PMAR *pulse_number*	Generates the FM Address Equal marker (FM Event Marker 2) at beginning of the specified pulse.
:SOUR:GLOB:PMAR?	Reads the pulse number where the FM Address Equal marker (FM Event Marker 2) is generated.
:SOUR:GLOB:POFF *phase*	Sets the phase offset for all pulses.
:SOUR:GLOB:POFF?	Reads the global phase offset.
:SOUR:GLOB:PRI *interval*	Sets the PRI for all pulses.
:SOUR:GLOB:PRI?	Reads the global PRI.

Table 3-7. Global Subsystem Command Summary (continued)

Command	Description
:SOUR:GLOB:PSH:TYPE *EXP, GAUS, TRAP, or USER*	Selects the pulse shape for signal models 1 and 4.
:SOUR:GLOB:PSH:TYPE?	Reads the selected pulse shape for signal models 1 and 4.
:SOUR:GLOB:PSH:USER:AMIN *amplitude*	Sets the minimum amplitude for a user-defined pulse shape in dB relative to the system output level.
:SOUR:GLOB:PSH:USER:AMIN?	Reads the minimum amplitude for a user-defined pulse shape in dB relative to the system output level.
:SOUR:GLOB:PSH:USER:PATT '*name*'	Specifies the name of the user pattern on the removable cartridge to be used for pulse shaping. For signal model 1 only.
:SOUR:GLOB:PSH:USER:PATT '*name*'	Reads the name of the user pattern being used for pulse shaping.
:SOUR:GLOB:RIS *time*	Sets the rise time for all pulses for signal models 1 and 4. Pulse shape must be exponential or trapezoidal.
:SOUR:GLOB:RIS?	Reads the global rise time for signal models 1 and 4.
:SOUR:GLOB:RUN	Generates a signal based on the current signal parameter settings.
:SOUR:GLOB:SMOD *number*	Selects the signal model.
:SOUR:GLOB:SMOD?	Reads the signal model.
:SOUR:GLOB:TPUL *number*	Sets the total number of individual pulses.
:SOUR:GLOB:TPUL?	Reads the total number of individual pulses.
:SOUR:GLOB:WIDT *width*	Sets the pulse width for all pulses.
:SOUR:GLOB:WIDT?	Reads the global pulse width.

Table 3-8. Hop Patterns Subsystem Command Summary

Command	Description
:SOUR:HPAT:BURS:BINT *time*	Sets the burst interval.
:SOUR:HPAT:BURS:BINT?	Reads the burst interval.
:SOUR:HPAT:BURS:FRE1 *frequency*	Sets the frequency of the first group of pulses in a burst.
:SOUR:HPAT:BURS:FRE1?	Reads the frequency of the first group of pulses in a burst.
:SOUR:HPAT:BURS:FRE2 *frequency*	Sets the frequency of the second group of pulses in a burst.
:SOUR:HPAT:BURS:FRE2?	Reads the frequency of the second group of pulses in a burst.
:SOUR:HPAT:BURS:FRE3 *frequency*	Sets the frequency of the third group of pulses in a burst.
:SOUR:HPAT:BURS:FRE3?	Reads the frequency of the third group of pulses in a burst.
:SOUR:HPAT:BURS:FRE4 *frequency*	Sets the frequency of the fourth group of pulses in a burst.
:SOUR:HPAT:BURS:FRE4?	Reads the frequency of the fourth group of pulses in a burst.
:SOUR:HPAT:BURS:FRE5 *frequency*	Sets the frequency of the fifth group of pulses in a burst.
:SOUR:HPAT:BURS:FRE5?	Reads the frequency of the fifth group of pulses in a burst.
:SOUR:HPAT:BURS:FRE6 *frequency*	Sets the frequency of the sixth group of pulses in a burst.
:SOUR:HPAT:BURS:FRE6?	Reads the frequency of the sixth group of pulses in a burst.

Table 3-8. Hop Patterns Subsystem Command Summary (continued)

Command	Description
:SOUR:HPAT:CONS *frequency*	Sets the constant frequency of all pulses.
:SOUR:HPAT:CONS?	Reads the constant frequency of all pulses.
:SOUR:HPAT:MAKE	Makes a carrier frequency hop pattern of the specified pattern type.
:SOUR:HPAT:PRAN:AFRE *frequency*	Sets the average frequency of a pseudo-random hop pattern.
:SOUR:HPAT:PRAN:AFRE?	Reads the average frequency of a pseudo-random hop pattern.
:SOUR:HPAT:PRAN:FDEV *frequency*	Sets the peak-to-peak frequency deviation of a pseudo-random hop pattern.
:SOUR:HPAT:PRAN:FDEV?	Reads the peak-to-peak frequency deviation of a pseudo-random hop pattern.
:SOUR:HPAT:PRAN:TYPE *GAUS, UNIF, or USH*	Selects the pseudo-random hop pattern type.
:SOUR:HPAT:PRAN:TYPE?	Reads the selected pseudo-random hop pattern type.
:SOUR:HPAT:PRAN:WFR *frequency*	Sets the wobbulation frequency for a U-shaped pseudo-random hop pattern.
:SOUR:HPAT:PRAN:WFR?	Reads the wobbulation frequency for a U-shaped pseudo-random hop pattern.
:SOUR:HPAT:STEP:NFRE *number*	Sets the number of frequencies for a stepped hop pattern.
:SOUR:HPAT:STEP:NFRE?	Reads the number of frequencies for a stepped hop pattern.

Table 3-8. Hop Patterns Subsystem Command Summary (continued)

Command	Description
:SOUR:HPAT:STEP:STAR *frequency*	Sets the start frequency for a stepped hop pattern.
:SOUR:HPAT:STEP:STAR?	Reads the start frequency for a stepped hop pattern.
:SOUR:HPAT:STEP:STOP *frequency*	Sets the stop frequency for a stepped hop pattern.
:SOUR:HPAT:STEP:STOP?	Reads the stop frequency for a stepped hop pattern.
:SOUR:HPAT:TYPE *BURS, CONS, PRAN, STEP, or USER*	Selects the frequency hop pattern type.
:SOUR:HPAT:TYPE?	Reads the selected frequency hop pattern type.
:SOUR:HPAT:USER:FMAX *frequency*	Sets the maximum frequency for a user-defined hop pattern.
:SOUR:HPAT:USER:FMAX?	Reads the maximum frequency for a user-defined hop pattern.
:SOUR:HPAT:USER:FMIN *frequency*	Sets the minimum frequency for a user-defined hop pattern.
:SOUR:HPAT:USER:FMIN?	Reads the minimum frequency for a user-defined hop pattern.
:SOUR:HPAT:USER:PATT *'name'*	Specifies the name of the user pattern on the removable cartridge to be used for the hop pattern.
:SOUR:HPAT:USER:PATT?	Reads the name of the user pattern being used for the hop pattern.

Table 3-9. Power Subsystem Command Summary

Command	Description
:POW:ATT *attenuation* :POW:ATT?	Sets the output attenuator. Returns the output attenuator setting.
:POW:OFF	Sets the output attenuator for maximum attenuation.
:POW:ON	Sets the output attenuator to the setting it was at prior to issuing the :POW:OFF command.
:POW:STAT?	Returns whether the power is set to on or off.

Table 3-10. PRI Patterns Subsystem Command Summary

Command	Description
:SOUR:PRIP:BURS:BINT *time*	Sets the burst interval.
:SOUR:PRIP:BURS:BINT?	Reads the burst interval.
:SOUR:PRIP:BURS:PPB *number*	Sets the number of pulses per burst.
:SOUR:PRIP:BURS:PPB?	Reads the number of pulses per burst.
:SOUR:PRIP:BURS:PRI1 *time*	Sets the first PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI1?	Reads the first PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI2 *time*	Sets the second PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI2?	Reads the second PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI3 *time*	Sets the third PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI3?	Reads the third PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI4 *time*	Sets the fourth PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI4?	Reads the fourth PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI5 *time*	Sets the fifth PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI5?	Reads the fifth PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI6 *time*	Sets the sixth PRI for a group of pulses in a burst.
:SOUR:PRIP:BURS:PRI6?	Reads the sixth PRI for a group of pulses in a burst.

Table 3-10. PRI Patterns Subsystem Command Summary (continued)

Command	Description
:SOUR:PRIP:CONS *time*	Sets the constant PRI of all pulses.
:SOUR:PRIP:CONS?	Reads the constant PRI of all pulses.
:SOUR:PRIP:JITT:APRI *time*	Sets the average PRI for a jittered PRI pattern.
:SOUR:PRIP:JITT:APRI?	Reads the average PRI for a jittered PRI pattern.
:SOUR:PRIP:JITT:PDEV *percent*	Sets the percent of average PRI deviation for a jittered PRI pattern.
:SOUR:PRIP:JITT:PDEV?	Reads the percent of deviation for a jittered PRI pattern.
:SOUR:PRIP:JITT:TYPE *GAUS, UNIF, or USH*	Selects the jittered PRI pattern type.
:SOUR:PRIP:JITT:TYPE?	Reads the selected jittered PRI pattern type.
:SOUR:PRIP:LIN:STAR *time*	Sets the start PRI for a linear PRI pattern.
:SOUR:PRIP:LIN:STAR?	Reads the start PRI for a linear PRI pattern.
:SOUR:PRIP:LIN:STOP *time*	Sets the stop PRI for a linear PRI pattern.
:SOUR:PRIP:LIN:STOP?	Reads the stop PRI for a linear PRI pattern.
:SOUR:PRIP:MAKE	Makes a PRI pattern of the selected pattern type.
:SOUR:PRIP:STAG:PRI1 *time*	Sets the first PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI1?	Reads the first PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI2 *time*	Sets the second PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI2?	Reads the second PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI3 *time*	Sets the third PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI3?	Reads the third PRI in a staggered pulse train.

Table 3-10. PRI Patterns Subsystem Command Summary (continued)

Command	Description
:SOUR:PRIP:STAG:PRI4 *time*	Sets the fourth PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI4?	Reads the fourth PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI5 *time*	Sets the fifth PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI5?	Reads the fifth PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI6 *time*	Sets the sixth PRI in a staggered pulse train.
:SOUR:PRIP:STAG:PRI6?	Reads the sixth PRI in a staggered pulse train.
:SOUR:PRIP:STEP:NPRI *number*	Sets the number of PRIs for a stepped PRI pattern.
:SOUR:PRIP:STEP:NPRI?	Reads the number of PRIs for a stepped PRI pattern.
:SOUR:PRIP:STEP:STAR *time*	Sets the start PRI for a stepped PRI pattern.
:SOUR:PRIP:STEP:STAR?	Reads the start PRI for a stepped PRI pattern.
:SOUR:PRIP:STEP:STOP *time*	Sets the stop PRI for a stepped PRI pattern.
:SOUR:PRIP:STEP:STOP?	Reads the stop PRI for a stepped PRI pattern.
:SOUR:PRIP:TYPE *BURS, CONS, JITT, LIN, STAG, STEP, USER, or WOBB*	Selects the PRI pattern type.
:SOUR:PRIP:TYPE?	Reads the selected PRI pattern type.
:SOUR:PRIP:USER:PATT *'name'*	Specifies the name of the user pattern on the removable cartridge to be used for the PRI pattern.
:SOUR:PRIP:USER:PATT?	Reads the name of the user pattern being used for the PRI pattern.

Table 3-10. PRI Patterns Subsystem Command Summary (continued)

Command	Description
:SOUR:PRIP:USER:PMAX *time*	Sets the maximum PRI for a user-defined PRI pattern.
:SOUR:PRIP:USER:PMAX?	Reads the maximum PRI for a user-defined PRI pattern.
:SOUR:PRIP:USER:PMIN *time*	Sets the minimum PRI for a user-defined PRI pattern.
:SOUR:PRIP:USER:PMIN?	Reads the minimum PRI for a user-defined PRI pattern.
:SOUR:PRIP:WOBB:STAR *time*	Sets the start PRI for a wobbulation PRI pattern.
:SOUR:PRIP:WOBB:STAR?	Reads the start PRI for a wobbulation PRI pattern.
:SOUR:PRIP:WOBB:STOP *time*	Sets the stop PRI for a wobbulation PRI pattern.
:SOUR:PRIP:WOBB:STOP?	Reads the stop PRI for a wobbulation PRI pattern.
:SOUR:PRIP:WOBB:TYPE *SAWT, SIN, or TRI*	Selects the wobbulation PRI pattern type.
:SOUR:PRIP:WOBB:TYPE?	Reads the selected wobbulation PRI pattern type.
:SOUR:PRIP:WOBB:WFR *frequency*	Sets the wobbulation frequency for a PRI pattern.
:SOUR:PRIP:WOBB:WFR?	Reads the wobbulation frequency for a PRI pattern.

Table 3-11. Pulse Subsystem Command Summary

Command	Description
:SOUR:PULS:AMPL *amplitude*	Sets the individual pulse amplitude relative to the system output level. For signal models 3 and 6 only.
:SOUR:PULS:AMPL?	Reads the individual pulse amplitude.
:SOUR:PULS:DPUL *pulse_number*	Deletes the specified pulse and renumbers the remaining pulses.
:SOUR:PULS:FREQ *frequency*	Sets the individual pulse carrier frequency.
:SOUR:PULS:FREQ?	Reads the individual pulse carrier frequency.
:SOUR:PULS:IPUL *pulse_number*	Inserts a pulse after the pulse specified and renumbers the pulses that come after it.
:SOUR:PULS:MOD *ON or OFF*	Turns the frequency/phase modulation on or off. For signal models 4, 5, and 6 only.
:SOUR:PULS:MOD?	Reads the frequency/phase modulation state.
:SOUR:PULS:NPUL	Selects the next pulse in the pulse train.
:SOUR:PULS:POFF *phase*	Sets the phase offset for an individual pulse.
:SOUR:PULS:POFF?	Reads the phase offset for an individual pulse.
:SOUR:PULS:PPUL	Selects the previous pulse in the pulse train.
:SOUR:PULS:PRI *time*	Sets the PRI for an individual pulse.
:SOUR:PULS:PRI?	Reads the PRI for an individual pulse.
:SOUR:PULS:SPUL *pulse_number*	Selects an individual pulse to edit.
:SOUR:PULS:SPUL?	Reads the number of the pulse being edited.
:SOUR:PULS:STAT *ON or OFF*	Sets the state of the selected pulse to either on or off.
:SOUR:PULS:STAT?	Reads the state of the selected pulse.
:SOUR:PULS:WIDT *width*	Sets the individual pulse width. For signal models 4, 5, and 6 only.
:SOUR:PULS:WIDT?	Reads the individual pulse width.

Table 3-12. SID Subsystem Command Summary

Command	Description
:SID:CAT? *IMAG, PAT, or SET*	Returns a listing of all hardware images, user patterns, or ID settings installed on the removable cartridge.
:SID:IMAG:COPY?	Copies the contents of image register 0 to an external controller.
:SID:IMAG:DUP *register, register*	Duplicates a hardware image from a source register to a destination register.
:SID:IMAG:LOAD	Loads a hardware image from an external controller to image register 0.
:SID:IMAG:REC *register*	Recalls a previously saved hardware image.
:SID:IMAG:SAVE *register*	Saves a hardware image.
:SID:SEND *'(7xx)', 'command'*	Sends HP-IB commands directly to a specific instrument in the HP FASS system.
:SID:SEND? *'(7xx)', 'query?'*	Sends HP-IB queries directly to a specific instrument in the HP FASS system.
:SID:SETT:COPY?	Copies the current ID setting to an external controller.
:SID:SETT:LOAD	Loads an ID setting from an external controller into the system as the current ID setting.
:SID:SETT:REC *register*	Recalls a previously saved ID setting.
:SID:SETT:SAVE *register*	Saves an ID setting.
:SID:SHUT	Saves all of the hardware and application information that currently resides in the HP FASS system to the removable cartridge.
:SID:SPEC *function, parameter*	Implements a special function and enters any required parameters.

Table 3-12. SID Subsystem Command Summary (continued)

Command	Description
:SID:TEXT '\USR\PATTERNS*file_name*', *data*	Transfers user patterns from an external controller to the removable cartridge.
:SID:TEXT? '\USR\PATTERNS*file_name*'	Transfers user patterns from the removable cartridge to an external controller.

Table 3-13. Synchronization Subsystem Command Summary

Command	Description
:SYNC:CONF *MAST or SLAV*	Configures the HP FASS system as either a master or slave.
:SYNC:RCL	Reconnects the clock in the master HP FASS.
:SYNC:RDIV	Resets the clock dividers in preparation for synchronization.

Table 3-14. System Subsystem Command Summary

Command	Description
:SYST:ERR?	Returns system errors.

Table 3-15. Trigger Subsystem Command Summary

Command	Description
:TRIG:IMM	Triggers the system immediately (for external triggering only).
:TRIG:INIT *ECON, ESIN, or FRUN*	Enables the trigger setup for the specified mode.
:TRIG:INIT?	Returns the current trigger mode.
:TRIG:PAUS	Pauses the system.

Table 3-16. WGL Subsystem Command Summary

Command	Description
:WGL:CLR	Clears all user definitions in WGL.
:WGL:COM 'WGL', *WGL_command*	Sends WGL commands over HP-IB.
:WGL:CTX?	Returns the number of data points in the WGL working wave.
:WGL:LOAD *'drive:\directory\file.extension'*	Loads a WGL program file from the removable cartridge or flexible disk.
:WGL:STOR *'drive:\directory\file.extension'*	Stores a WGL program file to the removable cartridge or flexible disk.
:WGL:WAVE 'WGL', *wave_data*	Sends waveform data to the WGL Working Wave.
:WGL:WAVE?	Returns waveform data from the WGL Working Wave.

4

Common Commands

Introduction

The common commands are defined by IEEE Standard 488.2. These commands are common to all devices that comply with this standard. The common commands control some of the basic system functions, such as reset and how the Status Byte is read and cleared.

Common commands can be issued at any time, either as separate program messages or within other program messages.

Examples:

```
OUTPUT 719; "*CLS"
```
Separate program message
```
OUTPUT 719; ":POW:ATT 30; *CLS; ON"
```
Within another program message

If a subsystem has been selected and a common command is received by HP FASS, HP FASS remains in the selected subsystem.

See chapter 2, "Status Reporting" for a complete discussion of how to read the status registers and how to use status information available from this system.

Figure 4-1 shows the common commands syntax diagram.

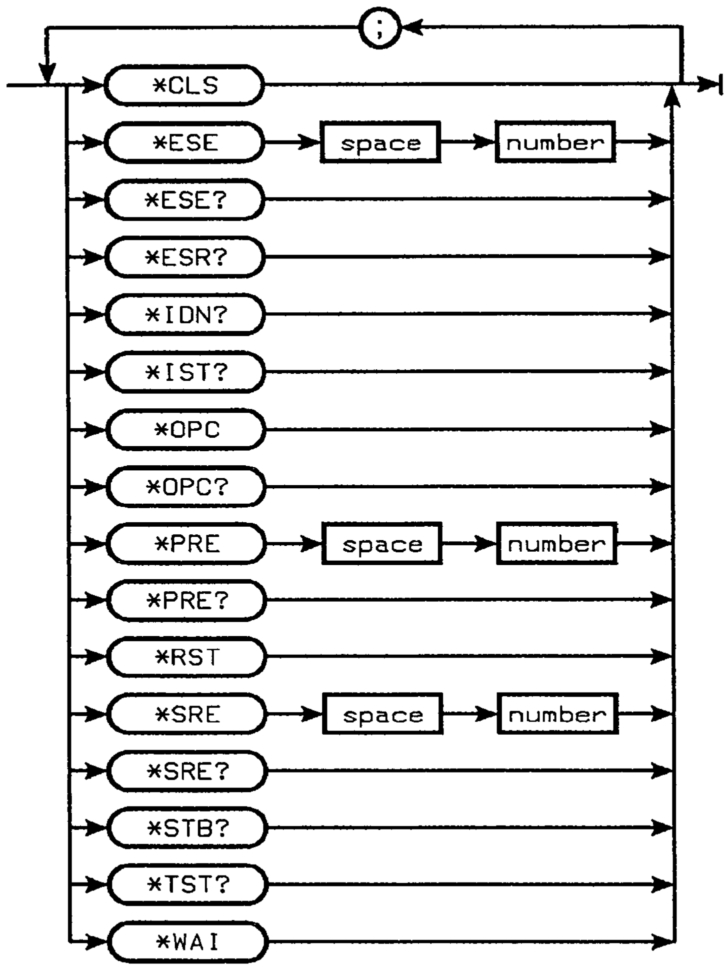


Figure 4-1. Common Commands Syntax Diagram

*CLS (Clear Status)

Syntax

```
*CLS
```

Description

The *CLS command clears the Status Byte Register and the Standard Event Status Register. *CLS also clears error messages that have not yet been read.

If the *CLS command immediately follows a program message terminator, the Output Queue and the MAV bit will be cleared.

Example

To clear the Status Byte Register:

```
OUTPUT 719; "*CLS"
```

Comments

The *CLS command does not clear data memories or any settings other than the status data structures.

See chapter 2, "Status Reporting," for additional information about status data structures.

Related HP-IB Commands

*ESR?
*STB?

*ESE (Event Status Enable)

Syntax

*ESE *number*

*ESE?

Item	Description	Range/Restrictions
Number	Weight of bits to be enabled in the Standard Event Status Register	0 to 255

Description

The *ESE command sets the Standard Event Status Enable Register bits. Setting a bit to 1 in the Standard Event Status Enable Register enables the corresponding bit in the Standard Event Status Register.

When a bit is set to 1 in the Standard Event Status Enable Register and its corresponding bit in the Standard Event Status Register is set to 1, the Event Status bit (ESB) in the Status Byte Register is set.

In response to *ESE?, the system returns a number between 0 and 255. This number represents the total weight of all bits in the Standard Event Status Enable Register that are set to 1.

The weight of each bit in the Standard Event Status Enable Register is shown in the following table.

Standard Event Status Enable Register

Bit	Weight	Description
7	128	Power On
6	64	User Request
5	32	Command Error
4	16	Execution Error
3	8	Device Dependent Error
2	4	Query Error
1	2	Request Control
0	1	Operation Complete

Example

To enable command, execution, device-dependent, and query errors to set bit 5 (ESB, Event Status Bit) of the Status Byte Register:

```
OUTPUT 719; "*ESE 60"
```

Comments

When power to the HP FASS system is turned on, the Standard Event Status Enable Register is set to 0.

See chapter 2, "Status Reporting," for additional information about the Standard Event Status Register.

Related HP-IB Commands

*ESR?
*OPC
*SRE
*STB?

*ESR?(Event Status Register Query)

Syntax

*ESR?

Description

The *ESR? query returns the contents of the Standard Event Status Register. This register is an 8-bit register. It is constantly updated as events occur. Once a bit is set to 1, it remains set until the register is read with the *ESR? query or cleared with the *CLS command.

The following table shows each bit in the Standard Event Status Register and the bit weight. When you read the Standard Event Status Register, the value returned is the total bit weights of all bits that are set to 1 at the time you read the byte.

Example

To read the current integer value of the Event Status Register:

```
10  OUTPUT 719; "*ESR?"
20  ENTER 719; A
30  PRINT "EVENT STATUS REGISTER ="; A
40  END
```

Related HP-IB Commands

*CLS
*ESE
*OPC
*SRE
*STB?

Standard Event Status Register

Bit	Weight	Description
7	128	Power On - indicates that the math accelerator boards in the Smart Interface (SI) have been reconfigured. The math accelerator boards are reconfigured whenever there is an off-to-on transition in the SI power supply or whenever application IDs are changed.
6	64	User Request - not used. This bit will always be read as a zero.
5	32	Command Error - indicates an error in the format or contents of a program message is detected. Error numbers 20 through 99 are command errors.
4	16	Execution Error - indicates the current command cannot be processed due to an out of range parameter or conflicting settings. Error number 10 is the only execution error.
3	8	Device Dependent Error - indicates HP FASS was unable to complete an operation for device dependent reasons. Error numbers 100 and above are device-dependent errors.
2	4	Query Error - indicates either an attempt was made to read the Output Queue when it was empty or output data has been lost. Error numbers 1 through 5 are query errors.
1	2	Request Control - not used. This bit will always be read as a zero.
0	1	Operation Complete - indicates HP FASS has completed any pending operations and is ready to accept new commands. This bit is generated only in response to the *OPC command.

*IDN? (Identification Query)

Syntax

```
*IDN?
```

Description

This query causes the system to identify itself over the bus. In response to *IDN?, the system sends the following string:

```
HEWLETT-PACKARD,8791,MODEL 200,0,x.xx<NL with EOI>
```

Hewlett-Packard is the manufacturer.
8791,Model 200 is the model number.
0 is returned instead of the system serial number.
x.xx is the firmware version.
<NL with EOI> is the message terminator (it is not printed in the string).

Example

To determine the system's version of firmware:

```
10  OUTPUT 719; "*IDN?"
20  DIM A$[40]
30  ENTER 719; A$
40  PRINT "SYSTEM IS"; A$
50  END
```

Comments

*IDN? should always be the last query in a command line because <NL with EOI> terminates the entire message. HP FASS will not send any more data until it receives another query.

Related HP-IB Commands

None

*IST? (Individual Status Query)

Syntax

*IST?

Description

This query lets you read what HP FASS sends in response to a parallel poll without having to perform a parallel poll. It reads the current state of the individual status bit (IST). Each bit in the Parallel Poll Enable Register is logically ANDed with its corresponding bit in the Status Byte Register. The resulting bits are ORed together to generate the individual status bit.

In response to *IST?, HP FASS returns a 0 if false and a 1 if true. For example, if bit 5 in the Status Byte is set and the Parallel Poll Enable Register is set to 32, the system will return a 1 in response to *IST?.

Example

To read the individual status bit:

```
10  OUTPUT 719; "*ESE 255"
20  OUTPUT 719; "*PRE 255"
30  OUTPUT 719; "*IST?"
40  ENTER 719; A
50  PRINT "INDIVIDUAL STATUS BIT IS"; A
60  END
```

Line 10 sets the Event Status Enable Register to allow any bit in the Standard Event Status Register to set the Event Status bit in the Status Byte.

Line 20 sets the Parallel Poll Enable Register to allow any bit in the Status Byte to generate IST.

Comments

It is not necessary to configure the system to respond to a Parallel Poll (that is, assign the data line and logic sense of the status bit) to get a valid response from the *IST? query. However, the Parallel Poll Enable Register must be set (use command *PRE) to get a valid response from the *IST? query.

See chapter 2, "Status Reporting," for additional information about parallel polling.

Related HP-IB Commands

*PRE

*OPC (Operation Complete)

Syntax

```
*OPC
*OPC?
```

Description

The *OPC command sets the operation complete bit (bit 0) in the Standard Event Status Register when the system has completed all pending operations.

In response to *OPC?, the system sends an ASCII "1" when it completes all pending operations.

Example

To print a message when HP FASS has completed a level calibration, which takes approximately six minutes:

```
10  OUTPUT 719; ":FASS:CAL; *OPC?"
20  ENTER 719; A
30  PRINT "LEVEL CALIBRATION COMPLETE"
40  END
```

Comments

The *OPC? query does not affect the Operation Complete bit in the Standard Event Status Register.

Related HP-IB Commands

*ESE
*ESR?
*SRE
*STB?
*WAI

*PRE (Parallel Poll Register Enable)

Syntax

*PRE *number*

*PRE?

Item	Description	Range/Restrictions
Number	Weight of bits to be enabled in the Status Byte Register	0 to 255

Description

This command sets the bits in the Parallel Poll Enable Register. These bits enable the corresponding conditions in the Status Byte Register for parallel polling. When an enabled condition occurs,the system responds affirmatively to a parallel poll or individual status query (*IST?). (The logic sense of the HP FASS system's response to a parallel poll is determined by the controller.)

The *PRE? query returns the total bit weights of all the bits that are set to 1.

The weight of each bit in the Parallel Poll Enable Register is shown in the following table.

Parallel Poll Enable Register

Bit	Weight	Description
7	128	Not Used
6	64	RQS - Request Service
5	32	ESB - Event Status Bit
4	16	MAV - Message Available
3	8	Not Used
2	4	Not Used
1	2	Not Used
0	1	Not Used

Example

To configure the system to respond to a parallel poll with positive-true logic on HP-IB data line DIO3 when any bit in the Status Byte is set to 1:

```
10  PPOLL CONFIGURE 719; 10
20  OUTPUT 719; "*PRE 255"
30  END
```

Line 10: Configures the logic sense and the data line on which the system will respond to a parallel poll. The value 10 is the sum of a four-bit byte. The least significant three bits (bits 0 through 2) specify the data line. In this case, a value of 2 specifies DIO3. Bit 3 specifies the logic sense. In this case, a value of 8 (bit 3 = 1) specifies positive-true logic.

Line 20: Sets the Parallel Poll Enable Register.

*PRE (Parallel Poll Register Enable)

Comments

When power to HP FASS is turned on, the Parallel Poll Enable Register is set to 0.

If the controller sends the system the Parallel Poll Unconfigure command, the system is disabled from responding to a parallel poll. (Parallel Poll Unconfigure is a controller-dependent command.)

See chapter 2, "Status Reporting," for additional information about parallel polling.

Related HP-IB Commands

*ESE
*IST

*RST (Reset)

Syntax

```
*RST
```

Description

This command completely resets the system to default (known) conditions. Reset conditions are shown in table 4-1. *RST does not affect the contents of the hardware image and ID settings storage registers. It also does not affect the internal registers related to status reporting.

Example

To reset the system to default parameters:

```
OUTPUT 719; "*RST"
```

Comments

The *RST command is the same as selecting the (RESET) command button on the front panel.

When you change signal models, RSID automatically resets to default parameters for that model.

Related HP-IB Commands

See following table.

*RST (Reset)

Table 4-1. Reset Conditions

Mnemonic	Command Name	Reset Condition
Common Commands		*RST has no effect on any register settings.
Antenna Modulation Subsystem		
:SOUR:AMOD:RAD:AZIM	3 dB azimuth beamwidth	1.0°
:SOUR:AMOD:RAD:COSN	Radiation pattern cosine power	2
:SOUR:AMOD:RAD:ELEV	3 dB elevation beamwidth	2.0°
:SOUR:AMOD:RAD:NDEP	Radiation pattern null depth	-60 dB
:SOUR:AMOD:RAD:PROG:FSL	First side lobe level for a programmable radiation pattern	-11.2 dB
:SOUR:AMOD:RAD:PROG:ROFF	Roll off for a programmable radiation pattern	6 dB/octave
:SOUR:AMOD:RAD:TYPE	Radiation pattern type	RECT (rectangular)
:SOUR:AMOD:REC:HRL	Horizontal receiver location	15°
:SOUR:AMOD:REC:VRL	Vertical receiver location	0°
:SOUR:AMOD:SCAN:BWID	Bar width for a raster scan	4°
:SOUR:AMOD:SCAN:FBT	Flyback time for unidirectional raster and sector scans	2 ms
:SOUR:AMOD:SCAN:MOD	Antenna scan modulation	ON
:SOUR:AMOD:SCAN:NRB	Number of raster bars for a raster scan	3

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
Antenna Modulation Subsystem (continued)		
:SOUR:AMOD:SCAN:RTIM	Retrace time for a raster scan	500 μs
:SOUR:AMOD:SCAN:RWID	Raster width for a raster scan	50°
:SOUR:AMOD:SCAN:SCD	Scanning cone diameter for a conical scan	10°
:SOUR:AMOD:SCAN:SDPS	Scan rate in degrees per second for a raster or sector scan	100 degrees/second
:SOUR:AMOD:SCAN:SHZ	Scan rate in hertz for a conical scan	100 Hz
:SOUR:AMOD:SCAN:SRPM	Scan rate in revolutions per minute for a circular scan	15 rpm
:SOUR:AMOD:SCAN:SWID	Sector width for a sector scan	50°
:SOUR:AMOD:SCAN:TYPE	Scan pattern type	CIRC (circular)

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
Diagnostic Subsystem		
:DIAG:CW	CW signal	33.554432 MHz, 0 dB
:DIAG:TEST?	Diagnostic test query	ALL
FASS Subsystem		
:FASS:ARAT	Address rate divider	1
:FASS:CAT?	File catalog query	Purges the directories of all file names but the data is still in modulation memory.
:FASS:CINT	Internal clock	Clock source set to internal with a frequency of 134.217728 MHz
:FASS:DDAT	Dynamic data mode	SYNC (synchronous)
:FASS:DDEL	Dynamic data delay	DYNSEQ
:FASS:DEG	Degrees	Phase memory data format set to degrees
:FASS:ESEL *'EMAR1'*	Event Marker 1 port selection	SEQSTART (Sequence Start)
:FASS:ESEL *'EMAR2'*	Event Marker 2 port selection	ADDREQUAL (Equal Address)

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
FASS Subsystem (continued)		
:FASS:MARK:ADDR	Marker address	Equal Address marker set to an address of 0
:FASS:MDEL	Event marker delay	1
:FASS:MEM	Active memory	ACS
:FASS:PCOH	Phase coherence	Off
:FASS:PURG:SEQ	Purge sequencer memory	All sequence data is purged.
:FASS:SEQ:JUMP	Group jump source	INT
:FASS:SEQ:JTYP	Sequencer jump type	IMM
:FASS:SEQ:MODE	Sequencer mode	INT
:FASS:SEQ:POIN	Sequence pointers	0 (for all four sequencers)
:FASS:SFAC	Stretch factor	1
:FASS:SMOD	Sequencer model	MDL11

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
Frequency/Phase Modulation Subsystem		
:SOUR:FPM:BARK:DIR	Barker code direction	FORW (forward)
:SOUR:FPM:BARK:NEL	Barker code number of elements	13
:SOUR:FPM:CBAR:IDIR	Compound Barker code direction of inner elements	FORW (forward)
:SOUR:FPM:CBAR:NIEL	Compound Barker code number of inner elements	13
:SOUR:FPM:CBAR:NOEL	Compound Barker code number of outer elements	13
:SOUR:FPM:CBAR:ODIR	Compound Barker code direction of outer elements	FORW
:SOUR:FPM:LCH	Linear chirp frequency deviation	10 MHz
:SOUR:FPM:TYPE	Frequency or phase modulation type	CW
:SOUR:FPM:VCH	V chirp frequency deviation	10 MHz

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
Global Subsystem		
:SOUR:GLOB:FALL	Global fall time	17.881393432617 ns
:SOUR:GLOB:FOFF	Global frequency offset	0 Hz
:SOUR:GLOB:FREQ	Global frequency	536.870912 MHz
:SOUR:GLOB:OLEV	Peak output level	-15 dBm
:SOUR:GLOB:PMAR	Pulse marker	1
:SOUR:GLOB:POFF	Global phase offset	0°
:SOUR:GLOB:PRI	Global PRI	100.0166 μs
:SOUR:GLOB:PSH:TYPE	Pulse shape type	TRAP (trapezoidal)
:SOUR:GLOB:RIS	Global rise time	17.881393432617 ns
:SOUR:GLOB:SMOD	Signal model	1 (Pulse Shaping)
:SOUR:GLOB:TPUL	Total number of pulses	1
:SOUR:GLOB:WIDT	Global pulse width	5.0142 μs
Hop Patterns Subsystem		
:SOUR:HPAT:CONS	Constant frequency	536.870912 MHz
:SOUR:HPAT:TYPE	Hop pattern type	CONS (constant)
Power Subsystem		
:POW:ATT	Output attenuation	30 dB
:POW:ON	Power on	The output attenuator is set to 30 dB
PRI Patterns Subsystem		
:SOUR:PRIP:CONS	Constant PRI	100.01659393 μs
:SOUR:PRIP:TYPE	PRI pattern type	CONS (constant)

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
Pulse Subsystem		
:SOUR:PULS:AMPL	Relative pulse amplitude	0 dB (Models 3 and 6 only)
:SOUR:PULS:FREQ	Pulse frequency	536.870912 MHz
:SOUR:PULS:MOD	Intrapulse modulation	ON
:SOUR:PULS:POFF	Pulse phase offset	0°
:SOUR:PULS:PRI	Pulse PRI	100.0166 μs
:SOUR:PULS:SPUL	Selected pulse	1
:SOUR:PULS:STAT	Pulse state	ON
:SOUR:PULS:WIDT	Pulse width	5.0142 μs
SID Subsystem		Image registers and ID setting registers are not affected by *RST.
:SID:SPEC 14.1	AUC output attenuator	30 dB (Model 11) 10 dB (Model 21)
:SID:SPEC 14.3	AMUC low output attenuator	30 dB
:SID:SPEC 14.4	AMUC high output attenuator	30 dB
:SID:SPEC 14.5	AMUC input attenuator	0 dB
:SID:SPEC 16.1	BMUC band setting	1 (100 to 3000 MHz)
:SID:SPEC 16.2	BMUC band and LO settings	1 (band = 100 to 3000 MHz; LO = 10 MHz, level = OFF)
:SID:SPEC 16.3	BMUC output attenuation	0 dB

Table 4-1. Reset Conditions (continued)

Mnemonic	Command Name	Reset Condition
SID Subsystem (continued)		
:SID:SPEC 41.1	HP-IB address	No effect
:SID:SPEC 50.1	FM user pattern interpolation	0 (no interpolation)
:SID:SPEC 51.1	PM user pattern interpolation	0 (no interpolation)
:SID:SPEC 52.1	Lock FLC (models 3 and 6)	0 (FLC is not locked)
:SID:SPEC 55.1	Model change parameter rollover	0 (parameter rollover disabled.
:SID:SPEC 58.1	Mark all pulses	0 (mark all pulses disabled)
:SID:SPEC 59.1	BMUC frequency support	0 (BMUC frequency support disabled)
:SID:SPEC 60.1	Best signal-to-noise ratio	0 (disabled)
Synchronization Subsystem		
:SYNC:CONF	Configure system for synchronization	Master
:SYNC:RDIV	Reset the clock dividers	Clock dividers are reset
System Subsystem		
:SYST:ERR?	System error query	*RST does not clear system errors.
Trigger Subsystem		
:TRIG:INIT	Initialize trigger and set triggering mode	FRUN (free run)

*SRE (Service Request Enable)

Syntax

*SRE *number*

*SRE?

Item	Description	Range/Restrictions
Number	Weight of bits in the Status Byte Register to be enabled.	0 to 255

Description

This command sets the Service Request Enable Register bits. This register determines which bits in the Status Byte can generate a service request interrupt (SRQ). Setting a bit to 1 in the Service Request Enable Register enables the corresponding bit in the Status Byte Register; setting a bit to 0 disables the bit in the Status Byte Register.

The weight of each bit in the Service Request Enable Register is shown in the following table.

In response to *SRE?, the system returns a number between 0 to 63 or 128 to 191. (Bit 6, the RQS bit, cannot be set.) This number represents the total weight of all bits in the Service Request Enable Register that are set to 1.

Service Request Enable Register

Bit	Weight	Description
7	128	Not Used
6	64	RQS - Request Service
5	32	ESB - Event Status Bit
4	16	MAV - Message Available
3	8	Not Used
2	4	Not Used
1	2	Not Used
0	1	Not Used

Example

To enable the Message Available and Event Status bits to generate SRQ:

```
OUTPUT 719; "*ESE 255; *SRE 48"
```

(*ESE 255 enables the bits in the Standard Event Status Register to set the Event Status Bit in the Status Byte.)

Comments

When power to HP FASS is turned on, the Service Request Enable Register is set to 0.

See chapter 2, "Status Reporting," for additional information about the Status Byte Register.

Related HP-IB Commands

*ESE
*ESR?
*STB?

*STB? (Status Byte Query)

Syntax

```
*STB?
```

Description

The *STB? query returns the current value of the HP FASS system's Status Byte Register. The MSS (Master Summary Status) bit and not the RQS bit is reported on bit 6. The MSS bit indicates whether or not the system has at least one reason for requesting service. If any bit is set to 1, the lower level register or queue that sets that bit should be read to obtain additional information.

The weight of each bit in the Status Byte Register is shown in the following table.

Status Byte Register

Bit	Weight	Description
7	128	Not Used
6	64	MSS - Master Summary Status
5	32	ESB - Event Status Bit
4	16	MAV - Message Available
3	8	Not Used
2	4	Not Used
1	2	Not Used
0	1	Not Used

Example

To read the Status Byte Register:

```
10  OUTPUT 719; "*STB?"
20  ENTER 719; A
30  DISP "STATUS BYTE ="; A
40  END
```

Comments

*STB? does not clear any bits in the Status Byte Register.

When power to HP FASS is turned on, the Status Byte Register is set to 0.

Related HP-IB Commands

*CLS
*ESE
*ESR?
*SRE

*TST? (Self-Test Query)

Syntax

```
*TST?
```

Description

The *TST? query causes the system to execute an internal self-test and report whether or not it detected any errors. A "0" response indicates that the test completed without detecting any errors. A "1" response indicates that the system detected an error. If necessary, refer to the *HP 8791 Model 11 System Service Manual* or refer the problem to qualified service personnel for repair.

Example

To perform a self-test query:

```
10  OUTPUT 719; "*TST?"
20  ENTER 719; A
30  PRINT A
40  END
```

Comments

Using this query will purge hardware memory.

The system takes approximately nine minutes to execute the self-test and respond to this query.

Related HP-IB Commands

Diagnostics Subsystem
TEST?
TRES?

*WAI (Wait to Continue)

Syntax

*WAI

Description

This command makes the system wait until all the previous commands or queries are executed. The system then continues executing commands that follow the *WAI command.

Example

To write a simple error checking program that ensures the previous command was executed prior to checking the error queue for errors:

```
10  OUTPUT 719; "*WAI; :SYST:ERR?"
20  ENTER 719; A
30  PRINT "ERROR=";A
40  END
```

Related HP-IB Commands

*OPC

5

Antenna Modulation Subsystem

Introduction

The commands in this subsystem control the antenna modulation capability of RSID. These commands correspond to the commands in the Antenna Modulation dialog box, which is accessed by the [ANTENNA MOD] Global Edit command. Note that the commands in this subsystem are valid for signal models 2 and 5 only.

Note

Changing signal models resets signal parameters. See the SCAN:TYPE command in this subsystem for a list of default values for each scan pattern.

Antenna modulation is defined by specifying a scan pattern, a radiation pattern, and the receiver location. Any radiation pattern can be used with any scan pattern. The flowchart in figure 5-1 shows the choices available for scan and radiation patterns and the additional commands required to implement these patterns. See the RAD:TYPE and SCAN:TYPE commands for a pictorial description of each pattern type.

You must issue the :SOUR:GLOB:RUN command to actually generate a signal. The examples shown under each command are the antenna modulation portion of the signal definition.

Figure 5-2 shows the syntax diagram for the antenna modulation subsystem.

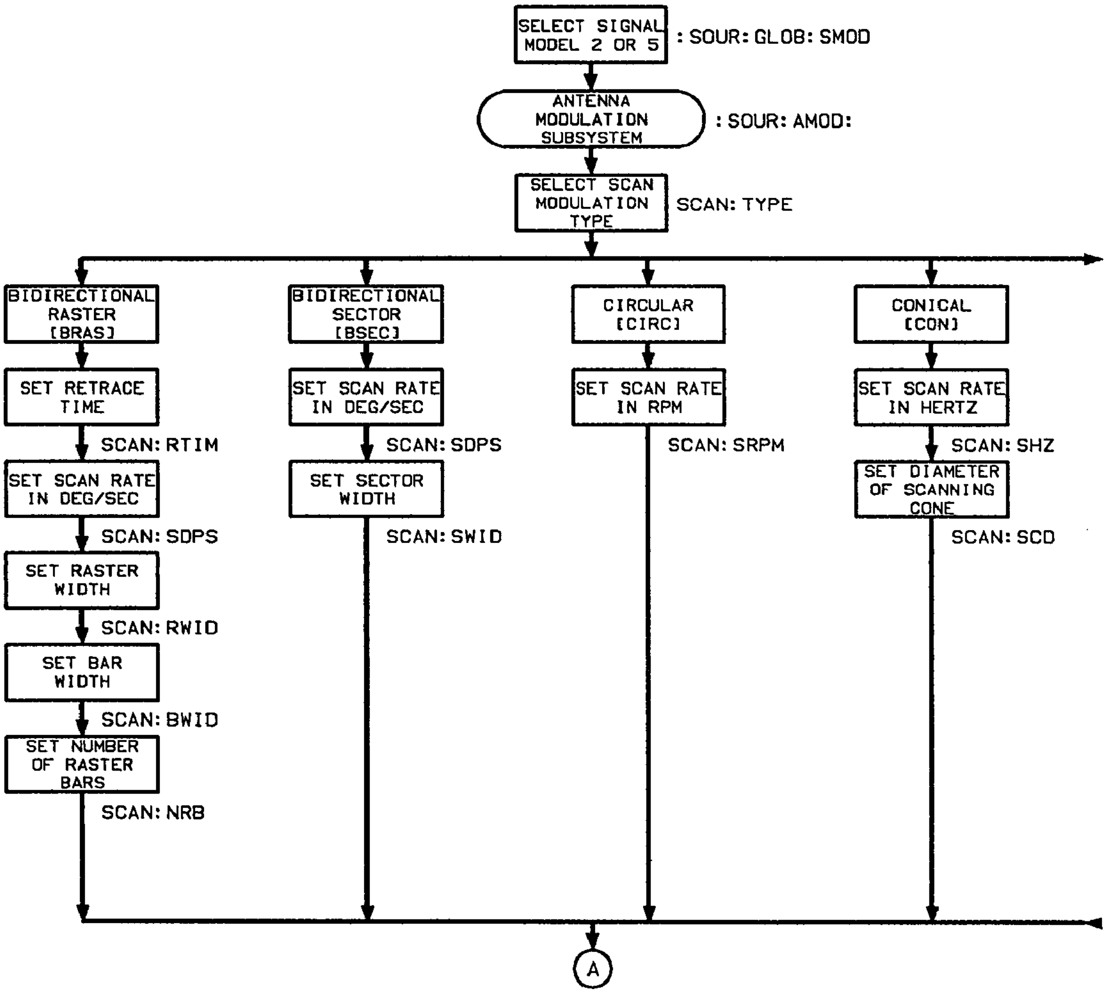


Figure 5-1. Antenna Modulation Subsystem Flowchart

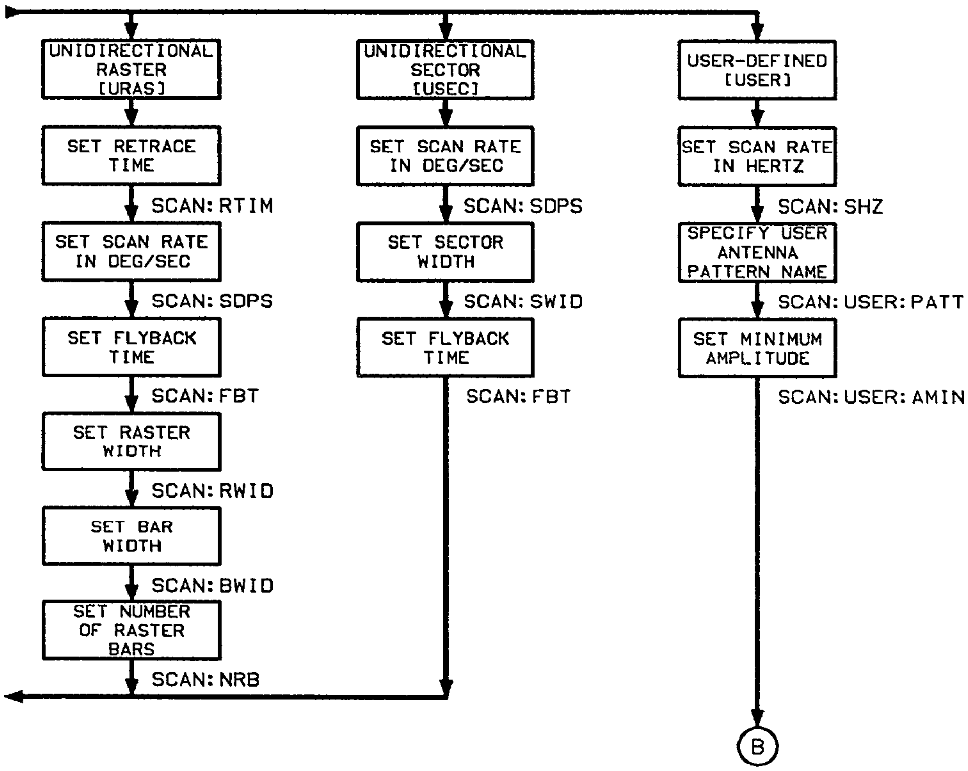


Figure 5-1. Antenna Modulation Subsystem Flowchart (continued)

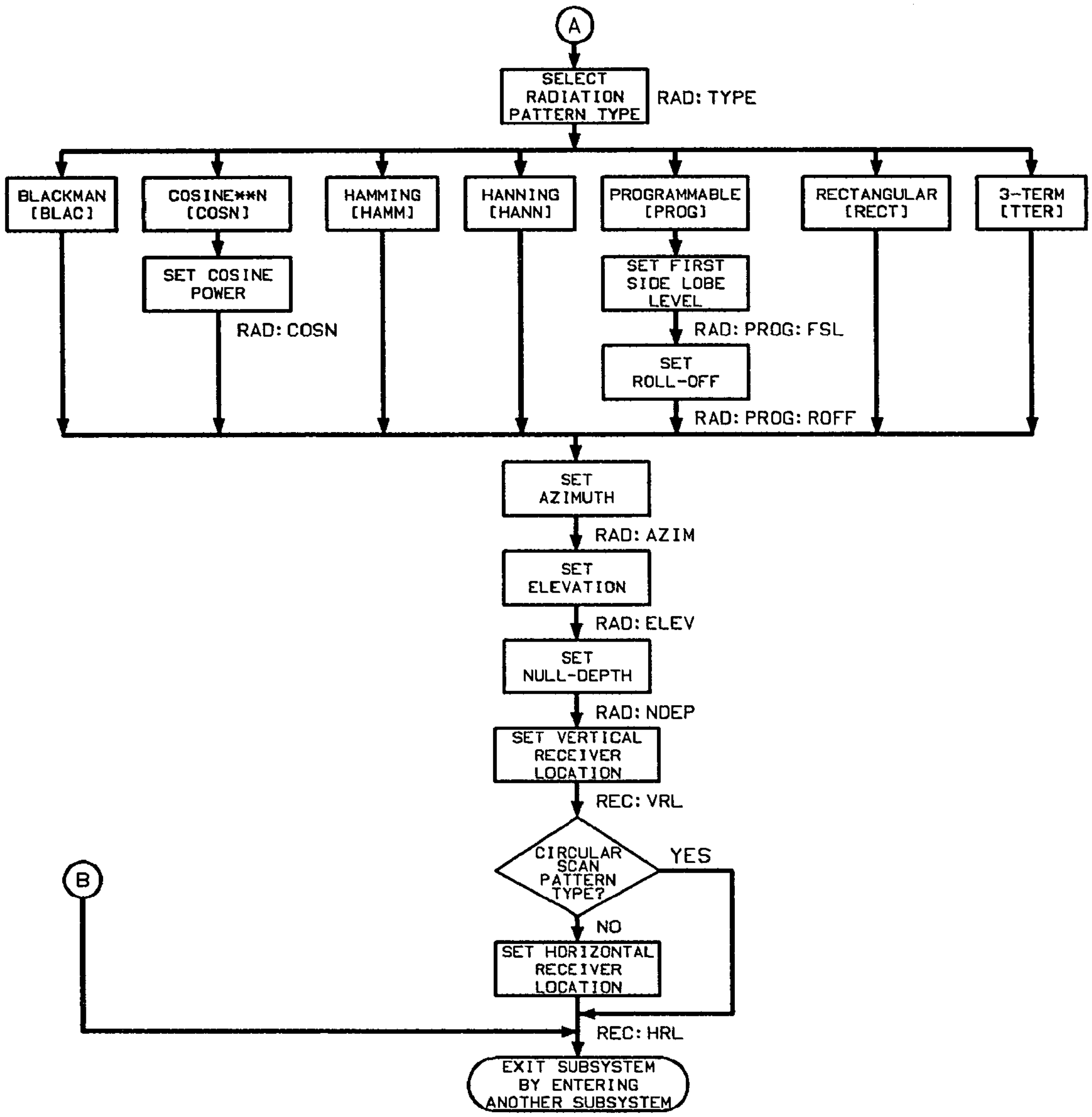


Figure 5-1. Antenna Modulation Subsystem Flowchart (continued)

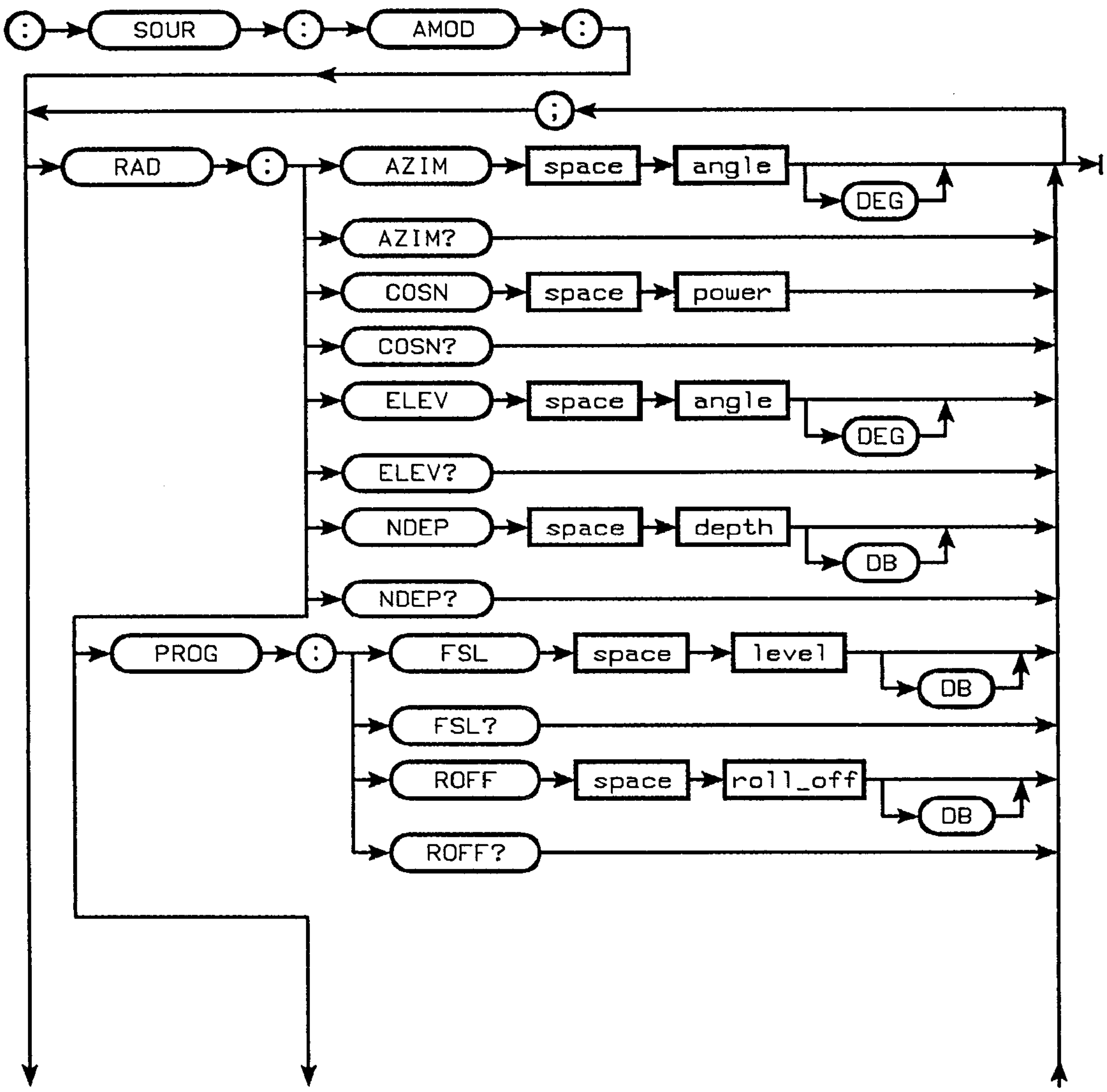


Figure 5-2. Antenna Modulation Subsystem Syntax Diagram

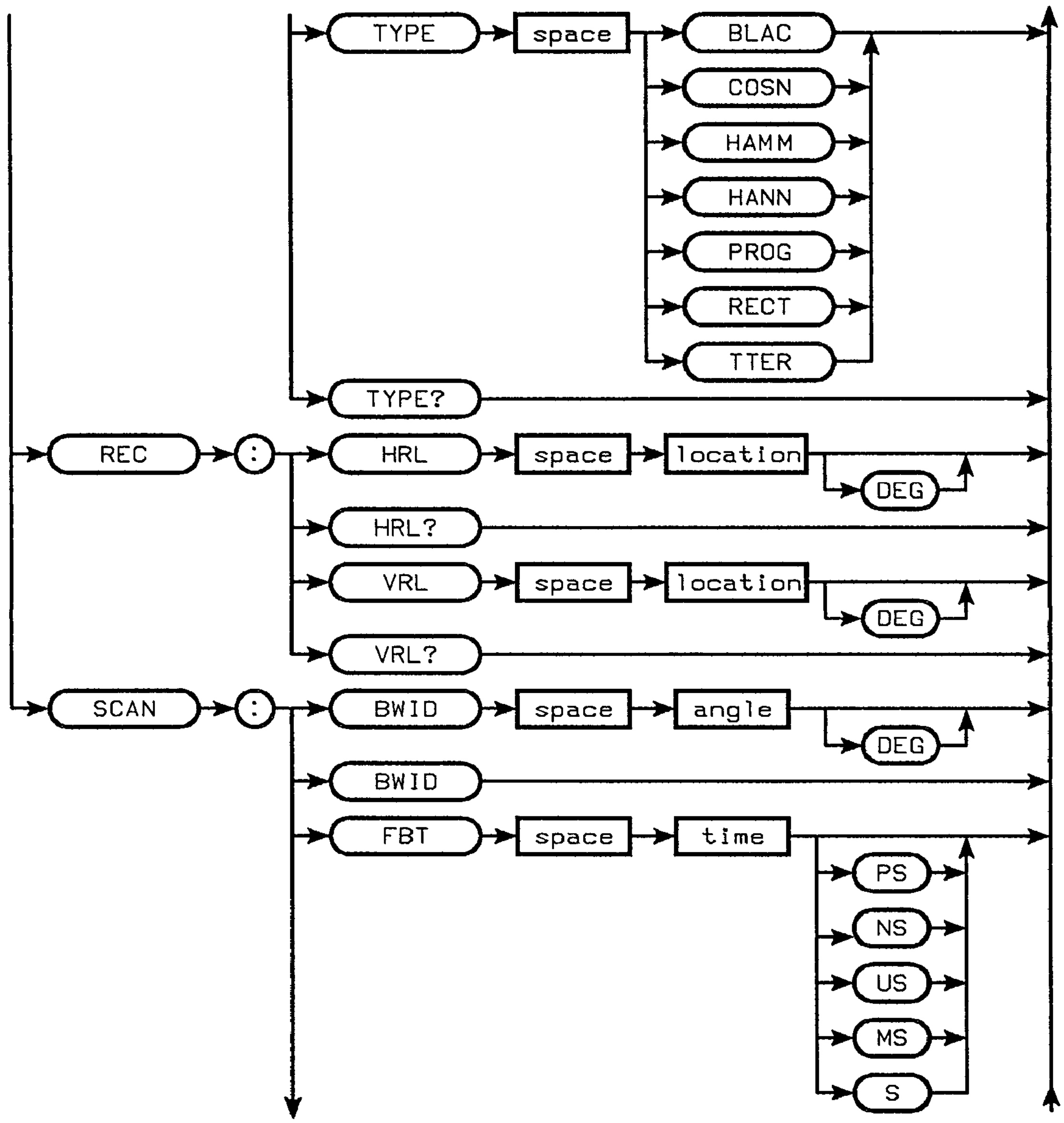


Figure 5-2. Antenna Modulation Subsystem Syntax Diagram (continued)

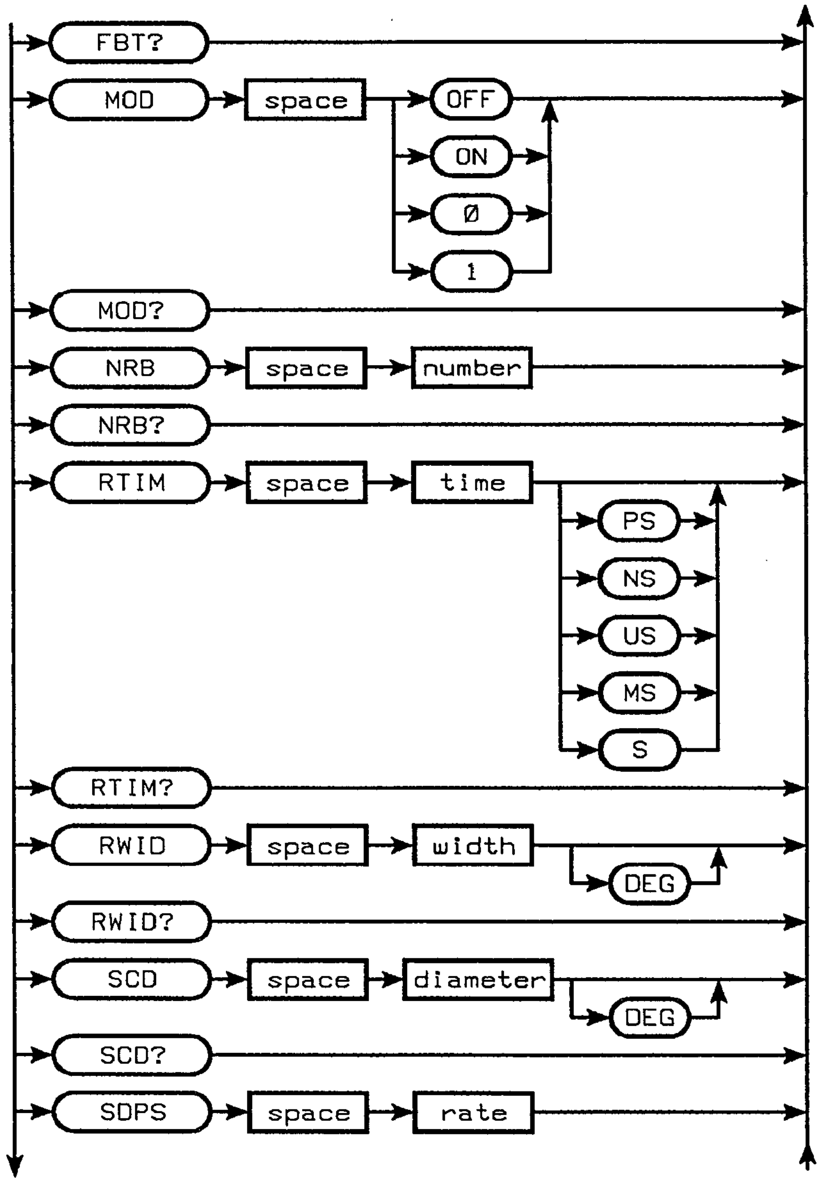


Figure 5-2. Antenna Modulation Subsystem Syntax Diagram (continued)

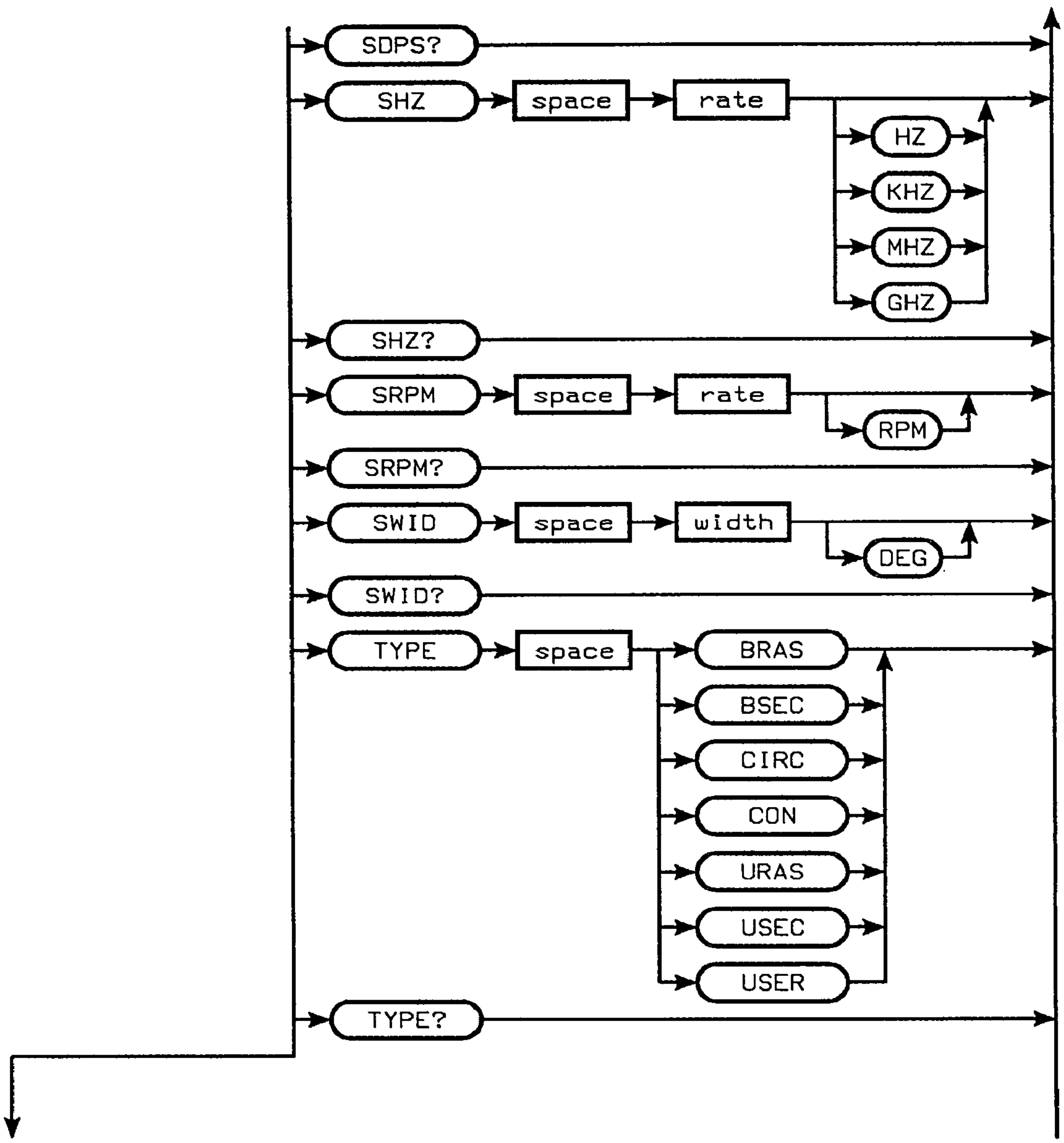


Figure 5-2. Antenna Modulation Subsystem Syntax Diagram (continued)

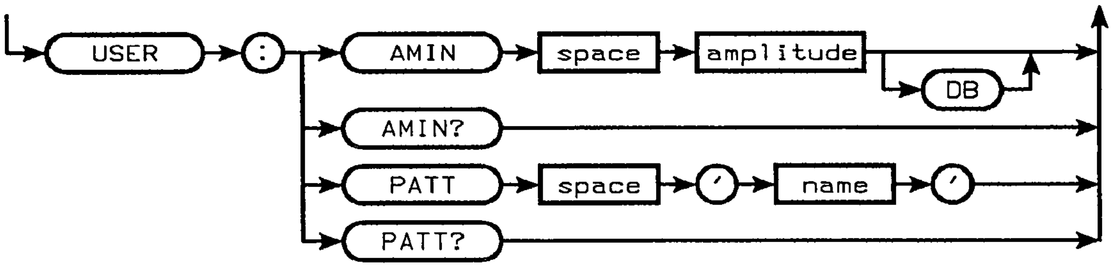


Figure 5-2. Antenna Modulation Subsystem Syntax Diagram (continued)

RAD:AZIM (Azimuth)

Syntax

:SOUR:AMOD:RAD:AZIM *angle* [DEG]

:SOUR:AMOD:RAD:AZIM?

Item	Description	Range/Restrictions
Angle	3 dB azimuth beam width	0 to 360° in 0.1° steps

Description

This command specifies the 3 dB azimuth beam width for a radiation pattern.

The query returns the current setting of the azimuth angle in degrees.

Example

To select a Blackman radiation pattern with a 3 dB azimuth beam width of 15° and a circular scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE BLAC"
100 !
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
150 !
```

```
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

The reset value for the 3 dB azimuth beam width is 1°.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:ELEV
RAD:NDEP
RAD:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Radiation Parameters...) + Azimuth Beam Width

RAD:COSN (Cosine N)

Syntax

:SOUR:AMOD:RAD:COSN *power*

:SOUR:AMOD:RAD:COSN?

Item	Description	Range/Restrictions
Power	Power to which the cosine function is raised	1 to 5

Description

This command sets the power of the cosine radiation pattern.

The query returns the current setting of the cosine power.

Example

To create a Cosine**4 radiation pattern and a circular scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  COSINE RADIATION PATTERN AND COSINE POWER
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE COSN"
100 OUTPUT 719; ":SOUR:AMOD:RAD:COSN 4"
110 !
120 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
130 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
150 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
```

```
160 !
170 !  VERTICAL RECEIVER LOCATION
180 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
190 !
200 END
```

Comments

The reset value for cosine power is 2.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:ELEV
RAD:NDEP
RAD:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Radiation Parameters...] (for COS**N Radiation Type) + Cosine Power

RAD:ELEV (Elevation)

Syntax

:SOUR:AMOD:RAD:ELEV *angle* [DEG]

:SOUR:AMOD:RAD:ELEV?

Item	Description	Range/Restrictions
Angle	3 dB elevation beam width	0 to 360° in 0.1° steps

Description

This command specifies the 3 dB elevation beam width of a radiation pattern.

The query returns the current elevation setting in degrees.

Example

To select a Hamming radiation pattern with a 3 dB elevation beam width of 15° and a circular scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE HAMM"
100 !
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
150 !
```

```
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

The reset value for elevation beam width is 2°.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:NDEP
RAD:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Radiation Parameters...) + Elevation Beam Width

RAD:NDEP (Null Depth)

Syntax

`:SOUR:AMOD:RAD:NDEP` *depth* [`DB`]

`:SOUR:AMOD:RAD:NDEP?`

Item	Description	Range/Restrictions
Depth	Null depth	−60 to 0 dB in 0.1 dB steps

Description

This command specifies the null depth of the radiation pattern.

The query returns the current setting of the null depth in dB.

Example

To select a Hanning radiation pattern with a null depth of −60 dB and a circular scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE HANN"
100 !
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
150 !
```

```
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

The reset value for null depth is −60 dB.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:ELEV
RAD:TYPE

Global Subsystem
SMOD .

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Radiation Parameters...) + Null Depth

RAD:PROG:FSL (First Side Lobe)

Syntax

:SOUR:AMOD:RAD:PROG:FSL *level* [DB]

:SOUR:AMOD:RAD:PROG:FSL?

Item	Description	Range/Restrictions
Level	Level of first side lobe	−60 to 0 dB in 0.1 dB steps

Description

This command sets the level of the first side lobe for a programmable radiation pattern.

The query returns the current setting of the first side lobe level in dB.

Example

To create a programmable radiation pattern with a first side lobe level of -28 dB and a unidirectional sector scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, FLYBACK TIME, AND SECTOR WIDTH
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE USEC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
70  OUTPUT 719; ":SOUR:AMOD:SCAN:FBT 60 MS"
80  OUTPUT 719; ":SOUR:AMOD:SCAN:SWID 75 DEG"
90  !
100 !PROGRAMMABLE RADIATION PATTERN, FIRST SIDE LOBE AND ROLL_OFF
110 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE PROG"
120 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:FSL -28 DB"
130 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:ROFF 6 DB"
140 !
```

```
150 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
160 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 3 DEG"
170 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 2 DEG"
180 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
190 !
200 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
210 OUTPUT 719; ":SOUR:AMOD:REC:HRL 25 DEG"
220 OUTPUT 719; ":SOUR:AMOD:REC:VRL 1 DEG"
230 !
240 END
```

Comments

The reset value for first side lobe level is −11.2 dB.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:ELEV
RAD:NDEP
RAD:PROG:ROFF
RAD:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Radiation Parameters...) (for Programmable Radiation) + First Side Lobe Level

RAD:PROG:ROFF (Roll Off)

Syntax

`:SOUR:AMOD:RAD:PROG:ROFF` *roll_off* [DB]

`:SOUR:AMOD:RAD:PROG:ROFF?`

Item	Description	Range/Restrictions
Roll_off	Roll-off factor in dB per octave	6 to 36 dB in 6 dB steps

Description

This command sets the roll-off factor in dB per octave for a programmable radiation pattern.

The query returns the current setting of the roll-off factor in dB per octave.

Example

To create a programmable radiation pattern with a roll-off of 6 dB/octave and a unidirectional sector scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, FLYBACK TIME, AND SECTOR WIDTH
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE USEC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
70  OUTPUT 719; ":SOUR:AMOD:SCAN:FBT 60 MS"
80  OUTPUT 719; ":SOUR:AMOD:SCAN:SWID 75 DEG"
90  !
100 !PROGRAMMABLE RADIATION PATTERN, FIRST SIDE LOBE AND ROLL_OFF
110 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE PROG"
120 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:FSL -28 DB"
130 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:ROFF 6 DB"
140 !
```

```
150 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
160 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 3 DEG"
170 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 2 DEG"
180 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
190 !
200 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
210 OUTPUT 719; ":SOUR:AMOD:REC:HRL 25 DEG"
220 OUTPUT 719; ":SOUR:AMOD:REC:VRL 1 DEG"
230 !
240 END
```

Comments

The reset value for roll-off is 6 dB per octave.

Values in between 6 dB steps will be rounded to the nearest 6 dB.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:ELEV
RAD:NDEP
RAD:PROG:FSL
RAD:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Radiation Parameters...] (for Programmable Radiation) + Roll-off in dB/Octave

RAD:TYPE (Radiation Pattern Type)

Syntax

$$:\mathtt{SOUR:AMOD:RAD:TYPE} \left\{ \begin{array}{l} \mathtt{BLAC} \\ \mathtt{COSN} \\ \mathtt{HAMM} \\ \mathtt{HANN} \\ \mathtt{PROG} \\ \mathtt{RECT} \\ \mathtt{TTER} \end{array} \right\}$$

```
:SOUR:AMOD:RAD:TYPE?
```

Description

This command selects the radiation pattern type. The following pattern types can be selected:

- BLAC (Blackman)
- COSN (Cosine**N)
- HAMM (Hamming)
- HANN (Hanning)
- PROG (Programmable)
- RECT (Rectangular)
- TTER (Three Term)

The different types of radiation patterns, as plotted on a spectrum analyzer using HP FASS Model 11 hardware, are shown in the following figures.

The query returns the currently selected radiation pattern.

Blackman Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Blackman
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

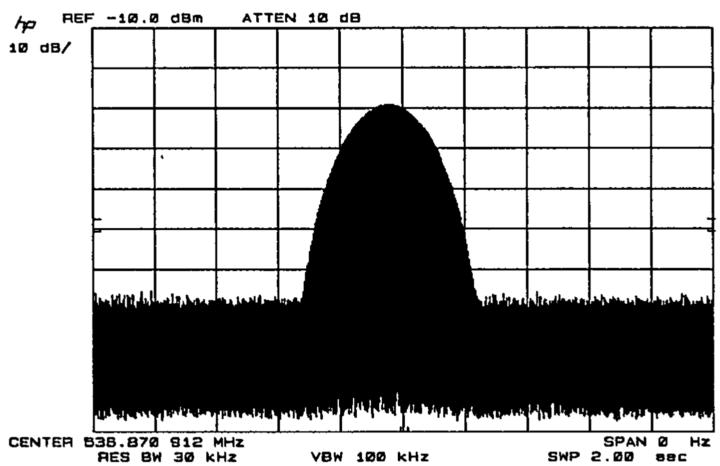


Figure 5-3. Typical Blackman Radiation Pattern

Cosine4 Radiation Pattern Parameters**

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Cosine**N
Cosine Power	4
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

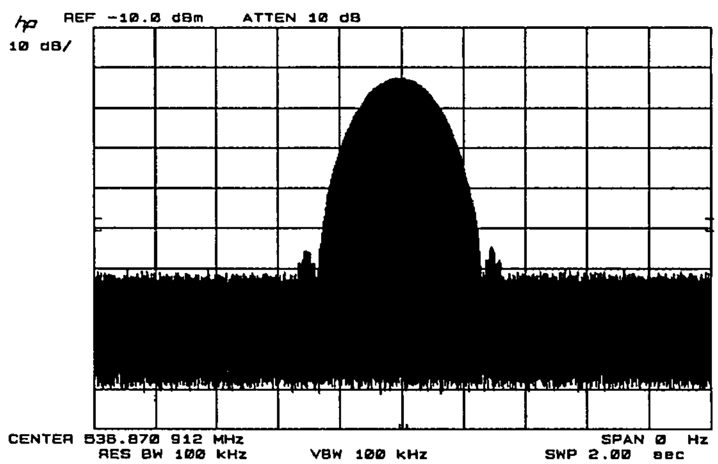


Figure 5-4. Typical Cosine4 Radiation Pattern**

Hamming Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Hamming
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

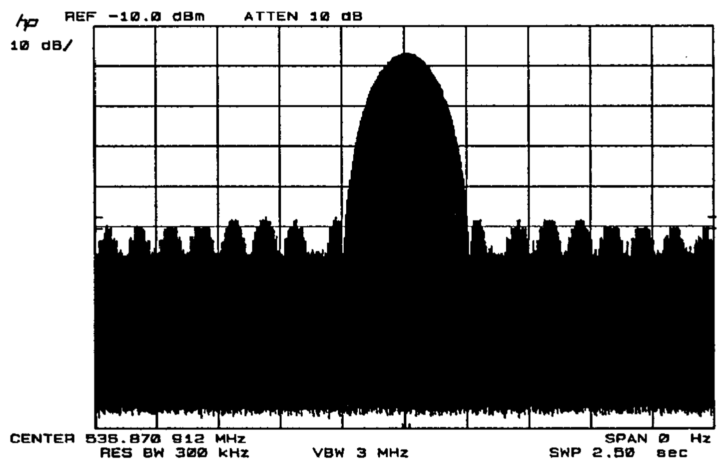


Figure 5-5. Typical Hamming Radiation Pattern

RAD:TYPE (Radiation Pattern Type)

Hanning Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Hanning
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	–60 dB
Vertical Receiver Location	0°

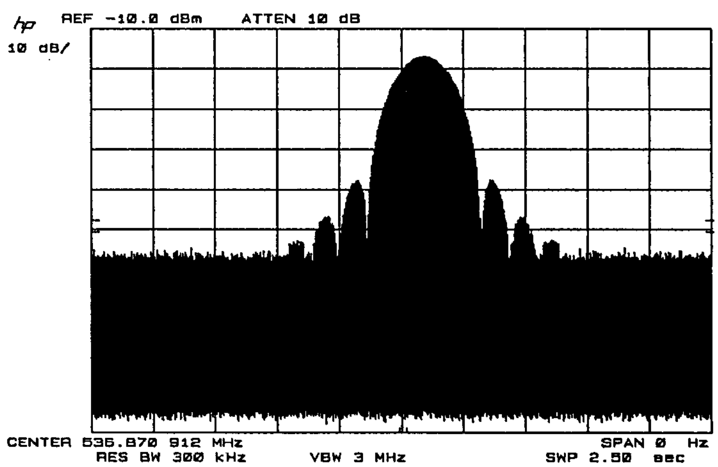


Figure 5-6. Typical Hanning Radiation Pattern

Programmable Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Programmable
First Side Lobe Level	−20 dB
Roll-off	12 dB/octave
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

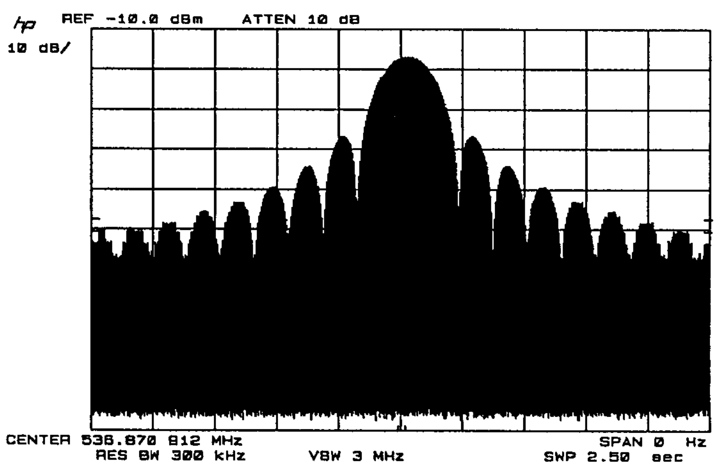


Figure 5-7. Typical Programmable Radiation Pattern

RAD:TYPE (Radiation Pattern Type)

Rectangular Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Rectangular
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

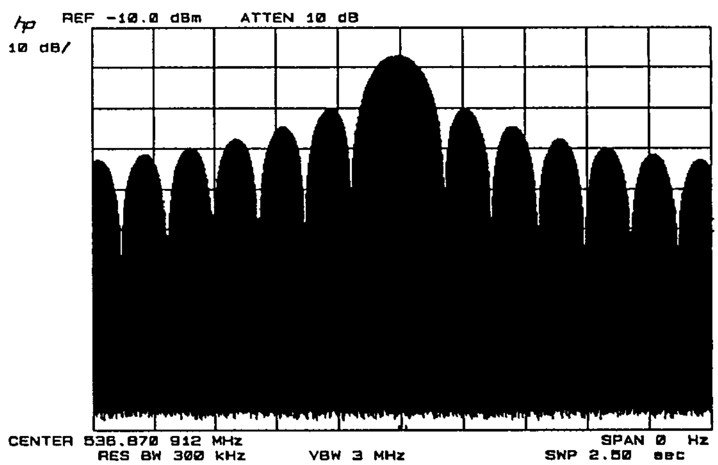


Figure 5-8. Typical Rectangular Radiation Pattern

Three Term Radiation Pattern Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Radiation Type	Three Term
3 dB Azimuth	15°
3 dB Elevation	2°
Null Depth	−60 dB
Vertical Receiver Location	0°

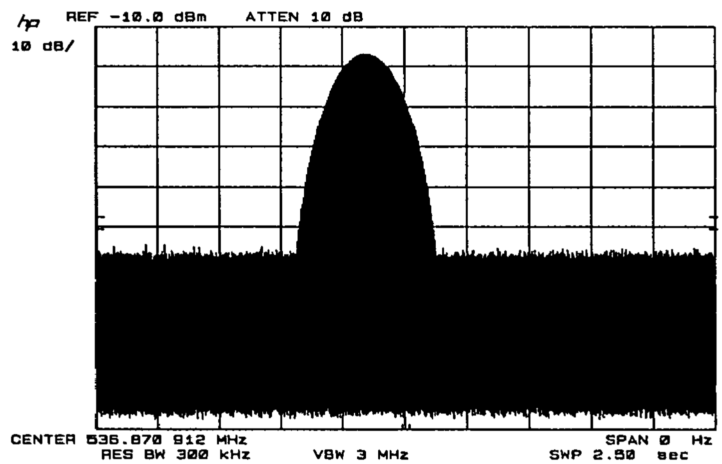


Figure 5-9. Typical Three Term Radiation Pattern

Example

To select a rectangular radiation pattern and a conical scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, AND SCANNING CONE DIAMETER
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CON"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 100 HZ"
70  OUTPUT 719; ":SOUR:AMOD:SCD 4 DEG"
80  !
90  !  RADIATION TYPE
100 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
110 !
120 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
130 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
150 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -50 DB"
160 !
170 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
180 OUTPUT 719; ":SOUR:AMOD:REC:HRL 4 DEG"
190 OUTPUT 719; ":SOUR:AMOD:REC:VRL 8 DEG"
200 !
210 END
```

Comments

The reset value for radiation pattern type is rectangular.

If the Cosine**N or Programmable radiation pattern type is selected, additional parameters must be specified. Cosine**N requires that you specify the cosine power. Programmable requires that you specify the first side lobe level and roll-off factor.

A Blackman radiation pattern has a first side lobe level of −58 dB.

A Hamming radiation pattern has a first side lobe level of −43 dB.

A Hanning radiation pattern has a first side lobe level of −32 dB.

A rectangular pattern has a first side lobe level of −13 dB.

A Hanning radiation pattern is identical to a Cosine**2 radiation pattern.

A rectangular radiation pattern is identical to a Cosine**0 radiation pattern.

Related HP-IB Commands

Antenna Modulation Subsystem
RAD:AZIM
RAD:COSN
RAD:ELEV
RAD:NDEP
RAD:PROG:FSL
RAD:PROG:ROFF

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- Radiation Type

REC:HRL (Horizontal Receiver Location)

Syntax

:SOUR:AMOD:REC:HRL *location* [DEG]
:SOUR:AMOD:REC:HRL?

Item	Description	Range/Restrictions
Location	Horizontal receiver location	$-180°$ to $+180°$ in $0.1°$ steps

Description

This command specifies the horizontal receiver location with respect to the source for the selected scan pattern.

The query returns the current setting of the horizontal receiver location in degrees.

Example

To select a rectangular radiation pattern with a conical scan pattern and a horizontal receiver location of 4°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, AND SCANNING CONE DIAMETER
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CON"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 100 HZ"
70  OUTPUT 719; ":SOUR:AMOD:SCD 4 DEG"
80  !
90  !  RADIATION TYPE
100 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
110 !
120 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
130 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
150 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -50 DB"
```

```
160 !
170 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
180 OUTPUT 719; ":SOUR:AMOD:REC:HRL 4 DEG"
190 OUTPUT 719; ":SOUR:AMOD:REC:VRL 8 DEG"
200 !
210 END
```

Comments

The reset value for horizontal receiver location is 15°.

Related HP-IB Commands

Antenna Modulation Subsystem
REC:VRL
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Receiver Location...) +
Horizontal Location

REC:VRL (Vertical Receiver Location)

Syntax

```
:SOUR:AMOD:REC:VRL location [DEG]
:SOUR:AMOD:REC:VRL?
```

Item	Description	Range/Restrictions
Location	Vertical receiver location	−180° to +180° in 0.1° steps

Description

This command specifies the vertical receiver location with respect to the source for the specified scan pattern.

The query returns the current setting of the vertical receiver location in degrees.

Example

To select a Hanning radiation pattern and a circular scan pattern with a vertical receiver location of 0°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE HANN"
100 !
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
150 !
```

```
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

The reset value for vertical receiver location is 0°.

Related HP-IB Commands

Antenna Modulation Subsystem
REC:HRL
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Receiver Location...] + Vertical Location

SCAN:BWID (Bar Width)

Syntax

:SOUR:AMOD:SCAN:BWID *angle* [DEG]
:SOUR:AMOD:SCAN:BWID?

Item	Description	Range/Restrictions
Angle	Angle between bars	0 to 360°. See comments below.

Description

This command sets the raster bar width for a bidirectional or unidirectional raster scan pattern.

The query returns the current setting of the raster bar width in degrees.

Example

To create a bidirectional raster scan pattern with a raster bar width of 4°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE BRAS"
60  !
70  !  RETRACE TIME, SCAN RATE, RASTER WIDTH,
80  !  BAR WIDTH, AND NUMBER OF RASTER BARS
90  OUTPUT 719; ":SOUR:AMOD:SCAN:RTIM 1 MS"
100 OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
110 OUTPUT 719; ":SOUR:AMOD:RWID 40 DEG"
120 OUTPUT 719; ":SOUR:AMOD:BWID 4 DEG"
130 OUTPUT 719; ":SOUR:AMOD:SCAN:NRB 3"
140 !
150 !  RADIATION TYPE
160  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
```

```
170 !
190 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
200 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
210 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
220 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
230 !
240 !  VERTICAL AND HORIZONTAL RECEIVER LOCATION
250 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
260 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
270   END
```

Comments

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time for a bidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width) + (Bar\ Width)(No.\ Bars - 1)}{Scan\ Rate} + Retrace\ Time$$

where:

Raster width and bar width is in degrees
Scan rate is in degrees per second

For unidirectional raster scan patterns, bar width is not a factor in determining the total scan time.

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:NRB
SCAN:RTIM
SCAN:RWID
SCAN:SDPS
SCAN:TYPE

SCAN:BWID (Bar Width)

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- Scan Parameters... (for Bidir. or Unidir. Raster Scan Type) + Bar Width Angle

SCAN:FBT (Flyback Time)

Syntax

```
                                  ┌PS┐
                                  │NS│
:SOUR:AMOD:SCAN:FBT time          │US│
                                  │MS│
                                  └S ┘
:SOUR:AMOD:SCAN:FBT?
```

Item	Description	Range/Restrictions
Time	Flyback time	See comments below.

Description

This command sets the flyback time for a unidirectional raster or unidirectional sector scan pattern.

The query returns the current setting of the flyback time.

Example

To create a unidirectional sector scan with a flyback time of 60 ms and a programmable radiation pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, FLYBACK TIME, AND SECTOR WIDTH
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE USEC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
70  OUTPUT 719; ":SOUR:AMOD:SCAN:FBT 60 MS"
80  OUTPUT 719; ":SOUR:AMOD:SCAN:SWID 75 DEG"
90  !
100 !PROGRAMMABLE RADIATION PATTERN, FIRST SIDE LOBE AND ROLL_OFF
110 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE PROG"
120 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:FSL -28 DB"
```

```
130 OUTPUT 719; ":SOUR:AMOD:RAD:PROG:ROFF 6 DB"
140 !
150 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
160 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 3 DEG"
170 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 2 DEG"
180 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
190 !
200 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
210 OUTPUT 719; ":SOUR:AMOD:REC:HRL 25 DEG"
220 OUTPUT 719; ":SOUR:AMOD:REC:VRL 1 DEG"
230 !
240 END
```

Comments

The reset value for flyback time is 2 ms.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time of a unidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width)}{Scan\ Rate} + (No.\ Bars - 1)(Flyback\ Time) + Retrace\ Time$$

where:

Raster width is in degrees
Scan rate is in degrees per second

The total scan time of a unidirectional sector scan pattern =

$$\frac{Sector\ Width}{Scan\ Rate} + Flyback\ Time$$

where:

Sector width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:BWID
SCAN:NRB
SCAN:RTIM
SCAN:RWID
SCAN:SDPS
SCAN:SWID
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Scan Parameters...) (for Unidir. Raster and Unidir. Sector Scan Types) + Flyback Time

SCAN:MOD (Modulation On/Off)

Syntax

```
:SOUR:AMOD:SCAN:MOD { OFF or 0 }
                    { ON or 1  }

:SOUR:AMOD:SCAN:MOD?
```

Description

This command turns the antenna scan modulation on and off.

The query returns a 0 if the antenna scan modulation is off and a 1 if the scan modulation is on.

Example

To turn the antenna scan modulation off:

```
OUTPUT 719; ":SOUR:AMOD:SCAN:MOD OFF"
```

Comments

In previous versions of RSID, this command had its sense reversed (that is, 0 or OFF enabled modulation and 1 or ON disabled modulation). RSID 2.0 fixes this problem. Now 0 disables modulation and 1 enables modulation.

The reset value for antenna modulation is on.

Related HP-IB Commands

Antenna Modulation Subsystem - SCAN:TYPE

Global Subsystem - SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- Ant. Modulation

SCAN:NRB (Number of Raster Bars)

Syntax

```
:SOUR:AMOD:SCAN:NRB number
:SOUR:AMOD:SCAN:NRB?
```

Item	Description	Range/Restrictions
Number	Number of raster bars	0 to 10,000. See comments below.

Description

This command sets the number of raster bars in a bidirectional or unidirectional raster scan pattern.

The query returns the current setting for the number of raster bars.

Example

To create a bidirectional raster scan pattern with 3 raster bars:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE BRAS"
60  !
70  !  RETRACE TIME, SCAN RATE, RASTER WIDTH,
80  !  BAR WIDTH, AND NUMBER OF RASTER BARS
90  OUTPUT 719; ":SOUR:AMOD:SCAN:RTIM 1 MS"
100 OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
110 OUTPUT 719; ":SOUR:AMOD:RWID 40 DEG"
120 OUTPUT 719; ":SOUR:AMOD:BWID 4 DEG"
130 OUTPUT 719; ":SOUR:AMOD:SCAN:NRB 3"
140 !
150 !  RADIATION TYPE
```

```
160  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
170 !
180 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
190 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
200 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
210 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
220 !
230 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
240 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
250 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
260 !
270 END
```

Comments

The reset value for number of raster bars is 3.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time for a bidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width) + (Bar\ Width)(No.\ Bars - 1)}{Scan\ Rate} + Retrace\ Time$$

where:

Raster width and bar width are in degrees
Scan rate is in degrees per second

The total scan time of a unidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width)}{Scan\ Rate} + (No.\ Bars - 1)(Flyback\ Time) + Retrace\ Time$$

where:

Raster width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:BWID
SCAN:FBT
SCAN:RTIM
SCAN:RWID
SCAN:SDPS
SCAN:SWID
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Scan Parameters...) (for Bidir. Raster or Unidir. Raster Scan Type) + Number Of Raster Bars

SCAN:RTIM (Retrace Time)

Syntax

```
:SOUR:AMOD:SCAN:RTIM time [PS | NS | US | MS | S]

:SOUR:AMOD:SCAN:RTIM?
```

Item	Description	Range/ Restrictions
Time	Retrace time	See comments below.

Description

This command sets the retrace time for bidirectional and unidirectional raster scan patterns.

The query returns the current setting of the retrace time in seconds.

Example

To create a bidirectional raster scan pattern with a retrace time of 1 ms:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE BRAS"
60  !
70  !  RETRACE TIME, SCAN RATE, RASTER WIDTH,
80  !  BAR WIDTH, AND NUMBER OF RASTER BARS
90  OUTPUT 719; ":SOUR:AMOD:SCAN:RTIM 1 MS"
100 OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
110 OUTPUT 719; ":SOUR:AMOD:RWID 40 DEG"
```

```
120 OUTPUT 719; ":SOUR:AMOD:BWID 4 DEG"
130 OUTPUT 719; ":SOUR:AMOD:SCAN:NRB 3"
140 !
150 !  RADIATION TYPE
160 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
170 !
180 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
190 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
200 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
210 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
220 !
230 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
240 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
250 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
260 !
270 END
```

Comments

The reset value for retrace time is 500 μs.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time for a bidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width) + (Bar\ Width)(No.\ Bars - 1)}{Scan\ Rate} + Retrace\ Time$$

where:

Raster width and bar width are in degrees
Scan rate is in degrees per second

SCAN:RTIM (Retrace Time)

The total scan time of a unidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width)}{Scan\ Rate} + (No.\ Bars - 1)(Flyback\ Time) + Retrace\ Time$$

where:

Raster width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:BWID
SCAN:FBT
SCAN:NRB
SCAN:RWID
SCAN:SDPS
SCAN:SWID
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for Bidir. Raster or Unidir. Raster Scan Type) + Retrace Time

SCAN:RWID (Raster Width)

Syntax

```
:SOUR:AMOD:SCAN:RWID width [DEG]
:SOUR:AMOD:SCAN:RWID?
```

Item	Description	Range/Restrictions
Width	Raster width	0 to 360° in 0.1° steps. See comments below.

Description

This command sets the raster width for bidirectional and unidirectional raster scan patterns.

The query returns the current setting of the raster width in degrees.

Example

To create a unidirectional raster scan pattern with a raster width of 40°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE URAS"
60  !
70  !  RETRACE TIME, SCAN RATE, FLYBACK TIME, RASTER WIDTH,
80  !  BAR WIDTH, AND NUMBER OF RASTER BARS
90  OUTPUT 719; ":SOUR:AMOD:SCAN:RTIM 1 MS"
100 OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
110 OUTPUT 719; ":SOUR:AMOD:SCAN:FBT 40 MS"
120 OUTPUT 719; ":SOUR:AMOD:RWID 40 DEG"
130 OUTPUT 719; ":SOUR:AMOD:BWID 4 DEG"
140 OUTPUT 719; ":SOUR:AMOD:SCAN:NRB 3"
150 !
```

```
160 !  RADIATION TYPE
170  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
180 !
190 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
200 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
210 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
220 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
230 !
240 !  VERTICAL AND HORIZONTAL RECEIVER LOCATION
250 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
270 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
280  END
```

Comments

The reset value for raster width is 50°.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time for a bidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width) + (Bar\ Width)(No.\ Bars - 1)}{Scan\ Rate} + Retrace\ Time$$

where:

Raster width and bar width are in degrees
Scan rate is in degrees per second

The total scan time of a unidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width)}{Scan\ Rate} + (No.\ Bars - 1)(Flyback\ Time) + Retrace\ Time$$

where:

Raster width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:BWID
SCAN:FBT
SCAN:NRB
SCAN:RTIM
SCAN:SDPS
SCAN:SWID
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Scan Parameters...) (for Bidir. Raster or Unidir. Raster Scan Type) + Raster Width Angle

SCAN:SCD (Scanning Cone Diameter)

Syntax

```
:SOUR:AMOD:SCAN:SCD diameter [DEG]
:SOUR:AMOD:SCAN:SCD?
```

Item	Description	Range/Restrictions
Diameter	Scanning cone diameter	0 to 360° in 0.1° steps

Description

This command sets the diameter of the scanning cone for a conical scan pattern.

The query returns the current diameter of the scanning cone in degrees.

Example

To select a conical scan pattern with a cone diameter of 4°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, AND SCANNING CONE DIAMETER
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CON"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 100 HZ"
70  OUTPUT 719; ":SOUR:AMOD:SCD 4 DEG"
80  !
90  !  RADIATION TYPE
100 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
110 !
120 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
130 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
150 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -50 DB"
```

```
160 !
170 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
180 OUTPUT 719; ":SOUR:AMOD:REC:HRL 4 DEG"
190 OUTPUT 719; ":SOUR:AMOD:REC:VRL 8 DEG"
200 !
210 END
```

Comments

The reset value for scanning cone diameter is 10°.

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:TYPE
SCAN:SHZ

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- (Scan Parameters...) (for Conical Scan Type) + Cone Diameter

SCAN:SDPS (Scan Rate in Degrees per Second)

Syntax

:SOUR:AMOD:SCAN:SDPS *rate*
:SOUR:AMOD:SCAN:SDPS?

Item	Description	Range/Restrictions
Rate	Scan rate	See comments below.

Description

This command sets the scan rate in degrees per second for raster and sector scan patterns.

The query returns the current scan rate in degrees per second.

Example

To create a unidirectional raster scan pattern with a scan rate of 200 degrees per second:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE URAS"
60  !
70  !  RETRACE TIME, SCAN RATE, FLYBACK TIME, RASTER WIDTH,
80  !  BAR WIDTH, AND NUMBER OF RASTER BARS
90  OUTPUT 719; ":SOUR:AMOD:SCAN:RTIM 1 MS"
100 OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
110 OUTPUT 719; ":SOUR:AMOD:SCAN:FBT 40 MS"
120 OUTPUT 719; ":SOUR:AMOD:RWID 40 DEG"
130 OUTPUT 719; ":SOUR:AMOD:BWID 4 DEG"
140 OUTPUT 719; ":SOUR:AMOD:SCAN:NRB 3"
```

```
150 !
160 !  RADIATION TYPE
170  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
180 !
190 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
200 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
210 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
220 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
230 !
240 !  VERTICAL AND HORIZONTAL RECEIVER LOCATION
250 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
260 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
270   END
```

Comments

The reset value for scan rate in degrees per second is 100 degrees per second.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

The total scan time for a bidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width) + (Bar\ Width)(No.\ Bars - 1)}{Scan\ Rate} + Retrace\ Time$$

where:

Raster width and bar width are in degrees
Scan rate is in degrees per second

The total scan time of a unidirectional raster scan pattern =

$$\frac{(No.\ Bars)(Raster\ Width)}{Scan\ Rate} + (No.\ Bars - 1)(Flyback\ Time) + Retrace\ Time$$

where:

Raster width is in degrees
Scan rate is in degrees per second

Total scan time for a bidirectional sector scan pattern =

$$\frac{2(Sector\ Width)}{Scan\ Rate}$$

where:

Sector width is in degrees
Scan rate is in degrees per second

Total scan time for a unidirectional sector scan pattern =

$$\frac{Sector\ Width}{Scan\ Rate} + Flyback\ Time$$

where:

Sector width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:BWID
SCAN:FBT
SCAN:NRB
SCAN:RTIM
SCAN:RWID
SCAN:SWID
SCAN:TYPE

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for Bidir. Raster, Unidir. Raster, Bidir. Sector, or Unidir. Sector Scan Types) + Scan Rate

SCAN:SHZ (Scan Rate in Hertz)

Syntax

```
:SOUR:AMOD:SCAN:SHZ rate [HZ | KHZ | MHZ | GHZ]

:SOUR:AMOD:SCAN:SHZ?
```

Item	Description	Range/Restrictions
Rate	Scan rate	0.0626 Hz to 762 kHz

Description

This command sets the scan rate in hertz (cycles per second) for a conical or user-defined scan pattern.

The query returns the current scan rate in hertz.

Example

To select a conical scan pattern with a scan rate of 100 Hz:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE, SCAN RATE, AND SCANNING CONE DIAMETER
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CON"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 100 HZ"
70  OUTPUT 719; ":SOUR:AMOD:SCD 4 DEG"
80  !
90  !  RADIATION TYPE
100 OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
110 !
120 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
130 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
```

```
140 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 8 DEG"
150 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -50 DB"
160 !
170 !  HORIZONTAL AND VERTICAL RECEIVER LOCATION
180 OUTPUT 719; ":SOUR:AMOD:REC:HRL 4 DEG"
190 OUTPUT 719; ":SOUR:AMOD:REC:VRL 8 DEG"
200 !
210 END
```

Comments

The reset value for scan rate in hertz is 100 Hz.

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:TYPE
SCAN:SHZ
SCAN:USER:PATT
SCAN:USER:AMIN

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for Conical or User Scan Types) + Scan Rate

SCAN:SRPM (Scan Rate in Revolutions per Minute)

Syntax

:SOUR:AMOD:SCAN:SRPM *rate* [RPM]
:SOUR:AMOD:SCAN:SRPM?

Item	Description	Range/Restrictions
Rate	Scan rate	3.751 to 45,756,043 rpm

Description

This command sets the scan rate in revolutions per minute (rpm) for a circular scan pattern.

The query returns the current scan rate in revolutions per minute.

Example

To select a circular scan pattern with a scan rate of 15 rpm:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE HANN"
100 !
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
```

SCAN:SRPM (Scan Rate in Revolutions per Minute)

```
150 !
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

The reset value for scan rate in revolutions is 15 rpm.

Related HP-IB Commands

Antenna Modulation Subsystem - SCAN:TYPE

Global Subsystem - SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for Circular Scan Type) + Scan Rate

SCAN:SWID (Sector Width)

Syntax

```
:SOUR:AMOD:SCAN:SWID width [DEG]
:SOUR:AMOD:SCAN:SWID?
```

Item	Description	Range/Restrictions
Width	Sector width	0 to 360° in 0.1° steps. See comments below.

Description

This command sets the sector width for a bidirectional or unidirectional sector scan pattern.

The query returns the current setting of the sector width in degrees.

Example

To create a Bidirectional sector scan pattern with a sector width of 50°:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE BSEC"
60  !
70  !  SCAN RATE AND SECTOR WIDTH
80  OUTPUT 719; ":SOUR:AMOD:SCAN:SDPS 200"
90  OUTPUT 719; ":SOUR:AMOD:SCAN:SWID 50 DEG"
100 !
110 !  RADIATION TYPE
120  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE RECT"
130 !
140 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
150 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 4 DEG"
```

```
160 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 2 DEG"
170 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -58 DB"
180 !
190 !  VERTICAL AND HORIZONTAL RECEIVER LOCATION
200 OUTPUT 719; ":SOUR:AMOD:REC:VRL 4 DEG"
210 OUTPUT 719; ":SOUR:AMOD:REC:HRL 30 DEG"
220   END
```

Comments

The reset value for sector width is 50°.

Scan parameters are interrelated and cannot be specified independently of other parameter values. Scan parameters are dependent on the total scan time, as shown in the following equation. The total scan time for any scan pattern must be between 1.311 μs and 15.999 seconds.

Total scan time for a bidirectional sector scan pattern =

$$\frac{2(Sector\ Width)}{Scan\ Rate}$$

where:

Sector width is in degrees
Scan rate is in degrees per second

Total scan time for a unidirectional sector scan pattern =

$$\frac{Sector\ Width}{Scan\ Rate} + Flyback\ Time$$

where:

Sector width is in degrees
Scan rate is in degrees per second

Related HP-IB Commands

Antenna Modulation
SCAN:FBT
SCAN:SDPS

Global Subsystem
SMOD

Equivalent Front Panel Command

Antenna Modulation Dialog Box- Scan Parameters... (for Bidir. Sector or Unidir. Sector Scan Type) + Sector Width Angle

SCAN:TYPE (Scan Pattern Type)

Syntax

```
                          ⎧ BRAS ⎫
                          ⎪ BSEC ⎪
                          ⎪ CIRC ⎪
:SOUR:AMOD:SCAN:TYPE      ⎨ CON  ⎬
                          ⎪ URAS ⎪
                          ⎪ USEC ⎪
                          ⎩ USER ⎭
:SOUR:AMOD:SCAN:TYPE?
```

Description

This command selects the antenna scan pattern type. The following types can be selected:

- BRAS (Bidirectional Raster)
- BSEC (Bidirectional Sector)
- CIRC (Circular)
- CON (Conical)
- URAS (Unidirectional Raster)
- USEC (Unidirectional Sector)
- USER (User-defined)

The different types of scan patterns, as plotted on a spectrum analyzer using HP FASS Model 11 hardware, are shown in the following figures. All the plots use a rectangular radiation pattern with the 3 dB azimuth set to 15°, the 3 dB elevation set to 2°, and the null depth set to −60 dB.

The query returns the currently selected antenna scan type. The returned format is character data.

Bidirectional Raster Scan Parameters

Parameter	Value
Scan Type	Bidirectional Raster
Scan Rate	20 degrees/second
Raster Time	1 ms
Raster Width	45°
Bar Width	2°
Number of Bars	5
Vertical Receiver Location	4°
Horizontal Receiver Location	15°

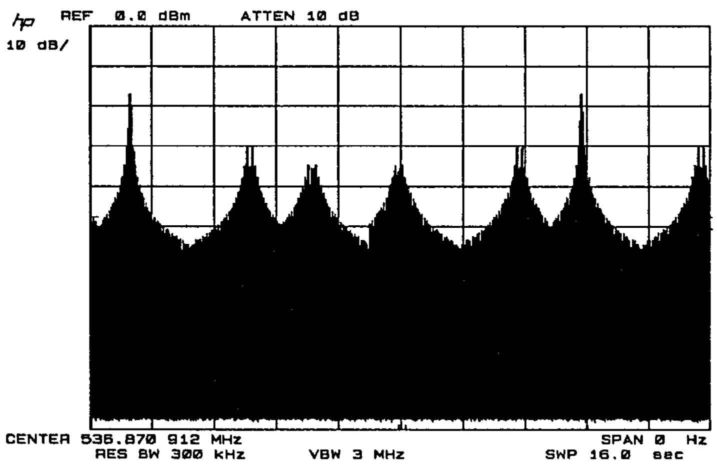


Figure 5-10. Five Raster Bidirectional Raster Scan Pattern

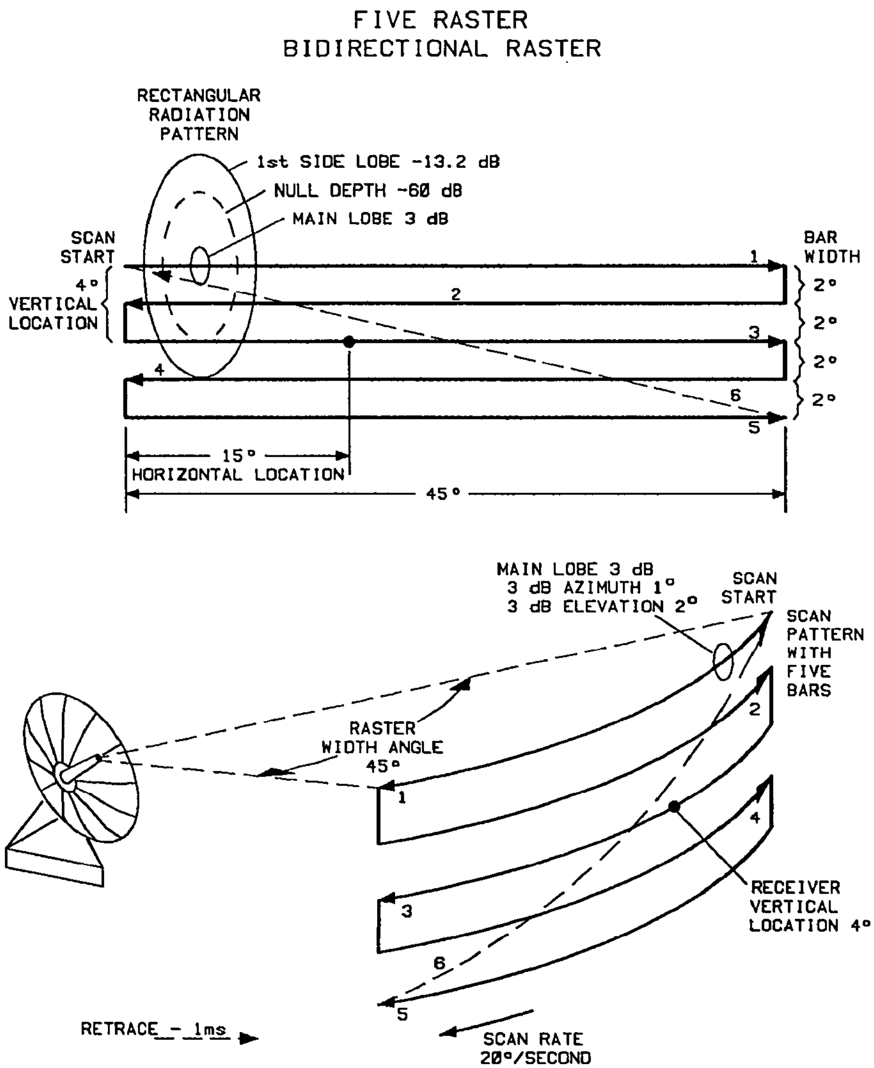


Figure 5-11. Five Raster Bidirectional Radar

Bidirectional Sector Scan Parameters

Parameter	Value
Scan Type	Bidirectional Sector
Scan Rate	20 degrees/second
Sector Width	45°
Vertical Receiver Location	0°
Horizontal Receiver Location	15°

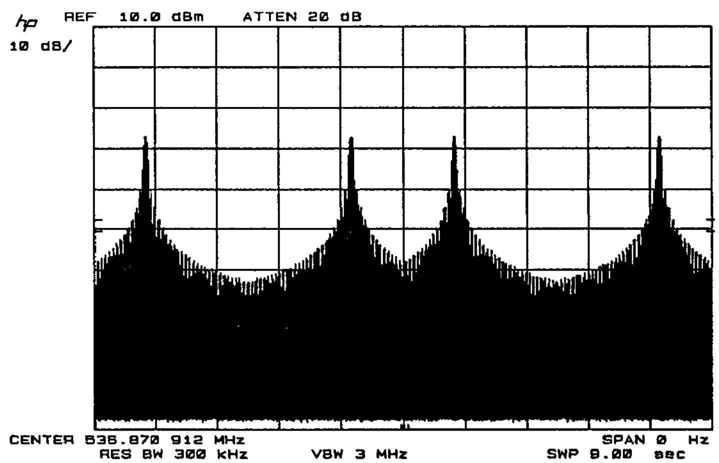


Figure 5-12. Typical Bidirectional Sector Scan Pattern

SCAN:TYPE (Scan Pattern Type)

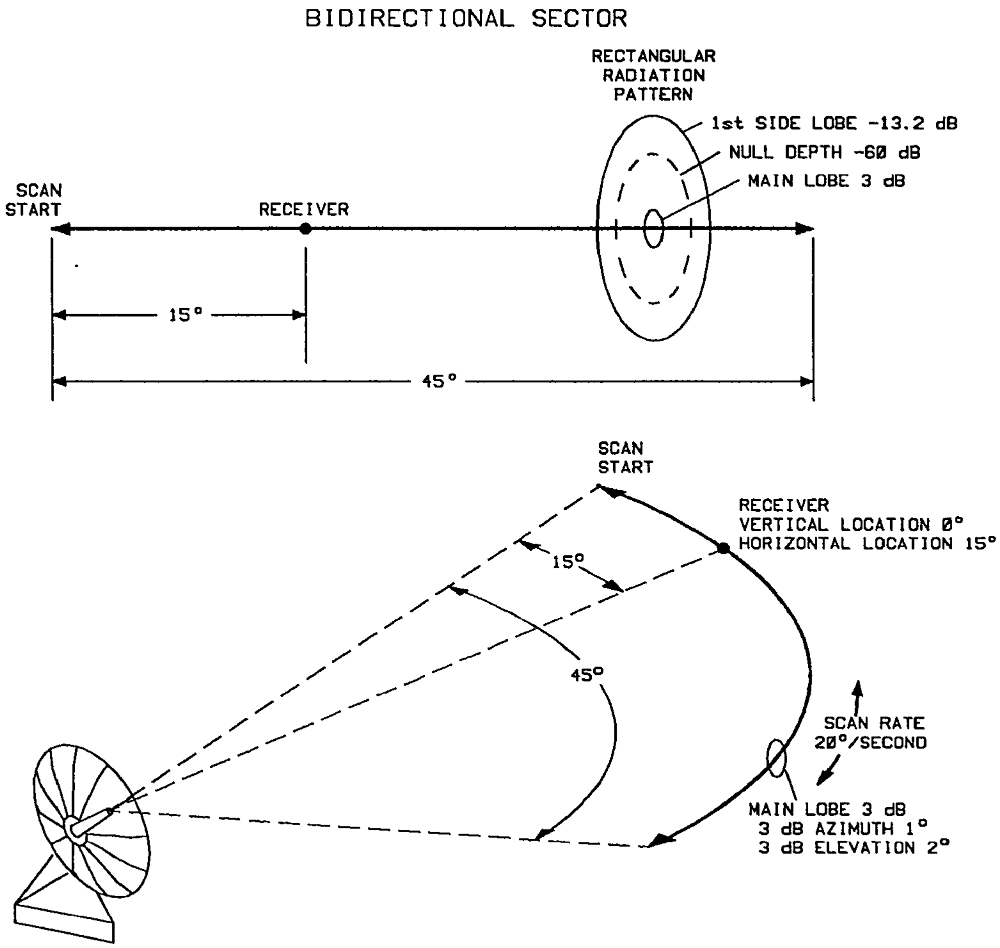


Figure 5-13. Typical Bidirectional Sector Scan Radar

Circular Scan Parameters

Parameter	Value
Scan Type	Circular
Scan Rate	15 RPM
Vertical Receiver Location	0°

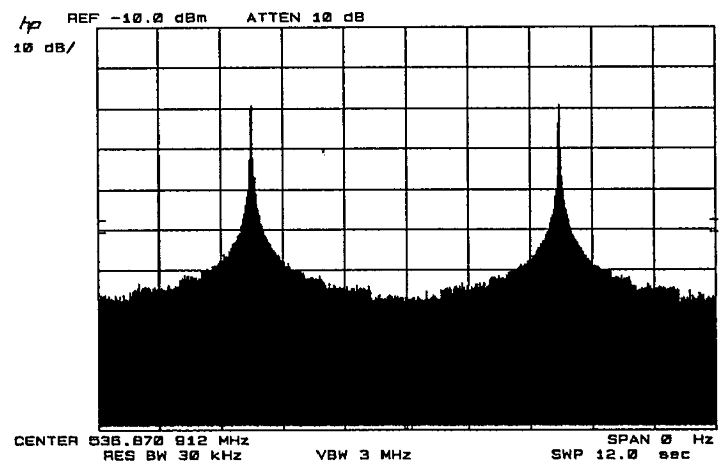


Figure 5-14. Typical Circular Scan Pattern

SCAN:TYPE (Scan Pattern Type)

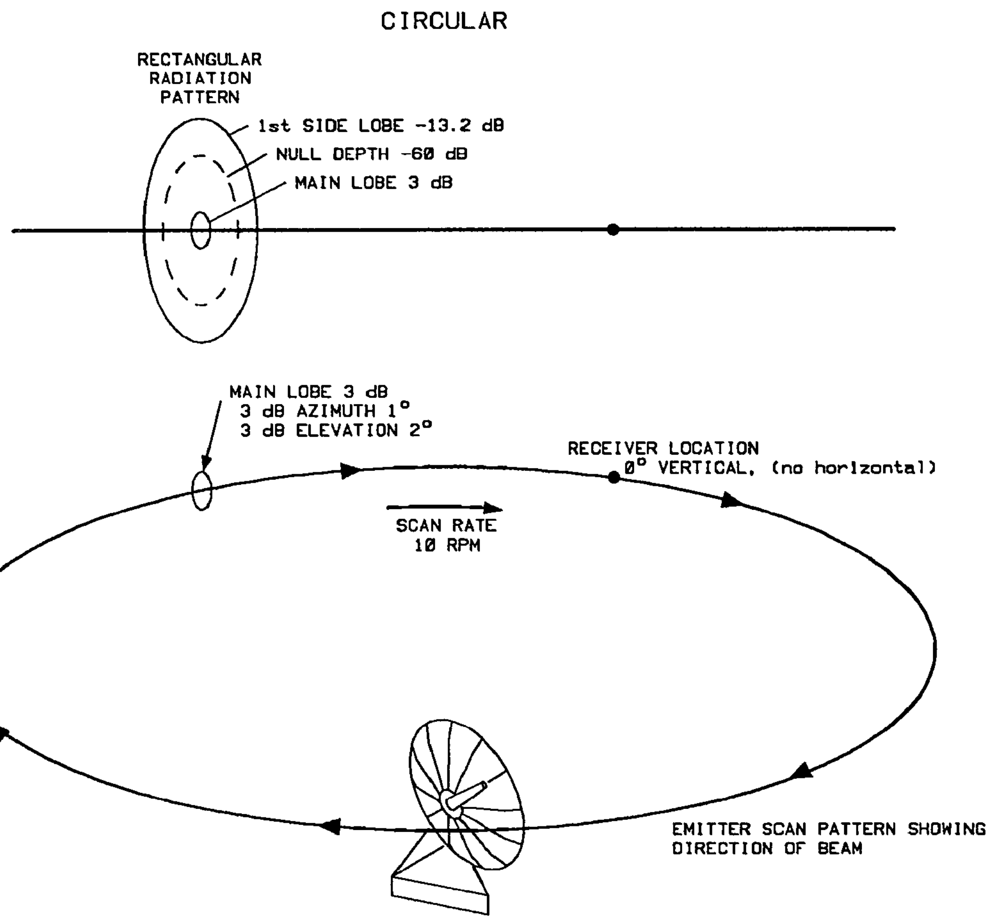


Figure 5-15. Typical Circular Scan Radar

Conical Scan Parameters

Parameter	Value
Scan Type	Conical
Scan Rate	120 Hz
Scanning Cone Diameter	10°
Vertical Receiver Location	4°
Horizontal Receiver Location	3°

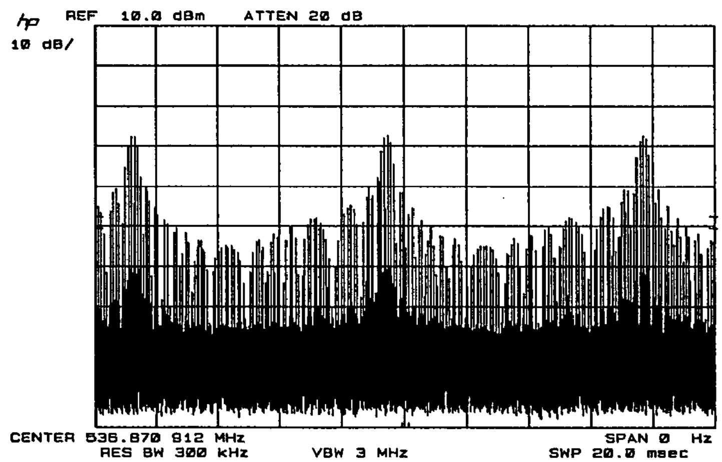


Figure 5-16. Typical Conical Scan Pattern

SCAN:TYPE (Scan Pattern Type)

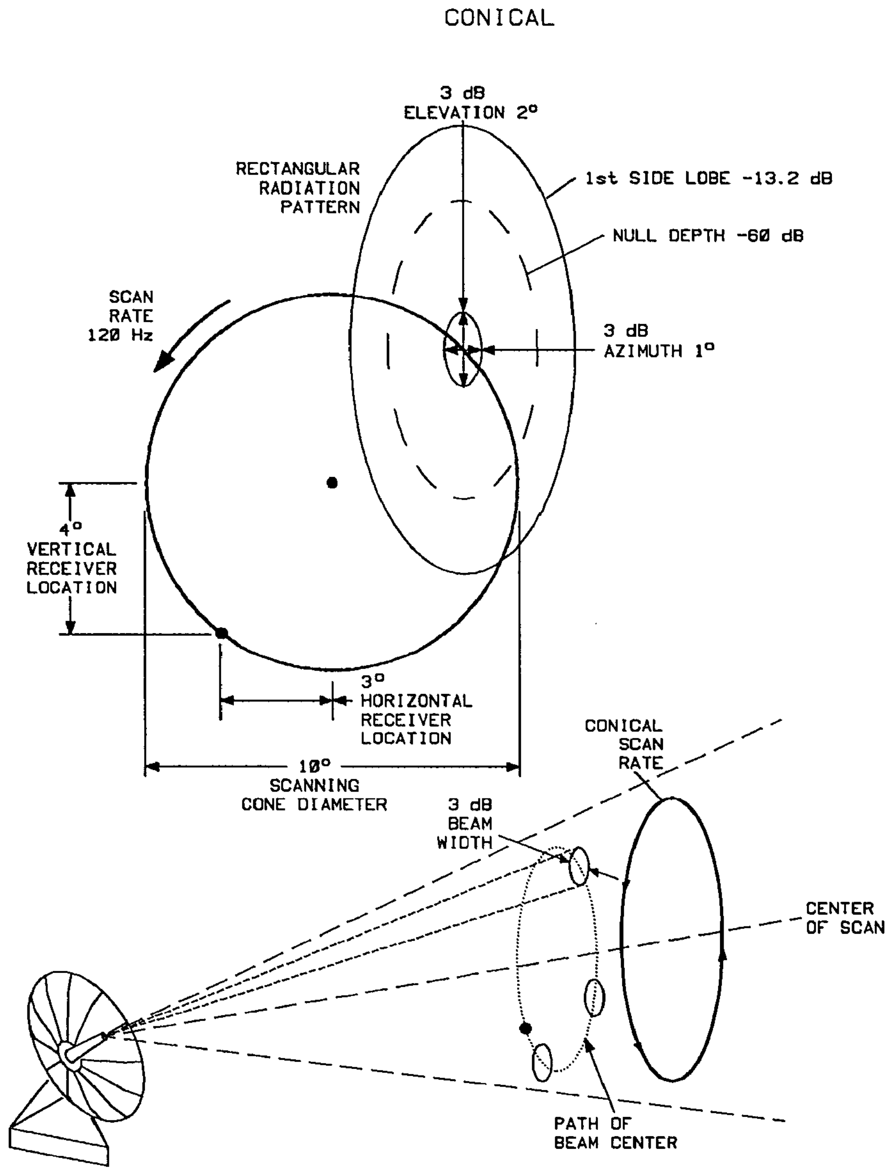


Figure 5-17. Typical Conical Scan Radar

Unidirectional Raster Scan Parameters

Parameter	Value
Scan Type	Unidirectional Raster
Scan Rate	20 degrees/second
Raster Time	1 ms
Raster Width	45°
Bar Width	2°
Number of Bars	3
Vertical Receiver Location	4°
Horizontal Receiver Location	20°

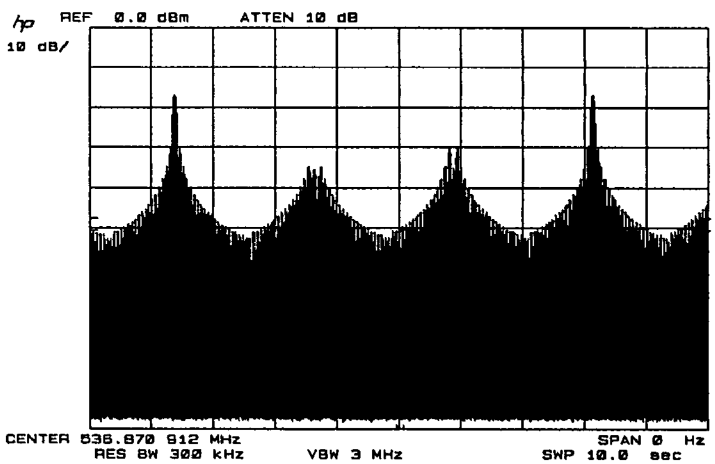


Figure 5-18. Unidirectional Raster Scan Pattern

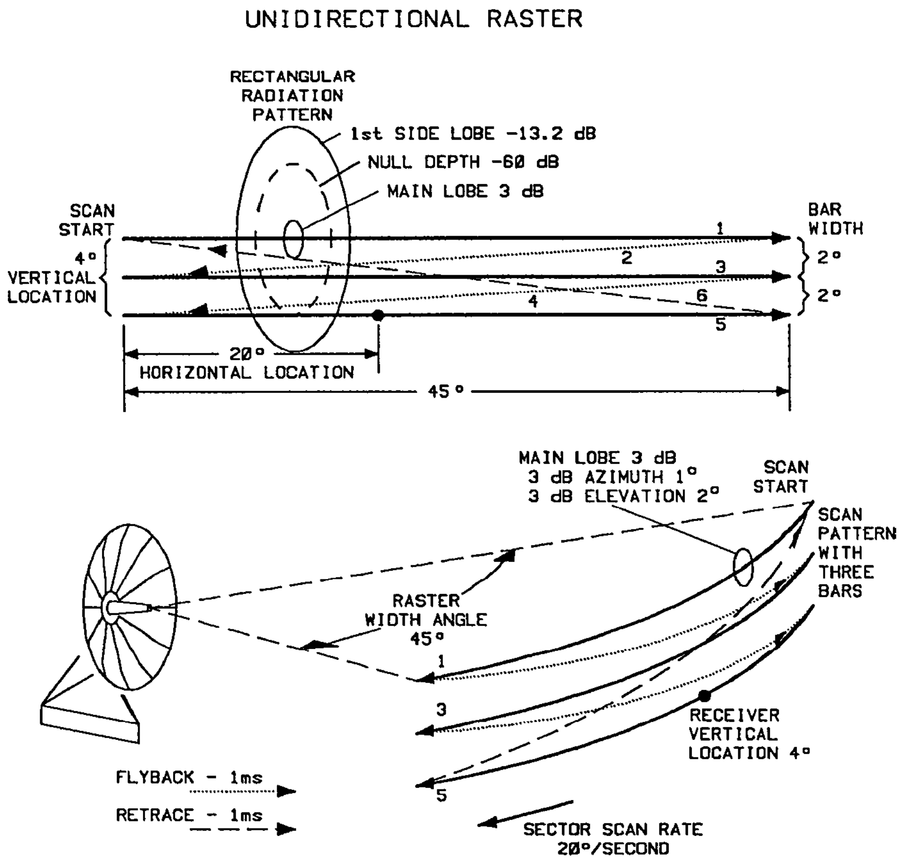


Figure 5-19. Typical Unidirectional Raster Scan Radar

Unidirectional Sector Scan Parameters

Parameter	Value
Scan Type	Unidirectional Sector
Scan Rate	20 degrees/second
Flyback Time	1 ms
Sector Width	60°
Vertical Receiver Location	0°
Horizontal Receiver Location	15°

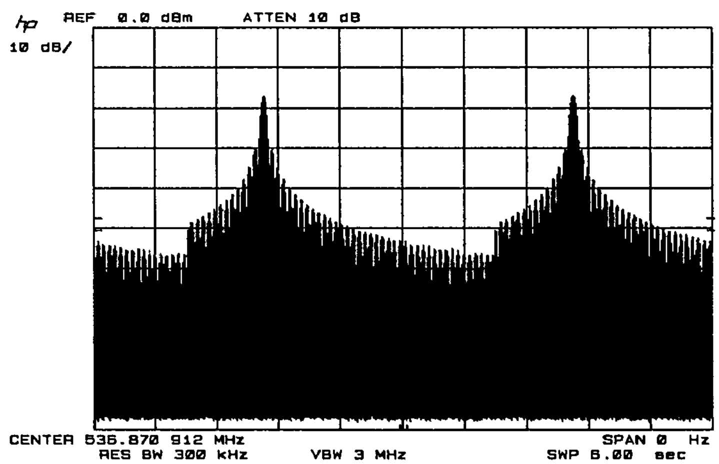


Figure 5-20. Typical Unidirectional Sector Scan Pattern

SCAN:TYPE (Scan Pattern Type)

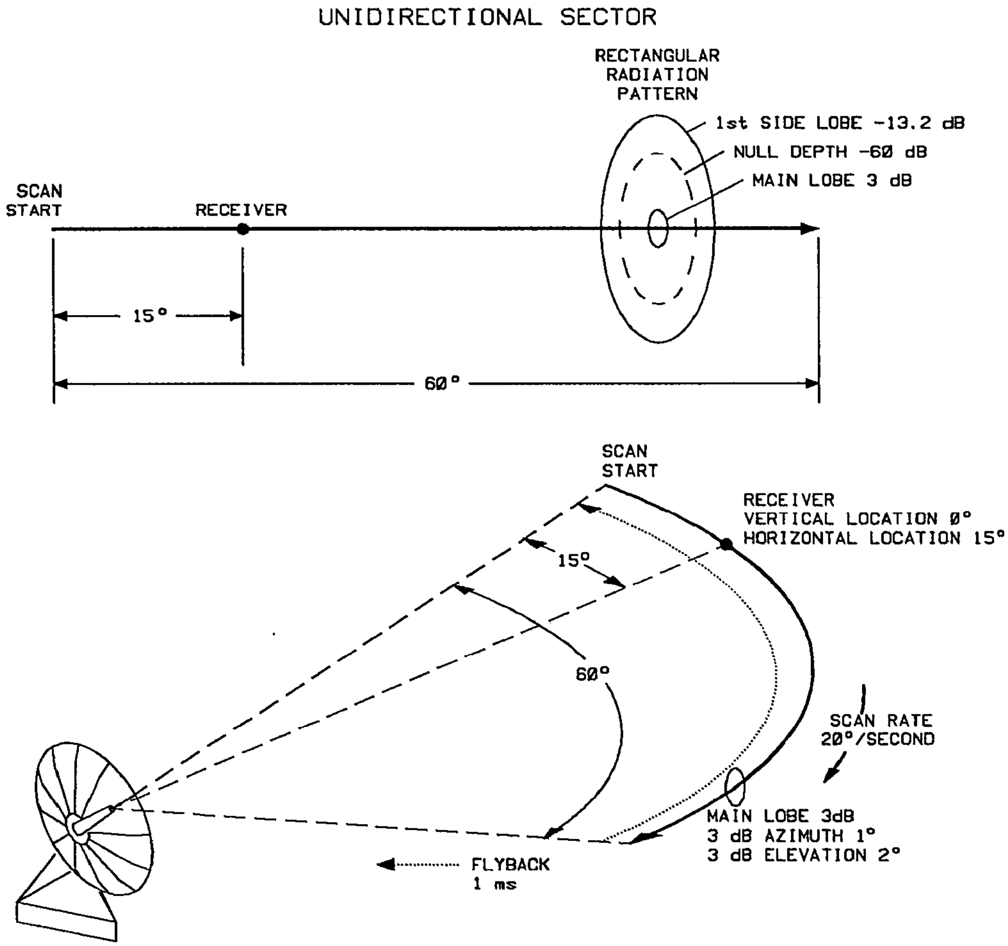


Figure 5-21. Typical Unidirectional Sector Scan Radar

User-Defined Scan Parameters

Parameter	Value
Scan Type	User
Scan Rate	20 Hz
Minimum Amplitude	-50 dB

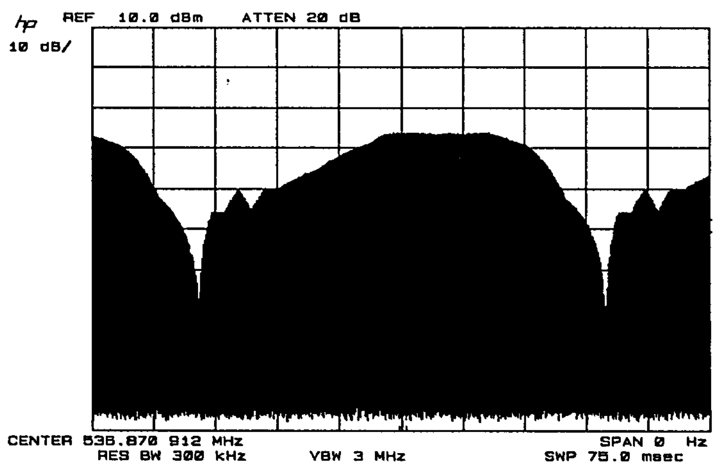


Figure 5-22. User-Defined Scan Pattern

Example To select circular scan pattern:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE CIRC"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SRPM 15 RPM"
70  !
80  !  RADIATION TYPE
90  OUTPUT 719; ":SOUR:AMOD:RAD:TYPE HANN"
100 !
```

```
110 !  3 dB AZIMUTH, 3 dB ELEVATION, AND NULL DEPTH
120 OUTPUT 719; ":SOUR:AMOD:RAD:AZIM 15 DEG"
130 OUTPUT 719; ":SOUR:AMOD:RAD:ELEV 15 DEG"
140 OUTPUT 719; ":SOUR:AMOD:RAD:NDEP -60 DB"
150 !
160 !  VERTICAL RECEIVER LOCATION
170 OUTPUT 719; ":SOUR:AMOD:REC:VRL 0 DEG"
180 !
190 END
```

Comments

Changing signal models resets signal parameters. The reset value for scan type is circular. In addition, the parameters for each scan type default to the following values. There are no default parameters for user-defined scan patterns.

Bidirectional Raster Scan Default Parameters

Parameter	Default Value
Scan Rate	100 degrees/second
Retrace Time	500 μs
Raster Width	50°
Bar Width	4°
Number of Bars	3

Bidirectional Sector Scan Default Parameters

Parameter	Default Value
Scan Rate	100 degrees/second
Sector Width	50°

Circular Scan Default Parameters

Parameter	Default Value
Scan Rate	15 rpm
Vertical Receiver Location	0°

Conical Scan Default Parameters

Parameter	Default Value
Scan Rate	100 Hz
Scanning Cone Diameter	10°

Unidirectional Raster Scan Default Parameters

Parameter	Default Value
Scan Rate	100 degrees/second
Retrace Time	500 μs
Flyback Time	2 ms
Raster Width	50°
Bar Width	4°
Number of Bars	3

Unidirectional Sector Scan Default Parameters

Parameter	Default Value
Scan Rate	100 degrees/second
Flyback Time	2 ms
Sector Width	50°

SCAN:TYPE (Scan Pattern Type)

Equivalent Front Panel Command

Antenna Modulation Dialog Box- Scan Type

SCAN:USER:AMIN (Minimum Scan Amplitude)

Syntax

`:SOUR:AMOD:SCAN:USER:AMIN` *amplitude* [`DB`]
`:SOUR:AMOD:SCAN:USER:AMIN?`

Item	Description	Range/Restrictions
Amplitude	Minimum amplitude	−60 to 0 dB in 0.1 dB steps.

Description

This command sets the null depth of a user-defined scan pattern by setting the minimum scan amplitude. The maximum scan amplitude is set by the system output level.

The query returns the current setting of the minimum scan amplitude in dB.

Example

To use a pattern named SIN.USR for the antenna modulation scan pattern and set the minimum scan amplitude to −40 dB:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE USER"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 15"
70  !
80  !  PATTERN NAME
90  OUTPUT 719; ":SOUR:AMOD:SCAN:USER:PATT 'SIN.USR'"
100 !
110 !  MINIMUM AMPLITUDE
120 OUTPUT 719; ":SOUR:AMOD:SCAN:USER:AMIN -40 DB"
```

```
130 END
```

Comments

Radiation pattern and receiver location are not used with a user-defined scan pattern.

For information on how to define, install and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *Radar Simulator ID Local Operation Reference Manual.*

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:SHZ
SCAN:TYPE
SCAN:USER:PATT

Global Subsystem
SMOD

SID Subsystem
TEXT

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for User Scan Type) + Minimum Amp

SCAN:USER:PATT (User Pattern Name)

Syntax

```
:SOUR:AMOD:SCAN:USER:PATT 'name'
:SOUR:AMOD:SCAN:USER:PATT?
```

Item	Description	Range/Restrictions
Name	User-defined pattern name	The name must match an installed file name on the removable cartridge.

Description

This command selects a user-defined pattern to be used as a scan pattern. The pattern must already be installed on the removable cartridge in order for this command to work.

The query returns the name of the user-defined scan pattern. The returned format is string data.

Example

To use a pattern named SIN.USR for the antenna modulation scan pattern and set the minimum scan amplitude to −40 dB:

```
10  !  SIGNAL MODEL
20  OUTPUT 719; ":SOUR:GLOB:SMOD 2"
30  !
40  !  SCAN TYPE AND SCAN RATE
50  OUTPUT 719; ":SOUR:AMOD:SCAN:TYPE USER"
60  OUTPUT 719; ":SOUR:AMOD:SCAN:SHZ 15"
70  !
80  !  PATTERN NAME
90  OUTPUT 719; ":SOUR:AMOD:SCAN:USER:PATT 'SIN.USR'"
100 !
```

SCAN:USER:PATT (User Pattern Name)

```
110 !  MINIMUM AMPLITUDE
120 OUTPUT 719; ":SOUR:AMOD:SCAN:USER:AMIN -40 DB"
130 END
```

Comments

User patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

For information on how to define, install and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *Radar Simulator ID Local Operation Reference Manual.*

Radiation pattern and receiver location are not used with a user scan pattern.

Related HP-IB Commands

Antenna Modulation Subsystem
SCAN:SHZ
SCAN:TYPE
SCAN:USER:AMIN

Global Subsystem
SMOD

SID Subsystem
TEXT

Equivalent Front Panel Command

Antenna Modulation Dialog Box- [Scan Parameters...] (for User Scan Type) + [Select User Pattern]

6

Diagnostics Subsystem

Introduction

The commands in the Diagnostic subsystem provide the system service and diagnostic routines.

Figure 6-1 shows the syntax diagram for the Diagnostics subsystem.

Note

Using any of the commands in this subsystem will purge the hardware memory.

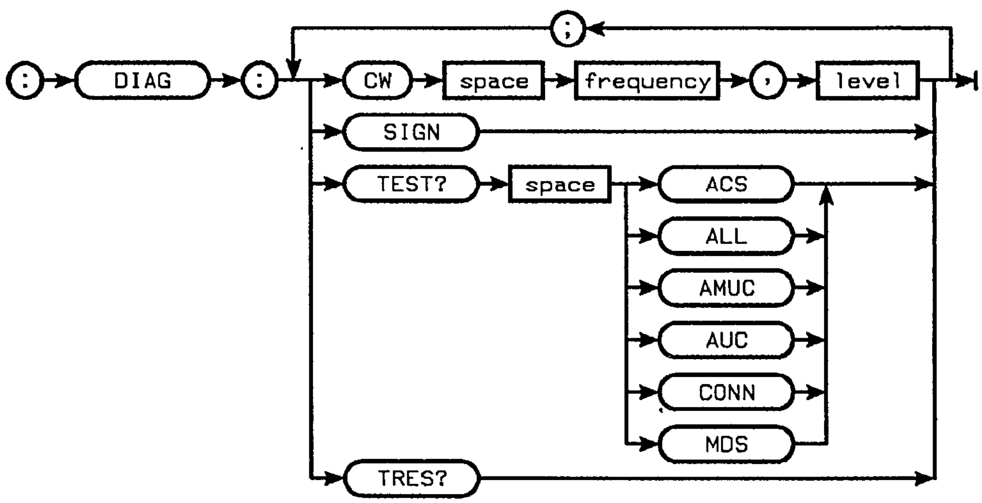


Figure 6-1. Diagnostics Subsystem Syntax Diagram

CW (CW Signal)

Syntax `:DIAG:CW` *frequency, level*

Item	Description	Range/Restrictions
Frequency	CW frequency	See table below.
Level	Amplitude of CW signal	See table below.

Description This command generates a continuous wave signal of a specified frequency and amplitude. Frequency must always be entered in hertz and level must be entered in dBm. Suffixes specifying the units of measure (such as kHz or dBm) are not allowed. Allowable values are as follows:

Hardware Model	Frequency	Level
Model 7	0 to 67.1 MHz in 0.125 Hz steps	-100 to +10 dBm in 0.1 dB steps
Model 11	2 MHz to 3.05 GHz in 0.125 Hz steps	-107 to +22 dBm in 0.1 dB steps
Model 21	10 MHz to 19 GHz in 0.125 Hz steps	-100 to +6 dBm in 0.1 dB steps

Example

To generate a 33 MHz signal at -10 dBm:

```
OUTPUT 719; ":DIAG:CW 33E+06, -10"
```

Comments

The reset value is 33.554432 MHz at 0 dBm.

Generating this signal will purge hardware memory.

For Model 21, you can get a level of +10 dBm by using special function 14.1 to change to AUC output attenuator to 0 dB (default is 10 dB). However, the amplitude will be off by 10 dB and spur performance may be degraded.

Equivalent Front Panel Command

Utilities Menu - CW Signal

SIGN (Test Signal)

Syntax

```
:DIAG:SIGN
```

Description

This command generates a test signal. This signal is used to verify whether the system is operating properly.

Example

To verify that the system is operating properly:

```
OUTPUT 719; ":DIAG:SIGN"
```

Connect a spectrum analyzer to the system's RF OUTPUT. Verify that the following signal appears as shown. The overall test signal for each model is shown first (figures 6-2 through 6-5). Then, for Models 11 and 21 only, four areas of interest are shown individually in figures 6-6 through 6-9.

For Model 21 hardware, figure 6-6, AM Test Signal, is displayed with the spectrum analyzer connected to the RF OUTPUT 0.05-0.5 GHz connector (Low Band). Figures 6-7 through 6-9 are displayed with the spectrum analyzer connected to the RF OUTPUT 0.5-18 GHz connector (High Band).

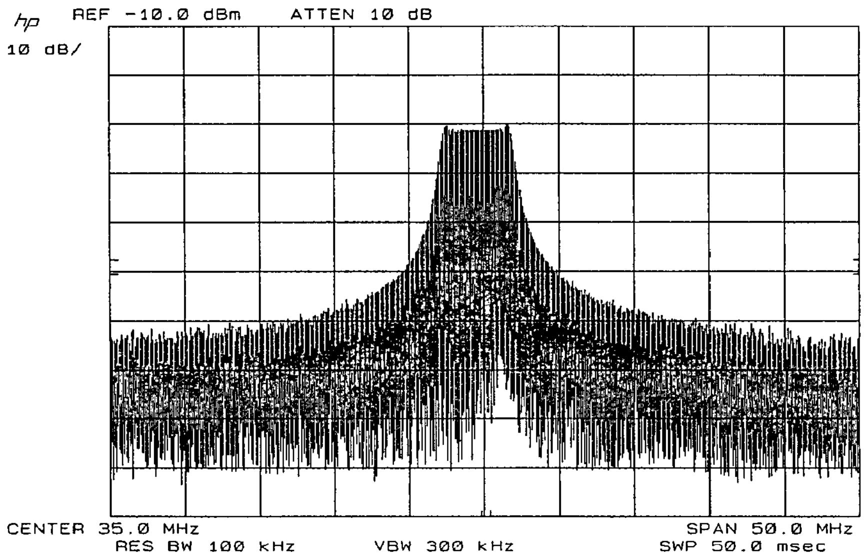


Figure 6-2. Model 7 Overall Test Signal

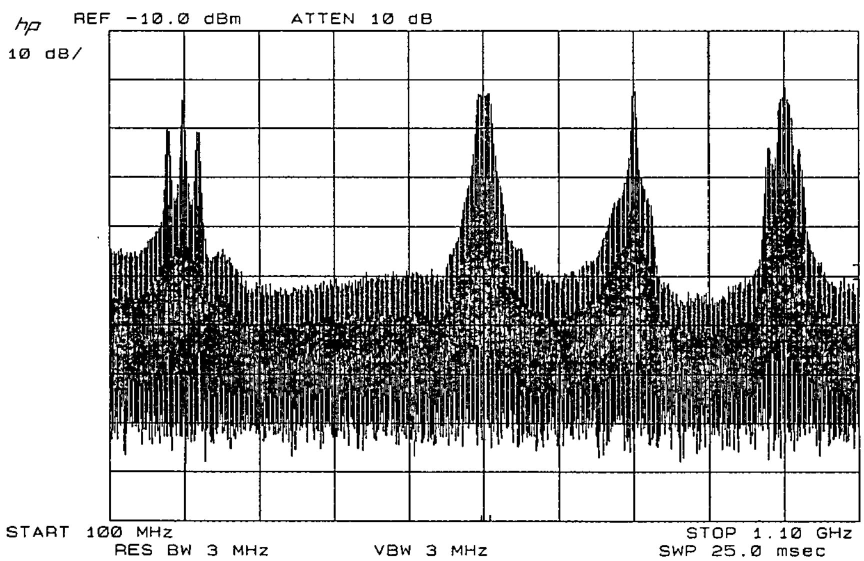


Figure 6-3. Model 11 Overall Test Signal

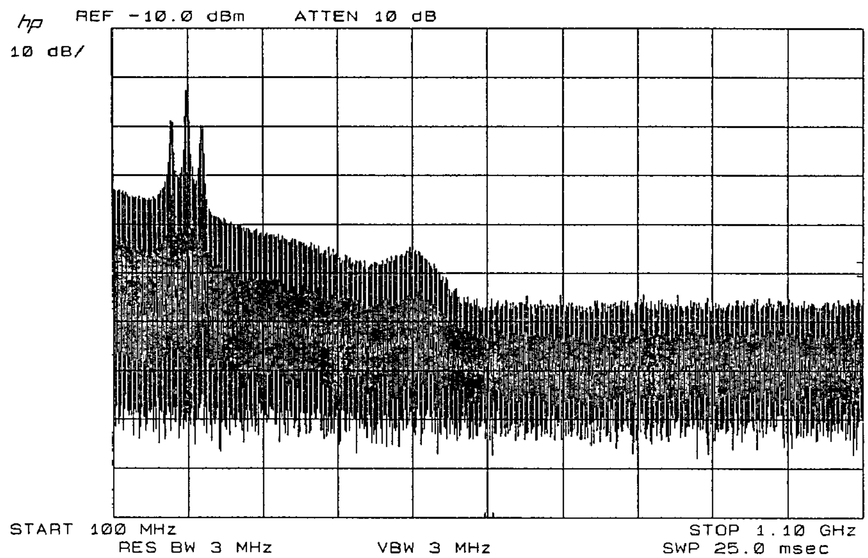


Figure 6-4. Model 21 Low Band Overall Test Signal

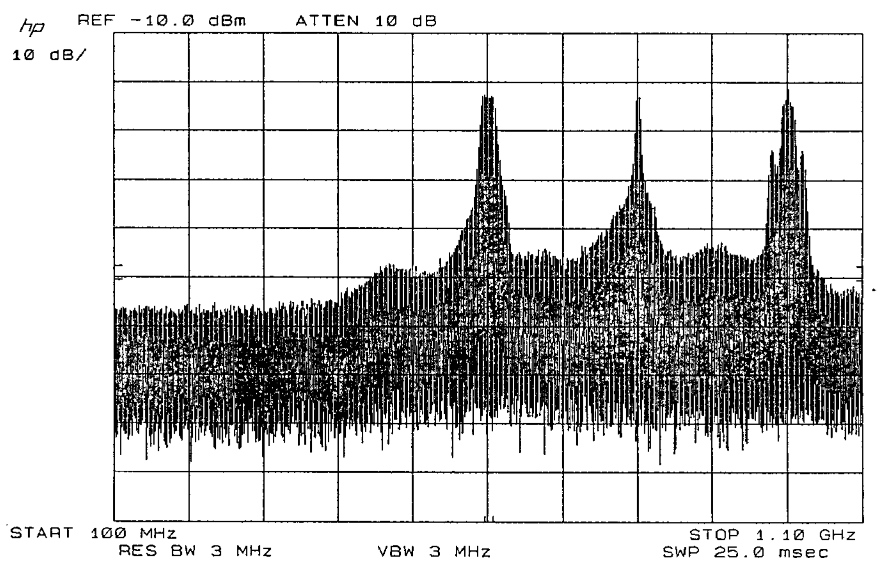


Figure 6-5. Model 21 Overall Test Signal

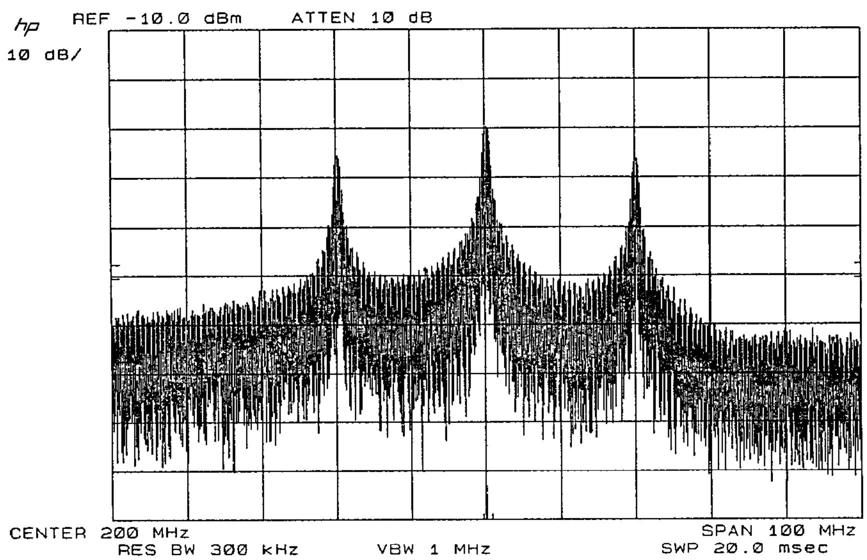


Figure 6-6. AM Test Signal (Models 11 and 21)

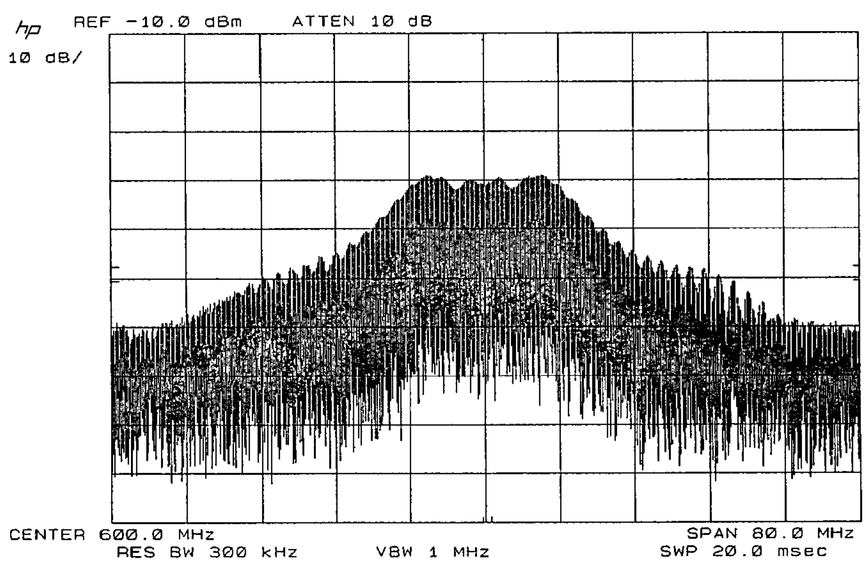


Figure 6-7. Linear Chirp Test Signal (Models 11 and 21)

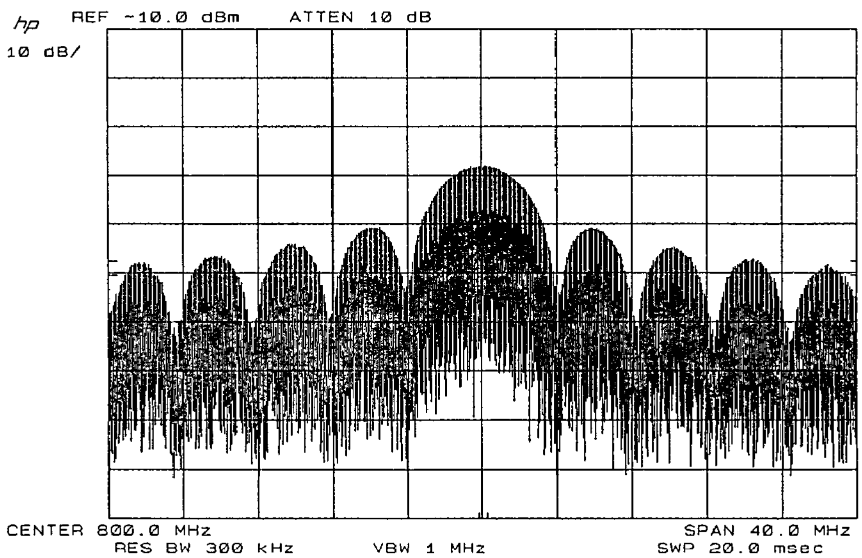


Figure 6-8. Pulse Carrier Test Signal (Models 11 and 21)

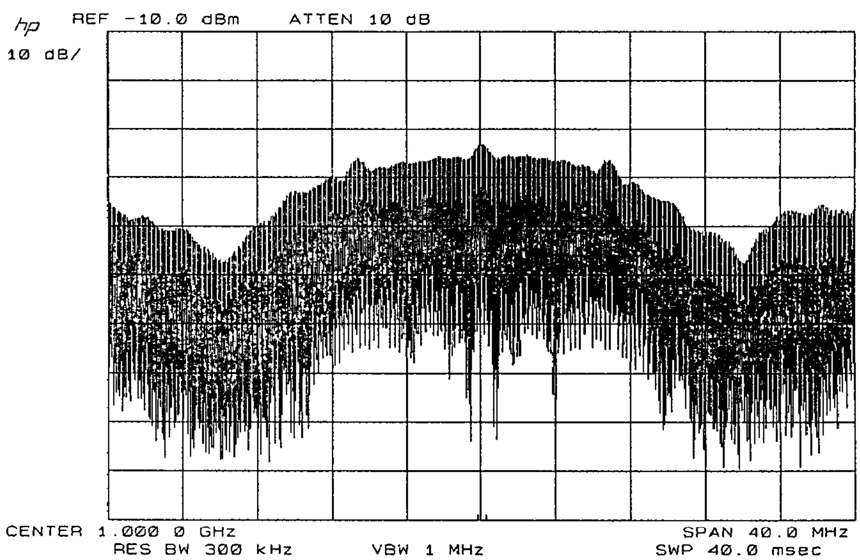


Figure 6-9. Thirteen Element Barker Code Test Signal (Models 11 and 21)

Comments Generating this signal will purge hardware memory.

Related HP-IB Commands None

Equivalent Front Panel Command *Utilities Menu* - Test Signal

TEST?
(Test Query)

Syntax

```
            ⎧ ACS  ⎫
            ⎪ ALL  ⎪
            ⎪ AMUC ⎪
:DIAG:TEST? ⎨ AUC  ⎬
            ⎪ CONN ⎪
            ⎩ MDS  ⎭
```

Description

This query specifies the tests to be performed and returns the result. The following tests can be performed:

ACS	HP 86791A Agile Carrier Synthesizer
ALL	ACS, AMUC, AUC, MDS, and the interconnections
AMUC	HP 86793A Agile Microwave Upconverter (Model 21 only)
AUC	HP 86792A Agile Upconverter (except Model 7)
CONN	Interconnections between the instruments in the system
MDS	HP 86790B Modulation Data Source

A "0" is returned if the test passes and a "1" is returned if the test fails.

Example

To run the diagnostic test on the MDS and read back the result (0 or 1):

```
10  OUTPUT 719; ":DIAG:TEST? MDS"
20  ENTER 719; A
30  PRINT A
40  END
```

Comments

Using this query will purge hardware memory.

Related HP-IB Commands

Diagnostics Subsystem - TRES?

Equivalent Front Panel Command

Utilities Menu - Diagnostics

TRES? (Test Result Query)

Syntax

```
:DIAG:TRES?
```

Description

This query returns text that describes the results of the last diagnostic test that was run with the DIAG:TEST? query.

Example

To read the test results from the AUC diagnostic test:

```
10  DIM A$[1500]
20  OUTPUT 719; ":DIAG:TEST? AUC"
30  ENTER 719; B
40  OUTPUT 719; ":DIAG:TRES?"
50  ENTER 719 USING "-K"; A$
60  A$=A$[19,LEN(A$)]
70     !Strip off block data heading
80  PRINT USING "#,K"; A$
80  END
```

Comments

Using this command will purge hardware memory.

Related HP-IB Commands

Diagnostics Subsystem - TEST?

Equivalent Front Panel Command

Utilities Menu - Diagnostics

7

FASS Subsystem

Introduction

The FASS subsystem commands are used to generate a signal by controlling the four MDS memories. Figure 7-1 shows the general structure of the portion of an HP-IB program that uses the FASS subsystem commands. As the figure shows, these commands allow you to perform the following tasks, among others:

- Perform a level calibration.
- Select either an internal or external clock source.
- Configure the system for dynamic data or dynamic sequence modes.
- Load data into the modulation memories.
- Create loop packets, packets, and sequences.
- Set markers.
- Start and stop the system.

Most of the commands in this subsystem involve loading data into the modulation memories, and creating sequences for outputting the data.

See Product Note 8791-3, *Theory of Operation for the HP 8791 Model 7/10/11/21 Frequency Agile Signal Simulator* for additional information about system theory, and, in particular for further details on the MDS memories, including diagrams.

The Modulation Memories and Sequencers

In HP FASS, you can define signal characteristics by specifying the carrier frequency and modulation content. FASS has four modulation memories that independently store information:

- Amplitude Modulation (AM or PM2) memory
- Frequency Modulation (FM) memory
- Frequency (FREQ) memory
- Phase Modulation (PM) memory

The FREQ memory is further divided into four fields:

- ACS carrier frequency
- AUC upconversion frequency band
- Fast attenuator level control (FLC) in the AUC
- Pulse (PULS) On/Off Flags

Each field of the FREQ memory can be selected individually for loading data.

The Model 21 hardware has two RF outputs on the front panel. In general, signals lower than 500 MHz come out of the low frequency output and signals greater than 500 MHz come out of the high frequency output. However, the actual output used depends on the AUC upconversion frequency band being used. For frequency bands less than 119 the low frequency output is used. For frequency bands greater than or equal to 119, the high frequency output is used. In practice, it is possible to get signals higher than 500 MHz out of the low frequency output. It is also possible to get signals lower than 500 MHz out of the high frequency output.

Each of the four modulation memories has a corresponding sequencer. The sequencer memory stores information about the order in which modulation memory data should be accessed.

Definition of Terms

The following definitions apply to the modulation memories and sequencers.

Wave Segment. A wave segment is waveform data contained in a group of consecutive modulation memory addresses. These memory addresses are stored as data in the sequencer.

Scan. A scan is one pass through a wave segment.

Packet. A packet is one or more scans through a wave segment.

Loop Packet. A loop packet is a user-defined series of packets that are repeated as a group one or more times. (The repetitions of a given group of packets constitute a "loop", after the programmer's term for such repetitions.)

Sequence. A sequence is a user-defined series of packets and/or loop packets.

Summary of Characteristics

The sequencers address the locations in modulation memory that are used for signal generation. Because there is only one sequencer for the entire FREQ memory, packet parameters for the frequency memory correspond to the data in the ACS field.

Table 7-1. Modulation Memory Characteristics

Memory Field	Effective Memory Length	Wave Segment Length
ACS	65536	2 to 65536 in multiples of 2
AM	262144	8 to 262144 in multiples of 4
AUC	32768	1 to 32768
FLC	32768	1 to 32768
FM	65536	2 to 65536
PM	262144	8 to 262144 in multiples of 4
PM2	262144	8 to 262144 in multiples of 4
PULS	262144	8 to 262144 in multiples of 8

Packet dwell is a measure of the time spent in a given packet. It is defined as:

packet dwell = *wave segment length* × *scans*

The minimum packet dwell for each sequencer memory is specified in the following table. These specifications should be kept in mind when creating packets (which is done with one or more of the following commands: :FASS:DATA 'SEQ2', :FASS:PCKM, :FASS:PCLM).

Table 7-2. Minimum Packet Dwell

Memory	Minimum Packet Dwell[1]		
	Normal Packet	Last Packet in Loop	Last Packet in Sequence
AM or PM2	12	16	24
FM	3	4	6
PM	12	16	24
Frequency	3	4	6

1 Minimum Packet Dwell *must* be increased by an additional 12 dwell units (AM and PM) or by an additional 3 dwell units (FM and FREQ) when using the sequence jump capability or doing continuous sequence downloading. When both modes are active you must take into account the increase for both.

Loading Data into the Modulation Memory

Selecting the active memory with the :FASS:MEM command should be one of the first steps in using most of the commands in this subsystem. The active memory is the memory that is affected by subsequent commands. The active memory consists of two sub-memories: the modulation memory and the sequencer memory.

Each field of the FREQ memory can be selected as the active memory. However, some commands affect the entire frequency memory, not just the selected field.

Preparing to Load Data Into Modulation Memory

Before you load data into an active modulation memory, you may want to know what data already exists. Use the :FASS:CAT? query to obtain a directory of all named files in the active modulation memory. Use the :FASS:DATA? query to read the contents of active modulation memory by address or file name.

You can purge the entire contents of active modulation memory with the :FASS:PURG:MEM command or purge a selected file with the :FASS:PURG:FILE command. To purge the contents of all modulation memories and sequencers, use the :FASS:PURG:ALL command.

Loading Data

The primary command for loading data into the active modulation memory is the :FASS:DATA command. Data can be loaded by file name or by address.

Data can also be loaded using other commands. The :FASS:CARR command loads data in the ACS and AUC fields of FREQ memory so that HP FASS generates a specified carrier frequency. For improved download speed, the :FASS:IDAT command can be used to load data into the active modulation memory in internal format. The :FASS:CONS command loads a constant value into the active modulation memory. The :FASS:VMAP and :FASS:VSIN commands load a linear ramp and a sine wave, respectively, into the active modulation memory.

Creating Sequences

Each sequencer memory contains information used to access the wave segments in modulation memory. This information is in the form of sequences, which consist of packets and loop packets.

Selecting the Sequencer Model

The sequencer model determines the sequencer memory capability.

HP FASS has two sequencer models:

- Model 10
- Model 7, 11, or 21

The sequencer model is set with the :FASS:SMOD command. The system always powers up in Model 7, 11, or 21.

Sequencer Model 10 is provided for backwards compatibility. If you have saved hardware images or developed programs for Model 10 hardware, your images and programs will run on Model 11 or 21 hardware. However, once a hardware image has been loaded onto Model 11 or Model 21 hardware, it is automatically saved for Sequencer Model 7, 11, or 21, even if the SMOD command is set to Model 10.

Sequencer Model 7, 11, or 21 is the recommended mode of operation. It has much more capability than Model 10. Sequencer Model 10 is limited to one sequence and a maximum of 2048 packets per memory. Sequencer Model 7, 11, or 21 mode allows up to 1024 different sequences and up to 32768 packets and loop packets per memory.

Several commands that existed for Sequencer Model 10 have been replaced for Model 7, 11, or 21 in order to take advantage of the expanded sequencer capability. These newer commands work with all sequencer models. However, the Model 10 commands are still available. The following commands have been replaced:

Table 7-3. Model 10.Replacement Commands

Model 10 Command	Model 7, 11, or 21 Command
ASO	SEQ:MODE
DATA 'SEQUENCE'	DATA 'SEQ2'
NSEQ	PURG:SEQ
PACK	PCKM
PACL	PCLM
SCAT?	SEQ:CAT?

Preparing to Create a Sequence

To catalog the names of all the files in the active sequencer memory, use the :FASS:SEQ:CAT? query.

Use the :FASS:PURG:SEQ command to purge a single sequence or all the sequence data from the active sequencer memory.

Creating a New Sequence

For Sequencer Model 7, 11, or 21, each new sequence must begin with a :FASS:SEQ:BEG command and end with a :FASS:SEQ:END command. The first packet in the sequence must be a loop packet.

Creating a Loop Packet

A loop packet is created using the :FASS:SLP command, which defines the number of scans through the loop and the advance mode. All packets defined after that command are included in the loop packet until either another loop packet command or a :FASS:SEQ:END command occurs. Loop packets are not available for Sequencer Model 10.

Creating Packets

Packets can be created by file name or by address. To create a packet by file name, use the :FASS:PCKM command. To create a packet by address, use the :FASS:PCLM command. For a long sequence of packets or when the packet information has been stored numerically in an array (computer generated), the :FASS:DATA 'SEQ2' command can be used.

A packet contains either a file name or the beginning address and length of a wave segment, the number of scans of the wave segment before advancing to the next packet, and the method of advancing to the next packet. For Sequencer Model 7, 11, or 21, there is also provision for marking a packet.

New packets are appended to any other packets that have been defined since a :FASS:SEQ:BEG command was last issued. A sequencer memory can contain up to 1024 sequences.

In this chapter, the term "advance" is used for packets, and the term "jump" is used for sequences. Control *advances* to the next packet, but control *jumps* to a new sequence.

Editing Packets and Sequences

Several commands exist that allow you to edit a packet, loop packet, or sequence once you have already defined a sequence.

The :FASS:SEQ:EDIT:CAT? query returns information about the contents of specific packet or loop packet. The :FASS:SEQ:EDIT:LOOP and :FASS:SEQ:EDIT:PACK commands allow you to redefine a loop packet and packet, respectively. The :FASS:SEQ:EDIT:END command allows you to turn the end-of-sequence flag on or off, thus enabling you to split a sequence or add more packets to a sequence.

Continuous Sequence Download

Continuous sequence download refers to loading part of the sequencer memory while the sequencer continues to send addresses to the modulation memory. This capability requires no special mode and can be used at any time.

Two restrictions apply when using this capability. First, do not download the new sequence to the portion of sequencer memory that is currently playing or to a portion of sequencer memory you may want to play. Second, minimum packet dwell times increase. See table 7-2 and the text following the table to determine the increased dwell times.

To use this capability successfully, you want to know the locations of all your sequences in the sequencer memory. Be sure to program sequence locations explicitly by avoiding the "-1" parameter in the :FASS:SEQBEG command.

Before purging a sequence that is running, stop the sequencers.

Selecting RAM Mode, Dynamic Data Mode, or Dynamic Sequence Mode

HP FASS has three modes of operation: RAM mode, dynamic data mode, and dynamic sequence mode.

In RAM mode, signal information is loaded into one or more of the four modulation memories. Once the information is loaded, the HP FASS memory sequencers address the modulation memories that contain the desired data. RAM mode is also called internal mode.

In dynamic data mode, the sequencer is bypassed. You load waveform data into at least one of the four modulation memories. Then, in real-time, you must use an external source to provide the waveform addresses via the DYNAMIC DATA/DYNAMIC SEQUENCE ports on the rear panel of the MDS.

In dynamic sequence mode, the number of the desired sequence is input through the DYNAMIC DATA/DYNAMIC SEQUENCE ports on the rear panel of the MDS. The sequence begins executing when a sequence jump command or an external sequence jump signal is activated. The jump timing is determined by the :FASS:SEQ:JTYP command. This sequencing mode allows you to randomly execute sequences in real time.

The desired mode of operation is selected by the :FASS:SEQ:MODE command: the INT (internal) parameter selects RAM mode, the EXTADDR (external address) parameter selects dynamic data mode, and the LOCAL, MASTER, SLAVE, and OFF parameters provide various options relating to dynamic sequence mode.

See the Product Note 8791-1, *Real-Time Control of HP FASS* for additional information about dynamic data and dynamic sequence.

Starting and Stopping the System

The :FASS:STAR command starts all four sequencers running simultaneously at the current sequence. The :FASS:SALL command starts all four sequencers running at a specified sequence.

The :FASS:STOP command stops and resets all four sequencers immediately.

Any time you want to modify memory or sequencer data for the modulation memories, issue a :FASS:STOP command to stop all sequencers.

Figures

Figure 7-1 shows the general structure of the part of an HP-IB program that generates signals.

Figure 7-2 shows the syntax diagram for the FASS subsystem commands.

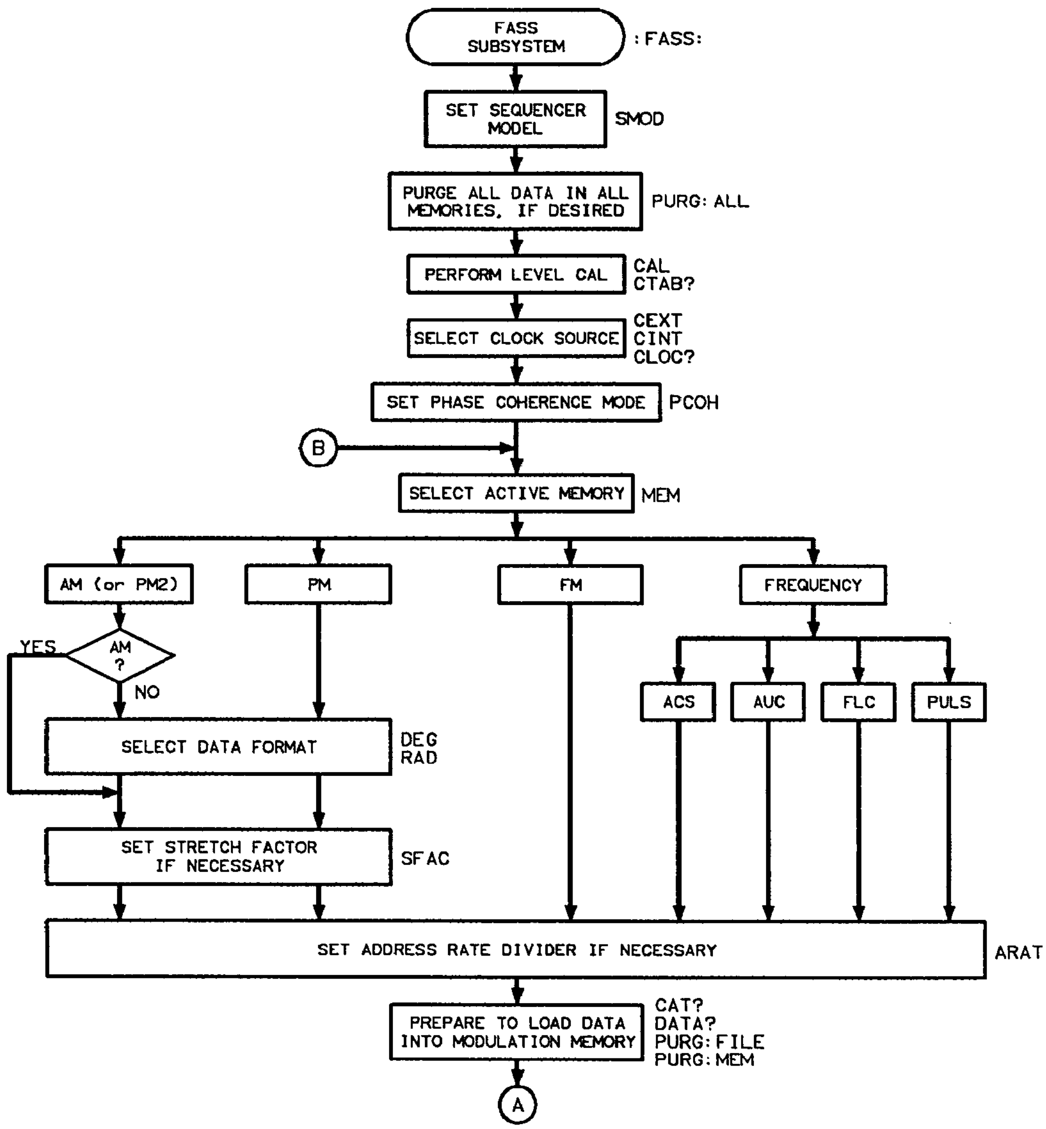


Figure 7-1. Portion of HP-IB Program that Generates Signals

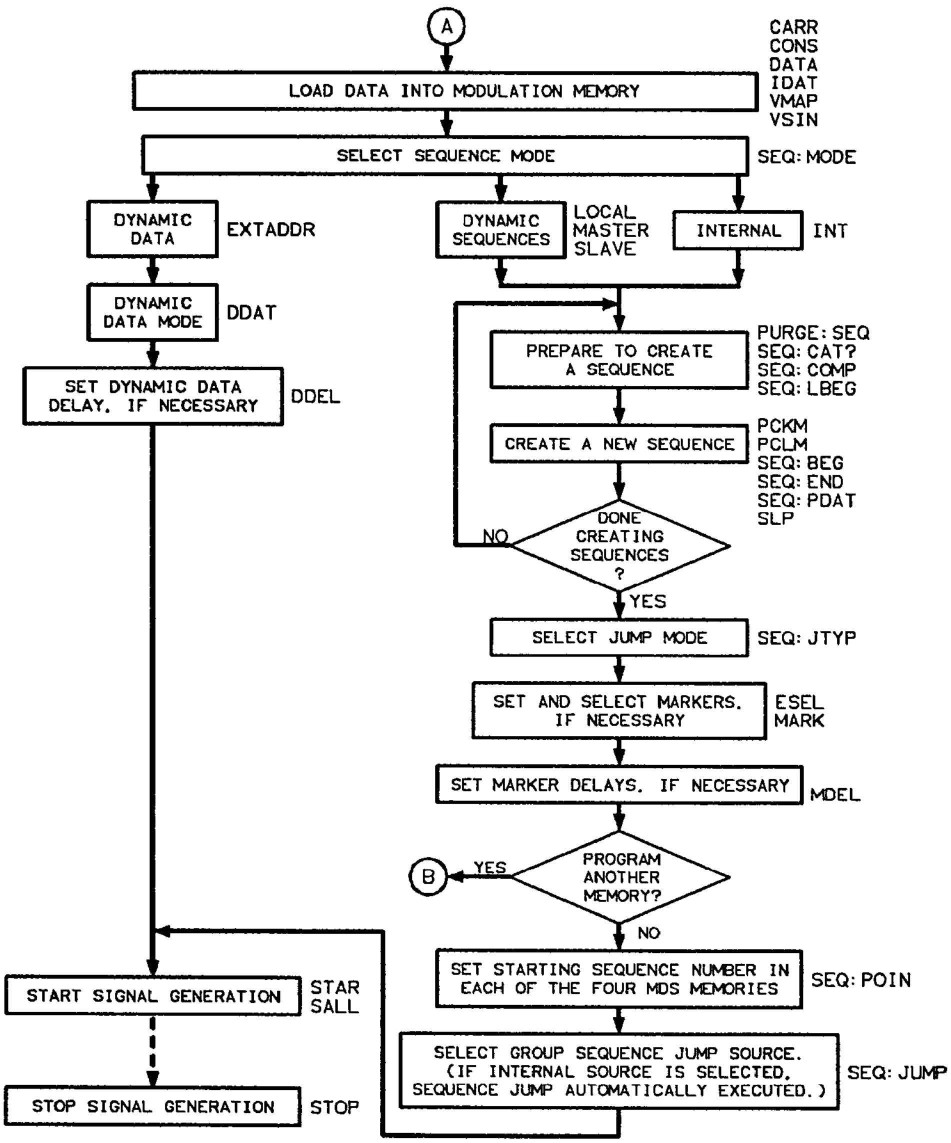


Figure 7-1 (cont'd). Portion of HP-IB Program that Generates Signals

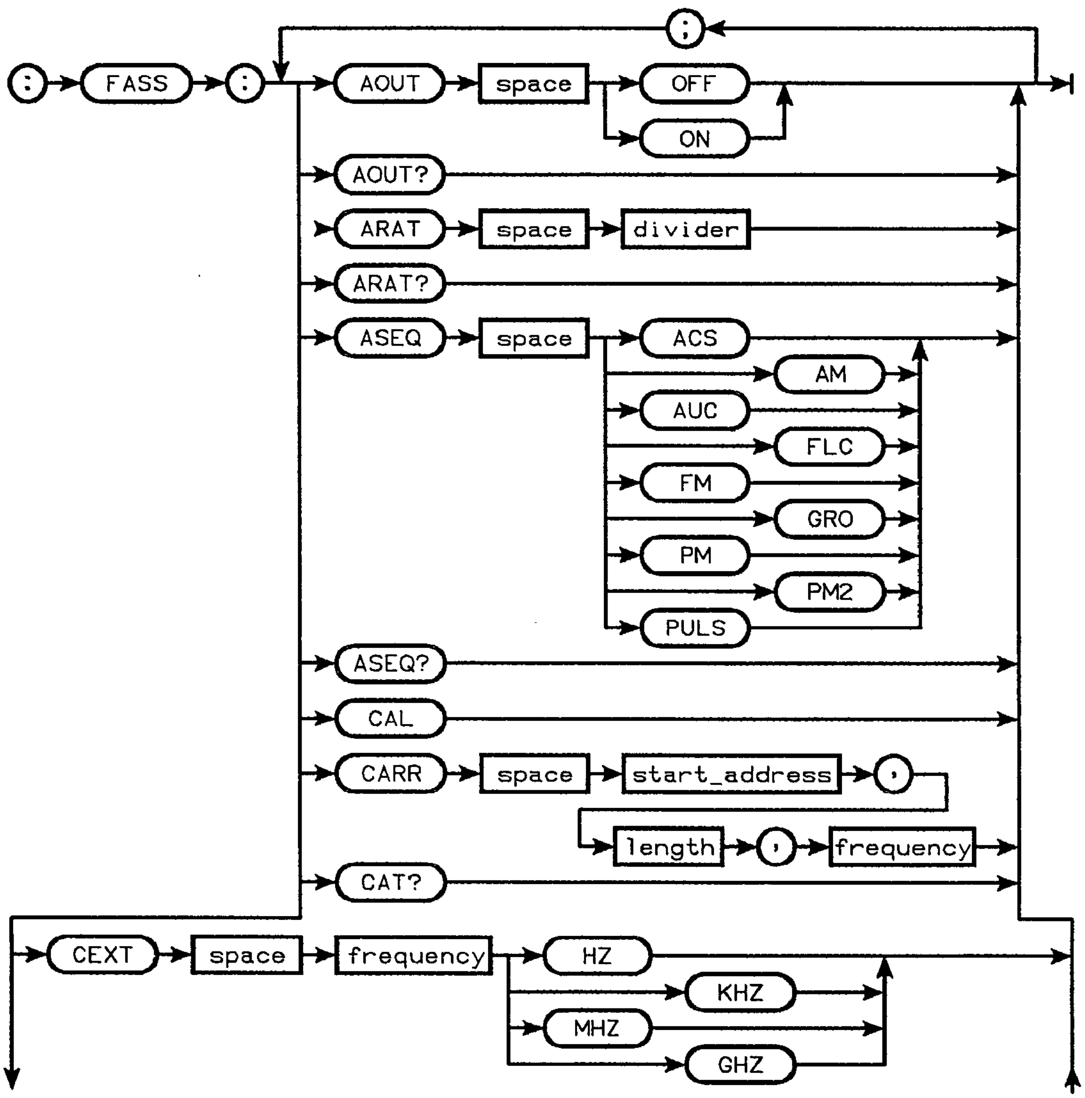


Figure 7-2. FASS Subsystem Syntax Diagram

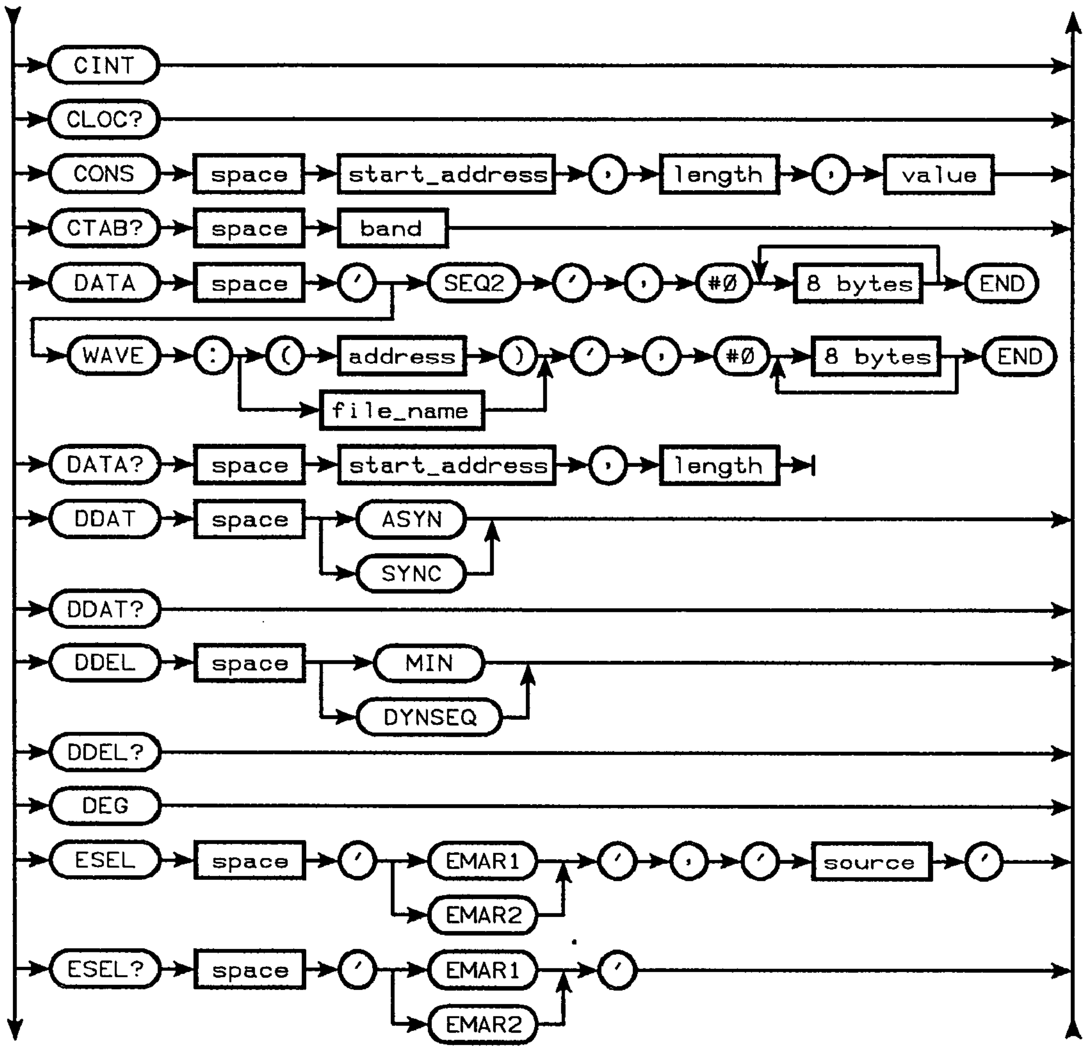


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

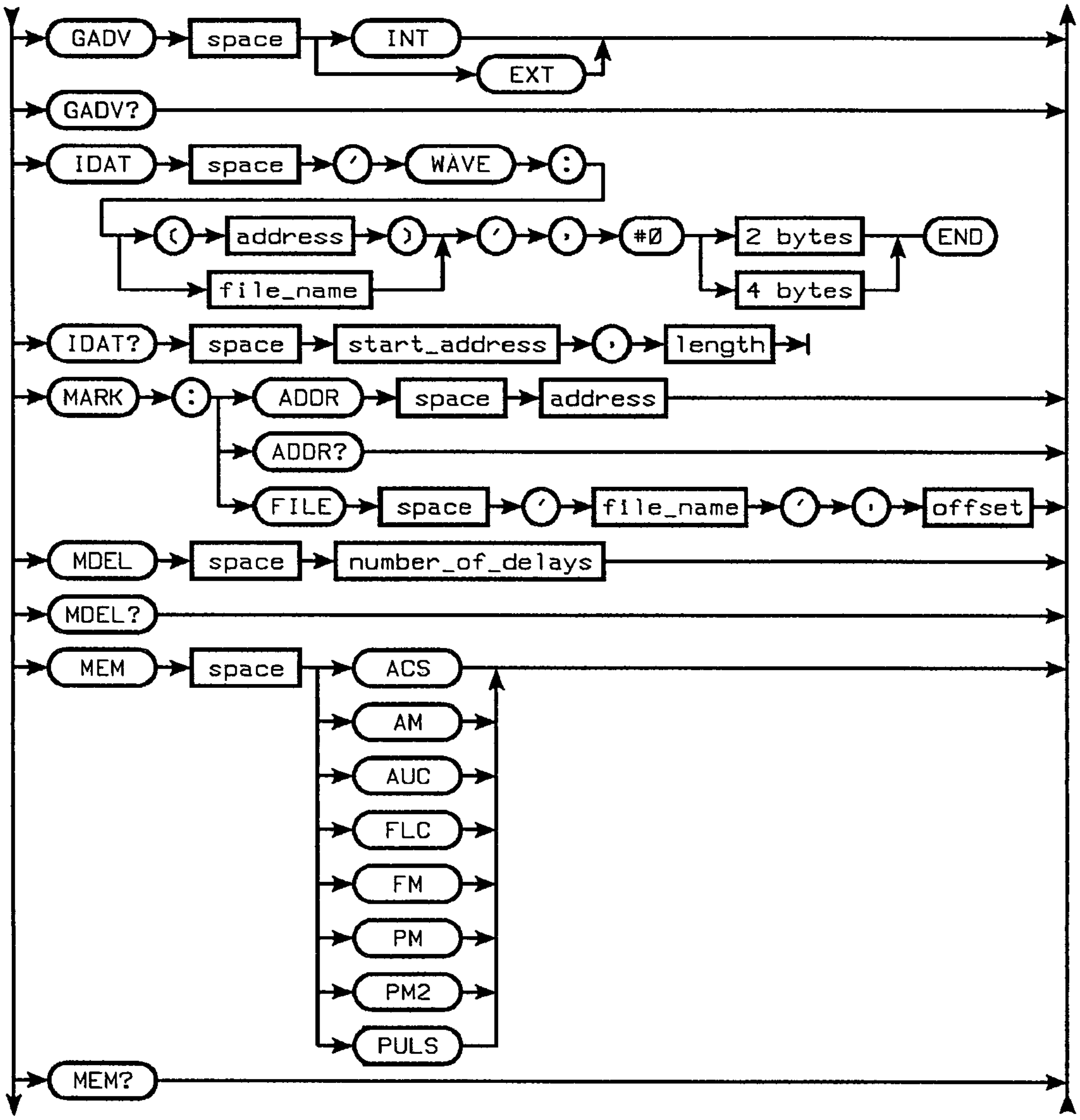


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

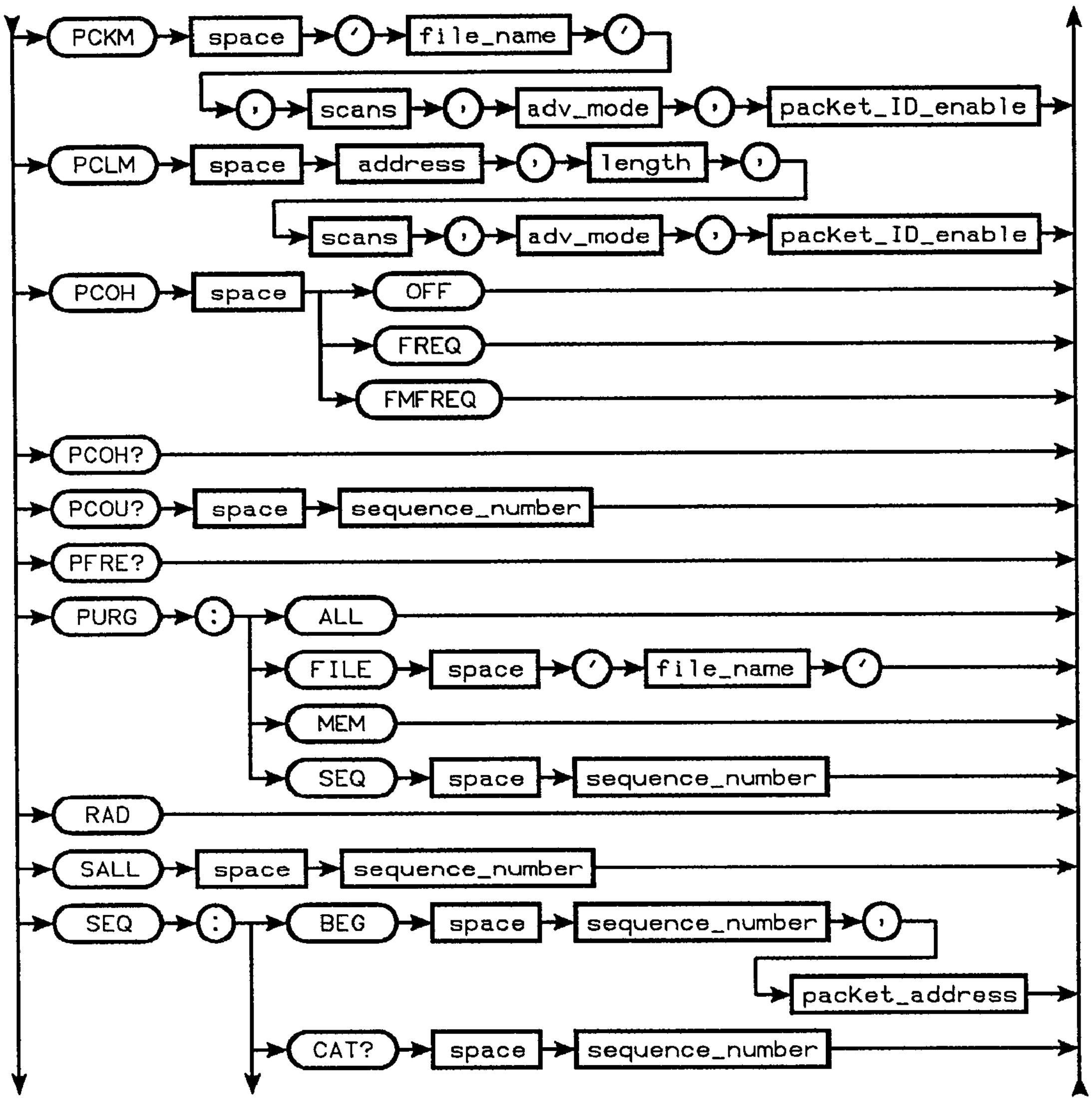


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

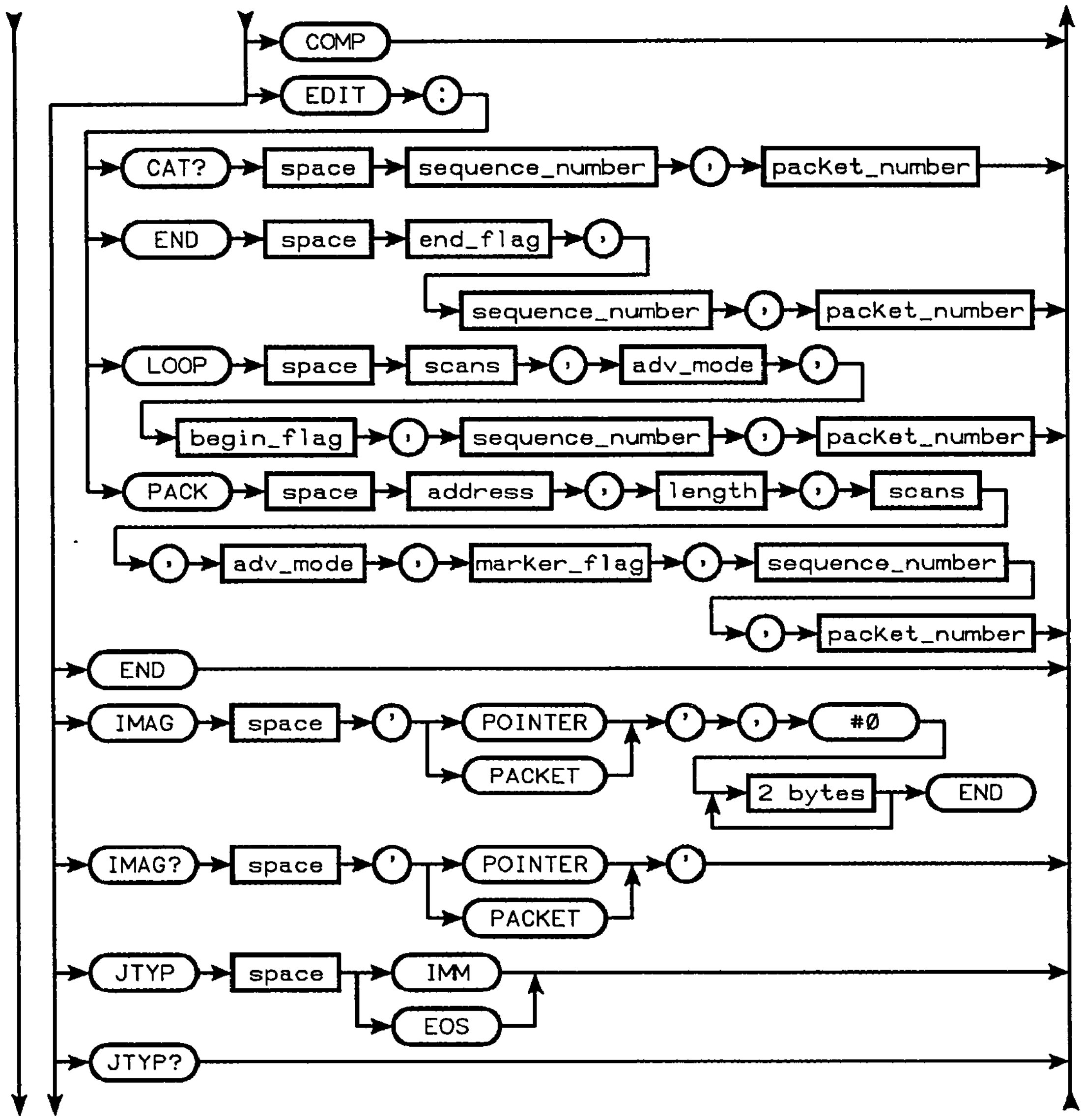


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

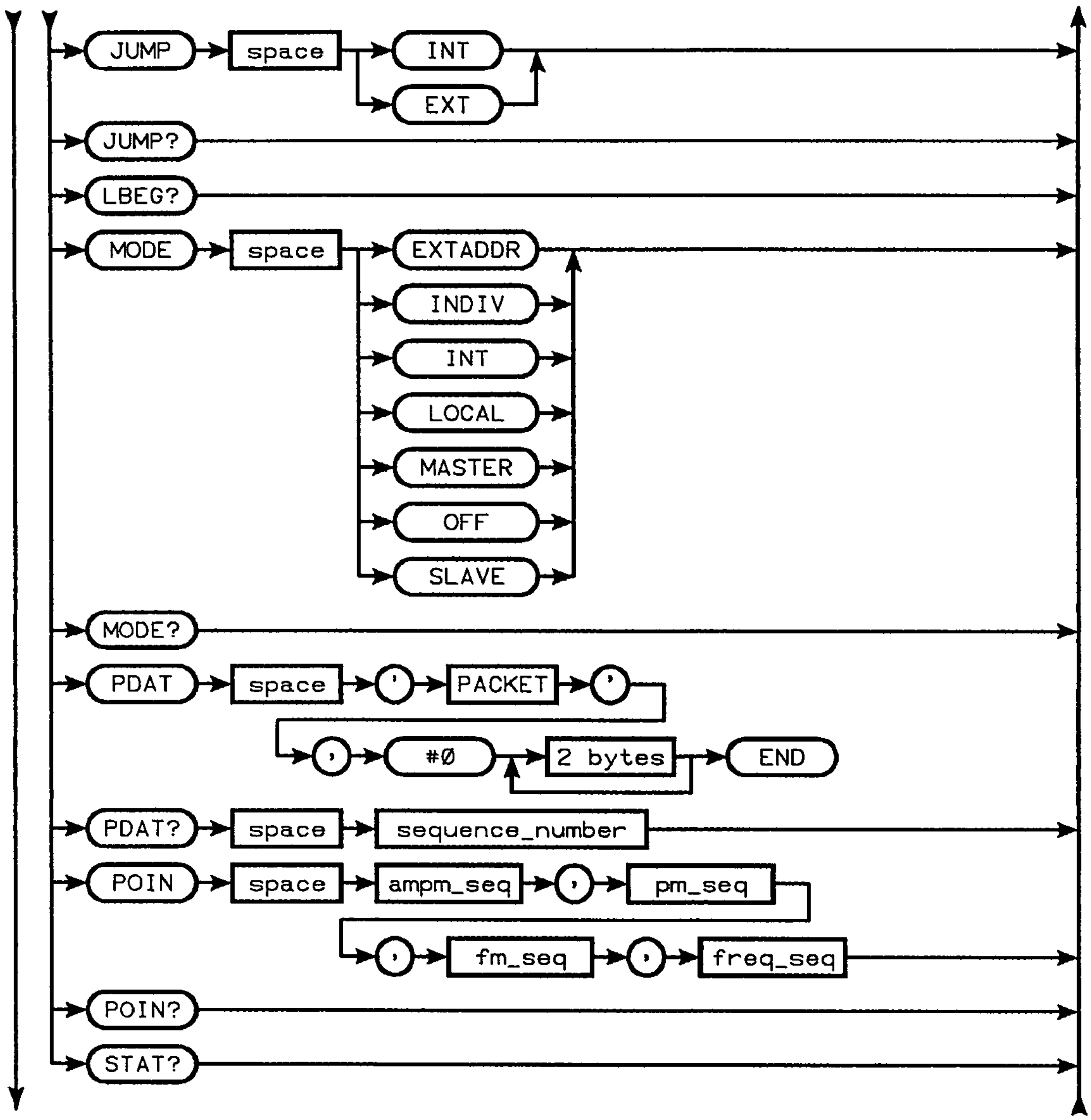


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

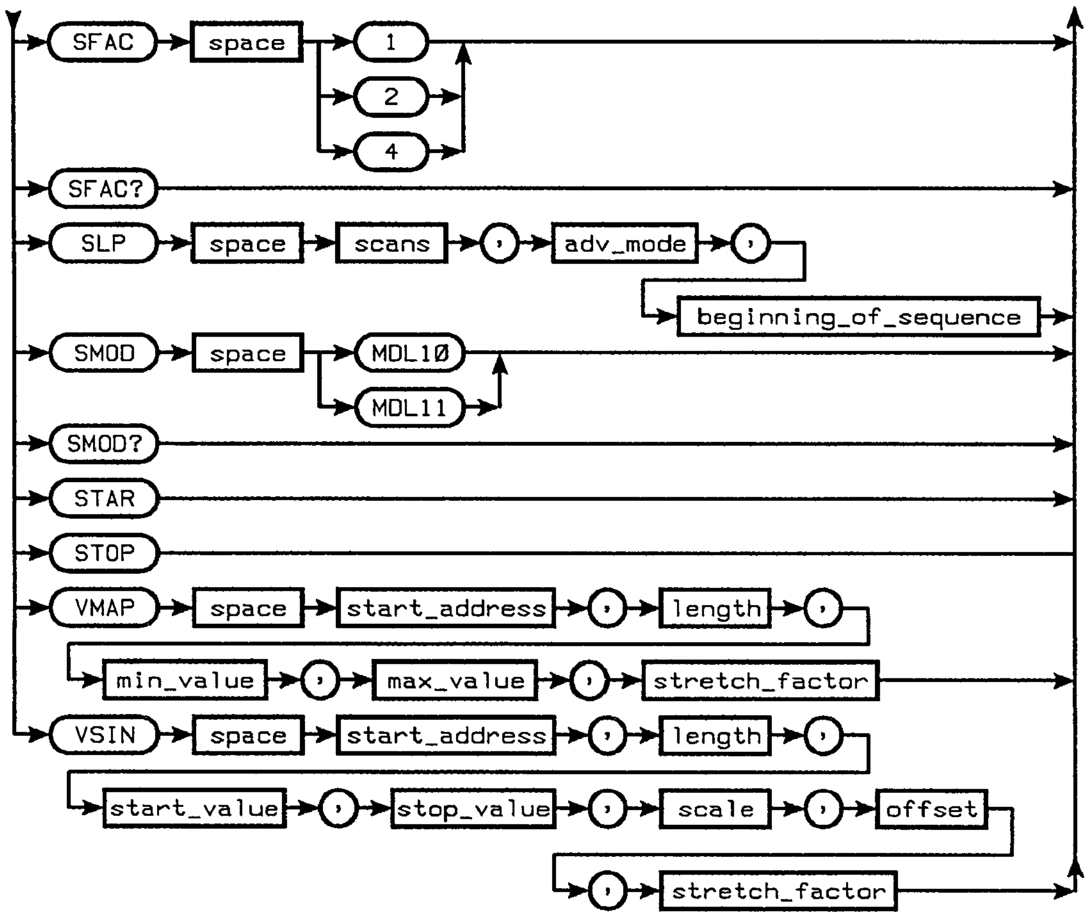


Figure 7-2 (cont'd). FASS Subsystem Syntax Diagram

AOUT (Address Out)

Syntax

$$\texttt{:FASS:AOUT} \begin{Bmatrix} \texttt{OFF} \\ \texttt{ON} \end{Bmatrix}$$

```
:FASS:AOUT?
```

Description

The modulation memory address that is currently being accessed by the sequencer can be output on the DYNAMIC DATA/DYNAMIC SEQUENCE port on the rear panel of the MDS while the sequencer is running . This command turns the capability on or off.

The modulation memory addresses can only be output on the DYNAMIC DATA/DYNAMIC SEQUENCE port when the port is not being used for dynamic data or dynamic sequence input. Therefore, setting the :FASS:AOUT command to ON is valid only if the :FASS:SEQ:MODE command is set to INT, SLAVE, or OFF.

The FASS:AOUT? query returns 0 if the command is set to OFF and 1 if set to ON.

Example

To output FM memory addresses currently being accessed:

```
OUTPUT 719; ":FASS:SEQ:MOD INT"
OUTPUT 719; ":FASS:MEM FM"
OUTPUT 719; ":FASS:AOUT ON"
```

Comments

See Appendix B for timing characteristics of DYNAMIC DATA/DYNAMIC SEQUENCE port when it is used to output addresses.

The default value for AOUT is off.

Related HP-IB Commands

FASS Subsystem
MEM
SEQ:MODE

Equivalent Front Panel Command

SID Extended Control Panel - Memory Address Out

ARAT (Address Rate Divider)

Syntax

```
:FASS:ARAT divider
```

```
:FASS:ARAT?
```

Item	Description	Range/Restrictions
Divider	Number of clock cycles that a sequencer address is repeated	1 and 2 to 65536 in multiples of 2

Description

This command sets the address rate divider for the active memory. The address rate divider is used to slow down the sequencer of the active memory. The sequencer dwells at an address for the number of clock cycles specified by the address rate divider.

Using the address rate divider can result in more effective use of memory when repetition of the same data point is desired.

Note

Be sure to read the comments on the next page before using the rate divider with AMPM or PM memory.

The query returns the current setting of the address rate divider.

Example

To set the address rate divider to 4 for the AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:ARAT 4"
OUTPUT 719; ":FASS:SFAC 4"
```

(In this example the effective rate divider is 16.)

Comments

It is important to understand the relationship between address rate division and the stretch factor.

The AM data stream and the PM data stream are multiplexed from four RAM boards. Each board operates at a 29.8 ns per element rate for an effective rate of 7.45 ns per element. To use the rate divider on one or both of these memories, the data should be stretched, or the desired output will not be obtained. (The stretch command is :FASS:SFAC.)

To illustrate why this is necessary, we will examine the multiplexing scheme of the AM and PM memories. Let ABCDEFGH be the data representing a waveform. When you load this data into one of these memories, it will map to the memory boards as follows:

Board 1		A	E	*If there is no rate division,*
Board 2		B	F	*the output of the multiplexer*
Board 3		C	G	*will be A B C D E F G H*
Board 4		D	H	

Four data points (one from each board) are accessed in parallel during each clock cycle and then multiplexed to provide a serial data stream. As you can see, the data stream above leaves the memory just as it was intended. However, if you load the data as above and use the rate divider set to 2, the output will be as follows:

Board 1	$\boxed{}$	$\boxed{A}$	$\boxed{E}$	*If the rate divider*
Board 2	$\boxed{}$	$\boxed{B}$	$\boxed{F}$	*is set to 2, the output*
Board 3	$\boxed{}$	$\boxed{C}$	$\boxed{G}$	*of the multiplexer will be*
Board 4	$\boxed{}$	$\boxed{D}$	$\boxed{H}$	*A B C D A B C D E F G H E F G H*

In most cases the desired result, which would be A A B B C C D D E E F F G G H H. If you want to divide the rate by 2, stretch the data by a factor of 2 instead, and the result will be as follows:

Board 1	$\boxed{A}$	$\boxed{C}$	$\boxed{E}$	$\boxed{G}$	*If the rate divider*
Board 2	$\boxed{A}$	$\boxed{C}$	$\boxed{E}$	$\boxed{G}$	*is set to 1, the output*
Board 3	$\boxed{B}$	$\boxed{D}$	$\boxed{F}$	$\boxed{H}$	*of the multiplexer will be*
Board 4	$\boxed{B}$	$\boxed{D}$	$\boxed{F}$	$\boxed{H}$	*A A B B C C D D E E F F G G H H*

As you can see, stretching the data is equivalent to rate division. The actual divisor for the data will be the stretch factor times the rate divider setting. Therefore, for AM, PM, and PM2 memories, to obtain an effective rate divider of 2 or 4, stretch the data by a factor of 2 or 4 and do not use the rate divider at all.

For address rate dividers beyond 4, use a combination of a stretch factor of 4 and the address rate divider (see the following table). For example, an effective address rate of 16 is achieved by using the stretch factor of 4 and an address rate divider of 4.

As the PULS field of the FREQ memory is also multiplexed by a factor of 4, when using the rate divider in the FREQ memory, pulse data should only change value on a boundary which is a multiple of 4, for reasons similar to those discussed above. For example, with 20 pulse points (5 ACS points): 00001111000000001111.

ARAT (Address Rate Divider)

Effective Address Rate Divider for AM, PM, and PM2 Memories

Effective Address Rate Divider	Actual Address Rate Divider	Stretch Factor*	Effective Memory Size
1	1	1	256k
2	1	2	128k
4	1	4	64k
8	2	4	64k
16	4	4	64k
$2^{17}-8$	$2^{15}-2$	4	64k

* The data is automatically stretched by the firmware during downloading. The stretch factor is specified with the :FASS:SFAC command.

The address rate divider uses the clock to dwell at each point for a number of clock cycles to effectively stretch data. The stretch factor command (:FASS:SFAC) uses the memory to stretch data. (The stretch factor command can only be used when the active memory is AM, PM, or PM2.) For example, an address rate divider of 2 would address the same data point in memory for two clock cycles. On the other hand, a stretch factor of 2 would load each data point into two consecutive address locations in memory, thereby occupying twice as much memory as unstretched data.

An address rate divider other than 1 can result in increased modulation distortion because of aliased sidebands.

Related HP-IB Commands

FASS Subsystem
MEM
SFAC

Equivalent Front Panel Command

SID Extended Control Panel -Rate Divider

ASEQ (Advance Sequence)

Syntax

```
              ⎧ ACS  ⎫
              ⎪ AM   ⎪
              ⎪ AUC  ⎪
              ⎪ FLC  ⎪
:FASS:ASEQ    ⎨ FM   ⎬
              ⎪ GRO  ⎪
              ⎪ PM   ⎪
              ⎪ PM2  ⎪
              ⎩ PULS ⎭

:FASS:ASEQ?
```

Description

This command advances the specified memory sequencer from the current packet or loop packet to the next packet or loop packet in the sequence.

This command is valid only when the sequencer is running and the current packet advance mode is defined as one of the following:

- 1 (BUS)
- 2 (GROUP)
- 3 (BIMM - for packets, but not loop packets)
- 4 (GIMM - for packets, but not loop packets)

The packet advance mode is defined in the :FASS:DATA 'SEQ2', :FASS:PCKM, and :FASS:PCKL commands.The query returns a number that indicates the advance mode of the packet or loop packet that is currently active.

0 No pending packet or loop packet advances. Neither the currently active packet or loop packet is in BUS advance mode.

1	Ready for BUS advance of a packet. The currently active packet is in BUS mode.
2	Ready for BUS advance of a packet or loop packet. The currently active packet and the currently active loop packet are both in BUS mode. This mode is not recommended because the result is unpredictable.
3	Ready for BUS advance of a loop packet. The currently active loop packet is in BUS mode.
4	Ready for GROUP advance of a packet. The currently active packet is in GROUP advance mode.
5	No pending packet or loop packet advances. Neither the currently active packet or loop packet is in GROUP advance mode.
6	Ready for GROUP advance of a packet or loop packet. The currently active packet and the currently active loop packet are both in GROUP mode. This mode is not recommended because the result is unpredictable.
7	Ready for GROUP advance of a loop packet. The currently active loop packet is in GROUP mode.

Example

To advance the AM memory sequencer to the next packet (assuming the packet advance mode is set to bus):

```
OUTPUT 719; ":FASS:ASEQ AM"
```

Comments

When the :FASS:ASEQ GRO command is issued, only those sequencers whose current packets are set to GROUP advance mode will advance.

Related HP-IB Commands

FASS Subsystem
DATA
MEM
PCKM
PCLM

Equivalent Front Panel Command

None

ASO
(Address Source)

Syntax

$$:FASS:ASO \begin{Bmatrix} EXT \\ INT \end{Bmatrix}$$

```
:FASS:ASO?
```

Description

The ASO command has been replaced by the SEQ:MODE command. ASO is provided for backwards compatibility with versions of SID released prior to SID 2.0.

This command selects the address source for the active modulation memory. INT selects an internal address source, for RAM mode. EXT selects and external address source for dynamic data mode.

CAL (Calibration)

Syntax

```
:FASS:CAL
```

Description

This command performs a level calibration procedure. There are two types of level calibration that are used in the HP FASS. The type of calibration used in your system depends on the type of hardware that you are using.

With Model 11 hardware, level correction is done in software. The level calibration procedure creates a set of cal factors that can be used in the AM memory to adjust the output level. The CW function in SID automatically uses these cal factors to generate signals at the correct level. In most cases, IDs such as PSID and RSID will also use the cal factors automatically.

With Model 21 hardware, the calibration procedure sets up the hardware so it will automatically compensate for differences in output level over the system's frequency range. Because the compensation is built into the hardware, it is not necessary for the software to perform any level adjustments. This means that Model 21 level calibration will correct the level in any mode (SID CW, RSID, PSID or WGL).

Model 7 hardware does not require a level calibration.

Example

To print a message when HP FASS has completed a level calibration:

```
10  OUTPUT 719; ":FASS:CAL;*OPC?"
20  ENTER 719;A
30  PRINT "LEVEL CALIBRATION COMPLETE"
40  END
```

Comments

It takes approximately six minutes to perform a level calibration in Model 11 and approximately 20 minutes in Model 21.

In Model 11, cal factors are permanently stored on the removable cartridge by executing a shutdown. In Model 21, all calibration data will be lost when the AUC is turned off unless special functions 11 and 12 are used.

In Model 11, special function 40 sets all cal factors to 1. Special function 40.1 sets all cal factors to a constant value.

Related HP-IB Commands

FASS Subsystem
CTAB?

Equivalent Front Panel Command

Utilities Menu - Level Calibration

CARR (Load Constant Carrier)

Syntax

`:FASS:CARR` *address, length, frequency*

Item	Description	Range/Restrictions
Address	Starting address in ACS memory where data is to be placed	0 to 65535.
Length	Length of data	Starting address + length must be $\leq$ 65535.
Frequency	Frequency of constant carrier	0 to 50 MHz for Model 7; 2 MHz to 3.05 GHz for Model 11; 10 MHz to 19 GHz for Model 21. Frequency must be entered in Hz.

Description

This command loads data into the ACS and AUC fields in frequency memory to produce a specified carrier frequency. No other frequency fields or modulation memories are affected by this command.

Example

To load the frequency memory with data to create a 50 MHz carrier:

```
OUTPUT 719; ":FASS:CARR 0, 256, 50000000"
```

Comments

When an external clock is used, calculations are based on the entered clock rate. Therefore, unexpected results may occur is the entered clock rate does not match the actual clock rate.

Related HP-IB Commands

None

Equivalent Front Panel Command

None

CAT? (Catalog)

Syntax

`:FASS:CAT?`

Description

This query returns a catalog (directory listing) of the names of all the files that are currently defined by name in the active modulation memory. Files are defined using the :FASS:DATA command or WGL. The returned format is in IEEE 488.2 Indefinite Length Block Data Format, as follows:

MEMORY CATALOG,#0*ascii_string*

where *ascii_string* is a string of ASCII characters containing the name, starting address, and length of each named file.

If no named files are currently loaded in active memory, the string "*NO NAMED DATA IN MEMORY*" is returned.

Example

To catalog the named files in frequency modulation memory:

```
10  DIM A$[1000]
20  OUTPUT 719; ":FASS:MEM AUC"
30  OUTPUT 719; ":FASS:CAT?"
40  ENTER 719 USING "-K"; A$
50  A$=A$[18, LEN(A$)]
60     ! Strip off block data header
70  PRINT USING "#,K"; A$
80  END
```

Comments

This query does not return information on files that are defined by address. Use the :FASS:DATA? query to examine the contents of active modulation memory by address.

All fields in the frequency memory (ACS, AUC, FLC, and PULS) have the same directory.

Related HP-IB Commands

FASS Subsystem
DATA
MEM
SEQ:CAT?

Equivalent Front Panel Command

None

CEXT (Clock External)

Syntax

$$:\texttt{FASS:CEXT}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

Item	Description	Range/Restrictions
Frequency	External clock frequency	110 to 160 MHz (see note below). Resolution is determined by the external clock source.

Description

This command sets the clock source to external and selects the frequency of the external clock.

Note

The external clock range is 110 to 160 MHz. However, performance specifications are valid only for an external clock range of 120 to 140 MHz.

The external clock connects to the EXT CLOCK INPUT connector on the rear panel of ACS. The external clock should have an amplitude of 0 to +10 dBm into 50 ohms. The wave shape should be square wave to sine wave with approximately a 50% duty cycle.

Example

To set the external clock frequency to 132 MHz:

```
OUTPUT 719; ":FASS:CEXT 132 MHZ"
```

Comments

Using this command causes application ID parameters to reset to default conditions.

When this command is selected, application ID calculations are based on the entered clock rate. Therefore, problems will occur if the entered clock rate does not match the actual clock rate.

Related HP-IB Commands

FASS Subsystem
CINT
CLOC?

Equivalent Front Panel Command

SID Control Panel - System Clock

CINT (Clock Internal)

Syntax

```
:FASS:CINT
```

Description

This command sets the clock source to internal.

The internal clock has a frequency of 2^{27} Hz (134.217728 MHz).

For Models 11 and 21, the internal clock is derived from the 5 or 10 MHz frequency reference in the AUC. The clock frequency enters ACS from the CLK OUT 134 MHz rear panel connector of AUC. This results in a clock with a period of 7.45 ns.

In Model 7, the clock is derived from the 10 MHz frequency reference in ACS.

Example

To set the clock source to internal:

```
OUTPUT 719; ":FASS:CINT"
```

Comments

Using this command causes application ID parameters to reset to default conditions.

When this command is selected, application ID calculations are based on the internal clock rate. Therefore, problems will occur if the an external clock is used when the internal clock is the selected clock source.

Related HP-IB Commands

FASS Subsystem
CEXT
CLOC?

Equivalent Front Panel Command

SID Control Panel - System Clock

CLOC? (Clock Query)

Syntax

```
:FASS:CLOC?
```

Description

This query returns the clock source and the entered frequency of the external clock. A "0" is returned if the clock source is set to internal. The entered value of the external clock is returned in hertz if the clock source is external.

Example

To read the clock source:

```
10  OUTPUT 719; ":FASS:CLOC?"
20  ENTER 719; A$
30  PRINT A$
40  END
```

Comments

This command does not measure the external clock.

Related HP-IB Commands

FASS Subsystem
CEXT
CINT

Equivalent Front Panel Command

SID Control Panel - System Clock

CONS (Constant)

Syntax

`:FASS:CONS` *address, length, value*

Item	Description	Range/Restrictions
Address	Starting address in active modulation memory where value is to be placed.	0 to (memory length - 1). See following table. AM, PM, and PM2 memories must be multiples of 4. For FREQ memory fields, see description.
Length	Number of addresses to be loaded with the constant value	Starting address plus length must be less than or equal to memory length. See following table. AM, PM, and PM2 memories must be multiples of 4.
Value	Constant value	See following table for range of values.

Description

This command loads a constant value into the active modulation memory starting at the specified start address, for the specified length. The command is typically used to define a constant portion of a waveform. The following table shows the memory length and allowable values for each memory.

Modulation Memory Data

Memory Field	Memory Length	Range of Values
ACS	65536	0 to 67108863. Entered value is assumed to be in hertz.
AM	262144	-1 to +1
AUC	32768	0 to 728
FLC	32768	0 to 90 in multiples of 6. Entered value is assumed to be in dB.
FM	65536	-67108864 to +67108863.875. Entered value is assumed to be in hertz.
PM	262144	-180 to +180 (degrees format) or $-\pi$ to $+\pi$ (radians format)
PM2	262144	-180 to +180 (degrees format) or $-\pi$ to $+\pi$ (radians format)
PULS	262144	0 or 1

Due to the internal architecture of FASS, wave segments loaded into the ACS, AUC, FLC, and PULS fields of the FREQ memory must have lengths that satisfy a specific relationship. There must be two ACS data points for each AUC and FLC data point, and there must be four PULS data points for each ACS data point.

When using the :FASS:CONS command to load data into the frequency memory, a different addressing scheme is used depending on which field you are loading. When working with the ACS, AUC, or FLC fields, valid addresses range from 0 through 65535. For the PULS field, valid addresses range from 0 through 262143. Note that there are four addresses in the PULS field for every address in the other fields. This relationship must be accounted for when using this command. For example, loading constant data to address 200 of the ACS, AUC, and FLC fields requires you to load the corresponding constant pulse data to address 800 of the PULS field.

Example

To load data that is aligned and of equal lengths into the FREQ memory:

```
10  OUTPUT 719; ":FASS:MEM ACS"
20  OUTPUT 719; ":FASS:CONS 100, 200, 35000000"
30  OUTPUT 719; ":FASS:MEM AUC"
40  OUTPUT 719; ":FASS:CONS 100, 100, 12"
50  OUTPUT 719; ":FASS:MEM FLC"
60  OUTPUT 719; ":FASS:CONS 100, 100, 12"
70  OUTPUT 719; ":FASS:MEM PULS"
80  OUTPUT 719; ":FASS:CONS 400, 800, 1"
90  END
```

Comments

Use the :FASS:DATA? query to read the contents of active memory.

Related HP-IB Commands

FASS Subsystem
DATA
DEG
MEM
RAD

Equivalent Front Panel Command

None

CTAB? (Calibration Table Query)

Syntax

:FASS:CTAB? *band*

Item	Description	Range/Restrictions
Band	AUC frequency upconversion band	0 to 728

Note

This command is only valid for Model 11 hardware because Model 21 has hardware level calibration and no calibration table. Model 7 does not require a level calibration.

Description

This query returns the level calibration factor for the specified upconversion band in the AUC. The internal level calibration table that stores the cal factors is generated with the :FASS:CAL command.

The upconversion band is determined by the following equation.

Upconversion Band = INT[Output Frequency/2^{22}Hz]

where Output Frequency is the FASS RF output frequency, and INT is the integer portion of the expression.

Example

To read the calibration factor for band 476 (RF output is 2 GHz):

```
10  DIM A$[40]
20  OUTPUT 719; ":FASS:CTAB? 476"
30  ENTER 719; A$
40  PRINT "CAL FACTOR =";A$
50  END
```

Comments

Each band is 4.194304 MHz (2^{22}Hz) wide.

Related HP-IB Commands

FASS Subsystem - CAL

Equivalent Front Panel Command

None

DATA (Data Input)

Syntax

:FASS:DATA 'WAVE:(*address*)', *memory_data*

:FASS:DATA 'WAVE:*file_name*', *memory_data*

:FASS:DATA? *address, length*

:FASS:DATA 'SEQ2', *seq2_data*

:FASS:DATA 'SEQUENCE', *seq_data*

Note

The :FASS:DATA 'SEQUENCE' command has been replaced by :FASS:DATA 'SEQ2'. :FASS:DATA 'SEQUENCE' is provided for backwards compatibility with versions of SID released prior to SID 2.0.

DATA (Data Input)

Item	Description	Range/Restrictions
Address	Starting address in active modulation memory where data is to be placed	0 to (memory length -1). See following table. Addresses in AM, PM, and PM2 memories must be multiples of 4. Addresses in FREQ memory fields must be even.
File_name	Name of file in active modulation memory where data is to be placed	6 characters maximum. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha.
Length	Length of data	*address* + *length* must be ≤ (memory length − 1). See following table. Value of *length* for AM, PM, and PM2 memories, as well as for the PULS field in the FREQ memory, must be a multiple of 4.
Memory_data	Active modulation memory data	IEEE 488.2 Indefinite Length Block Data Format. The block data consists of real numbers in internal format. See following table for range of values.
Seq_data	Sequence data for the active sequencer memory (Sequencer Model 10)	IEEE 488.2 Indefinite Length Block Data Format. The block data consists of real numbers as shown in the table, "Sequencer Memory Data".
Seq2_data	Sequence data for active sequencer memory (Sequencer Model 7, 11, or 21)	Same as *seq_data*, plus an extra real number per packet which provides the capability of enabling or disabling individual packet markers, as shown in the table, "Sequencer Memory Data".

Description

This command is used to load data directly into the modulation memories and sequencer memories.

Loading Data into the Active Modulation Memory

Data can be loaded into the active modulation memory by address or by file name by using the :FASS:DATA 'WAVE' command . The following table shows the memory length and range of values for each memory.

Modulation Memory Data

Memory	Memory Length	Range of Data Values
ACS	65536	0 to 67108863.875. Entered value is assumed to be in hertz.
AM	262144	−1 to +1
AUC	32768	0 to 4412
FLC	32768	0 to 90 in multiples of 6. Entered value is assumed to be in dB.
FM	65536	−67108864 to +67108863.875. Entered value is assumed to be in hertz.
PM	262144	−180 to +180 (degrees format) or $-\pi$ to $+\pi$ (radians format).
PM2	262144	−180 to +180 (degrees format) or $-\pi$ to $+\pi$ (radians format).
PULS	262144	0 or 1

The :FASS:DATA? query returns the data in the active memory as an array of real numbers. Data is read from the starting address for the specified length. (See also further information below under "Comments".)

Due to the internal architecture of HP FASS, wave segments loaded into the ACS, AUC, FLC, and PULS fields of the FREQ memory must have lengths that satisfy a specific relationship. There must be two ACS data points for each AUC and FLC data point, and there must be four PULS data points for each ACS data point.

Figure 7-3 shows the addressing scheme for the modulation memories.

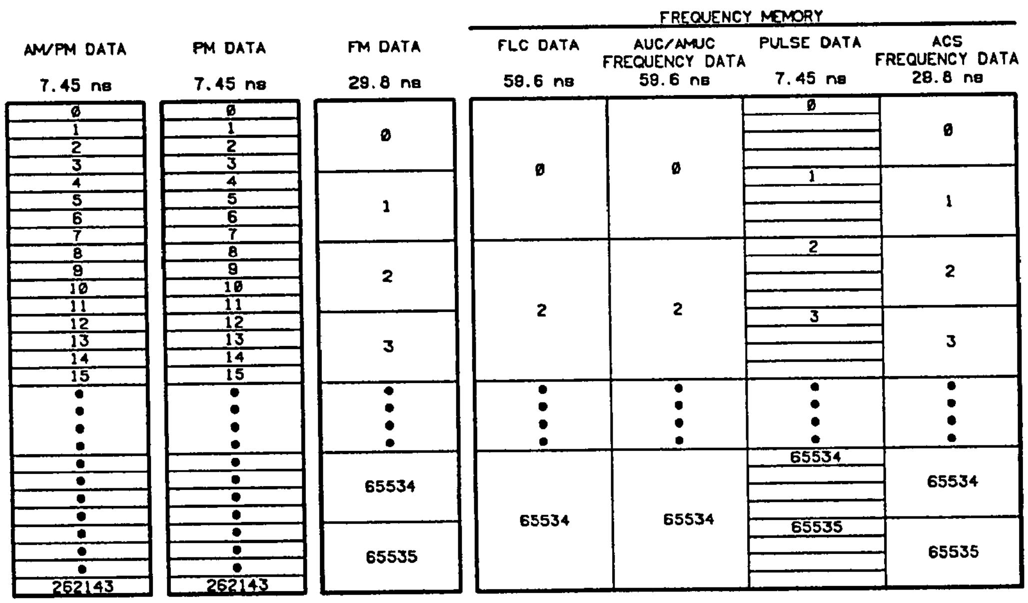


Figure 7-3. Modulation Memory Addressing Scheme

All accessing of data in the FREQ memory is done in terms of the ACS frequency field. Thus, data in the AUC, PULS and FLC fields of the FREQ memory is queried in terms of the address and length of the corresponding data in the ACS field. For example, if there are 400 ACS points stored starting at address

1000, and the corresponding contents of the AUC field are to be read, you would send the query :FASS:DATA? 1000, 400 with the active memory set to AUC. Since there is 1 AUC point for every 2 ACS points, 200 points would be returned. Similarly, if the active memory is set to PULS, 1600 points would be returned.

Valid query addresses for the AUC and FLC fields range from 0 to 65535 in multiples of 2. Valid query lengths range from 2 to 65535 in multiples of 2.

Valid query addresses for the PULS field range from 0 to 65535. Valid query lengths range from 1 to 65535.

Loading data into the active modulation memory stops signal execution by stopping and resetting the sequencers.

Loading Data into the Active Sequencer Memory

Sequence packets are created by file name using the :FASS:PCKM command or by address using the :FASS:PCLM command. The entire sequence is created by address using the :FASS:DATA 'SEQ2' command. For Sequencer Model 7, 11, or 21, the :FASS:SEQ:BEG command must appear prior to this command.

The sequence data is an array of real numbers that contains all the necessary parameters to define a sequence. The first number in the array is the number of packets in the sequence. This number is followed by the starting address, length, number of scans, and advance mode for the first packet. The *seq2_data* may include loop packets as well as ordinary packets. *seq2_data* also includes one additional parameter to enable the packet marker. For Sequencer Model 7, 11, or 21, *every sequence must begin with a loop packet.* The starting address, length, number of scans, and advance mode for subsequent packets in the sequence are likewise loaded into the rest of the array. The end of the sequence must be indicated by a :FASS:SEQ:END command.

The following table shows the information needed to define a sequence. Note that the :FASS:DATA 'SEQ2' command differs from the :FASS:DATA 'SEQUENCE' command in that it has an extra parameter for the extra packet ID marker field. Also, only the :FASS:DATA 'SEQ2' command can define loop packets.

Sequencer Memory Data

Parameter	Description	Range
Number of Packets and/or Loop Packets	Number of packets and/or loop packets defined in sequence	1 to 32768
Starting Address	Starting address of packet (Not used for loop packet)	0 to (memory length − length).
Length	Must be 0 for loop packet; otherwise, is the number of waveform elements in the packet	8 to 262144 for AM, PM, and PM2 memories; 2 to 65536 for FM; 2 to 65536 for FREQ memory
Number of Scans	Number of passes through the wave segment	0 through 65536 for BUS or GROUP advance mode; 1 to 65536 for AUTO advance mode
Advance Mode	Mode used to advance to the next packet in the sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, 4 for GIMM. Only 0, 1, 2 are allowed for loop packets; 0, 1, 2, 3, 4 are allowed for ordinary packets.
Marker	Unused for loop packets; for other packets, enables or disables the packet ID marker (for more information, see :FASS:ESEL command)	0 for packet ID marker off; 1 for packet ID marker on

In Sequencer Model 7, 11, or 21, HP FASS has the capability of loading part of the sequencer memory while the sequencer continues to send addresses to the modulation memory. This is called continuous sequence downloading.

Continuous sequence download refers to loading part of the sequencer memory while the sequencer continues to send addresses to the modulation memory. This capability requires no special mode and can be used at any time.

Two restrictions apply when using this capability. First, do not download the new sequence to the portion of sequencer memory that is currently playing or to a portion of sequencer memory you may want to play. Second, minimum packet dwell times increase. See table 7-2 and the text following the table to determine increased dwell times.

To use this capability successfully, you want to know the locations of all your sequences in the sequencer memory. Be sure to program sequence locations explicitly by avoiding the parameter "-1" in the :FASS:SEQBEG command.

Also, don't purge the current sequence while the sequencer is running. Stop the sequencers, then purge the sequence.

Example

The following example loads data into the frequency memory by address and then creates a sequence using the :FASS:DATA 'SEQ2' command.

```
10  REAL Acsdat(1:100),Aucdat(1:50),Flcdat(1:50)
20  REAL Pulsdat(1:400),Pack(0:10)
30  ASSIGN @Fmtoff TO 719; FORMAT OFF
40  !
50  !Set ACS to 37.085440 MHz output
60  FOR I=1 TO 100
70    Acsdat(I)=37085440
80  NEXT I
90  !
```

```
100 !Set AUC to 100 MHz output and FLC to 24 dB
110  FOR I=1 TO 50
120    Aucdat(I)=23
130    Flcdat(I)=24
140 NEXT I
150 !
160 !Turn pulse on
170 FOR I=1 TO 400
180   Pulsdat(I)=1
190 NEXT I
200 !
210 OUTPUT 719; "*RST"  !Reset system
220 !
230 PRINT "LOADING ACS MEMORY"
240 OUTPUT 719; ":FASS:MEM ACS"
250 OUTPUT 719; ":FASS:DATA 'WAVE:(0)',#0";
260 OUTPUT @Fmtoff;Acsdat(*)
270 OUTPUT 719 USING "-,K";"",END
280 !
290 PRINT "LOADING AUC MEMORY"
300 OUTPUT 719; ":FASS:MEM AUC"
310 OUTPUT 719; ":FASS:DATA 'WAVE:(0)',#0";
320 OUTPUT @Fmtoff; Aucdat(*);
330 OUTPUT 719 USING "-,K";"",END
340 !
350 PRINT "LOADING FLC MEMORY"
360 OUTPUT 719; ":FASS:MEM FLC"
370 OUTPUT 719; ":FASS:DATA 'WAVE:(0)',#0";
380 OUTPUT @Fmtoff; Flcdat(*);
390 OUTPUT 719 USING "-,K";"",END
400 !
410 PRINT "LOADING PULSE MEMORY"
420 OUTPUT 719; ":FASS:MEM PULS"
430 OUTPUT 719; ":FASS:DATA 'WAVE:(0)',#0";
440 OUTPUT @Fmtoff; Pulsdat(*);
450 OUTPUT 719 USING "-,K";"",END
460 !
470 PRINT "MAKING FREQUENCY PACKET"
```

```
480 Pack(0) = 2   !Number of Packets
490 Pack(1) = 0   !Unused
500 Pack(2) = 0   !Loop indicator
510 Pack(3) = 7   !Loop scans
520 Pack(4) = 1   !Loop advance - bus
530 Pack(5) = 0   !Unused
540 Pack(6) = 0   !Start Address
550 Pack(7) = 100 !Length
560 Pack(8) = 1   !Scans
570 Pack(9) = 0   !Automatic Packet Advance
580 Pack(10) = 1  !Mark Packet
590 OUTPUT 719; ":FASS:PURG:SEQ 0"
600 OUTPUT 719; ":FASS:SEQ:BEG 0,-1"
610 OUTPUT 719; ":FASS:DATA 'SEQ2',#0";
630 OUTPUT @Fmtoff; PACK(*)
640 OUTPUT 719 USING "-K";"",END
650 OUTPUT 719; ":FASS:SEQ:END"
660 !
670 OUTPUT 719;":FASS:STAR" !Start FASS
680 END
```

To read back data in the ACS field of the FREQ memory, starting at address 0 for a length of 100 addresses:

```
10  ASSIGN @Fmtoff to 719;FORMAT OFF
20  DIM Hdr$[9]
30  REAL Dat(1:100)
40  !
50  OUTPUT 719; ":FASS:MEM ACS"
60  OUTPUT 719; ":FASS:DATA? 0, 100"
70  ENTER 719 USING "#,K"; Hdr$
80  ENTER @Fmtoff; Dat(*)
90  ENTER 719
100 FOR I=1 TO 100
110    PRINT Dat(I);
120    IF (I MOD 4)=0 THEN PRINT
130 NEXT I
140 END
```

Comments

Data returned by the :FASS:DATA? query is returned as indefinite length block data. Inside the block the data is represented as an array of floating point numbers in internal format. If you are using HP BASIC, the data is best read using an ENTER statement on an I/O path configured with FORMAT OFF. The data can then be read directly into an array.

The data you get back from :FASS:DATA? may be different than the data you originally sent with :FASS:DATA. For the AM, PM and PM2 memories, FASS:DATA? returns the data in its integer format. The FM, AUC, ACS, FLC, and PULS memories return the data in the same form as it was sent.

Due to the internal architecture of the FASS, AM data loaded into the instrument is passed through an arc-cosine function. This means that the AM data returned by :FASS:DATA? is not only re-scaled, but also transformed.

Data Value Returned	AM Value Sent
2048	-1.0
1365	-0.5
1024	0.0
683	0.5
0	1.0

To go from a returned data value to the true AM value, convert the data value to an angle (0 to 2048 corresponds to 0 to 180 degrees) and then take the cosine. For example, a data value of 200 would correspond to an angle of 17.6 degrees, and a resulting amplitude of 0.9533.

For both the PM and PM2 memories, data was sent as a phase, either in degrees or radians. Data is returned as an integer ranging from 0 to 4095. Data ranging from 0 to 2048 corresponds to phases from 0 degrees to 180 degrees or from 0 to π radians. Data ranging from 2048 to 4095 corresponds to phases from -180 degrees to -0.08789 degrees or from $-\pi$ radians to $-\pi/4095$ radians. If you want to get data out of the instrument with :FASS:DATA? and send it back down again with :FASS:DATA, you'll need to rescale the data to compensate for this.

The following words should not be used for file names: AUTO, EXT, GROUP, BUS, LOCAL, LCL, BLOCK, BIMM, or GIMM.

The :FASS:DATA? query for the AM, PM, and PM2 memories has no knowledge of the stretch factor used during download. This means that the query will not unstretch the data.

The :FASS:DATA 'SEQ2' command is preferable to the :FASS:PCKM, :FASS:PCLM commands if you are creating large numbers of packets or if the packets are computer generated.

Because there is only one sequencer for the entire frequency memory, packet parameters for the FREQ memory correspond to data in the ACS field.

The first time you download data by file name to a field in the FREQ memory, the other three fields will be initialized. ACS frequency is set to 0 Hz, the FLC is set to 0 dB, the AUC frequency band is set to 0, and the pulse is set to 1 (on).

Downloading data using a file name that already exists in the active memory will write over the old file. If you want to download data to the FREQ memory fields using an existing file name and your new data has a different length than the old file, you must first purge the existing file.

The HP FASS limit on named files is 100 per memory.

If the method of packet advance is either BUS, GROUP, BIMM, or GIMM, the number of scans is indefinite. However, the scan parameter must be present in the HP-IB command statement.

Related HP-IB Commands

FASS Subsystem
IDAT
MEM
PCKM
PCLM

Equivalent Front Panel Command

None

DDAT (Dynamic Data Mode)

Syntax

```
:FASS:DDAT {ASYN | SYNC}

:FASS:DDAT?
```

Description

This command sets the dynamic data mode for the active memory. Two modes are available: asynchronous (ASYN) and synchronous (SYNC).

Asynchronous mode allows you to input data from a source with a clock unrelated to the FASS system clock at speeds slower than 250 ns.

Synchronous mode should be used whenever the external data source can be run at the same clock rate as the MDS and whenever jitter needs to be minimized.

The query returns the currently selected dynamic data format, either ASYN or SYNC.

Example

To select the synchronous dynamic data mode for the FM memory:

```
OUTPUT 719; ":FASS:MEM FM"
OUTPUT 719; ":FASS:SEQ:MODE EXTADDR"
OUTPUT 719; ":FASS:DDAT SYNC"
```

Comments

See Product Note 8791-1, *Real Time Control of HP FASS* for information about dynamic data.

Related HP-IB Commands

FASS Subsystem
MEM
SEQ:MODE

Equivalent Front Panel Command

SID Extended Control Panel - Dynamic Data Mode

DDEL (Dynamic Data Delay)

Syntax

$$\text{:FASS:DDEL} \left\{ \begin{array}{l} \text{MIN} \\ \text{DYNSEQ} \end{array} \right\}$$

```
:FASS:DDEL?
```

Description

This command selects the active modulation memory's delay mode for dynamic data input.

The meanings of the parameters are as follows:

- MIN - sets the latency period through the system for dynamic data to a minimum.
- DYNSEQ - adds delay to the dynamic data input so that the latency period through the system for dynamic data is the same as that for dynamic sequence data.

Example

To select the minimum latency period for dynamic data input to the active modulation memory:

```
10 OUTPUT 719; ":FASS:DDEL MIN"
```

Comments

See Product Note 8791-1, *Real-Time Control of HP FASS* for information about dynamic data.

Related HP-IB Commands

FASS Subsystem
SEQ:MODE

Equivalent Front Panel Command

SID Extended Control Panel - Sequence Delay

DEG (Degrees)

Syntax

```
:FASS:DEG
```

Description

This command sets the data format to degrees for the PM and PM2 memories.

Example

To set the data format of the PM2 memory to degrees:

```
OUTPUT 719; ":FASS:MEM PM2"
OUTPUT 719; ":FASS:DEG"
```

Comments

The reset condition for the phase memory data format is degrees.

Related HP-IB Commands

FASS Subsystem
DATA
MEM
RAD

Equivalent Front Panel Command

SID Control Panel - PM Data Mode

ESEL (Event Marker Port Selection)

Syntax

$$\text{:FASS:ESEL} \left\{ \begin{array}{l} \text{'EMAR1'} \\ \text{'EMAR2'} \end{array} \right\}, \text{'}\textit{source}\text{'}$$

$$\text{:FASS:ESEL?} \left\{ \begin{array}{l} \text{'EMAR1'} \\ \text{'EMAR2'} \end{array} \right\}$$

Item	Description	Range/Restrictions
Source	Marker that will be output through specified event marker port.	See description below.

Description

For the active memory, this command selects which marker will be output to which of the two event marker outputs that are available for each memory on the rear of the MDS panel. (EMAR1=Event Marker 1 and EMAR2=Event Marker 2.) The query returns the source for the specified port configuration.

The following values are allowed for the *source* parameter:

- ADDREQUAL - Equal Address Marker: this marker is output whenever the address specified by the :FASS:MARK command is reached. The delay between the time when the marker is output, and the time when the waveform data reaches the RF output, can be adjusted using the :FASS:MDEL command.
- LOOPSTART - Loop Packet Start Marker: a marker pulse is output at the start of each loop packet.

- PACKID - Packet ID Marker: the marker is output, and stays high, for the duration of the packets selected by the DATA 'SEQ2', PCLM, or PCKM command.
- PACKIDST - Pulsed Packet ID Marker; a marker pulse is output at the beginning of the packets selected by the DATA 'SEQ2', PCLM, or PCKM command.
- PACKSTART - Packet Start Marker: a marker pulse is output at the start of every packet.
- SCANSTART - Scan Start Marker: a marker pulse is output at the start of every packet scan.
- SEQSTART - Sequence Start Marker: a marker pulse is output at the start of every sequence.
- NONE - No marker is output.

Example

To set Event Marker 1 for a Sequence Start Marker and Event Marker 2 for an Equal Address Marker in the AM memory:

```
10 OUTPUT 719; ":FASS:MEM AM"
20 OUTPUT 719; ":FASS:ESEL 'EMAR1','SEQSTART'"
30 OUTPUT 719; ":FASS:ESEL 'EMAR2','ADDREQUAL'"
```

Comments

After the execution of a reset command (*RST), the default assignments for the event marker ports will be:

EMAR1 - SEQSTART
EMAR2 - ADDREQUAL

Related HP-IB Commands

FASS Subsystem
DATA 'SEQ2'
MARK
MDEL
PCKM
PCLM

Equivalent Front Panel Command

SID Event Markers
Event Marker 1
Event Marker 2

GADV (Group Packet Advance)

Syntax

$$:\texttt{FASS:GADV}\ \begin{Bmatrix} \texttt{INT} \\ \texttt{EXT} \end{Bmatrix}$$

```
:FASS:GADV?
```

Description

This command selects the source for the group packet advance signal. The group packet advance signal affects the packets in each sequence that are currently running in the GROUP or GIMM mode. If EXT is selected, the group packet advance source is the GROUP SEQUENCE JUMP input on the MDS rear panel. If INT is selected, the group packet advance source is set to internal and the :FASS:ASEQ GRO command is used to generate a group advance.

Related HP-IB Commands

PACK
PACL
PCKM
PCLM
ASEQ
SLP

Equivalent Front Panel Command

SID Control Panel - Group Packet Adv.

IDAT (Internal Format Data Input)

Syntax

:FASS:IDAT 'WAVE:(*address*)', *memory_data*

:FASS:IDAT 'WAVE:*file_name*', *memory_data*

:FASS:IDAT? *address, length*

Item	Description	Range/Restrictions
Address	Starting address in active modulation memory where data is to be placed	0 to (memory length -1). See following table. Addresses in AM and PM memories must be multiples of 4. Addresses in FREQ memory must be even.
File_name	Name of file in active modulation memory where data is to be placed	6 characters maximum. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha.
Memory_data	Active modulation memory data	IEEE 488.2 Indefinite Length Block Data Format. The block data consists of internal format 16-bit for AM and PM memory. or 32-bit integers for FM, ACS, and APF memory.
Length	Length of data	*address + length* must be ≤ (memory length -1). See following table. Value of *length* for AM and PM memories must be a multiple of 4.

Description

This command is used to load data in internal format directly into the modulation memories.

This command is very similar to the :FASS:DATA command. The advantage of loading data in internal format is improved download speed. The main disadvantage of this command is that you must put the data into internal format instead of relying on the Smart Interface to format the data for you.

Note

Internal format data is not range checked, so it is up to you to ensure that valid data is sent to the HP FASS.

Data can be loaded into the active modulation memory by address or by file name. The following table shows the memory length and range of values for each memory.

Modulation Memory Data

Memory	Memory Length	Range of Data Values
ACS	65536	0 to 67108863.875. Entered value is assumed to be in hertz.
AM	262144	−1 to +1
AUC	32768	0 to 4412
FLC	65536	0 to 90 in multiples of 6. Entered value is assumed to be in dB.
FM	65536	−67108864 to +67108863.875. Entered value is assumed to be in hertz.
PM	262144	−180° to +180°
Pulse	262144	0 or 1

Phase Modulation Data

Phase modulation in HP FASS is implemented as a 12-bit phase offset. This offset can be changed every 7.45 ns. The 12-bit range corresponds to 360 degrees. In internal format, phase modulation data is represented by the 12 least significant bits of a 16-bit number. (The four most significant bits are ignored.) A value of 0 corresponds to a 0 degree offset; a value of 2048 corresponds to a 180 degree offset.

The following formula is used to calculate phase modulation data in internal format:

$$P_{int} = Phase\left(\frac{2^{12}}{360}\right)$$

where Phase is in degrees.

Phase values greater than 360 degrees will result in a number that is larger than 4095 (12-bits). The upper four bits of the 16-bit number that is sent to HP FASS are ignored, so it is possible to use phases larger than 360 degrees.

Once converted, the data can be transferred to HP FASS over HP-IB in indefinite length block format data as an array of 16-bit numbers.

Amplitude Modulation Data

As explained in Product Note 8791-3, *Theory of Operation for the HP 8791 Model 7/10/11/21 Frequency Agile Signal Simulator*, AM is accomplished as a special case of phase modulation. To do this, AM data must be converted to phase with an arc-cosine function. This data can then be converted in the same fashion as phase data and sent to the HP FASS.

The following formula is used to calculate AM data in internal format:

$$A_{int} = arccos(Amplitude)X\frac{2^{12}}{360}$$

This equation assumes that the arc cosine returns a value between 0 and 180 degrees. For an amplitude of 1.0, the internal value is 0. For an amplitude of 0, the internal value is 1024. For an amplitude of -1, the internal value is 2048. These internal values are downloaded to the HP FASS as 16-bit numbers, in the same manner as the phase data.

Frequency Modulation Data

FM values are represented internally as 32-bit numbers. The least significant bit has a value of 0.125 Hz. The following equation is used to convert FM data to internal format:

$$F_{int} = 8(Frequency)$$

where frequency is in Hz.

Valid FM offsets range from -67108864 to 67108863.875.

ACS Frequency Data

The ACS frequency data uses the same representation as the FM data. However, the valid range of ACS frequencies is from 0 to 67108863.875.

The ACS instantaneous frequency is the sum of the FM and ACS frequency value being generated by the MDS. It is possible to program the HP FASS to generate an instantaneous frequency that is outside the HP FASS 40 MHz modulation bandwidth. However, this may result in a loss of signal or a signal at the wrong frequency.

AUC, Pulse, and FLC Data

The AUC, Pulse, and FLC (APF) data fields have the most complex internal data format. Inside the HP FASS, these three fields are stored as parts or fields within a 32-bit number. The AUC field is represented by 16 bits, the FLC field is represented by a four bits, and the pulse data requires four bits. To transfer these data values into the HP FASS in internal format requires that the values be combined into one 32-bit number before loading the data into the HP FASS.

The 32 bits are broken down as follows:

AUC, Pulse, and FLC Bit Definition

Bits	Field
31-28	not used
27-24	Pulse data
23-20	not used
19-16	FLC data
15-0	AUC index

To load data into the APF data field, the active memory must be either AUC, PULS, or FLC.

The FLC data is a four bit number with the least significant bit representing 6 dB of attenuation. The FLC data provides up to 90 dB of attenuation in 6 dB steps.

For information on AUC values, see the FASSFREQ command in the *Waveform Generation Language Programming Reference.*

Like all memory channels in HP FASS, the APF (AUC, Pulse, FLC) memory board is clocked at a 30 ns rate; however, the data rates for the AUC and FLC are based on a 60 ns clock cycle. The pulse data rate is 7.5 ns. These different data rates are accomplished by multiplexing the pulse bits and storing the AUC and FLC bits twice. The current loading method takes care of this multiplexing and duplicating automatically. IDAT does not.

To generate 60 ns of a given signal requires two 32-bit APF words. The first 20 bits of both words should be identical and contain the AUC index and the FLC setting. The pulse data in bit 24 contains the pulse state for the first 7.5 ns of the 60 ns period. Bit 25 contains the pulse state of the second 7.5 ns. The third and fourth 7.5 ns pulse values are in bits 26 and 27. The fifth through eighth pulse bits are in bits 24-27 of the second 32-bit word.

Consider a signal that requires ten AUC index data points. The AUC data and FLC data could each be stored in 10-point long arrays. The corresponding pulse data array would be 80 points long. The following table illustrates how the values would be stored in a 32-bit word in internal format. For this example, 20 32-bit words would be required. (Each line in the table represents a 32-bit word.)

Example of Loading Data in APF Memory

Field	empty	Pulse Bits				empty	FLC	AUC Index
Width	4	1	1	1	1	4	4	16
Time (ns)								
0.00	X	P[3]	P[2]	P[1]	P[0]	X	FLC[0]	AUC[0]
28.90	X	P[7]	P[6]	P[5]	P[4]	X	FLC[0]	AUC[0]
57.80	X	P[11]	P[10]	P[9]	P[8]	X	FLC[1]	AUC[1]
86.70	X	P[15]	P[14]	P[13]	P[12]	X	FLC[1]	AUC[1]
115.60	X	P[19]	P[18]	P[17]	P[16]	X	FLC[2]	AUC[2]
144.50	X	P[23]	P[22]	P[21]	P[20]	X	FLC[2]	AUC[2]
173.40	X	P[27]	P[26]	P[25]	P[24]	X	FLC[3]	AUC[3]
202.30	X	P[31]	P[30]	P[29]	P[28]	X	FLC[3]	AUC[3]
231.20	X	P[35]	P[34]	P[33]	P[32]	X	FLC[4]	AUC[4]
260.10	X	P[39]	P[38]	P[37]	P[36]	X	FLC[4]	AUC[4]
289.00	X	P[43]	P[42]	P[41]	P[40]	X	FLC[5]	AUC[5]
317.90	X	P[47]	P[46]	P[45]	P[44]	X	FLC[5]	AUC[5]
346.80	X	P[51]	P[50]	P[49]	P[48]	X	FLC[6]	AUC[6]
375.70	X	P[55]	P[54]	P[53]	P[52]	X	FLC[6]	AUC[6]
404.60	X	P[59]	P[58]	P[57]	P[56]	X	FLC[7]	AUC[7]
433.50	X	P[63]	P[62]	P[61]	P[60]	X	FLC[7]	AUC[7]
462.40	X	P[67]	P[66]	P[65]	P[64]	X	FLC[8]	AUC[8]
491.30	X	P[71]	P[70]	P[69]	P[68]	X	FLC[8]	AUC[8]
520.20	X	P[75]	P[74]	P[73]	P[72]	X	FLC[9]	AUC[9]
549.10	X	P[79]	P[78]	P[77]	P[76]	X	FLC[9]	AUC[9]

Example The following example creates a Barker code waveform for the phase memory and converts it to internal format. The internal format data is then downloaded using the :FASS:IDAT command. The data is created using a real array and then converted to integer data. (Of course the data could have been calculated as integer data.)

```
10      REAL Phase(0:259)
20      INTEGER Phase_idat(0:259)
30      !
40      ASSIGN @Fass TO 719
50      ASSIGN @Fmtoff TO 719;FORMAT OFF
60      !
70      ! Create the Barker code waveform
80      MAT Phase= (180)
90      FOR I=100 TO 139
100        Phase(I)=0
110        NEXT I
120     FOR I=180 TO 199
130        Phase(I)=0
140        NEXT I
150     FOR I=220 TO 239
160        Phase(I)=0
170        NEXT I
180     !
190     ! Convert the waveform to internal format
200     FOR I=0 TO 259
210        Phase_idat(I)=INT((Phase(I)*4096/360)+.5)
220     NEXT I
230     !
240     OUTPUT 719;":FASS:MEM PM"
250     OUTPUT 719;":FASS:IDAT 'WAVE(0)',#0";
260     OUTPUT @Fmtoff;Phase_idat(*)
270     OUTPUT 719 USING "-,K";"",END
280     !
290     END
```

The following example creates a sine wave for the AM memory and converts it to internal format.

```
10      REAL Am(0:199)
20      INTEGER Am_idat(0:199)
30      !
40      DEG
50      !
60      ASSIGN @Fass TO 719
70      ASSIGN @Fmtoff TO 719;FORMAT OFF
80      !
90      ! Create a simple sine wave for AM
100     FOR I=0 TO 199
110        Am(I)=(SIN(I*(360/200))+1)*.5
120        NEXT I
130     !
140     ! Convert the waveform to internal format
150     FOR I=0 TO 199
160        Am_idat(I)=INT((ACS(Am(I))*4096/360)+.5)
170     NEXT I
180     !
190     OUTPUT 719;":FASS:MEM AM"
200     OUTPUT 719;":FASS:IDAT 'WAVE(0)',#0";
210     OUTPUT @Fmtoff;Am_idat(*)
220     OUTPUT 719 USING "-,K";"",END
230     !
240     END
```

The following example shows how to load ACS frequency data:

```
10      REAL Freq(0:199)
20      DIM Freq_idat$[800]
30      !
40      ASSIGN @Fass TO 719
50      !
60      ! Create a ramp in frequency
70      FOR I=0 TO 199
80       Freq(I)=2.3654889E+7+I*100000
```

```
90      NEXT I
100    !
110    ! Convert the waveform to internal format
120    FOR I=0 TO 199
130       Freq_val=INT(Freq(I)*8)
140       !
150       ! High word
160       H_word=INT(Freq_val/256^2)
170       L_word=Freq_val MOD 256^2
180       !
190       Freq_idat$[I*4+1]=CHR$(H_word DIV 256)
200       Freq_idat$[I*4+2]=CHR$(H_word MOD 256)
210       Freq_idat$[I*4+3]=CHR$(L_word DIV 256)
220       Freq_idat$[I*4+4]=CHR$(L_word MOD 256)
230       !
240    NEXT I
250    !
260    OUTPUT @Fass;":FASS:MEM ACS"
270    OUTPUT @Fass;":FASS:IDAT 'WAVE(0)',#0";Freq_idat$;
280    OUTPUT @Fass USING "-,K";"",END
290    !
300    END
```

The following example creates arrays of AUC, Pulse, and FLC and then merges and downloads the data.

```
10     REAL Acsdat(0:99),Auc(0:49),Flcdat(0:49)
20     REAL Pulse(0:399)
30     !
40     INTEGER Apf(0:199)
50     !
60     ASSIGN @Fass TO 719
70     ASSIGN @Fmtoff TO 719;FORMAT OFF
80     !
90     !
100    FOR I=0 TO 49
110           Auc(I)=100+I
120           NEXT I
130           !
```

```
140     MAT Flcdat= (24)
150   !
160   !Turn pulse on
170    MAT Pulse= (1)
180   !
190   !
200   ! Merge all of the data fields into one array
210    FOR I=0 TO 199 STEP 4
220      ! Do the first four Pulse bits and the FLC
230      Flc=INT(Flcdat(I/4)/6)
240      Pbits=8*Pulse(I*2+3)+4*Pulse(I*2+2)+2*Pulse(I*2+1)+Pulse(I*2)
250      Apf(I)=INT(Pbits*256+Flc)
260      Apf(I+1)=Auc(I/4)
270     !
280      ! Do the second four Pulse bits and the FLC
290      Pbits=8*Pulse(I*2+7)+4*Pulse(I*2+6)+2*Pulse(I*2+5)+Pulse(I*2+4)
300      Apf(I+2)=INT(Pbits*256+Flc)
310      Apf(I+3)=Auc(I/4)
320      NEXT I
330   !
340   !
350   OUTPUT @Fass;":FASS:MEM AUC"
360   OUTPUT @Fass;":FASS:IDAT 'WAVE(0)',#0";
370   OUTPUT @Fmtoff;Apf(*)
380   OUTPUT @Fass USING "-,K";"",END
390   !
400   END
```

Comments

Loading data into the active modulation memory stops signal execution by stopping and resetting the sequencers.

The following words should not be used for file names: AUTO, EXT, GROUP, BUS, LOCAL, LCL, BLOCK, BIMM, or GIMM.

Downloading data using a file name that already exists in the active memory will write over the old file. If you want to download data to the FREQ memory fields using an existing file name and your new data has a different length than the old file, you must first purge the existing file.

The number of named files must be less than 100 per memory.

Related HP-IB Commands

FASS Subsystem
DATA
MEM

Equivalent Front Panel Command

None

MARK (Marker)

Syntax

`:FASS:MARK:ADDR` *address*

`:FASS:MARK:ADDR?`

`:FASS:MARK:FILE` *'file_name'*, *offset*

Item	Description	Range/Restrictions
Address	Active memory address	0 to 262140 in multiples of 4 for AM, PM, and PM2 memories; 0 to 65535 for FM memory, 0 to 65534 in multiples of 2 for AUC, ACS, FLC, and PULS fields
File_name	Name of file in active memory	6 characters maximum. Valid characters are A-Z, a-z, 0-9, and _. The first character of the file name must be alpha.
Offset	Added offset from the starting address of the named file	0 to the length of the file. For AM, PM, and PM2 memories, offset must be multiples of 4. For ACS, AUC, FLC, and PULS fields, offset must be a multiple of 2.

Description

This command sets the Equal Address marker of the active memory to the start address of a named file plus an offset, or to a specified address.

In the reset state, the Equal Address marker for each memory is output on the EVENT MARKER 2 connector on the rear panel of the MDS. However, the output connector can be changed using the :FASS:ESEL command.

Example

To set the PM memory Equal Address marker:

```
10  REAL Filedat(1:100)
20  ASSIGN @Fmtoff to 719;FORMAT OFF
30  OUTPUT 719; "*RST"
40  OUTPUT 719; ":FASS:MEM PM"
50  OUTPUT 719; ":FASS:DEG"
55  OUTPUT 719; ":FASS:ESEL 'EMAR1', 'ADDREQUAL'"
60  !
70  ! LOAD ARRAY
80  FOR I=1 TO 100
90    Filedat(I)=I
100 NEXT I
110 !
120 ! LOAD PM MEMORY
130 OUTPUT 719; ":FASS:DATA 'WAVE:PMFILE',#0";
140 OUTPUT @Fmtoff;Filedat(*);
150 OUTPUT 719 USING "-,K";"",END
160 !
170 ! CREATE NEW SEQUENCE
180 OUTPUT 719; ":FASS:PACK 'PMFILE',100,0"
190 !
200 ! SET MARKER TO BEGINNING OF PM FILE
210 OUTPUT 719; ":FASS:MARK:FILE 'PMFILE',0"
220 !
230 OUTPUT 719; ":FASS:STAR" ! Start FASS
240 END
```

Comments

The reset value for marker address is 0.

There is only one Equal Address marker for the entire frequency memory (that is, the ACS, AUC, FLC, and Pulse fields).

Each of the four modulation memories (AM/PM2, PM, FM, and FREQ) is controlled by a sequencer. Each sequencer has eight TTL-compatible marker outputs: Equal Address, Loop Packet Start, Packet ID, Packet ID Start Marker, Packet Start, Scan Start, Sequence Start, and None. Here, the term "Packet ID" refers to a packet whose packet ID marker has been enabled. For details on how this is done, see the :FASS:DATA, :FASS:ESEL, :FASS:PCKM and :FASS:PCLM commands in this chapter.

For each active memory, it is possible to programmatically assign any of the eight marker outputs to EVENT MARKER 1, and any of the eight marker outputs to EVENT MARKER 2. For more information on how to do this, and on markers in general, see the :FASS:ESEL command. Each marker is approximately 29.8 ns long and 2.4 volts high, except PACKID, which stays high for the length of the packet.

There is a latency period between the time when a marker comes out the rear panel of MDS and when the corresponding RF output comes out of the AUC. This period can be programmatically adjusted using the :FASS:MDEL command.

Related HP-IB Commands

FASS Subsystem

ESEL
MDEL
MEM

Equivalent Front Panel Command

SID Event Markers - Marker Address

MDEL (Marker Delay)

Syntax

```
:FASS:MDEL delay
```

```
:FASS:MDEL?
```

Item	Description	Range/Restrictions
Delay	Number of clock delays	1 to 64

Description

This command selects the number of clock delays on the active sequencer memory's marker outputs.

The query returns the currently set number of clock delays.

Example

To set the number of 29.8 ns clock delays on the active sequencer memory's marker outputs to 4:

```
OUTPUT 719; ":FASS:MDEL 4"
```

Comments

This command is used to vary the latency period between the time when a marker comes out the rear panel of MDS and when the corresponding RF output comes out of the AUC.

Related HP-IB Commands

FASS Subsystem

DDEL
ESEL
MARK

Equivalent Front Panel Command

SID Event Markers - Marker Delay

MEM (Active Memory)

Syntax

```
           ⎧ ACS  ⎫
           ⎪ AM   ⎪
           ⎪ AUC  ⎪
           ⎪ FLC  ⎪
:FASS:MEM  ⎨ FM   ⎬
           ⎪ PM   ⎪
           ⎪ PM2  ⎪
           ⎩ PULS ⎭

:FASS:MEM?
```

Description

This command selects the active memory.

The FASS system has four modulation memories (associated with each modulation memory is a sequencer and sequencer memory):

- AM - Amplitude Modulation
- FM - Frequency Modulation
- FREQ - Frequency
- PM - Phase Modulation

The AM memory has two modulation modes: amplitude and phase. Setting the active memory to PM2 uses the AM memory with the modulation mode set to phase modulation. This provides a second memory to be used for phase modulation, if desired. AM and PM2 are physically the same memory.

In addition, the FREQ memory can be subdivided into four fields:

- ACS - Agile Carrier Synthesizer frequency

- AUC - Agile Upconverter frequency band
- FLC - Fast switching attenuator in the AUC
- PULS - Pulse on/off flag

The query returns the currently selected active memory.

Example

To select the AM memory as the active memory:

```
OUTPUT 719; ":FASS:MEM AM"
```

Comments

Each field in the FREQ memory is selected individually. However, the following commands affect the entire frequency memory:

:FASS:ASEQ	:FASS:PCKM	:FASS:SEQ:IMAG
:FASS:CAT?	:FASS:PCLM	:FASS:SEQ:JTYP
:FASS:DATA 'SEQ2'	:FASS:PURG:FILE	:FASS:SEQ:LBEG
:FASS:DDAT	:FASS:SEQ:BEG	:FASS:SEQ:MODE
:FASS:DDEL	:FASS:SEQ:CAT?	:FASS:SEQ:PDAT
:FASS:ESEL	:FASS:SEQ:COMP	:FASS:SEQ:POIN
:FASS:MARK	:FASS:SEQ:END	:FASS:SEQ:PURG
:FASS:MDEL	:FASS:SEQ:JUMP	:FASS:SLP

Related HP-IB Commands

FASS Subsystem

ARAT	MDEL	SEQ:IMAG
ASEQ	PCKM	SEQ:JTYP
CAT?	PCLM	SEQ:JUMP
CONS	POIN	SEQ:LBEG
DATA 'SEQ2'	PURG	SEQ:MODE
DDAT	RAD	SEQ:PDAT
DDEL	SEQ:BEG	SFAC
DEG	SEQ:CAT	SLP
ESEL	SEQ:COMP	
MARK	SEQ:END	

Equivalent Front Panel Command

SID Extended Control Panel - Active Memory

NSEQ (Purge Sequence)

Syntax

```
:FASS:NSEQ
```

Description

The NSEQ command has been replaced by the PURG:SEQ command. NSEQ is provided for backwards compatibility with versions of SID released prior to SID 2.0.

This command purges all the sequence data in sequence number 0 in the active sequencer memory.

PACK (Create Packet by File Name)

Syntax :FASS:PACK *'file_name', scans, adv_mode*

Item	Description	Range/Restrictions
File_name	Active memory file name that the sequencer should access for this packet.	6 characters maximum. Valid characters are A-Z, a-z, 0-9 and _. The first character of the file name must be alpha.
Scans	Number of passes through the file in active memory	1 to 65536 for auto advance mode; 0 to 65536 for bus or group advance mode
Adv_mode	Mode used to advance to the next packet in a sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, 4 for GIMM

Description This PACK command has been replaced by the PCKM command. PACK is provided for backwards compatibility with versions of SID released prior to SID 2.0.

Note The PACK command is similar to the PCKM command. However, PCKM has an additional parameter for *packet_ID enable.*

This command defines a packet by file name for the current sequence of the active sequencer memory. New packets are appended to any other packets that have been defined since a :FASS:PURG:SEQ command was last issued.

PACL (Create Packet by Address)

Syntax :FASS:PACL *address, length, scans, adv_mode*

Item	Description	Range/Restrictions
Address	Starting address of the packet	0 to 262140 for AM, PM, and PM2 memories in multiples of 4; 0 to 65535 for FM and frequency memories.
Length	Length of packet	2 to 262144 for AM, PM, and PM2 memories in multiples of 4; 2 to 65536 for FM; 2 to 65536 in multiples of 2 for all fields in FREQ memory
Scans	Number of passes through the specified wave segment of active memory	1 to 65536 for AUTO advance mode; 0 to 65536 for BUS or GROUP advance mode
Adv_mode	Mode used to advance to the next packet in a sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, or 4 for GIMM

Description This PACL command has been replaced by the PCLM command. PACL is provided for backwards compatibility with versions of SID released prior to SID 2.0.

Note The PACL command is similar to the PCLM command. However, PCLM has an additional parameter for *packet_ID enable*.

PACL (Create Packet by Address)

This command defines a packet by address. New packets are appended to any other packets that have been defined since a :FASS:PURG:SEQ command was issued.

PCKM (Create Packet By File Name)

Syntax

:FASS:PCKM *'file_name'*, *scans*, *adv_mode*, *packet_ID_enable*

Item	Description	Range/Restrictions
File_name	Active memory file name that the sequencer should access for this packet.	6 characters maximum. Valid characters are A-Z, a-z, 0-9 and _. The first character of the file name must be alpha. Maximum number of files allowed is 100.
Scans	Number of passes through the file in active memory	1 to 65536 for auto advance mode; 0 to 65536 for bus or group advance mode.
Adv_mode	Mode used to advance to the next packet in a sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, 4 for GIMM
Packet_ID_enable	Unused for loop packets. For other packets, enables or disables the packet ID marker.	0 disables the packet ID marker; 1 enables the packet ID marker.

Description

This command defines a packet by file name for the current sequence of the active sequencer memory. New packets are appended to any other packets that have been defined since a :FASS:PURG:SEQ command was last issued.

There are five ways to exit a packet and advance to the next packet in a sequence:

- 0 (AUTO mode): Automatically advance to the next packet when the specified number of scans has been completed (in this chapter, the "next" packet means the packet which was loaded after the current one).
- 1 (BUS mode): Continue scanning the current packet until the next packet advance (:FASS:ASEQ) command is received. Once the command is received, complete the current scan and then advance to the next packet.
- 2 (GROUP mode): Continue scanning the current packet until the next group packet advance (ASEQ GRO) command is received; then make *all* sequencers that have their current advance mode set to GROUP, finish their current scan and advance to the next packet.
- 3 (BIMM mode): continue the current scan until the next ASEQ command is received, then advance the active sequencer immediately to the next packet.
- 4 (GIMM mode): Continue scanning the current packet until the next group packet advance (ASEQ GRO) command is received; then make all the sequencers that have their current advance mode set to GIMM advance immediately to the next packet.

The :FASS:ESEL command is used to select whether or not the packet ID marker signal is connected to the rear panel, and, if so, to what event marker port.

The packet ID marker can either be high for the entire packet, or it can be a 30 ns pulse at the beginning of the packet, depending on which packet ID marker is selected with the :FASS:ESEL command.

Example

To create a packet by file name for the AM memory sequencer:

```
10  ASSIGN @Fmtoff TO 719;FORMAT OFF
20  REAL Amdat(1:128)
30  !
40  !LOAD ARRAY WITH REAL NUMBERS
50  FOR I=1 TO 128
60      Amdat(I)=(I*1.8/128-.918)
70  NEXT I
80  !
90  OUTPUT 719; "*RST"
100 OUTPUT 719; ":FASS:MEM AM"
110 !
120 PRINT "LOADING AM MEMORY"
130 OUTPUT 719; ":FASS:DATA 'WAVE:FILE1',#0";
140 OUTPUT @Fmtoff;Amdat(*);
150 OUTPUT 719 USING "-,K";"",END
160 !
170 !CREATE A PACKET OF 8 SCANS AND AUTOMATIC
180 !PACKET ADVANCE
190 OUTPUT 719; ":FASS:PURG:SEQ -1"
200 OUTPUT 719; ":FASS:PCKM 'FILE1',8,0,0"
210 !
220 !DEFINE REST OF SIGNAL
230 !
240 OUTPUT 719; ":FASS:STAR"   !Generate signal
250 END
```

Comments

Because there is only one sequencer for the entire frequency memory, packet parameters for the FREQ memory correspond to data in the ACS field.

The first time you download data by file name to a field in the FREQ memory, the other three fields will be initialized. ACS frequency is set to 0 Hz, the FLC is set to 0 dB, the AUC frequency band is set to 0, and the pulse is set to 1 (on).

Downloading data using a file name that already exists in the active memory will write over the old file. If you want to download data to the FREQ memory fields using an existing file name and your new data has a different length than the old file, you must first purge the existing file.

HP FASS has a limit of 100 files per memory that can be downloaded by file name.

A sequencer memory can contain up to 2048 packets for Sequencer Model 10 and 32768 packets and loop packets for Sequencer Model 7, 11, and 21.

If the method of packet advance is BUS, GROUP, BIMM, or GIMM, the number of scans is indefinite. However, the scan parameter must be present in the HP-IB command statement.

Related HP-IB Commands

FASS Subsystem
ASEQ
DATA
ESEL
MEM
PCLM
PURG:SEQ
SEQ:CAT?

Equivalent Front Panel Command

None

PCLM (Create Packet by Address)

Syntax

`:FASS:PCLM` *address, length, scans, adv_mode, packet_ID_enable*

Item	Description	Range/Restrictions
Address	Starting address of the waveform file in modulation memory	0 to 262140 for AM, PM, and PM2 memories in multiples of 4; 0 to 65535 for FM and frequency memories.
Length	Number of elements in the waveform file	2 to 262144 for AM, PM, and PM2 memories in multiples of 4; 2 to 65536 for FM; 2 to 65536 in multiples of 2 for all fields in FREQ memory
Scans	Number of passes through the file in active memory	1 to 65535 for auto advance mode; 0 to 65536 for bus or group advance mode
Adv_mode	Mode used to advance to the next packet in a sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, 4 for GIMM
Packet_ID_enable	Unused for loop packets. For other packets, enables or disables the packet ID marker.	0 disables the packet ID marker; 1 enables the packet ID marker.

Description

This command defines a packet by using the addresses of waveforms in the modulation memory. Packets are defined for the current sequence of the active memory sequencer. New packets are appended to any other packets that have been defined sin a :FASS:PURG:SEQ command was issued.

There are five ways to exit the packet and advance to the next packet in a sequence:

- 0 (AUTO mode): Automatically advance to the next packet when the specified number of scans has been completed (the "next" packet means the packet that was loaded after the current one).
- 1 (BUS mode): Continue scanning the current packet until the next packet advance (ASEQ) command is received. Once the command is received, complete the current scan and then advance to the next packet.
- 2 (GROUP mode): Continue scanning the current packet until the next group packet advance (ASEQ GRO) command is received; then make *all* sequencers that have their current advance mode set to GROUP, finish their current scan and advance to the next packet.
- 3 (BIMM mode): Continue the current scan until the next ASEQ command is received, then advance the active sequencer immediately to the next packet.
- 4 (GIMM mode): continue scanning the current packet until the next group packet advance (ASEQ GRO) command is received; then make all the sequencers that have their current advance mode set to GIMM advance immediately to the next packet.

The :FASS:ESEL command is used to select whether or not the packet ID marker signal is connected to the rear panel, and, if so, to what event marker port.

The packet ID marker can either be high for the entire packet, or it can be a 30 ns pulse at the beginning of the packet, depending on which packet ID marker is selected with the :FASS:ESEL command.

Example To create a packet by address for the AM memory sequencer:

```
10  ASSIGN @Fmtoff TO 719;FORMAT OFF
20  REAL Amdat(1:128)
30  !
40  !LOAD ARRAY WITH REAL NUMBERS
50  FOR I=1 TO 128
60      Amdat(I)=(I*1.8/128-.918)
70  NEXT I
80  !
90  OUTPUT 719; "*RST"
100 OUTPUT 719; ":FASS:MEM AM"
110 !
120 PRINT "LOADING AM MEMORY"
130 OUTPUT 719; ":FASS:DATA 'WAVE:(0)',#0";
140 OUTPUT @Fmtoff;Amdat(*);
150 OUTPUT 719 USING "-,K";"",END
160 !
170 !CREATE A PACKET
180 OUTPUT 719; ":FASS:PURG:SEQ -1"
190 OUTPUT 719; ":FASS:PCLM 0,128,8,0,0"
200 !
220 !DEFINE REST OF SIGNAL
230 !
240 OUTPUT 719; ":FASS:STAR"   !Generate signal
250 END
```

Comments

Because there is only one sequencer for the entire frequency memory, packet parameters for the FREQ memory correspond to data in the ACS field.

If the method of packet advance is either BUS or Group, the number of scans is indefinite. However, the scan parameter must be present in the HP-IB command statement.

FASS Subsystem
ASEQ
DATA
ESEL
MEM
PCKM
PURG:SEQ
SEQ:CAT?

Equivalent Front Panel Command

None

PCOH
(Phase Coherence)

Syntax

```
               ⎧ OFF    ⎫
:FASS:PCOH     ⎨ FREQ   ⎬
               ⎩ FMFREQ ⎭
```

```
:FASS:PCOH?
```

Description

This command selects the HP FASS coherence mode. In phase-coherent frequency switching, the signal appears as if each frequency were being generated by a separate, continuously-running oscillator that is being switched in and out as needed. Whenever the simulator returns to a specific frequency, the phase of the output signal is as if the signal has always been at that frequency.

The meanings of the parameters in this command are as follows:

- OFF - No phase coherence. Phase continuous (there are no discontinuities in the phase of the output signal during switching).
- FREQ - Make only FREQ data be phase coherent.
- FMFREQ - Make both FM and FREQ data be phase coherent.

Example

To make only the FREQ data be phase coherent:

```
OUTPUT 719; ":FASS:PCOH FREQ"
```

Comments

None

Equivalent Front Panel Command

SID Control Panel - Coherence

PCOU? (Packet Count)

Syntax

```
:FASS:PCOU? seq_number
```

Item	Description	Range/Restrictions
Seq_number	Sequence number	-1 to 1023

Description

This query returns the number of defined packets and loop packets in the specified sequence of the active memory.

If you use -1 as the sequence number, the query returns the number of defined packets and loop packets in all sequences.

Example

To determine the number of defined packets in sequence 0 of FM memory:

```
10  OUTPUT 719; ":FASS:MEM FM"
20  OUTPUT 719; ":FASS:PCOU? 0
30  ENTER 719; A
40  PRINT "DEFINED PACKETS=";A
50  END
```

Comments

The maximum number of packets and loop packets allowed for Sequencer Model 7, 11, and 21 is 32768. The maximum number of packets allowed for Sequencer Model 10 is 2048.

Related HP-IB Commands

FASS Subsystem
PFRE?

PFRE? (Packets Free)

Syntax

:FASS:PFRE?

Description

This query returns the number of packets and loop packets that can be added before the sequencer memory of the active memory is full.

Example

To determine the number of packets that can be added to FM memory:

```
10  OUTPUT 719; ":FASS:MEM FM"
20  OUTPUT 719; ":FASS:PFRE?
30  ENTER 719; A
40  PRINT "PACKETS AVAILABLE=";A
50  END
```

Comments

The maximum number of packets and loop packets available per memory is 32768 for Sequencer Model 7, 11, and 21 and 2048 for Sequencer Model 10 is 2048.

Related HP-IB Commands

FASS Subsystem
PFRE?

PURG:ALL (Purge All Data)

Syntax

```
:FASS:PURG:ALL
```

Description

This command purges the data in all modulation memories, sequencers, and directories. After executing this command, all the modulation memories will contain zeroes.

Example

To purge the data in all the modulation memories and sequencers:

```
OUTPUT 719; ":FASS:PURG:ALL"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
CAT?
DATA
MEM
PCKM
PCLM
PURG:FILE
PURG:MEM
PURG:SEQ
SEQ:CAT?

Equivalent Front Panel Command

None

PURG:FILE (Purge Selected File)

Syntax

:FASS:PURGE *'file_name'*

Item	Description	Range/Restrictions
File_name	Name of file in active memory	6 characters maximum

Description

This command purges the data in the designated file in active memory. The active memory is specified by the :FASS:MEM command.

Example

To purge a file named "MYDAT" in AM memory;

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:PURGE:FILE 'MYDAT'"
```

Comments

This command purges the entire frequency file (that is, all frequency fields) if any field of FREQ memory is the active memory.

Related HP-IB Commands

FASS Subsystem
DATA
MEM
PURG:ALL
PURG:MEM

Equivalent Front Panel Command

None

PURG:MEM (Purge Active Memory)

Syntax

```
:FASS:PURG:MEM
```

Description

This command purges the contents of the active memory and writes zeros in the memory. The active memory is specified by the :FASS:MEM command.

Example

To purge AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:PURG:MEM"
```

Comments

This command has no effect on the sequencer. This means that although the memory data has been purged, the definition of the sequences has not changed.

This command purges the entire FREQ memory if the active memory is any field of the frequency memory (that is, ACS, AUC, FLC, or PULS).

Related HP-IB Commands

FASS Subsystem
DATA
MEM
PURG:ALL
PURG:FILE

Equivalent Front Panel Command

None

PURG:SEQ (Purge Sequence)

Syntax

```
:FASS:PURG:SEQ seq_number
```

Item	Description	Range/Restrictions
Seq_number	Sequence number	-1 to 1023

Description

This command erases the specified sequence in the active sequencer memory. Sequences are numbered starting from 0.

If the specified sequence number is -1, the entire contents of the active sequencer memory will be purged.

Example

To erase the sequence whose number is 4 from the FM sequencer memory:

```
OUTPUT 719; ":FASS:MEM:FM"
OUTPUT 719; ":FASS:PURG:SEQ 4"
```

Comments

The contents of the memory are *not* automatically compressed after this command is executed. The compression command (:FASS:SEQ:COMP) must be given explicitly. Typically compression is done when an attempt to load a new sequence reveals that the sequence is too big for available memory.

Related HP-IB Commands

FASS Subsystem
SEQ:PDAT

Equivalent Front Panel Command

None

RAD (Radians)

Syntax

```
:FASS:RAD
```

Description

This command sets the data format for the PM and PM2 memories to radians.

Example

To set the data format of the PM2 memory to radians:

```
OUTPUT 719; ":FASS:MEM PM2"
OUTPUT 719; ":FASS:RAD"
```

Comments

The reset condition for the phase memory data format is degrees.

Related HP-IB Commands

FASS Subsystem
DATA
DEG
MEM

Equivalent Front Panel Command

SID Extended Control Panel - PM Data Mode

SALL (Start All Sequencers)

Syntax

```
:FASS:SALL seq_number
```

Item	Description	Range/Restrictions
Seq_number	Sequence number	0 to 1023

Description

This command starts all sequencers at the specified sequence number. Both the group jump source and the sequence mode must be set to INT.

Example

To start all sequencers at sequence number 18:

```
OUTPUT 719;":FASS:SALL 18"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
STAR
STOP

Equivalent Front Panel Command

None

SCAT? (Sequencer Catalog)

Syntax

```
:FASS:SCAT?
```

Description

SCAT? been replaced by the SEQ:CAT? query. :FASS:SCAT? is provided for backwards compatibility with versions of SID released prior to SID 2.0.

This query returns a catalog (directory, list) of all the packets that define the current sequence in active memory. The returned format is in IEEE 488.2 Indefinite Length Block Data Format, as follows:

SEQUENCE CATALOG,#0*ascii_string*

where *ascii_string* is a string of ASCII characters containing, for each packet, the name, or starting address and length of the file, followed by the number of scans, advance mode and marker status.

If no named files are currently loaded in active memory, the string "*NO PACKETS IN SEQUENCER MEMORY*" is returned.

SEQ:BEG (Set Beginning of Sequence)

Syntax

`:FASS:SEQ:BEG` *seq_number, packet_address*

Item	Description	Range/Restrictions
Seq_number	Sequence number	0 to 1023
Packet_address	Packet address of the first packet in the sequence	-1 to 32767

Description

This command is valid for Sequencer Model 7, 11, or 21 only. It is used to establish the sequence number and packet address for a sequence which will then be loaded (into the active sequencer memory) using the :FASS:SEQ:PDAT, :FASS:PCKM, or :FASS:PCLM commands.

If the specified packet address is -1, HP FASS will automatically generate a packet address.

The packet address is an offset address in sequencer memory. Sequencer memory has a capacity of 32768 total packets, and the packet address specifies the packet number at which the sequence data following this command will be loaded into sequencer memory. This capability can be used to aid in continuous sequencer downloading.

Example

To establish sequence number 1 at address 2048 in the AM sequencer memory:

```
OUTPUT 719; ":FASS:MEM:AM"
OUTPUT 719; ":FASS:SEQ:BEG 1, 2048"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
SEQ:PDAT
PCKM
PCLM
SEQ:END

Equivalent Front Panel Command

None

SEQ:CAT? (Sequencer Catalog)

Syntax

`:FASS:SEQ:CAT?` *seq_number*

Item	Description	Range/Restrictions
Seq_number	Sequence number	-1 to 1023

Description

This query returns a catalog (directory, list) of all the packets and loop packets that define the specified sequence. Sequences are numbered starting from 0.

If the specified sequence number is -1, all the packets and loop packets in the entire sequencer memory will be returned.

Files are defined using the :FASS:DATA command. The returned format is in IEEE 488.2 Indefinite Length Block Data Format, as follows:

SEQUENCE CATALOG,#0*ascii_string*

where *ascii_string* is a string of ASCII characters.

For Sequencer Model 7, 11, or 21, the string represents the following information for each sequence:

- For loop packets:
  - Sequence number
  - Sequence address
  - Number of scans
  - Advance mode
  - Beginning-of-sequence status (BOS if the loop packet is the beginning of the sequence, NOB if not).

- For packets
  - Sequence number
  - Sequence address
  - File name or starting address
  - Length of the packet
  - Number of scans
  - Advance mode
  - Marker status (PACKMARK if packet marker or NOMARK if no packet marker)

For Sequencer Model 10, for each packet the string represents the following:

- File name or starting address of packet
- Length of packet
- Number of scans
- Advance mode

If no named files are currently loaded in active memory, the string "*NO PACKETS IN SEQUENCER MEMORY*" is returned.

Example

To obtain a catalog (list) of the named files in sequence number 1 in the FREQ memory:

```
10  DIM A$[1000]
20  OUTPUT 719; ":FASS:MEM AUC"
30  OUTPUT 719; ":FASS:SEQ:CAT? 1"
40  ENTER 719 USING "-K"; A$
50  A$=A$[20, LEN(A$)]
60     ! Strip off block data header
70  PRINT USING "#,K"; A$
80  END
```

Examples of the information returned are as follows:

For Sequencer Model 7, 11, or 21:

```
SEQUENCE CATALOG, #0AMPM:SEQ:BEGIN 1,0;LOOP 1,
```

```
AUTO,NOB;PACK 0,256,0,BUS,NOMARK;END
```

For Sequencer Model 10:

```
SEQUENCE CATALOG, #0FILE1,5,AUTO,0,256,0,BUS
```

Comments

Use the :FASS:DATA? query to examine the contents of the active sequencer memory by address.

All fields in the FREQ memory (ACS, AUC, FLC, and PULS) are stored in a single list.

If the packet advance mode is BUS or GROUP, 0 will be returned for the number of scans.

Related HP-IB Commands

FASS Subsystem	PCKL
DATA	PDAT
MEM	SEQ:BEG
PCKM	SEQ:END

Equivalent Front Panel Command

None

SEQ:COMP (Compress Sequencer Data)

Syntax

```
:FASS:SEQ:COMP
```

Description

This command compresses the data in the active sequencer memory. It moves the data so that all of the packets currently being used by valid sequences are at the beginning of the memory. This maximizes the amount of memory available for storing additional packets.

Example

To compress the data in the PM sequencer memory:

```
10 OUTPUT 719; ":FASS:MEM PM"
20 OUTPUT 719; ":FASS:SEQ:COMP"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
PURG:SEQ

Equivalent Front Panel Command

None

SEQ:EDIT:CAT? (Edit Catalog Query)

Syntax

```
:FASS:SEQ:EDIT:CAT? seq_number, packet_number
```

Item	Description	Range/Restrictions
Seq_number	Sequence number	0 to 1023
Packet_number	Location of the packet in the sequence	0 to 32767

Description

This query returns packet information for a specified packet in a specified sequence. This query works for both packets and loop packets. Information is returned in an ASCII string.

The following information is returned for a packet:

PACK *starting address, length, scans, advance mode, marker flag*

The following information is returned for a loop packet:

LOOP *scans, advance mode, beginning-of-sequence flag*

For the beginning-of-sequence flag, BOS is returned for the beginning of a sequence and NOB is returned for not the beginning of a sequence.

Example

To return information about the second packet in sequence 0:

```
10  OUTPUT 719; ":FASS:SEQ:EDIT:CAT? 0, 1"
20  ENTER 719; A$
30  PRINT A$
40  END
```

Comments

This command is only valid for Sequencer Model 7, 11, or 21.

This command does not tell you whether the packet is at the end of the sequence.

The first loop packet of a sequence is always the beginning of the sequence. However, the SEQ:EDIT:CAT? query always returns NOB (not beginning of sequence) for first loop packet of a sequence.

The beginning of sequence defaults to the last loop packet in a sequence that has the beginning-of-sequence flag turned on.

Related HP-IB Commands

FASS Subsystem
SEQ:EDIT:END
SEQ:EDIT:LOOP
SEQ:EDIT:PACK

SEQ:EDIT:END (Edit End of Sequence)

Syntax

`:FASS:SEQ:EDIT:END` *end_flag,seq_number, packet_number*

Item	Description	Range/Restrictions
End_flag	End-of-sequence flag	0 turns flag off; 1 turns flag on
Seq_number	Sequence number	0 to 1023
Packet_number	Location of the packet in the sequence	0 to 32767

Description

This command allows you turn the end-of-sequence flag on and off. By turning the flag off, you can add more packets to a previously defined sequence. By turning the flag on, you can insert an end of sequence in the middle of an existing sequence.

This command can only be used with regular packets; it is not valid for loop packets.

Example

To mark the second packet in sequence 0 of AM memory as the end of sequence:

```
OUTPUT 719; ":FASS:SEQ:EDIT:END 1, 0, 1"
```

Comments

If you turn the end-of-sequence flag off, be sure you turn it on again or execute a :FASS:SEQ:END command so that the end of sequence is defined before being run.

This command is only valid for Sequencer Model 7, 11, or 21.

Related HP-IB Commands

FASS Subsystem
SEQ:EDIT:CAT?
SEQ:EDIT:LOOP
SEQ:EDIT:PACK

SEQ:EDIT:LOOP (Edit Loop Packet)

Syntax

`:FASS:SEQ:EDIT:LOOP` *scans, adv_mode, begin_flag, seq_number, packet_number*

Item	Description	Range/Restrictions
Scans	Number of passes through the loop packet	1 to 65536
Adv_mode	Mode used to advance to the next packet in the sequence	0 for AUTO, 1 for BUS, 2 for GROUP
Begin_flag	Beginning of new sequence flag	0 indicates this is not the beginning of a new sequence; 1 indicates the beginning of a new sequence
Seq_number	Sequence number	0 to 1023
Packet_number	Location of the packet in the sequence	0 to 32767

Description

This command allows you to change the parameters of a specified loop packet. This command is useful for changing a loop packet once you have already defined a sequence.

When you are using this command, you must redefine the entire loop packet.

Example

To redefine loop packet 0 in sequence 0 of the AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:SEQ:EDIT:LOOP 1, 0, 1, 0. 0"
```

Comments

Do not define a BUS or GROUP advance mode for a loop packet if either of these modes is defined for a packet within the loop packet. It is legal to do so, but the result is unpredictable.

You cannot change a loop packet to a packet and vice versa.

This command is only valid for Sequencer Model 7, 11, or 21.

Related HP-IB Commands

FASS Subsystem
SEQ:EDIT:CAT?
SEQ:EDIT:END
SEQ:EDIT:PACK

SEQ:EDIT:PACK (Edit Packet)

Syntax

`:FASS:SEQ:EDIT:PACK` *address, length, scans, adv_mode, marker_flag, seq_number, packet_number*

Item	Description	Range/Restrictions
Address	Starting address of the packet	0 to 262140 in multiples of 4 for AM, PM, and PM2 memories; 0 to 65535 for FM and frequency memories
Length	Length of a packet	2 to 262144 in multiples of 4 for AM, PM, and PM2 memories; 2 to 65536 for FM; 2 to 65536 in multiples of 2 for frequency memory
Scans	Number of passes through the loop packet	1 to 65536 for AUTO; 0 to 65536 for BUS or GROUP
Adv_mode	Mode used to advance to the next packet in the sequence	0 for AUTO, 1 for BUS, 2 for GROUP, 3 for BIMM, 4 for GIMM
Marker_flag	Marker flag	0 indicates the flag is not set; 1 indicates the flag is set
Seq_number	Sequence number	0 to 1023
Packet_number	Location of the packet in the sequence	0 to 32767

Description

This command allows you to change the parameters of a specified non-loop packet. This command is useful for changing a packet in a given sequence once the sequence is already defined.

When you are using this command, you must redefine the entire packet.

Example

To redefine packet 1 in sequence 0 of the AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:SEQ:EDIT:PACK 100, 512, 1, 0, 0, 0, 1"
```

Comments

You cannot change a packet to a loop packet and vice versa.

Related HP-IB Commands

FASS Subsystem
SEQ:EDIT:CAT?
SEQ:EDIT:END
SEQ:EDIT:LOOP

SEQ:END (End Current Sequence)

Syntax

```
:FASS:SEQ:END
```

Description

The command is valid for Sequencer Model 7, 11, or 21 only. It specifies the end of the sequence that is currently being defined.

Example

To specify the end of the sequence that is currently being defined:

```
OUTPUT 719; ":FASS:SEQ:BEG 1, -1"
OUTPUT 719; ":FASS:SLP 1,0"
OUTPUT 719; ":FASS:PCKM 'FILE1',2,0,0"
OUTPUT 719; ":FASS:SEQ:END"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
SEQ:BEG
SEQ:PDAT
PCKM
PCLM

Equivalent Front Panel Command

None

SEQ:IMAG (Load/Read Entire Sequencer Memory)

Syntax

$$\texttt{:FASS:SEQ:IMAG} \left\{ \begin{array}{l} \texttt{'PACKET'} \\ \texttt{'POINTER'} \end{array} \right\} \texttt{,}\, \textit{seq\_data}$$

$$\texttt{:FASS:SEQ:IMAG?} \left\{ \begin{array}{l} \texttt{'PACKET'} \\ \texttt{'POINTER'} \end{array} \right\}$$

Item	Description	Range/Restrictions
Seq_data	Sequence data	IEEE 488.2 Indefinite Length Block Data Format. The block consists of the entire contents of sequencer packet or pointer memory in internal format. Packet information is encoded as integer data.

Description

This command/query is used for loading/reading an image of the entire packet memory or pointer memory for the active sequencer memory. Packet memory is the part of sequencer memory which contains all the packets and loop packets for all sequences. Pointer memory contains, for each sequence in packet memory, the number of that sequence and a pointer into packet memory to where the packet information for that sequence starts (i.e., the sequence address).

The format in which information is returned by the query is either:

'PACKET',#0*block_data*

or

'POINTER',#0*block_data*

Example

To obtain an image of the packet memory in the active sequencer memory:

```
OUTPUT 719; "FASS:SEQ:IMAG? 'PACKET'"
```

Comments

None

Related HP-IB Commands

None

Equivalent Front Panel Command

None

SEQ:JTYP (Sequence Jump Type)

Syntax

```
:FASS:SEQ:JTYP { IMM }
               { EOS }
```

```
:FASS:SEQ:JTYP?
```

Description

This command is valid in Model 11 sequencing mode only. It selects the jump type for all the sequences in the active sequencer memory.

The possible jump type parameters are:

- IMM (Jump Immediate): As soon as the jump signal is received—which, depending on the sequencer mode and the jump source, can be through the BNC connector labelled GROUP SEQUENCE JUMP on the MDS rear panel or through the external data port or as a result of the execution of the :FASS:SEQ:JUMP command—the sequencer will immediately jump to the next sequence.
- EOS (Jump at End-of-Sequence): When the jump signal is received from one of the sources described above, the sequencer finishes the sequence it is currently executing and then jumps to the next sequence.

Example

To set the sequencer mode to IMM:

```
OUTPUT 719; ":FASS:SEQ:JTYP IMM"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
SEQ:JUMP
SEQ:MODE

Equivalent Front Panel Command

SID Extended Control Panel - Sequence Jump Type

SEQ:JUMP (Sequence Jump Source)

Syntax

$$\texttt{:FASS:SEQ:JUMP} \begin{Bmatrix} \texttt{INT} \\ \texttt{EXT} \end{Bmatrix}$$

```
:FASS:SEQ:JUMP?
```

Description

Certain sequencer modes obtain the signal for executing a sequence jump—that is, a jump to a different sequence—from the group jump source. This source causes a group of sequencers, not merely one, to execute a jump. The :FASS:SEQ:JUMP command—which is valid in Model 11 sequencing mode only—selects a source for the group sequence jump signal. This affects all sequencers which are in modes that use the GROUP jump source (see :FASS:SEQ:MODE command).

The effect of the parameters is as follows:

- INT switches group jump source to internal and executes a group sequence jump. All sequencers currently using the group jump source will jump to their respective new sequences as these were set up with the SEQ:POIN command or through the external data port (depending on how the sequencers have been configured by the SEQ:MODE command). If no sequence numbers have been set, the sequencers will jump to the beginning of the sequence currently being run or the last sequence run. The default is sequence 0. 0
- EXT switches the group jump source to external, that is, to the GROUP SEQUENCE JUMP port on the MDS rear panel.

Example

To switch the group jump source to internal and execute a sequence jump:

```
OUTPUT 719; ":FASS:SEQ:JUMP INT"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
SEQ:JTYP
SEQ:MODE

Equivalent Front Panel Command

SID Control Panel - Seq. Jump Source

SEQ:LBEG? (Last Beginning of Sequence)

Syntax

```
:FASS:SEQ:LBEG?
```

Description

This query returns the value of *sequence_number* in the most recently issued :FASS:SEQ:BEG command since the last system reset. If no :FASS:SEQ:BEG command was executed since the last system reset, a value of -1 is returned.

Example

To find the sequence number in the most recently issued SEQ:BEG command:

```
10  OUTPUT 719; ":FASS:SEQ:LBEG?"
20  ENTER 719; A
30  PRINT "SEQUENCE NUMBER=";A
40  END
```

Comments

None

Related HP-IB Commands

FASS Subsystem
SEQ:BEG

Equivalent Front Panel Command

None

SEQ:MODE (Sequence Mode)

Syntax

```
                 ⎧ INT     ⎫
                 ⎪ OFF     ⎪
                 ⎪ LOCAL   ⎪
:FASS:SEQ:MODE   ⎨ MASTER  ⎬
                 ⎪ SLAVE   ⎪
                 ⎪ INDIV   ⎪
                 ⎩ EXTADDR ⎭
```

```
:FASS:SEQ:MODE?
```

Description

This command sets the active sequencer memory mode, which determines how the DYNAMIC DATA/DYNAMIC SEQUENCER connectors on the MDS rear panel are used.

The following types of sequencer modes of operation are available:

- Internal operation (see INT parameter, below).
- External input of dynamic sequence data (see LOCAL, MASTER, SLAVE, and INDIV parameters, below).
- Dynamic waveform data (see EXTADDR parameter).
- Off (see OFF parameter, below).

The meaning of each parameter is as follows:

- INT disables the external input for the active sequencer memory (that is, the DYNAMIC DATA/DYNAMIC SEQUENCE port for the active memory on the MDS rear panel). It also configures the sequencer to run in internal mode. The sequence jump signal comes from the group source. This is the normal mode of operation.

- OFF disables the sequence jump capability and turns sequencer input off for the active sequencer memory. If the sequencer is running when this command is issued, the sequencer will continue to execute the current sequence. All jump commands and jump signals subsequent to the issuing of this command are ignored, regardless of source.

  Starting in this mode is not recommended. When starting in this mode, the sequence that is run will depend on the last sequence number used prior to setting the mode to OFF. The :FASS:SEQ:POIN command has no effect in this mode as the sequencer inputs are off.

- LOCAL places the active sequencer memory in external mode. Sequence numbers will be input through the data port corresponding to the active sequencer. The sequence jump signal will be taken from the local source (25-pin connector on the MDS rear panel).
- MASTER places the active sequencer memory in external mode and configures it to drive all of the sequencer memories that are configured in SLAVE mode. The sequence jump signal comes from the group source (see the :FASS:SEQ:JUMP command).
- SLAVE places the active sequencer in SLAVE mode, meaning, that this sequencer receives its dynamic sequencer data from the sequencer that has been set to MASTER mode. It receives exactly the same sequence numbers that are input to the MASTER sequencer through the DYNAMIC DATA/DYNAMIC SEQUENCE port on the MDS rear panel.

  If no MASTER sequencer has been specified, results are unpredictable.

  The sequence jump signal comes from the group source (see the :FASS:SEQ:JUMP command).

- INDIV sets the active sequencer to external mode without being MASTER or SLAVE. The sequence jump signal comes from the group source (see the :FASS:SEQ:JUMP command).
- EXTADDR places the active sequencer memory in dynamic data mode. In this mode, the sequencer is bypassed, and modulation memory addresses are input into the DYNAMIC DATA/DYNAMIC SEQUENCE port on the MDS rear panel in real time.

Example

To set the active sequencer memory to MASTER mode:

```
OUTPUT 719; ":FASS:SEQ:MODE MASTER"
```

Comments

If the active sequencer memory is put into dynamic data mode with the ASO command, the SEQ:MODE setting is automatically changed to EXTADDR. (The ASO command should not be used in Model 11 sequencing mode; it is only included for backwards compatibility with early versions of SID.)

A SEQ:MODE command automatically overrides any previous ASO command.

Related HP-IB Commands

FASS Subsystem
ASO
SEQ:POIN

Equivalent Front Panel Command

SID Extended Control Panel - Sequence Mode

SEQ:PDAT (Sequence Packet Data)

Syntax

```
:FASS:SEQ:PDAT 'PACKET', packet_data
```

```
:FASS:SEQ:PDAT? sequence_number
```

Item	Description	Range/Restrictions
Packet_data	Data that defines a packet in active memory	IEEE 488.2 Indefinite Length Block Data Format
Seq_number	Sequence number	0 to 1023

Description

This command loads packet data into the active sequencer memory in internal form. The format is IEEE 488.2 Indefinite Length Block Data Format, with the data after the header being in MDS internal format for packet data, that is, the packet information is encoded in integer data.

The sequence number and packet address are determined by the last SEQ:BEG command. If no such command has been given, the sequence number is assumed to be 0. Data from subsequent SEQ:PDAT commands is appended to the end of the last data sent.

The query returns information in the form:

'PACKET',#0*block_data*

SEQ:PDAT (Sequence Packet Data)

Regular Packet Internal Format

The 64-bit internal packet format consists of seven fields. From most significant to least significant, the fields are as follows:

Field Name	Start Address	Repeat Count -1	Stop Address -1	Advance Mode	Packet Marker	End Mark	Begin Mark
Width	20	16	20	3	1	2	2
Bits	63-44	43-28	27-8	7-5	4	3-2	1-0

Regular Packet Field Description

Field Name	**Description**
Start Address	Start address for the packet (0-65535). Divide by 4 for AM or PM memory.
Repeat Count - 1	Number of times to repeat the packet minus 1 (0-65535).
Stop Address -1	Stop address minus 1 for the packet (0-65534). Divide by 4 for AM or PM memory.
Advance Mode	0 = BIMM (bus, immediate advance) 1 = BUS (complete packet before advancing) 2 = GIMM (group, immediate advance) 3 = GROUP (complete packet before advancing) 4 = AUTO (advance after repeat count has been exhausted)
Packet Marker	0 = unmarked packet 1 = marked packet
End Mark	0 = regular packet 1 = end of loop 2 = end of sequence
Begin Mark	0 or 1; 1 = beginning of sequence

Loop Packet Internal Format

The 64-bit loop packet consists of four fields (and two unused fields). From most significant bit to least significant bit, the fields are as follows:

Field Name	Repeat Count -1	Not Used	Advance Mode	Not Used	Identify as Loop Packet
Width	16	13	2	31	2
Bits	63-48	47-35	34-33	32-2	1-0

Loop Packet Field Description

Field Name	**Description**
Repeat Count -1	Number of times to repeat the packet minus 1 (0-65535).
Advance Mode	0 = AUTO 1 = BUS 2 = GROUP
Identify as Loop Packet	2 = loop packet

Example

To create one loop packets and three regular packets:

```
10      ! This example creates four packets
20      ! 4 packets = 32 bytes = 16 integers
30      !
40      ASSIGN @Raw TO 719;FORMAT OFF
50      INTEGER Sequence(0:15)
60      MAT Sequence= (0)        ! initialize
70      !
80      OUTPUT 719;":FASS:MEM FM"
90      !
100     ! create the loop packet
```

```
110    Lp_repeat=17
120    Lp_advance=0    ! AUTO
140    !
150    Sequence(0)=Lp_repeat-1
160    Sequence(1)=(Lp_advance*2)
170    Sequence(3)=2   ! identify it as a loop packet
180    !
190    !
200    ! create a regular packet (1)
210    !
220    Pkt_start=1000
240    Pkt_length=444
245    Pkt_repeat=247
250    Advance=4         ! AUTO advance
260    Packet_mark=1     ! mark this packet
270    End_mark=0        ! regular packet
280    Begin_mark=0      ! not beginning of sequence
290    !
300    Sequence(4)=Pkt_start DIV 16
310    Sequence(5)=BINIOR(SHIFT((Pkt_start MOD 16),-12),
       ((Pkt_repeat-1) DIV 16))
320    Sequence(6)=
       BINIOR(SHIFT(((Pkt_repeat-1) MOD 16),-12),
       ((Pkt_start+Pkt_length-2) DIV 256))
330    Sequence(7)=
       BINIOR(SHIFT(((Pkt_start+Pkt_length-2) MOD 256),-8),
       (Advance*32+Packet_mark*16+End_mark*4+Begin_mark))
340    !
350    !
360    ! create a regular packet (2)
370    !
380    Pkt_start=0
400    Pkt_length=16000
405    Pkt_repeat=57000
410    Advance=4         ! AUTO advance
420    Packet_mark=0     ! don't mark this packet
430    End_mark=0        ! regular packet
440    Begin_mark=0      ! not beginning of sequence
```

```
450     !
460     Sequence(8)=Pkt_start DIV 16
470     Sequence(9)=BINIOR(SHIFT((Pkt_start MOD 16),-12),
        ((Pkt_repeat-1) DIV 16))
480     Sequence(10)=
        BINIOR(SHIFT(((Pkt_repeat-1) MOD 16),-12),
        ((Pkt_start+Pkt_length-2) DIV 256))
490     Sequence(11)=
        BINIOR(SHIFT(((Pkt_start+Pkt_length-2) MOD 256),-8),
        (Advance*32+Packet_mark*16+End_mark*4+Begin_mark))
500     !
510     !
520     ! create a regular packet (3)
530     !
540     Pkt_start=9000
560     Pkt_length=1044
565     Pkt_repeat=1
570     Advance=1          ! BUS advance
580     Packet_mark=0      ! don't mark this packet
590     End_mark=0         ! regular packet
600     Begin_mark=0       ! not beginning of sequence
610     !
620     Sequence(12)=Pkt_start DIV 16
630     Sequence(13)=BINIOR(SHIFT((Pkt_start MOD 16),-12),
        ((Pkt_repeat-1) DIV 16))
640     Sequence(14)=
        BINIOR(SHIFT(((Pkt_repeat-1) MOD 16),-12),
        ((Pkt_start+Pkt_length-2) DIV 256))
650     Sequence(15)=
        BINIOR(SHIFT(((Pkt_start+Pkt_length-2) MOD 256),-8),
        (Advance*32+Packet_mark*16+End_mark*4+Begin_mark))
660     !
670     !
680     OUTPUT 719;":FASS:SEQ:BEG 0,-1"
690     OUTPUT 719;":FASS:SEQ:PDAT 'PACKET',#0";
700     OUTPUT @Raw;Sequence(*)
710     OUTPUT 719 USING "-,K";"",END
720     OUTPUT 719;":FASS:SEQ:END"
```

```
730    END
```

Comments

This command can be used to copy one sequence to another sequence.

This command can be used to copy sequence data to be stored and reloaded at a later time. It can also be used in combination with the :FASS:PCKM and :FASS:PCLM commands to create a sequence.

Related HP-IB Commands

FASS Subsystem
DATA
SEQ:CAT?

Equivalent Front Panel Command

None

SEQ:POIN (Load Pointer Latches)

Syntax

:FASS:SEQ:POIN *ampm_seq, pm_seq, fm_seq, freq_seq*

:FASS:SEQ:POIN?

Item	Description	Range/Restrictions
Ampm_seq	Number of the sequence in AM or PM2 memory to be executed	-1 to 1023
Pm_seq	Number of the sequence in PM memory to be executed	-1 to 1023
Fm_seq	Number of the sequence in FM memory to be executed	-1 to 1023
Freq_seq	Number of the sequence in FREQ memory to be executed	-1 to 1023

Description

This command establishes the number of the sequence in the specified sequencer memories that will be executed when the :FASS:STAR command is issued, or either a :FASS:SEQ:JUMP command is issued or an external group sequence jump signal is received, depending on the group jump source (see :FASS:SEQ:JUMP command).

If the sequence number is −1, the existing starting sequence number for that sequencer will be used.

The query returns four numbers. These numbers represent the current setting of the sequence pointer for each memory in the following order: AMPM sequencer, PM sequencer, FM sequencer, Frequency sequencer.

Example

To set the starting sequence number of the AM sequencer to 0, the PM sequencer to 657, and to keep the starting sequence numbers of the FM and frequency sequencers the same:

```
OUTPUT 719; ":FASS:SEQ:POIN 0, 657, -1, -1"
```

Comments

If a sequence number other than -1 is specified, the sequence mode for the specified sequencer will be set to internal, i.e., the effect will be the same as if a :FASS:SEQ:MODE INT command had been issued.

If you use the :FASS:SEQ:POIN? query while HP FASS is in external sequencing mode, the number returned may not correspond to the sequence that is running.

Related HP-IB Commands

SEQ:JUMP
SEQ:JTYP
SEQ:MODE
STAR

Equivalent Front Panel Command

None

SEQ:STAT? (Sequencer Status)

Syntax

```
:FASS:SEQ:STAT?
```

Description

This query returns the status of a pending sequence jump for the active memory.

If a "0" is returned, there is no pending sequence jump. If a "1" is returned, a sequence jump has been received and is pending. This means the jump type is EOS (end of sequence).

Example

To return the AM memory sequence status:

```
10  OUTPUT 719; ":FASS:MEM AM"
20  OUTPUT 719; ":FASS:SEQ:STAT?"
30  ENTER 719; A
40  PRINT A
50  END
```

Comments

None

Related HP-IB Commands

FASS Subsystem

SEQ:JTYP

Equivalent Front Panel Command

None

SFAC (Stretch Factor)

Syntax

$$:FASS:SFAC \begin{Bmatrix} 1 \\ 2 \\ 4 \end{Bmatrix}$$

```
:FASS:SFAC?
```

Description

This command sets the stretch factor used when downloading data to the AM, PM, or PM2 memories. (See the :FASS:MEM command.) The stretch factor determines how many times each data point in the active memory is duplicated.

The query returns the current setting of the stretch factor.

Example

To set the stretch factor to 4 for the AM memory:

```
OUTPUT 719;":FASS:MEM AM"
OUTPUT 719;":FASS:SFAC 4"
```

Comments

The reset value for the stretch factor is 1.

You must execute this command before you download data to the modulation memories with the :FASS:DATA command.

The address rate divider uses the clock to stretch data. The stretch factor command (:FASS:SFAC) uses the memory to stretch data. (The stretch factor command can only be used when the active memory is AM, PM, or PM2.) For example, an address rate divider of 2 would address the same data point in memory for two clock cycles. On the other hand, a stretch factor of 2 would load each data point into two consecutive address locations in memory, thereby occupying twice as much memory as unstretched data.

Once you set the stretch factor for a memory, it is used every time you download data to that memory until the system is reset or the stretch factor is changed.

For further information on the relationship between the stretch factor and the address rate divider, see the :FASS:ARAT command.

Related HP-IB Commands

FASS Subsystem
ARAT
MEM

Equivalent Front Panel Command

None

SLP (Sequence Loop Packet)

Syntax

`:FASS:SLP` *scans, adv_mode, begin_flag*

Item	Description	Range/Restrictions
Scans	Number of passes through the loop packet	1 to 65536
Adv_mode	Mode used to advance to the next packet in the sequence	0 for AUTO, 1 for BUS, 2 for GROUP
Begin_flag	Beginning-of-new-sequence flag	0 indicates this packet is not the beginning of a new sequence; 1 indicates this packet defines the beginning of a new sequence

Description

This command creates a loop packet for the current sequence. In Model 7, 11, or 21 sequencing mode, all sequences must begin with a loop packet.

The beginning-of-new-sequence flag redefines the starting point of a sequence. This allows a sequence to have one or more preamble packets that are not repeated during subsequent scans of the sequence.

If this is the first loop packet in the sequence, it will automatically be defined as the beginning of the sequence until another loop packet is defined as the beginning of the sequence.

This command is valid only for Sequencer Model 7, 11, or 21.

Example

To create, for the current sequence, a loop packet consisting of 126 scans of two packets with a BUS advance mode (see PCKM command), where this packet is not redefining the beginning of the sequence:

```
10 OUTPUT 719; ":FASS:SEQ:BEG"
20 OUTPUT 719; ":FASS:SLP 126, BUS, 0"
30 OUTPUT 719; ":FASS:PCKM 'FILE1',2,0,0"
20 OUTPUT 719; ":FASS:PCKM 'FILE2',5,0,1"
30 OUTPUT 719; ":FASS:SEQ:END"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
PCKM
PCLM
SEQ:END

Equivalent Front Panel Command

None

SMOD (Sequencer Model)

Syntax

```
:FASS:SMOD { MDL10 }
           { MDL11 }
```

```
:FASS:SMOD?
```

Description

This command selects the sequencer model for the HP FASS system. Two models are available:

- Model 10
- Model 7, 11, or 21.

Sequencer Model 10 is provided for backwards compatibility. If you have saved hardware images or developed programs on Model 10 hardware, your images and programs will run on Model 11 or Model 21 hardware. However, you will not be able use the additional memory and sequencer capabilities in the HP FASS Model 11 or Model 21. In Sequencer Model 10, you are limited to one sequence with a maximum of 2048 packets. In addition, loop packets are not allowed in Model 10.

Sequencer Model 7, 11, or 21 allows up to 1024 different sequences, with a total of 32768 packets and/or loop packets for all sequences. Every sequence must begin with a loop packet.

The MDL10 parameter selects Sequencer Model 10. MDL11 selects Sequencer Model 7, 11, or 21.

The query returns the currently selected sequencer model, either "MDL10" for Model 10 or "MDL11" for Model 7, 11, or 21.

Example

To set the FASS system Sequencer Model 11:

```
OUTPUT 719; ":FASS:SMOD MDL11"
```

Comments

FASS automatically boots up in Sequencer Model 11.

If you change the sequencer model from Model 11 to Model 10 while running an HP-IB program, all sequence data, except for sequence 0, will be cleared from the sequencer memories.

Once a hardware image has been loaded into Model 11 or Model 21 hardware, it is automatically saved for Sequencer Model 7, 11, or 21, even if the SMOD command is set to Model 10.

Related HP-IB Commands

None

Equivalent Front Panel Command

SID Control Panel - Sequencer Model

STAR (Start)

Syntax

```
:FASS:STAR
```

Description

This command starts signal execution by starting all sequencers running simultaneously. If a sequencer has been set to internal (INT) mode by the SEQ:MODE command, execution will start at the last sequence numbers that were loaded with the :FASS:SEQ:POIN command. After the execution of a *RST command, all sequence numbers are set to 0.

If a sequencer has been set to one of the external modes by the SEQ:MODE command, the sequence will be determined by external data.

This command is used to start the system when the trigger mode is set to free run.

Example

To start generating a signal:

```
OUTPUT 719; ":FASS:STAR"
```

Comments

The system must be stopped, using the STOP command, before it can be started.

Related HP-IB Commands

FASS Subsystem	*Trigger Subsystem*
STOP	IMM
	INIT
	PAUS

Equivalent Front Panel Command

Utilities Menu - Signal Control

STOP

Syntax

```
:FASS:STOP
```

Description

This command stops signal execution by stopping and resetting the sequencers.

Example

To stop the signal:

```
OUTPUT 719; ":FASS:STOP"
```

Comments

None

Related HP-IB Commands

FASS Subsystem
STAR

Trigger Subsystem
IMM
INIT
PAUS

Equivalent Front Panel Command

Utilities Menu - Signal Control

VMAP (Vector Map)

Syntax `:FASS:VMAP` *address, length, min, max, stretch*

Item	Description	Range/Restrictions
Address	Starting address of the ramp	0 to 262140 in multiples of 4 for AM, PM, and PM2 memories; 0 to 65535 for FM and frequency memories
Length[1]	Length of the ramp	0 to 262144 for AM, PM, and PM2 memories; 0 to 65536 for FM and frequency memories
Min	Minimum value of the ramp	-1 to +1 for AM and PM2 memories; -180 to +180° for PM memory; -67108864 to +67108864 for FM and frequency memories
Max	Maximum value of the ramp	-1 to +1 for AM and PM2 memories; -180 to +180° for PM memory; -67108864 to +67108864 for FM and frequency memories
Stretch	Stretch factor	1, 2, or 4

1 The length depends on the stretch factor. If the stretch factor is 2 or 4, the upper limit for the length must be divided by 2 or 4, respectively.

Description

This command allows you to create a linear ramp in the active waveform memory. Using this command is faster than creating a ramp in WGL and downloading it to HP FASS.

Example

To create a linear ramp in AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:VMAP 100, 512, -1, 1, 1"
```

Comments

This command is equivalent to the RAMP2 command in WGL.

Approximate times for using VMAP to create data are as follows:

Modulation Memory	Data Length	Approximate Time
AMPM	262144	13.25 seconds
PM	262144	1.5 seconds
FM	65536	850 ms
FREQ	65536	850 ms

HP-IB Related Commands

FASS Subsystem - VSIN

VSIN (Vector Sine)

Syntax

`:FASS:VSIN` *address, length, start, stop, scale, offset, stretch*

Item	Description	Range/Restrictions
Address	Starting address of the sine wave	0 to 262140 in multiples of 4 for AM, PM, and PM2 memories; 0 to 65535 for FM and frequency memories
Length[1]	Length of the sine wave	0 to 262144 for AM, PM, and PM2 memories; 0 to 65536 for FM and frequency memories
Start	Starting phase for sine wave (in degrees)	-2.98E8 to +2.98E8
Stop	Ending phase for sine wave (in degrees)	-2.98E8 to +2.98E8
Scale	Multiplier (or scale) of sine wave	-1 to +1 for AM and PM2 memories; -180 to +180° for PM memory;-67108864 to +67108864 for FM and frequency memories
Offset[2]	Sine wave offset	-1 to +1 for AM and PM2 memories; -180 to +180° for PM memory; -67108864 to +67108864 for FM and frequency memories
Stretch	Stretch factor	1, 2, or 4

1 The length depends on the stretch factor. If the stretch factor is 2 or 4, the upper limit for the length must be divided by 2 or 4, respectively.

2 The value of "scale + offset" cannot exceed the range of values allowed for either the scale or the offset.

Description

This command is used to create a sine wave in the active waveform memory.

Example

To create a sine wave in AM memory:

```
OUTPUT 719; ":FASS:MEM AM"
OUTPUT 719; ":FASS:VSIN 100, 512, 0, 360, .5, .5, 1"
```

After creating a suitable packet, this will give you double-sideband, large-carrier AM with a modulation index of 1 and a modulation frequency of approximately 262 kHz.

Comments

The VSIN command generates a signal that can be expressed as sinusoidal modulation on a carrier:

$$[offset + scale * sin(\omega_m t)] * sin(\omega_c t)$$

where:

$$\omega_m = 2\pi * \left(\frac{start - stop}{360}\right)\left(\frac{clock}{length * stretch}\right)$$

ω_c is the HP FASS carrier frequency.

Clock is the HP FASS sampling clock (internal clock is 2^{27}).

The other variables are defined in the command syntax.

For the AM memory, $offset + scale$ cannot exceed 1, which is the upper limit for AM memory data. The modulation index is defined as $m = \frac{scale}{offset}$.

The start and stop parameters in this command are equivalent to the starting and ending values in the RAMP3 command in WGL. The RAMP3 command builds a ramp from the starting value to the ending value, but does not include the ending value as part of the ramp.

VSIN (Vector Sine)

This command is equivalent to the following in WGL:

length CTX *start stop* RAMP3 SIN *scale** *offset*+

where WGL commands are shown in uppercase and the arguments to the commands are shown in italics.

Approximate times for using VSIN to create data are as follows:

Modulation Memory	Data Length	Approximate Time
AMPM	262144	174 seconds
PM	262144	166 seconds
FM	65536	45 seconds
FREQ	65536	45 seconds

Note that VSIN takes approximately three minutes to fill the entire AMPM memory with data.

HP-IB Related Commands

FASS Subsystem - VMAP

8

Frequency/Phase Modulation Subsystem

Introduction

The commands in this subsystem are used to select frequency and phase modulation for all signal models.

The commands in this subsystem correspond to the commands in the Frequency and Phase Modulation dialog box, which is accessed by the Global Edit command (FREQ/ΦMOD).

Frequency and phase modulation is also referred to as intrapulse modulation. For signal models 4, 5, and 6, the intrapulse modulation can be turned off on a pulse-by-pulse basis.

To use commands in this subsystem, first select a frequency or phase modulation type and then set any additional parameters required for the selected modulation type. See figure 8-1, Frequency/Phase Modulation Subsystem Flowchart, for the types of modulation available. See the TYPE command for a pictorial description of available types of intrapulse modulation.

See figure 8-2 for the syntax diagram of the Frequency/Phase Modulation subsystem.

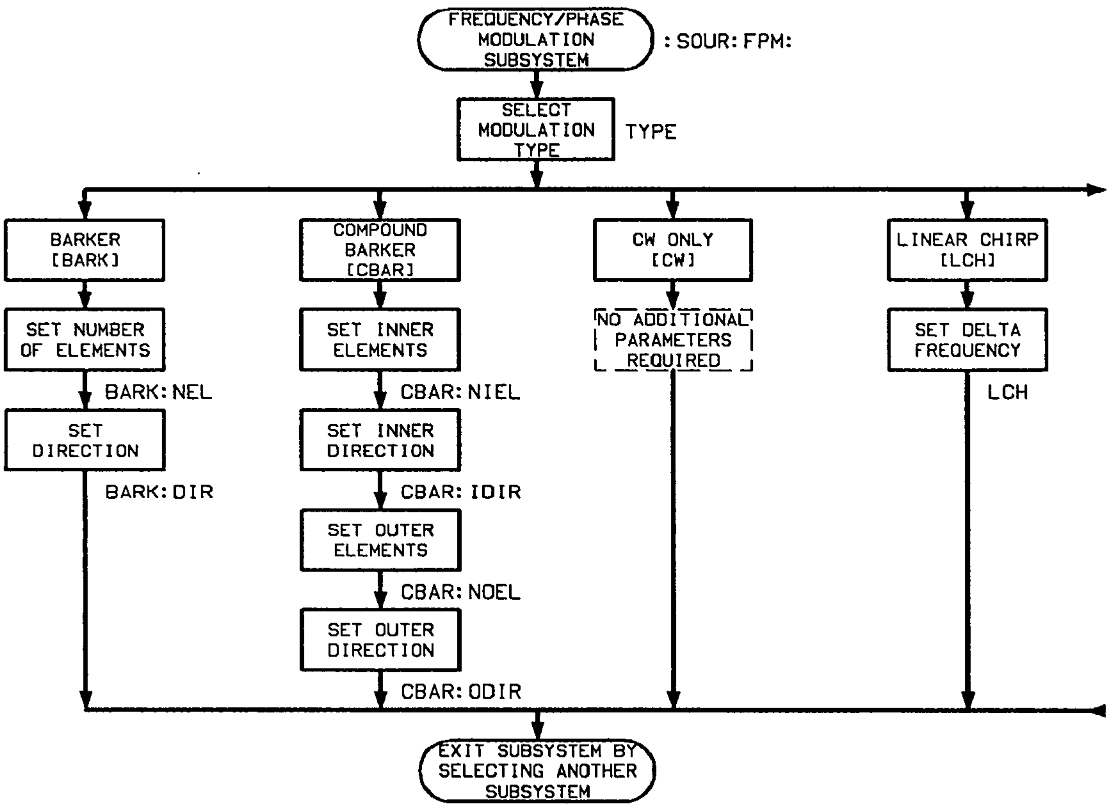


Figure 8-1. Frequency/Phase Modulation Subsystem Flowchart

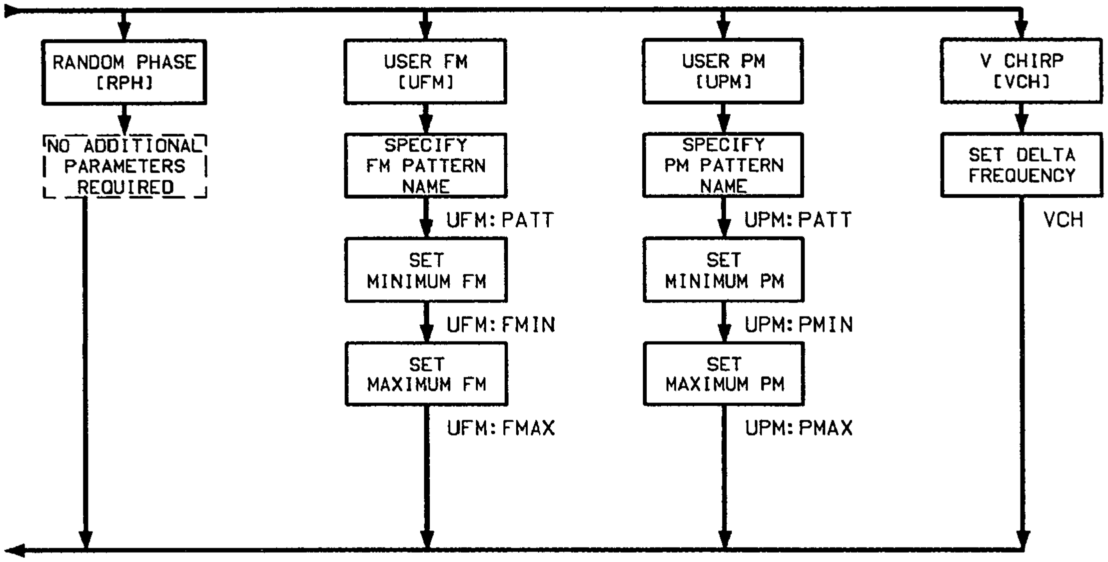


Figure 8-1. Frequency/Phase Modulation Subsystem Flowchart (continued)

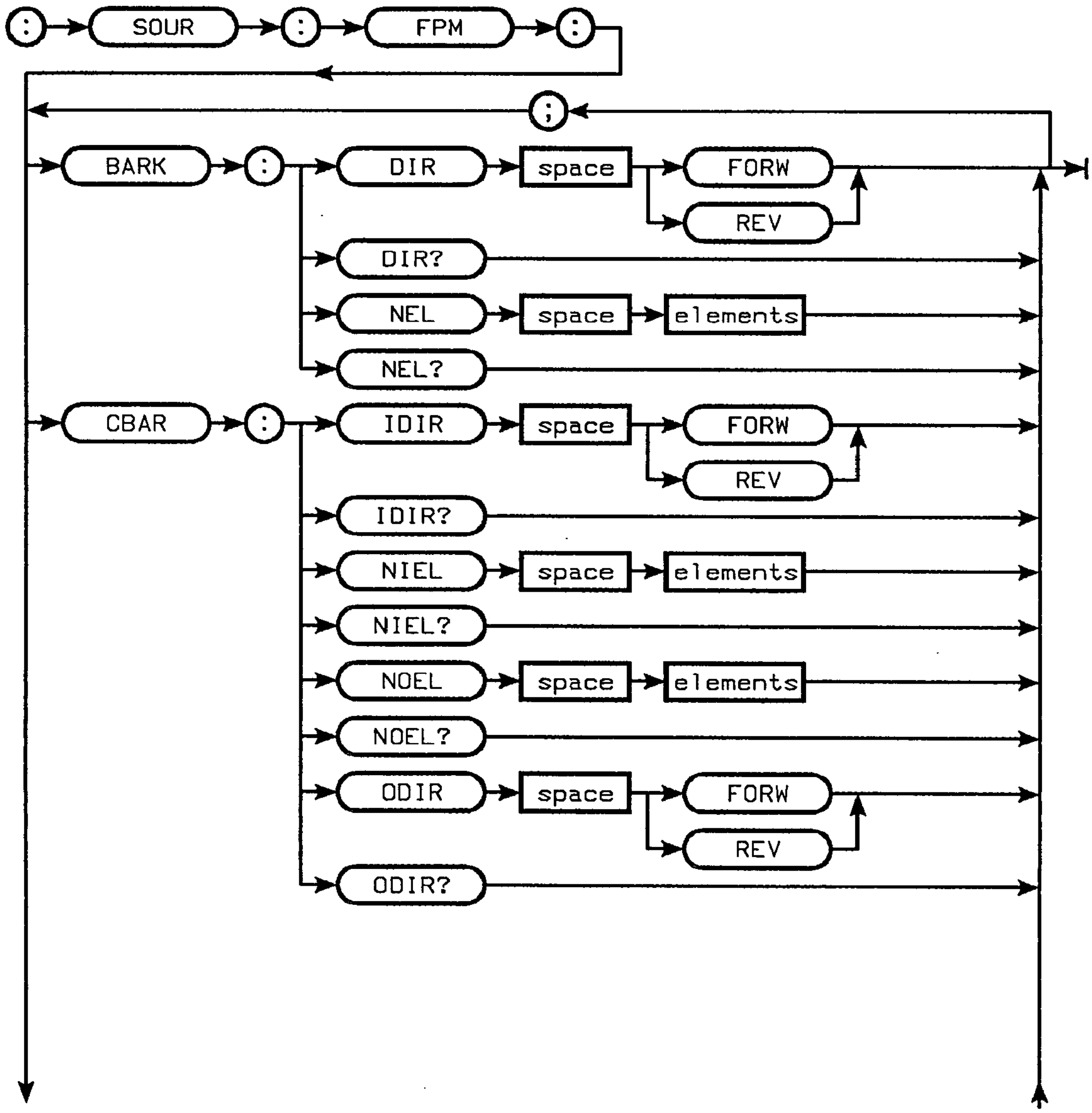


Figure 8-2. Frequency/Phase Modulation Subsystem Syntax Diagram

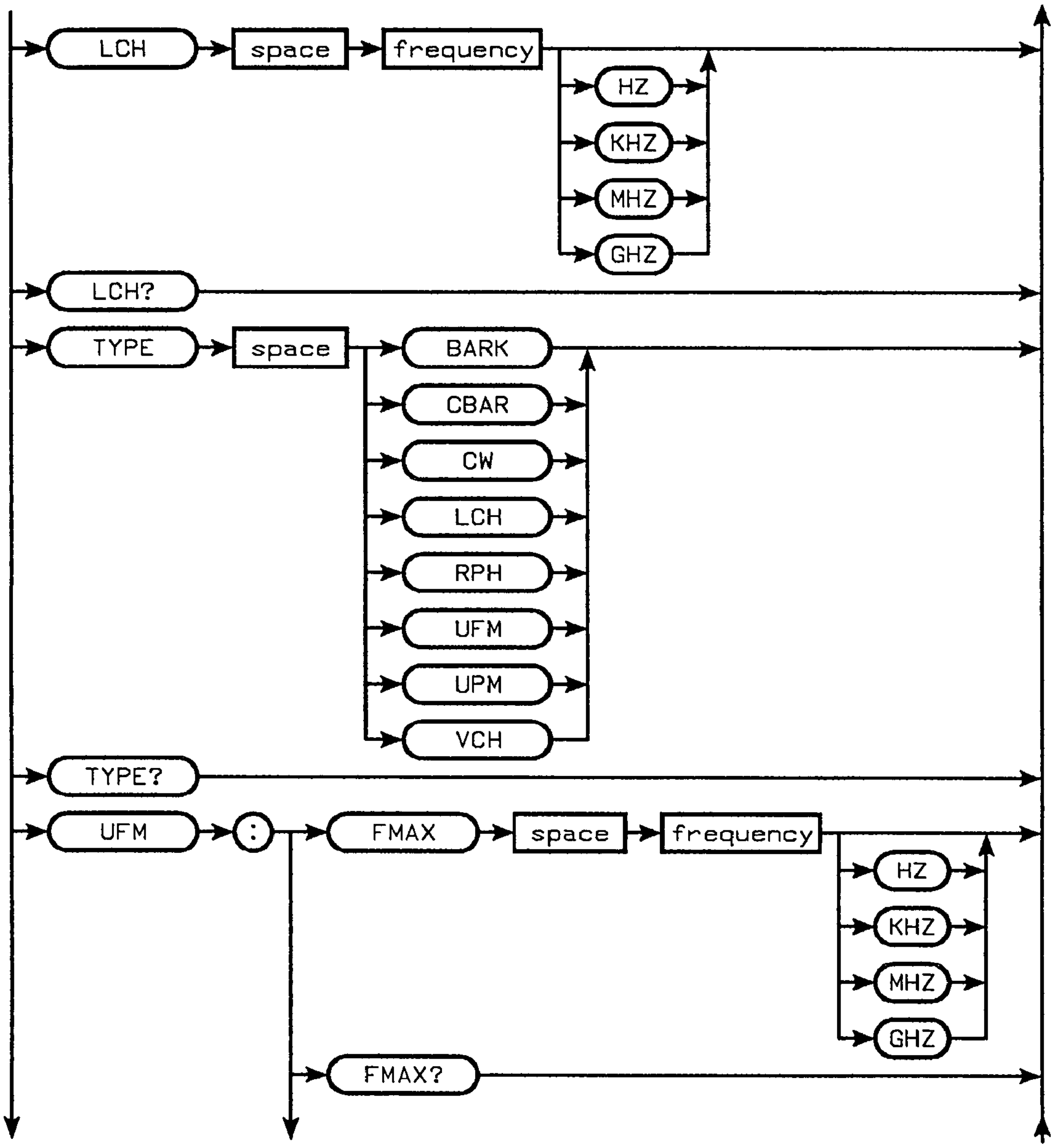


Figure 8-2.

Figure 8-2. Frequency/Phase Modulation Subsystem Syntax Diagram (continued)

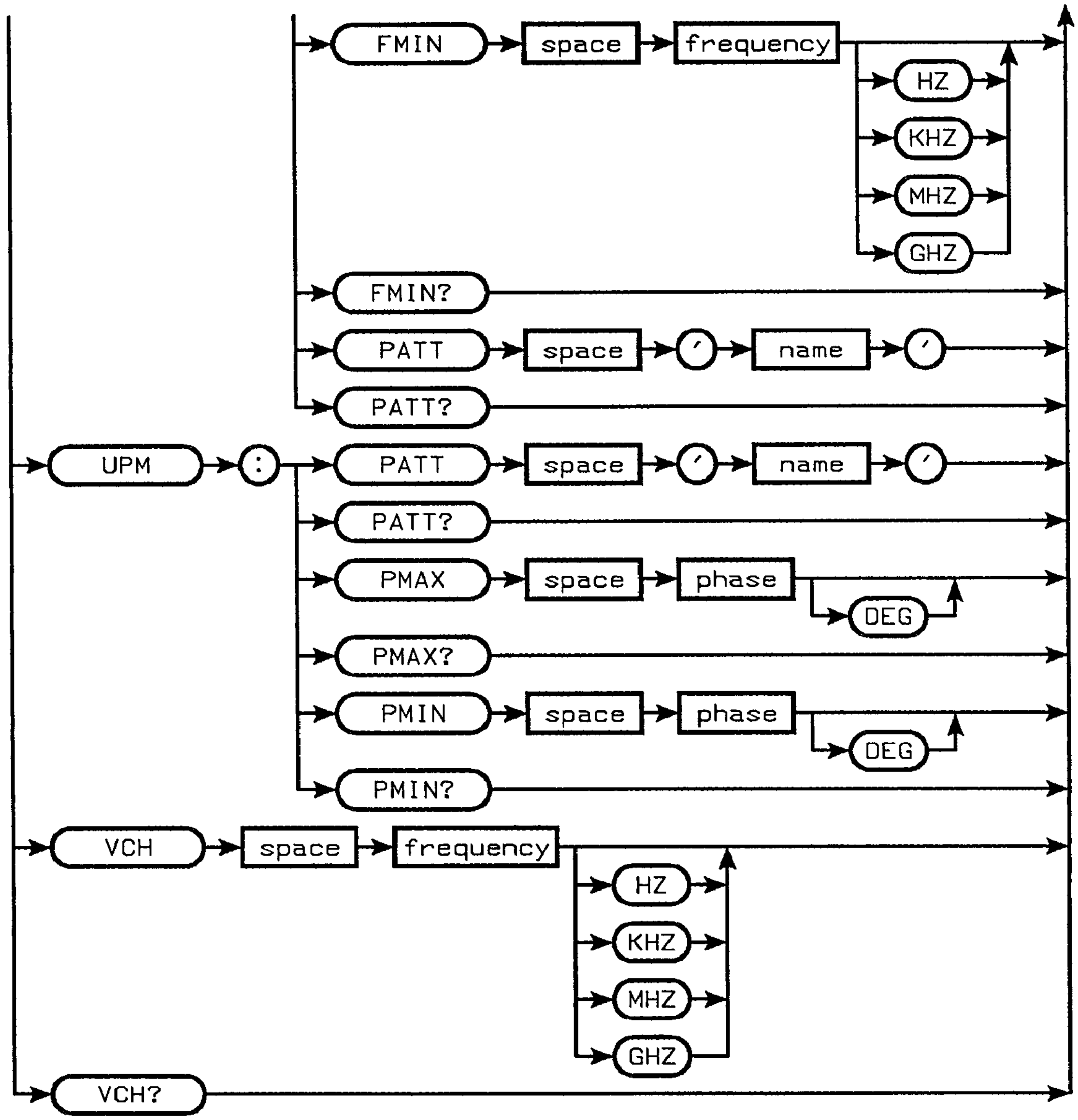


Figure 8-2. Frequency/Phase Modulation Subsystem Syntax Diagram (continued)

BARK:DIR (Barker Code Direction)

Syntax

```
:SOUR:FPM:BARK:DIR {FORW | REV}

:SOUR:FPM:BARK:DIR?
```

Description

This command specifies the direction of a Barker code. Either forward or reverse direction can be selected.

The query returns the current direction of the Barker code elements, either FORW for forward or REV for reverse.

Example

To select a 13-element, forward-direction, normal Barker code:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE BARK"
20  OUTPUT 719; ":SOUR:FPM:BARK:NEL 13"
30  OUTPUT 719; ":SOUR:FPM:BARK:DIR FORW"
40  END
```

Comments

Forward direction is the reset condition.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
BARK:NEL
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Barker Modulation Type) + Element Direction

BARK:NEL (Number of Elements)

Syntax

:SOUR:FPM:BARK:NEL *elements*

:SOUR:FPM:BARK:NEL

Item	Description	Range/Restrictions
Elements	Number of elements	±2, ±3, ±4, ±5, ±7, ±11, ±13

Description

This command sets the number of elements in a Barker code. The polarity of any of the Barker codes can be inverted by entering a negative number of elements.

The query returns the current number of elements in the Barker code.

Example

To select a 13-element, forward-direction, normal Barker code:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE BARK"
20  OUTPUT 719; ":SOUR:FPM:BARK:NEL 13"
30  OUTPUT 719; ":SOUR:FPM:BARK:DIR FORW"
40  END
```

Comments

The reset value for number of Barker code elements is 13.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
BARK:DIR
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Barker Modulation Type) + Number Of Elements

CBAR:IDIR (Inner Element Direction)

Syntax

$$\texttt{:SOUR:FPM:IDIR} \left\{ \begin{array}{l} \texttt{FORW} \\ \texttt{REV} \end{array} \right\}$$

```
:SOUR:FPM:IDIR?
```

Description

This command specifies the direction of the inner elements for a compound Barker code. Either forward or reverse direction can be selected.

The query returns the current direction of the compound Barker code inner elements, either FORW for forward or REV for reverse.

Example

To select a compound Barker code with 13 forward-direction inner elements and 2 reverse-direction outer elements:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE CBAR"
20  OUTPUT 719; ":SOUR:FPM:CBAR:IDIR FORW"
30  OUTPUT 719; ":SOUR:FPM:CBAR:NIEL 13"
40  OUTPUT 719; ":SOUR:FPM:CBAR:ODIR REV"
50  OUTPUT 719; ":SOUR:FPM:CBAR:NOEL 2"
60  END
```

Comments

Forward direction is the reset condition.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
CBAR:NIEL
CBAR:NOEL
CBAR:ODIR
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Compound Barker Modulation Type) + Inner Element Direction

CBAR:NIEL (Number of Inner Elements)

Syntax

```
:SOUR:FPM:CBAR:NIEL elements
:SOUR:FPM:CBAR:NIEL?
```

Item	Description	Range/Restrictions
Elements	Number of inner elements	±2, ±3, ±4, ±5, ±7, ±11, ±13

Description

This command sets the number of inner elements for a compound Barker code. The polarity complement of a compound Barker code can be inverted by specifying a negative number of elements.

The query returns the current number of inner elements for a compound Barker code.

Example

To select a compound Barker code with 13 forward-direction inner elements and 2 reverse-direction outer elements:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE CBAR"
20  OUTPUT 719; ":SOUR:FPM:CBAR:IDIR FORW"
30  OUTPUT 719; ":SOUR:FPM:CBAR:NIEL 13"
40  OUTPUT 719; ":SOUR:FPM:CBAR:ODIR REV"
50  OUTPUT 719; ":SOUR:FPM:CBAR:NOEL 2"
60  END
```

Comments

The reset value is 13.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
CBAR:IDIR
CBAR:NOEL
CBAR:ODIR
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Compound Barker Modulation Type) + Inner Elements

CBAR:NOEL (Number of Outer Elements)

Syntax

:SOUR:FPM:CBAR:NOEL *elements*

:SOUR:FPM:CBAR:NOEL?

Item	Description	Range/Restrictions
Elements	Number of outer elements	2, 3, 4, 5, 7, 11, 13

Description

This command sets the number of outer elements for a Barker code.

The query returns the current number of outer elements for a compound Barker code.

Example

To select a compound Barker code with 13 forward-direction inner elements and 2 reverse-direction outer elements:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE CBAR"
20  OUTPUT 719; ":SOUR:FPM:CBAR:IDIR FORW"
30  OUTPUT 719; ":SOUR:FPM:CBAR:NIEL 13"
40  OUTPUT 719; ":SOUR:FPM:CBAR:ODIR REV"
50  OUTPUT 719; ":SOUR:FPM:CBAR:NOEL 2"
60  END
```

Comments

A negative number of elements cannot be used to set polarity. The CBAR:NIEL command (number of inner elements) controls the polarity of the compound Barker code.

The reset value is 13.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
CBAR:IDIR
CBAR:NIEL
CBAR:ODIR
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - More... (for Compound Barker Modulation Type) + Outer Elements

CBAR:ODIR (Outer Element Direction)

Syntax

$$:SOUR:FPM:CBAR:ODIR \begin{Bmatrix} FORW \\ REV \end{Bmatrix}$$

```
:SOUR:FPM:CBAR:ODIR?
```

Description

This command specifies the direction of the outer elements for a compound Barker code. Either forward or reverse direction can be selected.

The query returns the current direction of the compound Barker code outer elements, either FORW for forward or REV for reverse.

Example

To select a compound Barker code with 13 forward-direction inner elements and 2 reverse-direction outer elements:

```
10 OUTPUT 719; ":SOUR:FPM:TYPE CBAR"
20 OUTPUT 719; ":SOUR:FPM:CBAR:IDIR FORW"
30 OUTPUT 719; ":SOUR:FPM:CBAR:NIEL 13"
40 OUTPUT 719; ":SOUR:FPM:CBAR:ODIR REV"
50 OUTPUT 719; ":SOUR:FPM:CBAR:NOEL 2"
60 END
```

Comments

Forward direction is the reset condition.

Related HP-IB Commands

Frequency Phase Modulation Subsystem
CBAR:IDIR
CBAR:NIEL
CBAR:NOEL
TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Compound Barker Modulation Type) + Outer Element Direction

LCH (Linear Chirp Frequency Deviation)

Syntax

$$\texttt{:SOUR:FPM:LCH}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:FPM:LCH?
```

Item	Description	Range/Restrictions
Frequency	Frequency deviation	−40 MHz to +40 MHz

Description

This command sets the peak-to-peak frequency deviation for a linear chirp. The linear chirp is centered on the carrier frequency specified for each pulse. Setting a negative number for the frequency deviation causes the frequency to decrease rather than increase with time.

The query returns the current frequency deviation for the linear chirp in hertz.

Example

To select a frequency deviation of 20 MHz:

```
OUTPUT 719; ":SOUR:FPM:TYPE LCH"
OUTPUT 719; ":SOUR:LCH 20 MHZ"
```

Comments

The reset value for the linear chirp frequency deviation is 10 MHz.

The signal modulation bandwidth must be less than 40 MHz.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for Linear Chirp Modulation Type) + Delta Frequency

TYPE (Modulation Type)

Syntax

$$:SOUR:FPM:TYPE \left\{ \begin{array}{l} BARK \\ CBAR \\ CW \\ LCH \\ RPH \\ UFM \\ UPM \\ VCH \end{array} \right\}$$

```
:SOUR:FPM:TYPE?
```

Description

This command selects one of the available intrapulse modulation types. The following types can be selected:

- BARK - selects Barker code carrier modulation.
- CBAR - selects compound Barker code carrier modulation.
- CW - selects pulse modulated CW (no frequency or phase modulation).
- LCH - selects linear chirp carrier modulation.
- RPH - selects uniform random phase carrier modulation.
- UFM - selects user-defined carrier frequency modulation.
- UPM - selects user-defined carrier phase modulation.
- VCH - selects V-shaped carrier frequency modulation.

The query returns the currently selected frequency/phase modulation type.

See figures 8-3 through 8-10 for examples of available frequency and phase modulation types.

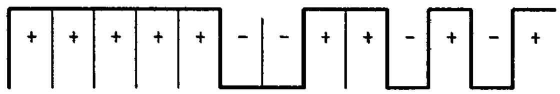


Figure 8-3. Barker Code Modulation

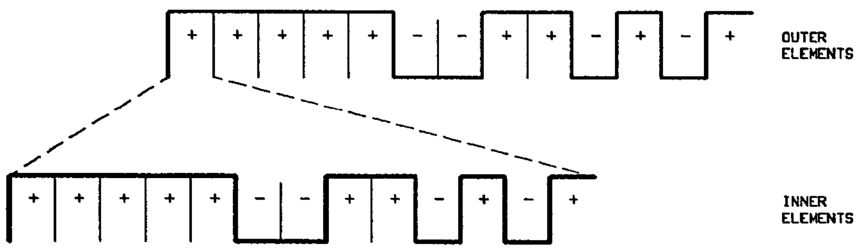


Figure 8-4. Compound Barker Code Modulation

Figure 8-5. Pulsed CW Modulation

TYPE (Modulation Type)

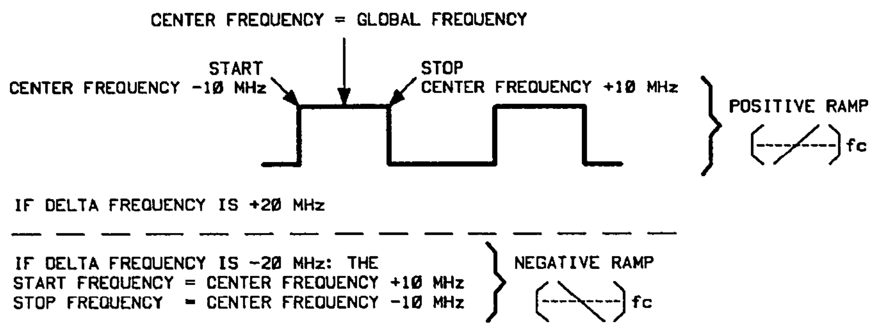


Figure 8-6. Linear Chirp Modulation

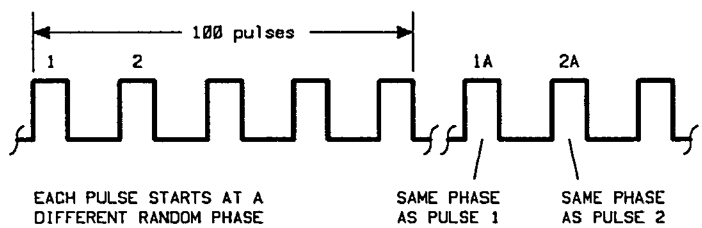


Figure 8-7. Random Phase Modulation

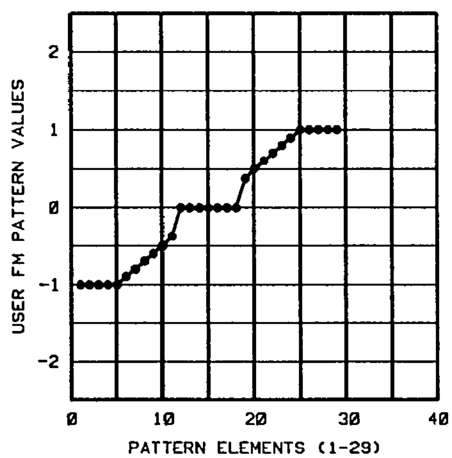


Figure 8-8. Typical User-Defined FM Pattern

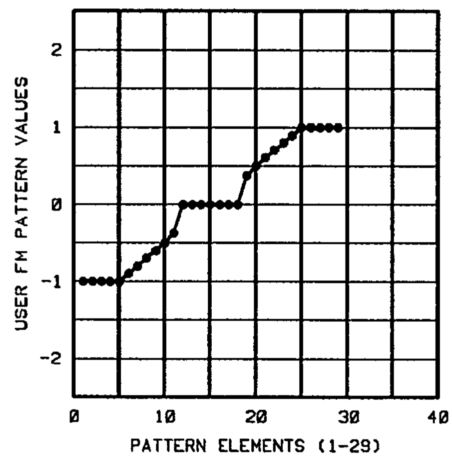


Figure 8-9. Typical User-Defined PM Pattern

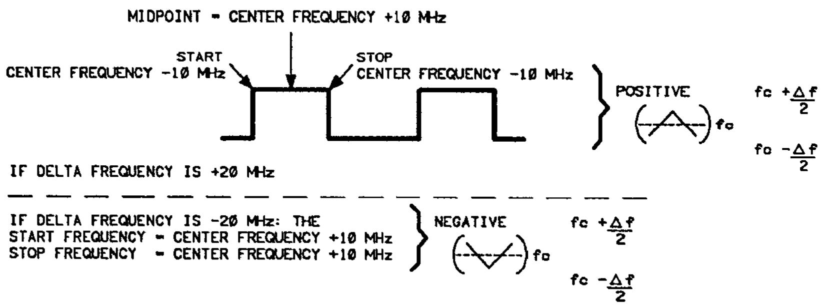


Figure 8-10. V Chirp Modulation

Example To select random phase modulation:

```
OUTPUT 719; ":SOUR:FPM:TYPE RPH"
```

Comments

CW is the default modulation type.

You must select a modulation type prior to selecting other commands in this subsystem.

CW and random phase modulation do not require additional parameters.

When random phase is selected, the system immediately sets all individual pulse phase offsets to pseudo-random phase values. The pseudo-random pattern is repeatable, that is, the same set of phase values are generated each time the :SOUR:FPM:TYPE RPH command is executed.

You can first select random phase modulation to set the phase offset for all pulses, then select linear chirp, user-defined FM, or V chirp without losing that phase information.

If the total number of pulses has been increased since random phase was last selected, it is necessary to select CW and then reselect random phase in order to regenerate the random phase pattern over all pulses.

Selecting CW resets all individual pulse phase offsets to 0°.

Only one user-defined modulation pattern, either User FM or User PM, can be used for intrapulse modulation.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - all commands

Pulse Subsystem - POFF

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - Modulation Type

UFM:FMAX (Maximum User FM)

Syntax

```
:SOUR:FPM:UFM:FMAX frequency [HZ | KHZ | MHZ | GHZ]
```

```
:SOUR:FPM:UFM:FMAX?
```

Item	Description	Range/Restrictions
Frequency	Maximum frequency deviation	−20 MHz to +20 MHz

Description

This command sets the maximum frequency deviation for a user-defined FM pattern. Data in a user-defined FM pattern is scaled between the minimum and maximum frequency deviation. Any data outside this range generates an error.

The query returns the current setting of the maximum frequency deviation in hertz.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

To select a user-defined FM pattern named MYTEST.USR that has a minimum frequency deviation of −10 MHz and a maximum frequency deviation FM of +10 MHz:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UFM"
```

```
20 OUTPUT 719; ":SOUR:FPM:UFM:PATT 'MYTEST.USR'"
30 OUTPUT 719; ":SOUR:FPM:UFM:FMAX 10 MHZ"
40 OUTPUT 719; ":SOUR:FPM:UFM:FMIN -10 MHZ"
50 END
```

Comments

The signal modulation bandwidth must be less than 40 MHz.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
TYPE
UFM:FMIN
UFM:PATT

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for User FM Modulation Type) + Maximum FM

UFM:FMIN (Minimum User FM)

Syntax

```
:SOUR:FPM:UFM:FMIN frequency [HZ | KHZ | MHZ | GHZ]
```

```
:SOUR:FPM:UFM:FMIN?
```

Item	Description	Range/Restrictions
Frequency	Minimum frequency deviation	−20 MHz to +20 MHz

Description

This command sets the minimum frequency deviation for a user-defined FM pattern. Data in a user-defined FM pattern is scaled between the minimum and minimum frequency deviation. Any data outside this range generates an error.

The query returns the current setting of the minimum frequency deviation in hertz.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

UFM:FMIN (Minimum User FM)

To select a user-defined FM pattern named MYTEST.USR that has a minimum frequency deviation of −10 MHz and a maximum frequency deviation FM of +10 MHz:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UFM"
20  OUTPUT 719; ":SOUR:FPM:UFM:PATT 'MYTEST.USR'"
30  OUTPUT 719; ":SOUR:FPM:UFM:FMAX 10 MHZ"
40  OUTPUT 719; ":SOUR:FPM:UFM:FMIN -10 MHZ"
50  END
```

Comments

The signal modulation bandwidth must be less than 40 MHz.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
TYPE
UFM:FMAX
UFM:PATT

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for User FM Modulation Type) + Minimum FM

UFM:PATT (User FM Pattern Name)

Syntax

```
:SOUR:FPM:UFM:PATT 'name'
```

```
:SOUR:FPM:UFM:PATT?
```

Item	Description	Range/Restrictions
Name	User-defined pattern name	The pattern name must match an installed file name on the removable cartridge.

Description

This command specifies the name of a user-defined pattern to be used for the User FM pattern. The pattern must already be installed on the removable cartridge, otherwise, an error is returned.

The query returns the name of the currently specified User FM pattern. The returned format is string data.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

UFM:PATT (User FM Pattern Name)

To select a user-defined FM pattern named MYTEST.USR that has a minimum frequency deviation of −10 MHz and a maximum frequency deviation FM of +10 MHz:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UFM"
20  OUTPUT 719; ":SOUR:FPM:UFM:PATT 'MYTEST.USR'"
30  OUTPUT 719; ":SOUR:FPM:UFM:FMAX 10 MHZ"
40  OUTPUT 719; ":SOUR:FPM:UFM:FMIN -10 MHZ"
50  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
TYPE

UFM:FMAX
UFM:FMIN

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - [More...] (for User FM Modulation Type) + [Select User Pattern]

UPM:PATT (User PM Pattern Name)

Syntax

:SOUR:FPM:UPM:PATT *'name'*

:SOUR:FPM:UPM:PATT?

Item	Description	Range/Restrictions
Name	User-defined pattern	The pattern name must match an installed file name on the removable cartridge.

Description

This command specifies the name of a user-defined pattern to be used for the User PM pattern. The file must already be installed on the removable cartridge, otherwise, an error is returned.

The query returns the name of the currently specified User PM pattern. The returned format is string data.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

UPM:PATT (User PM Pattern Name)

To select a user-defined PM pattern named PM_TST.USR that has a minimum phase deviation of 0° and a maximum phase deviation of +180°:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UPM"
20  OUTPUT 719; ":SOUR:FPM:UPM:PATT 'PM_TST.USR'"
30  OUTPUT 719; ":SOUR:FPM:UPM:PMAX 180 DEG"
40  OUTPUT 719; ":SOUR:FPM:UPM:PMIN 0 DEG"
50  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
UPM:PMAX
UPM:PMIN
TYPE

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for User PM Modulation Type) + (Select User Pattern)

UPM:PMAX (Maximum User PM)

Syntax

:SOUR:FPM:UPM:PMAX *phase* [DEG]

:SOUR:FPM:UPM:PMAX?

Item	Description	Range/Restrictions
Phase	Maximum phase deviation	−180° to +180° in 0.1° steps

Description

This command sets the maximum phase deviation for a user-defined PM pattern. Data in a user-defined PM pattern is scaled between the minimum and minimum phase deviation. Any data outside this range generates an error.

The query returns the current setting of the maximum phase deviation in degrees.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

To select a user-defined PM pattern named PM_TST.USR that has a minimum phase deviation of 0° and a maximum phase deviation of +180°:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UPM"
20  OUTPUT 719; ":SOUR:FPM:UPM:PATT 'PM_TST.USR'"
30  OUTPUT 719; ":SOUR:FPM:UPM:PMAX 180 DEG"
40  OUTPUT 719; ":SOUR:FPM:UPM:PMIN 0 DEG"
50  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
UPM:PATT
UPM:PMIN
TYPE

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for User PM Modulation Type) + Maximum PM

UPM:PMIN (Minimum User PM)

Syntax

```
:SOUR:FPM:UPM:PMIN phase [DEG]

:SOUR:FPM:UPM:PMIN?
```

Item	Description	Range/Restrictions
Phase	Minimum phase deviation	−180°to +180° in 0.1° steps

Description

This command sets the minimum phase deviation for a user-defined PM pattern. Data in a user-defined PM pattern is scaled between the minimum and minimum phase deviation. Any data outside this range generates an error.

The query returns the current setting of the minimum phase deviation in degrees.

Example

In order to use a user-defined pattern, the pattern must already be installed on the removable cartridge. Patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

To select a user-defined PM pattern named PM_TST.USR that has a minimum phase deviation of 0° and a maximum phase deviation of +180°:

```
10  OUTPUT 719; ":SOUR:FPM:TYPE UPM"
20  OUTPUT 719; ":SOUR:FPM:UPM:PATT 'PM_TST.USR'"
30  OUTPUT 719; ":SOUR:FPM:UPM:PMAX 180 DEG"
40  OUTPUT 719; ":SOUR:FPM:UPM:PMIN 0 DEG"
50  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Frequency/Phase Modulation Subsystem
UPM:PATT
UPM:PMAX
TYPE

SID Subsystem
TEXT

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for User PM Modulation Type) + Minimum PM

VCH (V Chirp Frequency Deviation)

Syntax

$$:\texttt{SOUR:FPM:VCH}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:FPM:VCH?
```

Item	Description	Range/Restrictions
Frequency	Frequency deviation	−40 MHz to +40 MHz in 0.25 steps

Description

This command sets the peak-to-peak frequency deviation for a V chirp. Setting a negative number for the frequency deviation causes the V chirp to be inverted.

The query returns the current frequency deviation for the V chirp in hertz.

Example

To select a V chirp frequency deviation of 20 MHz:

```
OUTPUT 719; ":SOUR:FPM:TYPE VCH"
OUTPUT 719; ":SOUR:FPM:VCH 20 MHZ"
```

Comments

See the TYPE command for a pictorial description of V chirp.

The reset value for V chirp frequency deviation is 10 MHz.

The signal modulation bandwidth must be less than 40 MHz.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - TYPE

Equivalent Front Panel Command

Frequency and Phase Modulation Dialog Box - (More...) (for V Chirp Modulation Type) + Delta Frequency

9

Global Subsystem

Introduction

The commands in this subsystem allow you to set signal parameters that affect all pulses. When generating pulse trains, set the global parameters before editing the parameters for individual pulses.

The command to select the signal model should always be issued first. Other commands in this subsystem should be issued in accordance with the flowchart shown in figure 9-1.

Figure 9-2 shows the Global subsystem syntax diagram.

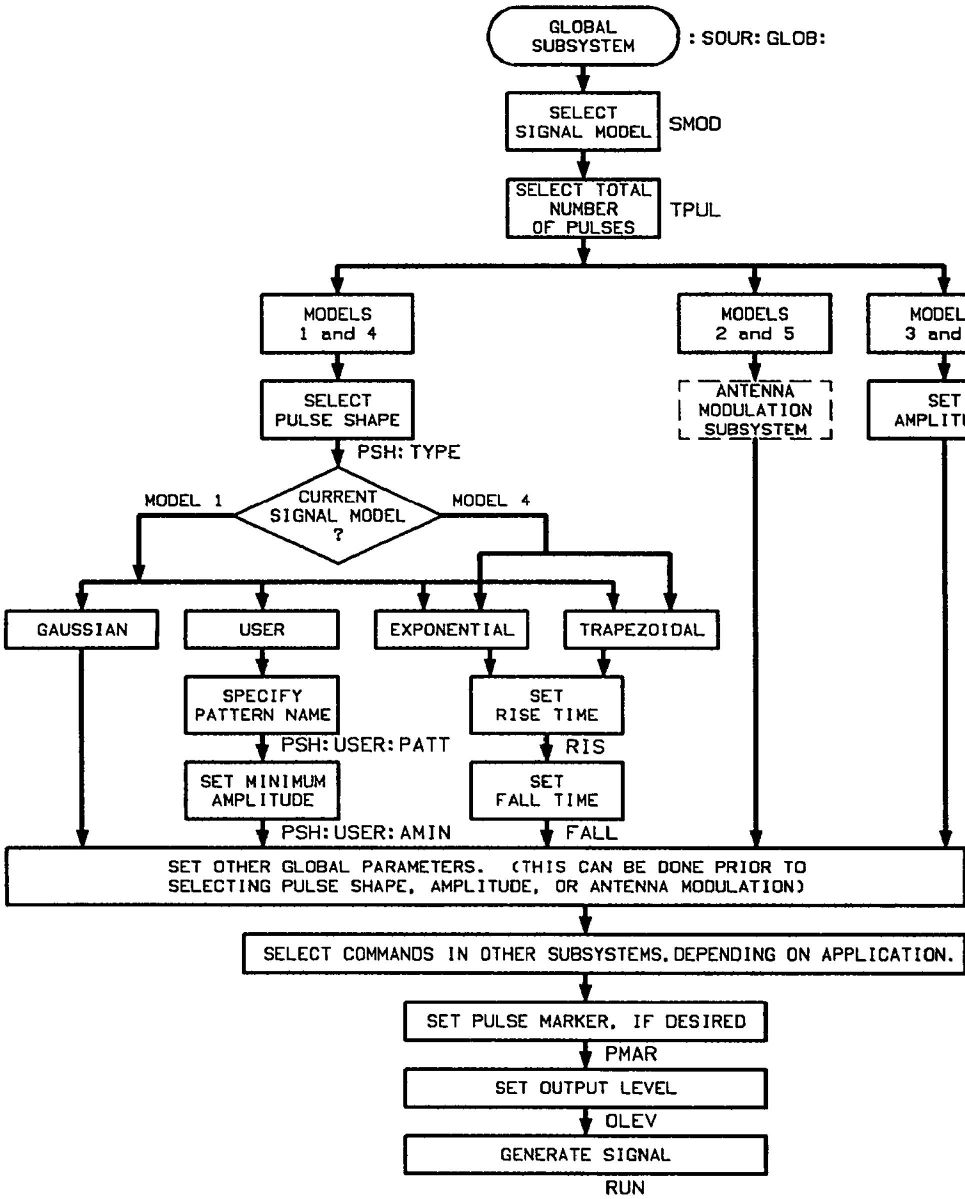


Figure 9-1. Global Subsystem Flowchart

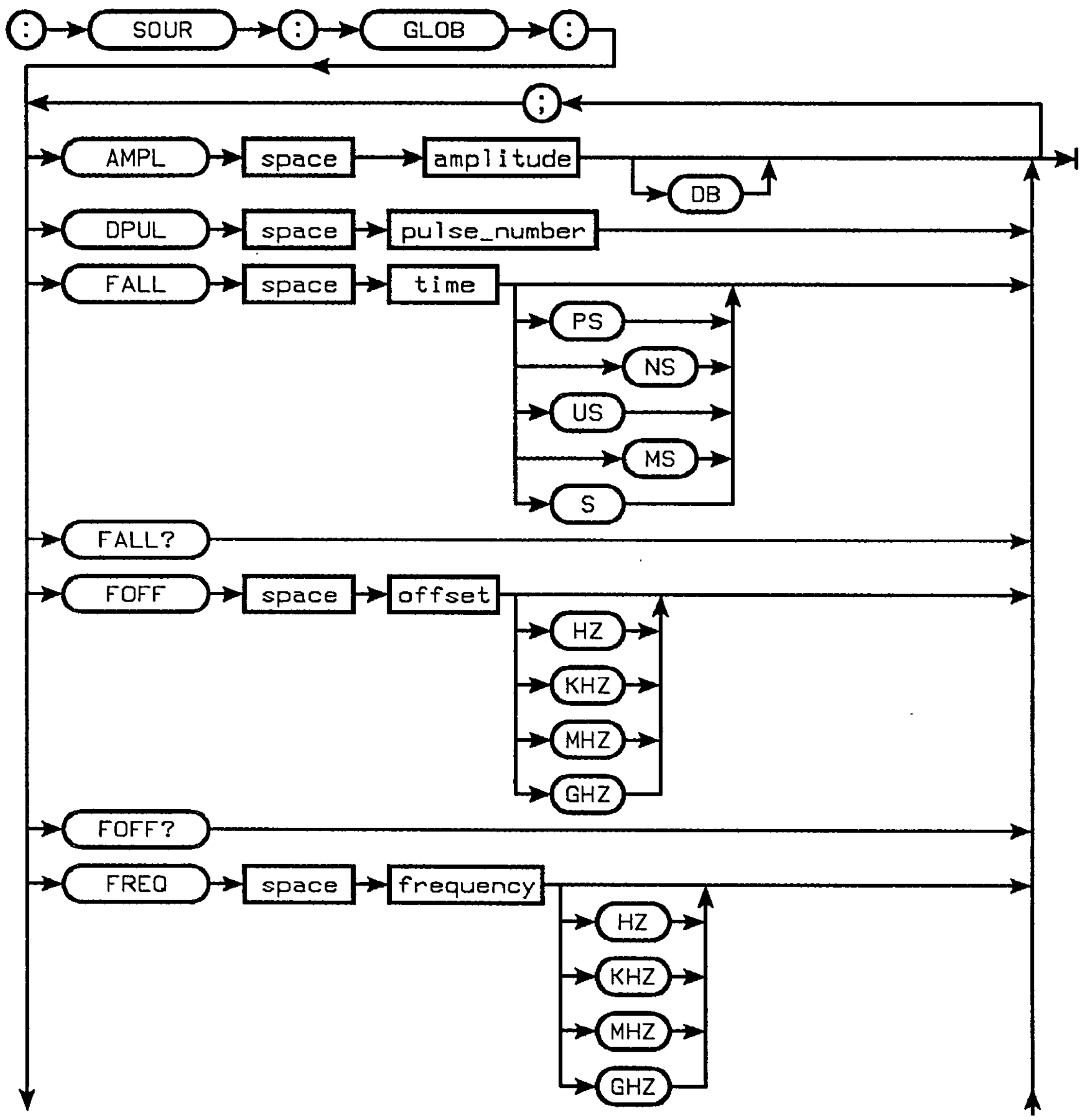


Figure 9-2. Global Subsystem Syntax Diagram

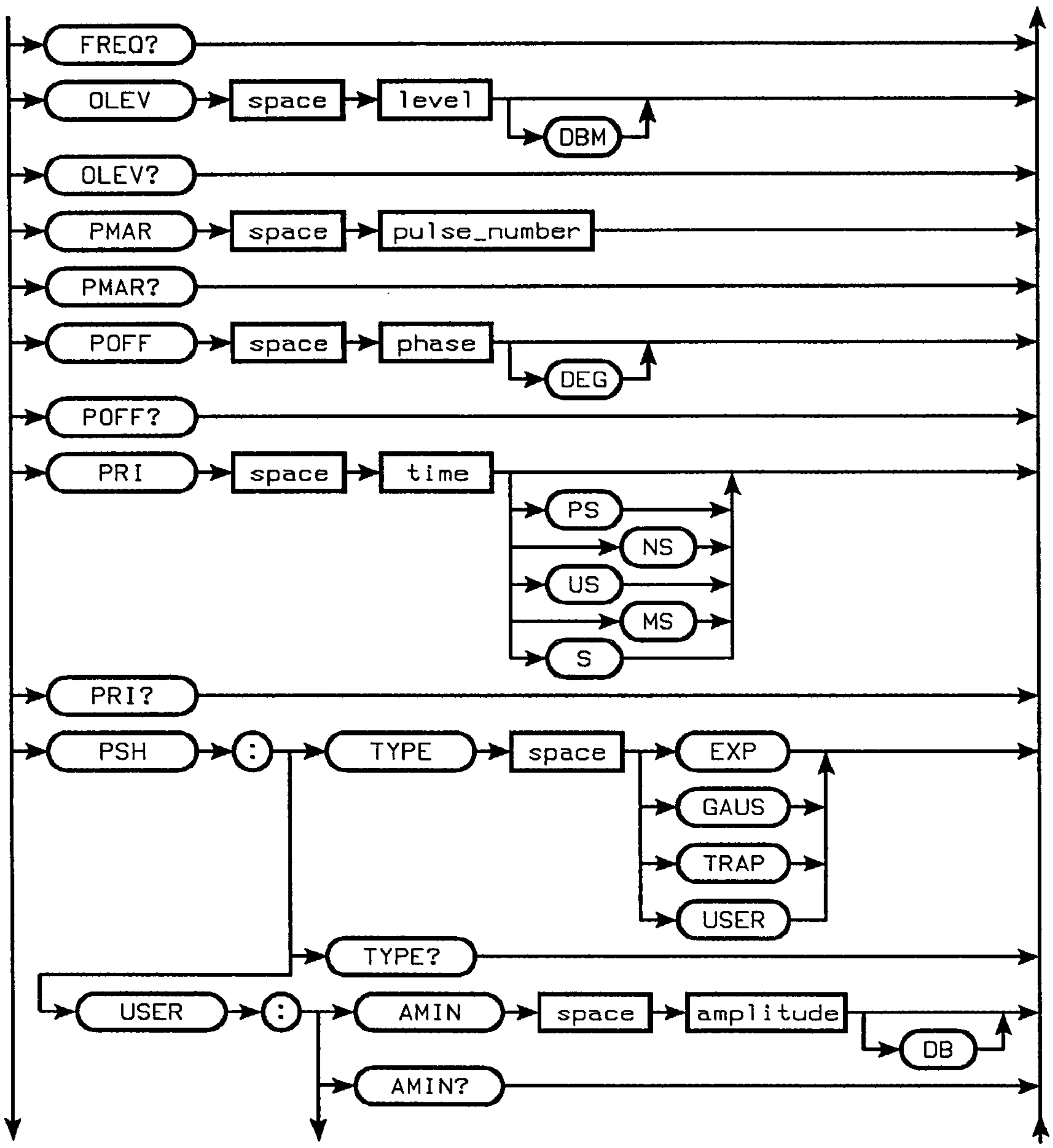


Figure 9-2. Global Subsystem Syntax Diagram (continued)

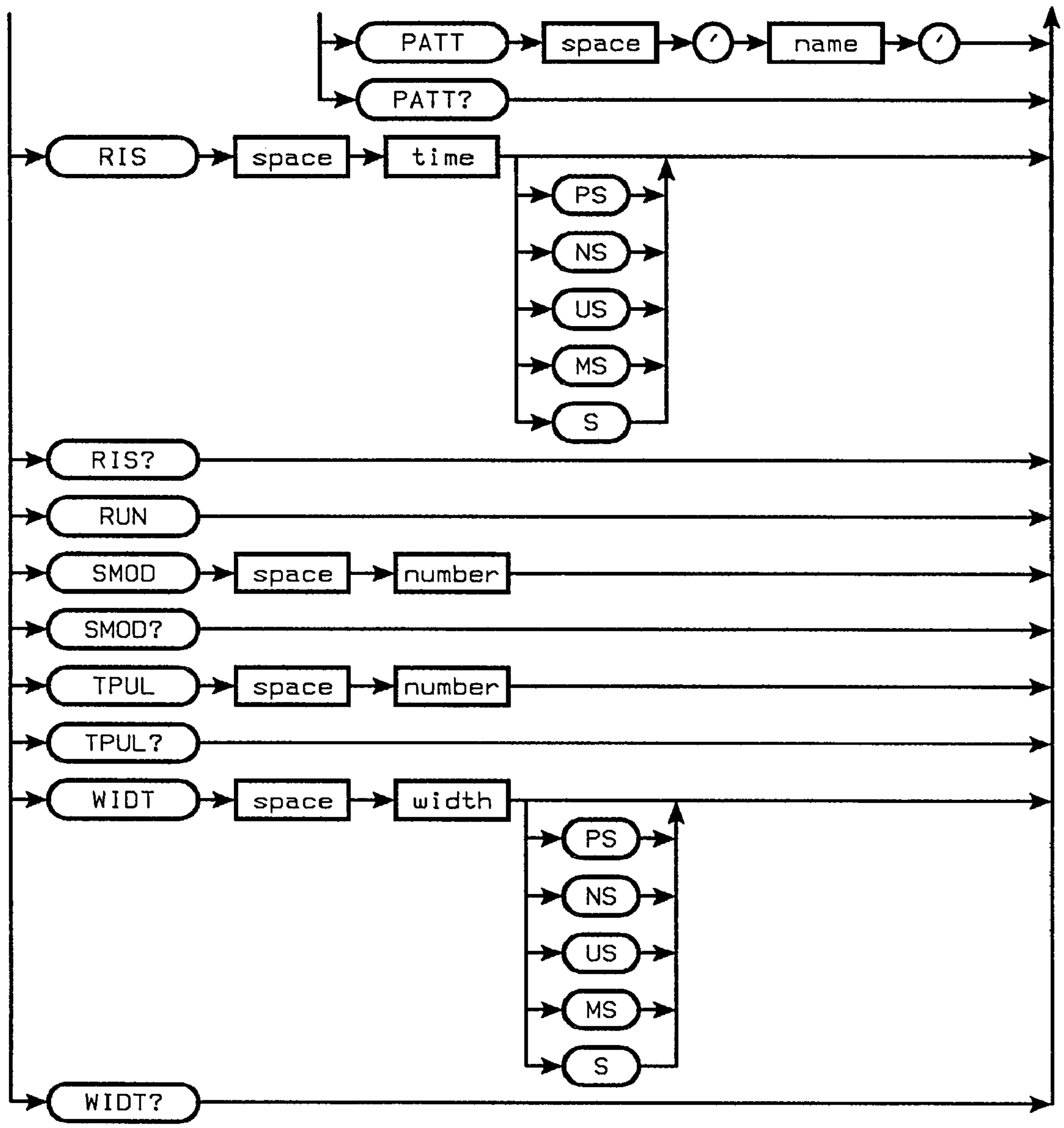


Figure 9-2. Global Subsystem Syntax Diagram (continued)

AMPL (Amplitude)

Syntax

`:SOUR:GLOB:AMPL` *amplitude* [DB]

Item	Description	Range/Restrictions
Amplitude	Global amplitude	See Description, below.

Description

This command sets the amplitude of all pulses relative to the system output level. (The output level is set by the :GLOB:OLEV command.) The allowable range of settings is as follows:

- HP FASS Model 7: -100 to +10 dB in 0.1 dB steps.
- HP FASS Model 11: -107 to +22 dB in 0.1 dB steps.
- HP FASS Model 21: -100 to +6 dB in 0.1 dB steps.

The output level plus the amplitude must be within the valid range for the hardware model, as shown above.

Note

This command is valid for signal models 3 and 6 only.

Example

To set the amplitude of all pulses to 3 dB (relative to the system output level):

```
OUTPUT 719; ":SOUR:GLOB:SMOD 3"
OUTPUT 719; ":SOUR:GLOB:OLEV 0 DBM"
OUTPUT 719; ":SOUR:GLOB:AMPL 3 DB"
```

Comments

Output level accuracy is as follows:

- HP FASS Model 7: ±1 dB for signal dynamic ranges ≤40 dB; ±3 dB for signal dynamic ranges > 40 dB.
- HP FASS Model 11: ±1 dB for RSID signal models 3 and 6 with internal leveling.
- HP FASS Model 21: ±2.2 dB at 0 dBm when calibrated.

If the pulse amplitude plus the peak output level is greater than +10 dB, the signal will be distorted for HP FASS Model 11.

If the output level is set to 0 dBm, amplitude will effectively be in dBm, rather than dB.

Related HP-IB Commands

Global Subsystem
OLEV
PSH:USER:AMIN
SMOD

Pulse Subsystem
AMPL

Equivalent Front Panel Command

Global Edit Commands - (AMPLITUDE)

DPUL
(Delete Pulses)

Syntax

`:SOUR:GLOB:DPUL` *pulse_number*

Item	Description	Range/Restrictions
Pulse_number	Number from which the remainder of pulses are deleted	2 to 512 for signal models 1 and 4; 2 to 113 for signal models 2, 3, 5, and 6

Description

This command deletes all pulses starting with the pulse specified to the end of the pulse train.

Example

To delete all pulses after the first one:

```
OUTPUT 719; ":SOUR:GLOB:DPUL 2"
```

Comments

You must always have at least one pulse specified. Trying to delete all pulses generates an error.

Related HP-IB Commands

Global Subsystem - TPUL

Pulse Subsystem - DPUL

Equivalent Front Panel Command

Global Edit Commands - [DELETE PULSES]

FALL (Fall Time)

Syntax

```
                       ⎡PS⎤
                       ⎢NS⎥
:SOUR:GLOB:FALL time   ⎢US⎥
                       ⎢MS⎥
                       ⎣S ⎦
```

```
:SOUR:GLOB:FALL?
```

Item	Description	Range/Restrictions
Time	Fall time	15 ns to 370 μs. Total edge time (rise + fall) must be $\leq$370 μs for a trapezoidal pulse shape and $\leq$122 μs for an exponential pulse shape.

Description

This command specifies the fall time of all pulses for signal models 1 and 4. Fall time is defined as the 90% to 10% amplitude change. It can be set only for exponential and trapezoidal pulse shapes. Rise and fall times are not specified for Gaussian and user-defined pulse shapes.

The query returns the current fall time setting in seconds.

Example

To set the fall time of all pulses to 20 ns:

```
OUTPUT 719; ":SOUR:GLOB:SMOD 1"
OUTPUT 719; ":SOUR:GLOB:PSH:TYPE TRAP"
OUTPUT 719; ":SOUR:GLOB:RIS 20 NS"
OUTPUT 719; ":SOUR:GLOB:FALL 20 NS"
```

Comments

The reset value for fall time is 17.881393432617 ns.

The rise and fall times have a 7.45 ns resolution when using the internal clock.

For signal models 2, 3, 5, and 6, pulse rise and fall times are fixed and are determined by hardware filtering. It is between 15 and 20 ns.

The rise and fall times are set to a minimum value whenever the pulse shape is changed. This is 17.88 ns for a trapezoidal pulse shape and 15.74 ns for an exponential pulse shape.

An error is generated if the total edge time (rise + fall) exceeds the pulse width or the maximum allowable edge time (370 ns).

The limit for a trapezoidal pulse shape is approximately

$$1.25(RiseTime + FallTime) \leq 460ns$$

The limit for an exponential pulse shape is approximately

$$4(RiseTime + FallTime) \leq 460ns$$

Related HP-IB Commands

Global Subsystem
PSH:TYPE
RIS
SMOD
WIDT

Pulse Subsystem
WIDT

Equivalent Front Panel Command

Global Edit Commands - [FALL]

FOFF (Frequency Offset)

Syntax

```
                      ⎡HZ ⎤
:SOUR:GLOB:FOFF offset⎢KHZ⎥
                      ⎢MHZ⎥
                      ⎣GHZ⎦
```

```
:SOUR:GLOB:FOFF?
```

Item	Description	Range/Restrictions
Offset	Frequency offset	−200 GHz to +200 GHz in 0.125 Hz steps.

Description

This command sets the constant frequency offset that is added to the carrier frequency of all pulses.

The carrier frequency plus the frequency offset of each pulse must be between the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The query returns the current setting of the frequency offset in hertz.

Example

To set the global frequency offset to 100 kHz:

```
OUTPUT 719; ":SOUR:GLOB:FOFF 100 KHZ"
```

Comments

Frequency range checking is done when the RUN command is issued.

The reset value for global frequency offset is 0 Hz.

If you want to use a frequency hop pattern, make the hop pattern before setting the frequency offset. When making a frequency hop pattern, the frequency offset is set to zero.

Related HP-IB Commands

Global Subsystem - FREQ

Pulse Subsystem - FREQ

Equivalent Front Panel Command

Global Edit Commands - F OFST

FREQ (Frequency)

Syntax

$$\texttt{:SOUR:GLOB:FREQ}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:GLOB:FREQ?
```

Item	Description	Range/Restrictions
Frequency	Carrier frequency	0 Hz to 200 GHz. Output frequency is hardware-dependent.

Description

This command sets the carrier frequency for all pulses.

The carrier frequency plus the frequency offset of each pulse must be between the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The query returns the current setting of the global carrier frequency in hertz. The returned value does not reflect any individual pulse frequencies, which may have been set with the FREQ command in the Pulse subsystem.

Example

To set the global carrier frequency to 50 MHz:

```
OUTPUT 719; ":SOUR:GLOB:FREQ 50 MHZ"
```

Comments

Frequency range checking is done when the RUN command is issued.

The reset value for global frequency is 536.870912 MHz for HP FASS Models 11 and 21, and 33.554432 MHz for HP FASS Model 7.

The frequency resolution is determined by the system clock. When the internal system clock is used, resolution is 0.125 Hz. When an external system clock is used, resolution is CLOCK/2^{30}.

This command is equivalent to making a constant hop pattern. It will alter the hop pattern parameters such that the hop pattern type is set to constant, the constant frequency is equal to the global frequency, and the global phase offset is set to 0.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - TYPE CW

Global Subsystem - FOFF

Hop Pattern Subsystem
CONS
TYPE

Pulse Subsystem - FREQ

FASS Subsystem
CEXT
CINT
CLOC?

Equivalent Front Panel Command

Global Edit Commands - (FREQUENCY)

OLEV (Output Level)

Syntax

`:SOUR:GLOB:OLEV` *level* [DBM]

`:SOUR:GLOB:OLEV?`

Item	Description	Range/Restrictions
Level	Output level	See Description, below.

Description

This command sets the output level of the system. All other levels, such as global or individual pulse amplitude, are set relative to this level. The allowable range of settings is as follows:

- HP FASS Model 7: -100 to +10 dBm in 0.1 dB steps.
- HP FASS Model 11: -107 to +22 dBm in 0.1 dB steps.
- HP FASS Model 21: -100 to +6 dBm in 0.1 dB steps.

The output level plus the amplitude must be within the valid range for the hardware model, as shown above.

The query returns the current setting of the output level in dBm.

Example

To set the output level to 0 dBm:

```
OUTPUT 719; ":SOUR:GLOB:OLEV 0 DBM"
```

Comments

The reset value for peak output level is −15 dBm.

If the pulse amplitude plus the peak output level is greater than +10 dB, the signal will be distorted.

For HP FASS Model 21 power levels greater than +6 dB, use Special Function 14.1 to set the AUC output attenuator to 0 dB. RSID does not take this into account, so the output power will be 10 dB greater than indicated in RSID. Resetting the system sets the attenuator to the default of 10 dB.

Output level accuracy is as follows:

- HP FASS Model 7: ±1 dB for signal dynamic ranges ≤40 dB; ±3 dB for signal dynamic ranges > 40 dB
- HP FASS Model 11: ±3 dB at 0 dBm (±1.0 dB for signal models 3 and 6 with internal leveling)
- HP FASS Model 21: ±2.2 dB at 0 dBm when calibrated

For HP FASS Model 11 in signal models 1, 2, 4, and 5, the cal factor is based on the frequency of the first pulse for amplitude flatness correction. All other pulses are scaled to the first pulse. For signal models 3 and 6, each pulse is corrected individually. For HP FASS Model 21, all calibration is done in hardware.

If the output level is set to 0 dBm, amplitude will effectively be in dBm rather than dB.

Related HP-IB Commands

Global Subsystem
AMPL
PSH:USER:AMIN

Pulse Subsystem
AMPL

Equivalent Front Panel Command

Global Edit Commands - RUN + Output Level

PMAR (Pulse Marker)

Syntax

`:SOUR:GLOB:PMAR` *pulse_number*

`:SOUR:GLOB:PMAR?`

Item	Description	Range/Restrictions
Pulse_number	Pulse number for marker	1 to 512 for signal models 1 and 4; 1 to 113 for signal models 2, 3, 5, and 6

Description

This command sets the pulse number for marker generation. A TTL level signal is generated at the beginning of the specified pulse each time the pulse is generated.

In order for this command to work, the FM EVENT MARKER 1 or 2 must be assigned to the Equal Address marker. (Use the :FASS:ESL command or use the SID front panel to assign the marker.) The EVENT MARKER output is available from the rear panel of the MDS. When shipped from the factory, the FM EVENT MARKER 2 is connected to the Equal Address marker of the FM sequencer in the MDS.

The query returns the current setting of the pulse marker.

Example

To generate a marker on the first pulse:

```
OUTPUT 719; ":SOUR:GLOB:PMAR 1"
```

Comments

The reset value for the pulse marker is 1.

Related HP-IB Commands

FASS Subsystem

ESEL
MARK

Equivalent Front Panel Command

Global Edit Commands - (RUN) + Pulse Marker

POFF (Phase Offset)

Syntax

`:SOUR:GLOB:POFF` *phase* [`DEG`]

`:SOUR:GLOB:POFF?`

Item	Description	Range/Restrictions
Phase	Phase offset	$-180°$ to $+180°$ in $0.1°$ steps

Description

This command sets the global phase offset that is added to the individual pulse phase offsets.

The query returns the current setting of the global phase offset in degrees.

Example

To set the global phase offset to 45°:

```
OUTPUT 719; ":SOUR:GLOB:POFF 45 DEG"
```

Comments

The reset value for the global phase offset is 0°.

This command is useful when trying to eliminate phase skew between two or more synchronized HP FASS systems. See the Synchronization subsystem for a more complete description of multi-system synchronization.

Related HP-IB Commands

Pulse Subsystem - POFF

Equivalent Front Panel Command

Global Edit Commands - [Φ OFST]

PRI (Pulse Repetition Interval)

Syntax

$$\texttt{:SOUR:GLOB:PRI}\ \textit{time} \begin{bmatrix} \texttt{PS} \\ \texttt{NS} \\ \texttt{US} \\ \texttt{MS} \\ \texttt{S} \end{bmatrix}$$

```
:SOUR:GLOB:PRI?
```

Item	Description	Range/Restrictions
Time	Global pulse repetition interval	1.58 μs to 1 second. See comments below for resolution.

Description

This command sets the PRI for all pulses.

The query returns the current global setting of the PRI in seconds. The returned value does not reflect any individual pulse PRIs that have been set with the PRI command in the Pulse subsystem.

Example

To set the global PRI to 1 ms:

```
OUTPUT 719; ":SOUR:GLOB:PRI 1 MS"
```

Comments

The reset value for the global PRI is 100.0166 μs.

If the frequency or phase modulation is CW or random phase, the PRI resolution is CLOCK/4 (29.8 ns with internal clock). If there is any other type of frequency or phase modulation in the pulse, the PRI resolution is given by N(CLOCK/4), where N is determined by the following equation:

$$N = 1 + INT[\frac{t\frac{Clock}{4}}{15724}]$$

where: INT is the integer portion of the expression
t is the pulse on time

See figure 9-3 for a definition of ontime.

The PRI must be greater than or equal to the pulse ontime plus 240 ns.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - TYPE

Global Subsystem - WIDT

Pulse Subsystem - PRI

Equivalent Front Panel Command

Global Edit Commands - (PRI)

PSH:TYPE (Pulse Shape Type)

Syntax

$$:\texttt{SOUR:GLOB:PSH:TYPE} \left\{ \begin{array}{l} \texttt{EXP} \\ \texttt{GAUS} \\ \texttt{TRAP} \\ \texttt{USER} \end{array} \right\}$$

```
:SOUR:GLOB:PSH:TYPE?
```

Description

This command selects the pulse shaping for signal models 1 and 4.

For model 1, the following pulse shapes can be selected:

- EXP (Exponential)
- GAUS (Gaussian)
- TRAP (Trapezoidal)
- USER (User-defined)

For model 4, only the following pulse shapes can be selected:

- EXP (Exponential)
- TRAP (Trapezoidal)

For exponential and trapezoidal pulse shapes, the global rise time and fall time commands are used to provide additional pulse shaping.

See figure 9-3, Programmable Pulse Shapes, for a description of each type of pulse shaping.

The query returns the currently selected pulse shape.

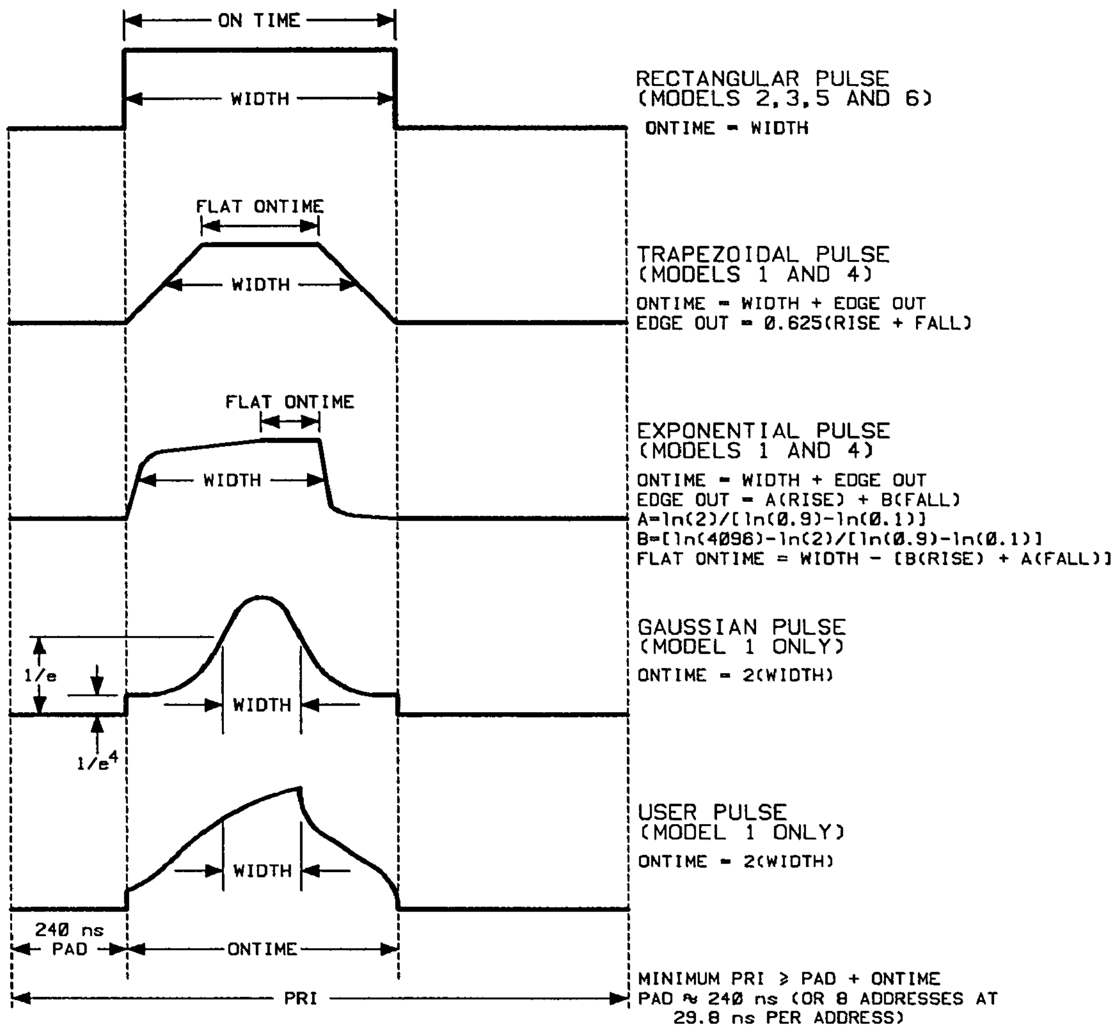


Figure 9-3. Programmable Pulse Shapes

Example

To select an exponential pulse shape:

```
OUTPUT 719; ":SOUR:GLOB:SMOD 4"
OUTPUT 719; ":SOUR:GLOB:PSH:TYPE EXP"
OUTPUT 719; ":SOUR:GLOB:RIS 2 US"
OUTPUT 719; ":SOUR:GLOB:FALL 1 US"
```

Comments

For signal models 2, 3, 5, and 6, the pulse shape is always rectangular. It cannot be changed.

The default pulse shape for signal models 1 and 4 is trapezoidal.

The rise and fall times are set to the minimum whenever pulse shapes are changes. This is 17.88 ns for a trapezoidal pulse shape and 15.74 ns for an exponential pulse shape.

The maximum pulse width for Gaussian and User-defined pulse shapes is 230 μs.

Related HP-IB Commands

Global Subsystem
FALL
PSH:USER:AMIN
PSH:USER:PATT
RIS
SMOD
WIDT

Equivalent Front Panel Command

Global Edit Commands - PULSE SHAPE + Pattern Type

PSH:USER:AMIN (Minimum Pulse Shape Amplitude)

Syntax

:SOUR:GLOB:PSH:USER:AMIN *amplitude* [DB]

:SOUR:GLOB:PSH:USER:AMIN?

Item	Description	Range/Restrictions
Amplitude	Minimum amplitude	−60 to 0 dB in 0.1 dB steps.

Description

This command sets the minimum pulse shape amplitude for a user-defined pulse shape. This amplitude is relative to the peak output level (top of pulse).

User-defined pulse shapes are available for model 1 only.

The query returns the current setting of the minimum amplitude in dB.

Example

To use a user-defined pattern named PULSEPAT.USR (assuming PULSEPAT.USR is already installed on the removable cartridge) that has a minimum Amplitude of −40 dB:

```
10  OUTPUT 719; "SOUR:GLOB:SMOD 1; PSH:TYPE USER"
20  OUTPUT 719; ":SOUR:GLOB:PSH:USER:PATT 'PULSEPAT.USR' "
30  OUTPUT 719; ":SOUR:GLOB:PSH:USER:AMIN -40 DB "
40  END
```

PSH:USER:AMIN (Minimum Pulse Shape Amplitude)

Comments

The maximum on/off ratio of the system is −60 dB.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

Related HP-IB Commands

Global Subsystem
OLEV
PSH:TYPE
PSH:USER:PATT

Equivalent Front Panel Command

Global Edit Commands - (PULSE SHAPE) + (More...) (for User Shape Pattern Type) + Minimum Amp

PSH:USER:PATT (Pulse Shape User Pattern)

Syntax

```
:SOUR:GLOB:PSH:USER:PATT 'name'
:SOUR:GLOB:PSH:USER:PATT?
```

Item	Description	Range/Restrictions
Name	Name of user-defined pattern	The pattern name must match an the name of an installed name on the removable cartridge.

Description

This command specifies the name of the user-defined pattern to be used for pulse shaping. User-defined pulse shapes are valid only for signal model 1.

The query returns the file name of the currently selected user- defined pulse shape pattern. The returned format is string data.

Example

To use a user-defined pattern named PULSEPAT.USR (assuming PULSEPAT.USR is already installed on the removable cartridge) that has a minimum amplitude of −40 dB:

```
10  OUTPUT 719; "SOUR:GLOB:SMOD 1; PSH:TYPE USER"
20  OUTPUT 719; ":SOUR:GLOB:PSH:USER:PATT 'PULSEPAT.USR' "
30  OUTPUT 719; ":SOUR:GLOB:PSH:USER:AMIN -40 DB "
40  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

User-defined patterns are installed on the removable cartridge over the HP-IB using the :SID:TEXT command.

The actual on-time of a user-defined pulse shape is equal to twice the pulse width.

Related HP-IB Commands

Global Subsystem
PSH:TYPE
PSH:USER:AMIN

Equivalent Front Panel Command

Global Edit Commands - (PULSE SHAPE) + (More...) (for User Shape Pattern Type) + (Select User Pattern)

RIS (Rise Time)

Syntax

```
                           ┌PS┐
                           │NS│
:SOUR:GLOB:RIS time        │US│
                           │MS│
                           └S ┘
```

```
:SOUR:GLOB:RIS?
```

Item	Description	Range/Restrictions
Time	Rise time	15 ns to 370 μs. Total edge time (rise + fall) must be $\leq$370 μs for a trapezoidal pulse shape and $\leq$122 μs for an exponential pulse shape.

Description

This command specifies the rise time of all pulses for signal models 1 and 4. Rise time is defined as the 10% to 90% amplitude change. It is entered only for exponential and trapezoidal pulse shapes. Rise and fall time is not specified for Gaussian and user defined pulse shapes.

The query returns the current rise time setting in seconds.

Example

To set the rise time of all pulses to 20 ns:

```
OUTPUT 719; ":SOUR:GLOB:SMOD 1"
OUTPUT 719; ":SOUR:GLOB:PSH:TYPE EXP"
OUTPUT 719; ":SOUR:GLOB:RIS 20 NS"
OUTPUT 719; ":SOUR:GLOB:FALL 20 NS"
```

Comments

The reset value for fall time is 17.881393432617 ns.

The rise and fall times have a 7.45 ns resolution when using the internal clock.

For signal models 2, 3, 5, and 6, pulse rise and fall times are fixed and are determined by hardware filtering. It is between 15 and 20 ns.

The rise and fall times are set to a minimum value whenever the pulse shape is changed. This is 17.88 ns for a trapezoidal pulse shape and 15.74 ns for an exponential pulse shape.

An error is generated if the total edge time (rise + fall) exceeds the pulse width or the maximum allowable edge time (370 ns).

The limit for a trapezoidal pulse shape is approximately

$$1.25(RiseTime + FallTime) \leq 460ns$$

The limit for an exponential pulse shape is approximately

$$4(RiseTime + FallTime) \leq 460ns$$

Related HP-IB Commands

Global Subsystem
FALL
PSH:TYPE
SMOD
WIDT

Pulse Subsystem
WIDT

Equivalent Front Panel Command

Global Edit Commands - RISE

RUN

Syntax

```
:SOUR:GLOB:RUN
```

Description

This command generates a signal based on the current RSID software settings. The RUN command starts system calculations, downloads the calculated binary data to the hardware, and generates the defined RF signal.

Example

To generate a signal:

```
OUTPUT 719; "SOUR:GLOB:RUN"
```

Comments

The output level and trigger mode must be set prior to selecting the RUN command. Otherwise, the output signal will not be correct. If the *RST command has been issued or signal models have changed since the last time the RUN command was issued, output level and trigger mode are reset to default values. Output level is reset to −15 dBm and trigger mode is reset to free run.

Related HP-IB Commands

Global Subsystem - OLEV

Trigger Subsystem - INIT

Equivalent Front Panel Command

Global Edit Commands - RUN

SMOD (Signal Model)

Syntax

`:SOUR:GLOB:SMOD` *number*

`:SOUR:GLOB:SMOD?`

Item	Description	Range/Restrictions
Number	Signal model number	1-6

Description

This command selects the signal model. Only one model can be active at a time. The following signal models can be selected:

- 1 (Pulse Shape/Constant Pulse Width) - allows you to select different pulse shapes.
- 2 (Antenna Scan Modulation/Constant Pulse Width) - allows you to select different antenna modulation patterns.
- 3 (Individual Pulse Amplitude/Constant Pulse Width) - allows you to control the amplitude of the individual pulses.
- 4 (Pulse Shape/Individual Pulse Width) - similar to model 1 except that the intrapulse modulation can be turned on and off and the pulse width can be modified on a pulse by pulse basis.
- 5 (Antenna Scan Modulation/Individual Pulse Width) - similar to model 2 except that the intrapulse modulation can be turned on and off and the pulse width can be modified on a pulse by pulse basis.
- 6 (Individual Pulse Amplitude/Individual Pulse Width) - similar to model 3 except that the intrapulse

modulation can be turned on and off and the pulse width can be modified on a pulse by pulse basis.

Note

Changing signal models initializes the signal parameters to their reset values (except when Special Function 55.1 is enabled). See the *RST command in chapter 4 for a complete list of reset conditions.

The query returns the currently selected signal model number.

Example

To select antenna scan modulation with individual pulse width:

```
OUTPUT 719; ":SOUR:GLOB:SMOD 5"
```

Comments

The reset value for signal model is 1.

Related HP-IB Commands

Common Commands
*RST

Antenna Modulation Subsystem
all commands

Global Subsystem
AMPL
PSH:TYPE
PSH:USER:AMIN
PSH:USER:PATT

Pulse Subsystem all commands

Equivalent Front Panel Command

Global Edit and Pulse Edit Commands - SIGNAL MODEL

TPUL
(Total Pulses)

Syntax

`:SOUR:GLOB:TPUL` *number*

`:SOUR:GLOB:TPUL?`

Item	Description	Range/Restrictions
Number	Total number of pulses	1 to 512 for signal models 1 and 4; 1 to 113 for signal models 2, 3, 5, and 6

Description

This command sets the total number of individual pulses in the pulse train.

The query returns the current setting for the number of individual pulses.

Example

To create 100 pulses:

```
OUTPUT 719; ":SOUR:GLOB:TPUL 100"
```

Comments

The reset value for the total number of pulses is 1.

This command creates as many pulses as you specify. If you increase the total number of pulses, the last pulse is duplicated until the pulse train contains the specified number of pulses. If you decrease the number of pulses, pulses are deleted from the end of the pulse train.

Each individual pulse may have its own unique carrier frequency, PRI, phase offset, width (models 4, 5, and 6 only) and amplitude (models 3 and 6 only).

Related HP-IB Commands

Global Subsystem - DPUL

Equivalent Front Panel Command

Global Edit Commands - [TOTAL PULSES]

WIDT (Pulse Width)

Syntax

```
:SOUR:GLOB:WIDT width [PS|NS|US|MS|S]
```

```
:SOUR:GLOB:WIDT?
```

Item	Description	Range/Restrictions
Width	Pulse width	20 ns to 105 ms, depending on pulse shape. See comments below.

Description

This command sets the pulse width for all pulses. Width is defined as the time between the 50% amplitude points of the rising and falling edges of the pulse (see figure 9-3).

The query returns the current global setting for the pulse width in seconds. For models 4, 5, and 6, the returned values doe not reflect any individual pulse widths that may have been set with the WIDT command in the Pulse subsystem.

Example

To select a global pulse width of 10 μs:

```
OUTPUT 719; ":SOUR:GLOB:WIDT 10 US"
```

Comments

The reset value for pulse width is 5.0142 μs.

Minimum pulse width is 20 ns for trapezoidal, Gaussian, and user-defined pulse shapes. The minimum pulse width for an exponential pulse shape is 60 ns.

The minimum pulse width that can be entered is 20 ns, but this value is rounded to the closest value that can actually be produced by the hardware. With the internal clock (134 MHz), the minimum pulse width is 29.8 ns.

The maximum pulse width for Gaussian and user pulse shapes is 230 μs, otherwise the maximum pulse width is 105 ms.

An error is generated if the total edge time (rise + fall) exceeds the pulse width.

Pulse width for an exponential pulse shape must be at least four times the total edge time.

For models 4, 5, and 6, this command overrides any individual pulse width settings that may have been previously set and turns the intrapulse modulation on for all pulses.

Related HP-IB Commands

Global Subsystem
FALL
PSH:TYPE
RIS

Pulse Subsystem
WIDT

Equivalent Front Panel Command

Global Edit Commands - WIDTH

10

Hop Patterns Subsystem

Introduction

The commands in this subsystem are used to create frequency hop patterns for all signal models. The commands in this subsystem correspond to the commands in the Hop Pattern dialog box, which is accessed by the Global Edit command (HOP PATTERNS). A pictorial description of the available hop patterns can be found in the TYPE command.

To create a hop pattern, you should execute functions in the order shown in the flowchart in figure 10-1. Note that your PRI pattern should be made prior to creating a hop pattern. Prior to executing hop pattern commands, be sure to set the total number of pulses (:SOUR:GLOB:TPUL) needed to make the pattern being defined.

Note

Data returned in response to a query is valid only for parameters of the currently selected hop pattern.

The commands BURS:FRE3, BURS:FRE4, BURS:FRE5, and BURS:FRE6 are not described separately because their operation is identical to BURS:FRE2.

Figure 10-2 shows the syntax diagram for the hop pattern commands.

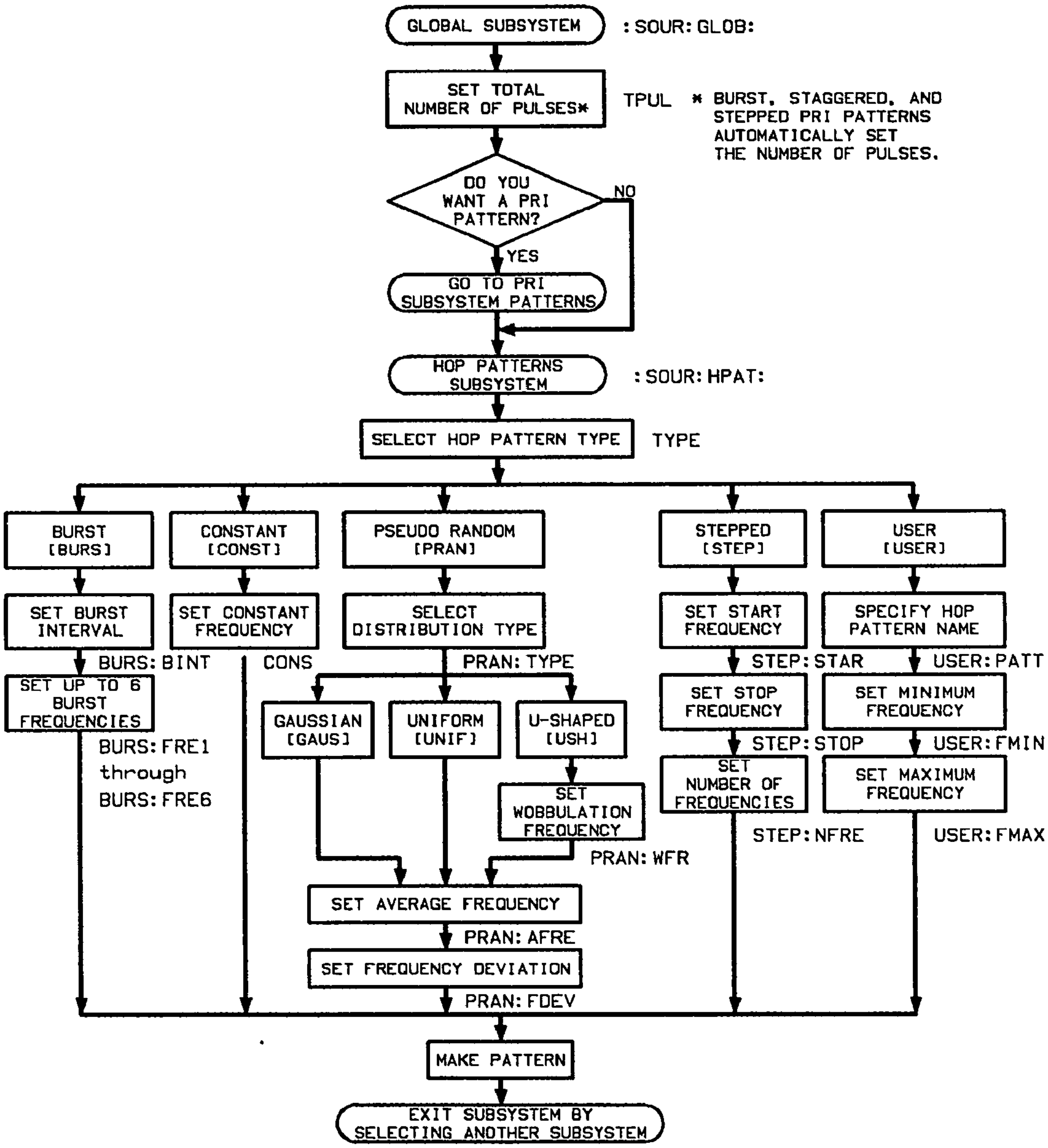


Figure 10-1. Hop Patterns Subsystem Flowchart

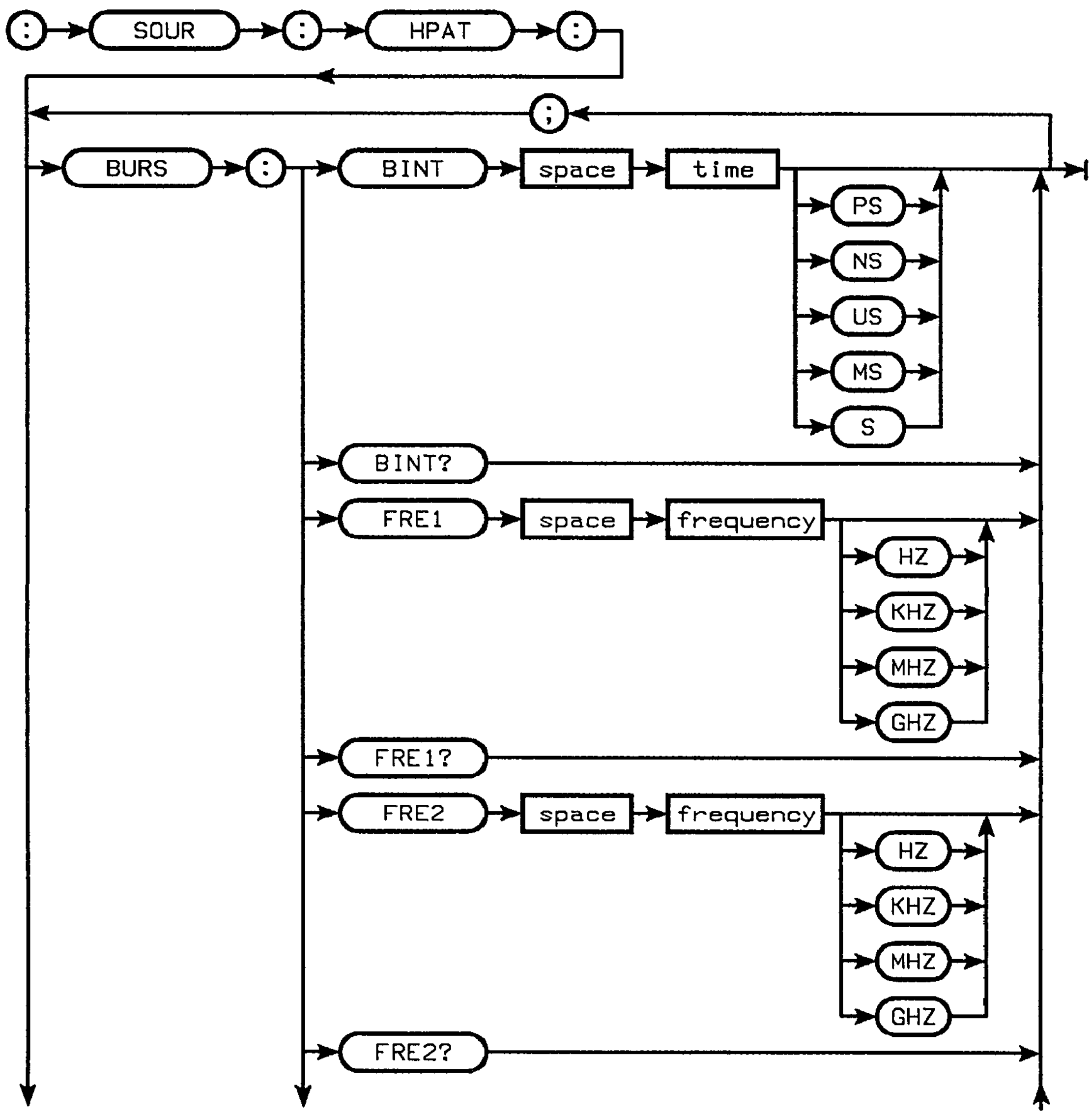


Figure 10-2. Hop Patterns Syntax Diagram

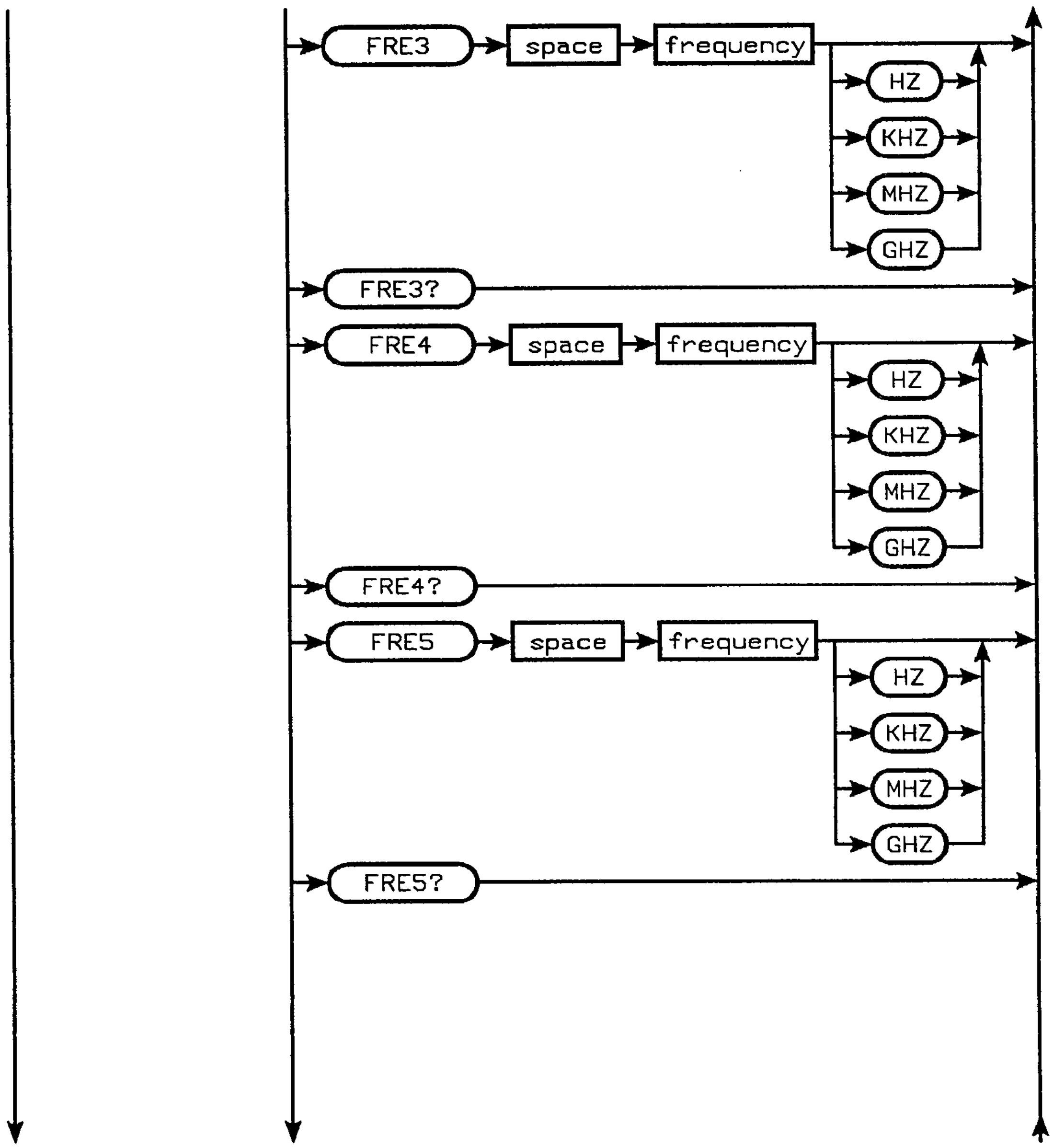


Figure 10-2. Hop Patterns Syntax Diagram (continued)

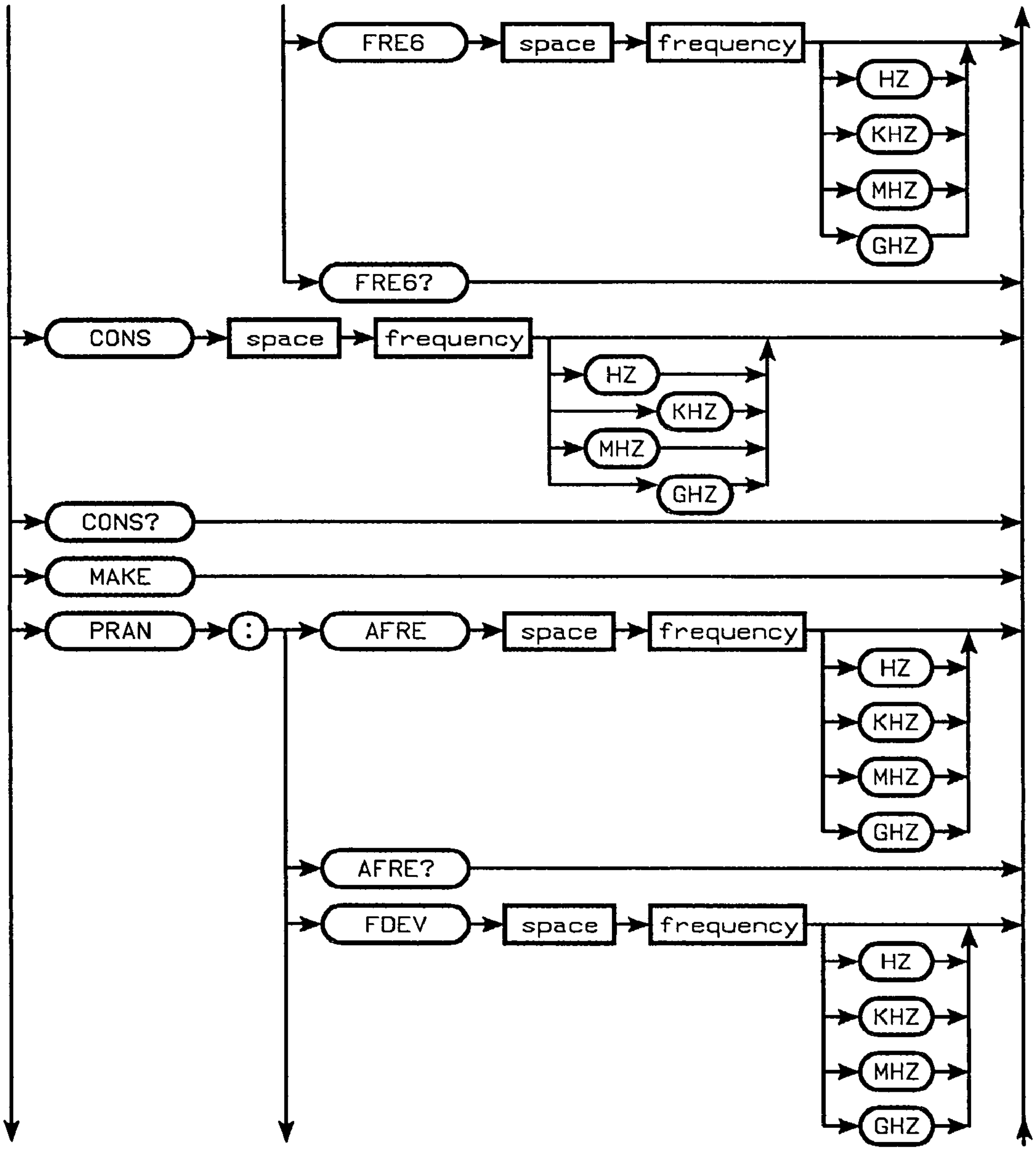


Figure 10-2. Hop Patterns Syntax Diagram (continued)

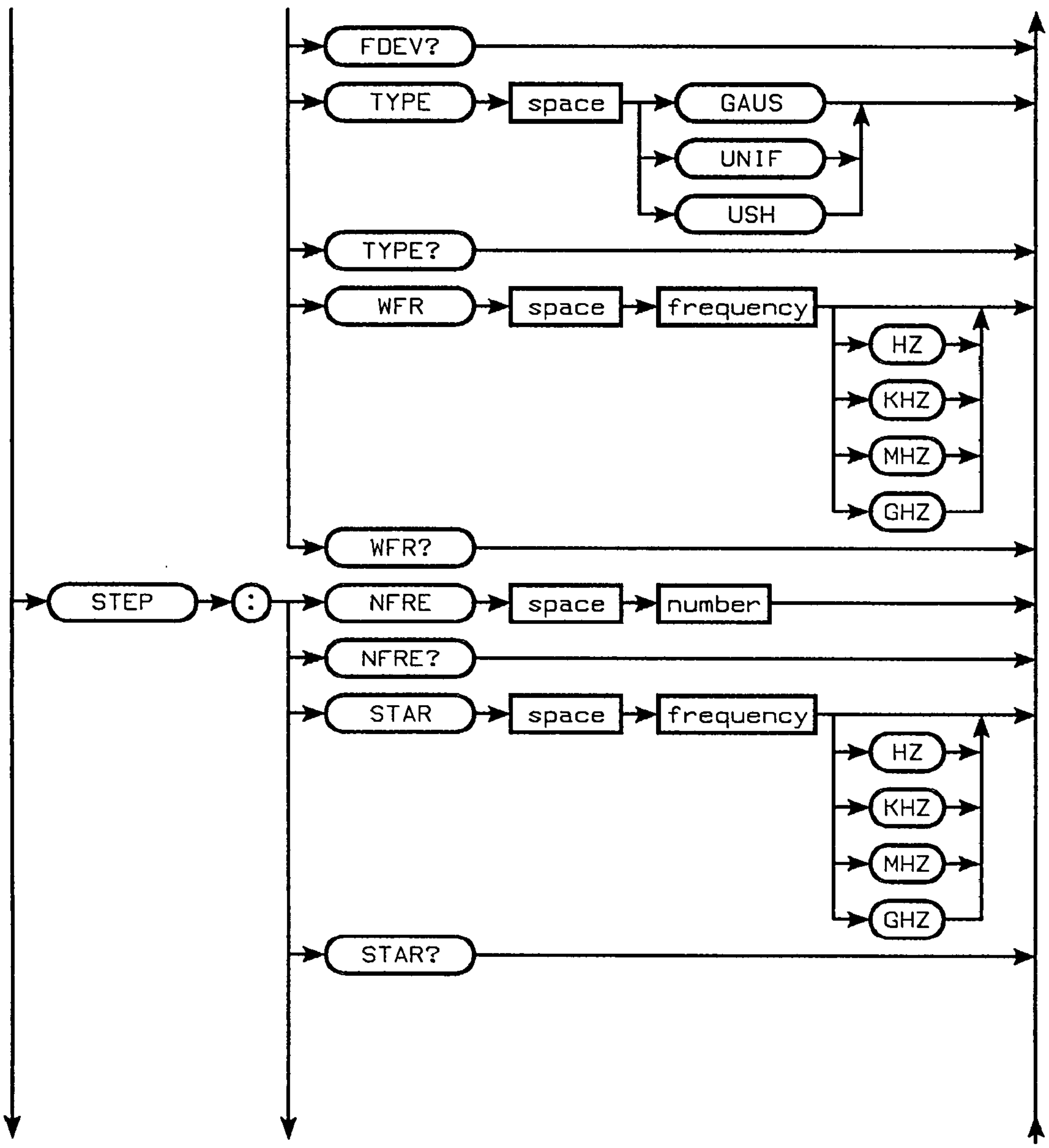


Figure 10-2. Hop Patterns Syntax Diagram (continued)

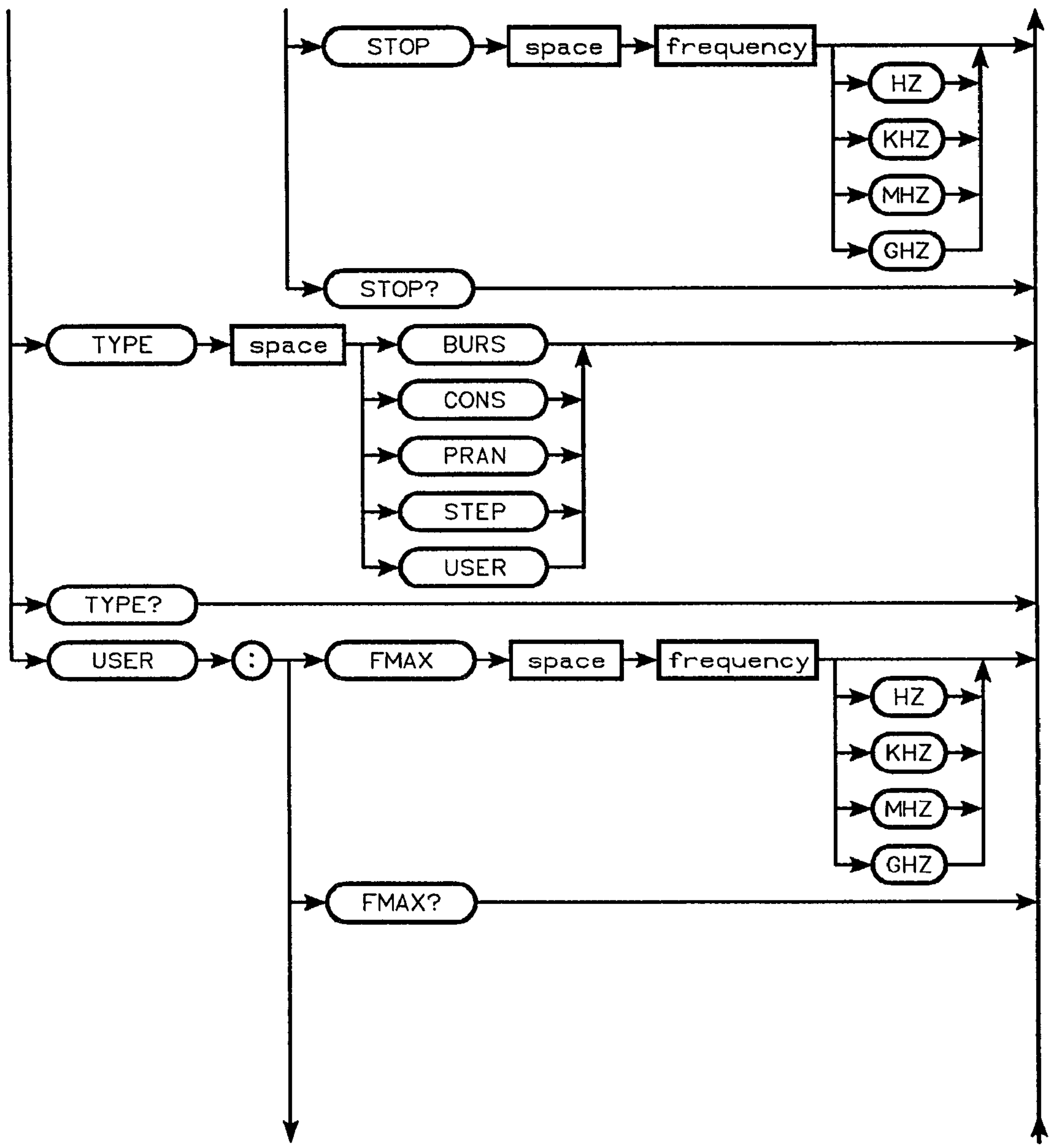


Figure 10-2. Hop Patterns Syntax Diagram (continued)

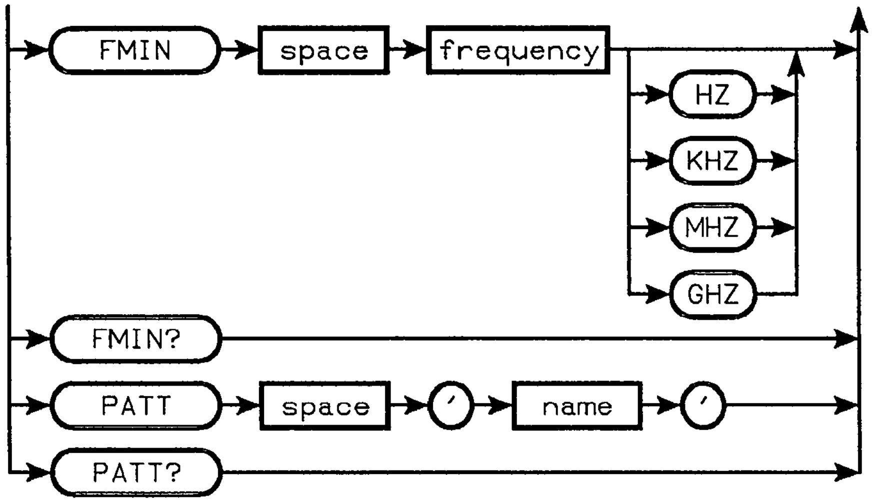


Figure 10-2. Hop Patterns Syntax Diagram (continued)

BURS:BINT (Burst Interval)

Syntax

$$:\mathrm{SOUR{:}HPAT{:}BURS{:}BINT}\ \mathit{time} \begin{bmatrix} \mathrm{PS} \\ \mathrm{NS} \\ \mathrm{US} \\ \mathrm{MS} \\ \mathrm{S} \end{bmatrix}$$

```
:SOUR:HPAT:BURS:BINT?
```

Item	Description	Range/Restrictions
Time	Burst interval	1.58 μs to 512 seconds

Description

This command sets the frequency burst interval. The burst interval is the dwell time of a given frequency.

The query returns the current setting of the burst interval in seconds.

Example

To create a burst hop pattern with a burst interval of 200 μs:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 9"
20  OUTPUT 719; ":SOUR:GLOB:PRI 100 MS"
30  OUTPUT 719; ":SOUR:HPAT:TYPE BURS"
40  OUTPUT 719; ":SOUR:HPAT:BURS:BINT 200 MS"
50  OUTPUT 719; ":SOUR:HPAT:BURS:FRE1 10 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:BURS:FRE2 25 MHZ"
70  OUTPUT 719; ":SOUR:HPAT:BURS:FRE3 50 MHZ"
80  OUTPUT 719; ":SOUR:HPAT:MAKE"
90  END
```

Comments

If you are going to use a PRI pattern, be sure to define that pattern first because the frequency burst interval is tied to the individual pulse PRIs. If the PRI pattern is also a burst, you may want to specify identical burst intervals for both the hop pattern and the PRI pattern because the frequency interval is based on the PRI spacing.

If you make a burst PRI pattern and then select a burst hop pattern, the frequency burst interval will be set equal to the PRI burst interval.

The hop pattern is not made if there is an insufficient total number of pulses or an insufficient total signal period.

Related HP-IB Commands

Global Subsystem
PRI
TPUL

Hop Patterns Subsystem
BURS:FRE1
BURS:FRE2
TYPE
MAKE

PRI Subsystem
BURS:BINT

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Burst Pattern Type)+ Burst Interval

BURS:FRE1 (Burst Frequency 1)

Syntax

```
:SOUR:HPAT:BURS:FRE1 frequency [HZ | KHZ | MHZ | GHZ]
```

```
:SOUR:HPAT:BURS:FRE1?
```

Item	Description	Range/Restrictions
Frequency	Burst frequency	0 Hz to 200 GHz in 0.125 Hz steps. Output frequency is hardware-dependent.

Description

This command sets the first frequency of a burst hop pattern. The number of pulses generated at this frequency is determined by the actual PRI spacing and the frequency burst interval.

The query returns the current setting of the first burst frequency in Hz.

Example

To create a burst hop pattern with the first burst frequency set to 10 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 9"
20  OUTPUT 719; ":SOUR:GLOB:PRI 100 MS"
30  OUTPUT 719; ":SOUR:HPAT:TYPE BURS"
40  OUTPUT 719; ":SOUR:HPAT:BURS:BINT 200 MS"
50  OUTPUT 719; ":SOUR:HPAT:BURS:FRE1 10 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:BURS:FRE2 25 MHZ"
70  OUTPUT 719; ":SOUR:HPAT:BURS:FRE3 50 MHZ"
```

```
80  OUTPUT 719; ":SOUR:HPAT:MAKE"
90  END
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

When this command is executed, parameter range checking is done under the assumption that the global frequency offset is set to 0. When a pattern is made, the global frequency offset is reset to 0. If a hop pattern is not made, the frequency offset remains unchanged.

BURS:FRE1 must be a valid frequency. BURS:FRE2 through BURS:FRE6 can be valid frequencies or they can be set to zero. When a burst pattern is made, frequencies set to zero are ignored. The pattern does not leave gaps for frequencies that are set to zero.

Related HP-IB Commands

Global Subsystem
PRI
TPUL

Hop Patterns Subsystem
BURS:BINT
BURS:FRE2
TYPE
MAKE

PRI Subsystem
BURS:BINT

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Burst Pattern Type)+ Frequency 1

BURS:FRE2 (Burst Frequency 2)

Syntax

`:SOUR:HPAT:BURS:FRE2` *frequency* [HZ | KHZ | MHZ | GHZ]

`:SOUR:HPAT:BURS:FRE2?`

Item	Description	Range/Restrictions
Frequency	Burst frequency	0 Hz to 200 GHz in 0.125 Hz steps. Output frequency is hardware-dependent.

Note

The commands BURS:FRE3, BURS:FRE4, BURS:FRE5, and BURS:FRE6 are not described separately because their operation is identical to BURS:FRE2. The syntax for these commands is shown in figure 10-2.

Description

This command sets the second frequency of a burst hop pattern. The number of pulses generated at this frequency is determined by the actual PRI spacing and the frequency burst interval.

The query returns the current setting of the second burst frequency in Hz.

Example

To create a burst hop pattern with the second group burst frequency set to 25 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 9"
20  OUTPUT 719; ":SOUR:GLOB:PRI 100 MS"
30  OUTPUT 719; ":SOUR:HPAT:TYPE BURS"
40  OUTPUT 719; ":SOUR:HPAT:BURS:BINT 200 MS"
50  OUTPUT 719; ":SOUR:HPAT:BURS:FRE1 10 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:BURS:FRE2 25 MHZ"
70  OUTPUT 719; ":SOUR:HPAT:BURS:FRE3 50 MHZ"
80  OUTPUT 719; ":SOUR:HPAT:MAKE"
90  END
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

When this command is executed, parameter range checking is done under the assumption that the global frequency offset is set to 0. When a pattern is made, the global frequency offset is reset to 0. If a hop pattern is not made, the frequency offset remains unchanged.

BURS:FRE1 must be a valid frequency. BURS:FRE2 through BURS:FRE6 can be valid frequencies or they can be set to zero. When a burst pattern is made, frequencies set to zero are ignored. The pattern does not leave gaps for frequencies that are set to zero.

Related HP-IB Commands

Global Subsystem
PRI
TPUL

Hop Patterns Subsystem
BURS:BINT
BURS:FRE1
TYPE
MAKE

PRI Subsystem
BURS:BINT

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Burst Pattern Type)+ Frequency 2

CONS (Constant Frequency)

Syntax

```
:SOUR:HPAT:CONS frequency [HZ | KHZ | MHZ | GHZ]

:SOUR:HPAT:CONS?
```

Item	Description	Range/Restrictions
Frequency	Constant frequency	0 Hz to 200 GHz in 0.125 Hz. Output frequency is hardware-dependent. steps

Description

This command sets the frequency of all pulses to a constant frequency. This command is equivalent to the global frequency command (:SOUR:GLOB:FREQ).

The query returns the current setting of the constant frequency in Hz. This may not represent the actual frequency of the signal if the pattern has not been made.

Example

To make a constant frequency hop pattern of 20 MHz:

```
OUTPUT 719; ":SOUR:HPAT:TYPE CONS"
OUTPUT 719; ":SOUR:HPAT:CONS 20 MHZ"
OUTPUT 719; ":SOUR:HPAT:MAKE
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The default value for the constant frequency is the current global frequency setting.

When a hop pattern is made, the global frequency offset is reset to 0. If the hop pattern is not made, the frequency offset is not changed.

Resetting the system sets the hop pattern type to CONS and sets the constant frequency to 536.870912 MHz for HP FASS Models 11 and 21 and to 33.554432 MHz for HP FASS Model 7.

Related HP-IB Commands

Global Subsystem
FREQ

Hop Patterns Subsystem
MAKE
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Constant Pattern Type)+ Global Frequency

MAKE (Make Pattern)

Syntax

```
:SOUR:HPAT:MAKE
```

Description

This command makes a carrier frequency hop pattern of the specified pattern type, setting new carrier frequencies for each pulse.

Example

To make a constant frequency hop pattern of 20 MHz:

```
OUTPUT 719; ":SOUR:HPAT:TYPE CONS"
OUTPUT 719; ":SOUR:HPAT:CONS 20 MHZ"
OUTPUT 719; ":SOUR:HPAT:MAKE
```

Comments

Error checking of parameter interactions is done when a pattern is made.

Setting hop pattern parameters does not affect the ID settings until the hop pattern is made.

Making a hop pattern causes the global frequency offset to be reset to 0. Therefore, you should make the pattern before setting any frequency offsets for individual pulses.

Prior to making a hop pattern, be sure to set the total number of pulses for the pattern you are creating. The defined hop pattern may not be made correctly if an insufficient number of pulses are available.

Related HP-IB Commands

Hop Patterns Subsystem - TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - [MAKE PATTERN]

PRAN:AFRE (Pseudo-Random Average Frequency)

Syntax

$$\texttt{:SOUR:HPAT:PRAN:AFRE}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:HPAT:PRAN:AFRE?
```

Item	Description	Range/Restrictions
Frequency	Average frequency	0 Hz to 200 GHz in 0.125 Hz steps; output frequency is hardware-dependent.

Description

This command sets the average frequency for a pseudo-random hop pattern.

The average frequency plus the frequency deviation plus the frequency offset for each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The query returns the current setting of the average frequency in Hz.

PRAN:AFRE (Pseudo-Random Average Frequency)

Example

To create a frequency hop pattern with a U-shaped frequency distribution, an average frequency of 2 GHz, a peak frequency deviation of 200 MHz, and a wobbulation rate of 1 kHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:GLOB:PRI 10 US"
30  OUTPUT 719; ":SOUR:GLOB:WIDT 3 US"
40  OUTPUT 719; ":SOUR:HPAT:TYPE PRAN"
50  OUTPUT 719; ":SOUR:HPAT:PRAN:TYPE USH"
60  OUTPUT 719; ":SOUR:HPAT:PRAN:WFR 1 KHZ"
70  OUTPUT 719; ":SOUR:HPAT:PRAN:AFRE 2 GHZ"
80  OUTPUT 719; ":SOUR:HPAT:PRAN:FDEV 200 MHZ"
90  OUTPUT 719; ":SOUR:HPAT:MAKE"
100 END
```

Comments

The default value for average frequency is the current global frequency setting.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
PRAN:FDEV
PRAN:TYPE
PRAN:WFR
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - [More...] (for Pseudo-Random Pattern Type) + Average Frequency

PRAN:FDEV (Pseudo-Random Frequency Deviation)

Syntax

:SOUR:HPAT:PRAN:FDEV *frequency* [HZ | KHZ | MHZ | GHZ]

:SOUR:HPAT:PRAN:FDEV?

Item	Description	Range/Restrictions
Frequency	Frequency deviation	−200 GHz to +200 GHz in 0.125 Hz steps

Description

This command sets the peak frequency deviation for a pseudo-random hop pattern.

The average frequency plus the frequency deviation plus the frequency offset for each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The query returns the current setting of the frequency deviation in Hz.

Example

To create a frequency hop pattern with a U-shaped frequency distribution, an average frequency of 2 GHz, a peak frequency deviation of 200 MHz, and a wobbulation rate of 1 kHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:GLOB:PRI 10 US"
30  OUTPUT 719; ":SOUR:GLOB:WIDT 3 US"
40  OUTPUT 719; ":SOUR:HPAT:TYPE PRAN"
50  OUTPUT 719; ":SOUR:HPAT:PRAN:TYPE USH"
60  OUTPUT 719; ":SOUR:HPAT:PRAN:WFR 1 KHZ"
70  OUTPUT 719; ":SOUR:HPAT:PRAN:AFRE 2 GHZ"
80  OUTPUT 719; ":SOUR:HPAT:PRAN:FDEV 200 MHZ"
90  OUTPUT 719; ":SOUR:HPAT:MAKE"
100 END
```

Comments

The default setting for frequency deviation is 20 MHz.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
PRAN:AFRE
PRAN:TYPE
PRAN:WFR
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Pseudo-Random Pattern Type) + Frequency Deviation

PRAN:TYPE (Pseudo-Random Distribution Type)

Syntax

```
                        ⎧ GAUS ⎫
:SOUR:HPAT:PRAN:TYPE    ⎨ UNIF ⎬
                        ⎩ USH  ⎭
```

```
:SOUR:HPAT:PRAN:TYPE?
```

Description

This command selects the pseudo-random hop pattern distribution type. The following types can be selected:

- GAUS - specifies a Gaussian pseudo-random frequency distribution
- UNIF - specifies a uniform pseudo-random frequency distribution
- USH - specifies a U-shaped (sinusoidal) pseudo-random frequency distribution

The query returns the currently selected pseudo-random distribution type. The returned format is character data.

Example

To create a frequency hop pattern with a U-shaped frequency distribution, an average frequency of 2 GHz, a peak frequency deviation of 200 MHz, and a wobbulation rate of 1 kHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:GLOB:PRI 10 US"
30  OUTPUT 719; ":SOUR:GLOB:WIDT 3 US"
40  OUTPUT 71'9; ":SOUR:HPAT:TYPE PRAN"
50  OUTPUT 719; ":SOUR:HPAT:PRAN:TYPE USH"
60  OUTPUT 719; ":SOUR:HPAT:PRAN:WFR 1 KHZ"
70  OUTPUT 719; ":SOUR:HPAT:PRAN:AFRE 2 GHZ"
80  OUTPUT 719; ":SOUR:HPAT:PRAN:FDEV 200 MHZ"
```

```
90  OUTPUT 719; ":SOUR:HPAT:MAKE"
100 END
```

Comments

When the hop pattern is made, the carrier frequency of each pulse is set according to the selected distribution type. The distribution of frequencies is repeatable each time the hop pattern is made and is also repeatable from one HP FASS system to another.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
PRAN:AFRE
PRAN:FDEV
PRAN:WFR
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Pseudo-Random Pattern Type) + Pattern Type

PRAN:WFR (Pseudo-Random Wobbulation Frequency)

Syntax

:SOUR:HPAT:PRAN:WFR *frequency* [HZ | KHZ | MHZ | GHZ]

:SOUR:HPAT:PRAN:WFR?

Item	Description	Range/Restrictions
Frequency	Wobbulation frequency	0 to 200 kHz

Description

This command sets the wobbulation frequency for a U-shaped pseudo-random hop pattern.

The query returns the current setting of the wobbulation frequency in Hz.

Example

To create a frequency hop pattern with a U-shaped frequency distribution, an average frequency of 2 GHz, a peak frequency deviation of 200 MHz, and a wobbulation rate of 1 kHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:GLOB:PRI 10 US"
30  OUTPUT 719; ":SOUR:GLOB:WIDT 3 US"
40  OUTPUT 719; ":SOUR:HPAT:TYPE PRAN"
50  OUTPUT 719; ":SOUR:HPAT:PRAN:TYPE USH"
60  OUTPUT 719; ":SOUR:HPAT:PRAN:WFR 1 KHZ"
70  OUTPUT 719; ":SOUR:HPAT:PRAN:AFRE 2 GHZ"
```

```
80  OUTPUT 719; ":SOUR:HPAT:PRAN:FDEV 200 MHZ"
90  OUTPUT 719; ":SOUR:HPAT:MAKE"
100 END
```

Comments

The resolution of the wobbulation frequency is equal to the reciprocal of the total signal period. The wobbulation frequency you specify will automatically be rounded to the nearest integer multiple of this base frequency.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
PRAN:AFRE
PRAN:FDEV
PRAN:TYPE
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - [More...] (for Pseudo-Random Pattern Type) + Wobbulation Frequency

STEP:NFRE (Stepped Number of Frequencies)

Syntax

```
:SOUR:HPAT:STEP:NFRE number
```

```
:SOUR:HPAT:STEP:NFRE?
```

Item	Description	Range/Restrictions
Number	Number of frequencies	1 to 512 for signal models 1 and 4; 1 to 113 for signal models 2, 3, 5, and 6

Description

This command sets the number of frequencies for a stepped hop pattern.

The query returns the current setting of the number of frequencies for a stepped hop pattern.

Example

To make a stepped frequency hop pattern of 10 frequencies starting at 10 MHz and stopping at 19 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:HPAT:TYPE STEP"
30  OUTPUT 719; ":SOUR:HPAT:STEP:NFRE 10"
40  OUTPUT 719; ":SOUR:HPAT:STEP:STAR 10 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:STEP:STOP 19 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:MAKE"
70  END
```

Comments

You need a pulse for every step or integer multiple of steps. (Total number of pulses/number of steps must be an integer.) For example, if the total number of pulses in the above example were 20, there would be 2 pulses at each frequency.

Related HP-IB Commands

Global Subsystem
TPUL

Hop Patterns Subsystem
MAKE
STEP:STAR
STEP:STOP
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Stepped Pattern Type) + Number of Frequencies

STEP:STAR (Stepped Start Frequency)

Syntax

$$:\mathtt{SOUR:HPAT:STEP:STAR}\ \textit{frequency} \begin{bmatrix} \mathtt{HZ} \\ \mathtt{KHZ} \\ \mathtt{MHZ} \\ \mathtt{GHZ} \end{bmatrix}$$

`:SOUR:HPAT:STEP:STAR?`

Item	Description	Range/Restrictions
Frequency	Start frequency	0 Hz to 200 GHz; output frequency is hardware-dependent

Description

This command sets the start frequency for a stepped hop pattern.

The query returns the current setting of the start frequency for a stepped hop pattern in Hz.

Example

To make a stepped frequency hop pattern of 10 frequencies starting at 10 MHz and stopping at 19 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:HPAT:TYPE STEP"
30  OUTPUT 719; ":SOUR:HPAT:STEP:NFRE 10"
40  OUTPUT 719; ":SOUR:HPAT:STEP:STAR 10 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:STEP:STOP 19 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:MAKE"
70  END
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

To reverse the direction of the frequency change, make the start frequency larger than the stop frequency.

Related HP-IB Commands

Global Subsystem
TPUL

Hop Patterns Subsystem
MAKE
STEP:NFRE
STEP:STOP
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Stepped Pattern Type) + Start Frequency

STEP:STOP (Stepped Stop Frequency)

Syntax

```
:SOUR:HPAT:STEP:STOP frequency [HZ | KHZ | MHZ | GHZ]
```

```
:SOUR:HPAT:STEP:STOP?
```

Item	Description	Range/Restrictions
Frequency	Stop frequency	0 Hz to 200 GHz. Output frequency is hardware-dependent.

Description

This command sets the stop frequency for a stepped pattern.

The query returns the current setting of the stop frequency in Hz for a stepped hop pattern.

Example

To make a stepped frequency hop pattern of 10 frequencies starting at 10 MHz and stopping at 19 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:HPAT:TYPE STEP"
30  OUTPUT 719; ":SOUR:HPAT:STEP:NFRE 10"
40  OUTPUT 719; ":SOUR:HPAT:STEP:STAR 10 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:STEP:STOP 19 MHZ"
60  OUTPUT 719; ":SOUR:HPAT:MAKE"
70  END
```

STEP:STOP (Stepped Stop Frequency)

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

To reverse the direction of the frequency change, make the stop frequency smaller than the start frequency.

Related HP-IB Commands

Global Subsystem
TPUL

Hop Patterns Subsystem
MAKE
STEP:NFRE
STEP:STAR
TYPE

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for Stepped Pattern Type) + Stop Frequency

TYPE (Hop Pattern Type)

Syntax

$$:SOUR:HPAT:TYPE \left\{ \begin{array}{l} BURS \\ CONS \\ PRAN \\ STEP \\ USER \end{array} \right\}$$

:SOUR:HPAT:TYPE?

Description

This command selects the frequency hop pattern type. The following patterns can be selected:

- BURS (Burst)
- CONS (Constant)
- PRAN (Pseudo-Random)
- STEP (Stepped)
- USER (User-defined)

The query returns the currently selected frequency hop pattern type.

See figures 10-3 through 10-7 for examples of available hop pattern types.

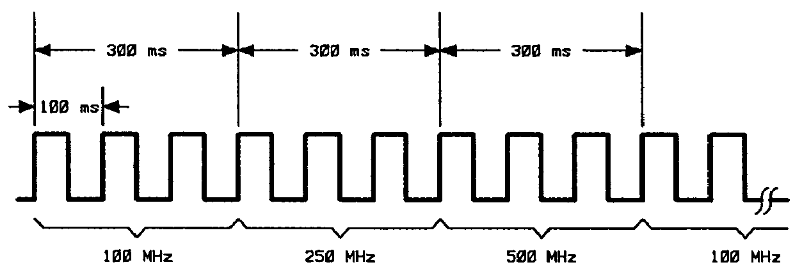


Figure 10-3. Typical Burst Frequency Hop Pattern

TYPE (Hop Pattern Type)

Figure 10-4. Typical Constant Frequency Hop Pattern

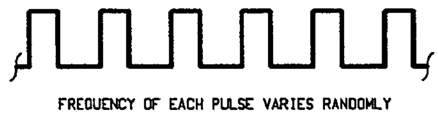


Figure 10-5. Typical Pseudo-Random Frequency Hop Pattern

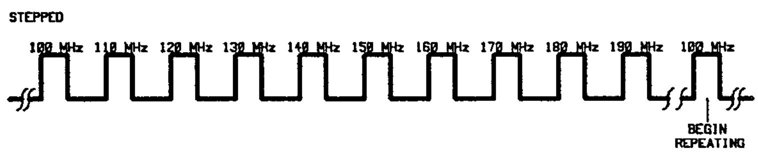


Figure 10-6. Typical Stepped Frequency Hop Pattern

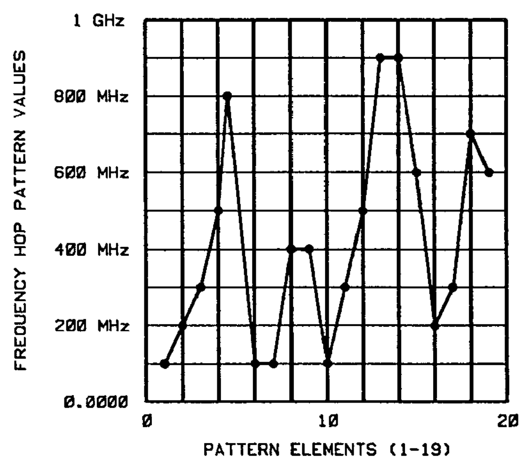


Figure 10-7. Typical User-Defined Frequency Hop Pattern

Example

To make a constant frequency hop pattern of 20 MHz:

```
OUTPUT 719; ":SOUR:HPAT:TYPE CONS"
OUTPUT 719; ":SOUR:HPAT:CONS 20 MHZ"
OUTPUT 719; ":SOUR:HPAT:MAKE
```

Comments

The default hop pattern type is constant with a frequency of 536.870912 MHz for HP FASS Models 11 and 21 and 33.554432 MHz for HP FASS Model 7.

Uniform is the default distribution type upon selecting pseudo-random.

Related HP-IB Commands

Global Subsystem
TPUL

Hop Patterns Subsystem
MAKE

Equivalent Front Panel Command

Hop Patterns Dialog Box - Pattern Type

USER:FMAX (User Pattern Maximum Frequency)

Syntax

$$:\mathtt{SOUR:HPAT:USER:FMAX}\ \textit{frequency} \begin{bmatrix} \mathtt{HZ} \\ \mathtt{KHZ} \\ \mathtt{MHZ} \\ \mathtt{GHZ} \end{bmatrix}$$

`:SOUR:HPAT:USER:FMAX?`

Item	Description	Range/Restrictions
Frequency	Maximum frequency	0 Hz to 200 GHz. Output frequency is hardware-dependent.

Description

This command sets the maximum frequency for a user-defined hop pattern. Data in a user-defined hop pattern can be either valid frequencies for the hardware or general user pattern data scaled between −1 and +1. If a pattern consists of valid frequencies, maximum frequency is automatically set equal to the maximum value in the pattern when it is loaded. Otherwise, it is set equal to the value specified with this command.

The query returns the current setting of the maximum frequency in Hz for a user pattern.

Example

To specify a user-defined hop pattern named HOPPAT.USR (assuming HOPPAT.USR is already installed on the removable cartridge) and to set the minimum frequency to 20 MHz and the maximum frequency to 50 MHz:

```
10  OUTPUT 719; ":SOUR:HPAT:TYPE USER
20  OUTPUT 719; ":SOUR:HPAT:USER:PATT 'HOPPAT.USR'"
30  OUTPUT 719; ":SOUR:HPAT:USER:FMAX 50 MHZ"
40  OUTPUT 719; ":SOUR:HPAT:USER:FMIN 20 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:MAKE
60  END
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference.*

Changing the minimum or maximum frequency will change the scaling of the user-defined hop pattern, but it will not change the shape of the pattern.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
TYPE
USER:FMIN
USER:PATT

SID Subsystem
TEXT

Equivalent Front Panel Command

Hop Patterns Dialog Box - (More...) (for User Hop Pattern) + Maximum Freq

USER:FMIN (User Pattern Minimum Frequency)

Syntax

$$\texttt{:SOUR:HPAT:USER:FMIN}\ \mathit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:HPAT:USER:FMIN?
```

Item	Description	Range/Restrictions
Frequency	Minimum frequency	0 Hz to 200 GHz. Output frequency is hardware-dependent.

Description

This command sets the minimum frequency for a user-defined hop pattern. Data in a user-defined hop pattern can be either valid frequencies for the hardware or general user-pattern data scaled between −1 and +1. If a pattern consists of valid frequencies, minimum frequency is automatically set equal to the minimum value in the pattern when it is loaded. Otherwise, it is set equal to the value specified with this command.

The query returns the current setting of the minimum frequency in Hz for a user pattern.

Example

To specify a user-defined hop pattern named HOPPAT.USR (assuming HOPPAT.USR is already installed on the removable cartridge) and to set the minimum frequency to 20 MHz and the maximum frequency to 50 MHz:

```
10  OUTPUT 719; ":SOUR:HPAT:TYPE USER
20  OUTPUT 719; ":SOUR:HPAT:USER:PATT 'HOPPAT.USR'"
30  OUTPUT 719; ":SOUR:HPAT:USER:FMAX 50 MHZ"
40  OUTPUT 719; ":SOUR:HPAT:USER:FMIN 20 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:MAKE
60  END
```

Comments

The frequency plus the frequency offset of each pulse must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference.*

Changing the minimum or maximum frequency will change the scaling of the user-defined hop pattern, but it will not change the shape of the pattern.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
TYPE
USER:FMAX
USER:PATT

SID Subsystem
TEXT

USER:FMIN (User Pattern Minimum Frequency)

Equivalent Front Panel Command	*Hop Patterns Dialog Box* - (More...) (for User Hop Pattern) + Minimum Freq

USER:PATT (User Pattern Name)

Syntax

`:SOUR:HPAT:USER:PATT` *'name'*

`:SOUR:HPAT:USER:PATT?`

Item	Description	Range/Restrictions
Name	User-defined pattern name	The pattern name must match an installed file name on the removable cartridge.

Description

This command specifies the name of a user-defined pattern to be used for the hop pattern. The pattern must already be installed on the removable cartridge. Otherwise, an error is returned.

The query returns the name of the currently specified user-defined hop pattern. The returned format is string data.

Example

To specify a user-defined pattern named HOPPAT.USR (assuming HOPPAT.USR is already installed on the removable cartridge and to set the minimum frequency to 20 MHz and the maximum frequency to 50 MHz:

```
10  OUTPUT 719; ":SOUR:HPAT:TYPE USER
20  OUTPUT 719; ":SOUR:HPAT:USER:PATT 'HOPPAT.USR'"
30  OUTPUT 719; ":SOUR:HPAT:USER:FMAX 50 MHZ"
40  OUTPUT 719; ":SOUR:HPAT:USER:FMIN 20 MHZ"
50  OUTPUT 719; ":SOUR:HPAT:MAKE
60  END
```

Comments

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference Manual.*

The user-defined hop pattern can consist of actual frequency data it can be a standard pattern scaled between −1 and +1.

The USER:FMIN and USER:FMAX commands will automatically be set to the minimum and maximum frequencies of the pattern when the pattern is loaded if the pattern contains actual frequency data.

Related HP-IB Commands

Hop Patterns Subsystem
MAKE
TYPE
USER:FMAX
USER:FMIN

SID Subsystem
TEXT

Equivalent Front Panel Command

Hop Patterns Dialog Box - [More...] (for User Hop Pattern) + [Select User Pattern]

11

Power Subsystem

Introduction

The commands in this subsystem are used to control the output attenuator and the output power of the system.

Figure 11-1 shows the Power subsystem syntax diagram.

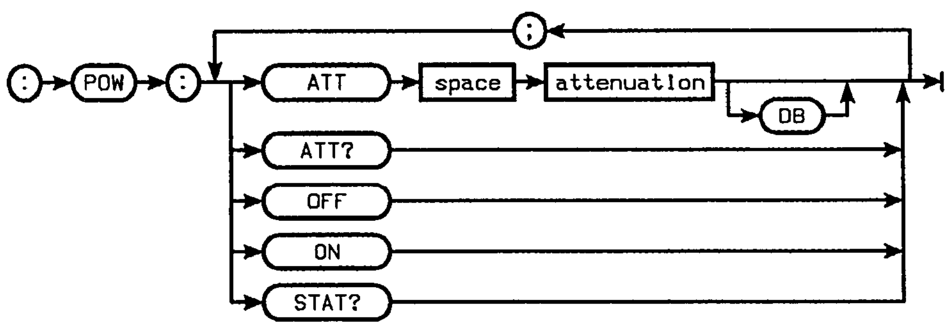


Figure 11-1. Power Subsystem Syntax Diagram

ATT (Attenuation)

Syntax

`:POW:ATT` *attenuation* `[DB]`

`:POW:ATT?`

Item	Description	Range/Restrictions
Attenuation	Output attenuator setting	See Description, below.

Description

This command sets the RF output attenuator. The allowable range of settings is as follows:

- HP FASS Model 7 - 0 to 110 dB in 10 dB steps.
- HP FASS Model 11 - 0 to 70 dB in 10 dB steps.
- HP FASS Model 21 - 0 to 110 dB in 1 dB steps.

The query returns the current output attenuator setting in dB.

Note

RSID automatically determines the attenuator setting, based on the output level (set with the :SOUR:GLOB:OLEV command).

Example

To set the output attenuator to 20 dB:

```
OUTPUT 719; ":POW:ATT 20 DB"
```

Comments

The reset value for the output attenuator is 30 dB.

In HP FASS Model 7, the output attenuator is located in the ACS. In Model 11, the output attenuator is located in the AUC.

In Model 21, the output attenuation is a combination of three separate attenuators in the AMUC. These attenuators can be controlled individually by using special functions.

For Model 21, you can get a level of +10 dBm by using Special Function 14.1 to change the AUC output attenuator to 0 dB (default is 10 dB).

Related HP-IB Commands

Global Subsystem
OLEV

Power Subsystem
OFF
ON

Equivalent Front Panel Command

SID Control Panel - Attenuator

OFF

Syntax

```
:POW:OFF
```

Description

For Model 11 and Model 21, this command selects the maximum attenuation for the FLC (fast level control) attenuator and switches other internal instrument settings to effectively turn the system's output power off. For Model 7, this command switches the ACS pulse source to internal and then to off.

Example

To turn off the output power:

```
OUTPUT 719; ":POW:OFF"
```

Comments

None

Related HP-IB Commands

Power Subsystem
ATT
ON

Equivalent Front Panel Command

SID Control Panel - RF Output

ON

Syntax

```
:POW:ON
```

Description

This command sets the FLC (fast level control) attenuator and other internal settings, including the ACS pulse source, back to the values that were selected prior to issuing the last :POW:OFF command.

Example

To turn on the output power:

```
OUTPUT 719; ":POW:ON"
```

Comments

None

Related HP-IB Commands

Power Subsystem
ATT
OFF

Equivalent Front Panel Command

SID Control Panel - RF Output

STAT?

Syntax

```
:POW:STAT?
```

Description

This query returns the status of the output. If a "0" is returned, the output is set for maximum attenuation, effectively turning off the system's output power. If a "1" is returned, the output is turned on.

Example

To check the status of the RF output:

```
10  OUTPUT 719; ":POW:STAT?"
20  ENTER 719; A
30  PRINT "OUTPUT POWER=";A
40  END
```

Comments

None

Related HP-IB Commands

Power Subsystem
OFF
ON

Equivalent Front Panel Command

SID Control Panel - RF Output

12

PRI Patterns Subsystem

Introduction

The commands in this subsystem are used for creating PRI modulation patterns for all signal models. These commands correspond to the front panel commands in the PRI Patterns dialog box, which is accessed by the (PRI PATTERNS) Global Edit command.

Figure 12-1 shows a flowchart of the PRI Patterns subsystem. Note that the PRI pattern type should be selected prior to issuing other commands. A pictorial description of available PRI patterns can be found in the TYPE command.

Figure 12-2 shows the syntax diagram for the PRI Patterns subsystem.

Note

The PRI subsystem allows for up to six PRIs to be specified for a staggered pattern. For a pattern requiring more than six stagger levels, a user-defined pattern must be used. This allows you to create up to 512 stagger levels.

The commands BURS:PRI3, BURS:PRI4, BURS:PRI5, and BURS:PRI6 are not described separately because their operation is identical to BURS:PRI2.

The commands STAG:PRI3, STAG:PRI4, STAG:PRI5, and STAG:PRI6 are not described separately because their operation is identical to STAG:PRI2.

Data returned in response to a query is valid only for the currently selected PRI pattern.

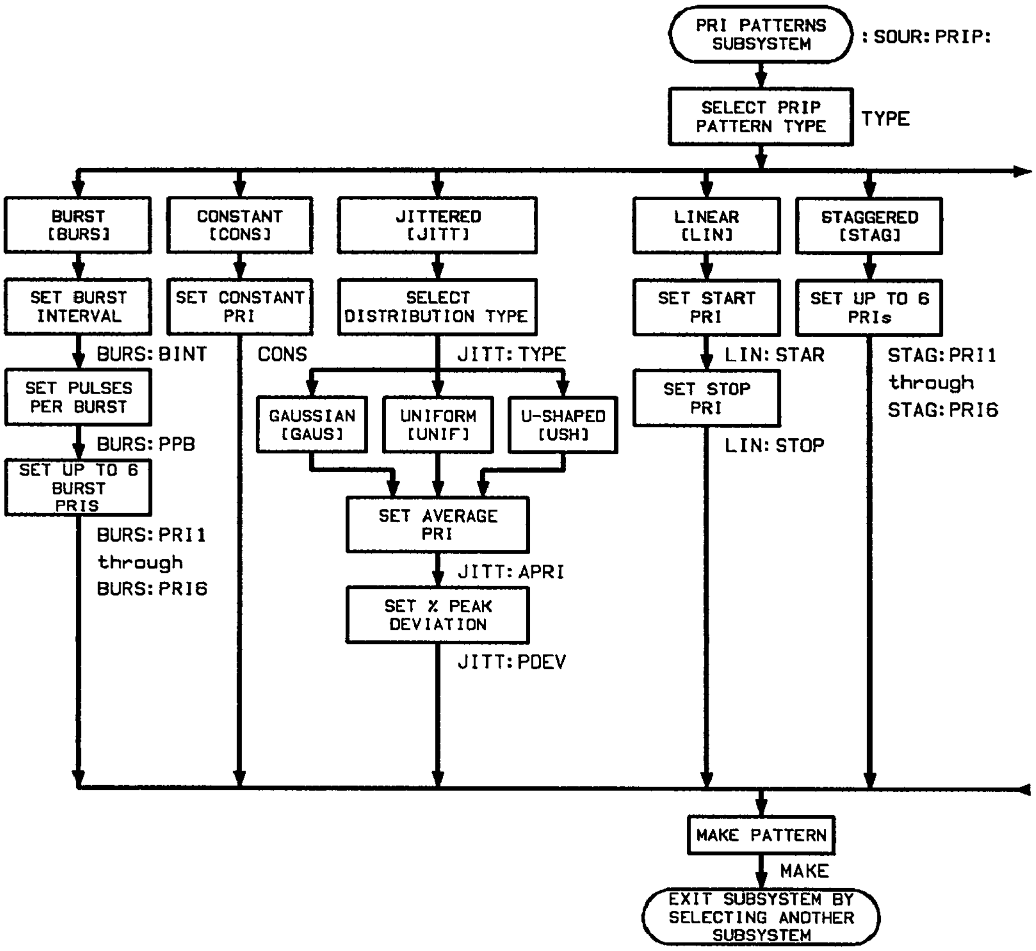


Figure 12-1. PRI Patterns Subsystem Flowchart

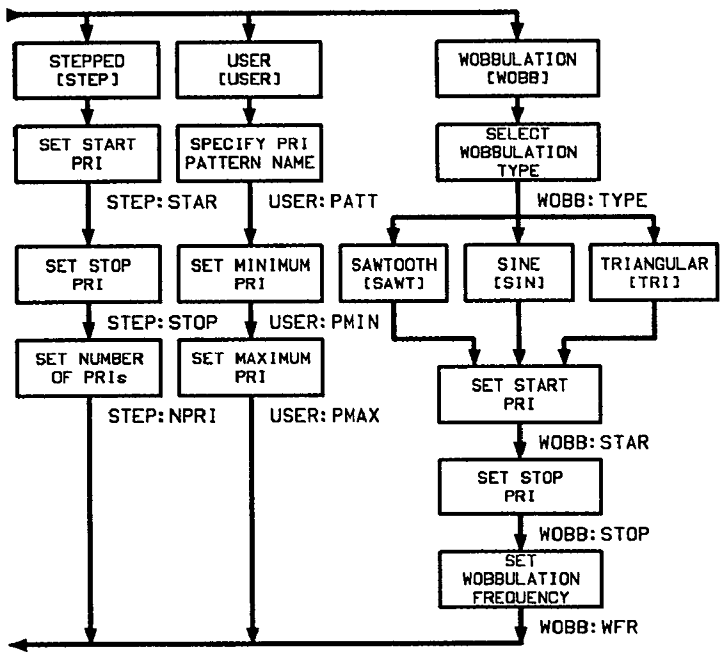


Figure 12-1. PRI Patterns Subsystem Flowchart (continued)

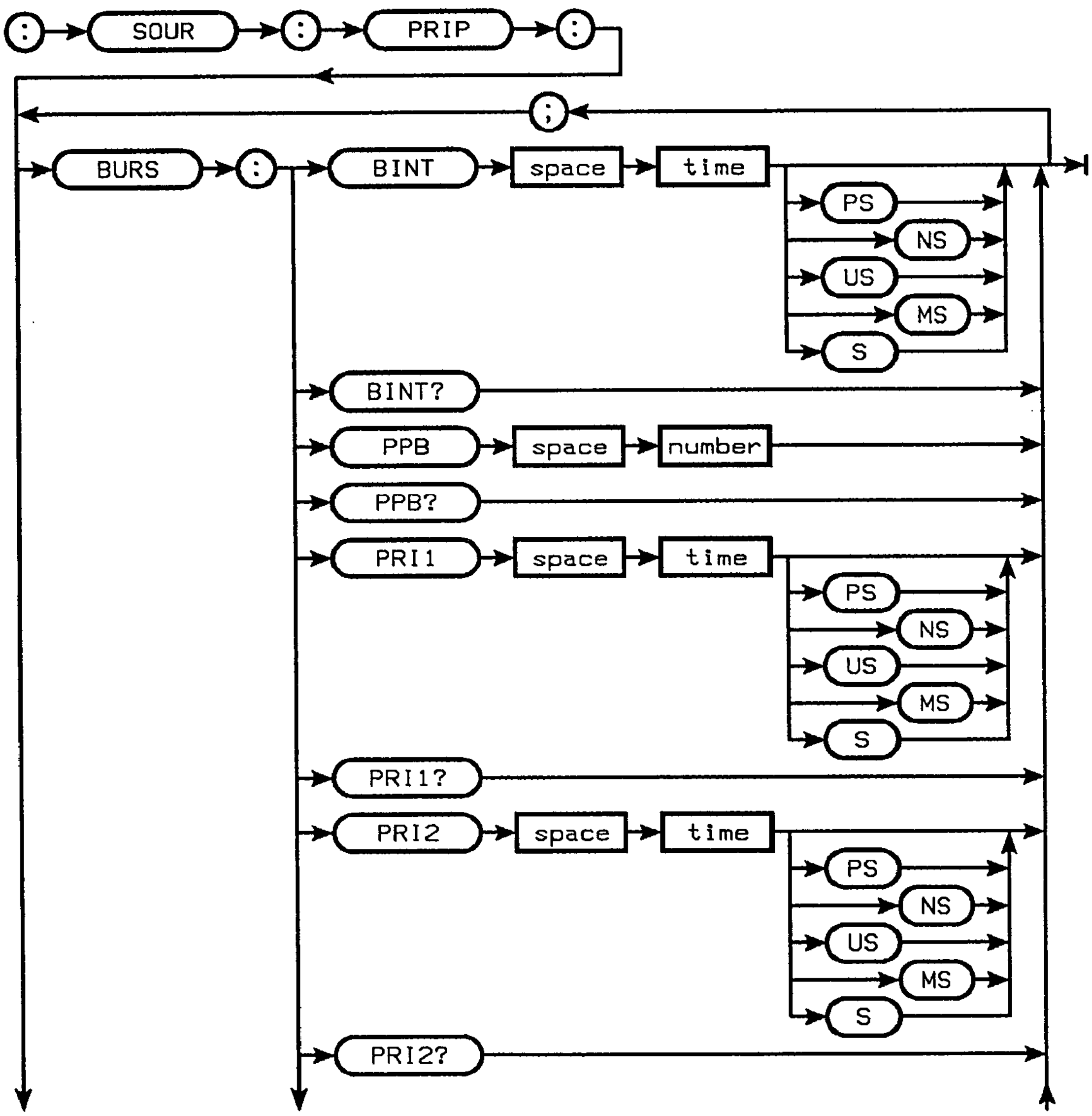


Figure 12-2. PRI Patterns Syntax Diagram

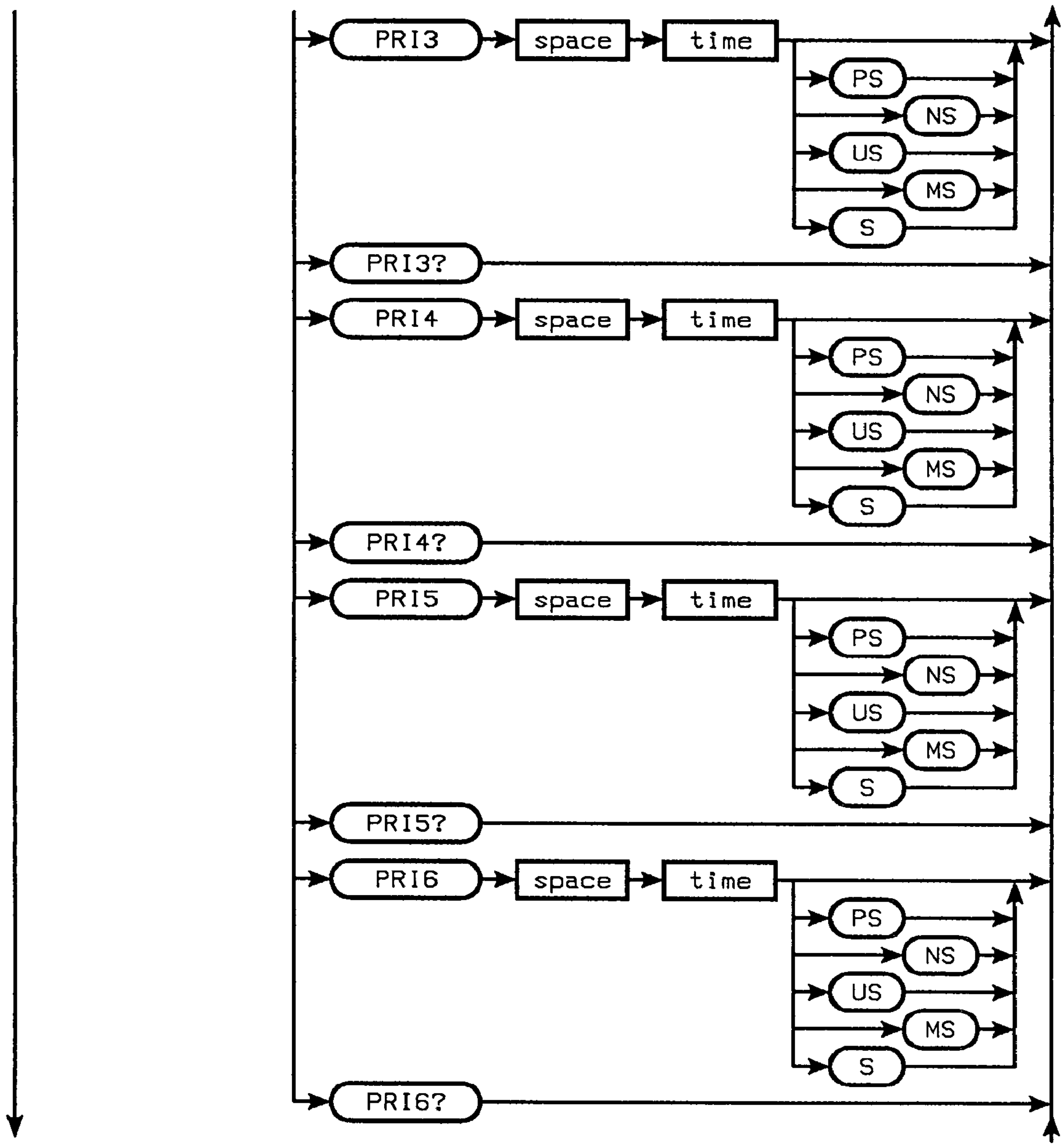


Figure 12-2. PRI Patterns Syntax Diagram (continued)

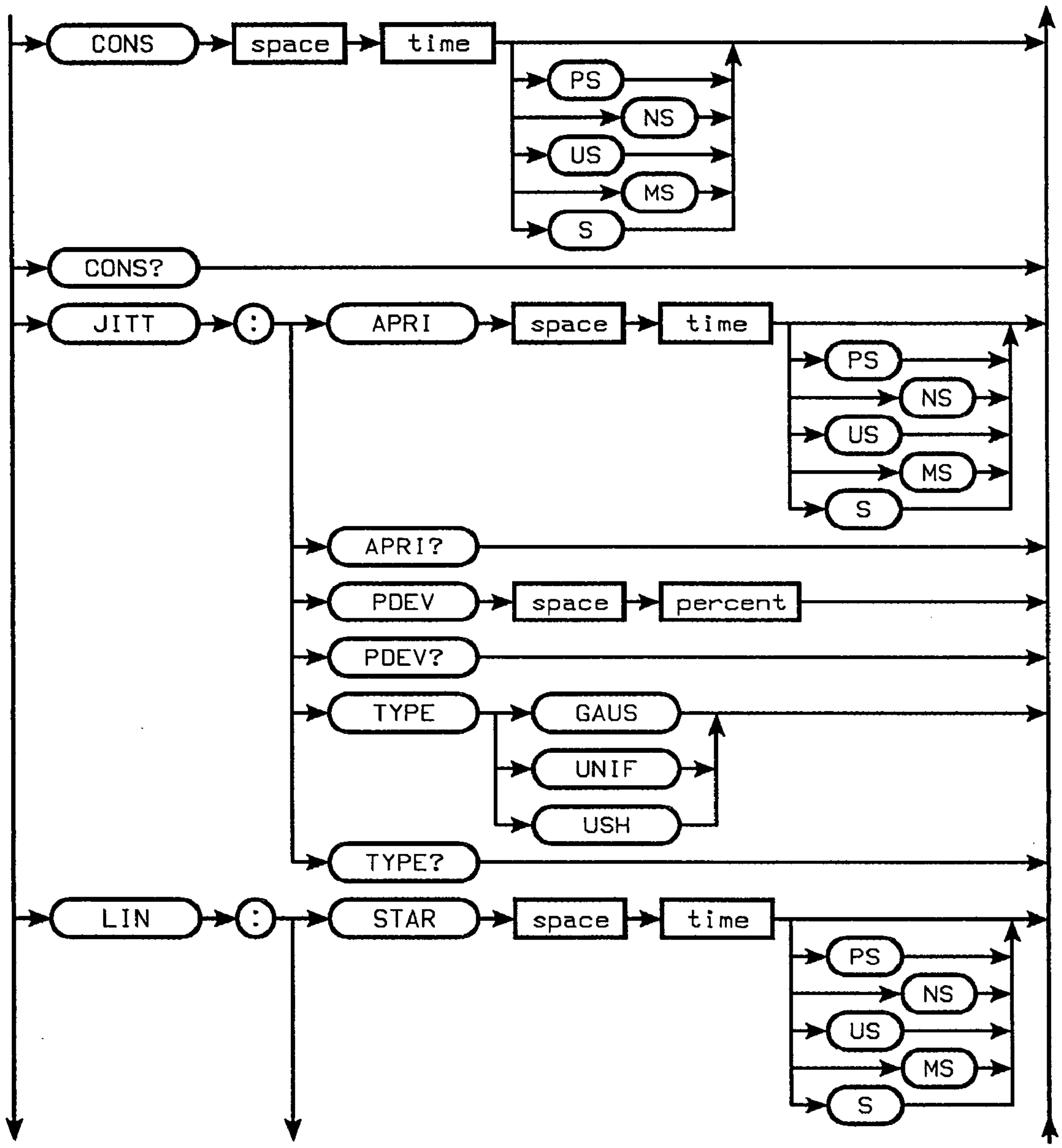


Figure 12-2. PRI Patterns Syntax Diagram (continued)

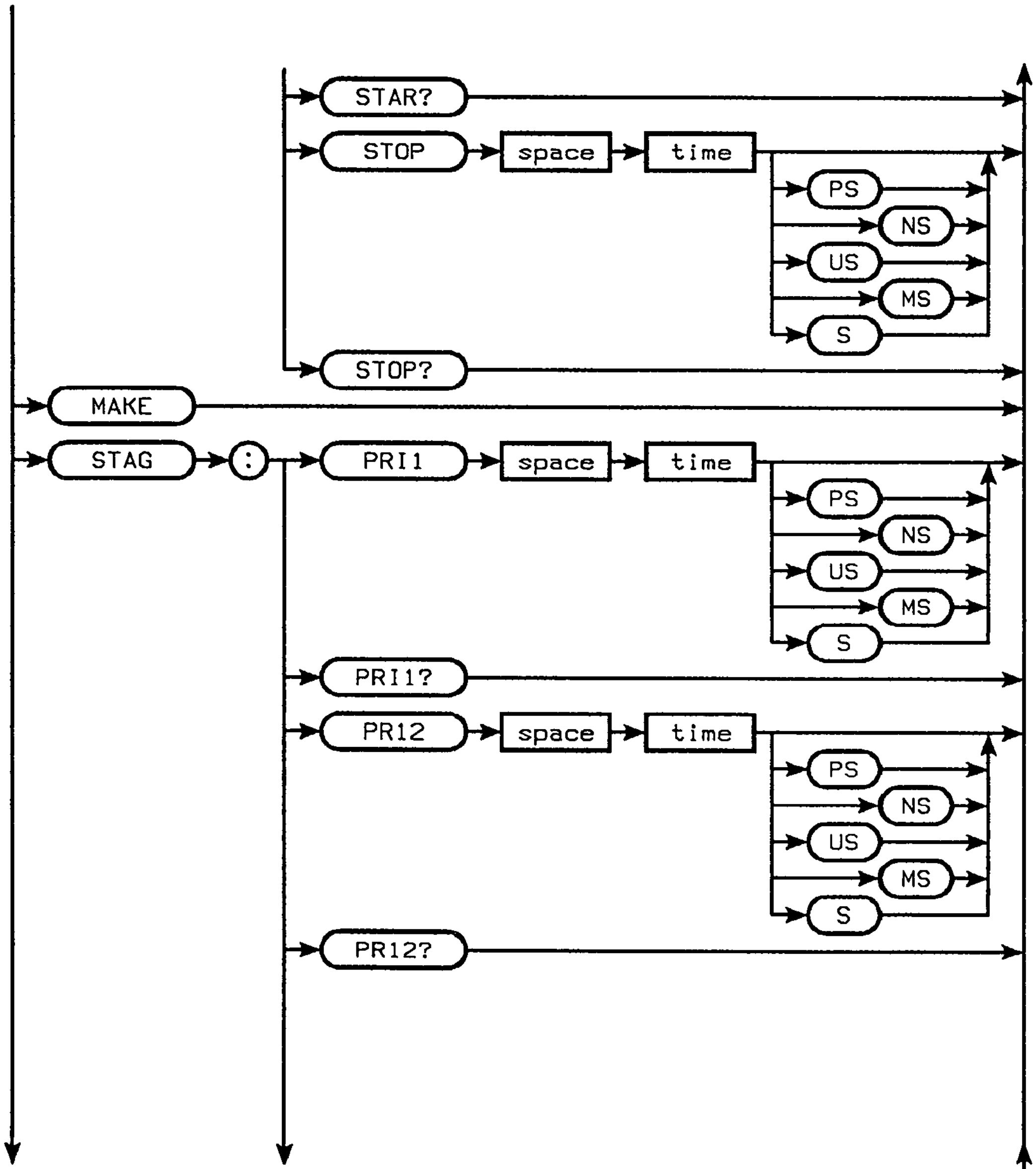


Figure 12-2. PRI Patterns Syntax Diagram (continued)

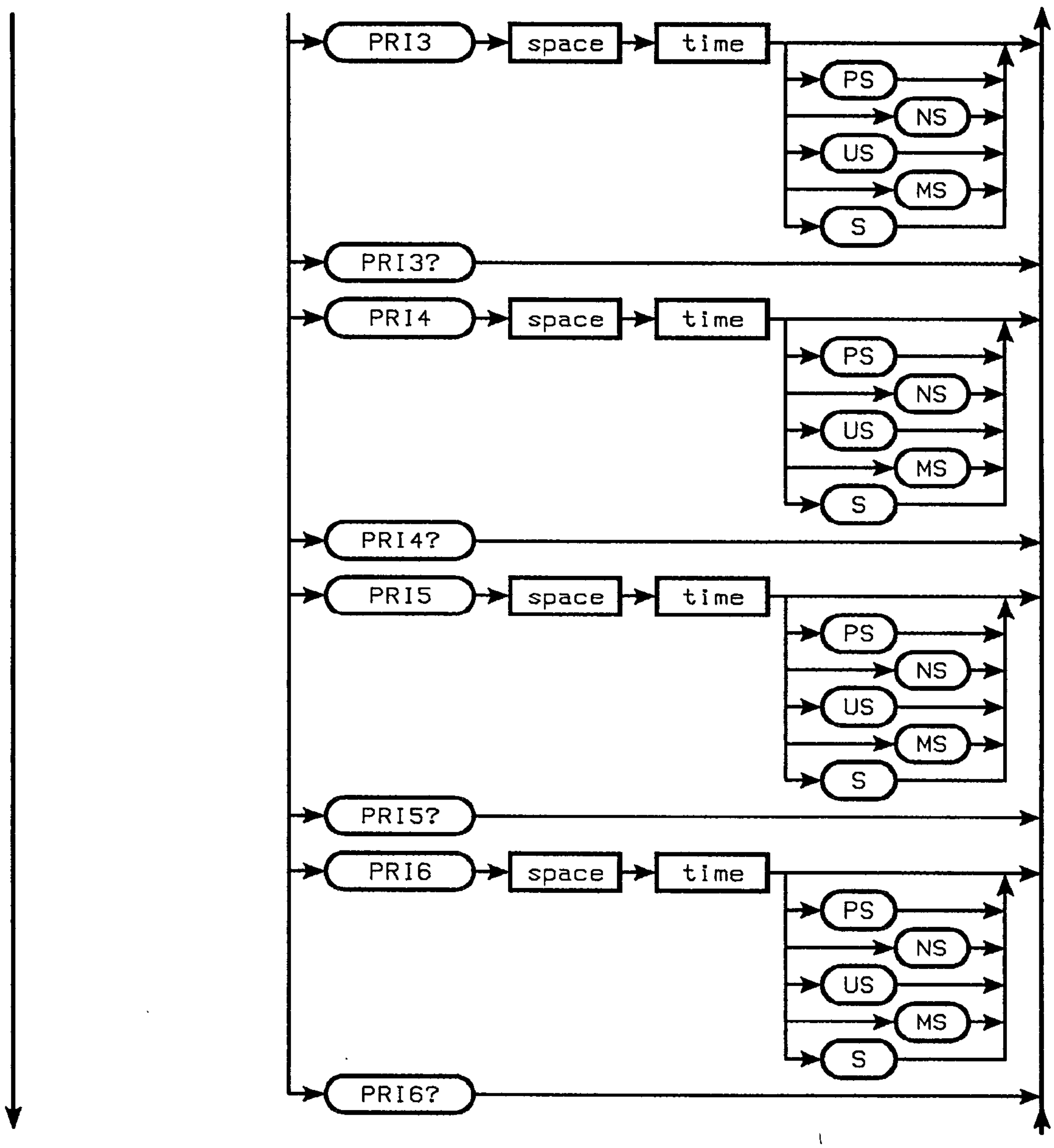


Figure 12-2. PRI Patterns Syntax Diagram (continued)

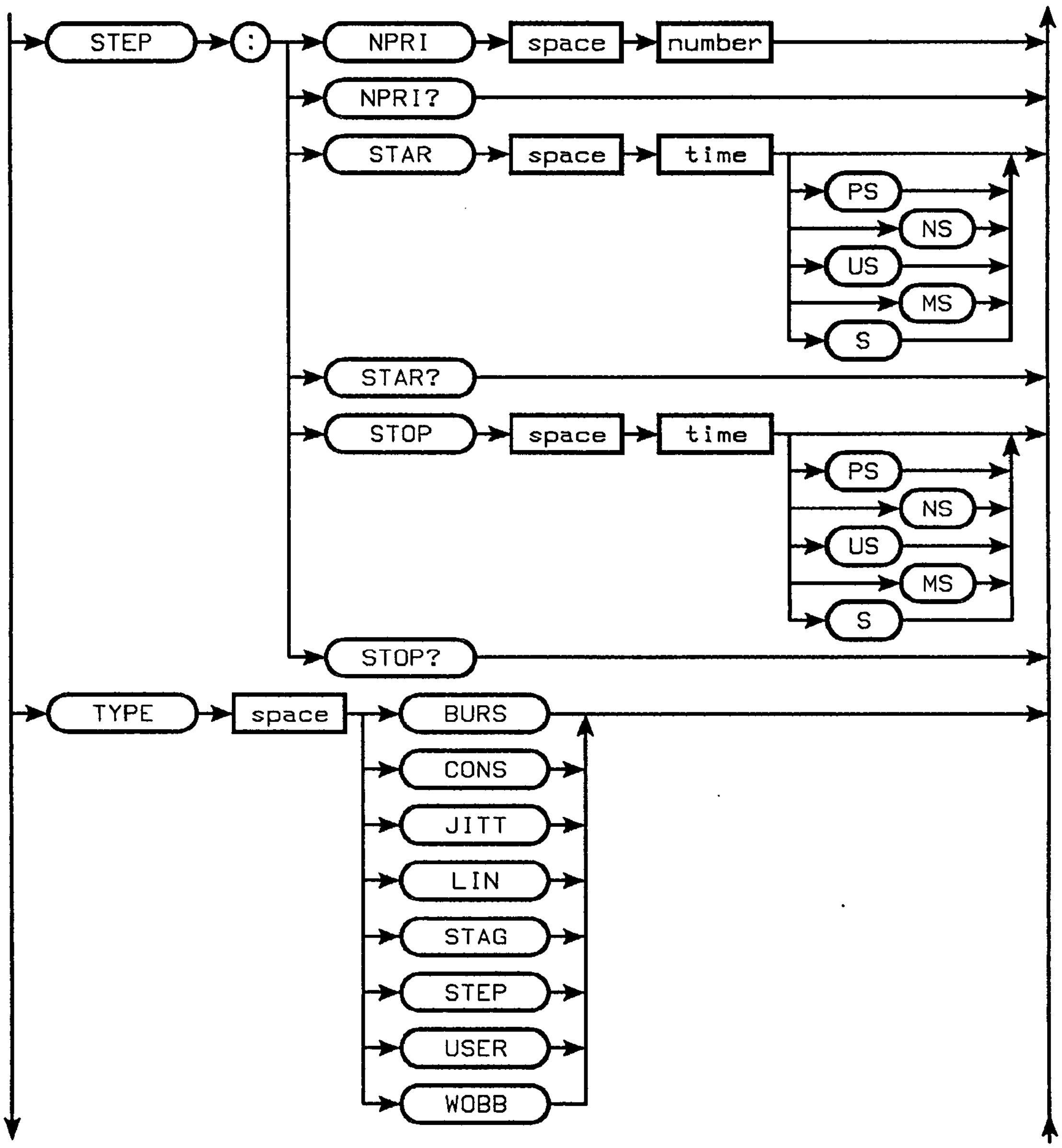


Figure 12-2. PRI Patterns Syntax Diagram (continued)

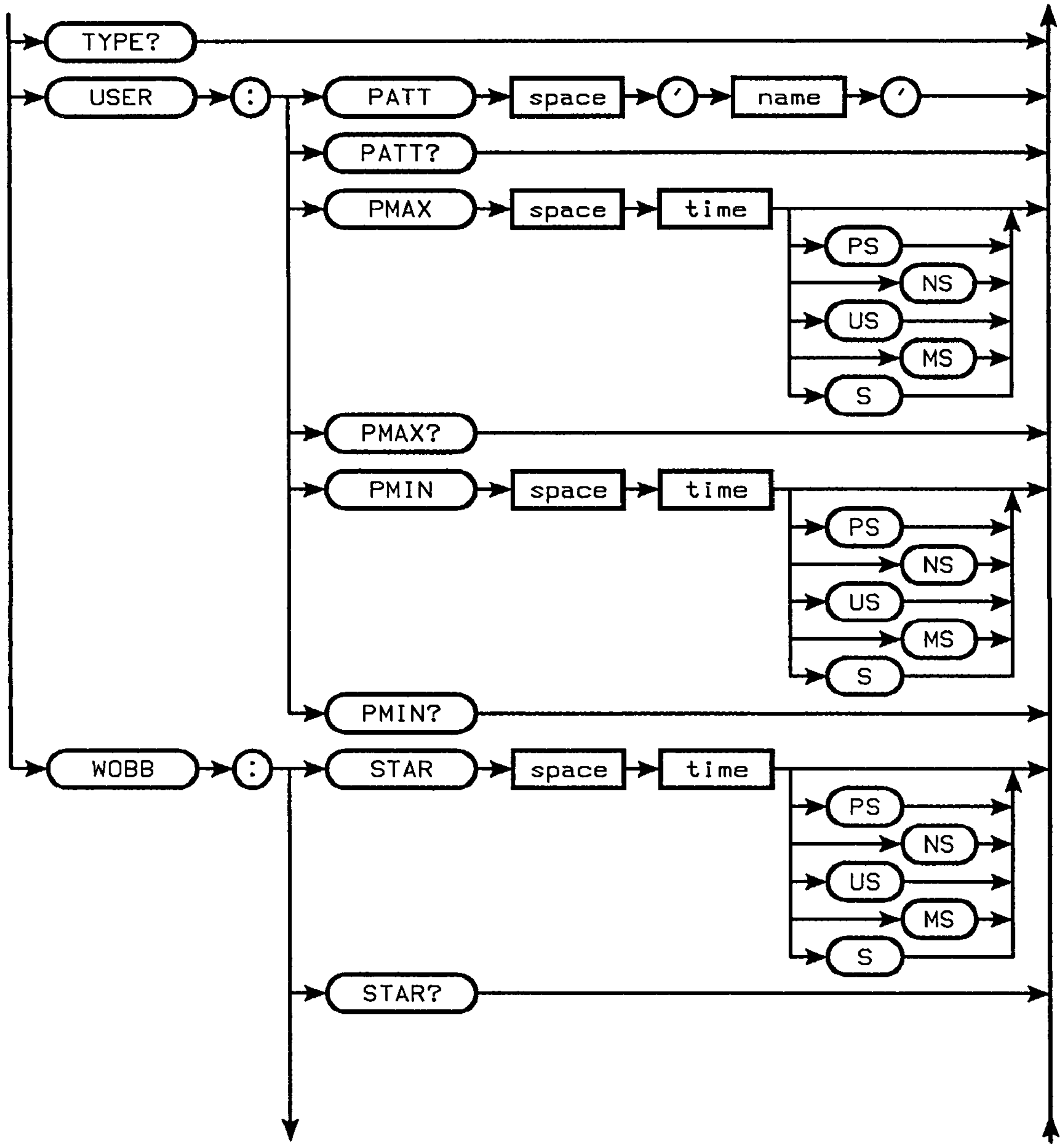


Figure 12-2. PRI Patterns Syntax Diagram (continued)

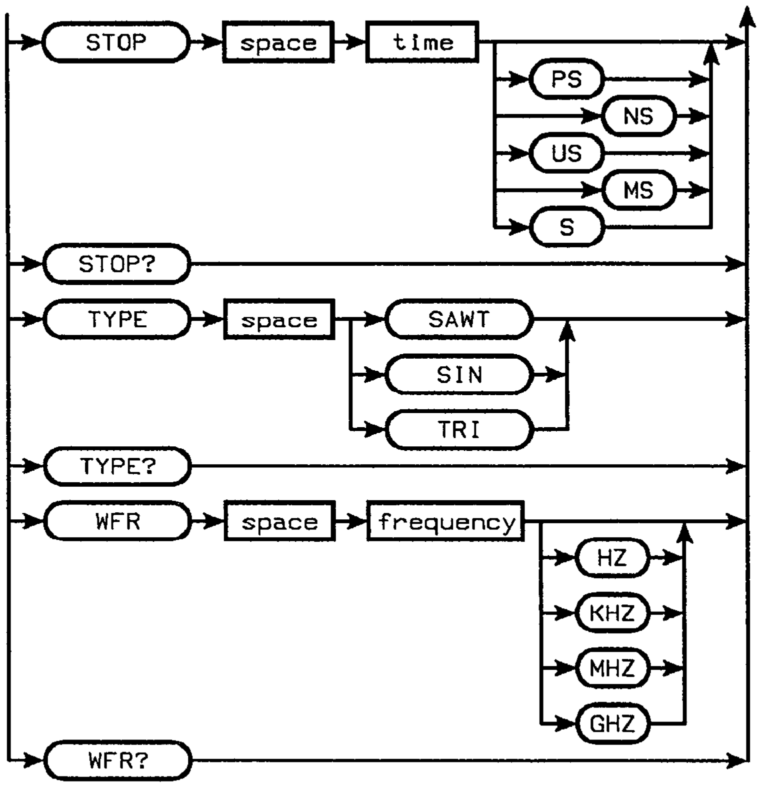


Figure 12-2. PRI Patterns Syntax Diagram (continued)

BURS:BINT (Burst Interval)

Syntax

```
                                      ┌PS┐
                                      │NS│
:SOUR:PRIP:BURS:BINT time             │US│
                                      │MS│
                                      └S ┘
```

```
:SOUR:PRIP:BURS:BINT?
```

Item	Description	Range/Restrictions
Time	Burst interval	1.58 μs to 512 seconds for models 1 and 4; 1.58 μs to 113 seconds for models 2, 3, 5, and 6. See Comments.

Description

This command sets the PRI burst interval, which is the dwell time at a given PRI.

The query returns the current setting of the PRI burst interval in seconds.

Example

To make a PRI pattern with a burst interval of 200 μs, 5 pulses per burst, with four burst PRIs of 10 μs, 20 μs, 30 μs, and 20 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE BURS"
20  OUTPUT 719; ":SOUR:PRIP:BURS:BINT 200 US"
30  OUTPUT 719; ":SOUR:PRIP:BURS:PPB 5"
40  OUTPUT 719; ":SOUR:PRIP:BURS:PRI1 10 US"
50  OUTPUT 719; ":SOUR:PRIP:BURS:PRI2 20 US"
60  OUTPUT 719; ":SOUR:PRIP:BURS:PRI3 30 US"
70  OUTPUT 719; ":SOUR:PRIP:BURS:PRI4 20 US"
```

```
80  OUTPUT 719; ":SOUR:PRIP:MAKE"
90  END
```

Comments

The maximum burst interval is approximately 1 second larger than (Pulses per Burst) x (Shortest PRI).

If the frequency hop pattern is also a burst, you may want to specify identical burst intervals for both the hop pattern and the PRI pattern because the frequency burst interval is based on the PRI spacing.

Related HP-IB Commands

Hop Patterns Subsystem
BURS:BINT

PRI Patterns Subsystem
BURS:PPB
BURS:PRI1
BURS:PRI2
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Burst Pattern Type) + Burst Interval

BURS:PPB (Pulses Per Burst)

Syntax

```
:SOUR:PRIP:BURS:PPB number
```

```
:SOUR:PRIP:BURS:PPB?
```

Item	Description	Range/Restrictions
Number	Number of pulses per burst	1 to 512 for models 1 and 4; 1 to 113 for models 2, 3, 5, and 6

Description

This command sets the number of PRI pulses per burst.

The query returns the current setting of the number of PRI pulses per burst.

Example

To make a PRI pattern with a burst interval of 200 μs, 5 pulses per burst, with four burst PRIs of 10 μs, 20 μs, 30 μs, and 20 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE BURS"
20  OUTPUT 719; ":SOUR:PRIP:BURS:BINT 200 US"
30  OUTPUT 719; ":SOUR:PRIP:BURS:PPB 5"
40  OUTPUT 719; ":SOUR:PRIP:BURS:PRI1 10 US"
50  OUTPUT 719; ":SOUR:PRIP:BURS:PRI2 20 US"
60  OUTPUT 719; ":SOUR:PRIP:BURS:PRI3 30 US"
70  OUTPUT 719; ":SOUR:PRIP:BURS:PRI4 20 US"
80  OUTPUT 719; ":SOUR:PRIP:MAKE"
90  END
```

Comments

The total number of pulses in a PRI burst pattern is equal to the number of pulses per burst times the number of burst PRIs.

Pulses per burst times the number of burst PRIs must be $\leq$ 512 for models 1 and 4 and 113 for models 2, 3, 5, and 6.

If the total number of pulses set is less than the number of pulses needed in a PRI burst pattern, the total number of pulses is automatically increased to match the number of pulses required for the burst pattern.

If the total number of pulses set is greater than the number of pulses needed in a PRI burst pattern, the burst pattern is cloned to set the PRIs of the extra pulses.

Related HP-IB Commands

Global Subsystem
TPUL

PRI Patterns Subsystem
BURS:BINT
BURS:PRI1
BURS:PRI2
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Burst Pattern Type) + Number of Pulses/Burst

BURS:PRI1 (Burst PRI 1)

Syntax

```
                         ┌PS┐
                         │NS│
:SOUR:PRIP:BURS:PRI1 time│US│
                         │MS│
                         └S ┘
```

```
:SOUR:PRIP:BURS:PRI1?
```

Item	Description	Range/Restrictions
Time	First burst PRI	1.58 μs to 1 second in 29.8 ns steps

Description

This command sets the pulse repetition interval (PRI) for the first burst of a PRI burst pattern.

The query returns the current setting of the first burst PRI in seconds.

Example

To make a PRI pattern with a burst interval of 200 μs, 5 pulses per burst, with four burst PRIs of 10 μs, 20 μs, 30 μs, and 20 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE BURS"
20  OUTPUT 719; ":SOUR:PRIP:BURS:BINT 200 US"
30  OUTPUT 719; ":SOUR:PRIP:BURS:PPB 5"
40  OUTPUT 719; ":SOUR:PRIP:BURS:PRI1 10 US"
50  OUTPUT 719; ":SOUR:PRIP:BURS:PRI2 20 US"
60  OUTPUT 719; ":SOUR:PRIP:BURS:PRI3 30 US"
70  OUTPUT 719; ":SOUR:PRIP:BURS:PRI4 20 US"
80  OUTPUT 719; ":SOUR:PRIP:MAKE"
90  END
```

Comments

The individual burst PRI times the number of pulses per burst must be ≤ the burst interval.

PRI1 must be a valid PRI. PRI2 through PRI6 can be valid PRIs or they can be set to zero. When a PRI burst pattern is made, PRIs set to zero are ignored. The pattern does not leave gaps for PRIs that are set to zero.

(Pulse ontime + 240 ns) ≤ PRI ≤ Burst Interval/Pulses per burst

Related HP-IB Commands

PRI Patterns Subsystem
BURS:BINT
BURS:PPB
BURS:PRI2
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Burst Pattern Type) + PRI 1

BURS:PRI2 (Burst PRI 2)

Syntax

```
                                     [PS]
                                     [NS]
:SOUR:PRIP:BURS:PRI2 time            [US]
                                     [MS]
                                     [S ]
```

```
:SOUR:PRIP:BURS:PRI2?
```

Item	Description	Range/Restrictions
Time	Second burst PRI	0 and 1.58 μs to 1 second. See comments.

Note

The commands BURS:PRI3, BURS:PRI4, BURS:PRI5, and BURS:PRI6 are not described separately because their operation is identical to BURS:PRI2. The syntax for these commands is shown in Figure 12-2.

Description

This command sets the pulse repetition interval (PRI) for the second burst of a PRI burst pattern.

The query returns the current setting of the second burst PRI in seconds.

Example

To make a PRI pattern with a burst interval of 200 μs, 5 pulses per burst, with four burst PRIs of 10 μs, 20 μs, 30 μs, and 20 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE BURS"
20  OUTPUT 719; ":SOUR:PRIP:BURS:BINT 200 US"
30  OUTPUT 719; ":SOUR:PRIP:BURS:PPB 5"
40  OUTPUT 719; ":SOUR:PRIP:BURS:PRI1 10 US"
```

```
50  OUTPUT 719; ":SOUR:PRIP:BURS:PRI2 20 US"
60  OUTPUT 719; ":SOUR:PRIP:BURS:PRI3 30 US"
70  OUTPUT 719; ":SOUR:PRIP:BURS:PRI4 20 US"
80  OUTPUT 719; ":SOUR:PRIP:MAKE"
90  END
```

Comments

The individual burst PRIs times the number of pulses per burst must be $\leq$ the burst interval.

PRI1 must be a valid PRI. PRI2 through PRI6 can be valid PRIs or they can be set to zero. When a PRI burst pattern is made, PRIs set to zero are ignored. The pattern does not leave gaps for PRIs that are set to zero.

(Pulse ontime + 240 ns) $\leq$ PRI $\leq$ Burst Interval/Pulses per burst

Related HP-IB Commands

PRI Patterns Subsystem
BURS:BINT
BURS:PPB
BURS:PRI1
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Burst Pattern Type) + PRI 2

CONS (Constant PRI)

Syntax

$$\texttt{:SOUR:PRIP:CONS}\ \mathit{time} \begin{bmatrix} \texttt{PS} \\ \texttt{NS} \\ \texttt{US} \\ \texttt{MS} \\ \texttt{S} \end{bmatrix}$$

```
:SOUR:PRIP:CONS?
```

Item	Description	Range/Restrictions
Time	Constant PRI	1.58 μs to 1 second

Description

This command sets the constant PRI for all pulses.

The query returns the current setting of the constant PRI in seconds.

Example

To make a PRI pattern with a constant PRI of 200 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE CONS"
20  OUTPUT 719; ":SOUR:PRIP:CONS 200 US"
30  OUTPUT 719; ":SOUR:PRIP:MAKE"
40  END
```

Comments

Constant PRI is the default PRI pattern type. The default value is set equal to the current global PRI.

This command is equivalent to using the PRI command in the global subsystem.

Related HP-IB Commands

Global Subsystem
PRI

PRI Patterns Subsystem
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Constant Pattern Type) + Global PRI

JITT:APRI (Jittered Average PRI)

Syntax

$$:SOUR:PRIP:JITT:APRI\ \textit{time} \begin{bmatrix} PS \\ NS \\ US \\ MS \\ S \end{bmatrix}$$

```
:SOUR:PRIP:JITT:APRI?
```

Item	Description	Range/Restrictions
Time	Average PRI	1.58 μs to 1 second

Description

This command sets the average PRI for a jittered PRI pattern.

The query returns the current setting of the jittered average PRI in seconds.

Example

To make a jittered PRI pattern with a Gaussian PRI distribution, an average PRI of 1 ms, and a 25% deviation:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE JITT"
20  OUTPUT 719; ":SOUR:PRIP:JITT:TYPE GAUS"
30  OUTPUT 719; ":SOUR:PRIP:APRI 1 MS"
40  OUTPUT 719; ":SOUR:PRIP:PDEV 25"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

PRI Range = APRI(1 - PDEV/100) to APRI(1 + PDEV/100)

where APRI is the average PRI and PDEV is the percent deviation.

A valid PRI = (Pulse ontime + 240 ns) $\leq$ PRI $\leq$ 1 second.

Related HP-IB Commands

PRI Patterns Subsystem
JITT:PDEV
JITT:TYPE
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box + (More...) (for Jittered Pattern Type) + Average PRI

JITT:PDEV (Jittered Percent Deviation)

Syntax

```
:SOUR:PRIP:JITT:PDEV percent

:SOUR:PRIP:JITT:PDEV?
```

Item	Description	Range/Restrictions
Percent	Percent deviation	0 to 100%

Description

This command specifies the maximum PRI deviation as a percent of the average PRI for a jittered PRI pattern.

The query returns the current setting of the deviation in percent.

Example

To make a jittered PRI pattern with a Gaussian PRI distribution, an average PRI of 1 ms, and a 25% deviation:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE JITT"
20  OUTPUT 719; ":SOUR:PRIP:JITT:TYPE GAUS"
30  OUTPUT 719; ":SOUR:PRIP:APRI 1 MS"
40  OUTPUT 719; ":SOUR:PRIP:PDEV 25"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

The average PRI plus the percent deviation must be a valid PRI.

A valid PRI = (Pulse ontime + 240 ns) $\leq$ PRI $\leq$ 1s.

PRI Range = APRI(1 - PDEV/100) to APRI(1 + PDEV/100) where APRI is the average PRI and PDEV is the percent deviation.

Related HP-IB Commands

PRI Patterns Subsystem
JITT:APRI
JITT:TYPE
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Jittered Pattern Type) + % Peak Deviation

JITT:TYPE (Jittered Pattern Type)

Syntax

```
                       { GAUS }
:SOUR:PRIP:JITT:TYPE   { UNIF }
                       { USH  }
```

```
:SOUR:PRIP:JITT:TYPE?
```

Description

This command selects the type of PRI distribution for a jittered PRI pattern. The following types can be selected:

- GAUS - specifies a Gaussian PRI distribution.
- UNIF - specifies a uniform PRI distribution.
- USH - specifies a U-shaped PRI distribution, that is, a sinusoidally varying PRI pattern.

The query returns the currently selected distribution type.

Example

To make a jittered PRI pattern with a Gaussian PRI distribution, an average PRI of 1 ms, and a 25% deviation:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE JITT"
20  OUTPUT 719; ":SOUR:PRIP:JITT:TYPE GAUS"
30  OUTPUT 719; ":SOUR:PRIP:APRI 1 MS"
40  OUTPUT 719; ":SOUR:PRIP:PDEV 25"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

Uniform is the default pattern type.

Related HP-IB Commands

PRI Patterns Subsystem
JITT:APRI
JITT:PDEV
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - More... (for Jittered Pattern Type) + Pattern Type

LIN:STAR (Linear Start PRI)

Syntax

```
                                  ┌PS┐
                                  │NS│
:SOUR:PRIP:LIN:STAR time          │US│
                                  │MS│
                                  └S ┘
```

```
:SOUR:PRIP:LIN:STAR?
```

Item	Description	Range/Restrictions
Time	Start PRI	1.58 μs to 1 second

Description

This command sets the start PRI for a linear PRI pattern.

The query returns the current setting of the start PRI in seconds.

Example

To create a linear PRI pattern with a start PRI of 100 μs and a stop PRI of 190 μs:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:PRIP:TYPE LIN"
30  OUTPUT 719; ":SOUR:PRIP:LIN:STAR 100 US"
40  OUTPUT 719; ":SOUR:PRIP:LIN:STOP 190 US"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

To reverse the direction of the linear PRI pattern, set the start PRI to be greater than the stop PRI.

A linear PRI pattern is the same as a stepped PRI pattern when the number of PRIs for the stepped pattern is set equal to the total number of pulses for the linear pattern.

Related HP-IB Commands

PRI Subsystem
LIN:STOP
MAKE
TYPE

Equivalent Front Panel Command

Pri Patterns Dialog Box - (More...) (For Linear Pattern Type) + Start PRI

LIN:STOP (Linear Stop PRI)

Syntax

```
                                 ┌PS┐
                                 │NS│
:SOUR:PRIP:LIN:STOP time         │US│
                                 │MS│
                                 └S ┘
```

```
:SOUR:PRIP:LIN:STOP?
```

Item	Description	Range/Restrictions
Time	Stop PRI	1.58 μs to 1 second

Description

This command sets the stop PRI for a linear pattern.

The query returns the current setting of the stop PRI in seconds.

Example

To create a linear PRI pattern with a start PRI of 100 μs and a stop PRI of 100 ms:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:PRIP:TYPE LIN"
30  OUTPUT 719; ":SOUR:PRIP:LIN:STAR 100 US"
40  OUTPUT 719; ":SOUR:PRIP:LIN:STOP 190 US"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

To reverse the direction of the linear PRI pattern, set the start PRI to be greater than the stop PRI.

A linear PRI pattern is the same as a stepped PRI pattern when the number of PRIs for the stepped pattern is set equal to the total number of pulses for the linear pattern.

Related HP-IB Commands

PRI Subsystem
LIN:STAR
MAKE
TYPE

Equivalent Front Panel Command

Pri Patterns Dialog Box - [More...] (For Linear Pattern Type) + Stop PRI

MAKE (Make Pattern)

Syntax

```
:SOUR:PRIP:MAKE
```

Description

This command makes a PRI pattern based on the parameters set for the selected pattern type

Example

To make a linear PRI pattern with a start PRI of 100 μs and a stop PRI of 100 ms:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:PRIP:TYPE LIN"
30  OUTPUT 719; ":SOUR:PRIP:LIN:STAR 100 US"
40  OUTPUT 719; ":SOUR:PRIP:LIN:STOP 190 US"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

When you make a PRI pattern, all pulse widths are set to the global pulse width. Therefore, you should make the pattern before setting any pulse widths for individual pulses.

When you set a parameter for a selected PRI pattern, the system checks to make sure the value is within the allowable range. When you make a pattern, the system checks the interactions between all parameters for the selected PRI pattern.

Related HP-IB Commands

PRI Patterns Subsystem - TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - [MAKE PATTERN]

STAG:PRI1 (Staggered PRI 1)

Syntax

$$:\mathtt{SOUR:PRIP:STAG:PRI1}\ \textit{time} \begin{bmatrix} \mathtt{PS} \\ \mathtt{NS} \\ \mathtt{US} \\ \mathtt{MS} \\ \mathtt{S} \end{bmatrix}$$

```
:SOUR:PRIP:STAG:PRI1?
```

Item	Description	Range/Restrictions
Time	First staggered PRI	1.58 μs to 1 second

Description

This command sets the first pulse repetition interval (PRI) in a staggered pulse train.

The query returns the current setting of the first PRI in a staggered pulse train in seconds.

Example

To make a staggered PRI pattern of 100 μs, 250 μs, and 500 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE STAG"
20  OUTPUT 719; ":SOUR:PRIP:STAG:PRI1 100 US"
30  OUTPUT 719; ":SOUR:PRIP:STAG:PRI2 250 US; PRI3 500 US"
40  OUTPUT 719; ":SOUR:PRIP:MAKE"
50  END
```

Comments

If the total number of pulses set is less than the number of PRIs in a staggered pattern, the total number of pulses is automatically increased to match the number of PRIs.

If the total number of pulses set is greater than the number of PRIs in a staggered pattern, the staggered pattern is cloned to fill the extra pulses.

PRI1 must be a valid PRI. PRI2 through PRI6 can be valid PRIs or they can be set to zero. When a PRI pattern is made, PRIs set to zero are ignored. The pattern does not leave gaps for PRIs that are set to zero.

Related HP-IB Commands

PRI Pattern Subsystem
MAKE
STAG:PRI2
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Staggered Pattern Type) + PRI 1

STAG:PRI2 (Staggered PRI 2)

```
                      ┌PS┐
                      │NS│
:SOUR:PRIP:STAG:PRI2 time │US│
                      │MS│
                      └S ┘
```

```
:SOUR:PRIP:STAG:PRI2?
```

Item	Description	Range/Restrictions
Time	Second staggered PRI	0 and 1.58 μs to 1 second. See comments.

Note

The commands STAG:PRI3, STAG:PRI4, STAG:PRI5, and STAG:PRI6 are not described separately because their operation is identical to STAG:PRI2. The syntax for these commands is shown in Figure 12-2.

Description

This command sets the second pulse repetition interval (PRI) in a staggered pulse train.

The query returns the current setting of the second PRI in a staggered pulse train in seconds.

Example

To make a staggered PRI pattern of 100 μs, 250 μs, and 500 μs:

```
10  OUTPUT 719; ":SOUR:PRIP:TYPE STAG"
20  OUTPUT 719; ":SOUR:PRIP:STAG:PRI1 100 US"
30  OUTPUT 719; ":SOUR:PRIP:STAG:PRI2 250 US; PRI3 500 US"
40  OUTPUT 719; ":SOUR:PRIP:MAKE"
50  END
```

Comments

If the total number of pulses set is less than the number of PRIs in a staggered pattern, the total number of pulses is automatically increased to match the number of PRIs.

If the total number of pulses set is greater than the number of PRIs in a staggered pattern, the staggered pattern is cloned to fill the extra pulses.

PRI1 must be a valid PRI. PRI2 through PRI6 can be valid PRIs or they can be set to zero. When a PRI pattern is made, PRIs set to zero are ignored. The pattern does not leave gaps for PRIs that are set to zero.

Related HP-IB Commands

PRI Pattern Subsystem
MAKE
STAG:PRI1
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Staggered Pattern Type) + PRI 2

STEP:NPRI (Number of PRIs)

Syntax

```
:SOUR:PRIP:STEP:NPRI number
```

```
:SOUR:PRIP:STEP:NPRI?
```

Item	Description	Range/Restrictions
Number	Number of PRIs	1 to 512 for signal models 1 and 4; 1 to 113 for models 2, 3, 5, and 6

Description

This command sets the number of PRIs for a stepped PRI pattern.

The query returns the current setting of the number of PRIs in a stepped PRI pattern.

Example

To make a stepped PRI pattern with 10 steps, starting at 100 μs and stopping at 190 μs with 5 pulses at each step:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 50"
20  OUTPUT 719; ":SOUR:PRIP:TYPE STEP"
30  OUTPUT 719; ":SOUR:PRIP:STEP:NPRI 10"
40  OUTPUT 719; ":SOUR:PRIP:STEP:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:STEP:STOP 190 US"
60  OUTPUT 719; ":SOUR:PRIP:MAKE"
70  END
```

Comments

To ensure the same number of pulses at each step, make the total number of pulses an integer multiple of the number of PRIs.

A stepped PRI pattern is identical to a linear PRI pattern when the number of PRIs for the stepped pattern is equal to the total number of pulses for the linear pattern.

Setting the number of PRIs to 1 results in a constant PRI.

Related HP-IB Commands

Global Subsystem
TPUL

PRI Patterns Subsystem
MAKE
STEP:STAR
STEP:STOP
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for Stepped Pattern Type) + Number of PRIs

STEP:STAR (Stepped Start PRI)

Syntax

$$:\mathrm{SOUR:PRIP:STEP:STAR}\ \mathit{time} \begin{bmatrix} \mathrm{PS} \\ \mathrm{NS} \\ \mathrm{US} \\ \mathrm{MS} \\ \mathrm{S} \end{bmatrix}$$

```
:SOUR:PRIP:STEP:STAR?
```

Item	Description	Range/Restrictions
Time	Start PRI	1.58 μs to 1 second

Description

This command sets the start PRI for a stepped PRI pattern.

The query returns the current setting of the start PRI for a stepped PRI pattern.

Example

To make a stepped PRI pattern with 10 steps, starting at 100 μs and stopping at 190 μs with 5 pulses at each step:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 50"
20  OUTPUT 719; ":SOUR:PRIP:TYPE STEP"
30  OUTPUT 719; ":SOUR:PRIP:STEP:NPRI 10"
40  OUTPUT 719; ":SOUR:PRIP:STEP:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:STEP:STOP 190 US"
60  OUTPUT 719; ":SOUR:PRIP:MAKE"
70  END
```

Comments

To reverse the direction of the stepped PRI pattern, set the start PRI to be greater than the stop PRI.

Related HP-IB Commands

PRI Patterns Subsystem
MAKE
STEP:NPRI
STEP:STOP
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for Stepped Pattern Type) + Start PRI

STEP:STOP (Stepped Stop PRI)

Syntax

```
:SOUR:PRIP:STEP:STOP time [PS|NS|US|MS|S]
```

```
:SOUR:PRIP:STEP:STOP?
```

Item	Description	Range/Restrictions
Time	Stop PRI	1.58 μs to 1 second

Description

This command sets the stop PRI for a stepped PRI pattern.

The query returns the current setting of the stop PRI for a stepped PRI pattern.

Example

To make a stepped PRI pattern with 10 steps, starting at 100 μs and stopping at 190 μs with 5 pulses at each step:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 50"
20  OUTPUT 719; ":SOUR:PRIP:TYPE STEP"
30  OUTPUT 719; ":SOUR:PRIP:STEP:NPRI 10"
40  OUTPUT 719; ":SOUR:PRIP:STEP:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:STEP:STOP 190 US"
60  OUTPUT 719; ":SOUR:PRIP:MAKE"
70  END
```

Comments

To reverse the direction of the stepped PRI pattern, set the start PRI to be greater than the stop PRI.

Related HP-IB Commands

PRI Patterns Subsystem
JITT:APRI
JITT:TYPE
MAKE
TYPE

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Stepped Pattern Type) + Stop PRI

TYPE (PRI Pattern Type)

Syntax

```
                    ⎧ BURS ⎫
                    ⎪ CONS ⎪
                    ⎪ JITT ⎪
                    ⎪ LIN  ⎪
:SOUR:PRIP:TYPE     ⎨ STAG ⎬
                    ⎪ STEP ⎪
                    ⎪ USER ⎪
                    ⎩ WOBB ⎭

:SOUR:PRIP:TYPE?
```

Description

This command selects the PRI pattern type. The following patterns can be selected:

- BURS (Burst)
- CONS (Constant)
- JITT (Jittered)
- LIN (Linear)
- STAG (Staggered)
- STEP (Stepped)
- USER (User defined)
- WOBB (Wobbulation)

The query returns the currently selected PRI pattern. See figures 12-3 through 12-10 for examples of available PRI patterns.

TYPE (PRI Pattern Type)

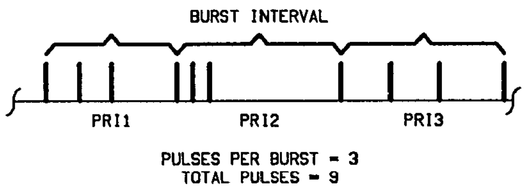


Figure 12-3. Typical Burst PRI Pattern

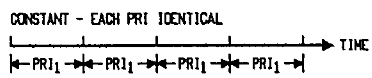


Figure 12-4. Typical Constant PRI Pattern

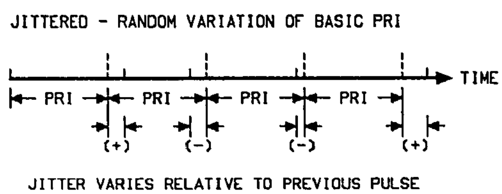


Figure 12-5. Typical Jittered PRI Pattern

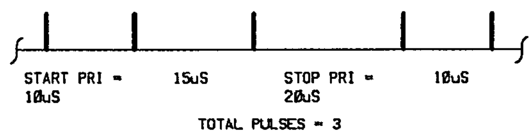


Figure 12-6. Typical Linear PRI Pattern

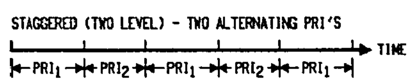


Figure 12-7. Typical Staggered PRI Pattern

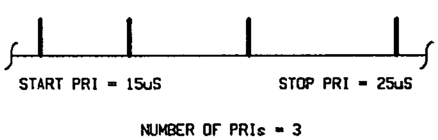


Figure 12-8. Typical Stepped PRI Pattern

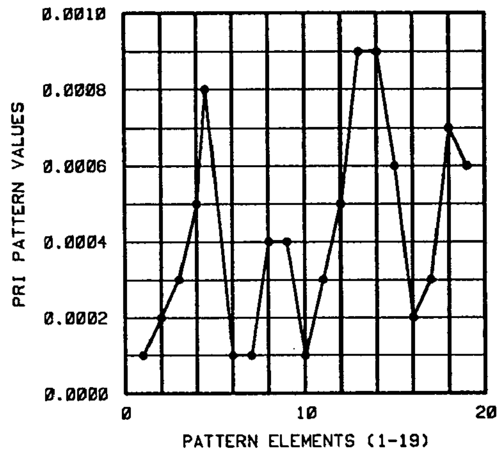


Figure 12-9. Typical User-Defined PRI Pattern

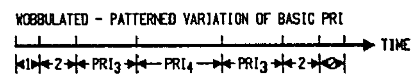


Figure 12-10. Typical Wobbulation PRI Pattern

Example

To select a linear PRI pattern:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 10"
20  OUTPUT 719; ":SOUR:PRIP:TYPE LIN"
30  OUTPUT 719; ":SOUR:PRIP:LIN:STAR 100 US"
40  OUTPUT 719; ":SOUR:PRIP:LIN:STOP 190 US"
50  OUTPUT 719; ":SOUR:PRIP:MAKE"
60  END
```

Comments

Constant is the default PRI pattern type.

The default jittered PRI distribution type is uniform.

The default wobbulation PRI pattern type is sawtooth.

Related HP-IB Commands

All commands in this subsystem.

Equivalent Front Panel Command

PRI Patterns Dialog Box - Pattern Type

USER:PATT (User Pattern Name)

Syntax

`:SOUR:PRIP:USER:PATT` *'name'*

`:SOUR:PRIP:USER:PATT?`

Item	Description	Range/Restrictions
Name	User-defined pattern name	The name must match an installed file name on the removable cartridge.

Description

This command specifies the name of a user-defined pattern to be used as a PRI pattern. The pattern must already be installed on the removable cartridge in order for this command to work.

The query returns the name of the currently specified user-defined PRI pattern.

Example

To specify a user-defined pattern named PRIPAT.USR as the PRI pattern (assuming the pattern is already installed on the removable cartridge) and set the maximum PRI to 1 ms and the minimum PRI to 100 μs:

```
10 OUTPUT 719; ":SOUR:GLOB:TPUL 20"
20 OUTPUT 719; ":SOUR:PRIP:TYPE USER"
30 OUTPUT 719; ":SOUR:PRIP:USER:PATT 'PRIPAT.USR'"
40 OUTPUT 719; ":SOUR:PRIP:USER:PMAX 900 US"
50 OUTPUT 719; ":SOUR:PRIP:USER:PMIN 100 US"
60 OUTPUT 719; ":SOUR:PRIP:MAKE"
70 END
```

Comments

User patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

For information on how to define, install, and incorporate user-defined patterns, see “User Patterns” in chapter 2 of the *RSID Local Operation Reference.*

If the user pattern has more data than there are pulses available, the data is truncated.

If there is not enough data for the number of pulses available, the data is cloned.

You may want to set the total number of pulses to be the same as the size of the user pattern so that all data in the pattern is used.

Related HP-IB Commands

PRI Patterns Subsystem
MAKE
TYPE
USER:PMAX
USER:PMIN

SID Subsystem
TEXT

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for User PRI Pattern) + [Select User Pattern]

USER:PMAX (Maximum User PRI)

Syntax

```
                          ┌PS┐
                          │NS│
:SOUR:PRIP:USER:PMAX time │US│
                          │MS│
                          └S ┘
```

```
:SOUR:PRIP:USER:PMAX?
```

Item	Description	Range/Restrictions
Time	Maximum PRI for a user-defined pattern	1.58 μs to 1 second

Description

This command sets the maximum PRI for a user-defined PRI pattern. Data in a user-defined PRI pattern can be either valid PRIs or general user pattern data scaled between -1 and $+1$. If a pattern consists of valid PRIs, the maximum PRI is automatically set to the maximum value in the pattern when the pattern is loaded. Otherwise, it is set equal to the value specified in this command.

The query returns the current setting of the maximum PRI in seconds for a user pattern.

Example

To specify a user-defined pattern named PRIPAT.USR as the PRI pattern (assuming the pattern is already installed on the removable cartridge) and set the maximum PRI to 1 ms and the minimum PRI to 100 μs:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 20"
20  OUTPUT 719; ":SOUR:PRIP:TYPE USER"
30  OUTPUT 719; ":SOUR:PRIP:USER:PATT 'PRIPAT.USR'"
40  OUTPUT 719; ":SOUR:PRIP:USER:PMAX 900 US"
50  OUTPUT 719; ":SOUR:PRIP:USER:PMIN 100 US"
60  OUTPUT 719; ":SOUR:PRIP:MAKE"
70  END
```

Comments

User patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference.*

If the user pattern has more data than there are pulses available, the data is truncated.

If there is not enough data for the number of pulses available, the data is cloned.

You may want to set the total number of pulses to be the same as the size of the user pattern so that all data in the pattern is used.

Changing the minimum and maximum PRI will change the scaling of the user PRI pattern produced, but it will not change the shape of the pattern.

Related HP-IB Commands

PRI Patterns Subsystem
MAKE
TYPE
USER:PATT
USER:PMIN

SID Subsystem
TEXT

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for User PRI Pattern) + Maximum PRI

USER:PMIN (Minimum User PRI)

Syntax

```
                          ┌PS┐
                          │NS│
:SOUR:PRIP:USER:PMIN time │US│
                          │MS│
                          └S ┘
```

```
:SOUR:PRIP:USER:PMIN?
```

Item	Description	Range/Restrictions
Time	Minimum PRI for a user-defined pattern	1.58 μs to 1 second

Description

This command sets the minimum PRI for a user-defined PRI pattern. Data in a user-defined PRI pattern can be either valid PRIs or general user pattern data scaled between -1 and $+1$. If a pattern consists of valid PRIs, the minimum PRI is automatically set to the minimum value in the pattern when the pattern is loaded. Otherwise, it is set equal to the value specified with this command.

The query returns the current setting of the minimum PRI in seconds for a user pattern.

Example

To specify a user-defined pattern named PRIPAT.USR as the PRI pattern (assuming the pattern is already installed on the removable cartridge) and set the maximum PRI to 1 ms and the minimum PRI to 100 μs:

```
10 OUTPUT 719; ":SOUR:GLOB:TPUL 20"
20 OUTPUT 719; ":SOUR:PRIP:TYPE USER"
30 OUTPUT 719; ":SOUR:PRIP:USER:PATT 'PRIPAT.USR'"
40 OUTPUT 719; ":SOUR:PRIP:USER:PMAX 900 US"
50 OUTPUT 719; ":SOUR:PRIP:USER:PMIN 100 US"
60 OUTPUT 719; ":SOUR:PRIP:MAKE"
70 END
```

Comments

User patterns are installed on the removable cartridge over the HP-IB with the :SID:TEXT command.

For information on how to define, install, and incorporate user-defined patterns, see "User Patterns" in chapter 2 of the *RSID Local Operation Reference.*

If the user pattern has more data than there are pulses available, the data is truncated.

If there is not enough data for the number of pulses available, the data is cloned.

You may want to set the total number of pulses to be the same as the size of the user pattern so that all data in the pattern is used.

Changing the minimum and maximum PRI will change the scaling of the user PRI pattern produced, but it will not change the shape of the pattern.

Related HP-IB Commands

PRI Patterns Subsystem
MAKE
TYPE
USER:PATT
USER:PMAX

SID Subsystem
TEXT

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for User PRI Pattern) + Minimum PRI

WOBB:STAR (Wobbulation Start PRI)

Syntax

```
:SOUR:PRIP:WOBB:STAR time [PS | NS | US | MS | S]
```

```
:SOUR:PRIP:WOBB:STAR?
```

Item	Description	Range/Restrictions
Time	Starting PRI	1.58 μs to 1 second

Description

This command sets the start PRI for a wobbulation PRI pattern.

The query returns the current setting of the start PRI for a wobbulation PRI pattern.

Example

To make a sinusoidal wobbulation PRI pattern with a start PRI of 100 μs, a stop PRI of 500 μs, and a frequency of wobbulation of 33 Hz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:PRIP:TYPE WOBB"
30  OUTPUT 719; ":SOUR:PRIP:WOBB:TYPE SIN"
40  OUTPUT 719; ":SOUR:PRIP:WOBB:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:WOBB:STOP 500 US"
60  OUTPUT 719; ":SOUR:PRIP:WOBB:WFR 33 HZ"
70  OUTPUT 719; ":SOUR:PRIP:MAKE
80  END
```

Comments

When a wobbulation PRI pattern is made, the variation in PRI is distributed over the total number of pulses previously specified. As a result, the wobbulation frequency may be different than the one you set with the WOBB:WFR command.

As an alternative, special function 54.1 can be used. This function will increase or decrease the total number of pulses in order to achieve the desired wobbulation frequency.

Related HP-IB Commands

Global Subsystem
TPUL

PRI Patterns Subsystem
MAKE
TYPE
WOBB:STOP
WOBB:TYPE
WOBB:WFR

SID Subsystem
SPEC

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for Wobbulation Pattern Type) + Start PRI

WOBB:STOP (Wobbulation Stop PRI)

Syntax

```
                        ⎡PS⎤
                        ⎢NS⎥
:SOUR:PRIP:WOBB:STOP time ⎢US⎥
                        ⎢MS⎥
                        ⎣S ⎦
```

```
:SOUR:PRIP:WOBB:STOP?
```

Item	Description	Range/Restrictions
Time	Stop PRI	1.58 μs to 1 second

Description

This command sets the stop PRI for a wobbulation PRI pattern.

The query returns the current setting of the stop PRI for a wobbulation PRI pattern.

Example

To make a sinusoidal wobbulation PRI pattern with a start PRI of 100 μs, a stop PRI of 500 μs, and a frequency of wobbulation of 33 Hz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:PRIP:TYPE WOBB"
30  OUTPUT 719; ":SOUR:PRIP:WOBB:TYPE SIN"
40  OUTPUT 719; ":SOUR:PRIP:WOBB:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:WOBB:STOP 500 US"
60  OUTPUT 719; ":SOUR:PRIP:WOBB:WFR 33 HZ"
70  OUTPUT 719; ":SOUR:PRIP:MAKE
80  END
```

Comments

When a wobbulation PRI pattern is made, the variation in PRI is distributed over the total number of pulses previously specified. As a result, the wobbulation frequency may be different than the one you set with the WOBB:WFR command.

As an alternative, special function 54.1 can be used. This function will increase or decrease the total number of pulses in order to achieve the desired wobbulation frequency.

Related HP-IB Commands

Global Subsystem
TPUL

PRI Patterns Subsystem
MAKE
TYPE
WOBB:STAR
WOBB:TYPE
WOBB:WFR

SID Subsystem
SPEC

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Wobbulation Pattern Type) + Stop PRI

WOBB:TYPE (Wobbulation Pattern Type)

Syntax

```
                       { SAWT }
:SOUR:PRIP:WOBB:TYPE   { SIN  }
                       { TRI  }
```

```
:SOUR:PRIP:WOBB:TYPE?
```

Description

This command selects the type of wobbulation pattern. The following patterns can be selected:

- SAWT - specifies a sawtooth PRI pattern.
- SIN - specifies a sinusoidal PRI pattern.
- TRI - specifies a triangular PRI pattern.

The query returns the currently selected wobbulation PRI pattern.

Example

To make a sinusoidal wobbulation PRI pattern with a start PRI of 100 μs, a stop PRI of 500 μs, and a frequency of wobbulation of 33 Hz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:PRIP:TYPE WOBB"
30  OUTPUT 719; ":SOUR:PRIP:WOBB:TYPE SIN"
40  OUTPUT 719; ":SOUR:PRIP:WOBB:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:WOBB:STOP 500 US"
60  OUTPUT 719; ":SOUR:PRIP:WOBB:WFR 33 HZ"
70  OUTPUT 719; ":SOUR:PRIP:MAKE
80  END
```

Comments

Sawtooth is the default wobbulation pattern type.

When a wobbulation PRI pattern is made, the variation in PRI is distributed over the total number of pulses previously specified. As a result, the wobbulation frequency may be different than the one you set with the WOBB:WFR command.

As an alternative, special function 54.1 can be used. This function will increase or decrease the total number of pulses in order to achieve the desired wobbulation frequency.

Related HP-IB Commands

Global Subsystem
TPUL

PRI Patterns Subsystem
MAKE
TYPE
WOBB:STAR
WOBB:STOP
WOBB:WFR

SID Subsystem
SPEC

Equivalent Front Panel Command

PRI Patterns Dialog Box - [More...] (for Wobbulation Pattern Type) + Pattern Type

WOBB:WFR (Wobbulation Frequency)

Syntax

$$\texttt{:SOUR:PRIP:WOBB:WFR}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

```
:SOUR:PRIP:WOBB:WFR?
```

Item	Description	Range/Restrictions
Frequency	Wobbulation frequency	0 to 200 kHz

Description

This command sets the wobbulation frequency for a wobbulation PRI pattern.

The query returns the current setting of the wobbulation frequency in hertz.

Example

To make a sinusoidal wobbulation PRI pattern with a start PRI of 100 μs, a stop PRI of 500 μs, and a frequency of wobbulation of 33 Hz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 100"
20  OUTPUT 719; ":SOUR:PRIP:TYPE WOBB"
30  OUTPUT 719; ":SOUR:PRIP:WOBB:TYPE SIN"
40  OUTPUT 719; ":SOUR:PRIP:WOBB:STAR 100 US"
50  OUTPUT 719; ":SOUR:PRIP:WOBB:STOP 500 US"
60  OUTPUT 719; ":SOUR:PRIP:WOBB:WFR 33 HZ"
70  OUTPUT 719; ":SOUR:PRIP:MAKE
80  END
```

Comments

Wobbulation frequency accuracy and resolution is determined by the total number pulses (the more pulses, the better the resolution).

When a wobbulation PRI pattern is made, the variation in PRI is distributed over the total number of pulses previously specified. As a result, the wobbulation frequency may be different than the one you set with the WOBB:WFR command.

As an alternative, special function 54.1 can be used. This function will increase or decrease the total number of pulses in order to achieve the desired wobbulation frequency.

Related HP-IB Commands

PRI Patterns Subsystem
MAKE
TYPE
WOBB:STAR
WOBB:STOP
WOBB:TYPE

SID Subsystem
SPEC

Equivalent Front Panel Command

PRI Patterns Dialog Box - (More...) (for Wobbulation Pattern Type) + Wobbulation Frequency

13

Pulse Subsystem

Introduction

The commands in this subsystem are used for editing individual pulse parameters. These commands correspond to the front panel Pulse Edit commands, which are accessed by (GLOBAL EDIT/PULSE EDIT).

Figure 13-1 shows a typical flowchart for using commands in the Pulse subsystem.

Figure 13-2 shows the syntax diagram for the Pulse subsystem.

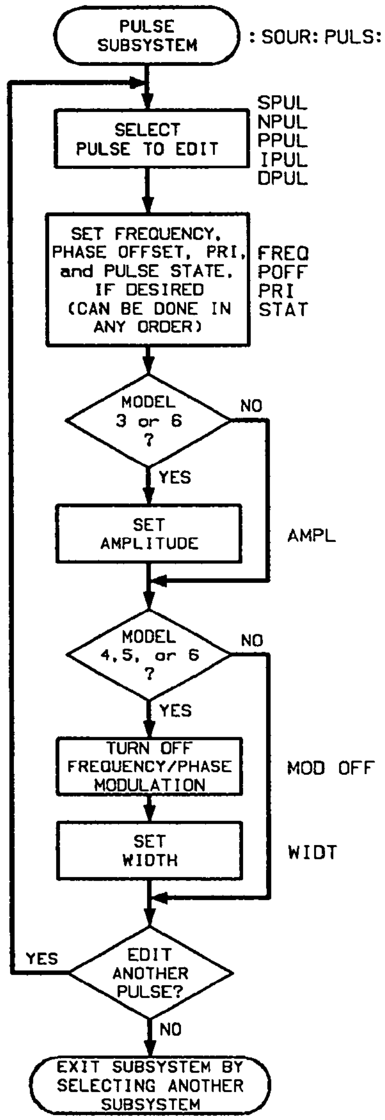


Figure 13-1. Pulse Subsystem Flowchart

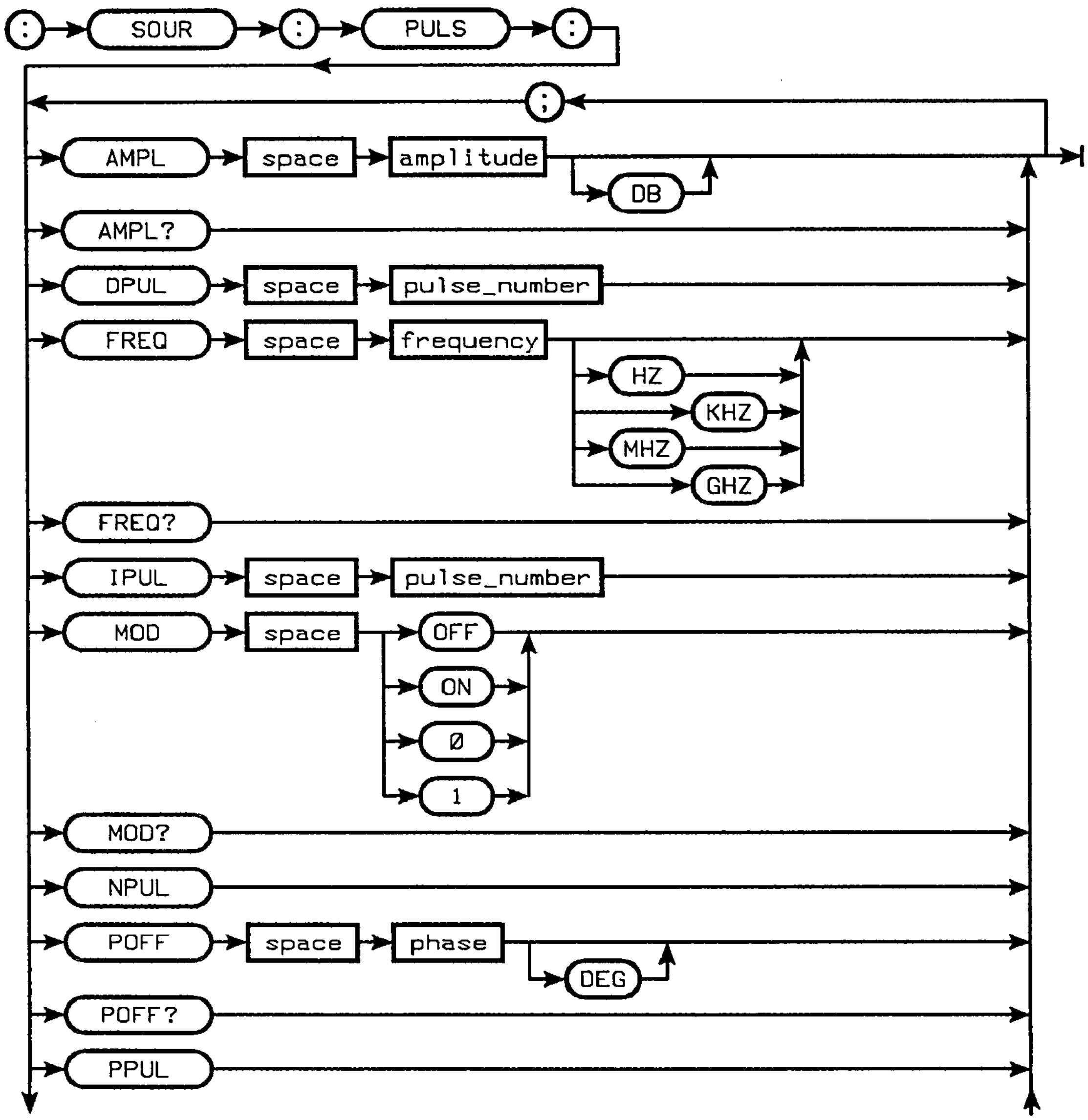


Figure 13-2. Pulse Subsystem Syntax Diagram

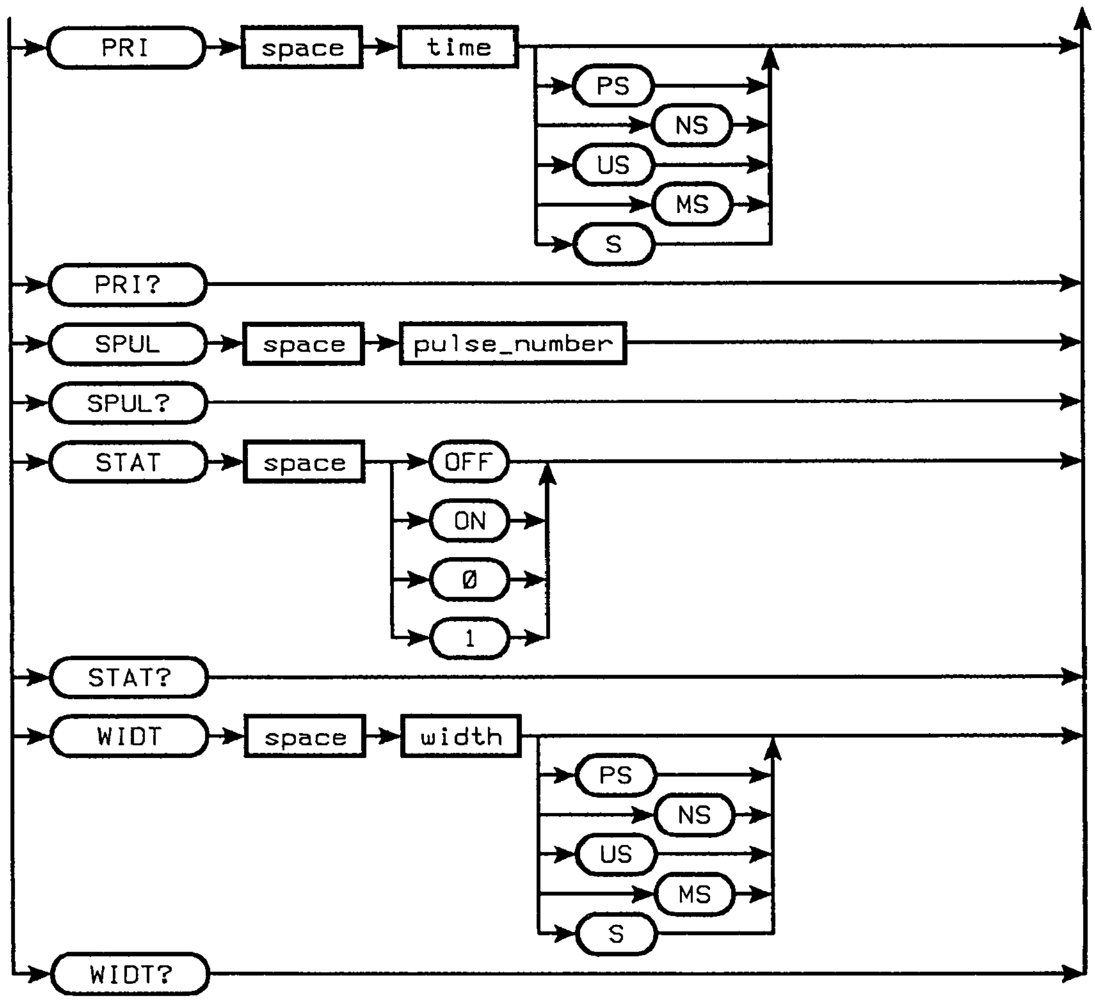


Figure 13-2. Pulse Subsystem Syntax Diagram (continued)

AMPL (Amplitude)

Syntax

`:SOUR:PULS:AMPL` *amplitude* [DB]

`:SOUR:PULS:AMPL?`

Item	Description	Range/Resolution
Amplitude	Individual pulse amplitude	See Description, below.

Description

This command sets the individual pulse amplitude relative to the system output level. (Output level is set by the :SOUR:GLOB:OLEV command.) The allowable range of settings is as follows:

- HP FASS Model 7: -100 to +10 dB in 0.1 dB steps.
- HP FASS Model 11: -107 to +22 dB in 0.1 dB steps.
- HP FASS Model 21: -100 to +6 dB in 0.1 dB steps.

The output level plus the amplitude must be within the valid range for the hardware model, as shown above.

This command is valid for signal models 3 and 6 only.

The query returns the current setting of the individual pulse amplitude.

Example

To set the pulse amplitude of the second pulse to −20 dB below a system output level of 10 dBm:

```
10  OUTPUT 719; ":SOUR:GLOB:SMOD 3"
20  OUTPUT 719; ":SOUR:GLOB:TPUL 5"
30  OUTPUT 719; ":SOUR:GLOB:OLEV 10 DBM"
40  OUTPUT 719; ":SOUR:PULS:SPUL 2"
50  OUTPUT 719; ":SOUR:PULS:AMPL -20 DB"
60  END
```

Comments

Actual Output Level = Output Level + Individual Pulse Amplitude.

Output level accuracy is as follows:

- HP FASS Model 7: ±1 dB for signal dynamic ranges ≤40 dB; ±3 dB for signal dynamic ranges > 40 dB.
- HP FASS Model 11: ±1 dB for RSID signal models 3 and 6 with internal leveling.
- HP FASS Model 21: ±2.2 dB at 0 dBm when calibrated.

If the pulse amplitude plus the peak output level is greater than +10 dB, the signal will be distorted for HP FASS Model 11.

The reset value for individual pulse amplitude is 0 dB.

If the output level is set to 0 dBm, amplitude will effectively be in dBm rather than dB.

The relative amplitude of all pulses can be set to the same level from the Global Subsystem with the :SOUR:GLOB:AMPL command.

Related HP-IB Commands

Global Subsystem
AMPL
OLEV
SMOD

Equivalent Front Panel Command

Pulse Edit Command - (AMPLITUDE)

DPUL (Delete Pulse)

Syntax

:SOUR:PULS:DPUL *pulse_number*

Item	Description	Range/Resolution
Pulse_number	Pulse to be deleted	1 to 512 for signal models 1 and 4; 1 to 113 for signal models 2, 3, 5, and 6.

Description

This command deletes the specified pulse and renumbers the remaining pulses. There must always be at least one valid pulse in a pulse train. Therefore, you cannot delete pulse 1 if it is the only remaining pulse.

Example

To delete the fifth pulse:

```
OUTPUT 719; ":SOUR:PULS:DPUL 5"
```

Comments

None

Related HP-IB Commands

Global Subsystem - TPUL

Equivalent Front Panel Command

Pulse Edit Command - DELETE PULSE

FREQ (Frequency)

Syntax

$$\texttt{:SOUR:PULS:FREQ}\ \textit{frequency} \begin{bmatrix} \texttt{HZ} \\ \texttt{KHZ} \\ \texttt{MHZ} \\ \texttt{GHZ} \end{bmatrix}$$

`:SOUR:PULS:FREQ?`

Item	Description	Range/Resolution
Frequency	Individual pulse carrier frequency	0 Hz to 200 GHz. Output frequency is hardware-dependent.

Description

This command sets the individual pulse carrier frequency. A pulse's carrier frequency plus the frequency offset must be within the following range:

- HP FASS Model 7: 0 Hz to 60 MHz.
- HP FASS Model 11: 2 MHz to 3.05 GHz.
- HP FASS Model 21: 10 MHz to 19 GHz.

The query returns the current setting of the individual pulse carrier frequency in hertz.

Example

To set the carrier frequency of the tenth pulse of a 60 pulse signal to 10 MHz:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 60"
20  OUTPUT 719; ":SOUR:PULS:SPUL 10"
30  OUTPUT 719; ":SOUR:PULS:FREQ 10 MHZ"
40  END
```

Comments

The reset value for the individual pulse frequency is 536.870912 MHz for HP FASS Models 11 and 21, and 33.554432 MHz for HP FASS Model 7.

Commands in the Hop Patterns subsystem provide another means of setting individual pulse frequencies.

Related HP-IB Commands

Global Subsystem
FOFF
TPUL

Hop Patterns Subsystem

Pulse Subsystem
SPUL

Equivalent Front Panel Command

Pulse Edit Command - FREQUENCY

IPUL (Insert Pulse)

Syntax

`:SOUR:PULS:IPUL` *pulse_number*

Item	Description	Range/Resolution
Pulse_number	Pulse after which new pulse is inserted	1 to 511 for signal models 1 and 4; 1 to 112 for signal models 2, 3, 5, and 6.

Description

This command inserts a pulse after the pulse specified and renumbers the pulses that follow. The inserted pulse is a copy of the specified pulse.

Example

To insert a pulse after the first pulse:

```
OUTPUT 719; ":SOUR:PULS:IPUL 1"
```

Comments

None

Related HP-IB Commands

Global Subsystem - TPUL

Equivalent Front Panel Command

Pulse Edit Command - [INSERT PULSE]

MOD (Modulation On/Off)

Syntax

$$\texttt{:SOUR:PULS:MOD} \begin{Bmatrix} \texttt{OFF or 0} \\ \texttt{ON or 1} \end{Bmatrix}$$

```
:SOUR:PULS:MOD?
```

Description

This command turns the frequency and phase modulation on or off for the selected pulse. When the modulation is off, you can change the width of the individual pulse. When the modulation is turned on, the individual pulse width is set to the global pulse width setting. This command is valid for signal models 4, 5, and 6 only.

The query returns a 0 if the modulation is off and a 1 if the modulation is on.

Example

To turn intrapulse modulation off for the first pulse of a four pulse linearly chirped signal:

```
10  OUTPUT 719; ":SOUR:GLOB:SMOD 4; TPUL 4"
20  OUTPUT 719; ":SOUR:FPM:TYPE LCH; LCH 2 MHZ"
30  OUTPUT 719; ":SOUR:PULS:SPUL 1"
40  OUTPUT 719; ":SOUR:PULS:MOD OFF"
50  END
```

Comments

The default state is having intrapulse modulation turned on.

Frequency and phase modulation is automatically turned off when the individual pulse width is changed.

Related HP-IB Commands

Global Subsystem
SMOD

Pulse Subsystem
PRI
SPUL
WIDT

Equivalent Front Panel Command

Pulse Edit Command - (MOD ON/OFF)

NPUL (Next Pulse)

Syntax

```
:SOUR:PULS:NPUL
```

Description

This command moves the selects the next pulse in a pulse train. This feature is useful when editing a series of consecutive pulses in succession.

Example

To select the next pulse:

```
OUTPUT 719; ":SOUR:PULS:NPUL"
```

Comments

The defined pulse train is repetitive in nature. That is, the next pulse after the last pulse is the first pulse.

If the total number of pulses is 1, this command has no effect.

Related HP-IB Commands

Pulse Subsystem
PPUL
SPUL

Global Subsystem
TPUL

Equivalent Front Panel Command

Pulse Edit Command - ▶

POFF (Phase Offset)

Syntax

```
:SOUR:PULS:POFF phase [DEG]

:SOUR:PULS:POFF?
```

Item	Description	Range/Resolution
Phase	Individual pulse phase offset	−180° to +180° in 0.1° steps

Description

This command sets the individual phase offset for the selected pulse relative to the global phase offset for all pulses.

The query returns the current setting of the phase offset in degrees.

Example

To set the relative phase offset of the third pulse in a 30 pulse signal to 45°:

```
10  OUTPUT 719; ":SOUR:GLOB:TPUL 30"
20  OUTPUT 719; ":SOUR:PULS:SPUL 3"
30  OUTPUT 719; ":SOUR:PULS:POFF 45 DEG"
40  END
```

Comments

The reset value for the individual phase offset is 0°.

If you are using CW or random phase intrapulse modulation, select CW or random phase before setting the individual pulse phase offset. Selecting CW frequency/phase modulation (:SOUR:FPM:TYPE CW) resets all individual phase offsets to 0°. Selecting random phase frequency/phase modulation (:SOUR:FPM:TYPE

RPH) overwrites the individual phase offsets with a random pattern of offsets between ±180°.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - TYPE

Global Subsystem - POFF

Pulse Subsystem - SPUL

Equivalent Front Panel Command

Pulse Edit Command - (Φ OFST)

PPUL (Previous Pulse)

Syntax

```
:SOUR:PULS:PPUL
```

Description

This command selects the previous pulse in the pulse train. This feature is useful when editing a series of consecutive pulses in succession.

Example

To select the previous pulse:

```
OUTPUT 719; ":SOUR:PULS:PPUL"
```

Comments

The defined pulse train is repetitive in nature. That is, the previous pulse before the first pulse is the last pulse.

If the total number of pulses is 1, this command has no effect.

Related HP-IB Commands

Pulse Subsystem
PPUL
SPUL

Global Subsystem
TPUL

Equivalent Front Panel Command

Pulse Edit Command - ◄

PRI (Pulse Repetition Interval)

Syntax

```
                                 ┌PS┐
                                 │NS│
:SOUR:PULS:PRI time              │US│
                                 │MS│
                                 └S ┘
```

```
:SOUR:PULS:PRI?
```

Item	Description	Range/Resolution
Time	Individual pulse PRI	1.58 μs to 1 second for all signal models except model 4; 3 μs to 1 second for model 4

Description

This command sets the individual PRI for the selected pulse.

The query returns the current setting of the individual pulse PRI in seconds.

Example

To set the PRI of the first pulse to 500 μs:

```
10  OUTPUT 719; ":SOUR:PULS:SPUL 1"
20  OUTPUT 719; ":SOUR:PULS:PRI 500 US"
30  END
```

Comments

The reset value for the individual pulse PRI is 100.0166 μs.

If the frequency or phase modulation is CW or random phase, the PRI resolution is CLOCK/4 (29.8 ns with internal clock). If there is any other type of frequency or phase modulation in the pulse, the PRI resolution is given by N(CLOCK/4), where N is determined by the following equation:

$$N = 1 + INT[\frac{t\frac{Clock}{4}}{15724}]$$

where: INT is the integer portion of the expression
t is the pulse on time

For signal models 4, 5, and 6, the individual pulse PRI must be $\geq$ the individual pulse width plus 240 ns.

Individual pulse width can be varied when frequency and phase modulation is turned off.

Related HP-IB Commands

Global Subsystem
WIDT

PRI Patterns Subsystem

Pulse Subsystem
MOD
SPUL
WIDT

Equivalent Front Panel Command

Pulse Edit Command - (PRI)

SPUL (Select Pulse)

Syntax

```
:SOUR:PULS:SPUL pulse_number
```

```
:SOUR:PULS:SPUL?
```

Item	Description	Range/Resolution
Pulse_number	Pulse to be edited	1 to 512 for signal models 1 and 4; 1 to 113 for signal models 2, 3, 5, and 6.

Description

This command selects an individual pulse to edit. Pulse subsystem commands affect the selected pulse.

The query returns the number of the currently selected pulse.

Example

To select the first pulse in the pulse train:

```
OUTPUT 719; ":SOUR:PULS:SPUL 1"
```

Comments

Pulse number 1 is the default selected pulse.

Related HP-IB Commands

Pulse Subsystem - all commands

Equivalent Front Panel Command

Pulse Edit Command - [SELECT PULSE]

STAT
(Pulse State)

Syntax

$$:SOUR:PULS:STAT \begin{Bmatrix} \texttt{OFF or 0} \\ \texttt{ON or 1} \end{Bmatrix}$$

```
:SOUR:PULS:STAT?
```

Description

This command turns the selected pulse on or off.

The query returns a 0 if the pulse is off and a 1 if the pulse is on.

Example

To turn off the first pulse in the pulse train:

```
10  OUTPUT 719; ":SOUR:PULS:SPUL 1"
20  OUTPUT 719; ":SOUR:PULS:STAT OFF"
30  END
```

Comments

The default condition turns all pulses on.

Related HP-IB Commands

Frequency/Phase Modulation Subsystem - all commands

Pulse Subsystem - SPUL

Equivalent Front Panel Command

Pulse Edit Command - (PULSE ON/OFF)

WIDT (Pulse Width)

Syntax

:SOUR:PULS:WIDT *width* [PS | NS | US | MS | S]

:SOUR:PULS:WIDT?

Item	Description	Range/Resolution
Width	Individual pulse width	For signal model 4 - 3 μs to 105 ms; for signal models 5 and 6 - 20 ns to 105 ms

Description

This command sets the individual pulse width for the selected pulse. This command is valid with signal models 4, 5, and 6 only.

The query returns the current setting of the individual pulse width in seconds.

Example

To set the second pulse of a 30 pulse signal to a pulse width of 50 μs:

```
10  OUTPUT 719; ":SOUR:GLOB:SMOD 4; TPUL 30"
20  OUTPUT 719; ":SOUR:PULS:SPUL 2"
30  OUTPUT 719; ":SOUR:PULS:WIDT 50 US"
```

Comments

The reset value of pulse width is 5.0142 μs.

The minimum pulse width that can be entered is 20 ns, but this value is rounded to the closest value that can actually be produced by the hardware. With an internal clock, the minimum pulse width is 29.8 ns.

In model 4 the minimum selected pulse width for trapezoidal and exponential pulse shapes is 3 μs.

Frequency and phase modulation is automatically turned off when the individual pulse width is changed. Individual pulse width can only be varied when the modulation is turned off.

The PRI must always be greater than or equal to the pulse width plus 240 ns.

When the frequency and phase modulation is turned on, the individual pulse width resets to the global pulse width setting.

Related HP-IB Commands

Global Subsystem
WIDT

Pulse Subsystem
MOD
PRI
SPUL

Equivalent Front Panel Command

Pulse Edit Command - (WIDTH)

14

SID Subsystem

Introduction

The commands in the SID subsystem control access to hardware images, ID settings, user patterns, and special functions. This subsystem also contains the command for shutting down the system.

Hardware Images

A hardware image is an exact copy of the HP FASS instrument state, including all hardware settings, modulation memory data, and sequencer information. It contains all the information necessary to recreate a signal.

HP FASS has six registers available for storing hardware images. All of these registers are located on the removable cartridge. Image register 0 is used to store the current hardware state when the system is shutdown. Register 0 is overwritten when the IMAG:LOAD command is used. Image registers 1 through 5 should be used for more permanent storage. Use the IMAG:SAVE command to save images and the IMAG:REC command to recall images.

In addition to storing hardware images in internal registers, images can be transferred to and from an external controller. Images are transferred from the controller to image register 0 with the IMAG:LOAD command. From image register 0, the image can be transferred to another image register or recalled to become the current system hardware image state.

Images are transferred to the controller from image register 0 with the IMAG:COPY? query. Save the current hardware state to register 0 or transfer the desired image to register 0 and then copy the image to the controller.

ID Settings

ID settings are the front panel button settings of an application ID. An ID setting contains all the information needed to calculate, download, and generate a signal once the setting is recalled and run.

HP FASS has 12 registers available for storing ID settings. In addition, a register 0 is used to store the ID settings when the system is shut down. These registers are located on the removable cartridge. Use the SETT:SAVE command to save settings and the SETT:REC command to recall settings.

In addition to storing ID settings in internal registers, ID settings can be transferred to and from an external controller. The current ID setting can be transferred to the controller using the SETT:COPY? query. An ID setting can be loaded into the system from a controller using the SETT:LOAD command. This ID setting becomes the current ID setting, replacing the existing one.

User Patterns

User patterns are ASCII text files that are used to customize application IDs. In order for a user pattern to be used by an ID, the pattern must be installed onto the removable cartridge. The TEXT command is used to create user patterns and to transfer patterns from the controller to the removable cartridge. The TEXT? query transfers the pattern from the cartridge to the controller.

User patterns can also be created and installed in local mode.

Copying Images, Settings, and Patterns

Copying a complete hardware image requires 2.8 MBytes of memory. Copying an ID setting requires 85 KBytes of memory.

Special Functions

Special functions perform certain functions with HP FASS that are not part of an application ID's normal operation. These are accessed with the SPEC command.

Shutdown

The system should be shut down before turning off the power. This guarantees that the system will boot up with its current hardware and software settings. The SHUT command allows you to shut the system down over the HP-IB.

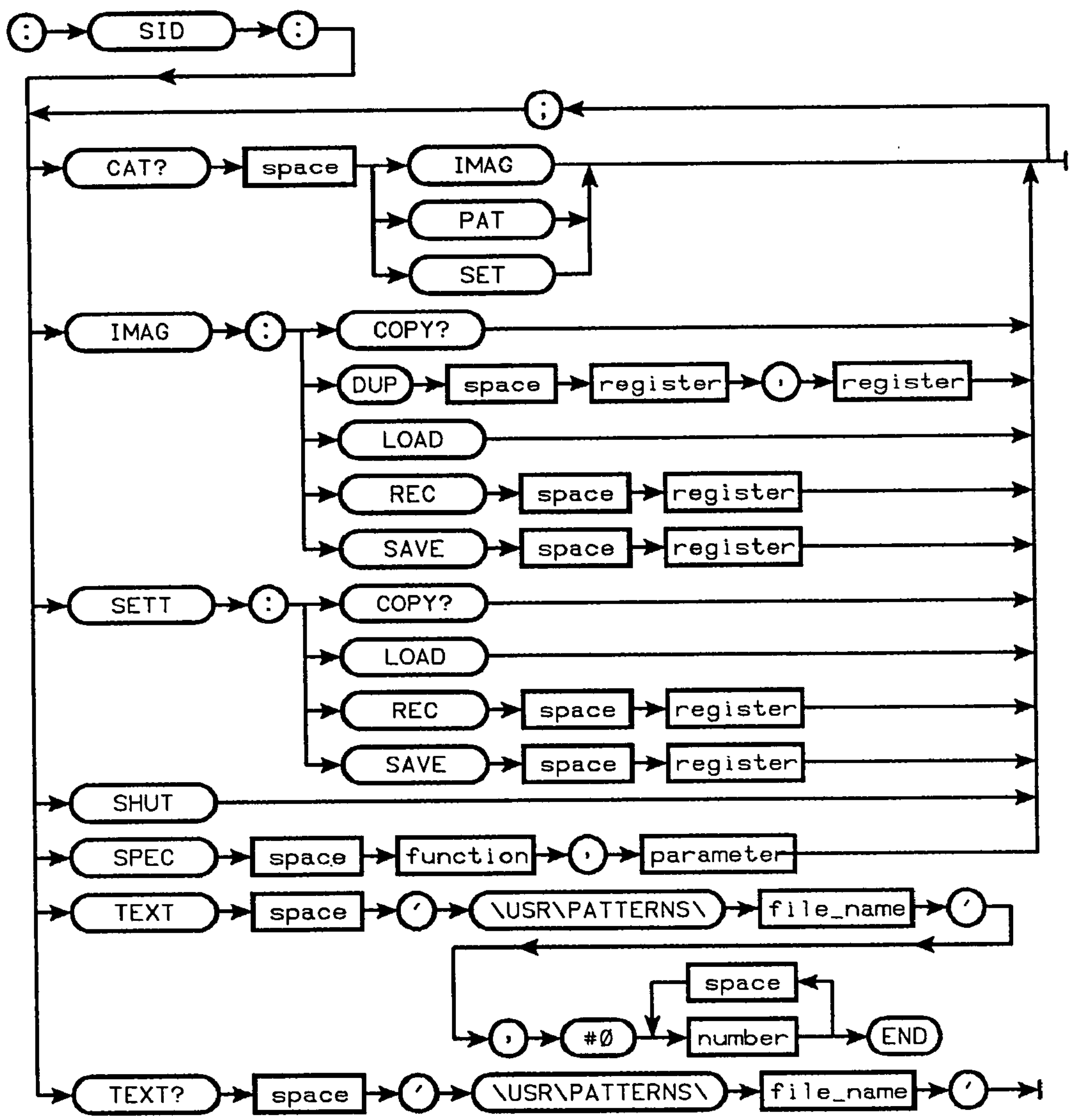


Figure 14-1. SID Subsystem Syntax Diagram

CAT? (Catalog Removable Cartridge)

Syntax

$$\text{:SID:CAT?} \begin{Bmatrix} \text{IMAG} \\ \text{PAT} \\ \text{SET} \end{Bmatrix}$$

Description

This query returns a catalog (listing) of all the hardware images, user patterns or ID settings installed on the removable cartridge.

Data is returned in block data format. The first 11 characters are header information.

Example

To return a listing of all settings installed on the removable cartridge:

```
10  DIM Catstring$[1000]
20  OUTPUT 719; ":SID:CAT? SET"
30  ENTER 719; Catstring$
40  PRINT Catstring$[11]
50  END
```

Comments

Related HP-IB Commands

SID Subsystem
IMAG:REC
IMAG:SAVE
SETT:REC
SETT:SAVE

Equivalent Front Panel Command

None

IMAG:COPY? (Copy Hardware Image)

Syntax

```
:SID:IMAG:COPY?
```

Description

This query copies the contents of image register 0 to an external controller. Image register 0 is one of six registers available for storing hardware images. Hardware images are transferred to image register 0 by using the :SID:IMAG:SAVE or :SID:IMAG:DUP command.

Example

To copy the contents of image register 0 and write it to a file:

```
10  CREATE BDAT "MYIMAGE", 2734    !Set up file to hold data
20  ASSIGN @Imagefile to "MYIMAGE" !Path to data file
30  ASSIGN @Fass to 719            !Path to FASS
40  !
50  DIM Tmp$[8192] BUFFER !Allocate buffer
60  ASSIGN @Buf TO BUFFER Tmp$     !Path to buffer
70  !
80  A=0
90  !
100 !
110 !Get hardware image data
120 OUTPUT @Fass; ":SID:IMAG:COPY?"
130 REPEAT
140    TRANSFER @Fass TO @Buf; END, WAIT
150    STATUS @Buf,4;Bytein
160    STATUS @Buf,10;Z
170 !
180    IF Z THEN
190       Lastcount=Bytein-1       !Leave of <NL>
200       A=A+Lastcount
```

```
210       TRANSFER @Buf to @Imagefile;COUNT Lastcount, WAIT
220    ELSE
230       A=A+Bytein
240       TRANSFER @Buf to @Imagefile;COUNT Bytein, WAIT
250    END IF
260 UNTIL BIT (Z,3)
270 PRINT "Total size of image file: ",A
280 END
```

Comments

Copying a complete hardware image will require 2.8 MBytes of memory.

All the image registers are located on the removable cartridge.

The system uses image register 0 to save and restore the current hardware state during shutdown and power up. If the system is shut down prior to turning off power, the current hardware state is stored in image register 0. If another hardware image is already stored in image register 0, it will be overwritten.

Related HP-IB Commands

SID Subsystem
IMAG:DUP
IMAG:LOAD
IMAG:REC
IMAG:SAVE

Equivalent Front Panel Command

None

IMAG:DUP (Duplicate Hardware Image)

Syntax

`:SID:IMAG:DUP` *register, register*

Item	Description	Range/Restrictions
Register	Hardware image register	0 to 5

Description

This command is used to duplicate a hardware image from a source register to a destination register. Six registers, 0 through 5, are available for storing hardware images.

Example

To duplicate a hardware image in register 1 to register 2:

```
OUTPUT 719; ":SID:IMAG:DUP 1, 2"
```

Comments

If the system is shut down prior to turning off power, the current hardware state is stored in image register 0. If another hardware image is already stored in image register 0, it will be overwritten.

Related HP-IB Commands

SID Subsystem
IMAG:COPY?
IMAG:LOAD
IMAG:REC
IMAG:SAVE

Equivalent Front Panel Command

Utilities Menu - Hardware Images ... + [Copy Image to Image]

IMAG:LOAD (Load Hardware Image)

Syntax

```
:SID:IMAG:LOAD
```

Description

This command loads a hardware image from an external controller into image register 0. Image register 0 is one of six registers available for storing hardware images.

Example

To load a hardware image from a file on a disk (file name is MYIMAGE) to image register 0:

```
10  ASSIGN @Imagefile to "MYIMAGE" !Path to data file
20  ASSIGN @Fass to 719            !Path to FASS
30  !
40  DIM Tmp$[8192] BUFFER         !Allocate buffer
50  ASSIGN @Buf TO BUFFER Tmp$    !Path to buffer
60  !
70  A=0
80  !
100 !Send data from file to FASS
110 OUTPUT @Fass; ":SID:IMAG:LOAD ";
120 REPEAT
130    TRANSFER @Imagefile TO @Buf;END,WAIT
140    STATUS @Buf,4;Bytein
150    STATUS @Buf,10;Z
160 !
170    A=A+Bytein
180    TRANSFER @Buf TO @FASS;COUNT Bytein,WAIT
190    IF Z THEN
200       OUTPUT @Fass USING "-,K";"",END
210    END IF
220 UNTIL BIT (Z,3)
230 PRINT "Total size of image file: ",A
240 END
```

Comments

The hardware image in register 0 can become the current hardware state by recalling the image from register 0 with the :SID:IMAG:REC command.

Related HP-IB Commands

SID Subsystem
IMAG:COPY?
IMAG:DUP
IMAG:REC
IMAG:SAVE

Equivalent Front Panel Command

None

IMAG:REC (Recall Hardware Image)

Syntax

```
:SID:IMAG:REC register
```

Item	Description	Range/Restrictions
Register	Hardware image register	0 to 5

Description

This command recalls a previously saved hardware image.

Example

To recall the contents of image register 2:

```
OUTPUT 719; ":SID:IMAG:REC 2"
```

Comments

When a hardware image is recalled, it becomes the new hardware state by replacing the existing state. When you recall the hardware image, however, it does not change the current ID settings and that these settings may not correspond to the signal defined by the hardware state.

Once the hardware image has been recalled, the signal is generated using either the :FASS:STAR command or the :TRIG:IMM command.

All the image registers are located on the removable cartridge.

If the system is shut down prior to turning off power, the current hardware state is stored in image register 0. If another hardware image is already stored in image register 0, it will be overwritten.

Related HP-IB Commands

FASS Subsystem
STAR
SID Subsystem
IMAG:COPY?
IMAG:DUP
IMAG:LOAD
IMAG:SAVE

Trigger Subsystem
IMM

Equivalent Front Panel Command

Utilities Menu - Hardware Images ... + [Recall]

IMAG:SAVE (Save Hardware Image)

Syntax

```
:SID:IMAG:SAVE register
```

Item	Description	Range/Restrictions
Register	Hardware image register	0 to 5

Description

This command saves the current hardware state to a hardware image register for recall at a later time.

Example

To save the current hardware state to image register 3:

```
OUTPUT 719; ":SID:IMAG:SAVE 3"
```

Comments

All the image registers are located on the removable cartridge.

If the system is shut down prior to turning off power, the current hardware state is stored in image register 0. If another hardware image is already stored in image register 0, it will be overwritten.

Related HP-IB Commands

SID Subsystem
IMAG:COPY?
IMAG:DUP
IMAG:LOAD
IMAG:REC

Equivalent Front Panel Command

Utilities Menu - Hardware Images . . . + (Save)

SEND

Syntax

`:SID:SEND '(`*7xx*`)', '`*command*`'`

`:SID:SEND? '(`*7xx*`)', '`*query?*`'`

Item	Description	Range/Restrictions
7xx	HP-IB address	714=AMUC; 715=AUC; 716=ACS; 717=MDS
Command	HP-IB command	
Query?	HP-IB query	

Description

This command allows you to send HP-IB commands to individual instruments in the HP FASS system. It is used for diagnostics and troubleshooting.

SETT:COPY? (Copy ID Setting)

Syntax :SID:SETT:COPY?

Description This query copies the current ID setting to an external controller.

Example To copy the current ID setting and write it to a file:

```
10  CREATE BDAT "MYSETTING", 390    !Set up file to hold data
20  ASSIGN @Setfile to "MYSETTING"  !Path to data file
30  ASSIGN @Fass to 719             !Path to FASS
40  !
50  DIM Tmp$[8192] BUFFER          !Allocate buffer
60  ASSIGN @Buf TO BUFFER Tmp$     !Path to buffer
70  !
80  A=0
90  !
100 !
110 !Get ID setting data
120 OUTPUT @Fass; ":SID:SETT:COPY?"
130 REPEAT
140    TRANSFER @Fass TO @Buf;END,WAIT
150    STATUS @Buf,4;Bytein
160    STATUS @Buf,10;Z
170 !
180    IF Z THEN
190       Lastcount=Bytein-1       !Leave of <NL>
200       A=A+Lastcount
210       TRANSFER @Buf to @Setfile;COUNT Lastcount, WAIT
220    ELSE
230       A=A+Bytein
240       TRANSFER @Buf to @Setfile;COUNT Bytein,WAIT
250    END IF
260 UNTIL BIT (Z,3)
```

```
270 PRINT "Total size of setting file: ",A
280 END
```

Comments A complete ID setting requires 85 KBytes of memory.

Related HP-IB Commands
SID Subsystem
SETT:LOAD
SETT:REC
SETT:SAV

Equivalent Front Panel Command None

SETT:LOAD
(Load ID Setting)

Syntax

```
:SID:SETT:LOAD
```

Description

This command loads an ID setting from an external controller into the system. This becomes the current ID setting.

Example

To load an ID setting from a file on a disk (file name is MYSETTING) to FASS:

```
10  ASSIGN @Setfile to "MYSETTING" !Path to data file
20  ASSIGN @Fass to 719            !Path to FASS
30  !
40  DIM Tmp$[8192] BUFFER           !Allocate buffer
50  ASSIGN @Buf TO BUFFER Tmp$      !Path to buffer
60  !
70  A=0
80  !
90  !
100 !Send data from file to FASS
110 OUTPUT @Fass; ":SID:SETT:LOAD ";
120 REPEAT
130    TRANSFER @Setfile TO @Buf;END,WAIT
140    STATUS @Buf,4;Bytein
150    STATUS @Buf,10;Z
160 !
170    A=A+Bytein
180    TRANSFER @Buf TO @FASS;COUNT Bytein,WAIT
190    IF Z THEN
200       OUTPUT @Fass USING "-,K";"",END
210    END IF
220 UNTIL BIT (Z,3)
230 PRINT "Total size of ID setting: ",A
240 END
```

Comments None

Related HP-IB Commands
SID Subsystem
SETT:COPY?
SETT:REC
SETT:SAV

Equivalent Front Panel Command None

SETT:REC (Recall ID Setting)

Syntax

```
:SID:SETT:REC register
```

Item	Description	Range/Restrictions
Register	ID setting register	0 to 12

Description

This command recalls a previously saved ID setting.

Example

To recall an ID setting from register 10:

```
OUTPUT 719; ":SID:SETT:REC 10"
```

Comments

Register 0 stores the ID setting that was current the last time the system was shut down. ID settings can be recalled from register 0 but they cannot be saved to it.

To calculate, download, and produce the signal defined by the current ID setting, use the application ID's RUN command.

Related HP-IB Commands

SID Subsystem
SETT:COPY?
SETT:LOAD
SETT:SAVE

Equivalent Front Panel Command

Utilities Menu - ID Settings ... + (Recall)

SETT:SAVE (Save ID Setting)

Syntax

`:SID:SETT:SAVE` *register*

Item	Description	Range/Restrictions
Register	ID setting register	1 to 12

Description

This command saves the current ID setting on the removable cartridge for recall at a later time.

Example

To save the current ID setting in register 10:

```
OUTPUT 719; ":SID:SETT:SAVE 10"
```

Comments

Related HP-IB Commands

SID Subsystem
SETT:COPY?
SETT:LOAD
SETT:REC

Equivalent Front Panel Command

Utilities Menu - ID Settings ... + (Save)

SHUT (Shutdown)

Syntax

```
:SID:SHUT
```

Description

This command saves the current hardware state and software ID settings to the removable cartridge. It guarantees that the system will reboot to its current configuration. This command should be executed prior to turning off power to the system.

Example

To shut the system down:

```
OUTPUT 719; ":SID:SHUT"
```

Comments

On shutdown, the current hardware state is stored in image register 0. If another image is stored in register 0, it will be overwritten. Software ID settings are stored in ID settings register 0.

Model 11, level calibration factors are stored on the removable cartridge when a shutdown is executed.

The system powers up to the HP-IB address it was at the last time the system was shut down. If the address has been changed, shut down the system to ensure that the system powers up to the new HP-IB address.

Related HP-IB Commands

None

Equivalent Front Panel Command

Utilities Menu - Shutdown

SPEC (Special Functions)

Syntax

`:SID:SPEC` *function, parameter*

Item	Description	Range/Restrictions
Function	Special function number	See table.
Parameter	Parameter for special function	See table.

Description

This command implements special functions. Special functions perform certain ID functions with FASS that are not part of an application's normal operation. See the following table for a list of special functions and their parameters.

Table 14-1. Special Functions

Special Function Number	Parameters	Description
10.1	-180° to +180°	**Phase Adjust** - adjusts the phase of the carrier frequency by loading a constant offset to PM memory. This is used to align the phase of two HP FASS systems. This special function disables phase modulation and overwrites the contents of PM memory.
11	0	**Save AUC Level Cal Data** - applies to Model 21 only. Can be used to save level calibration data prior to turning off power.
12	0	**Restore AUC Level Cal Data** - applies to Model 21 only. Restores the level calibration data that was saved using special function 11.
13.1	-1 to 1023	**Set AMPM Sequence Number** - selects the sequence in AMPM memory to be executed.
13.2	-1 to 1023	**Set PM Sequence Number** - selects the sequence in PM memory to be executed.
13.3	-1 to 1023	**Set FM Sequence Number** - selects the sequence in FM memory to be executed.
13.4	-1 to 1023	**Set FREQ Sequence Number** - selects the sequence in Frequency memory to be executed.
14.1	0 to 70 dB in 10 dB steps	**Set AUC Output Attenuator** - allows individual control of the AUC output attenuator for Model 21. Normally, the AUC output attenuator is set to 10 dB fixed for Model 21. For Model 11, the attenuator commands control the AUC output attenuator and this special function is not needed. Specifications will be downgraded when this special function is used.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
14.2		**Set AUC Mode** - determines how AUC translates the upconversion frequency band data. HP FASS automatically sets the AUC model based on whether or not an AMUC is present. This special function allows you to change the automatic setting.
	0	Model 11
	1	Model 21
14.3	0 to 110 dB in 10 dB steps	**Set AMUC Low Output Attenuator** - allows individual control of the AMUC output attenuator for the 50 MHz to 500 MHz output.
14.4	0 to 110 dB in 10 dB steps	**Set AMUC High Output Attenuator** - allows individual control of the AMUC output attenuator for the 500 MHz to 18 GHz output.
14.5	0 to 11 dB in 1 dB steps	**Set AMUC Input Attenuator** - allows individual control of the input attenuator to the AMUC.
15	0	**Broadband Upconverter Menu** - displays a menu on the front panel if a Broadband Microwave Upconverter is connected to the private bus.
16	0	**Display Upconverter Settings** - displays the LO and Broadband Microwave Upconverter settings on the front panel.
16.1	1 to 12	**Set Upconverter Band** -sets E2500A (options K01, K02, K09) Broadband Microwave Upconverter (BMUC) band settings. Sets BMUC band independent of LO settings.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
16.2	1 to 12	**Set Upconverter Band and LO** -sets E2500A (options K01, K02, K09) Broadband Microwave Upconverter (BMUC) band and LO settings. Sets BMUC band, LO frequency, and LO output level.
16.3	0 to 110 in steps of 10	**Set Upconverter Attenuator**- sets the E2500A (options K01, K02, K09) Broadband Microwave Upconverter output attenuation from 0 to 110 dB in 10 dB steps (default = 0 dB).
16.4	Frequency in Hz	**Set LO Frequency** - sets the E2500A (options K01, K02, K09) Upconverter LO frequency in Hz.
16.5	Level in dBm from +12 to −20 dBm	**Set LO Level** - sets the E2500A (options K01, K02, K09) Upconverter LO level in dBm from +12 to −20 dBm.
17	0	**Display Upconverter Band Info** -displays the E2500A (options K01, K02, K09) Broadband Upconverter band information on the front panel.
20	0	**Change to alternate hardware image directory** - switches to the alternate hardware image directory on the removable cartridge. This increases the amount of hardware images that can be stored. In order to access the alternate hardware image directory, all image registers in the main directory must contain images.
21	0	**Change to main hardware image directory** - switches from alternate hardware image directory to the main hardware image directory.
39	0	**Instrument Firmware Version** - displays the firmware version of the ACS, AUC, AMUC, and MDS on the front panel.
40	0	**Set Cal Factors to 1** - sets all the calibration factors to 1. See the CAL command in the FASS subsystem for additional information about calibration. Applicable only to Model 11.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
40.1	>0 and <1	**Set Cal Factors** - sets all calibration factors to a specified value. Applicable only to Model 11.
41.1	0 to 30	**Set HP-IB Address** - sets the HP-IB address over the HP-IB. This special function is intended for use with systems that do not have a keyboard, monitor, and mouse.
50.1		**Enable Interpolation on FM User Pattern** - determines how user-defined FM data is expanded to fit the pulse width.
	0	Expand the data without interpolation (reset condition).
	1	Linear interpolation of the data.
51.1		**Enable Interpolation on PM User Pattern** - determines how user-defined PM data is expanded to fit the pulse width.
	0	Expand the data without interpolation (reset condition).
	1	Linear interpolation of the data.
52.1		**Lock Fast Attenuator in AUC** - forces the fast attenuator to stay at a fixed level when generating signals using signal models 3 or 6. All amplitude control is done without the fast attenuator (FLC). This special function is used to suppress spurs.
	0	Unlock fast attenuator (reset condition).
	1	Lock fast attenuator.
53	0	**Barker Element Adjustment** - adjusts the element width of the Barker code or compound Barker code so that each element uses an integer number of phase data points. If necessary, the current pulse width is adjusted. This should be the final operation before selecting :SOUR:GLOB:RUN.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
54.1	1 to 200 kHz	**PRI Wobbulation Adjustment** - adjusts the number of pulses in a PRI wobbulation pattern that results in the closest wobbulation frequency. Wobbulation must already be selected as the current PRI pattern.
55.1		**Model Change Rollover Enable** - alters the way in which signal model changes occur. Normally, a signal model change results in the reset of all parameters. This special function is a best attempt and does not result in a perfect rollover. See comments.
	0	Disable parameter rollover (reset condition).
	1	Enable parameter rollover.
56.1	PRI error in seconds	**Coherent Pulses (PRI priority)** - takes the current PRI and frequency and alters them to generate fully coherent pulses. A fully coherent pulse is an integer number of carrier cycles within the PRI such that each pulse starts at the same phase. The parameter specifies an allowable PRI error range. The global frequency and global PRI are then altered to get fully coherent pulses. The worst case frequency error is related to the inverse of the PRI error.
57.1	Frequency error in hertz	**Coherent Pulses (Frequency priority)** - takes the current PRI and frequency and alters them to generate fully coherent pulses. A fully coherent pulse is an integer number of carrier cycles within the PRI such that each pulse starts at the same phase. The parameter specifies an allowable frequency error range. The global frequency and global PRI are then altered to get fully coherent pulses. The worst case PRI error is related to the inverse of the frequency error.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
58.1		**Mark All Pulses** - provides on and off markers for all pulses generated. A typical use of this special function provides markers to pulse blanking circuitry. The blanking circuitry prevents the high pulse power levels output by HP FASS from damaging sensitive equipment. Pulse-on marker produced by FM equal address marker and is accessed at MDS rear panel EVENT MARKER 1 FM. Pulse-off marker produced by FM packet start marker and is accessed at EVENT MARKER 2 FM. Mark All Pulses is disabled after model change or reset. Multiple pulse-on markers can occur while the pulse is on and one to three pulse-off markers can occur when the pulse is off. In no case will pulse-off markers occur while the pulse is on. Causes following changes to normal RSID operation when enabled: ■ Not possible to mark a specific pulse using Pulse Marker. ■ Resolution is (with 134 MHz internal clock): Res = 29.8 ns, when Ontime is $\leq$ 468.7 μs; (15724 × 29.8 ns) Res = 59.6 ns × (ROUNDUP[Ontime/15724 × 59.6 ns]), when Ontime is > 468.7 μs; (15724 × 29.8 ns) Ontime includes pulse edge time for models 1 and 4 (Pulse Shaping). ROUNDUP means to round a fractional part up to the next whole (e.g., ROUNDUP(8.33) = 9). 29.9 ns = System clock/4. ■ Pulse on and off markers indicate that pulse is always on for signals where the PRI is less than 3 μs. ■ Pulse-on and pulse-off markers are simultaneous. ■ Minimum pulse-on marker guard band is ≈210 ns. ■ Worst-case time from actual pulse off to pulse-off marker is 15 × Resolution. This is ≈450 ns for pulse ontimes < 450 μs. ■ Maximum pulse width for individual pulse widths (those without modulation) in signal models 4, 5, 6 is ≈15 ms (524288 × Resolution).

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
58.1		**Mark All Pulses** (continued)
		Note: The analog output signal has a longer delay than the pulse-on and pulse-off markers. This system delay is $\approx$3.14 μs for the default clock frequency. This delay is constant for a given system clock frequency . The delay is part digital and part analog. It must be accounted for in the blanking circuitry.
	0	Disable Mark All Pulses (default).
	1	Enable Mark All Pulses.
59.1		**E2500A (options K01, K02, K09) Broadband Microwave Upconverter (BMUC) Frequency Support** - allows RSID to work with BMUC. The frequency ranges of RSID have been increased from 1 MHz to 26 GHz. Does not mean to imply that the HP FASS hardware meets specifications at these limits. It means RSID will accept frequency parameters within this range when the special function is enabled. When the special function is disabled, RSID operation is unchanged.
		BMUC frequency support is disabled after a model change or reset.
		When enabled the following changes occur:
		■ Carrier frequency input parameter limits increase 1 MHz to 26 GHz. ■ RSID generates the desired signal by calculating upconversion band and HP FASS frequencies. ■ Current upconverter is to 18 GHz only by bands. ■ RSID will try to control the LO for the upconverter. HP 8360 Series (e.g., 83620A), HP 8341B. It doesn't care if it cannot find one of these. (You can use any appropriate signal generator.) ■ RSID does not automatically correct the PM or FM when the lower sideband is used for upconversion. Corrections can be made manually with RSID in many cases.

Table 14-1. Special Functions (continued)

Special Function Number	Parameters	Description
59.1		**BMUC Frequency Support** (continued)
		Hop pattern functions will work with the expanded frequency range. The Global subsystem FOFF parameter can be used to allow RSID to work with upconversion above 18 GHz. This is done by setting the FOFF to the negative value of the amount of upconversion. This is true with or without BMUC. For example, set RSID carrier to 25 GHz and FOFF to −10 GHz. This means HP FASS with BMUC must produce a signal at 15 GHz. HP FASS BMUC = Carrier + Offset.
	0	Disable BMUC Frequency Support (default).
	1	Enable BMUC Frequency Support.
60.1		**Best signal to noise** - applies to HP FASS Model 11 and 21 only. This special function tries to improve the signal-to-noise ratio. The trade offs are that the distortion on AM will be worse and for HP FASS Model 11 the harmonics on the RF output will be worse.
	0	Disable best signal-to-noise ratio (default).
	1	Enable best signal-to-noise ratio.
61		**List Pulse Data to WGL Command Log** - displays pulse data in the WGL Command Log rather than sending the data to a printer.

Example

To select special function 53 (Barker chip adjustment):

```
OUTPUT 719; ":SID:SPEC 53, 0"
```

Comments

Special Functions 15 through 17 are only valid if you have a Broadband Microwave Upconverter (BMUC). See the BMUC documentation for additional information about these special functions.

Changing the RSID signal model number resets the special functions above 50.

In general, the following conditions occur when special function 55.1 is enabled and the signal model is changed:

- Rise and fall times are set to approximately 17.5 ns.
- Global width is recalculated based on new rise and fall times.
- Pulse shape is set to trapezoidal or rectangular.
- Maximum number of pulses is set to 512 for models 1 and 4 and 113 for models 2, 3, 5, and 6.
- Individual pulse widths are set equal to the global pulse widths.
  *Pulse shaping becomes available for models 1 and 4, antenna modulation becomes available for models 2 and 5, and individual pulse amplitude control becomes available for models 3 and 6.

Equivalent Front Panel Command

Options Menu - Special Functions ...

TEXT

Syntax

`:SID:TEXT '\USR\PATTERNS\`*file_name',#0 data*

`:SID:TEXT? '\USR\PATTERNS\`*file_name'*

Item	Description	Range/Restrictions
File_name	ASCII text file	Each file name can have up to 8 characters with an extension of up to 3 characters. The name and extension must be separated by a period.
Data	ASCII text	Arbitrary length block data. Up to 8193 real numbers. If the file is a user pattern, the first number specifies the number of data points that follow. Each number must be separated by a space or a <NL>.

Description

This command is used to transfer user patterns and other ASCII files from an external controller to the removable cartridge. User patterns are stored on the cartridge under the \USR\PATTERNS directory.

The query is used to transfer user patterns and other ASCII files from the removable cartridge to an external controller. The returned format is string data for the file name, followed by a comma, #0, and the contents of the file. If the file is a user pattern, the first number a number returned after #0 represents the length of the file.

Example

To transfer a user pattern called MYPAT.USR from an external controller onto the cartridge:

```
OUTPUT 719; ":SID:TEXT '\USR\PATTERNS\MYPAT.USR', #04 1.1
2.2 3.3 4.4"
```

'\USR\PATTERNS\MYPAT.USR' is the full path name of the file.

#0 specifies that arbitrary length block data is to follow.

4 specifies the number of user pattern data points to follow.

The next four numbers are user pattern data. Note that the numbers are separated from each other by a space.

To transfer a user pattern named MYPAT.USR from the cartridge to an external controller:

```
10  DIM A$[513]
20  OUTPUT 719; ":SID:TEXT? '\USR\PATTERNS\MYPAT.USR'
30  ENTER 719; A$
40  PRINT A$
50  END
```

Comments

For HP 9000 Series 200 controllers, use (SHIFT) + () to get a back slash character (\). (Use the () on the numeric keypad on the right side of the keyboard.)

Related HP-IB Commands

None

Equivalent Front Panel Command

None

15

Synchronization Subsystem

Introduction

The commands in this subsystem are used to synchronize two or more HP FASS systems. Synchronization is the ability to start two or more HP FASS systems in unison within a known period after a trigger.

The process for synchronizing HP FASS systems is as follows:

1. Stop all HP FASS systems by sending the :FASS:STOP command to all systems.
2. Connect the cabling between systems. See figure 11-1 for Model 7 hardware, figure 11-2 for Model 11 hardware, or figure 11-3 for Model 21 hardware. (Appendix B shows the standard cabling for HP FASS.)
3. Configure one HP FASS as the master and the others as slaves with the :SYNC:CONF command.
4. Reset the clock dividers on all HP FASS systems by sending the :SYNC:RDIV command to all systems.
5. Reconnect the clock in the master HP FASS by sending it the :SYNC:RCL command.
6. Enable the slave units by sending each slave the :FASS:STAR command.
7. Simultaneously start all HP FASS systems by sending the master HP FASS the :FASS:STAR command, or the :TRIG:INIT command and using external triggering.

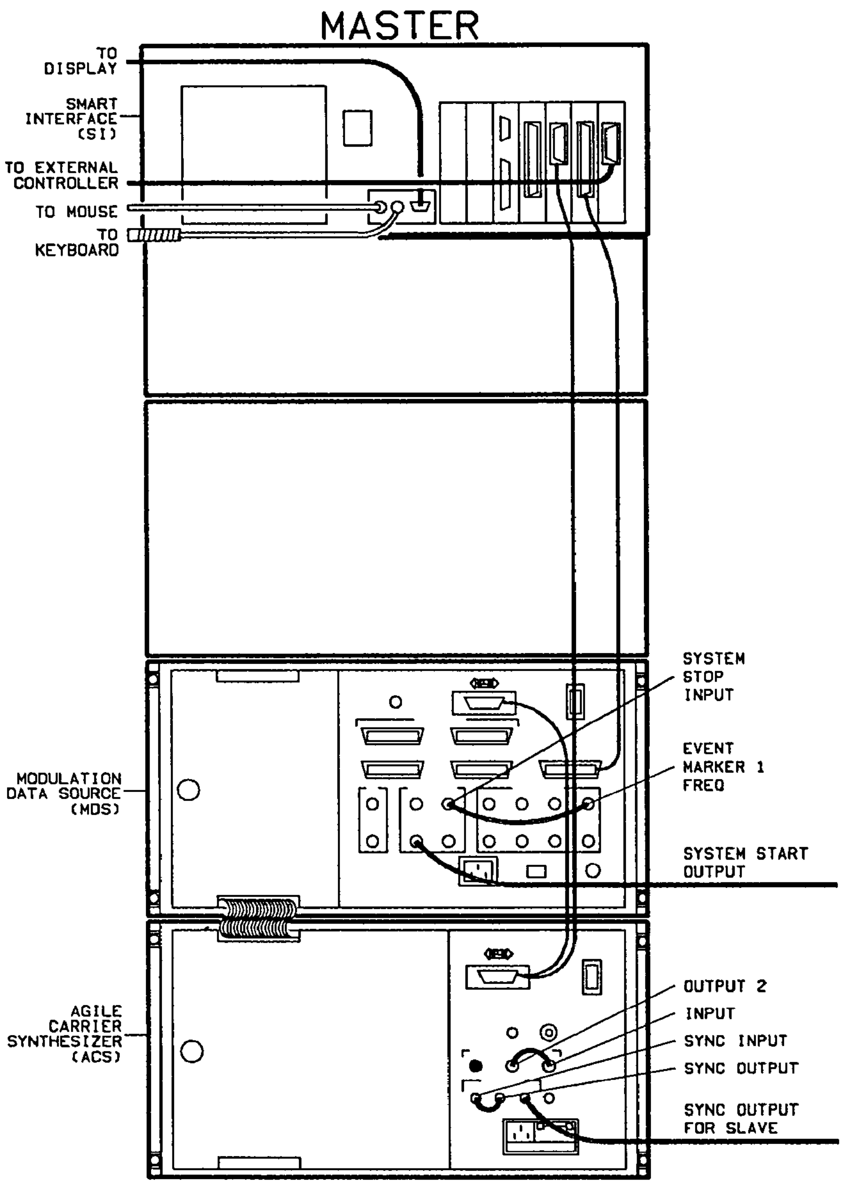


Figure 15-1. Cabling for Synchronizing Two Model 7 HP FASS Systems

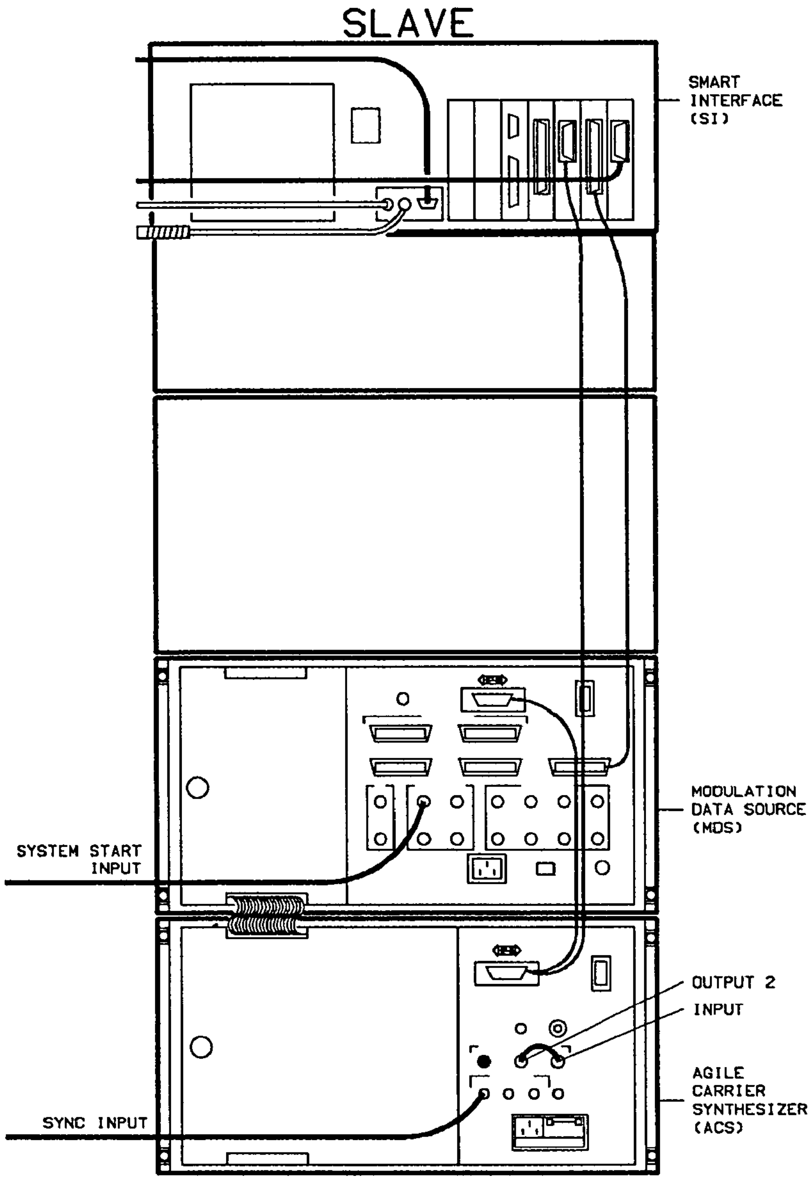


Figure 15-1 (cont'd). Cabling for Synchronizing Two Model 7 HP FASS Systems

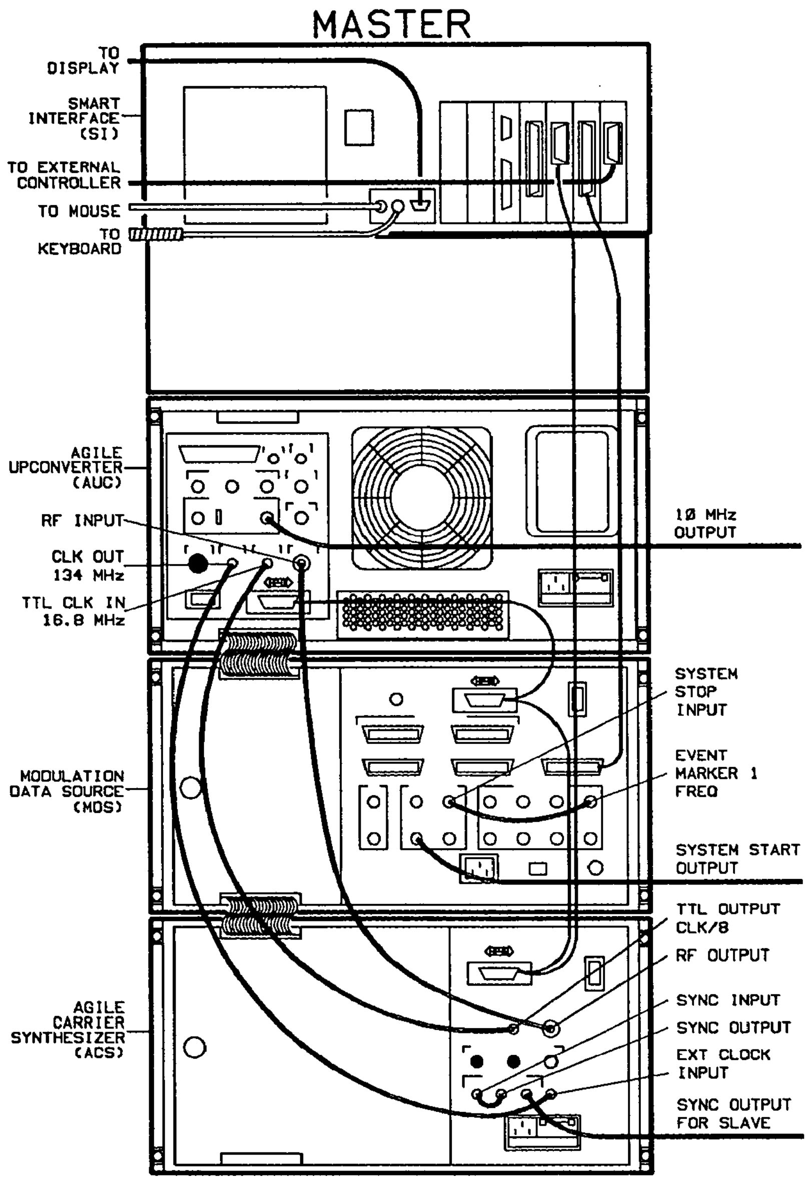


Figure 15-2. Cabling for Synchronizing Two Model 11 HP FASS Systems

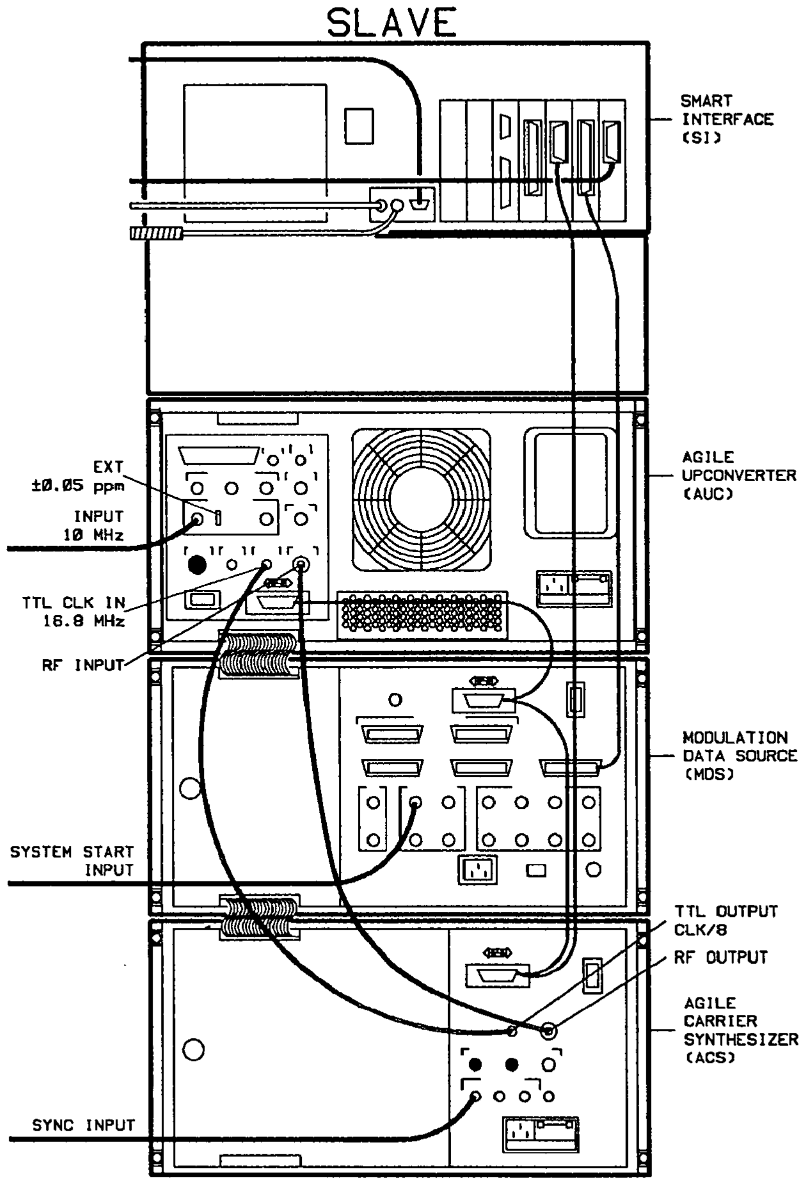


Figure 15-2 (cont'd). Cabling for Synchronizing Two Model 11 HP FASS Systems

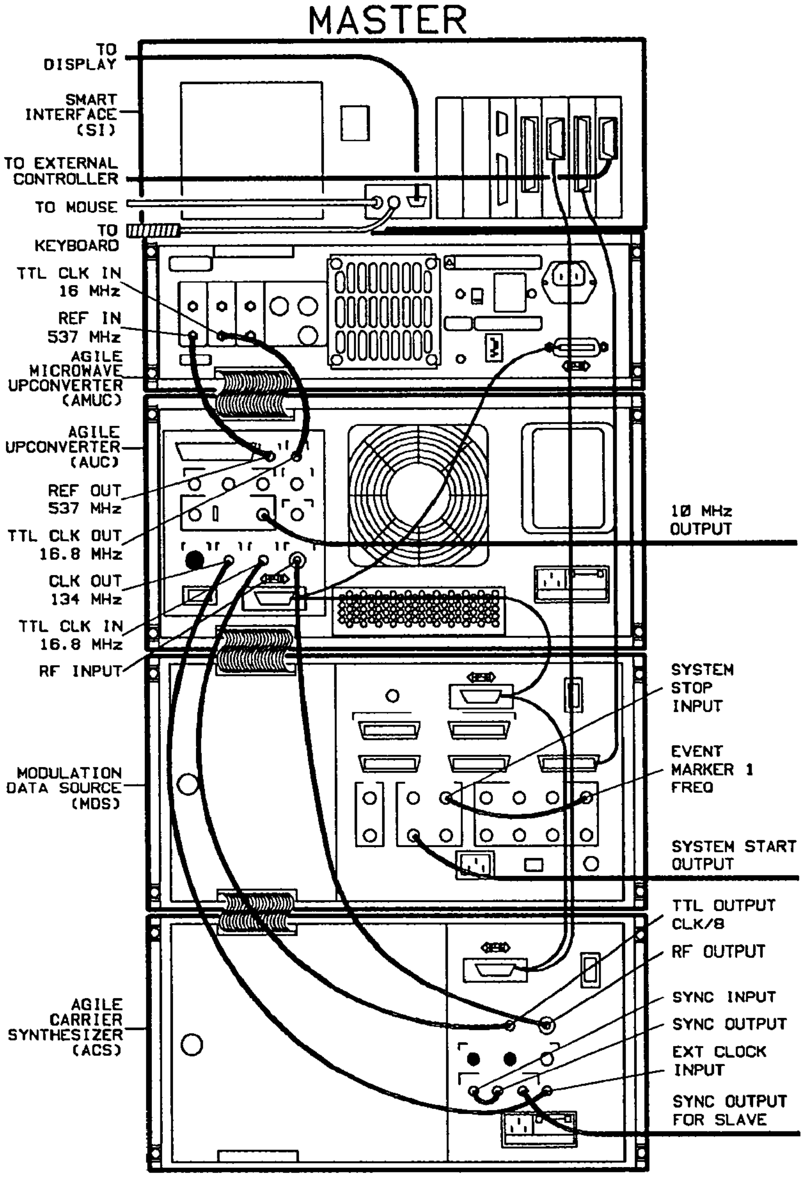


Figure 15-3. Cabling for Synchronizing Two Model 21 HP FASS Systems

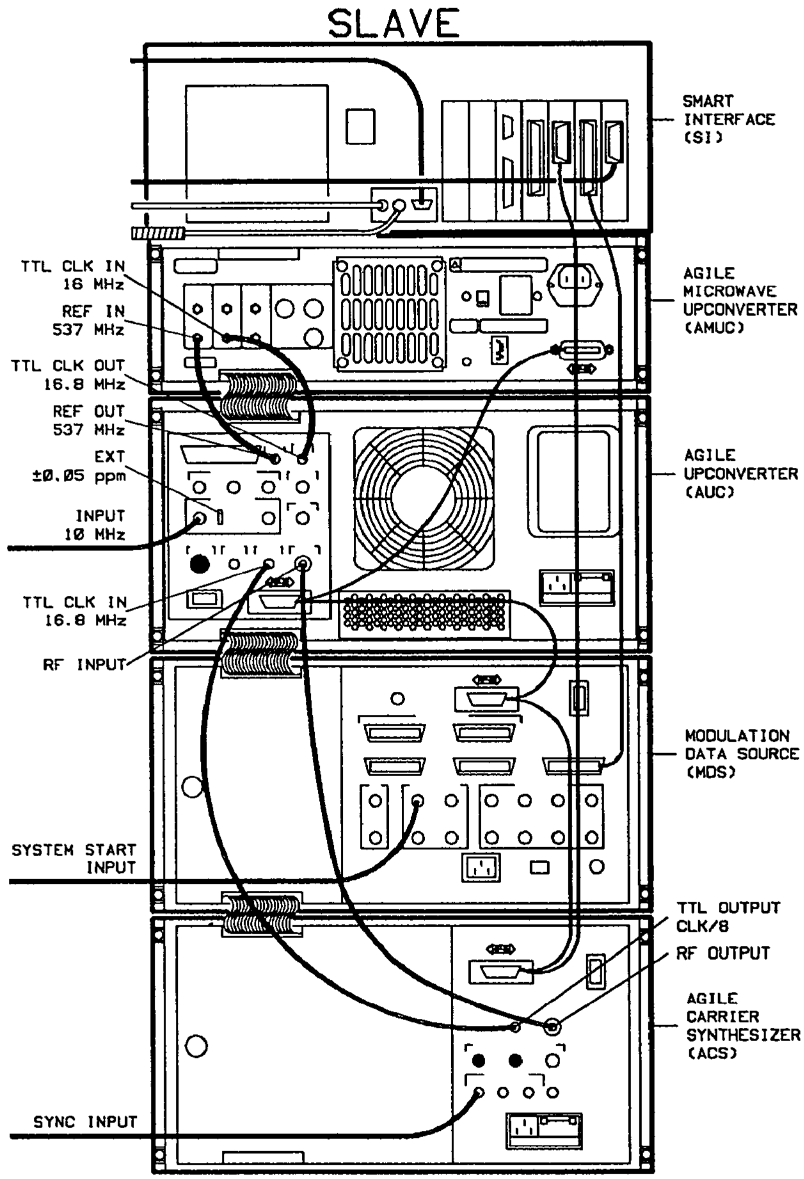


Figure 15-3 (cont'd). Cabling for Synchronizing Two Model 21 HP FASS Systems

Note

When synchronizing more than two HP FASS systems, an external ECL buffer is required for the SYNC OUTPUT connector on the master ACS. In addition, the master MDS may need an external buffer for the SYSTEM START OUTPUT connector.

Make sure that the master and slave HP FASS systems have different HP-IB addresses.

Figure 15-4 shows the syntax diagram of the synchronization subsystem commands.

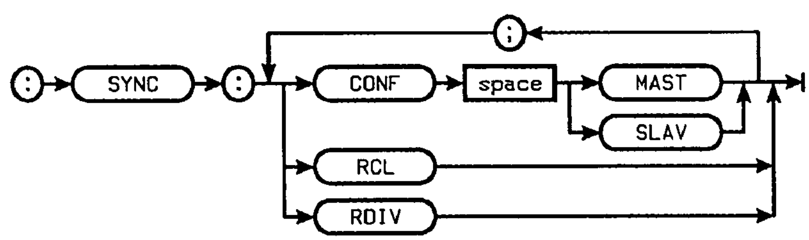


Figure 15-4. Synchronization Subsystem Syntax Diagram

CONF (Configure Synchronized Trigger)

Syntax

$$\texttt{:SYNC:CONF} \left\{ \begin{matrix} \texttt{MAST} \\ \texttt{SLAV} \end{matrix} \right\}$$

Description

This command is used to configure a HP FASS system as a master or a slave for synchronization purposes. This command also internally disconnects the system clock in the ACS of the master HP FASS system.

Example

This example assumes that the HP-IB address of the master HP FASS is 20 and the address of the slave is 19. It also assumes that the rear panel cabling has been configured for synchronization. Finally, this example assumes that a signal has been loaded into both HP FASS systems. It is not necessary that the signal parameters be identical for both systems. However, you probably want the signals to be of equal time duration in order to preserve synchronization.

```
10  OUTPUT 719; "*RST"
20  ! Load slave signal here.
30  !
40  OUTPUT 720; "*RST"
50  ! Load master signal here
60  !
70  ! Stop both systems
80  OUTPUT 719; ":FASS:STOP"
90  OUTPUT 720; ":FASS:STOP"
100 !
110 ! Configure master and slave
120 OUTPUT 720; ":SYNC:CONF MAST"
130 OUTPUT 719; ":SYNC:CONF SLAV"
```

```
140 !
150 ! Reset clock dividers
160 OUTPUT 720; ":SYNC:RDIV"
170 OUTPUT 719; ":SYNC:RDIV"
180 !
190 ! Reconnect the master clock
200 OUTPUT 720; ":SYNC:RCL"
210 !
220 ! Start generating synchronized signal
230 OUTPUT 719; ":FASS:STAR"
240 WAIT .3
250 OUTPUT 720; ":FASS:STAR"
260 END
```

Comments

If you want to reset the HP FASS systems, the synchronization commands should be reissued after the *RST command.

If you want to use external triggering to start the HP FASS systems, send the :FASS:STAR command to all slaves. Then, use the TRIG:INIT command to configure the trigger mode for the master HP FASS. You must issue the TRIG:INIT command after you have configured the HP FASS systems as master and slave.

Related HP-IB Commands

FASS Subsystem
STAR
STOP

Synchronization Subsystem
RCL
RDIV

Trigger Subsystem
INIT

RCL (Reconnect Clock)

Syntax

```
:SYNC:RCL
```

Description

This command is used to internally reconnect the system clock in the master HP FASS for synchronization.

Example

This example assumes that the HP-IB address of the master HP FASS is 20 and the address of the slave is 19. It also assumes that the rear panel cabling has been configured for synchronization. Finally, this example assumes that a signal has been loaded into both HP FASS systems. It is not necessary that the signal parameters be identical for both systems. However, you probably want the signals to be of equal time duration in order to preserve synchronization.

```
10  OUTPUT 719; "*RST"
20  ! Load slave signal here.
30  !
40  OUTPUT 720; "*RST"
50  ! Load master signal here
60  !
70  ! Stop both systems
80  OUTPUT 719; ":FASS:STOP"
90  OUTPUT 720; ":FASS:STOP"
100 !
110 ! Configure master and slave
120 OUTPUT 720; ":SYNC:CONF MAST"
130 OUTPUT 719; ":SYNC:CONF SLAV"
140 !
150 ! Reset clock dividers
160 OUTPUT 720; ":SYNC:RDIV"
170 OUTPUT 719; ":SYNC:RDIV"
180 !
```

```
190 ! Reconnect the master clock
200 OUTPUT 720; ":SYNC:RCL"
210 !
220 ! Start generating synchronized signal
230 OUTPUT 719; ":FASS:STAR"
240 WAIT .3
250 OUTPUT 720; ":FASS:STAR"
260 END
```

Comments

If you want to reset the HP FASS systems, the synchronization commands should be reissued after the *RST command.

Although the system clock was disconnected internally during the synchronization setup, it is still running. Therefore, when the clock is reconnected, it is still phase continuous.

Related HP-IB Commands

FASS Subsystem
STAR
STOP

Synchronization Subsystem
CONF
RDIV

Trigger Subsystem
INIT

RDIV (Reset Dividers)

Syntax

```
:SYNC:RDIV
```

Description

This command is used to reset the clock dividers in preparation for synchronization. It must be issued to both the master and slaves.

Example

This example assumes that the HP-IB address of the master HP FASS is 20 and the address of the slave is 19. It also assumes that the rear panel cabling has been configured for synchronization. Finally, this example assumes that a signal has been loaded into both HP FASS systems. It is not necessary that the signal parameters be identical for both systems. However, you probably want the signals to be of equal time duration in order to preserve synchronization.

```
10  OUTPUT 719; "*RST"
20  ! Load slave signal here.
30  !
40  OUTPUT 720; "*RST"
50  ! Load master signal here
60  !
70  ! Stop both systems
80  OUTPUT 719; ":FASS:STOP"
90  OUTPUT 720; ":FASS:STOP"
100 !
110 ! Configure master and slave
120 OUTPUT 720; ":SYNC:CONF MAST"
130 OUTPUT 719; ":SYNC:CONF SLAV"
140 !
150 ! Reset clock dividers
160 OUTPUT 720; ":SYNC:RDIV"
170 OUTPUT 719; ":SYNC:RDIV"
180 !
```

```
190 ! Reconnect the master clock
200 OUTPUT 720; ":SYNC:RCL"
210 !
220 ! Start generating synchronized signal
230 OUTPUT 719; ":FASS:STAR"
240 WAIT .3
250 OUTPUT 720; ":FASS:STAR"
260 END
```

Comments

The dividers need to be reset in both the master and slave systems in order to align the CLK/4 and CLK/8 signals and some dividers in the MDS.

If you want to reset the HP FASS systems, the synchronization commands should be reissued after the *RST command.

Related HP-IB Commands

FASS Subsystem
STAR
STOP

Synchronization Subsystem
CONF
RCL

Trigger Subsystem
INIT

16

System Subsystem

Introduction

The System subsystem command allows you to read errors over the HP-IB.

See figure 16-1 for the syntax diagram of the System subsystem.

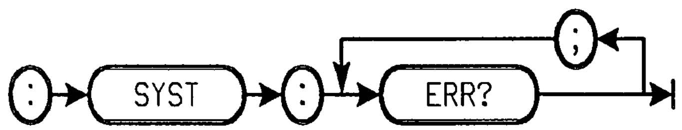


Figure 16-1. System Subsystem Syntax Diagram

ERR? (Error Query)

Syntax

```
:SYST:ERR?
```

Description

This query returns the next error number in the error queue over the HP-IB. HP FASS has an error queue that is 16 errors deep and operates on a first-in, first-out basis. Successively sending :SYST:ERR? returns the error numbers in the order they occurred until the queue is empty. Any further queries then return zeroes until another error occurs.

Note

See the tabbed section "Error Messages" at the back of this manual for a complete list of HP FASS system errors.

Example

To read the first error in the error queue:

```
10  OUTPUT 719; "*WAI; :SYST:ERR?"
20  ENTER 719; A
30  PRINT "ERROR NUMBER =";A
40  END
```

To read the entire contents of the error queue:

```
10  OUTPUT 719; "*WAI"
20  For I = 1 TO 16
30     OUTPUT 719; ":SYST:ERR?"
40     ENTER 719; A
50     PRINT A
60  NEXT I
70  END
```

Comments

Use the *WAI command with the :SYST:ERR? query to make sure errors are synchronized with the mnemonic being executed.

If the error queue is full, the number -32768 is stored in the last location.

The error queue is cleared when the power to HP FASS is turned on, by the *CLS command and by reading the last item in the error queue. The *RST command does not clear the error queue.

The Standard Event Status Register has bits for query errors, execution errors, command errors, and device dependent errors. Query errors are error numbers 1-5, execution error is error number 10, command errors are error numbers 20-99, and device-dependent errors are 100 and above.

Related HP-IB Commands

Common Commands
*WAI

17

Trigger Subsystem

Introduction

The commands in this subsystem are used for triggering HP FASS.

The HP FASS system has three trigger modes:

- Free Run
- External Continuous
- External Single (single-shot)

The trigger mode is selected with the :TRIG:INIT command.

In free run trigger mode, the system is started with the :FASS:STAR command. This command always starts generating the signal at the beginning of the specified sequence. The system is stopped with the :FASS:STOP command, which stops and resets the sequencers.

In external continuous mode, the system can be started with either an external TTL trigger or over the HP-IB with the :TRIG:IMM command. The signal can be paused with the :TRIG:PAUS command and then resumed from the point at which it was paused with the :TRIG:IMM command. The :TRIG:PAUS command pauses the sequencers at the current memory location and continues to generate that amplitude and frequency.

In external single mode, the system can be started with either an external TTL trigger or over the HP-IB with the :TRIG:IMM command. The signal sequence is executed once and then stopped until another trigger is received. The RSID maximum start trigger frequency is:

$$= \frac{1}{signal\ period + (10\ x\ 29.8\ ns)}$$

In order for the external single trigger mode to function correctly, a cable must be connected from one of the EVENT MARKER FREQ connectors to the SYSTEM STOP INPUT connector on the rear panel of the MDS. EVENT MARKER 1 FREQ is recommended because HP FASS is shipped in this configuration. This marker must be the active marker for the external single trigger mode to function. The :FASS:ESEL command selects the active marker and the marker output.

Note

RSID depends on the Event Marker 1 default (Sequence Start) to function properly. You may choose to use another configuration for your application.

In external continuous mode, the signal sequence is continuously executed. However, the signal sequence can be stopped at any time with an external TTL trigger input to the SYSTEM STOP INPUT on the MDS rear panel.

The :FASS:STAR and :FASS:STOP commands can also be used with the external trigger modes. However, the signal is always started at the beginning of the specified sequence.

See figure 17-1 for the Trigger subsystem flowchart. See figure 17-2 for the Trigger subsystem syntax diagram.

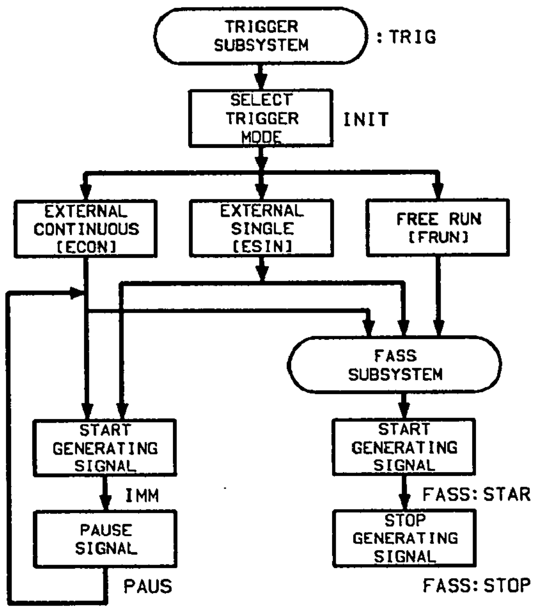


Figure 17-1. Trigger Subsystem Flowchart

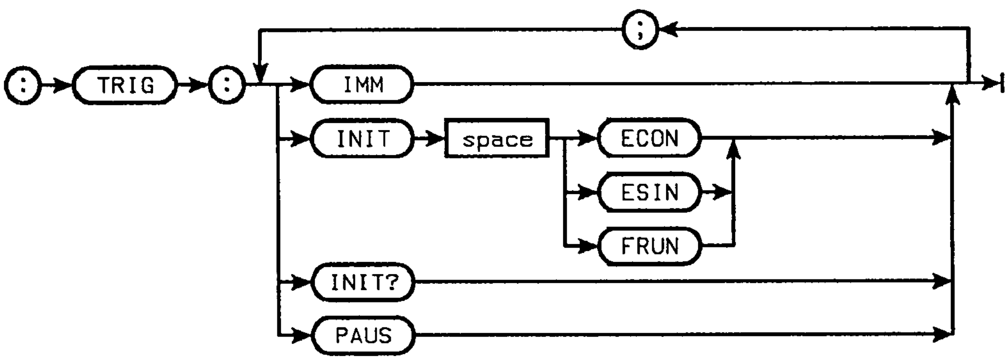


Figure 17-2. Trigger Subsystem Syntax Diagram

IMM (Immediate Trigger)

Syntax

```
:TRIG:IMM
```

Description

This command triggers the system to start generating a signal. (The sequencers start running.) Before issuing this command, the trigger setup must be initialized with the :TRIG:INIT command for either external single or external continuous trigger mode. This command is used in lieu of an external TTL trigger.

If you have previously done a triggered pause by either sending the :TRIG:PAUS command or pulsing the external SYSTEM STOP INPUT, this command will restart the sequencers at the point where they were paused.

Example

To do a triggered start over the HP-IB:

```
OUTPUT 719; ":TRIG:INIT ESIN"
OUTPUT 719; ":TRIG:IMM"
```

Comments

This command is not valid for free run trigger mode.

This command performs the same function as a TTL pulse input to the SYSTEM TRIGGERING SYSTEM START INPUT connector on the rear panel of the MDS. See "MDS Rear Panel Features" in appendix B for additional information about this connector.

Related HP-IB Commands

Trigger Subsystem
INIT
PAUS

Equivalent Front Panel Command

Utilities Menu - Signal Control ... + (Trigger) or (Continue)

INIT (Initialize Trigger Setup)

Syntax

$$:\!TRIG\!:\!INIT \begin{Bmatrix} ECON \\ ESIN \\ FRUN \end{Bmatrix}$$

```
:TRIG:INIT?
```

Description

This command initializes the trigger setup and sets the triggering mode.

Note

The trigger mode must be set prior to selecting the RUN command in the optional IDs. Otherwise, the output signal will not be correct.

Three triggering modes are available:

- External Continuous (ECON)
- External Single (ESIN)
- Free Run (FRUN)

In external continuous mode, the system is started with either an external TTL trigger, an HP-IB trigger, or a front panel trigger. Once started, the sequencers run continuously.

In external single mode, the system is started with either an external TTL trigger, an HP-IB trigger, or a front panel trigger. The defined sequence is executed once and then stopped until another trigger is received. The RSID maximum start trigger frequency is:

$$= \frac{1}{signal\ period + (10\ x\ 29.8\ ns)}$$

In free run mode, the sequencers run continuously. Free run mode does not require a triggered start.

The query returns the currently selected trigger mode.

Example

To set the triggering mode to free run:

```
OUTPUT 719; ":TRIG:INIT FRUN"
```

Comments

The TRIG:IMM command is used for the HP-IB trigger.

The external TTL trigger is input to the SYSTEM TRIGGERING SYSTEM START INPUT connector on the rear panel of the MDS. See "MDS Rear Panel Features" in appendix B for additional information about this connector.

When external single or external continuous is the selected trigger mode, this command enables the SYSTEM TRIGGERING SYSTEM START INPUT and SYSTEM STOP INPUT connectors on the rear panel of the MDS.

In external single mode, HP FASS needs to get its stop signal 14 clock cycles before the end of the sequence. Use the :FASS:ESEL command to select the EVENT MARKER 1 FREQ connector as the active maker whose output is the Equal Address marker. Make sure the signal is not being looped.

This command does not override any packet advance modes defined within the current sequence. See the :FASS:PCKM and :FASS:PCLM commands for additional information.

Related HP-IB Commands

Trigger Subsystem
IMM
PAUS

Equivalent Front Panel Commands

SID Control Panel - Trigger Setting

PAUS (Pause)

Syntax

```
:TRIG:PAUS
```

Description

This command pauses the sequencers at the current memory location and continues to generate that amplitude and frequency. (The sequencers are stopped.) The :TRIG:IMM command restarts the sequencers at the point where they were paused. In order to use this command, the trigger mode must be set to either external single or external continuous.

Example

To pause the system:

```
OUTPUT 719; ":TRIG:PAUS"
```

Comments

This command is not valid for free run trigger mode.

This command performs the same function as a TTL pulse input to the SYSTEM TRIGGERING SYSTEM STOP INPUT connector on the rear panel of the MDS. See "MDS Rear Panel Features" in appendix B for additional information about this connector.

Related HP-IB Commands

Trigger Subsystem
IMM
INIT

Equivalent Front Panel Command

Utilities Menu - Signal Control ... + (Pause)

18

WGL Subsystem

Introduction

WGL subsystem commands allow you to send WGL commands and user definitions to HP FASS from an external workstation.

Figure 18-1 shows the syntax diagram for the WGL subsystem.

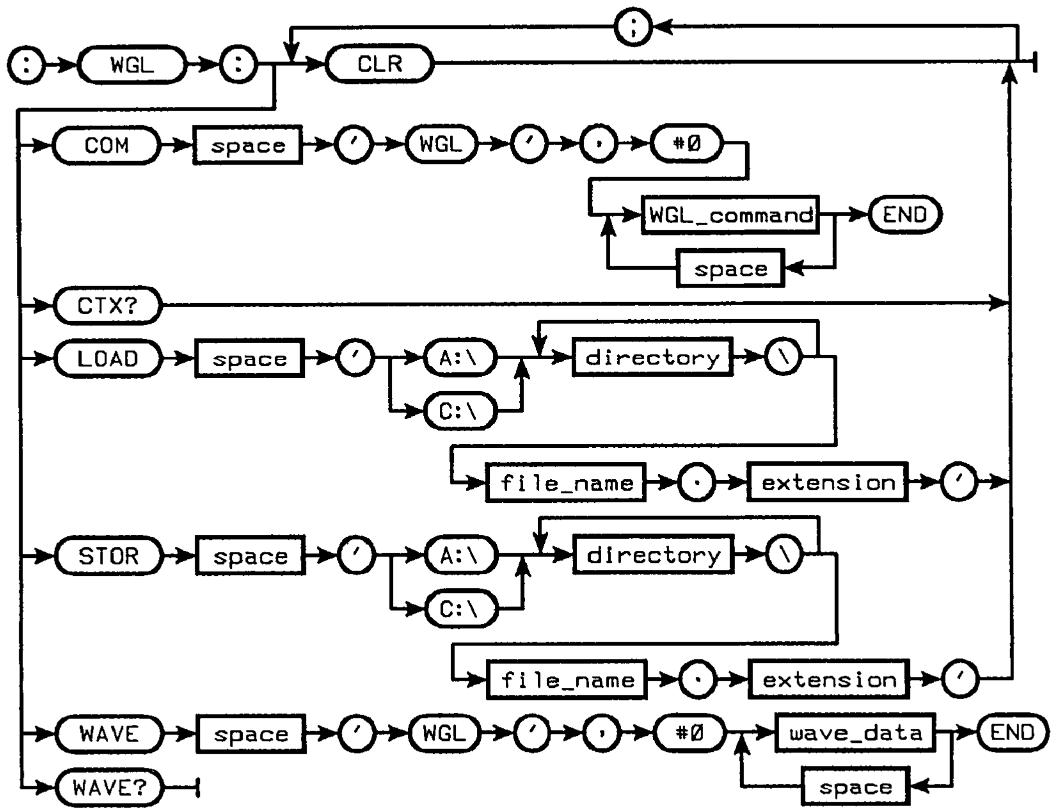


Figure 18-1. WGL Subsystem Syntax Diagram

CLR (Clear WGL Definitions)

Syntax

```
:WGL:CLEAR
```

Description

This command clears all user definitions in WGL. It is used to prevent you from running out of memory in the WGL workspace.

Example

To clear all user definitions:

```
OUTPUT 719; ":WGL:CLR"
```

Comments

None

Related HP-IB Commands

WGL Subsystem
LOAD
STOR

Equivalent Front Panel Command

WLG Menu - Clear Workspace

COM (WGL Command)

Syntax

```
:WGL:COM 'WGL',#0 wgl_cmd
```

Item	Description	Range/Restrictions
WGL_cmd	One or more WGL commands	Any valid WGL command. Sent in indefinite length block data format.

Description

This command allows you to send WGL commands over HP-IB. Commands are sent in indefinite length block data format, as a string of WGL commands.

Example

To create one cycle of a sine wave:

```
OUTPUT 719; ":WGL:COM 'WGL', #00 360 RAMP3 SIN"
OUTPUT 719 USING "-K";"",END
```

Comments

Data sent over HP-IB is not immediately reflected on the front panel. As a time saving measure, the graphics display is not refreshed. Once you do something to the data from the front panel, the graphics display will be updated.

WGL commands can use definitions previously created by users.

Related HP-IB Commands

WGL Subsystem
WAVE

Equivalent Front Panel Command

None

CTX? (WGL Context Query)

Syntax

```
:WGL:CTX?
```

Description

This query returns the current context size of the WGL working wave. It is used in conjunction with the :WGL:WAVE? query to indicate how many data points will be returned.

Example

To read the context of WGL working wave:

```
10      REAL Wave(0:999)
20      DIM Hdr$[10]
30      !
40      ASSIGN @Fass TO 719
50      ASSIGN @Fmtoff TO 719;FORMAT OFF
60      !
70      ! get the working wave context
80      OUTPUT @Fass;":WGL:CTX?"
90      ENTER @Fass;Context
100     !
110     REDIM Wave(0:Context-1)
120     !
130     OUTPUT @Fass;":WGL:WAVE?"
140     ENTER @Fass USING "#,K";Hdr$
150     ENTER @Fmtoff;Wave(*)
160     ENTER @Fass
170     !
180     END
```

Related HP-IB Commands

WGL Subsystem
WAVE

Equivalent Front Panel Command

None

LOAD (Load WGL Program)

Syntax

:WGL:LOAD *'drive:\directory\file_name.ext'*

Item	Description	Range/Restrictions
Drive	Disk drive on which file is located	A:=floppy disk; C:=removable cartridge
Directory	Directory where file resides	
File_name	Name of WGL program file	8 characters maximum plus and optional extension of up to 3 characters.
Ext	File name extension	WGL=ASCII text file; TXT=ASCII text file; CWC=compiled WGL program file

Description

This command is used to load a WLG program file from either the removable cartridge or a floppy disk. The WGL file can be either an ASCII text file (.WGL or .TXT extension) or a compiled WGL program file (.CWC extension).

The ASCII text file can contain WGL definitions, variables, and WGL commands. WGL definitions and variables are compiled as they are loaded. Therefore, loading ASCII text files can be slow. WGL commands are executed as they are loaded and are not compiled as part of the program. It is recommended that ASCII files have either a .WGL or .TXT extension.

A compiled WGL program file is already in internal format, and, therefore, loads quicker than an ASCII text file. Compiled WGL program files are identified by a .CWC extension. Only one compiled file can be loaded at one time.

Example

To load a file called MYFILE from the removable cartridge:

```
OUTPUT 719; "WGL:LOAD 'C:\USR\FILES\MYFILE.WGL'"
```

Comments

Always specify the complete path - drive, directory, filename, and extension. Files are not automatically loaded from the current directory.

Multiple .WGL files can be loaded into WGL. The new definitions are appended to the existing ones in the WGL workspace.

Multiple compiled files cannot be loaded into WGL. Loading a compiled (.CWC) file overwrites the existing WGL workspace, replacing all definitions and variables.

A .WGL file can be loaded after a .CWC files. Its definition will be those from the .CWC file.

Related HP-IB Commands

WGL Subsystem
CLR
STOR

Equivalent Front Panel Command

WGL Menu - Load WGL Program ...

STOR (Store WGL File)

Syntax

`:WGL:STOR` *'drive:\directory\file_name*`.CWC'`

Item	Description	Range/Restrictions
Drive	Disk drive where the file is to be stored	A:=floppy disk; C:=removable cartridge
Directory	Directory where file resides.	
File_name	Name of WGL program file	8 characters maximum

Description

This command is used to store a compiled WLG file to either the removable cartridge or a floppy disk. A compiled WGL file can contain definitions and variables. The file is identified by a .CWC (compiled WGL code) extension.

Example

To store a compiled WGL file called MYFILE to the removable cartridge:

```
OUTPUT 719; ":WGL:STOR 'C:\USR\FILES\MYFILE.CWC'"
```

If there is already a file named MYFILE on the removable cartridge, it will be overwritten.

Comments

Always specify the complete path - drive, directory, filename, and extension. Files are not automatically stored in the current directory.

Related HP-IB Commands

WGL Subsystem
CLR
LOAD

Equivalent Front Panel Command

WGL Menu - Store WGL Program ...

WAVE (WGL Working Wave)

```
:WGL:WAVE 'WGL', #0 wave_data
```

```
:WGL:WAVE?
```

Item	Description	Range/Restrictions
Wave_data	WGL working wave data	Real numbers. Sent in indefinite length block data format.

Description

This command is used load data into the WGL working wave. The WGL working wave is an array of data points that can be mathematically manipulated in WGL and then sent to any of the modulation memories in HP FASS.

The WAVE? query returns the data that is currently loaded in the WGL working wave as indefinite length block data. The number of points returned is determined by the current WGL context. It can be from 2 to 65536.

Example

To load data into the WGL working wave:

```
10      REAL Wave(1:200)
20      !
30      Cycles=5   ! CREATE CYCLES OF A SINEWAVE
40      !
50      ASSIGN @Fass TO 719
60      ASSIGN @Fmtoff TO 719;FORMAT OFF
70      !
80      ! Create the waveform
90      FOR I=1 TO SIZE(Wave,1)
100         Wave(I)=SIN(2*Cycles*I*PI/SIZE(Wave,1))
110         NEXT I
120     !
130     OUTPUT @Fass;":WGL:WAVE 'WGL',#0";
140     OUTPUT @Fmtoff;Wave(*)
```

```
150    OUTPUT @Fass USING "-,K";"",END
160    !
170    END
```

Comments

See the CTX? query in this chapter for an example using the :WGL:WAVE? query.

The maximum number of points of the WGL working wave is 65536.

Related HP-IB Commands

WGL Subsystem
COM

Equivalent Front Panel Command

None

A

General HP-IB Information

Introduction

This appendix describes interface functions, general bus management issues and messages that can be sent over the bus as bus commands. In general, these functions are defined by IEEE Standard 488.1 *Digital Interface for Programmable Instrumentation*.

The information contained in this appendix is intended for the system operator or test engineer using a non-HP controller and the system integrator incorporating HP FASS into a larger ATE system.

Interface Functions

The system's compatibility with HP-IB is defined in the following table of interface functions.

Interface Functions

Mnemonic	Description	System Capability
SH1	Source Handshake	Full Capability
AH1	Acceptor Handshake	Full Capability
T5	Talker	Basic talker with serial poll and talk only mode capability; unaddresses if listen address is received
TE0	Extended Talker	No Capability
L3	Listener	Basic listener with listen only mode capability; unaddresses if talk address is received
LE0	Extended Listener	No Capability
SR1	Service Request	Full Capability
RL1	Remote/Local	Complete Capability
PP1	Parallel Poll	Remote Configuration
DC1	Device Clear	Full Capability
DT0	Device Trigger	No Capability
C0	Controller	No Capability

Command and Data Concepts

The HP-IB has two modes of operation: command mode and data mode. The bus is in command mode when the ATN bus line is true. The command mode is used to send talk and listen addresses and various bus commands. The bus is in data mode when the ATN line is false. The data mode is used to convey device-dependent messages across the bus. The device-dependent messages include all the system commands and responses to query commands found in this manual.

Bus Commands

In command mode, the controller sends commands to all devices on the HP-IB. These commands serve several different purposes:

- Talk and listen addresses select the devices that will send and receive data over the data bus.
- Universal commands cause every device so equipped to perform a specific interface operation.
- Addressed commands are similar to universal commands, except that they only affect those devices that are addressed.
- Secondary commands are always used in conjunction with an address, universal command, or addressed command to provide additional command codes.

Addressing

Device addresses are sent by the active controller in command mode to specify who talks (via a talk address) and who listens (via a listen address). Every device has a listen address and a talk address, and the device address specifies both.

The HP FASS system's HP-IB address is set to 19 at the factory and is resettable during system configuration from the Options menu. The address can range from 0 to 30. See "Setting the System HP-IB Address" in chapter 3 for additional information.

System Response to Universal Commands

The system responds to the following universal commands. Refer to the language reference manual of the controller being used to find the corresponding commands allowed by the controller.

Universal Commands

Mnemonic	Command	Response
DCL	Device Clear	The system cancels any incomplete entries or messages.
LLO	Local Lockout	This command disables the return-to-local control.
SPE	Serial Poll Enable	Serial poll mode is established. When addressed to talk, the system will return an 8-bit status byte.
SPD	Serial Poll Disable	Serial poll mode is terminated and the system returns to its normal talker state where it outputs device-dependent data rather than status information.
PPU	Parallel Poll Unconfigure	The system resets to the idle state (no response to a parallel poll).
IFC	Interface Clear	The system stops talking and listening.
REN	Remote Enable	The system is enabled to be subsequently placed in remote mode. Remote mode is not entered until the system is addressed to listen.
ATN	Attention	When true, the system is placed in command mode. When false, the system is placed in data mode.
IDY	Identify	The system simultaneously asserts ATN and EOI in response to a parallel poll.

System Response to Addressed Commands

The system responds to the following addressed commands. Refer to the language reference manual of the controller being used to find the corresponding commands allowed by the controller.

Addressed Commands

Mnemonic	Command	Response
GET	Group Execute Trigger	The system does not respond to this command.
GTL	Go To Local	The system returns to local control.
SDC	Selected Device Clear	The system clears any incomplete entries or messages.
PPC	Parallel Poll Configure	The system will be configured according to the parallel poll enable secondary command that immediately follows this command.
TCT	Take Control	The system does not respond to this command.

System Response to Secondary Commands

The system responds to the following secondary commands. Refer to the language reference manual of the controller being used to find the corresponding commands allowed by the controller.

Secondary Commands

Mnemonic	Command	Response
PPE	Parallel Poll Enable	If the system has received the PPC command, it is configured to respond to a parallel poll on a particular DIO line with a particular level.
PPD	Parallel Poll Disable	If the system has received the PPC command, it is disabled from responding to a parallel poll.

B

Front and Rear Panel Features

Introduction

The following figures describe the front and rear panel features of each individual instrument in the HP FASS system:

- HP FASS Model 7 system figures B-1 and B-2.
- HP FASS Model 11 system figures B-2 and B-4.
- HP FASS Model 21 system figures B-5 and B-6.
- Smart Interface (SI) figures B-7 and B-8.
- Agile Microwave Upconverter (AMUC) figures B-9 through B-11.
- Agile Upconverter (AUC) figures B-12 through B-15.
- Modulation Data Source (MDS) figures B-16 through B-22.
- Agile Carrier Synthesizer (ACS) figures B-23 through B-28.
- HP-IB connection figure B-29.
- Dynamic Data/Dynamic Sequence figures B-30 through B-32.

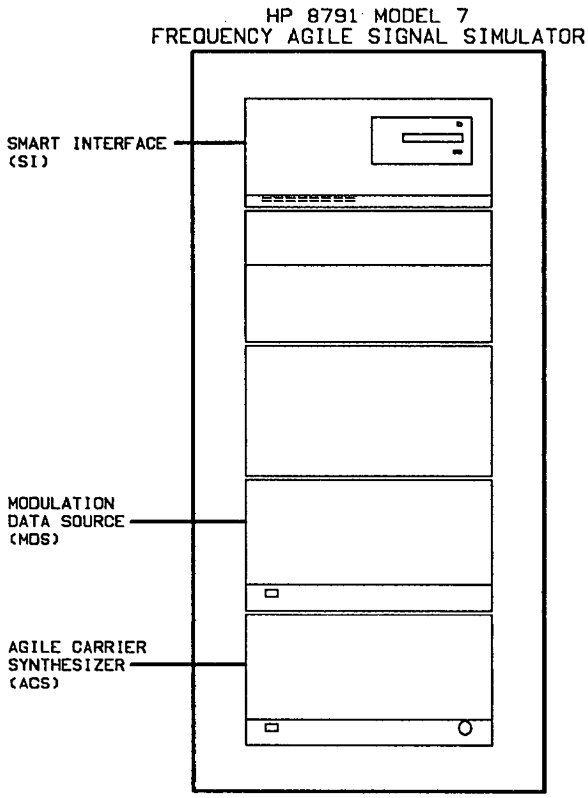


Figure B-1. HP FASS Model 7 Front Panel

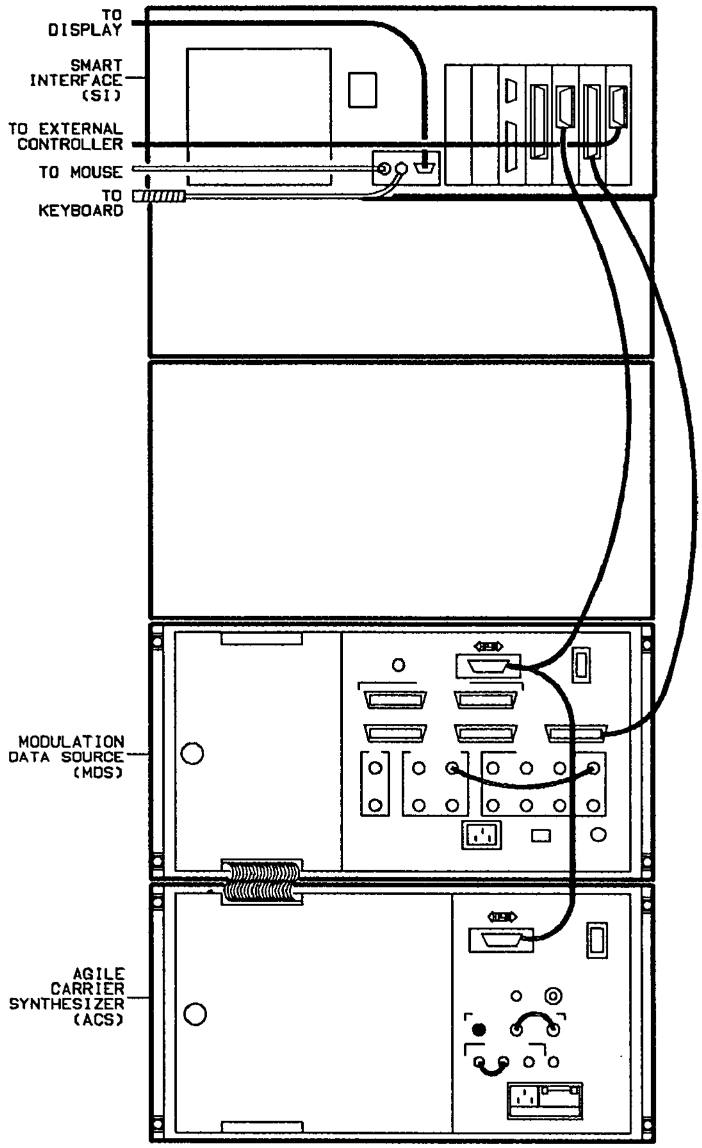


Figure B-2. HP FASS Model 7 Rear Panel

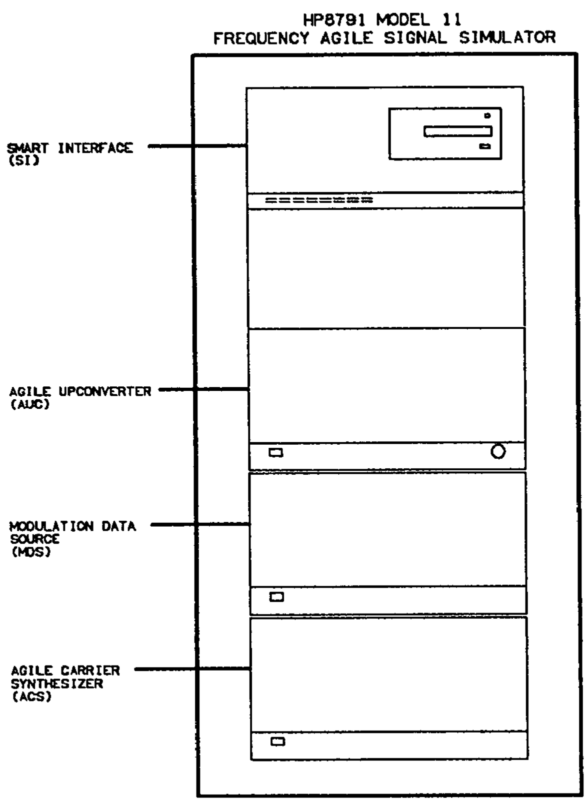


Figure B-3. HP FASS Model 11 Front Panel

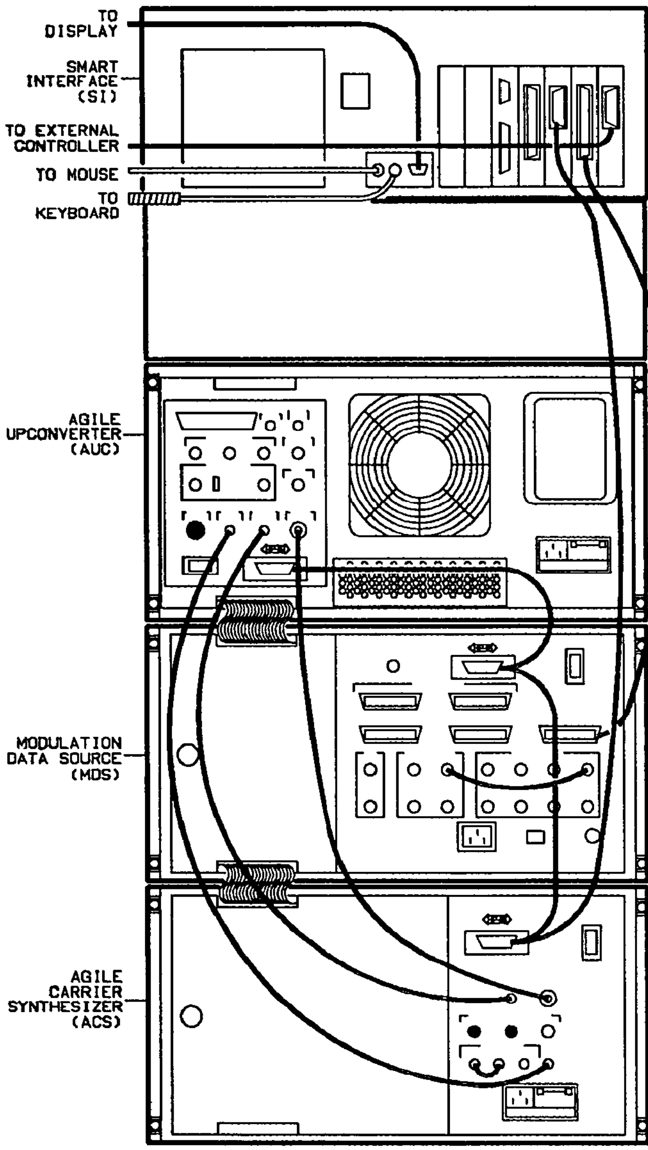


Figure B-4. HP FASS Model 11 Rear Panel

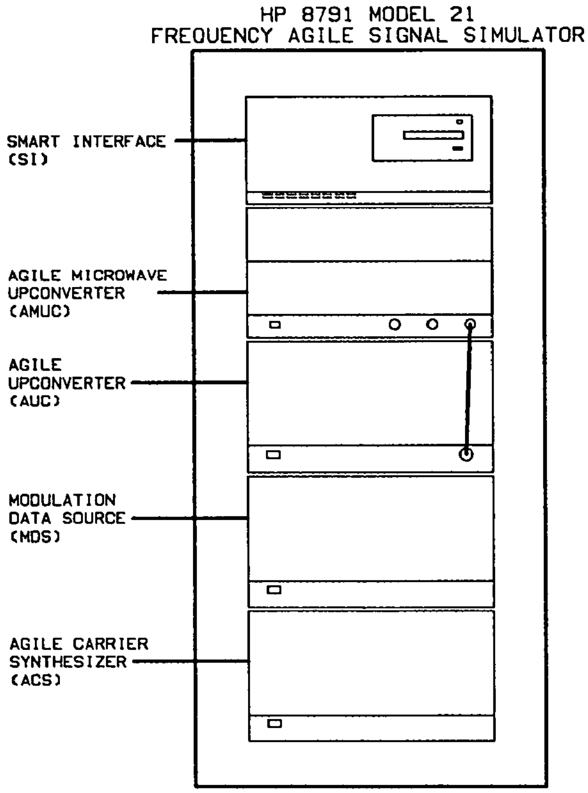


Figure B-5. HP FASS Model 21 Front Panel

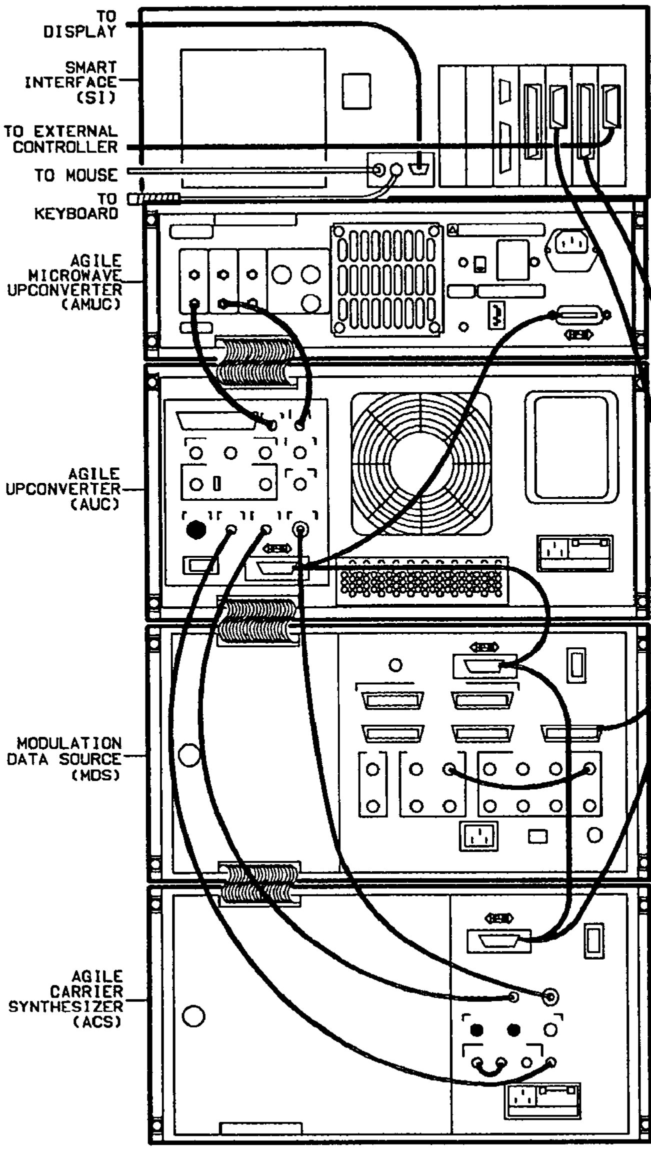


Figure B-6. HP FASS Model 21 Rear Panel

Smart Interface Front Panel Features

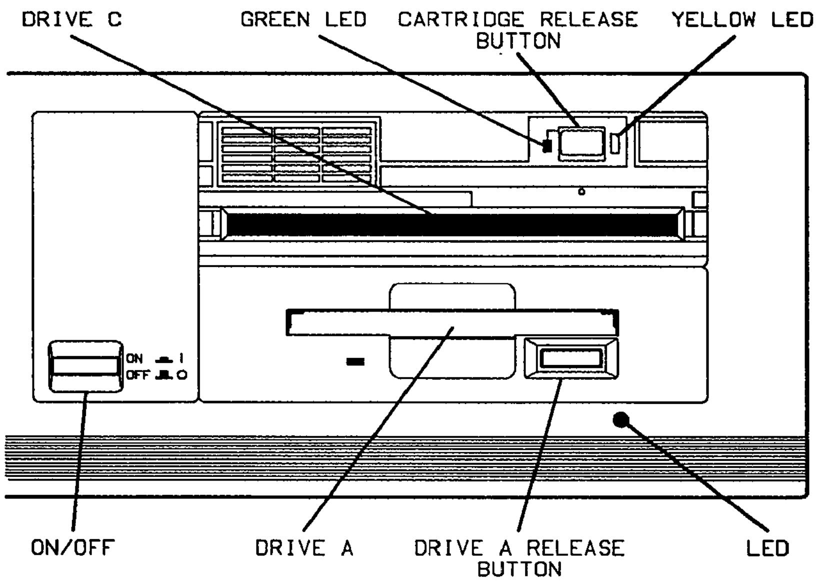


Figure B-7. SI Front Panel Features

Drive C ID cartridge drive.

Green LED Lights when the ID cartridge is inserted and ready for use.

Cartridge Release Button Unlatches the ID cartridge from the drive (drive C). (See any Getting Started Guide for information on installation or removal of an ID cartridge.)

Yellow LED Lights whenever the ID cartridge drive (drive C) is reading or writing information.

ON/OFF Applies power to the Smart Interface when depressed.

Caution Do not turn off the Smart Interface power before removing the ID cartridge. Removing power without first removing the cartridge can damage the cartridge. (See any Getting Started Guide for information on installation or removal of an ID cartridge.)

Drive A 1.44 MByte, 3.5 inch drive. Uses double-sided, high-density (quad-density) disks (box of 10 part number: HP 92192X).

Drive A Release Button Ejects the drive A floppy disk.

LED Not used with HP FASS.

Smart Interface Rear Panel Features

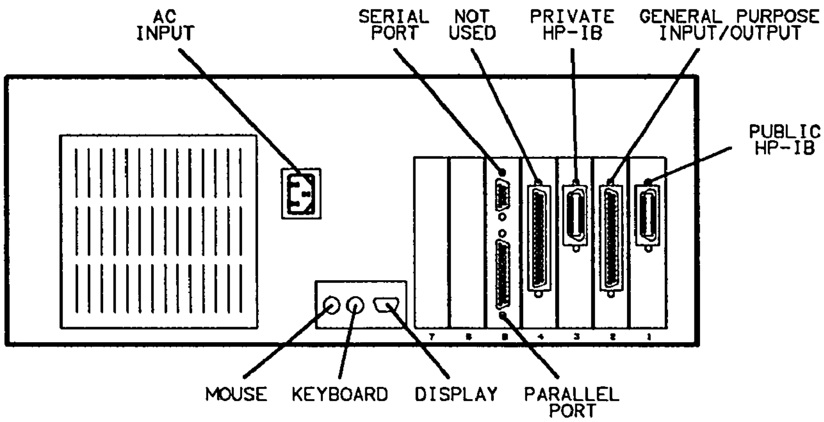


Figure B-8. SI Rear Panel Features

AC INPUT Permits operation at 115 or 230 Vac. (The input automatically adjusts to either voltage.)

Serial Port Connects to a printer using a serial interface.

Parallel Port Connects to a printer using a parallel interface.

Private HP-IB Connects the Smart Interface to the private Hewlett-Packard Interface Bus for communication with the other instruments in the system. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

General Purpose Input/Output

D-type, 37-pin, subminiature connector. Parallel TTL-level outputs to the MDS rear panel (DMA INPUT) provide for high-speed data transfer into MDS modulation and sequencer RAM.

Public HP-IB

Connects the HP FASS system to the public Hewlett-Packard Interface Bus for remote operation. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

Mouse

Connector for mouse cable.

Keyboard

Connector for keyboard cable.

Display

D-type, 15-pin, subminiature connector. Connects to the Smart Interface display.

AMUC Front Panel Features

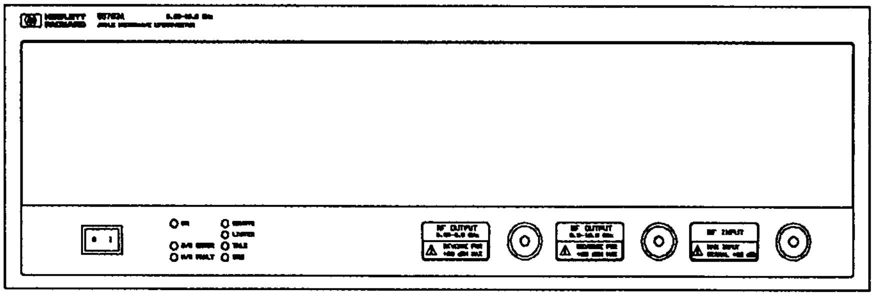


Figure B-9. AMUC Front Panel Features

Line Switch

Applies power to the AMUC when set to the on (I) position. All instrument settings are cleared when the line switch is set to standby (⏻).

Front Panel Annunciators

ON

Lights when the instrument is turned on.

S/W ERROR

Lights whenever AMUC receives a command over HP-IB that it cannot execute. If the annunciator lights, it can be cleared by the Smart Interface.

H/W FAULT

Lights when a hardware error is detected in the AMUC at power up.

Warning

Refer the instrument to qualified maintenance personnel or contact your nearest Hewlett-Packard office for service.

REMOTE

Lights when AMUC is in HP FASS mode of operation.

LISTEN

Lights when AMUC is addressed to receive data over HP-IB.

TALK

Lights when AMUC is addressed to send data over HP-IB.

SRQ

Not used with HP FASS.

RF OUTPUT 0.05-0.5 GHz

Type N connector. 50Ω output impedance. One of two main signal outputs from AMUC and the HP FASS system. This output is the through path for the AUC signal; no upconversion takes place. Frequency ranges from 50 MHz to 500 MHz. Output level ranges from +10 to −100 dBm; 0 dBm is nominal.

Caution

Maximum reverse power is +20 dBm peak.

RF OUTPUT connector is static sensitive. Avoid any contact with objects that may hold a charge.

RF OUTPUT 0.5-18.0 GHz

Type N connector. 50Ω output impedance. One of two main signal outputs from AMUC and the HP FASS system. This output is the upconverted signal from AUC. Frequency ranges from 500 MHz to 18 GHz. Output level ranges from +10 to −100 dBm. Nominal output is 0 dBm.

Caution

Maximum reverse power is +20 dBm peak.

RF OUTPUT connector is static sensitive. Avoid any contact with objects that may hold a charge.

RF INPUT

Type N connector. 50Ω input impedance. Input for signal to be upconverted. Connected to RF OUTPUT on the front panel of AUC.

AMUC Rear Panel Features

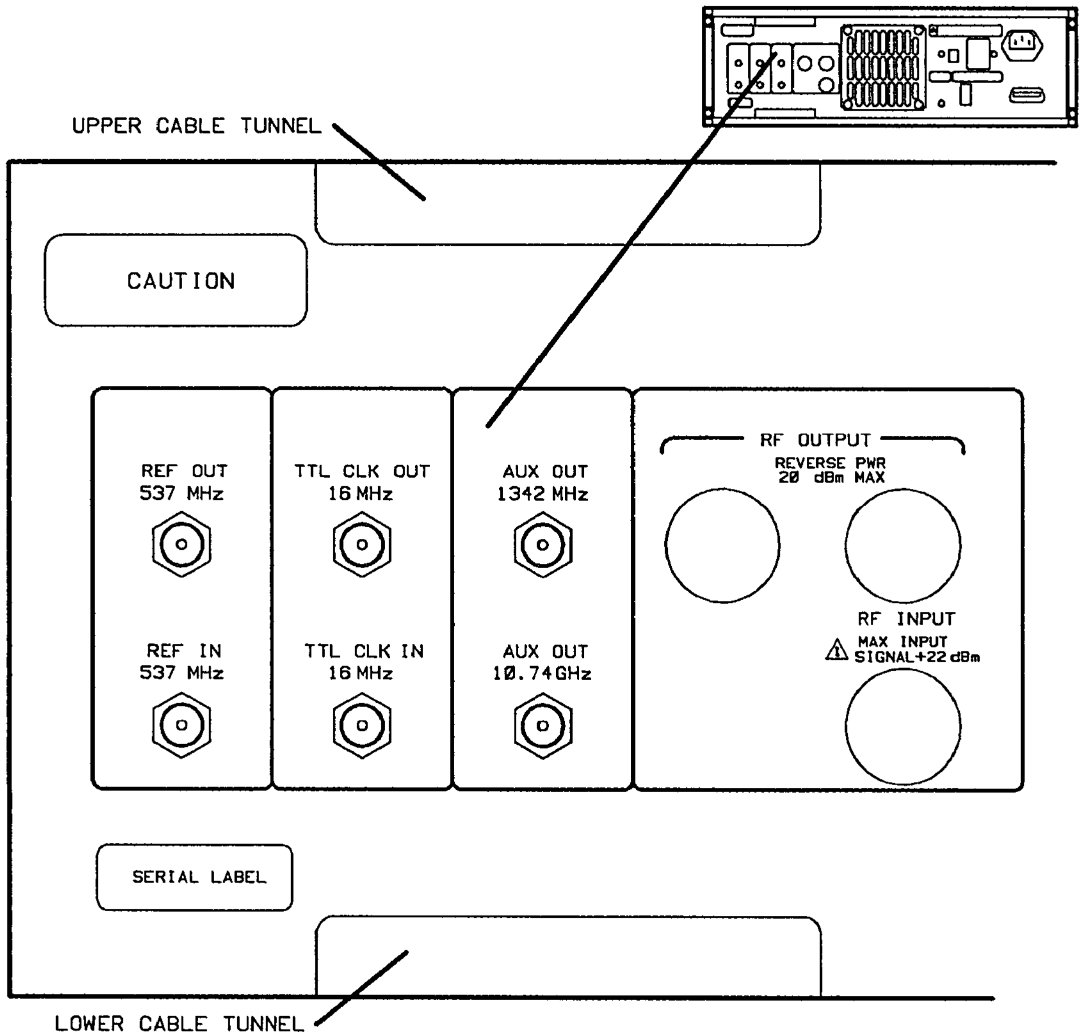


Figure B-10. AMUC Rear Panel Features

Upper Cable Tunnel Reserved for future use.

REF OUT 537 MHz SMA connector. 50Ω output impedance. Provides a 536.870 912 (2^{29}) MHz signal at 1 dBm (typical). Requires the 537 MHz signal from AUC to produce an output. This signal is useful for verifying phase noise performance.

REF IN 537 MHz SMA connector. 50Ω input impedance. Input for the 537 MHz signal used to generate agile LOs. Connects to the REF OUT 537 MHz on the rear panel of AUC. Typical input level is +10 dBm.

TTL CLK OUT 16 MHz SMA connector. 75Ω output impedance. Provides a system CLK/8 (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). Requires the 16.8 MHz input from AUC to produce an output.

TTL CLK IN 16 MHz SMA connector. 75Ω input impedance. Input for a TTL-level clock signal from AUC at a frequency 1/8 the HP FASS system clock rate (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). Connects to the TTL CLK OUT 16.8 MHz on the AUC rear panel.

AUX OUT 1342 MHz SMA connector. 50Ω output impedance. Provides a 1342 MHz signal at +3.0 dBm (typical). Requires the 537 MHz input from AUC to produce an output.

AUX OUT 10.74 GHz SMA connector. 50Ω output impedance. Provides a 10.74 GHz signal at -5 dBm (typical). Requires the 537 MHz input from AUC to produce an output. Used for verifying phase noise performance.

RF OUTPUT Reserved for future use.

RF INPUT Reserved for future use.

Lower Cable Tunnel Enables access for a ribbon cable that runs from AUC to AMUC. The cable provides digital data to control the AMUC output frequency.

AMUC Rear Panel Features (cont'd)

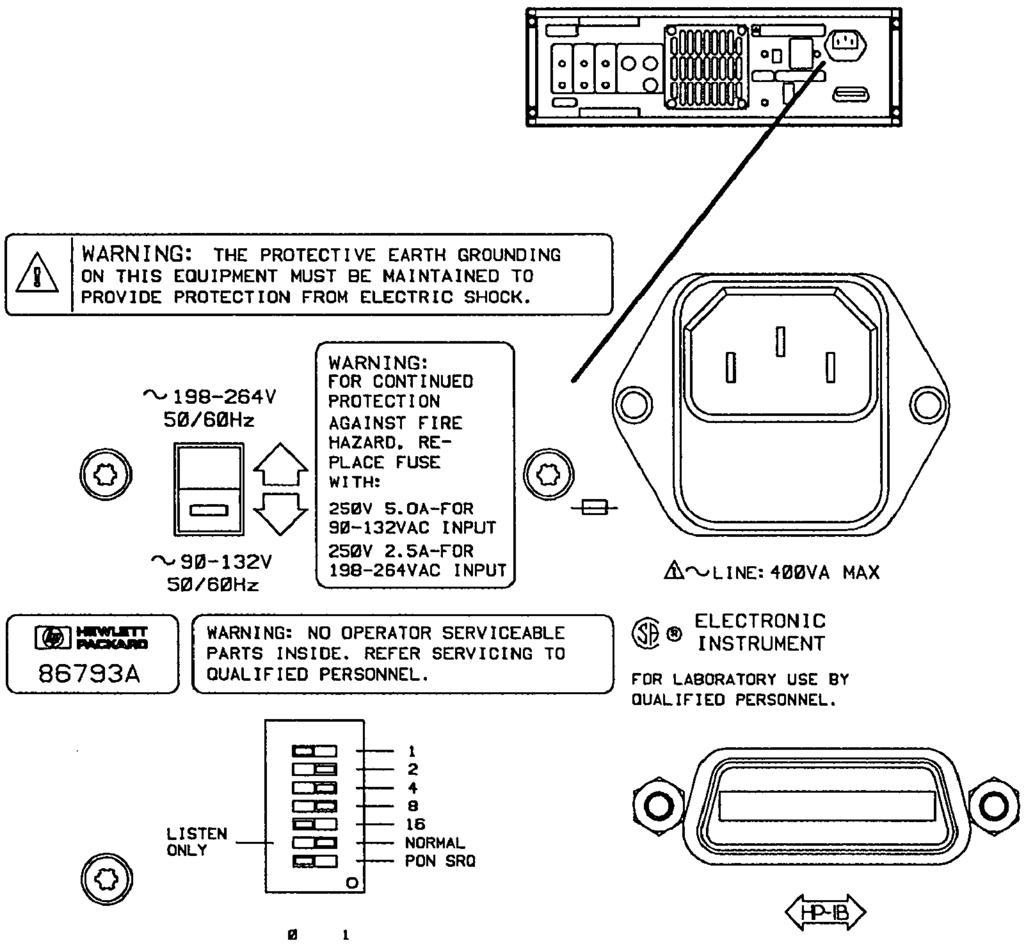


Figure B-11. AMUC Rear Panel Features

Line Voltage Selector Switch

Selects operation for either 198 to 264 Vac or for 90 to 132 Vac.

HP-IB Address Switch

Switch setting determines the AMUC address to be used for communications over HP-IB. Factory set to 14. Must be set to 14 to function in the HP FASS system. If power is on, changing the address switch will not change the HP-IB address. The address changes only at power up.

Power Cord Receptacle with Fuse

Metric fuse, 5 mm by 20 mm, is located inside power cord receptacle.

4.0 A (250 V, normal blow) for 90 to 132 Vac input.
2.0 A (250 V, normal blow) for 198 to 264 Vac input.

HP-IB Connector

Connects the AMUC to the private Hewlett-Packard Interface Bus for communication with the Smart Interface. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

AUC Front Panel Features

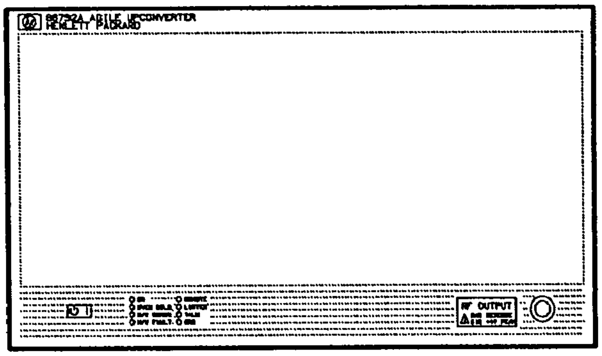


Figure B-12. AUC Front Panel Features

Line Switch

Applies power to the AUC when set to the on (I) position. Keeps the internal 10 MHz reference oscillator oven on when in the standby (⏻) position. With the oven on, the internal 10 MHz reference oscillator frequency remains stable, thereby stabilizing the system output frequency. Most instrument settings are cleared when set to standby.

Front Panel Annunciators

ON

Lights when the instrument is turned on.

OVEN COLD

Lights when the internal 10 MHz reference oscillator oven is cold. This annunciator is disabled when the rear panel FREQUENCY STANDARD switch is set to EXT ±5 ppm.

S/W ERROR

Lights whenever AUC receives a command over HP-IB that it cannot execute. Cleared by the Smart Interface.

H/W FAULT

Lights when a hardware error is detected in the AUC at power up.

Warning **Refer the instrument to qualified maintenance personnel.**

Also lights when an external source is not connected to the FREQUENCY STANDARD on the rear panel when the frequency standard switch is set to an external position.

REMOTE

Lights when AUC is in HP FASS mode of operation.

LISTEN

Lights when AUC is addressed to receive data over HP-IB.

TALK

Lights when AUC is addressed to send data over HP-IB.

SRQ

Not used with HP FASS.

RF OUTPUT Type N connector. 50Ω output impedance. Main signal output from AUC and HP FASS Model 11 system. For Model 21, connects to RF INPUT on AMUC. Frequency ranges from 10 MHz to 3 GHz. Output level ranges from +10 to −107 dBm.

Caution Maximum reverse power is +23 dBm peak.

RF OUTPUT connector is static sensitive. Avoid any contact with objects that may hold a charge.

AUC Rear Panel Features

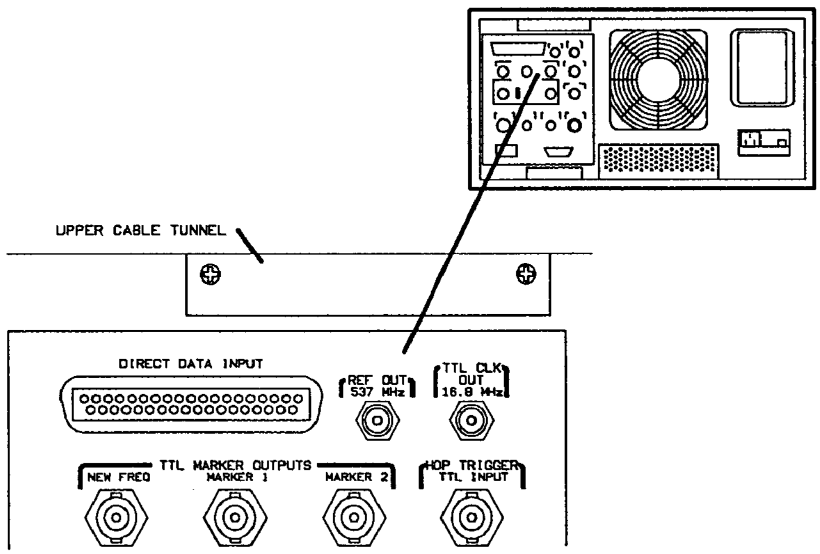


Figure B-13. AUC Rear Panel Features

Upper Cable Tunnel Enables access for a ribbon cable that runs from AUC to AMUC.

DIRECT DATA INPUT Not used with HP FASS.

REF OUT 537 MHz SMA connector. 50Ω output impedance. Provides a 536.870 912 (2^{29}) MHz signal at 10 dBm (typical). This signal is useful for verifying phase noise performance. For Model 21, connects to the REF IN 537 MHz on the rear panel of AMUC.

TTL CLK OUT 16.8 MHz

SMA connector. 75Ω output impedance. Provides a clock buffer for rear panel TTL CLK IN 16.8 MHz. Provides a system CLK/8 (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). For Model 21, connects to the TTL CLK IN 16 MHz on the rear panel of AMUC.

TTL MARKER OUTPUTS

NEW FREQ

Not currently used with HP FASS.

MARKER 1

Not currently used with HP FASS.

MARKER 2

Not currently used with HP FASS.

HOP TRIGGER TTL INPUT

Not used with HP FASS.

AUC Rear Panel Features (cont'd)

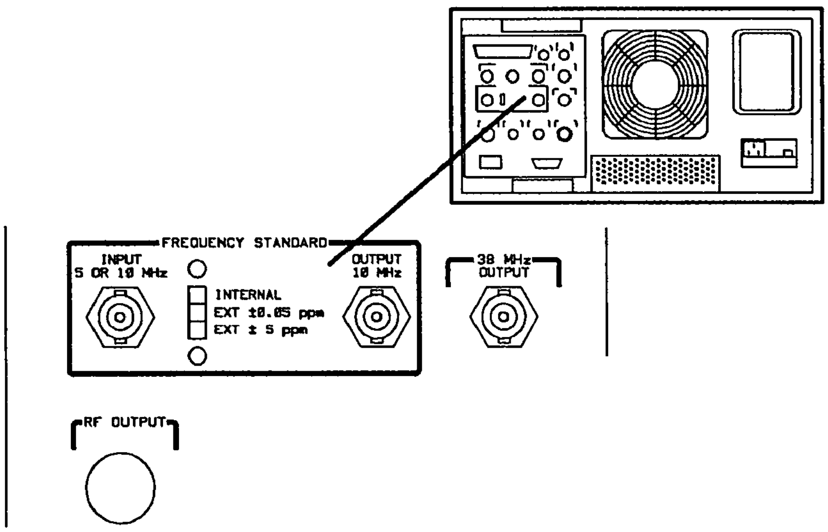


Figure B-14. AUC Rear Panel Features

FREQUENCY STANDARD

INPUT 5 or 10 MHz

BNC connector. 50Ω input impedance. Connects to a 5 or 10 MHz source. Input level should be +10 to +13 dBm for a 5 MHz input and 0 to +13 dBm for a 10 MHz input.

Switch

The switch setting selects the frequency standard for the AUC. The system's close-in ($\leq$ 100 Hz) phase noise is dependent on the frequency standard.

INTERNAL. Selects the AUC internal 10 MHz reference. Phase noise performance is set by the internal 10 MHz reference oscillator.

EXT ±0.05 ppm. Phase locks the AUC internal 10 MHz reference to a 5 or 10 MHz external source. The external source connects to the INPUT 5 or 10 MHz connector. It must be within 0.05 parts per million of its nominal frequency (that is, 5 MHz ±0.25 Hz or 10 MHz ±0.5 Hz). Otherwise, the phase lock loop will not lock. Phase noise performance is set by the internal 10 MHz reference oscillator. When set to this position, an external source must be provided or the AUC front panel H/W FAULT annunciator will light. This switch position is useful in phase locking the system (AUC) output to other instruments.

EXT ± 5 ppm. Selects an external source connected to the INPUT 5 or 10 MHz as the frequency standard. An AUC internal 134 MHz oscillator is phase locked directly to this external source. The unused internal 10 MHz reference oscillator output is automatically turned off. The external source must be within 5 parts per million of its nominal frequency (that is, 25 Hz for 5 MHz and 50 Hz for 10 MHz). When set to this position, an external source must be provided or the AUC front panel H/W FAULT annunciator will light. Phase noise performance at offsets of 100 Hz or less is set by the external reference. This switch position is useful in phase locking the system (AUC) output to other instruments.

OUTPUT 10 MHz

BNC connector. 50Ω output impedance. Provides 7 to 10 dBm (typically 8.5 dBm), 10 MHz reference signal derived from the reference frequency selected.

38 MHz OUTPUT

BNC connector. 50Ω output impedance. Provides a 37.748 736 MHz output signal. Output level is approximately −9 dBm.

RF OUTPUT

Not used.

AUC Rear Panel Features (cont'd)

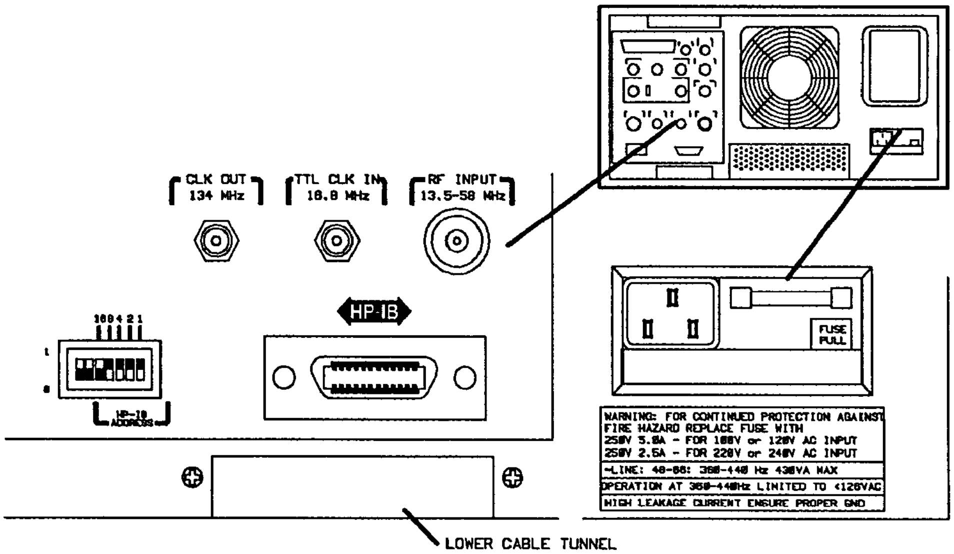


Figure B-15. AUC Rear Panel Features

CLK OUT 134 MHz SMA connector. 50Ω output impedance. Provides a 134.217 728 MHz (2^{27}) MHz, approximately 2.5 dBm signal. Provides HP FASS system clock when the system is internally clocked. Connects to the EXT CLK INPUT on the rear panel of ACS when system is internally clocked.

TTL CLK IN 16.8 MHz SMA connector. 75Ω input impedance. Input for a TTL-level clock signal from ACS at a frequency 1/8 the HP FASS system clock rate (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). This clock is used for clocking frequency and fast attenuator data from MDS to AUC. Connects to TTL OUTPUT CLK/8 on rear panel of ACS.

RF INPUT 13.5-58 MHz

Type N connector. 50Ω input impedance. This is the signal from ACS that is upconverted. Connects to RF OUTPUT on the rear panel of ACS.

HP-IB Address Switch

Switch setting determines the AUC address to be used for communications via HP-IB. Factory set to 15. Must be set to 15 to function in the HP FASS system. If the power is on, changing the address switch will not change the HP-IB address. The address changes only at instrument power up.

HP-IB Connector

Connects the AUC to the private Hewlett-Packard Interface Bus for communication with the Smart Interface. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

Lower Cable Tunnel

Enables access for a woven cable that runs from MDS to AUC. It provides frequency and fast attenuator data to the AUC.

Line Module

Permits operation from 100, 120, 220, or 240 V ac. The number visible in the window indicates the nominal line voltage to which the instrument must be connected. The center conductor is safety earth ground.

Caution

Failure to ground the instrument chassis (that is, using a two-pronged adapter on the line [Mains] power cable) will result in the output amplifier's increased sensitivity to damage by static discharge.

Fuse

5.0 A (250 V, normal blow) for 100/120 Vac input.

2.5 A (250 V, normal blow) for 220/240 Vac input.

MDS Front Panel Features

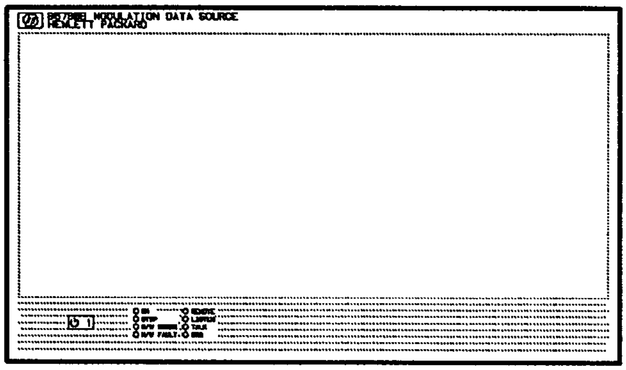


Figure B-16. MDS Front Panel Features

Line Switch

Applies power to the MDS when set to the on (I) position. Instrument settings are cleared when the line switch is set to standby (⏻).

Front Panel Annunciators

ON

Lights when the instrument is turned on.

STOP

Lights when the sequencers are halted.

S/W ERROR

Lights whenever the MDS receives a command over HP-IB that it cannot execute. If the annunciator lights, it is cleared by the Smart Interface.

H/W FAULT

Lights when a hardware error is detected in the MDS at power up.

Warning **Refer the instrument to qualified maintenance personnel or contact your nearest Hewlett-Packard office for service.**

REMOTE

Lights when the MDS is in the remote mode for operation in the HP FASS system.

LISTEN

Lights when the MDS is addressed to receive data over HP-IB.

TALK

Lights when the MDS is addressed to send data over the HP-IB.

SRQ

Not used with HP FASS.

MDS Rear Panel Features

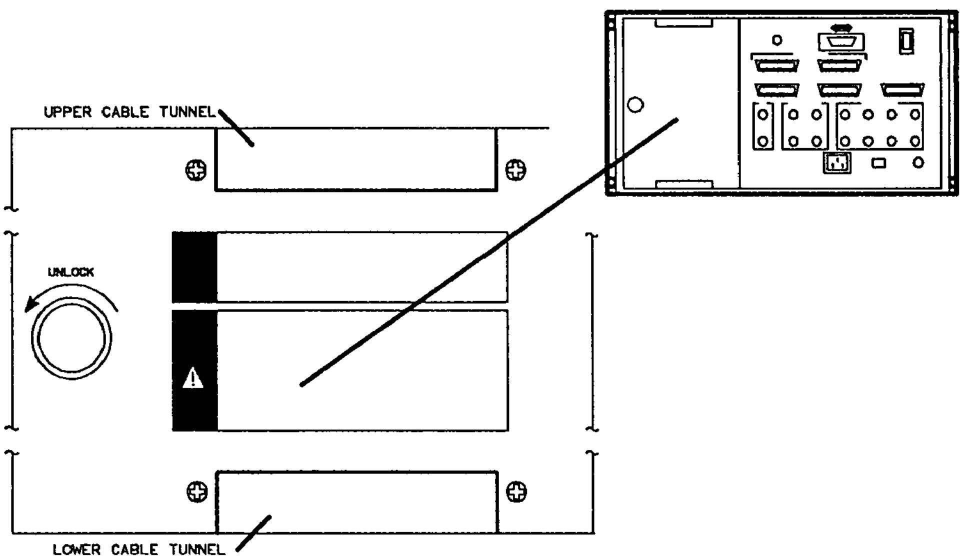


Figure B-17. MDS Rear Panel Features

Upper Cable Tunnel Enables access for a woven cable that runs from MDS to AUC. It provides frequency and fast attenuator data to the AUC.

Knob Enables access to the inside of the instrument for service.

Lower Cable Tunnel Enables access for five woven and two 75Ω coax cables that run between MDS and ACS. The woven cables provide ACS with the AM, PM, frequency, and pulse data that creates the ACS output signal. The coax cables provide MDS with a TTL level CLK/4 and CLK/8. If the system clock is the internal 134.217 728 MHz, CLK/4 is 33.554 432 MHz and CLK/8 is 16.777 216 MHz.

MDS Rear Panel Features (cont'd)

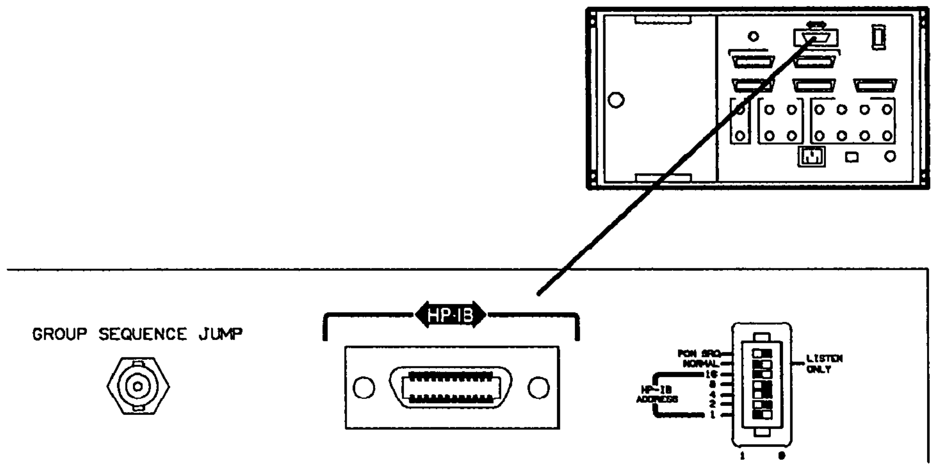


Figure B-18. MDS Rear Panel Features

GROUP SEQUENCE JUMP

BNC connector. 75Ω impedance. When the group sequence jump source is set to external (using the :FASS:SEQ:JUMP HP-IB command or the Seq. Jump Source command on the SID Control Panel), a TTL pulse having the following electrical characteristics causes a group sequence jump to occur for all sequencers enabled to do so:

- Pulse width: 30 ns.
- Maximum pulse rate: 3.0 MHz. A new pulse may occur at intervals no shorter than 330 ns. Rates greater than 3.0 MHz may cause unpredictable sequence jumping but will not lock up hardware.

HP-IB Connector

Connects the MDS to the private Hewlett-Packard Interface Bus for communication with the Smart Interface. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

HP-IB Address Switch

Switch setting determines the MDS address to be used for communications via HP-IB. Factory set to 17. Must be set to 17 to function in the HP FASS system. If the power is on, changing the address switch will not change the HP-IB address. The address changes only at instrument power up.

MDS Rear Panel Features (cont'd)

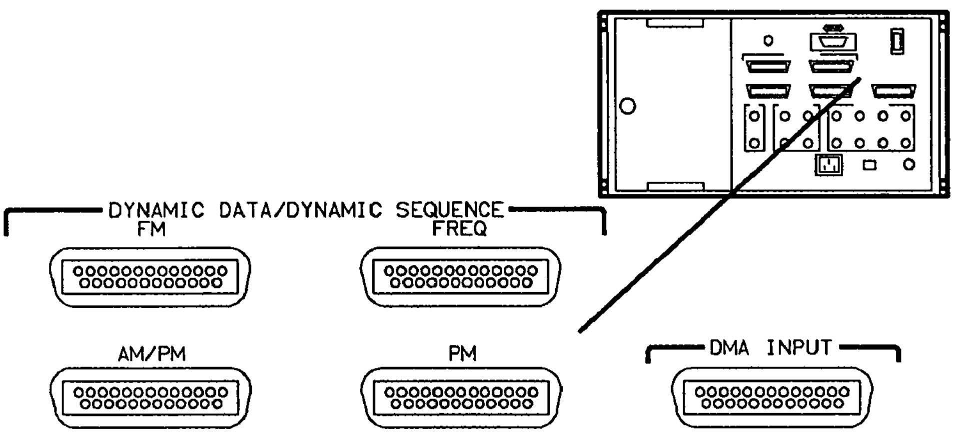


Figure B-19. MDS Rear Panel Features

DYNAMIC DATA/DYNAMIC SEQUENCE

AM/PM, PM, FM, FREQ

Cannon D, 25-pin connectors. Programmable for three modes: Dynamic Data, Dynamic Sequence, and Sequencer Address Out (see :FASS:SEQ:MODE command in FASS subsystem chapter for mode selection).

When HP FASS is in Dynamic Data mode, 16-bit parallel TTL-level inputs address the internal modulation RAM. The addressed RAM is latched every 29.8 ns (CLK/4) when the internal system clock of 134.217 728 MHz is used. The maximum addressing rate is system CLK/4. This provides for a real-time waveform generation mode. See product note 8791-1 (supplied with the system), *Real-Time Control of HP FASS* for more information.

When HP FASS is in Dynamic Sequence mode, 10-bit parallel TTL-level inputs select up to 1024 different waveform sequences. This provides for real-time random execution of sequences.

When HP FASS is in internal (RAM) mode, this port can be programmed to output 20-bit modulation memory addresses currently being accessed.

See figures B-30 through B-32 for more information about pin-outs, logic levels, mating connector, and timing characteristics for the corresponding mode.

DMA INPUT Cannon D, 25-pin connector. Parallel TTL-level inputs from the Smart Interface provide high-speed data transfer into MDS modulation and sequencer RAM. See the optional *HP 86790B Modulation Data Source Service Manual* for more information about signal lines, logic levels, and mating cable.

MDS Rear Panel Features (cont'd)

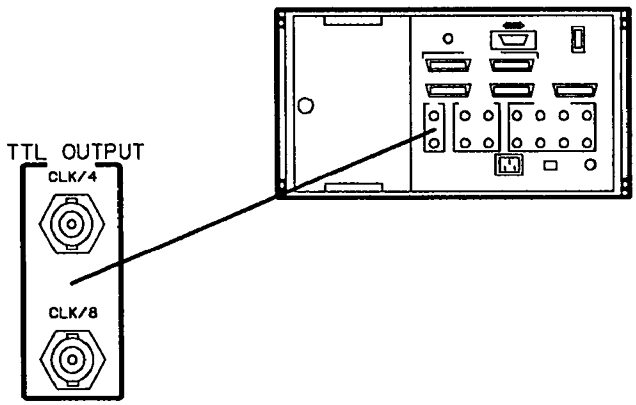


Figure B-20. MDS Rear Panel Features

TTL OUTPUT

CLK/4

BNC connector. 75Ω output impedance. Provides a TTL-level clock signal at a frequency 1/4 the system clock rate input at the EXT CLOCK INPUT of ACS (33.554 432 MHz when the internal system clock of 134.217 728 MHz is used). Can be used for synchronizing external instruments to internal system clocks.

CLK/8

BNC connector. 75Ω output impedance. Provides a TTL level clock signal at a frequency 1/8 the system clock rate input at the EXT CLOCK INPUT of ACS (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). Can be used for synchronizing external instruments to internal system clocks.

MDS Rear Panel Features (cont'd)

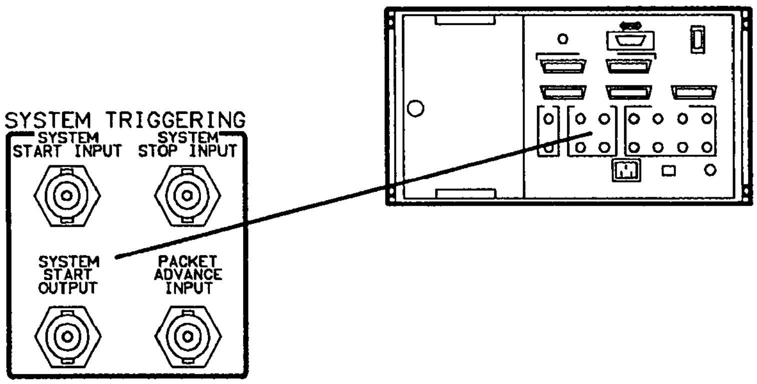


Figure B-21. MDS Rear Panel Features

SYSTEM TRIGGERING

SYSTEM START INPUT

BNC connector. 75Ω input impedance. When enabled through system programming, a TTL pulse with a minimum width of 10 ns causes the system to begin generating waveform data. (The sequencers start running.)

There are approximately eight CLK/4 cycles of delay between the time the trigger is latched and when the first address is generated. The overall system latency is approximately 3.6 μs from start trigger to RF output. With an asynchronous system start, the trigger uncertainty is 60 ns. With a synchronous system start, there is a short fixed delay between the trigger and when the trigger is latched at the system start.

Enabled by selecting either external continuous or external single trigger modes. In local operation, trigger modes are set with the Trigger Setting command on the

SID Control Panel. In remote operation, trigger modes are set with the :TRIG:INIT HP-IB command.

SYSTEM STOP INPUT

BNC connector. 75Ω input impedance. When enabled through system programming, a TTL pulse with a minimum width of 10 ns disables all MDS clocks and cause the system to stop generating waveform data. (The sequencers stop running.)

There are approximately eight CLK/4 cycles of delay between the time the trigger is latched and when the last address is generated. The overall system latency is approximately 3.6 μs from stop trigger to RF output. With an asynchronous system stop, the trigger uncertainty is 60 ns. With a synchronous system stop, there is a short fixed delay between the trigger and when the trigger is latched at the system stop.

HP FASS comes configured with this input connected to the rear panel EVENT MARKER 1 FREQ (frequency Sequence Start marker) with a BNC-to-BNC jumper cable for use in system triggering. The reset/default marker output at EVENT MARKER 1 FREQ is the frequency Sequence Start marker. This marker must be the active marker for the external single trigger mode to function. Enabled in remote operation by selecting either external continuous or external single trigger modes with the :TRIG:INIT command (see the "Triggering Subsystem" chapter). With SID local operation, this input is used to stop the system when the Trigger Setting command (on the SID Control Panel) is set to Ext. Single. When the external single trigger mode is selected, the scenario is run once and then the SYSTEM STOP INPUT stops the system via the trigger from EVENT MARKER 1 FREQ (frequency Sequence Start marker).

SYSTEM START OUTPUT

BNC connector. 75Ω output impedance. When a TTL pulse with a minimum width of 10 ns is applied to the SYSTEM START INPUT, a TTL pulse will appear one CLK/4 cycle later at this output. The CLK/4 cycle is 29.8 ns when the internal system clock of 134.217 728 MHz is used. When two HP FASS systems are synchronized, this output on the master MDS connects to the SYSTEM START INPUT of the slave MDS.

When synchronizing more than two HP FASS systems for system start, a multiple output TTL buffer is needed. See the "Synchronization Subsystem" chapter for more information.

PACKET ADVANCE INPUT

BNC connector. 75Ω input impedance. This input is used to advance to the next packet in the sequence when the current packet has been defined with an advance mode of GROUP, and is waiting for such a group advance. Both loop and ordinary packets have a group advance mode. See the commands :FASS:PCKM, :FASS:PCLM, and :FASS:SLP in the "FASS Subsystem" chapter of this manual.

The input must be a minimum of 60 ns wide. The packet advance input rate is determined by the minimum dwell time for a packet.

MDS Rear Panel Features (cont'd)

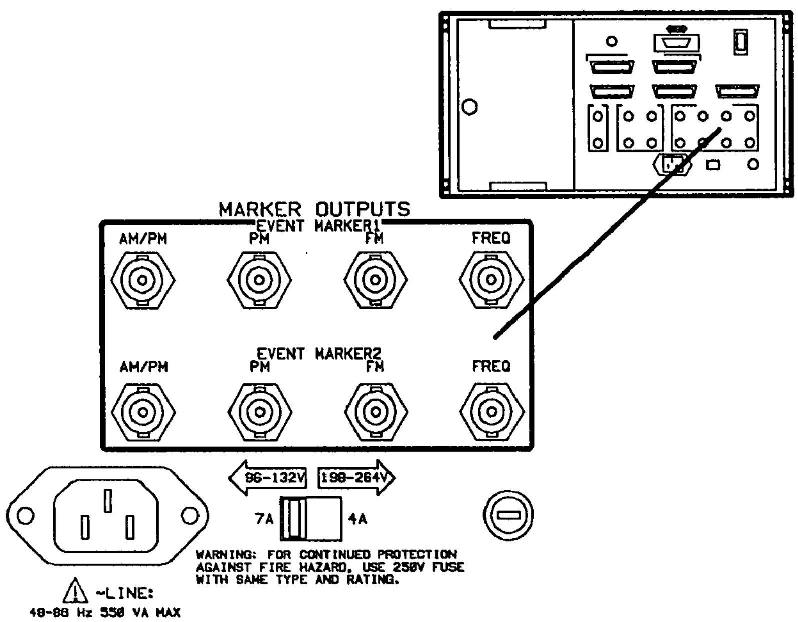


Figure B-22. MDS Rear Panel Features

MARKER OUTPUTS

Each of the four modulation memories (AM/PM, PM, FM, and FREQ) is controlled by a sequencer. Each sequencer has eight TTL-compatible marker outputs: Equal Address, Loop Packet Start, Packet ID, Packet ID Start Marker, Packet Start, Scan Start, Sequence Start, and None. Here, the term "Packet ID" refers to a packet whose packet ID marker has been enabled. For details on enabling the packet ID marker, see the :FASS:DATA, :FASS:PCKM and :FASS:PCLM commands in the "FASS Subsystem" chapter of this manual.

For each active memory, it is possible to programmatically assign any of the eight marker outputs to EVENT MARKER 1, and any of the eight marker outputs to EVENT MARKER 2. For more information on how to do this, and on markers in general, see the :FASS:ESEL and the :FASS:MARK commands in the "FASS Subsystem" chapter.

The MARKER OUTPUTS (see figure B-22) have a programmable delay which can be set between 1 and 64 clock cycle time intervals. The HP-IB command for setting this delay is :FASS:MDEL. In local operation, the delay can be set with the Marker Delay command on the SID Event Markers screen.

The electrical characteristics of the eight markers are as follows:

Marker	**Electrical Characteristics (see explanation of code below)**
Equal Address Marker	(1)
Loop Packet Start Marker	(2)
Packet ID Marker	(3)
Packet ID Start Marker	(2)
Packet Start Marker	(2)
Scan Start Marker	(2)
Sequence Start Marker	(2)
None	Output low

Marker Electrical Characteristics Code:

(1) Amplitude $\geq$ 2.5 V, width = $K \times 30$ ns, where K is the address rate divider selected (for more details, see the :FASS:ARAT command in the "FASS Subsystem").

(2) Amplitude $\geq$ 2.5 V, width approximately 30 ns.

(3) Amplitude $\geq$ 2.5 V during marked event.

Each marker outputs a TTL-level pulse and has an output impedance of 75Ω.

Line Module

Permits operation from 90 to 132 V ac or from 198 to 264 V ac. The numbers visible in the window indicate the nominal line voltages to which the instrument must be connected. The center conductor is safety earth ground.

Fuse

6.0 A (250 V, normal blow) for 90 to 132 V ac input.

3.0 A (250 V, normal blow) for 198 to 264 V ac input.

ACS Front Panel Features

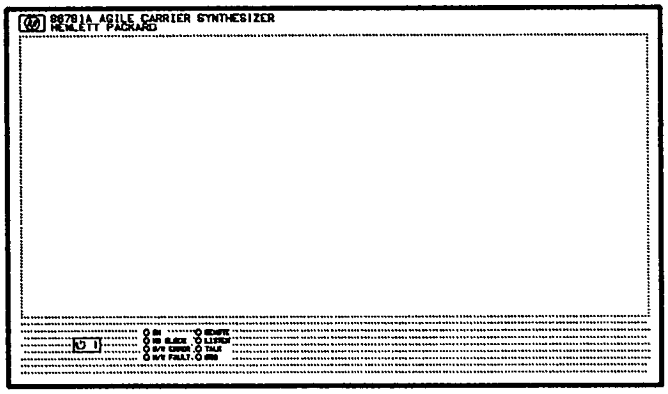


Figure B-23. ACS Front Panel Features

Note

The RF Output connector for Model 7 is located on the lower right side of the ACS front panel.

Line Switch

Applies power to the ACS when set to the on (I) position. Instrument settings are cleared when the line switch is set to standby (⏻).

Front Panel Annunciators

ON

Lights when the instrument is turned on.

NO CLOCK

Lights when no system clock is connected to the EXT CLOCK INPUT on the rear panel of ACS.

S/W ERROR

Lights whenever the ACS receives a command over HP-IB that it cannot execute. If the annunciator lights, it is cleared by the Smart Interface.

H/W FAULT

Lights when a hardware error is detected in the ACS at power up.

Warning

Refer the instrument to qualified maintenance personnel or contact your nearest Hewlett-Packard office for service.

REMOTE

Lights when the ACS is in the remote mode for operation in the HP FASS system.

LISTEN

Lights when the ACS is addressed to receive data over the HP-IB.

TALK

Lights when the ACS is addressed to send data over the HP-IB.

SRQ

Not used with HP FASS.

RF OUTPUT (Model 7 Only)

System RF Output for Model 7. Connector does not exist on front panel of Models 11 and 21. 50Ω Type N female connector. Output is typically -1 to +1 V (10 dBm) into 50Ω.

Caution

Maximum reverse power is ±3 V (20 dBm) peak. RF Output connector is static sensitive. Avoid any contact with objects that may hold a charge.

ACS Rear Panel Features

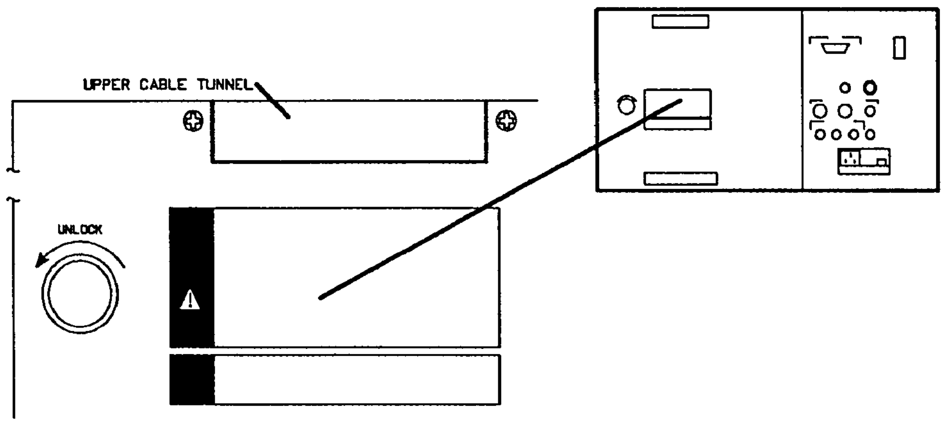


Figure B-24. ACS Rear Panel Features

Upper Cable Tunnel Enables access for five woven and two 75Ω coax cables that run between ACS and MDS. The woven cables provide ACS with the AM, PM, frequency, and pulse data that creates the ACS output signal. The coax cables provide MDS with a TTL level CLK/4 and CLK/8. If the system clock is the internal 134.217 728 MHz, CLK/4 is 33.554 432 MHz and CLK/8 is 16.777 216 MHz.

Knob Enables access to the inside of the instrument for service.

ACS Rear Panel Features (cont'd)

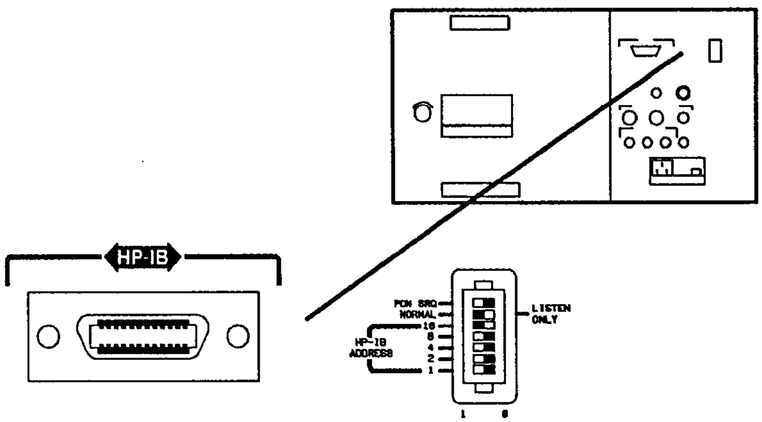


Figure B-25. ACS Rear Panel Features

HP-IB Connector Connects the ACS to the private Hewlett-Packard Interface Bus for communication with the Smart Interface. See figure B-29 for additional information about signal lines, logic levels, and mating cables.

HP-IB Address Switch Switch setting determines the ACS address to be used for communications via HP-IB. Factory set to 16. Must be set to 16 to function in the HP FASS system. If the power is on, changing the address switch will not change the HP-IB address. The address changes only at instrument power up.

ACS Rear Panel Features (cont'd)

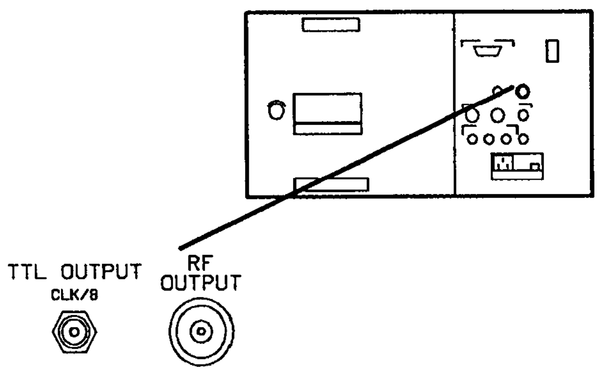


Figure B-26. ACS Rear Panel Features

TTL OUTPUT CLK/8

SMA Connector. 75Ω output impedance. Provides a TTL-level clock signal at a frequency 1/8 the HP FASS system clock rate (16.777 216 MHz when the internal system clock of 134.217 728 MHz is used). Connects to TTL CLK IN 16.8 MHz on the rear panel of AUC for clocking frequency and fast attenuator data from MDS to AUC.

RF OUTPUT

Plugged for Model 7. For Models 11 and 21, Type N connector. 50Ω output impedance. Main signal output from the ACS. Output is unfiltered and contains the desired 13.5-58 MHz (including the modulation sidebands) and undesired reflected products about the clock (134.217 728 MHz when the internal system clock is used). Undesired products are filtered out in the AUC. The 13.5-58 MHz nominal output level is −10 dBm. Provides the RF INPUT signal to the rear panel of AUC to be upconverted.

ACS Rear Panel Features (cont'd)

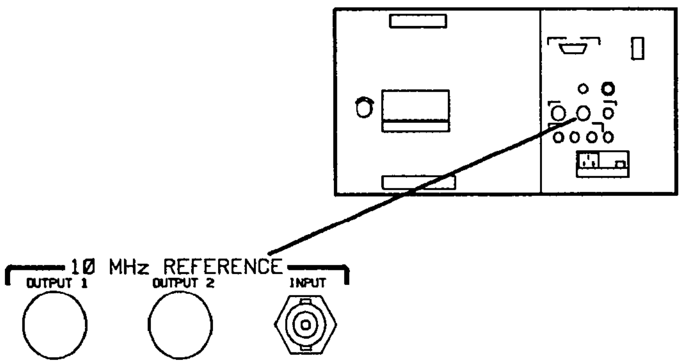


Figure B-27. ACS Rear Panel Features

10 MHz REFERENCE

OUTPUT 1

Plugged for Models 11 and 21. For Model 7, BNC connector. 50Ω output impedance. 10 MHz reference signal is derived from the HP 86791A-HO7 internal crystal reference.

OUTPUT 2

Plugged for Models 11 and 21. For Model 7, BNC connector. 50Ω output impedance. 10 MHz reference signal is derived from the HP 86791A-HO7 internal crystal reference. Jumpered to 10 MHz REFERENCE INPUT for use of internal reference.

INPUT

Plugged for Models 11 and 21. For Model 7, BNC connector. 50Ω output impedance. Connects to a 10 MHz reference for locking the internal 134 MHz phase-locked loop. Jumpered to OUTPUT 2 for use of the internal reference. To use an external reference, connect 10 MHz ±150 Hz, 0 to +10 dBm into 50Ω.

ACS Rear Panel Features (cont'd)

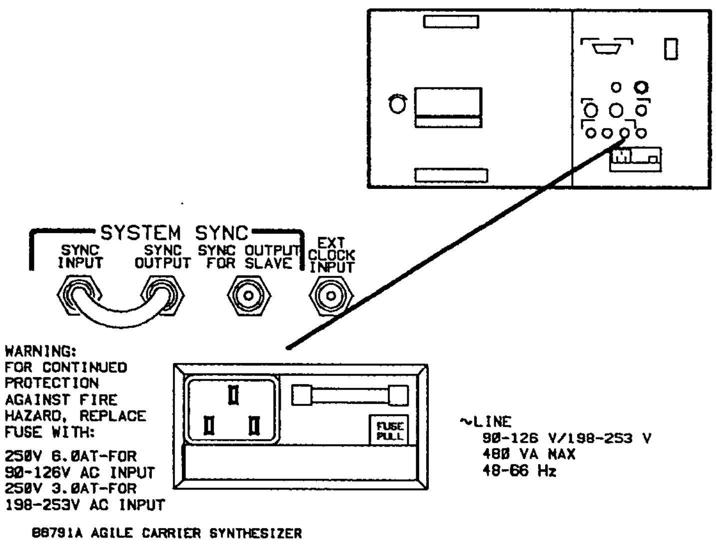


Figure B-28. ACS Rear Panel Features

SYSTEM SYNC

SYNC INPUT

SMA connector. 50Ω input impedance. Input is ECL level. Must always be connected to the main clock source. Normally, the SYNC INPUT is connected to the SYNC OUTPUT with a SMA-to-SMA jumper cable. When two or more HP FASS systems are being synchronized, the SYNC INPUT of the master ACS is connected to the SYNC OUTPUT of the same ACS with the jumper cable. The SYNC INPUT of the slave is connected to the SYNC OUTPUT FOR SLAVE of the master. See the "Synchronization Subsystem" chapter for more information.

SYNC OUTPUT

SMA connector. 50Ω output impedance. DC coupled. With a single HP FASS system or the master of synchronized systems: provides an ECL level of the main clock source input at the EXT CLOCK INPUT, and the SYNC OUTPUT is connected to the SYNC INPUT with a SMA-to-SMA jumper cable. See the "Synchronization Subsystem" chapter for more information. If this output is driving equipment other than an ACS, it must be tied externally to 50Ω at −2 Vdc.

SYNC OUTPUT FOR SLAVE

SMA connector. 50Ω output impedance. DC coupled. Provides an ECL level of the main clock source input to the EXT CLOCK INPUT. When two HP FASS systems are synchronized, this output on the master ACS connects to the SYNC INPUT on the slave. The SYNC OUTPUT FOR SLAVE on the slave is not used. See the "Synchronization Subsystem" chapter for more information. If this output is driving equipment other than an ACS, it must be tied externally to 50Ω at −2 Vdc.

EXT CLOCK INPUT

SMA connector. 50Ω input impedance. Connects to an ac-coupled, external clock source with a 50% duty cycle. Frequency can range from 120 to 140 MHz at 0 to 10 dBm. Sets the clocks for ACS, MDS, AMUC, and AUC frequency and fast attenuator data from MDS. For Models 11 and 21, when the internal system clock is used, a 134.217 728 MHz signal is provided from CLK OUT 134 MHz on the rear panel of the AUC.

In remote operation, the clock source can be set to either the internal system clock with the :FASS:CINT command or to an external source with the :FASS:CEXT command (see "FASS Subsystem" chapter). In local operation, the clock source can be set in the SID Control

Panel with the System Clock command (see the "SID Local Operation" chapter in either the "SID Reference" or any of the optional ID Local Operation Reference manuals).

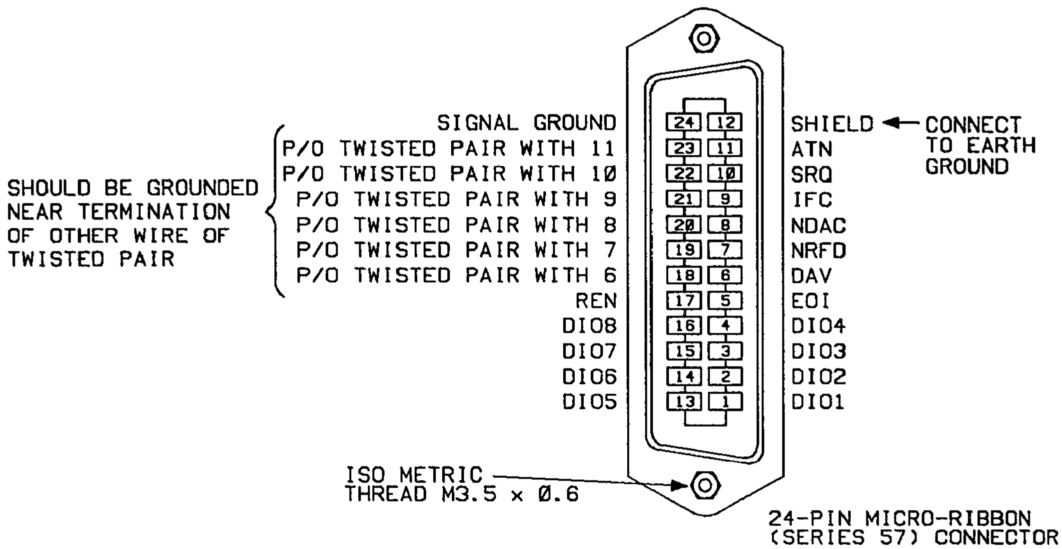
Line Module

Permits operation from 90-126 Vac or 198-253 Vac. The number visible in the window indicates the nominal line voltage to which the instrument must be connected. Center conductor is safety earth ground.

Fuse

6.0 A (250 V, time delay) for 90–124 V ac (60 Hz), 90–110 Vac (50 Hz) input.

3.0 A (250 V, time delay) for 198-243 Vac (50 Hz) input.



Logic Levels

The Hewlett-Packard Interface Bus Logic Levels are TTL compatible, that is, the true (1) state is 0.0 V dc to +0.4 V dc and the false (0) state is +2.5 V dc to +5.0 V dc.

Mating Connector

HP 1251-0293; Amphenol 57-30240.

Mating Cables Available

HP 10833A, 1 metre (3.3 ft), HP 10833B, 2 metres (6.6 ft)
HP 10833C, 4 metres (13.2 ft), HP 10833D, 0.5 metre (1.6 ft)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus system may contain no more than 2 metres (6.6 ft) of connecting cable per instrument.
2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus system is 20.0 metres (65.6 ft).

Figure B-29. Hewlett-Packard Interface Bus Connection

Logic Levels: TTL
High Level input voltage: 2.5V (min).
Low Level input voltage: 0.5V (max).

Mating Connector
25-pin Cannon D connector
HP part number 1251-0063

Mating Cable Available
HP 11738A, 2 metres (6.5 ft.)

Dynamic Data Input Restrictions

When in Dynamic Data mode there are critical timing considerations that must be met as shown in the following timing diagrams.

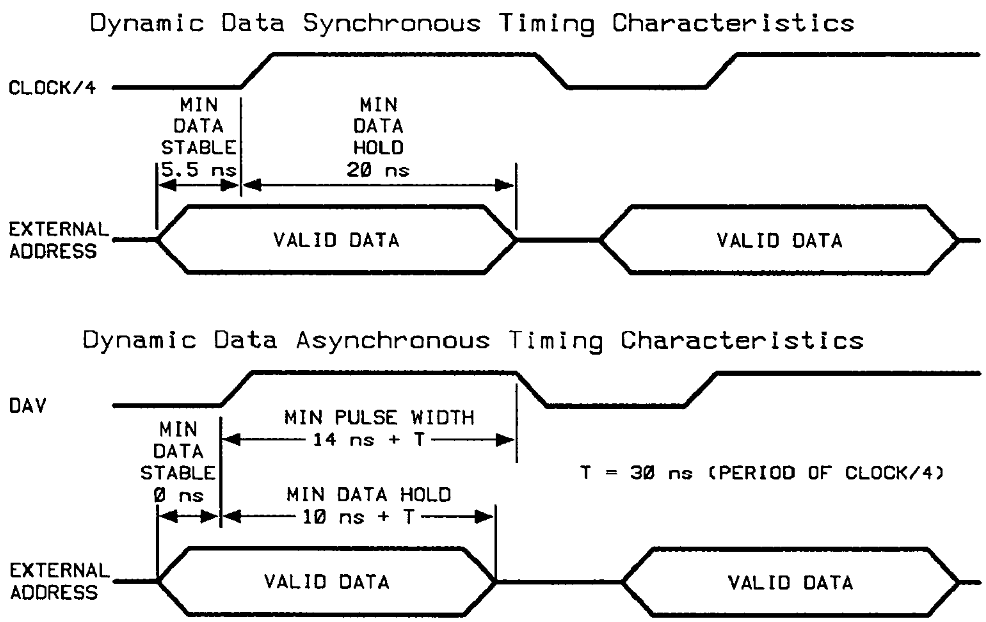
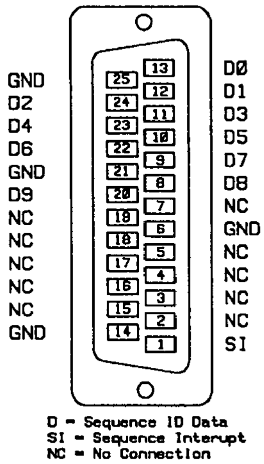


Figure B-30. Dynamic Data/Dynamic Sequence Port in Dynamic Data Mode



Logic Levels: TTL
High Level input voltage: 2.5V (min).
Low Level input voltage: 0.5V (max).

Mating Connector
25-pin Cannon D connector
HP part number 1251-0063

Mating Cable Available
HP 11738A, 2 metres (6.5 ft.)

Dynamic Sequence Input Restrictions

When in Dynamic Sequence mode there are critical timing considerations that must be met as shown in the following timing diagrams.

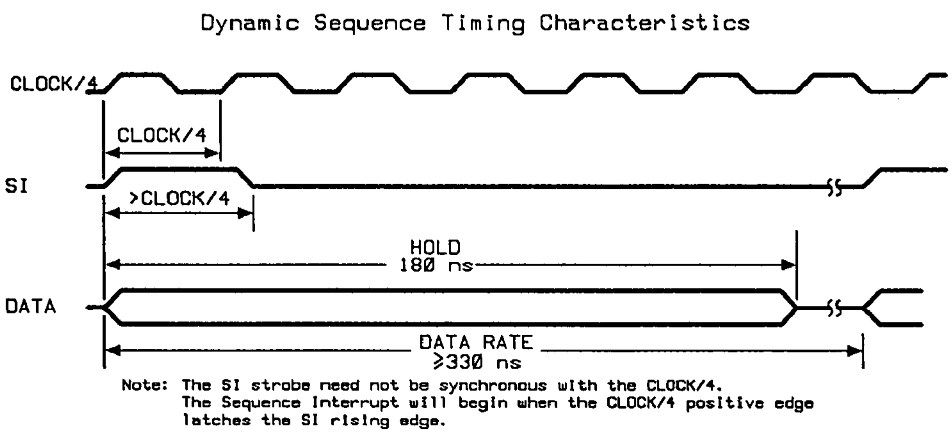
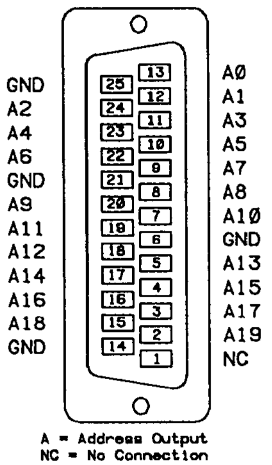


Figure B-31. Dynamic Data/Dynamic Sequence Port in Dynamic Sequence Mode



Logic Levels: TTL

Mating Connector
25-pin Cannon D connector
HP part number 1251-0063

Mating Cable Available
HP 11738A, 2 metres (6.5 ft.)

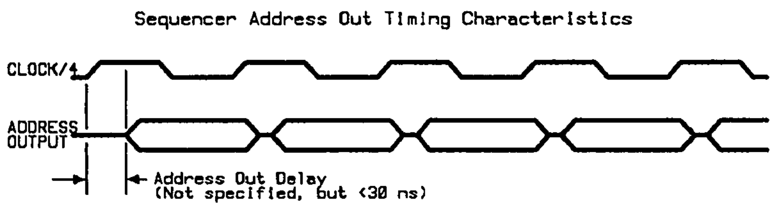


Figure B-32. Dynamic Data/Dynamic Sequence Port in Sequencer Address Out Mode

Error Messages

Error messages are read using the :SYST:ERR? query. See "System Subsystem" for additional information about this query.

0 **No error**

No action required.

1 **The system is placed into an interrupted state.**

The system received a new command or was addressed to talk before it finished responding to a query. Check that the controller is programmed to read the query response before issuing the next command.

2 **The system is placed into an unterminated state.**

Ensure the controller sends the system <NL> (new line) and EOI before addressing the system to talk.

3 **The system is placed into a deadlock state.**

Send the system eight or less queries in one command line.

4 **A query was executed when an indefinite query message has already been defined in the current message record.**

Send "*IDN?" and queries that return indefinite length block data as the last query of a command line.

5 **The system is addressed to talk but has nothing to say.**

Send the system a valid query before attempting to read query data.

10 **Decimal data is out of range.**

Re-enter the HP-IB command using decimal data within the allowable range for that command.

20 **Invalid mnemonic.**

See tables 3-2 through 3-16 for a list of valid HP-IB mnemonics.

21 **Undefined data type.**

Six data types are defined by IEEE Standard 488.2: character, decimal numeric, nondecimal numeric, string, arbitrary block, and expression. Re-enter the HP-IB command using the correct data type.

22 **Invalid data field separator.**

Use commas (,) to separate data fields and use a space to separate an HP-IB mnemonic from the data field.

23 **Empty data field within a message unit.**

The system received an HP-IB command that contained two commas with no data in between. Either add data between the commas or delete one of the commas.

24 **Character data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

25 **Character data overflow.**

Character data must be 12 or less characters.

26 **Invalid character within a character data type field.**

Valid character data characters are upper and lower case letters, 0 through 9, and underscore (_).

27 **Undefined character data.**

Re-enter the HP-IB command using valid data for the command.

28 **Improper string data type termination.**

Terminate string data with either single (') or double (") quotation marks. The terminator must be the same as the leading delimiter.

29 **String data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

30 **Block data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

31 **Invalid block type**

IEEE Standard 488.2 defines two types of block data: definite length and indefinite length. Definite length block data begins with a # and is followed by a non-zero digit indicating the number of length bits that follow. Indefinite length block data begins with #0. For additional information, see the description in this manual of the command in question or IEEE Standard 488.2.

32 **Improper block data termination**

Terminate block data with EOI asserted while the <NL> character is being sent on the bus.

33 **Non-decimal numeric data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

34 **Invalid non-decimal numeric data character.**

Valid characters for binary data are 0 and 1. Valid characters for octal data are 0-7. Valid characters for hexadecimal are 0-9 and A-F.

35 **Non-decimal numeric data overflow.**

Non-decimal numeric data must contain 8 bytes or less.

36 **Improper non-decimal numeric data type terminator.**

Use commas (,) to separate data fields, use a semicolon (;) to separate commands, and <NL> or <EOI> to terminate program messages.

37 **Decimal data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

38 **Improper decimal data type format.**

Re-enter the HP-IB command using the correct data format.

39 **Improper character within decimal data type field.**

Use only 0 through 9, E or e, . (period), + (plus sign), - (minus sign) and (white space).

40 **Decimal data type exponent overflow.**

The exponent value must be between -32000 and +32000.

41 **Decimal data suffix is not allowed for the entered mnemonic.**

Re-enter the HP-IB command with the decimal data in fundamental units and omit the suffix.

42 **Invalid decimal data suffix.**

Re-enter the HP-IB command using a valid suffix for the data. You can also enter the decimal data in fundamental units, such as hertz or seconds, and omit the suffix.

45 **Query is not allowed for the current mnemonic.**

Re-enter the command, deleting the ?.

46 **GROUP Execute Trigger in middle of message record.**

Delete the GROUP Execute Trigger BUS command from the program. HP FASS does not respond to this command.

47 **Improper non-decimal data field.**

Re-enter the HP-IB command using data that is valid for the command.

48 **Improper expression data type termination**

Terminate expression data with a parenthesis. Use a comma to separate data fields, a semicolon to separate commands, and a <NL> or <EOI> to terminate the message.

49 **Expression data is not allowed for the entered mnemonic.**

Re-enter the HP-IB command using the correct type of data.

51 **Invalid character received within a definite length block field.**

Re-enter the HP-IB command using the correct number of data bytes for definite length block data.

60 **Improper number of data fields in message unit**

Re-enter the HP-IB command using the number of data fields that are required by the command.

61 **Message unit is missing one or more data fields**

Re-enter the HP-IB command using the number of data fields that are required by the command.

62 **Numeric data buffer overflow**

Number is too large or has too many digits. Re-enter the HP-IB command with valid data.

63 **String data buffer overflow.**

String data has too many characters. Re-enter the HP-IB command with valid data.

64 **String data type field is expected.**

Re-enter the HP-IB command using string data.

65 **Decimal data type field is expected.**

Re-enter the HP-IB command using decimal data.

66 **Block data type field is expected.**

Re-enter the HP-IB command using block data.

67 **Block data type has overrun the destination buffer.**

See command description in manual regarding format of this block of data.

68 **Block data has underrun the destination buffer.**

See command description in manual regarding format of this block of data.

69 **Format error**

Re-enter the HP-IB command using the correct format for the command.

70 **Character data type field is expected.**

Re-enter the command using character data.

71 **An empty string data field was received.**

Re-enter the HP-IB command using valid data.

72 **An empty block data field was received.**

Re-enter the HP-IB command using valid data.

100 **A command was received from front panel while BUS was in remote mode.**

Enter the HP-IB command over the BUS or put the bus in local mode.

101 **A command was received over the BUS while the BUS was in local mode.**

Put the BUS in remote mode and re-enter the HP-IB command.

102 **Parallel port transfer failed due to a port timeout.**

Re-enter the HP-IB command.

201 **Start address out of range.**

Valid start addresses are 0 to 262143 in multiples of 4 for AM, PM2, and PM memories and PULS field; 0 to 32767 in multiples of 2 for the AUC and FLC fields; 0 to 65535 for the FM memory and the ACS field.

202 **File size out of range for this memory.**

Maximum file size is 262144 for AM, PM, and PM2 memories and FLC field; 32768 for AUC and FLC fields; 65536 for FM memory.

203 **Illegal HP-IB address specified.**

Valid addresses are 0 through 30.

204 **Illegal setting number specified.**

Valid ID setting numbers are 1 through 12

206 **Illegal filename**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha.

207 **Illegal advance mode specified.**

Valid loop advance modes are 0 for AUTO, 1 for BUS and 2 for GROUP. Packets have additional advance modes of 3 for BUS IMMediate, 4 for GROUP IMMediate. See the DATA, PCKM, PCLM and SLP commands in the "FASS Subsystem" chapter.

209 **Illegal memory specified.**

Valid memories are ACS, AM, AUC, FLC, FM, PM, PM2, and PULS. See MEM command in the "FASS Subsystem" chapter.

210 **Illegal external clock frequency.**

The system accepts 110 to 160 MHz. See the CEXT command in the "FASS Subsystem" chapter.

211 **Illegal number of scans for packet.**

Valid number of scans are 1 to 65536 for AUTO advance mode and 0 to 65536 for other advance modes. See the DATA, PCKM, PCLM, and SLP commands in the "FASS Subsystem" chapter.

212 **Illegal marker value specified.**

See the MARK command in the "FASS Subsystem" chapter.

214 **Illegal CW frequency or amplitude.**

Valid Model 7 CW frequency is 0 to 67.1 MHz; valid amplitude is -100 to +10 dBm.
Valid Model 11 CW frequency is 2 MHz to 3.05 GHz; valid amplitude is -107 to 22 dBm.
Valid Model 21 CW frequency is 10 MHz to 19 GHz; valid amplitude is -100 to 6 dBm.

216 **Not valid in this trigger mode.**

This error usually occurs when you try to use a triggered function while the system is in free run mode. See the "Trigger Subsystem" chapter.

218 **Illegal SID special function specified.**

See the SPEC command in the "SID Subsystem" chapter for a list of legal special functions.

219 **Illegal image number specified.**

Valid hardware image numbers are 0 through 5.

220 **Illegal test mode specified.**

See *HP FASS System Service Manual.*

221 **No stretch factor for this memory.**

A stretch factor is allowed for AM, PM, and PM2 memories only. See the SFAC command in the "FASS Subsystem" chapter.

222 **No phase format for this memory.**

Degrees and radians can be selected for PM and PM2 memories only.

225 **Illegal stretch factor specified.**

Valid stretch factors are 1, 2, and 4. See the SFAC command in the "FASS Subsystem" chapter.

226 **Zero value returned by the AUC detector.**

See *HP FASS System Service Manual.*

227 **Calibration error: bad detector voltage.**

See *HP FASS System Service Manual.*

228 **No Upconverter present.**

Check that Broadband Microwave Upconverter is present and all cables are connected. If the problem persists, see the *HP E2500A Supplemental Information* for options K01, K02,or K09.

229 **No LO Present**

Check that LO is present and all cables are connected. If the problem persists, see the *HP E2500A Supplemental Information* for options K01, K02,or K09.

231 **Size specified does not match data sent.**

This error occurs when using the :FASS:DATA 'SEQ2' command. The number of packets sent does not match the number of packets specified. See the DATA command in the "FASS Subsystem" chapter.

232 **Illegal number of packets specified.**

While using the :FASS:DATA 'SEQ2' command, too many packets have been specified. The maximum number of packets and loop packets allowed per memory is 32768.

233 **Incomplete or partial data transferred.**

Incorrect number of bytes loaded. Data should be 8-byte real numbers. Occurs when executing the :WGL:WAVE or :FASS:DATA 'SEQ2' commands and the total length of the data sent is not a multiple of 8.

234 **Illegal command for current system model.**

This error occurs when you attempt to execute an HP-IB command which is valid for HP FASS Model 11 mode only, on a HP FASS Model 10. Check description and comments for command.

235 **Invalid HP-IB string data**

This error usually occurs when you send string data and there is a format error in the string or the sting data is not one of the valid selections. See the DATA, ESEL, and SEQ:IMAG commands in the "FASS Subsystem" chapter.

236 **Download data out of range.**

Correct the data values so that they do not exceed the maximum amount allowed for the modulation memory to which you are trying to download. See the DATA command in the "FASS Subsystem" chapter.

237 **Address Out not allowed for this sequence mode.**

Setting the memory address out to on (:FASS:AOUT ON command) is not allowed if the sequence mode is set to local, master, individual, or external address.

238 **WGL program overflow - file too large.**

This error occurs when using the :WGL:LOAD command. Do not load a file that contains more than 60K characters.

239 **WGL array overflow.**

This error occurs when using the :WGL:WAVE command and attempting to load an amount of data that exceeds the maximum size of the WGL Working Wave. The maximum default size is 65536.

241 **Unable to complete level calibration.**

The level calibration procedure could not be completed because the proper level could not be reached at too many frequencies. See the WGL command log for more information.

242 **Some frequencies could not be calibrated.**

During the calibration procedure, the proper level could not be reached at some frequencies. See the WGL command log for a list of upconverter bands that could not be calibrated.

265 **Cal factor is out of range.**

When entering cal factor values using special functions, the cal factor must be between 0 and 1.

266 **Invalid HP-IB index.**

This error usually occurs when entering one or more commands that have several parameters and too few or too many parameters are given. Check that the required number of parameters are entered.

272 **Illegal cal factor index specified.**

Valid cal factor indexes for the :FASS:CTAB? query are 0 to 728.

400 **Invalid command sequence.**

See the flowcharts at the beginning of most subsystem chapters for valid command sequences.

401 **Cannot delete the last pulse.**

Total number of pulses must be 1 or more. See the TPUL command in the "Global Subsystem" chapter.

402 **Insert exceeds maximum pulses.**

The maximum number of pulses is 512 for models 1 and 4 and 113 for models 2, 3, 5, and 6. See the IPUL command in the "Global Subsystem" chapter.

403 **Selected pulse is out of range.**

Pulse does not exist. Select another pulse. See the SPUL command in the "Global Subsystem" chapter.

404 **Number of pulses is too large.**

The maximum number of pulses is 512 for models 1 and 4 and 113 for models 2, 3, 5, and 6. See the TPUL command in the "Global Subsystem" chapter.

405 **Pulse is out of range.**

The maximum number of pulses is 512 for models 1 and 4 and 113 for models 2, 3, 5, and 6. This error can also be caused by trying to delete a pulse that doesn't exits. See the DPUL and IPUL commands in the "Global Subsystem" chapter.

406 **Width exceeds the maximum duty cycle.**

Width < PRI. Decrease the width or increase the PRI. See the PRI and WIDT commands in the "Global Subsystem" chapter.

407 **Pulse width is larger than the PRI.**

Decrease the pulse width or increase the PRI. See the WIDT command in the "Global Subsystem" chapter.

408 **PRI is smaller than pulse width.**

Decrease the pulse width or increase the PRI. See the PRI command in the "Global Subsystem" chapter.

409 **PRI violates the maximum duty cycle.**

Decrease the pulse width or increase the PRI. See the PRI command in the Global subsystem.

410 **Invalid number of Barker elements.**

Valid numbers are 2, 3, 4, 5, 7, 11, and 13. See the BARK:NEL, CBAR:NIEL, or CBAR:NOEL commands in the "Frequency/Phase Modulation Subsystem" chapter.

411 **Flat on-time is too small for model 4.**

See the PSH:TYPE command in the "Global Subsystem" chapter.

412 **User pulse shape is not allowed in model 4.**

Change either the pulse shape type or the model number. See the PSH:TYPE command in the "Global Subsystem" chapter.

413 **Carrier frequency is out of range.**

Pulse frequency + frequency offset must be between 0 Hz and 60 MHz for HP FASS Model 7, 2 MHz and 3.05 GHz for HP FASS Model 11, and 10 MHz and 19 GHz for HP FASS Model 21. See the FREQ and FOFF commands in the "Global Subsystem" chapter.

414 **Width is too small for model 4.**

See the PSH:TYPE command in the "Global Subsystem" chapter.

415 **PRI is too small for model 4.**

Increase the PRI. See the PRI command in the "Global Subsystem" chapter.

416 **Cannot set pulse width for models 1, 2, and 3.**

Use signal models 4, 5, or 6, or see the WIDT command in the Pulse subsystem.

417 **PRI is smaller than the limit.**

Increase the PRI. See the PRI command in the "Global Subsystem" chapter.

418 **PRI is larger than the limit.**

Decrease the PRI. See the PRI command in the "Global Subsystem" chapter.

419 **Peak PRI is out of range.**

Decrease the percent of deviation for a jittered PRI pattern. See the JITT:PDEV command in the PRI Patterns subsystem.

420 **PRI exceeds the pulse burst repetition interval.**

See the BURS:BINT, BURS:PPB, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

421 **N pulses at PRI exceeds the pulse burst repetition interval.**

See the BURS:PPB, BURS:BINT, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

422 **Total number of pulses is out of range.**

The total number of pulses needed to make the PRI burst pattern is too large (>512 for models 1 and 4; >113 for models 2, 3, 5, and 6). See the BURS:BINT command in the "Hop Patterns Subsystem" chapter.

423 **Pulse burst repetition interval was altered.**

Hop pattern burst interval is tied the existing pulse PRIs. Check the new pulse burst repetition interval and then make the pattern.

424 **Pulses per burst is out of range.**

See the BURS:PPB command in the "PRI Patterns Subsystem" chapter.

425 **PBRI is smaller than the PRI.**

See the BURS:BINT, BURS:PPB, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

426 **Pulse burst repetition interval is smaller than n pulses at PRI.**

See the BURS:BINT, BURS:PPB, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

427 **Pulse burst repetition interval is smaller than the limit.**

See the BURS:BINT, BURS:PPB, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

428 **Pulse burst repetition interval is larger than the limit.**

See the BURS:BINT, BURS:PPB, and BURS:PRI commands in the "PRI Patterns Subsystem" chapter.

429 **Percent deviation is out of range.**

Allowable range for percent deviation is 0-100%. See the JITT:PDEV command in the "PRI Patterns Subsystem" chapter.

430 **Gaussian pulse shape not allowed in model 4.**

See the PHS:TYPE command in the "Global Subsystem" chapter.

431 **Wobbulation frequency is too large.**

Wobbulation frequency is tied to the average PRI and is not constant. See the WOBB:WFR command in the "PRI Patterns Subsystem" chapter.

432 **Wobbulation frequency is too small.**

Wobbulation frequency is tied to the average PRI and is not constant. See the WOBB:WFR command in the "PRI Patterns Subsystem" chapter.

433 **Additional pulses needed for pattern.**

Hop patterns do not set the number of pulses needed for the pattern. Getting this error indicates that the hop pattern can be completed by increasing the total number of pulses.

434 **Number of steps is out of range.**

See the STEP:NFRE command in the "Hop Patterns Subsystem" chapter.

435 **Steps exceed number of pulses.**

Increase the number of pulses. See the STEP:NFRE command in the "Hop Patterns Subsystem" chapter.

437 **Wobbulation frequency has been altered.**

Check the new wobbulation frequency and make the pattern again. See the WOBB:WFR command in the "PRI Patterns Subsystem" chapter or the PRAN:WFR command in the "Hop Patterns Subsystem" chapter.

438 **Total pulse edge time is too large.**

See the FALL and RIS commands in the "Global Subsystem" chapter.

439 **Total pulse edge time exceeds width.**

See the FALL and RIS commands in the "Global Subsystem" chapter.

440 **PRI altered after pulse mod enabled.**

See the MOD command in the "Pulse Subsystem" chapter.

441 **Total pulse on time exceeds duty cycle.**

See the PHS:TYPE command in the "Global Subsystem" chapter.

442 **Pulse width is smaller than the limit.**

Increase the pulse width. See the WIDT command in the "Global Subsystem" or the "Pulse Subsystem" chapters.

443 **Pulse width is larger than the limit.**

Decrease the pulse width. See the WIDT command in the "Global Subsystem" or the "Pulse Subsystem" chapters.

444 **Pulse width is smaller than edge time.**

See the FALL, RIS, and WIDT commands in the "Global Subsystem" chapter.

445 **Pulse on time is larger than the PRI.**

See the PHS:TYPE command in the "Global Subsystem" chapter.

446 **Pulse on time exceeds the duty cycle.**

See the PHS:TYPE command in the "Global Subsystem" chapter.

447 **Rise time is too small.**

Increase the rise time. See the RIS command in the "Global Subsystem" chapter.

448 **Rise time is too large.**

Decrease the rise time. See the RIS command in the "Global Subsystem" chapter.

449 **Fall time is too small.**

Increase the fall time. See the FALL command in the "Global Subsystem" chapter.

450 **Fall time is too large.**

Decrease the fall time. See the FALL command in the "Global Subsystem" chapter.

451 **Gaussian pulse width is out of range.**

Valid Gaussian pulse width is 20 ns to 230 μs. See the PHS:TYPE and WIDT commands in the "Global Subsystem" chapter.

452 **User pulse width is out of range.**

Valid user pulse width is 20 ns to 230 μs. See the PHS:TYPE and WIDT commands in the "Global Subsystem" chapter. See the PHS:TYPE command in the "Global Subsystem" chapter.

453 **Peak output level is out of range.**

Valid peak output level is -100 to +10 dBm for HP FASS Model 7, -107 to +22 dBm for HP FASS Model 11, and -100 to +6 dBm for HP FASS Model 21. See the OLEV command in the "Global Subsystem" chapter.

454 **User pattern size is out of range.**

The first number in a user pattern must specify the number of data points to follow. This number must be between 1 and 8192.

455 **User pattern not installed in RSID.**

Install user pattern on removable cartridge.

456 **External clock frequency out of range.**

System accepts 110 to 160 MHz. See the CEXT command in the FASS subsystem.

457 **Average frequency is out of range.**

Valid range is 0 Hz to 60 MHz for HP FASS Model 7, 2 MHz to 3.05 GHz for HP FASS Model 11, and 10 MHz to 19 GHz for HP FASS Model 21. Frequency Out = Frequency + Frequency Offset. See the PRAN:AFRE command in the "Hop Patterns Subsystem" chapter.

458 **Peak frequency is out of range**

The combination of average frequency and frequency deviation for a pseudo random hop pattern must be between 0 Hz and 60 MHz for HP FASS Model 7, 2 MHz and 3.05 GHz for HP FASS Model 11, and 10 MHz and 19 GHz for HP FASS Model 21. Frequency Out = Frequency + Frequency Offset. See the PRAN:AFRE and PRAN:FDEV commands in the "Hop Patterns Subsystem" chapter.

459 **Frequency is smaller than the limit.**

Increase the frequency.

460 **Frequency is larger than the limit**

Decrease the frequency.

461 **Illegal RSID special function.**

See the SPEC command in the "SID Subsystem" chapter for a list of legal special functions.

462 **Additional pulses needed for wobbulation frequency.**

Add pulses. See the WOBB:WFR command in the "PRI Patterns Subsystem" chapter.

463 **Percent deviation is too large.**

Decrease the percent of deviation. Average PRI x (1 ± % of deviation) must be a valid PRI. See the JITT:PDEV command in the "PRI Patterns Subsystem" chapter.

464 **Internal clock required.**

See special functions 56.1 and 57.1 in the SPEC command of the "SID Subsystem" chapter.

465 **Resulting carrier frequency is out of range.**

Valid frequency is 0 Hz to 60 MHz for HP FASS Model 7, 2 MHz to 3.05 GHz for HP FASS Model 11, and 2 MHz to 19 GHz for HP FASS Model 21. See the FOFF and FREQ commands in the "Global Subsystem" chapter.

466 **Resulting PRI is out of range.**

See special functions 56.1 and 57.1 in the SPEC command of the "SID Subsystem" chapter.

467 **Pulse on-time is larger than the limit.**

See the PHS:TYPE command in the "Global Subsystem" chapter.

468 **User delta FM range exceeds the limit.**

(FMAX - FMIN) < 40 MHz. See the UFM:FMAX and UFM:FMIN commands in the "Frequency/Phase Modulation Subsystem" chapter.

469 **Unique pulse ontime is too large.**

See special function 58.1.

470 **PRI is too small.**

See special function 58.1.

471 **Mark All Pulses duty cycle violation.**

See special function 58.1.

472 **PRI has incorrect resolution.**

See special function 58.1.

473 **BMUC frequency band violation.**

See special function 59.1.

480 **Scan period out of range.**

Change one or more of the parameters that affect the total scan time for the selected scan pattern. See the "Antenna Modulation Subsystem" chapter.

805 **Unable to allocate memory.**

The Windows environment does not have enough memory left to run the application. Close other applications or reboot the system.

808 **Alphanumeric string expected.**

Enter alphanumeric string (letters and numbers).

809 **Numeric input expected**

Enter numbers.

810 **Numeric entry out of range**

See appropriate command for limits.

826 **File already exists**

Use a different, unique file name.

829 **File contains invalid data**

Replace file.

830 **Error reading application resource file**

See *HP FASS System Service Manual.*

831 **Co-processor not responding**

See *HP FASS System Service Manual.*

832 **Cannot create directory.**

There may be a problem with the disk.

833 **Cannot delete file.**

There may be a problem with the disk.

834 **Unable to compress data enough to fit on flexible disk for hardware image.**

Copying a complete hardware image can require as much as 2.8 MBytes of memory, depending on the image, but typically requires in the range of 600 KBytes. This error occurs when the hardware image cannot be compressed enough to fit on a floppy disk. No data is saved on the floppy disk.

913 **Cannot access file**

Specify file name correctly. There may be a problem with the disk.

914 **Cannot append to file.**

There may be a problem with the disk.

920 **Error occurred in recalling hardware image register.**

Check that HP-IB cables are securely fastened. Try again. There may be a problem with the disk.

921 **Error occurred in saving hardware image register.**

Check that HP-IB cables are securely fastened. Try again. There may be a problem with the disk.

922 **Empty hardware register specified**

Specify a valid hardware image register.

923 **Hardware register out of range**

Valid hardware image registers are 0 through 5.

924 **Could not download to hardware**

See *HP FASS System Service Manual.*

925 **ID setting register out of range**

Valid ID setting numbers are 1 to 12.

926 **Empty ID setting register specified**

Specify a valid ID setting.

931 **Label specified is too long**

Shorten label.

932 **Incorrect floppy type in drive**

Use a 3.5 inch, high density 1.44 MByte floppy disk.

933 **No hardware image found**

Verify installed hardware images. Image files are missing. Ensure that all image files are present.

934 **No ID setting found**

Verify installed ID settings. ID setting files are missing. Ensure that all ID setting files are present.

937 **Pattern specified does not exist**

Specify a valid user pattern.

938 **Cannot delete file.**

Check that the file exists and can be accessed. There may be a problem with the disk.

939 **Maximum number of patterns exist**

Delete a user pattern if you want to install this one.

940 **Bad pattern data**

Check user pattern data.

942 **Too much data for hardware image**

The system received a file that doesn't contain a hardware image and the file is too long. Send system a valid hardware image file.

943 **Not enough data for hardware image.**

The system received a file that doesn't contain a hardware image and the file is too small. Send system a valid hardware image file.

944 **Incorrect file type.**

File must contain ID setting, hardware image, or user pattern.

945 **Too much data for current ID setting**

The system received a file that doesn't contain an ID setting and the file is too long. Send system a valid ID setting file.

946 **Not enough data for current ID setting**

The system received a file that doesn't contain an ID setting and the file is too small. Send system a valid ID setting file.

947 **File requested does not exist**

Specify a valid file.

949 **Printer timed out or not on line**

953 **Download error**

Check that the DMA cable is connected.

955 **Out of internal pattern memory.**

Too many large patterns are being used by the application. Use smaller or fewer user patterns.

958 **System does not contain pattern.**

This error can occur while using the RSID or PSID application. A user pattern was unable to be saved with the ID setting.

962 **Front panel input request while in remote.**

A WGL program running over HP-IB is trying to get input data from the front panel. Rewrite the program so that it does not request front panel input or script the responses.

963 **Application has been closed.**

An application was closed from the front panel and it is trying to be accessed over HP-IB. Open the application and then access it.

964 **Filename or path specified is too long.**

The path and filename must be less than 64 characters.

965 **Directory specified does not exist.**

966 **No filename specified.**

Specify a valid file name.

967 **Specified file already exists.**

This error only occurs over HP-IB. A compiled WGL program with a .CWC extension is trying to be stored to a file that already exists. Specify another file name or store the file from the front panel.

968 **Error in loading compiled WGL code.**

Try again. Make sure the code is good. It is possible that the .CWC file is defective. There may be a problem with the disk.

970 **Error in loading WGL program file.**

An error occurred while transferring a WGL file from the removable cartridge to HP FASS memory. Try again. If the problem persists, there may be something wrong with the system.

1501 **No more program space left.**

There is no more room to create definitions. Clear the WGL workspace.

1502 **No more variable space left.**

There are too many variables created using the STORE command. Clear the WGL workspace.

1504 **Expected variable reference.**

STORE not followed by a variable name. Make sure that it isn't a user definition or internal command name.

1505 **Context mismatch.**

See the SIZE command. The window or context was set to an illegal value.

1506 **String overflow.**

Do not enter more than 250 characters on the command line.

1507 **Invalid window . . . check context.**

Either the window is invalid or context size is out of range. Window must be smaller than the size specified with CTX. Valid context values are 2 to 65536.

1508 **Inconsistent parameter.**

Values on the stack are of incorrect type for this operation. Example: Trying to add a string to a number.

1509 **Invalid numeric entry.**

Number on stack is out of range for the operation. Example: Specifying a clock rate of −10 Hz.

1517 **File not found**

Source file for COPY not found.

1520 **No more space on mass storage device.**

1522 **Nonexistent file on mass storage.**

File name specified was not found. Example: Purging a file that does not exist.

1523 **File has inconsistent type for operation.**

This error occurs when an attempt is made to copy data from one modulation memory to another (for example, trying to copy an FM file to the AMPM memory).

1530 **Error detected in processing definition.**

Usually associated with mismatched parentheses which didn't get caught until executing the definition.

1531 **Unmatched parentheses.**

Detected error while the input line was being checked.

1532 **Invalid repeat syntax.**

Check to see that equal sign is preceded by a valid variable name.

1533 **Undefined WGL reference.**

A call was made to a WGL definition or WGL variable that does not exist. Most likely cause is a spelling error.

1534 **A-E, AA-EE, X reserved for waveforms.**

Do not try to store a numeric value into a variable that can only contain waveforms.

1535 **Strings cannot be stored.**

Tried to store a string in a variable. Strings can not be stored away.

1536 **Store waveforms in A-E, AA-EE, or X.**

Store waveforms in variables that are reserved for waveforms.

1538 **EVAL requires waveform register on stack.**

A waveform register containing the new X values must be on the top of the stack for this operation to work.

1540 **INSECS/SECS not available in frequency.**

These commands are only defined in the time domain.

1542 **System required for this operation.**

Make sure all hardware is turned on and connected to the Smart Interface. Reset the system.

1543 **Invalid sequence description.**

Working wave does not have the correct format for use with the SEQ2 command.

1546 **Wave not found.**

Select correct storage device.

1547 **Files must be of the same type.**

Copy waveform files of the correct type to the MDS modulation memories. (For example, copy .AM files to AMPM memory, .FM files to FM memory, etc.)

1548 **Duplicate file names.**

A file with the same name already exists in storage device.

1549 **Invalid definition name.**

WGL definition names should be 10 characters or less. Valid characters are A-Z, 0-9. There should be no other text on the line.

1550 **Invalid mass storage name.**

Storage device or directory does not exist.

1553 **Illegal context size for Fast Fourier Transform.**

Context size must be a power of two.

1557 **Improper memory active for this command.**

Displayed when the AM_MODE or PM_MODE commands are issued and the active memory is not the AMPM_MEM.

1558 **WGL clock out of range.**

Allowable range is 110 to 160 MHz for FASSFREQ command.

1559 **Pattern file exceeds maximum WGL context.**

Make sure size of pattern file does not exceed 65536 points.

1580 **Duplicate HP-IB addresses for SYNCSTART.**

Two slave HP FASS systems have the same address. Change the address on one slave. Do not use HP-IB addresses of 714-717.

1581 **Copy error.**

An error occurred while a file was being copied. The copy was probably not completed.

1582 **Invalid directory.**

WGL tried to access a directory that does not exist.

1583 **Directory not deleted.**

Directory cannot be deleted.

1584 **Inconsistent array sizes for APF file.**

The AUC array must be the same size as the FLC array. The Pulse array must be eight times as large as the AUC and FLC arrays. Register A=AUC; Register B=FLC; Working Wave=Pulse.

1585 **File not copied.**

MS-DOS error.

1586 **File not deleted.**

MS-DOS error.

1587 **Directory not created.**

MS-DOS error.

1588 **Recompile definition source code.**

An attempt was made to load a *file*.CWC into WGL. This file is not compatible with the current version of WGL. Recompile *file*.WGL.

1590 **Vector size out of range.**

Resizing of WGL array cannot be done. Use a smaller size.

1591 **Total vector size too big.**

An attempt was made to resize more than one WGL array. Total amount of space required for resizing is greater than the space available.

1593 **Error occurred while loading WGL program.**

Correct errors in program, clear workspace, and reload program.

1594 **WGL command not implemented.**

Some WGL workstation commands are not implemented in WGL on the Smart Interface.

1595 **Copy file not allowed.**

This occurs when data is copied from disk to the HP FASS modulation memories and an attempt is made to save the data in a different format (for example, saving .AM data as .FM). This error can also occur if a directory that does not support copying is selected.

1596 **Copy wave not allowed.**

This occurs when data is copied from the HP FASS modulation memories to disk and an attempt is made to save the data in a different format (for example, saving .AM data as .FM)

1599 **Unexpected system error.**

Reboot system.

2306 **AUC A/D failure.**

See *HP FASS System Service Manual.*

2307 **AUC phase-lock loop unlocked.**

See *HP FASS System Service Manual.*

2308 **External frequency standard error in AUC.**

Be sure that you want the AUC Frequency Standard switch set to EXT. Verify that an external frequency standard is connected to the FREQUENCY STANDARD INPUT. Also check that the external standard is within the specified tolerance. If problem persists, see the *HP FASS System Service Manual.*

2405 **No AUC at specified address.**

Check that AUC HP-IB address is set to 15 and that the HP-IB cables are securely fastened. If problem persists, see the *HP FASS System Service Manual.*

2407 **Unit at address is not an AUC.**

Check that the only instrument in the system with an HP-IB address of 15 is the AUC.

2425 **AUC I/O timeout.**

Check that all HP-IB cables are connected. Next, try resetting the system by sending the *RST command. If the error is still not cleared, try turning the AUC power off and then on. If the problem persists, refer to the *HP FASS System Service Manual.*

2601 **Invalid PM memory file name**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha.

2602 **PM memory file could not be opened.**

Possible causes are too many files have been created, no more room for data, or a file is already open.

2604 **Data being downloaded to the PM memory is out of range.**

Valid data for PM memory is -180 to +180 (degrees format) or -pi to +pi (radians format). See the DATA command in the "FASS Subsystem" chapter.

2605 **Unexpected data type encountered when loading data into PM memory.**

Numeric data is expected. See the DATA command in the "FASS Subsystem" chapter.

2606 **Out of memory. There is not enough room to store the file in the PM memory.**

PM memory holds a maximum of 262144 data points. See the DATA command in the "FASS Subsystem" chapter.

2607 **File not found in PM memory.**

Do not attempt to purge a non-existent file.

2610 **The address given for downloading data by address into the PM memory was not valid.**

Valid addresses for PM memory are 0 to 262140 in multiples of 4. See the DATA command in the "FASS Subsystem" chapter.

2620 **File size not multiple of four.**

Size of PM memory must be a multiple of 4.

2630 **PM stretch factor is out of range.**

Valid stretch factors are 1, 2 or 4. See the SFAC command in the "FASS Subsystem" chapter.

2640 **Illegal PM VSIN or VMAP address.**

Valid addresses are 0 to 262140 in multiples of 4.

2641 **Illegal PM VSIN or VMAP length.**

Valid length is 0 to 262144 if stretch factor is 1. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2642 **Illegal PM VSIN or VMAP start value.**

Legal start values for VSIN are -2.98E8 to +2.98E8. Legal start values for VMAP are -180 to +180°. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2643 **Illegal PM VSIN or VMAP stop value.**

Legal stop values for VSIN are -2.98E8 to +2.98E8. Legal stop values for VMAP are -180 to +180°. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2644 **Illegal PM VSIN offset.**

Legal offset values for VSIN are -180 to +180°.

2645 **Illegal PM VSIN amplitude.**

Legal amplitude (scale) values for VSIN are -180 to +180°.

2646 **Illegal PM VSIN offset + amplitude.**

The offset + amplitude (scale) must be between -180 and +180°.

2647 **PM VSIN or VMAP out of memory.**

Change address or length parameter. Address + length cannot exceed 262144.

2651 **Invalid filename used to load packet data into the PM sequencer.**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha. See the PCKM command in the "FASS Subsystem" chapter.

2652 **Illegal address division rate for the PM sequencer.**

Valid address rate dividers are 1 to 65536. See the ARAT command in the "FASS Subsystem" chapter.

2653 **Wrong number of arguments.**

The correct number of parameters must be used (usually related to loading PM packet data). See the PCKM and PCLM commands in the "FASS Subsystem" chapter.

2654 **The named file could not be found in the PM memory.**

The file specified has not been created in PM memory. See the CAT? and DATA commands in the "FASS Subsystem" chapter.

2656 **Wave segment too short to build a packet.**

PM memory wave segments must be at least 8 points long to build a valid packet. See table 7-1 and the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2657 **Overall packet dwell too short.**

Packets for the PM memory must meet minimum dwell time requirements. See table 7-2.

2658 **The PM Sequencer memory is full.**

The maximum number of packets is 32768.

2660 **The address or length used to define a packet was not valid.**

See the PCKM and PCLM commands in the "FASS Subsystem" chapter.

2661 **The address given for a marker was out of range.**

Valid addresses for a PM marker is 0 to 262143 in multiples of 4. See the MARK command in the "FASS Subsystem" chapter.

2662 **Illegal PM sequence command order.**

Command order should be to begin sequence (SEQBEG), create loop packet (LPACK), create packets and loop packets (PCLM, PCKM, LPACK), and end sequence (SEQEND). See these commands in the "FASS Subsystem" chapter.

2663 **Illegal PM sequence number (0-1023).**

Valid sequence numbers are 0 to 1023.

2664 **Illegal number of scans.**

Legal number of scans are 1 to 65535 for auto advance mode and 0 to 65535 for bus or group advance mode.

2665 **Illegal PM packet dwell.**

See table 7-2 in the "FASS Subsystem" chapter.

2667 **Invalid PM marker delay.**

Valid marker delay ranges from 1 to 64 clock cycles.

2669 **Invalid PM sequence end found.**

A sequence has been defined but the end of sequence is missing.

2682 **Invalid PM packet number.**

Valid packet numbers are 0 to 32767.

2683 **Undefined PM sequence number.**

A command that requires a sequence number parameter is being used, but that sequence number has not been defined.

2684 **EDIT:PACK used for loop packet.**

Use the :FASS:SEQ:EDIT:LOOP command to edit loop packets.

2685 **EDIT:LOOP used for packet.**

Use the :FASS:SEQ:EDIT:PACK command to edit regular packets.

2686 **Illegal edit of loop packet beginning of sequence.**

The sequencer model is probably set to Model 10. Change the sequencer model to Model 7, 11, or 21.

2692 **Out of PM packet memory.**

The maximum number of packets allowed is 32768.

2694 **Master sequencer already defined.**

Only one sequencer can be the master sequencer. See the SEQ:MODE command in the "FASS Subsystem" chapter.

2701 **Invalid file name in the AM or PM2 memory.**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9 and _. The first character of a filename must be alpha.

2702 **File could not be opened in the AM or PM2 memory.**

Possible causes are too many files have been created, no more room for data, or a file is already open.

2704 **Data being downloaded to the AM or PM2 memory was out of the legal range.**

Valid data for AM memory is -1 to +1. Valid data for PM2 memory is -180 to +180 (degrees format) or -pi to +pi (radians format). The entered value is assumed to be in degrees. See the DATA command in the "FASS Subsystem" chapter.

2705 **Unexpected data type encountered when loading data into the AM or PM2 memory.**

Numeric data is expected. See the DATA command in the "FASS Subsystem" chapter.

2706 **Out of memory. There was not enough room to store the file in the AM or PM2 memory.**

AM or PM2 memory holds a maximum of 262144 data points.

2707 **File not found in AM or PM2 memory.**

Do not attempt to purge a non-existent file.

2710 **The address given for downloading data by address into the AM or PM2 memory was not valid.**

Valid addresses for AM and PM2 memory are 0 to 262140 in multiples of 4. See the DATA command in the "FASS Subsystem" chapter.

2720 **File size not multiple of four.**

File size in AM or PM2 memory must be a multiple of four.

2730 **Stretch factor out of range**

Valid stretch settings are 1, 2 or 4. See the SFAC command in the "FASS Subsystem" chapter.

2740 **Illegal AM or PM2 VSIN or VMAP address.**

Valid addresses are 0 to 262140 in multiples of 4.

2741 **Illegal AM or PM2 VSIN or VMAP length.**

Valid length is 0 to 262144 if stretch factor is 1. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2742 **Illegal AM or PM2 VSIN or VMAP start value.**

Legal start values for VSIN are -2.98E8 to +2.98E8. Legal start values for VMAP are -1 to +1. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2743 **Illegal AM or PM2 VSIN or VMAP stop value.**

Legal stop values for VSIN are -2.98E8 to +2.98E8. Legal stop values for VMAP are -1 to +1. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2744 **Illegal AM or PM2 VSIN offset.**

Legal offset values for VSIN are -1 to +1.

2745 **Illegal AM or PM2 VSIN amplitude.**

Legal amplitude (scale) values for VSIN are -1 to +1.

2746 **Illegal AM or PM2 VSIN offset + amplitude.**

The offset + amplitude (scale) must be between -1 and +1.

2747 **AM VSIN or VMAP out of memory.**

Change address or length parameter. Address + length cannot exceed 262144.

2751 **Invalid filename used to load packet data into the AM or PM2 sequencer.**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha. See the PCKM command in the "FASS Subsystem" chapter.

2752 **Illegal address division rate for the AM or PM2 sequencer.**

Valid address rate dividers are 1 to 65536. See the ARAT command in the "FASS Subsystem" chapter.

2753 **Wrong number of arguments.**

The correct number of parameters must be used (usually related to loading AM or PM2 packet data). See the PCKM and PCLM commands in the "FASS Subsystem" chapter.

2754 **The named file could not be found in the AM or PM2 memory.**

Specified file has not been created in AM or PM2 memory. See the CAT? and DATA commands in the "FASS Subsystem" chapter.

2756 **Wave segment too short to build packet.**

Wave segments must be at least 8 points long to build a valid packet. See the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2757 **Overall packet dwell time too short.**

Packets in the AM or PM2 memory must meet minimum dwell time requirements. See table 7-2.

2758 **The AM or PM2 sequencer memory is full.**

The maximum number of packets is 32768.

2760 **The address or length used to define a packet was not valid.**

See the PCKM and PCLM commands in the "FASS Subsystem" chapter.

2761 **The address given for a marker was out of range.**

Valid addresses for an AM or PM2 marker is 0 to 262140 in multiples of 4. See the MARK command in the "FASS Subsystem" chapter.

2762 **Illegal AM OR PM2 sequence command order.**

Command order should be to begin sequence (SEQBEG), create loop packet (LPACK), create packets and loop packets (PCLM, PCKM, LPACK), and end sequence (SEQEND). See these commands in the "FASS Subsystem" chapter.

2763 **Illegal AM OR PM2 sequence number (0-1023).**

Valid sequence numbers are 0 to 1023.

2764 **Illegal number of scans.**

Legal number of scans are 1 to 65535 for auto advance mode and 0 to 65535 for bus or group advance mode.

2765 **Illegal AM OR PM2 packet dwell.**

See table 7-2 in the "FASS Subsystem" chapter.

2767 **Invalid AM OR PM2 marker delay.**

Valid marker delay ranges from 1 to 64 clock cycles.

2769 **Invalid AM OR PM2 sequence end found.**

A sequence has been defined but the end of sequence is missing.

2770 **AM or PM2 packet query error.**

See the PCOU? and PFRE? commands in the "FASS Subsystem" chapter.

2782 **Invalid AM OR PM2 packet number.**

Valid packet numbers are 0 to 32767.

2783 **Undefined AM OR PM2 sequence number.**

A command that requires a sequence number parameter is being used, but that sequence number has not been defined.

2784 **EDIT:PACK used for loop packet.**

Use the :FASS:SEQ:EDIT:LOOP command to edit loop packets.

2785 **EDIT:LOOP used for packet.**

Use the :FASS:SEQ:EDIT:PACK command to edit regular packets.

2786 **Illegal edit of loop packet beginning of sequence.**

The sequencer model is probably set to Model 10. Change the sequencer model to Model 7, 11, or 21.

2792 **Out of AM OR PM2 packet memory.**

The maximum number of packets allowed is 32768.

2794 **Master sequencer already defined.**

Only one sequencer can be the master sequencer. See the SEQ:MODE command in the "FASS Subsystem" chapter.

2801 **Invalid file name in the FM memory.**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha.

2802 **File could not be opened in the FM memory.**

Possible causes are too many files have been created, no more room for data, or a file is already open.

2804 **Data being downloaded to the FM memory was out of the legal range.**

Valid data for FM memory is -67108864 to +67108863.875. The entered value is assumed to be in hertz. See the DATA command in the "FASS Subsystem" chapter.

2805 **Unexpected data type encountered when loading data into the FM memory.**

Numeric data is expected. See the DATA command in the "FASS Subsystem" chapter.

2806 **Out of memory. There was not enough room to store the file in the FM memory.**

FM memory holds a maximum of 65536 data points. See the DATA command in the "FASS Subsystem" chapter.

2807 **File not found in FM memory.**

Do not attempt to purge a non-existent file.

2810 **The address given for downloading data by address into the FM memory was not valid.**

Valid addresses for FM memory are 0 to 65535. See the DATA command in the "FASS Subsystem" chapter.

2840 **Illegal FM VSIN or VMAP address.**

Valid addresses are 0 to 65535.

2841 **Illegal FM VSIN or VMAP length.**

Valid length is 0 to 65536.

2842 **Illegal FM VSIN or VMAP start value.**

Legal start values for VSIN are -2.98E8 to +2.98E8. Legal start values for VMAP are -67108864 to +67108864. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2843 **Illegal FM VSIN or VMAP stop value.**

Legal stop values for VSIN are -2.98E8 to +2.98E8. Legal stop values for VMAP are -67108864 to +67108864.

2844 **Illegal FM VSIN offset.**

Legal offset values are -67108864 to +67108864.

2845 **Illegal FM VSIN amplitude.**

Legal amplitude (scale) values are -67108864 to +67108864.

2846 **Illegal FM VSIN offset + amplitude.**

The offset + amplitude (scale) must be between -67108864 to +67108864.

2847 **FM VSIN or VMAP out of memory.**

Change address or length parameter. Address + length cannot exceed 65536.

2851 **Invalid filename used to load packet data into the FM sequencer.**

Filenames must be six characters or less. Valid characters are A-Z, a-z, 0-9, and _. The first character of a filename must be alpha. See the PCKM command in the "FASS Subsystem" chapter.

2852 **Illegal address division rate for the FM sequencer.**

Valid address rate dividers are 1 to 65536. See the ARAT command in the "FASS Subsystem" chapter.

2854 **The named file could not be found in the FM memory.**

Specified file has not been created in FM memory. See the CAT? and DATA commands in the "FASS Subsystem" chapter.

2856 **Wave segment too short to build packet.**

Wave segments must be at least 2 points long to build a valid packet. See table 7-1 and the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2857 **Overall packet dwell time too short.**

Packets in the FM memory must meet minimum dwell time requirements. See table 7-2 and the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2858 **The FM Sequencer memory is full.**

The maximum number of packets is 32768.

2860 **Invalid FM packet address or size.**

See the PCKM and PCLM commands in the "FASS Subsystem" chapter.

2861 **The address given for a marker was out of range.**

Valid addresses for an FM marker are 0 to 65535. See the MARK command in the "FASS Subsystem" chapter.

2862 **Illegal FM sequence command order.**

Command order should be to begin sequence (SEQBEG), create loop packet (LPACK), create packets and loop packets (PCLM, PCKM, LPACK), and end sequence (SEQEND). See these commands in the "FASS Subsystem" chapter.

2863 **Illegal FM sequence number (0-1023).**

Valid sequence numbers are 0 to 1023.

2864 **Illegal number of scans.**

Legal number of scans are 1 to 65535 for auto advance mode and 0 to 65535 for bus or group advance mode.

2865 **Illegal FM packet dwell.**

See table 7-2 in the "FASS Subsystem" chapter.

2867 **Invalid FM marker delay.**

Valid marker delay ranges from 1 to 64 clock cycles.

2869 **Invalid FM sequence end found.**

A sequence has been defined but the end of sequence is missing.

2870 **FM packet query error.**

See the PCOU? and PFRE? commands in the "FASS Subsystem" chapter.

2882 **Invalid FM packet number.**

Valid packet numbers are 0 to 32767.

2883 **Undefined FM sequence number.**

A command that requires a sequence number parameter is being used, but that sequence number has not been defined.

2884 **EDIT:PACK used for loop packet.**

Use the :FASS:SEQ:EDIT:LOOP command to edit loop packets.

2885 **EDIT:LOOP used for packet.**

Use the :FASS:SEQ:EDIT:PACK command to edit regular packets.

2886 **Illegal edit of loop packet beginning of sequence.**

The sequencer model is probably set to Model 10. Change the sequencer model to Model 7, 11, or 21.

2892 **Out of FM packet memory.**

The maximum number of packets allowed is 32768.

2894 **Master sequencer already defined.**

Only one sequencer can be the master sequencer. See the SEQ:MODE command in the "FASS Subsystem" chapter.

2901 **Invalid file name in the FREQ memory.**

Filenames must be six characters or less. Valid characters are upper-case alpha, digits and "_". The first character of a filename must be alpha.

2902 **File could not be opened in the FREQ memory.**

Possible causes are too many files have been created, no more room for data, or a file is already open.

2904 **Data being downloaded to the FREQ memory is out of the legal range.**

See the DATA command in the HP FASS subsystem for legal data values for the AUC, ACS, FLC, and PULS fields.

2905 **Unexpected data type encountered when loading data into the FREQ memory.**

Numeric data is expected. See the DATA command in the "FASS Subsystem" chapter.

2906 **Out of memory. There was not enough room to store the file into a frequency field.**

Maximum file size for each field is 65536 points for ACS, 32768 points for AUC and FLC, and 262144 points for PULS. See the DATA command in the "FASS Subsystem" chapter.

2907 **File not found in FREQ memory.**

Do not attempt to purge a non-existent file.

2908 **Incompatible length for FREQ file.**

This error occurs when data is loaded into the FREQ memory by file name. Make sure that data in the four fields of FREQ memory is in the correct ratio: 1 AUC data point, 1 FLC data point, 2 ACS points, and 8 PULS points.

2910 **The address given for downloading data by address into the FREQ memory was not valid.**

Valid addresses are 0 to 32768 in multiples of 2 for AUC and FLC fields, 0 to 65536 in multiples of 2 for the ACS field, and 0 to 262140 in multiples of 4 for the PULS field. See the DATA command in the "FASS Subsystem" chapter

2920 **Pulse Data Error.**

The number of PULS field data points must be a multiple of four.

2940 **Illegal FREQ VSIN or VMAP address.**

Valid addresses are 0 to 65535.

2941 **Illegal FREQ VSIN or VMAP length.**

Valid length is 0 to 65536.

2942 **Illegal FREQ VSIN or VMAP start value.**

Legal start values for VSIN are -2.98E8 to +2.98E8. Legal start values for VMAP are -67108864 to +67108864. See the VMAP and VSIN commands in the "FASS Subsystem" chapter.

2943 **Illegal FREQ VSIN or VMAP stop value.**

Legal stop values for VSIN are -2.98E8 to +2.98E8. Legal stop values for VMAP are -67108864 to +67108864.

2944 **Illegal FREQ VSIN offset.**

Legal offset values are -67108864 to +67108864.

2945 **Illegal FREQ VSIN amplitude.**

Legal amplitude (scale) values are -67108864 to +67108864.

2946 **Illegal FREQ VSIN offset + amplitude.**

The offset + amplitude (scale) must be between -67108864 and +67108864.

2947 **FREQ VSIN or VMAP out of memory.**

Change address or length parameter. Address + length cannot exceed 65536.

2951 **Invalid filename used to load packet data into the FREQ sequencer.**

Filenames must be six characters or less. Valid characters are upper-case alpha, digits and "_". The first character of a filename must be alpha. See the PCKM command in the "FASS Subsystem" chapter.

2952 **Illegal address division rate for the FREQ sequencer.**

Valid address rate dividers are 1 to 65536. See the ARAT command in the "FASS Subsystem" chapter.

2954 **The named file could not be found in the frequency memory.**

Specified file has not been created in frequency memory. See the CAT? and DATA commands in the "FASS Subsystem" chapter.

2956 **Wave segment too short to make packet.**

Wave segments must be at least 2 points long to build a valid packet. See table 7-1 (ACS memory field) and the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2957 **FREQ packet dwell time too short.**

Packets in the FREQ memory must meet minimum dwell time requirements. See table 7-2 and the DATA, PCKM, and PCLM commands in the "FASS Subsystem" chapter.

2958 **The FREQ Sequencer memory is full.**

The maximum number of packets is 32768.

2960 **Invalid FREQ packet address or size.**

See the PCLM and PCKM commands in the "FASS Subsystem" chapter.

2961 **The address given for a marker was out of range.**

Valid addresses for a FREQ marker are 0 to 65535. See the MARK command in the "FASS Subsystem" chapter.

2962 **Illegal FREQ sequence command order.**

Command order should be to begin sequence (SEQBEG), create loop packet (LPACK), create packets and loop packets (PCLM, PCKM, LPACK), and end sequence (SEQEND). See these commands in the "FASS Subsystem" chapter.

2963 **Illegal FREQ sequence number (0-1023).**

Valid sequence numbers are 0 to 1023.

2964 **Illegal number of scans.**

Legal number of scans are 1 to 65535 for auto advance mode and 0 to 65535 for bus or group advance mode.

2965 **Illegal FREQ packet dwell.**

See table 7-2 in the "FASS Subsystem" chapter.

2967 **Invalid FREQ marker delay.**

Valid marker delay ranges from 1 to 64 clock cycles.

2969 **Invalid FREQ sequence end found.**

A sequence has been defined but the end of sequence is missing.

2970 **FREQ packet query error.**

See the PCOU? and PFRE? commands in the "FASS Subsystem" chapter.

2982 **Invalid FREQ packet number.**

Valid packet numbers are 0 to 32767.

2983 **Undefined FREQ sequence number.**

A command that requires a sequence number parameter is being used, but that sequence number has not been defined.

2984 **EDIT:PACK used for loop packet.**

Use the :FASS:SEQ:EDIT:LOOP command to edit loop packets.

2985 **EDIT:LOOP used for packet.**

Use the :FASS:SEQ:EDIT:PACK command to edit regular packets.

2986 **Illegal edit of loop packet beginning of sequence.**

The sequencer model is probably set to Model 10. Change the sequencer model to Model 7, 11, or 21.

2992 **Out of FREQ packet memory.**

The maximum number of packets allowed is 32768.

2994 **Master sequencer already defined.**

Only one sequencer can be the master sequencer. See the SEQ:MODE command in the "FASS Subsystem" chapter.

3005 **No MDS at specified address.**

Check that the MDS HP-IB address is set to 17 and that the HP-IB cables are securely fastened. If problem persists, see the *HP FASS System Service Manual.*

3008 **The unit is not an MDS.**

Check that the only instrument in the system with an HP-IB address of 17 is the MDS.

3012 **Zero file length specified.**

Length parameter cannot be 0. See the DATA and the PCLM commands in the "FASS Subsystem" chapter.

3015 **Illegal packet advance mode.**

Valid loop packet advance modes are 0 for AUTO, 1 for BUS and 2 for GROUP. In addition, packets have 3 for BIMM and 4 for GIMM. See the DATA, PCKM, PCLM, and SLP commands in the "FASS Subsystem" chapter.

3020 **Number of packets specified as zero.**

The first number in the array of sequence data for the :FASS:DATA 'SEQ2' command is the number of packets in the sequence. This number must be something other than 0.

3032 **MDS I/O timeout.**

Check that all HP-IB cables are connected. Next, try resetting the system by sending the *RST command. If the error is still not cleared, try turning the MDS power off and then on. If the problem persists, refer to the *HP FASS System Service Manual.*

3047 **File not found in MDS**

File name specified was not found in modulation memory. Specify a valid file name.

3048 **File length is out of range.**

See the CONS, DATA, IDAT, PCLM, VMAP, and VSIN commands in the "FASS Subsystem" chapter.

3049 **File start address out of range.**

See the CONS, DATA, IDAT, PCLM, VMAP, and VSIN commands in the "FASS Subsystem" chapter.

3050 **File length < minimum size to create packet**

Minimum packet file size that can be used to create a packet is 8 for AM, PM2, and PM memories, 2 for FM memory, and 2 for FREQ memory.

3056 **Address in not the required multiple.**

Addresses in AM, PM, and PM2 memories must be multiples of 4. Addresses in FREQ memory fields must be multiples of 2.

3057 **Size is not the required multiple.**

AM, PM, PM2, and the PULS field in frequency memory must be a multiple of 4. ACS field in frequency memory must be a multiple of 2.

3058 **Illegal file size.**

See the DATA command in the "FASS Subsystem" chapter.

3205 **No ACS at specified address.**

Check that the ACS HP-IB address is set to 16 and that the HP-IB cables are securely fastened. If problem persists, see the *HP FASS System Service Manual.*

3207 **Unit at address is not ACS.**

Check that the only instrument in the system with an address of 16 is the ACS.

3211 **Zero file length specified.**

Specify valid parameter for file length. See the CONS, DATA, IDAT, PCLM, VMAP, and VSIN commands in the "FASS Subsystem" chapter.

3223 **ACS I/O timeout.**

Check that all HP-IB cables are connected. Next, try resetting the system by sending the *RST command. If the error is still not cleared, try turning the ACS power off and then on. If the problem persists, refer to the *HP FASS System Service Manual.*

3305 **No instrument at specified address.**

Verify that address being sent matches the instrument address setting. Check that the HP-IB cables are securely fastened.

3308 **Illegal HP-IB interface select code.**

The select code must be 7.

3309 **Illegal HP-IB device address.**

Valid HP-IB device addresses are 0 to 30.

3314 **EOI was not received at data end.**

Ensure that EOI is asserted with the last byte of data.

3332 **Instrument I/O timeout.**

Make sure that the command string sent is valid for the instrument receiving it. Check that the HP-IB cables are securely fastened. If necessary, reboot the instrument.

3506 **AMUC A/D failure.**

See *HP FASS System Service Manual.*

3605 **No AMUC at specified address.**

Check that the AMUC HP-IB address is set to 14 and that the HP-IB cables are securely fastened. If problem persists, see the *HP FASS System Service Manual.*

3625 **AMUC I/0 timeout.**

Check that all HP-IB cables are connected. Next, try resetting the system by sending the *RST command. If the error is still not cleared, try turning the AMUC power off and then on. If the problem persists, refer to the *HP FASS System Service Manual.*

5403 **Math accelerator hardware failure**

See *HP FASS System Service Manual.*

5441 **Math accelerator hardware failure**

See *HP FASS System Service Manual.*

5507 **Math accelerator hardware failure**

See *HP FASS System Service Manual.*

5508 **Math accelerator hardware failure**

See *HP FASS System Service Manual.*

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