MODEL
372XXA
VECTOR NETWORK ANALYZER

PROGRAMMING MANUAL

Software Version: 1.04
(Replaces Version 1.02 and earlier)

Wiltron

490 JARVIS DRIVE ● MORGAN HILL, CA 95037-2809

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NOTICE

Table Of Contents

Part 1 — GPIB Interface

Part 1 The GPIB Interface

This part consists of three chapters that describe how the IEEE- 488 (GPIB) interface is implemented within the 372XXA Vector Network Analyzer and how to perform basic GPIB communications operations.

***Chapter 1** – briefly describes the 372XXA GPIB programmer interface and describes the communication to and from the interface during remote-only (GPIB) operation of the 372XXA.*

***Chapter 2** – provides a tutorial for performing basic GPIB operations such as sending and receiving messages, synchronizing instrument operations, setting timeouts, and status checking.*

***Chapter 3** – provides sample program elements to familiarize the user with 372XXA programming techniques. They are also useful as an aid in developing 372XXA programs.*

Chapter 1
Model 372XXA GPIB Programmer Interface

Table of Contents

Chapter 1
Model 372XXA GPIB Programmer Interface

1-1 INTRODUCTION

This chapter contains a brief introduction to the 372XXA GPIB interface and programming environment.

1-2 REMOTE OPERATION INTERFACE

The following paragraphs describe the 372XXA facilities for remote operation.

The 372XXA fully supports the IEEE 488.2–1992 GPIB standard. All 372XXA front panel functions (except Power on/off and GPIB Test) can be controlled remotely using the GPIB commands listed in this manual and an external computer equipped with an IEEE 488 GPIB controller. When in the GPIB operating mode, the 372XXA VNA functions as both a listener and a talker.

GPIB Setup Menu

The 372XXA VNA GPIB address defaults to 6. This value may be changed via the Utility Menu key's GPIB ADDRESSES menu (below).

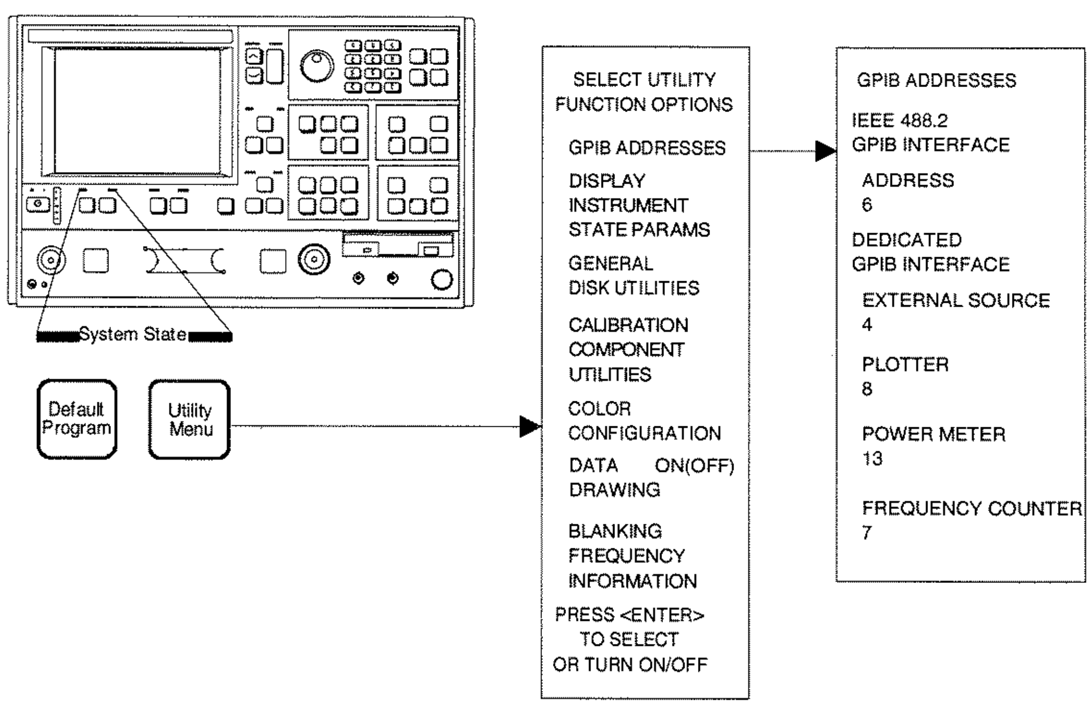
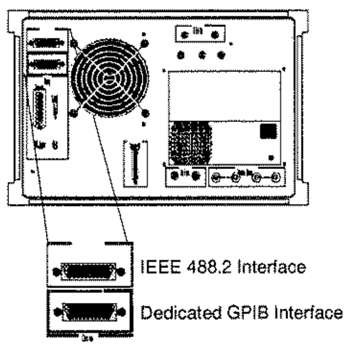


Figure 1-1. GPIB Address Menu

Interface Connection

Connect your external controller to the IEEE 488.2 GPIB interface connector on the rear panel (left). A pinout listing of this connector is contained in Table 1-1.



CAUTION

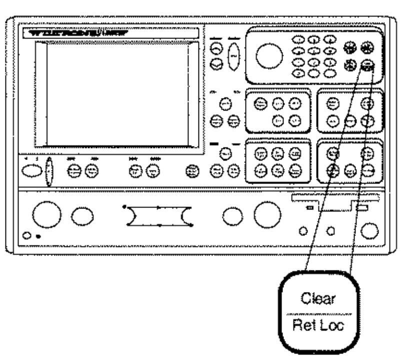
Do not connect your external GPIB controller to the "Dedicated GPIB Interface" connector (located below the "IEEE 488.2 GPIB interface" connector (left). This dedicated GPIB port is used by the 372XXA to control external GPIB devices, such as a plotter, second frequency source, frequency counter, or a power meter.

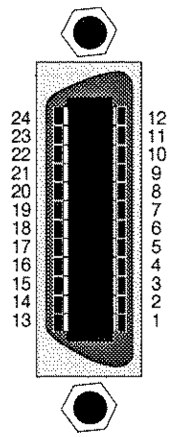
The GPIB system can accommodate up to 15 devices at any one time. To achieve maximum performance on the bus, proper timing and voltage level relationships must be maintained. If either the cable length between separate instruments or the accumulated cable length between all instruments is too long, the data and control lines cannot be driven properly and the system may fail to perform. The following guidelines should be observed:

- No more than 15 instruments may be installed on the bus (including the controller).
- Total accumulative cable length (in meters) may not exceed two times the number of bus instruments or 20 meters—whichever is less.
- Individual cable length should not exceed 4 meters.
- 2/3 of the devices must be powered on.
- Devices should not be powered on while bus is in operation (that is; actively sending or receiving messages, data, etc.).
- Minimize cable lengths to achieve maximum data transfer rates.

Local Operation Key

Press the Ret Loc key (below) to quickly restore the 372XXA to local operation. Local operation will be restored unless the 372XXA is programmed for local lockout; the Local Lockout LED indicator will be lit.

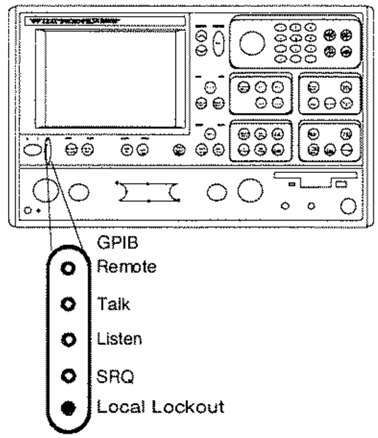




Pinout Diagram

PIN	NAME	DESCRIPTION
1-4	DIO 1 thru DIO 4	*Data Input/Output.* Bits are HIGH with the data is logical 0 and LOW when the data is logical 1.
5	EOI	*End Or Identify.* A low-true state indicates that the last byte of a multibyte message has been placed on the line.
6	DAV	*Data Valid.* A low-true state indicates that the talker has (1) sensed that NRFD is LOW, (2) placed a byte of data on the bus, and (3) waited an appropriate length of time for the data to settle.
7	NRFD	*Not Ready For Data.* A high-true state indicates that valid data has not yet been accepted by a listener.
8	NDAC	*Not Data Accepted.* A low-true state indicates that the current data byte has been accepted for internal processing by a listener.
9	IFC	*Interface Clear.* A low-true state places all bus instruments in a known state—such as, unaddressed to talk, unaddressed to listen, and service request idle.
10	SRQ	*Service Request.* A low-true state indicates that a bus instrument needs service from the controller.
11	ATN	*Attention.* A low-true state enables the controller to respond to both it's own listen/talk address and to appropriate interface messages — such as, device clear and serial poll.
12	Shield	Ground Point.
13-16	DIO 5 thru DIO 8	*Data Input/Output.* Bits are high with the data is logical 0 and LOW when the data is logical 1.
17	REN	*Remote Enable.* A low-true state enables bus instruments to be operated remotely, when addressed.
18-24	GND	Logic ground.

Figure 1-2. *Pinout Diagram, IEEE 488.2 GPIB Connector*



Remote Operation LED Indicators

GPIB Remote Indicators (above) signal operational status of the GPIB, as described below:

Remote:
Lights when the 372XXA switches to remote (GPIB) control. It remains lit until the unit returns to local control.

Talk:
Lights when you address the 372XXA to talk and remains lit until unaddressed to talk.

Listen:
Lights when you address the 372XXA to listen and remains lit until unaddressed to talk.

SRQ:
Lights when the 372XXA sends a Service Request (SRQ) to the external controller. The LED remains lit until the 372XXA receives a serial poll or until the controller resets the SRQ function.

Local Lockout:
Lights when a local lockout message is received. The LED remains lit until the message is rescinded. When lit, you cannot return the 372XXA to local control via the front panel.

Audible Indicators

A single beep is issued as follows:
(1) on a GPIB error,
(2) when a user warning is issued (see Chapter 12, Operational Error Messages)
(3) when a test limit line has been exceeded, if the limits testing beep function has been set (see Chapter 6)
(4) on system reset.
(5) any time the user's attention is required, such as at the end of a calibration step.

1-3 GPIB COMMUNICATION

The following paragraphs present a short summary of 372XXA GPIB communication. Subjects covered are program messages, separator/termination characters, status reporting, and GPIB error conditions and corresponding 372XXA responses. Refer to Chapter 7, Remote-Only Operation, for detailed description of these topics.

The primary GPIB messages that effect 372XXA operation consist of two major groups; Bus Interface Function messages, and Instrument Specific messages.

Bus Interface Function Messages

These are low level bus messages defined by IEEE 488.1. A discussion of these messages is beyond the scope of this programming manual. For further information, please refer to your GPIB controller documentation and/or to IEEE 488.1 Standards documents. Also refer to Appendix A at the end of this Programming Manual for a brief primer on the GPIB Interface. Table 1-1 summarizes some of the key Interface Function Messages and the 372XXA response to them.

Table 1-1. *IEEE-488 Interface Function Messages*

Interface Function Message	Message Function	Addressed Command	372XXA VNA Response
DCL	Device Clear	No	Resets the 372XXA GPIB communication functions.
SDC	Selected Device Clear	Yes	Resets the 372XXA GPIB communication functions.
GTL	Go To Local	Yes	Returns the 372XXA to local (front panel) control.
GET	Group Execute Trigger	Yes	Executes a string of commands defined by the IEEE 488.2 common command *DDT. A GET is also done by using the *TRG command (see Chapter 10, Command Dictionary).
IFC	Interface Clear	No	Stops the 372XXA GPIB from talking/listening.
LLO	Local Lockout	No	Disables the front panel RETURN TO LOCAL key.
REN	Remote Enable	No	Places the 372XXA in remote when addressed to listen.

372XXA Specific Messages

The 372XXA specific GPIB messages (also known as commands, queries, and mnemonics) are used to control 372XXA front panel functions. They also provide for remote only operations such as data transfers, status reporting and service request generation, error reporting, and instrument-to-application program timing synchronization.

Refer to Chapter 10, Command Dictionary; Appendix C, Quick Reference Guide; and Chapters 4-9 for information on all 372XXA commands. The commands are organized both alphabetically and by command function groups. There are many examples throughout the this manual to assist you in learning and using a desired command.

Most 372XXA commands are three character contractions of their functional descriptions. Examples include: **OM1** (Output Marker 1), **IFV** (input Frequency List), **TRS** (Trigger Sweep), **WFS** (Wait for a Full Sweep), **OFD** (Output Final [display format] Data), and **PFS** (Print Full Screen).

Numeric parameter entry commands *must* be followed by a numeric value. These commands can optionally accept a units or suffix terminator mnemonic. For example, **SRT 2 GHZ** (set start frequency to 2 GHz.)

Query commands, typically ending in a question mark (?), are used to inquire about the state of a particular instrument function. Many 372XXA setup commands have corresponding query commands listed in the same section as the basic setup command. An example is the **MK1?** query. It *outputs* the setting of Marker 1 Frequency, where the **MK1** command *sets* Marker 1 frequency.

IEEE 488.2 Common commands, which always start with the asterisk character (*), are defined by the IEEE 488.2 Standard. They are used to implement many standard instrument GPIB operations such as querying when an operation completes, status reporting, self test, and querying the instrument identification string. These commands are described throughout the Programming Manual in the specific funtional group where they are used. A consolidated listing of these commands can be found in Table 1-2, item 12 below and in Chapter 7. An example IEEE 488.2 Common command is the ***IDN?** query (Output Instrument ID String.)

Separator Characters

Separator characters are used to delimit program message elements sent to or received from the 372XXA. The permitted characters: semicolon (;), comma (,), and space ( ) and their usage is shown below.

Character	Used to separate
;	Multiple commands and multiple output response messages.
,	Multiple ASCII data elements for a single command.
Space	A command, its numerical entry value, and suffix mnemonic.

Terminator Character

The only allowed terminator character for 372XXA GPIB messages is the the linefeed character (0A, decimal 10).

GPIB Error Conditions

The 372XXA responds to GPIB errors in the following manner:

- A beep is issued.
- An error message is displayed on the screen.

- A bit is set in the Standard Event Status Register, and, if enabled, an SRQ is generated.
- An entry is written into the non-volatile Service Log describing the error condition, along with time and date and, often, details helpful in handling the error. When full, error entries at the bottom of the log are removed to make room for new entries.
- If the error is GPIB related, the error message and the offending program message, if applicable, can be output over the GPIB via a query command. The previous error, if any, is also available via another query.

The bits set in the Standard Event Status Register for GPIB errors are as follows:

Bit 5 - Command Error (CME)
Invalid syntax, unrecognized command or command arguments, separaters or terminators that do not conform to correct IEEEE 488.2 formats. *The 372XXA will ignore the remainder of commands in that program message.*

Bit 4 - Execution Error (EXE)
This bit is set if:
(1) A data entry parameter is out of range or not applicable.
(2) Action is impossible.
(3) Action is not possible in the current context or instrument state, or if a required option is not fitted.

Bit 3 - Device Dependant Error (DDE)
This bit is set if a valid requested action failed due to an instrument specific error condition, such as attempting to access a bad floppy disk.

Bit 2 - Query Error (QYE)
This bit is set if the 372XXA cannot provide the requested data. For example, if an output is attempted when no data has been requested or available, or if the output buffer is cleared due to sending more commands when data from a previous request has not yet been output.

Refer to Chapter 12, Error messages, for a listing of all 372XXA error messages (including GPIB errors).

Testing the 372XXA GPIB Operation

The following test can be used to check your GPIB cable and 372XXA GPIB connectors.

1. Disconnect all GPIB cables from the 372XXA.
2. Connect your GPIB cable between the two GPIB connectors on the 372XXA rear panel.
3. Invoke the test from the front panel as follows: Option Menu key, DIAGNOSTICS, PERIPHERAL TESTS, GPIB TEST. The test will run for a few seconds, then report the result on the front panel display.

1-4 IEEE 488.2 DOCUMENTATION SUMMARY

Table 1-2 provides answers to the "Device Documentation Requirements" listed in the IEEE Standard 488.2-1992. It is also a good summary of the GPIB operational characteristics of the 372XXA.

Table 1-2. 372XXA IEEE 488.2 Standard Documentation Summary (1 of 3)

Number	Requirement Item	Implementation in VNA
1	Interface Function Subsets Implemented	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0, E2.
2	Device behavior when the user (unit) GPIB address is set outside of the 0–30 range	VNA returns an Out-of-Range error, issues an audible beep, and the entry color on front panel menu display is changed to red. Entered address is not accepted.
3	When is a user address change recognized?	New address is accepted and entry color remains green.
4	Description of settings at power-on	The front panel setup that was in effect prior to power down will be restored, *except:* the 372XXA will be taken out of hold if it was previously set. Periodic IF Cal will be returned to timed operation. **Memories saved:** 1. GPIB address 2. Internal hardware calibration data 3. Information reported via the *IDN? and *OPT? queries. 4. Calibration coefficients 5. Normalized trace data 6. Stored front panel setups **Memories Cleared:** 1. Service Request message. 2. Standard event status register (except the Power-On bit is set) 3. Extended event status register 4. Limit pass/fail status register 5. Enable registers for items 2 thru 4, above. 6. GPIB input and output queues. 7. Trigger action for *TRG and GET reset to null. **Data Transfer:** 1. Data transfer is reset to MSB first for numerical array data transfers. 2. Data transfer format is reset to default, ASCII mode (FMA) for numerical array transfers. 3. Data pair format for OFD/IFD/OM1-OM6 commands is set to default (off) mode. (See command DPR0.) **Menu Displayed:** Setup Menu

Table 1-2. 372XXA IEEE 488.2 Standard Documentation Summary (2 of 3)

Number	Requirement Item	Implementation in VNA
5	Message exchange options a. Size and behavior of input buffer b. Queries that return more than one <RESPONSE MESSAGE UNIT> c. Queries that generate a response when parsed d. Queries that generate a response when read e. Commands that are coupled	a. Default size = 3 KByte. Size increases to required amount, as needed, for <Arbitrary Block> transfers. For the <Indefinite Length Arbitrary Block> data elements, the input buffer size for that element is 64 Kbyte. Attempting to program more data than 64 KByte will cause a loss of all data for that element. A DDE error message will be issued to indicate this condition. For <Definite Length Arbitrary Block> data elements, an attempt is made to set the buffer size for that element to the size indicated in the header. If there is insufficient system memory available at the time, all data for that element is lost. A DDE error message will be issued to indicate this condition. b. None c. All d. None e. None
6	Functional elements used in construction of device-specific commands.	See command descriptions.
7	Buffer size limitations	372XXA Attempts to allocate amount required; sets DDE error if not possible. (See 5a., above)
8	<PROGRAM DATA> elements that may appear within an <expression>	N/A (expressions are not used)
9	Response syntax for queries	See command descriptions.
10	Description of device-to-device message transfer traffic that does not follow the rules for <RESPONSE MESSAGES>	None
11	Size of block data responses	Variable, See command descriptions for details.
12	IEEE.488.2 Common commands and queries that are implemented	*CLS, *DDT, *DDT?, *ESE, *ESE?, *ESR?, *IDN?, *IST?, *OPC, *OPC?, *OPT?, *PRE, *PRE?, *RST, *SRE, *SRE?, *STB?, *TRG, *TST?, *WAI
13	State of VNA following the successful completion of the Calibration query	Normal State
14	Maximum length of the block used to define the trigger macro (1.) The method of interpreting *TRG within a *DDT command sequence (2.)	1. 255 characters. 2. On execution, the 372XXA returns a command error and ignores the rest of the string.

Table 1-2. 372XXA IEEE 488.2 Standard Documentation Summary (3 of 3)

Number	Requirement Item	Implementation in VNA
15	Maximum length and complexity of macro labels; maximum length of block used to define a macro; and how recursion is handled during macro expansion, if macro commands are implemented.	N/A
16	Response to common query *IDN?.	WILTRON, <Model>, <SN>, <SW revision>
17	Size of the protected user data storage area, if the *PUD command or *PUD? query are implemented.	N/A
18	Size of resource description, if the *RDT command or *RDT? query are implemented.	N/A
19	States affected by *RST, *LRN?, *RCL, and *SAV.	*RST = default state (see Chapter 11), *LRN, *RCL, *SAV not implemented
20	Scope of the self test performed by *TST? command.	Fully automated internal hardware testing/reporting. Failure results, if any, are written to the internal non-volatile service log for user access.
21	Additional status data structures used in status reporting.	Limits Event Status and Extended Event Status registers; refer to Chapter 7 for details.
22	Statement describing whether each command is overlapped or sequential.	All commands are sequential.
23	Functional criteria that is met when an operation complete message is generated in response to that command.	N/A – No overlapped commands.
24	Descriptions used for infinity and not-a-number.	N/A

Chapter 2
GPIB Programming Basics

Table of Contents

Chapter 2
GPIB Programming Basics

2-1 INTRODUCTION

This chapter contains a brief introduction to GPIB programming techniques and describes procedures to be used when preparing GPIB programs for the 372XXA VNA. It includes information about equipment requirements and configuration for GPIB control of the 372XXA VNA, and many programming tips.

Familiarity with manual (front panel) operation of the 372XXA is assumed. (Throughout this section, the 372XXA VNA is referred to simply as "372XXA".) A complete description of front panel operation is contained in the 372XXA Vector Network Analyzer System Operation Manual.

2-2 EQUIPMENT AND CONFIGURATION

The programming examples contained in this chapter assume the equipment listed below is present and configured as described.

Required Equipment

The following equipment represents a minimum GPIB controllable 372XXA VNA system:

- ☐ A 372XXA Vector Network Analyzer.
- ☐ A computer/controller that supports the IEEE 488 GPIB standard. The examples in this chapter address the IBM compatible computers.
- ☐ An IEEE-488 GPIB interface (built in, or add-in peripheral card) with appropriate driver software. The National Instruments GPIB IEEE-488.2 interface is assumed for all examples in this chapter.
- ☐ Appropriate software (any of the following):
  - Microsoft QuickBASIC, version 4.0 (or later)
  - Microsoft "C", version 5.1 or later, or Quick C, version 2.5.
  - Any other programming language, or application software, that supports the IEEE 488 GPIB interface (Pascal, Fortran, etc.).
- ☐ A GPIB cable (preferably 2 meters long).

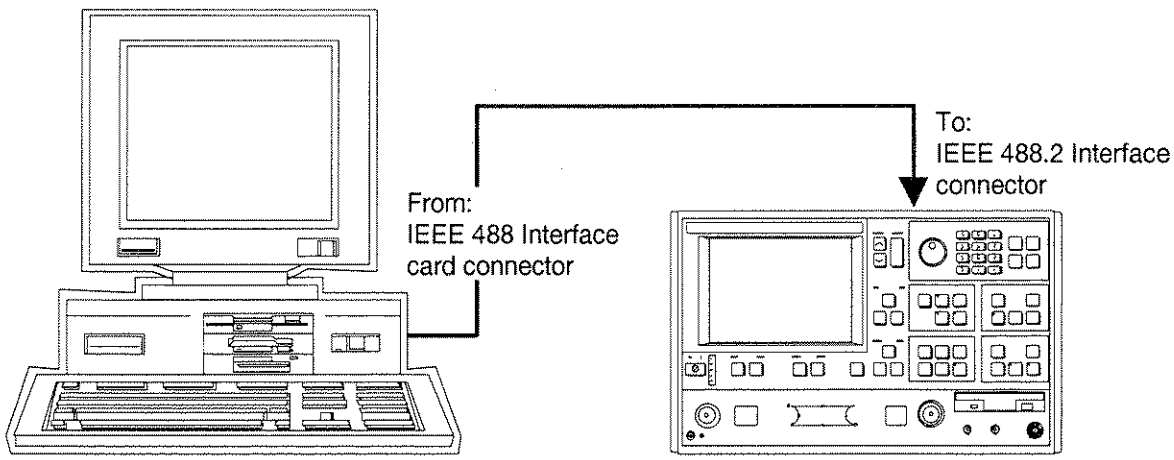
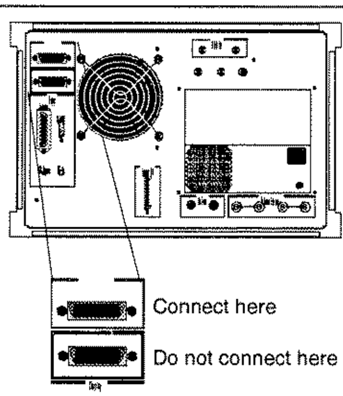


Figure 2-1. Model 372XXA Shown Connected to an IEEE 488.2 Controller

NOTE

The IBM PC and National Instruments GPIB interface were chosen for demonstrating the 372XXA GPIB operation in this manual. Any other GPIB controller that conforms to the IEEE 488 standard can be used to interface to the 372XXA.

Configuration



Configure the 372XXA as shown in Figure 2-1. Apply power to the 372XXA and allow the system software to load from disk. Once the software has finished loading and start-up testing is complete, the 372XXA is ready to be remotely controlled via the GPIB. It is important to note that *the 372XXA will not respond to GPIB commands until the 372XXA system software has been loaded.*

Connect a GPIB cable from the computer/controller to the rear panel IEEE 488.2 GPIB connector(left).

Apply power to the computer/controller and load the appropriate programming language software (QuickBASIC, “C”, etc.).

The default GPIB address for the 372XXA (6) is assumed for all examples in this chapter.

2-3 GPIB PROGRAM ELEMENTS

The discussions in this chapter demonstrate basic GPIB programming concepts that are typical elements of most GPIB application programs.

The controller used to demonstrate these concepts is the National Instruments 488.2 GPIB Interface which will be referred to as NI488 throughout this chapter.

NOTE
Regardless of the controller used, consult its documentation and software distribution disks for complete details and examples on setup and use of the controller's hardware and interface software functions.

National Instruments GPIB Interface

Throughout this chapter references will be made to variables, constants, and controller function calls declared in the NI488 file that your application uses to interface to the GPIB controller. This file is **decl.h** for C and **qbdecl.bas** for QuickBASIC, and it must be included in your GPIB program. Consult your documentation for the files used for other environments.

Including and compiling the appropriate NI488 file when preparing your application is what allows use of the NI488 GPIB interface procedures and function calls in your program. Also, the file named **gpib.com** must be installed in memory upon bootup of your computer. Typically, access to this file is through your system configuration file (that is, config.sys for DOS based computers).

The **gpib.com** is what allows your GPIB program to physically interface to the installed GPIB controller and to execute GPIB function calls during operation.

NOTE
Consult your controller's documentation for complete details on software and hardware setup, test, and use prior to proceeding with the following discussion. Knowledge of your controller and its operation will be assumed from this point forward.

Definitions

The following definitions apply for the remainder of this chapter:

- board = 0, Active controller board number
- address = 6, GPIB address of the instrument.
- Address List = addresList, list of GPIB addresses terminated with the NI488 constant NOADDR. For our examples the list consists of two elements (6, NOADDR).

2-4 INITIALIZING THE GPIB

Initializing is the process of directing your controller to take control of the bus (become CIC — Controller In Charge) and setting the GPIB software to initial default settings.

NOTE

Default initial installation configuration is assumed for the NI488 hardware and software.

NI488 does this by sending an interface clear to the desired board using:

```
SendIFC(board)
```

The board will become CACS (Active controller). NI488 software allows use of up to 4 controllers. The board specified by the SendIFC() function must be designated CIC – Controller In Charge in its setup and configuration. See NI488 config utility in NI488 documentation.

SendIFC() is also useful anytime you want to insure that your GPIB controller has control over the bus, the GPIB software is in its default parameters, and GPIB of all instruments on the bus is cleared and in idle state.

The following NI488 functions are also useful when initializing your application.

- ☐ To place all instruments in remote state, use:

  EnableRemote(board, addressList)

- ☐ To clear GPIB operation of all instruments use:

  DevClearList(board, addressList)

2-5 SHUTTING DOWN THE GPIB SYSTEM

An important step in quitting a GPIB application is to shut down the GPIB interface. For the NI488 this is done by

- ☐ Insuring that you have control over the bus.
- ☐ Clearing all instruments' GPIB and placing them in an idle state.
- ☐ Releasing the controller GPIB software and hardware.

Implement the above by sending:

```
SendIFC(board)
ibonl(board, 0)
```

2-6 DETECTING GPIB ERRORS

It is important to use error checking code throughout your application program. Error checking usually does not significantly impact the speed of a GPIB application. This is because the GPIB bus operations are I/O operations whose execution time depends on a handshake process. This process is typically much slower than executing (error checking) code in your computer's memory.

Full Error Detection

Full error detection and handling is an invaluable debugging tool that should be used to its fullest during development of your application.

Limited Handling Error Detection

Error detection with at least a limited amount of handling should be used after each GPIB I/O operation in your final program. This will insure predictable operation of your application, proper system control, and accurate data processing.

NI488 Global Variables

The NI488 interface maintains three global variables useful in determining correct GPIB operations. These variables are updated after, and reflect the condition of, the last GPIB call to the interface. The variables are:

- **IBSTA**
  This variable provides the latest bus activity status; that is, errors, completions, time outs, etc.
- **IBERR**
  This variable provides information on the type of error, if an error was reported in IBSTA.
- **IBCNT/IBCNTL**
  The number of data bytes transferred on the bus in the last operation. IBCNTL is the "long integer" version of IBCNT.

Example

Error checking for the NI488 interface is as follows. After each GPIB call, the IBSTA is checked for errors using the NI488 declared constant EERR - in BASIC, or ERR in C. If true, the gpiberr() function is called to decode and display the global variables IBSTA, IBERR, and IBCNT. For example, for QuickBASIC, the following code is inserted after a GPIB call:

```
IF IBSTA% AND EERR THEN
  CALL gpiberr("Error during GPIB operation.")
END IF
```

NOTE

The NI488 disks and documentation contain the source listing of the gpiberr() function. This function should be copied into your code and used after each GPIB function call. Use the example programs provided on the NI488 distribution disks. Note that gpiberr() can also be modified to fit a particular application's requirements.

2-7 SETTING GPIB OPERATION TIME OUT

Setting GPIB time out is necessary to allow for lengthy instrument operations to complete before the application program continues with its processing. (Refer to paragraph 2-1, Waiting for Instrument Operations to Complete.)

Example The NI488 time out is set using the ibtmo() interface call, as follows:

ibtmo(instrument_handle, timeout_setting)

Where:

- instrument_handle = The value returned by the ibfind() or ibdev() interface call for the instrument.
- timeout_setting = A value that disables or sets the time out setting. NI488 uses declared constants to represent the allowable time out settings, for example, the T100s constant is 100 seconds, T30ms is 30 milliseconds, TNone is 0, etc. The complete list is in the NI488 include file for your language (**qbdecl.bas**, **decl.h**).

NOTE

Consult NI488 documentation and distribution disks for information and an example on using ibtmo(), ifbind(), and ibdev().

2-8 SENDING COMMANDS

GPIB controllers provide for sending GPIB commands to an instrument (or the controller itself if its address is used). The NI488 uses several commands, the most common is:

Send (board, address, buffer, numBytes, eot_mode)

Where:

- ☐ board, address = see section 2-3 for definitions.
- ☐ buffer = String of one or more instrument specific GPIB commands from the defined list in the instrument's GPIB documentation.
- ☐ buffer = String of one or more instrument specific GPIB commands from the defined list in the instrument's GPIB documentation.
- ☐ numBytes = The number of bytes contained in the buffer.
- ☐ eot_mode = The method used to signal end of transmission. This is typically done using ASCII linefeed character 0A hex (10 decimal) and then setting EOI state (end of transmission) on the bus. The NI488 defines the following constants for use to setup end of transmission methods:
  - ■ NLend - linefeed with EOI
  - ■ DABend - EOI only
  - ■ NULLend - Do nothing to mark end of transmission

Example: Send the 372XXA at address 6, the commands "**CH2;DSP;MAG**", from controller number 0, using the linefeed with EOI to mark the end of transmission:

Send (0, 6, "**CH2;DSP;MAG**",11,NLend)

372XXA Commands Used The above example uses the following commands defined in the 372XXA command set:

CH2 – sets active channel to 2,

DSP – displays only the active channel on the whole screen,

MAG – displays the active channel's data in log magnitude format (dB).

NOTE

The semicolon (;) is used to separate the different commands.

2-9 RECEIVING DATA FROM AN INSTRUMENT

In order to receive data from an instrument over the GPIB, you must first instruct the instrument to output the desired data. You do this by using one of the instrument's defined data output commands and the controller Send() function (see paragraph 2-8, "Sending commands").

The instrument must then be given permission to start sending data (talk). The NI488 call to do this is:

```
Receive(board, address, buffer, numBytes,
    eod_mode)
```

Where:

- board, address = see section 2-3 for definitions.
- buffer = The name of the memory address of the buffer where the received data is to be placed. Typically this is an array of type characters (a string). Although, for binary data transfers, the NI488 software will accept an array of almost any type; that is. integer, floating point, etc.
- numBytes = The maximum number of bytes to read from the instrument. Insure that "buffer" above is of at least this size.
- eod_mode = The method used to signal the controller to stop receiving data. Typically the NI488 constant STOPend is used (EOI state – end of transmission – set with the last byte). If you want to stop receiving when a certain transmission terminator character is received, then use the hex value of that character instead of the STOPend.

Example: Use the NI488 controller number 0, to send the 372XXA at address 6, the command "**ONP**" using the line feed with EOI to mark end of transmission:

```
Send(0, 6, "ONP", 3, NLend)
```

Upon receiving a data output command, the 372XXA will prepare the data requested and wait for the controller to put it in the talk state so it can put the data out on the bus. This is done by:

```
numBytes = 20
Receive(0, 6, buffer, numBytes, STOPend)
```

Error Handling: The number of bytes actually sent on the bus can now be retrieved from the NI488 interface software by immediately storing the value of the IBCNT global variable in a program variable as follows:

```
actualReceivedBytes = IBCNT
```

If we expected an exact number of bytes to be received, we can compare the requested number of bytes "numBytes" with the actual received "actualReceievedBytes" and take some corrective action if they do not match. You should do this before continuing to the data processing section of the program:

```
If numBytes ISNOTEQUALTO actualReceivedBytes then
  Call gpiberr("incorrect number of bytes
  received")
END IF
```

NOTE:
Consult your programming language syntax for the operator used to check in-equality, to use in place of ISNOTEQUALTO.

372XXA Commands Used

The above example uses the following commands defined in the 372XXA command set:

- **ONP** – Outputs the number of data points in the current sweep. It will output the number represented in ASCII format.

2-10 SRQ HANDLING

Controllers use a dedicated line on the GPIB to detect if an instrument has requested service. An instrument sets this line when a predetermined set of conditions inside it have been met. These conditions are selected and programmed into the instrument by setting the Service Request Enable Register to a decimal value that corresponds to the bit values which, when true, will generate an SRQ. This is a binary weighted decimal value in the range 0 – 255.

Calculating the Binary Weighted Bit Value

The decimal value of a bit in a register is equal to the number 2 raised to a power equal to the bit number. For example, the decimal value of bit 4 in the Service Request Enable Register is 2 raised to the power 4 which is: $2^4 = 16$. Similarly, the decimal value of bit 0 is: $2^0 = 1$.

Enabling Service Request

To enable service request in the 372XXA, use the command ***SRE** - Service Request Enable, with the desired value.

Example

Command the 372XXA to request service, i.e. generate an SRQ, when it has data to send, then output the number of points in the current sweep. We need to enable bit 4 (MAV), Message Available, in the Service Request Enable Register, so a service request will be generated when the data is ready. The decimal value of bit 4 is 16 ($2^4 = 16$).

The NI488 Send() function is used to send the 372XXA at address 6, the commands "***SRE 16;ONP**" (12 ASCII bytes), from controller number 0, using the linefeed with EOI to mark end of transmission:

```
Send(0, 6, "*SRE 16;ONP", 12, NLend)
```

Commands Used The above example uses the following commands defined in the 372XXA command set:

***SRE** – Sends a Status Request Enable mask.

ONP – Outputs the number of sweep points.

NI488 SRQ Functions The following NI488 functions are useful in handling SRQ operations. Consult your NI488 documentation for full details.

- ☐ To test for occurrence of SRQ:

  TestSRQ(board, SRQset)

  Where:
  - SRQset contains 1 if SRQ is set, or 0 if it is not.

- ☐ To wait for occurrence of SRQ and report if it was set:

  WaitSRQ(board, SRQset)

  Where:
  - SRQset contains 1 if SRQ was set within the time out allowed, or 0 if it was not. (See paragraph 2-8, Setting GPIB Operation Time Out.)

- ☐ To find out which instrument is requesting service (set SRQ), instruct the controller to perform a serial poll and return the results as follows:

  FindRQS(board, addressList, statusByte)

  Where:
  - statusByte = The status byte of the first requester found is returned in this variable.
  - The index in addressList that contains the address of the instrument requesting service is returned in the IBCNT global variable.

- ☐ To read out the SRQ byte from an instrument:

  ReadStatusByte(board, address, statusByte)

- ☐ To parallel poll, see the following functions in the NI488 documentation.

  PPoll()

  PPollConfig()

  PPollUnconfig()

2-11 WAITING FOR INSTRUMENT OPERATIONS TO COMPLETE

Instruments often require a period of time to complete certain operations such as disk I/O, measurement sweep, data preparation, etc.. Your application program must allow the instrument time to complete these operations and be able to detect when operations are completed.

The simplest mechanism for synchronizing operations over the GPIB involve using the ***OPC?** - Operation Complete query and the ***OPC** - Operation Complete command.

Example 1 Command the 372XXA to perform a sweep and hold then place an ASCII "1" in its output buffer (***OPC?**) when done.

The NI488 Send() function is used to send the 372XXA at address 6, the commands, "**TRS;WFS;HLD;*OPC?**", from controller number 0, using the linefeed with EOI to mark end of transmission. The Receive() function is then used to hold the program from continuing processing until it receives the output of the ***OPC** command (or times out):

```
buffer = "TRS;WFS;HLD;*OPC?"
Send(0, 6, buffer, 17, NLend)
oneByte = 1
Receive(0, 6, buffer, oneByte, STOPend)
```

NOTE

The time out must be set high enough to allow the sweep to complete (see "Setting time outs" in paragraph 2-8).

Example 2 Now we will modify the above example to request service when bit 4 (MAV) in the Status Byte Register is set (***SRE 16**) to let the program know when the ***OPC?** data is ready to be output. This overcomes the time out problem but it does increase program complexity.

```
buffer = "*SRE 16;TRS;WFS;HLD;*OPC?"
Send(0, 6, buffer, 25, NLend)
SRQset = 0
WHILE (SRQset = 0)
   WaitSRQ(board, SRQset)
ReadStatusByte(board, address, statusByte)
oneByte = 1
Receive(0, 6, buffer, oneByte, STOPend)
```

NOTE

TestSRQ() can be used instead of WaitSRQ() to check for the occurrence of SRQ in the WHILE loop. This would allow your program to perform other tasks while waiting for SRQ inside the WHILE loop.

372XXA Commands Used

Examples 1 and 2 above used the following commands defined in the 372XXA command set:

***SRE** - sends a Status Request Enable value.

TRS - triggers a sweep

WFS - waits one full sweep

HLD - goes into hold mode

***OPC? - outputs an ASCII "1" when operation is complete**

NOTE:

Refer to Chapter 7, Remote Only Operations for more information and examples on status reporting and service request generation.

Chapter 3
Model 372XXA
Programming Examples

Table of Contents

Chapter 3
Model 372XXA
Programming Examples

3-1 INTRODUCTION

This chapter contains example programs to familiarize the user with 372XXA programming. Familiarity with manual (front panel) operation of the 372XXA is assumed. (Throughout this section, the 372XXA VNA is referred to simply as "372XXA".) A complete description of front panel operation is contained in the 372XXA Vector Network Analyzer System Operation Manual.

Also, it is assumed that you have read Chapters 1 and 2 and are familiar with the information they contain. This information describes the various syntax and functions used in the example sequences presented throughout the chapter. This includes: Send, Receive, IBCNT, IBERR, ISNOTEQUALTO, and others.

3-2 372XXA PROGRAMMING EXAMPLES

The main sequences for five example 372XXA programs are listed and explained in the following pages. In these examples, the NI488 function calls are abbreviated; refer to Chapter 2 and the NI488 documentation for full details. Refer to the 372XXA Command Function groups and the Command listings in this manual for complete details on 372XXA command operations.

NOTE

The functions and procedures called from the example sequences in paragraphs 3-3 through 3-7 are provided at the end of this chapter in paragraphs 3-8 through 3-10.

The intent of these example program sequences is to provide algorithms useful when programming various features of the 372XXA. You are encouraged to study these algorithms, copy them into your programming environment, and tailor them for your language and application.

3-3 EXAMPLE 1: BASIC OPERATIONS

This example sequence lists and explains some common 372XXA operations.

- Setup display and sweep frequencies

  Send "**CH2;DSP;MPH;SRT 40 MHZ;STP 20 GHZ**"

- Setup markers

  Send "**MK1 40 MHZ;MK2 20 GHZ**"

- Read and store current instrument setup
  - Request instrument setup string

    Send "**OFP**"

  - Read instrument setup string

    Receive(instrSetup, MAXSIZE, STOPend)

  - Get number of bytes transferred

    sizeInstrSetup = IBCNT

NOTE

Program variables *instrSetup* and *sizeInstrSetup* will be used later with the **IFP** command to input the saved setup string.

- Read sweep frequencies
  - Trigger and wait for full sweep then hold

    Send "**TRS;WFS;HLD**"

  - Wait for operations to complete (See "Wait for Instr()" example, page 3-14.)

    WaitForInstr()

  - Request sweep frequencies (**OFV**):
    Use floating point (64 bit) binary format (**FMB**), Least Significant Byte first ordering (**LSB** for IBM/compatible PCs only).

    Send "**LSB;FMB;OFV**"

  - Get number of bytes to read:
    See Chapter 7, "Data Transfer" section for details on <Arbitrary Block> data transfers and structure of the header used to precede and give number of bytes in data block. (See "GetNumBytes( )" example, page 3-15.)

    numBytes = GetNumBytes(address, headerString)

  - Read frequencies
    freqArray is a floating point double precision array of up to 1601 elements.

Receive(freqArray, numBytes, STOPend)

- □ Check for complete transfer

  if (numBytes ISNOTEQUALTO IBCNT then
  gpiberr("Could not read freq list correctly")

- ■ Reset instrument
  - □ Send reset command

    Send "***RST**"

  - □ Wait for operations to complete (page 3-14)

    WaitForInstr()

- ■ Download and restore a previously saved setup
  - □ Command instrument to receive a setup string. Use "NULLend" (see Chapter 2, paragraph 2-9.)

    Send "**IFP** "

NOTE

The space after the **IFP** command is needed to separate it from the setup string, which follows.

  - □ Send the setup string. Use "NLend" (see Chapter 2, paragraph 2-9.)

    Send(instrSetup, sizeInstrSetup)

  - □ Check if all data was sent correctly

    if (sizeInstrSetup ISNOTEQUALTO IBCNT then
    gpiberr("Error sending setup string")

- ■ Select instrument Marker 1 active

  Send "**MR1**"

- ■ Read measurement trace
  - □ Trigger and wait for full sweep then hold

    Send "**TRS;WFS;HLD**"

  - □ Wait for operations to complete (page 3-14)

    WaitForInstr()

  - □ Request trace data:
    in final trace graph type values (**OFD**), in floating point (32 bit) binary format (**FMC**). Use Least significant Byte first ordering (**LSB**, for IBM/compatible PCs only)

    Send "**LSB;FMC;OFD**"

- ☐ Get number of bytes to read (page 3-15)

  numBytes = GetNumBytes

- ☐ Read out the trace data values.

  Receive(traceData, numBytes, STOPend)

- ☐ Check if all data was transferred

  if (numBytes ISNOTEQUALTO IBCNT then
  gpiberr("Could not receive data.")

- ☐ Calculate number of sweep points in data string
  POINTSIZE is 8 bytes for data transfers using the **FMB** format and 4 bytes if using the **FMC** format. See Chapter 7, "Data Transfer Commands."

  numFreqs = numBytes / POINTSIZE

- ■ Put instrument(s) in local to allow use of front panel

  EnableLocal(board, addressList)

3-4 EXAMPLE 2: 12 TERM CALIBRATION

This example sequence lists and explains 372XXA commands used for automated 12 Term Calibration.

- ■ Display instructions to operator on computer screen

  PRINT "Install 33KFKF Phase Equal Insertable on
  Port 1"
  PRINT "Install 3670K502 Thru Line female side to
  Port 2"
  PRINT "so the new Port 2 is the male end of the
  thru"
  PRINT "Shape the end of the thru so it is near
  Port 1"
  PRINT "(Press a key when ready)"

- ■ Set up calibration parameters

  Send "**SCM;LTC;C12;ISN**"

- ■ Set up calibration frequencies

  Send "**DFC;FRS 1 GHZ;FRI 100 MHZ;FRP 41;
  FIL;DFD**"

- ■ Set up connectors and loads

  Send "**P1C;CFK;P2C;CMK;BBL**"

- ■ Begin calibration data collection

  Send "**BEG**"

- ■ Wait for operations to complete (page 3-14)

  WaitForInstr()

- Instruct operator via the controller screen...
  To connect ISOLATION DEVICES between Ports 1 and 2 and wait for him; then measure devices. (See TakeCalData(), pg 3-14).

```
PRINT "Connect ISOLATION DEVICES between
    Ports 1 and 2"
PRINT "Press ENTER when ready"
TakeCalData()
```

- Instruct operator via the controller screen....
  To connect BROADBAND LOADS between Ports 1 and 2 and wait for him; then measure devices.

```
PRINT "Connect BROADBAND LOADS between
    Ports 1 and 2.
PRINT "Press a key when ready"
TakeCalData()
```

- Instruct operator via the controller screen....
  To connect OPEN to Port 1 and SHORT to Port 2 and wait for him; then measure devices.

```
PRINT "Connect OPEN to Port 1 and SHORT
    to Port 2
PRINT "Press a key when ready"
TakeCalData()
```

- Instruct operator via the controller screen....
  To connect SHORT to Port 1 and OPEN to Port 2 and wait for him; then measure devices.

```
PRINT "Connect SHORT to Port 1 and OPEN
    to Port 2
PRINT "Press a key when ready"
TakeCalData()
```

- Instruct operator via the controller screen....
  To connect Port 1 and Port 2 with the reminder to NOT INSTALL ADDITIONAL THRU LINES/ADAPTERS BETWEEN PORTS, and wait for him; then measure devices.

```
PRINT "Connect Port 1 and Port 2 but
    DO NOT INSTALL ADDITIONAL THRU
    LINES/ADAPTERS BETWEEN PORTS
PRINT "Press a key when ready"
TakeCalData()
```

3-5 EXAMPLE 3: CALIBRATION DATA TRANSFER

This example sequence lists and explains 372XXA commands for transferring calibration error terms/coefficients.

- Setup a Frequency Response Transmission Calibration.
  - ☐ Set up calibration parameters

    Send "**SCM;LTC;CFT**"
  - ☐ Set up calibration frequencies

    Send "**DFC;FRS 1 GHZ;FRI 100 MHZ;FRP 41; FIL;DFD**"
  - ☐ Begin calibration data collection

    Send "**BEG**"
- Wait for operations to complete (page 3-14)

  WaitForInstr()
- Instruct operator via the controller screen...
  To connect THRU LINE between Ports 1 and 2 and wait for him.

  PRINT "Connect THRU LINE between Ports 1 and 2"
  PRINT "Press ENTER when ready"
  - ☐ Measure thruline (page 3-14).

    TakeCalData()
  - ☐ Read Calibration Coefficient Data from instrument and store the 488.2 data transfer header which is useful for sending the same size data array back to the 372XXA later. Also calculate and store the number of frequency points read in.
  - ☐ Request the error term/coefficient array (**OC1**) in 64 bit Floating Point format (**FMB**), Least Significant Byte order (**LSB**, for PCs only). See Chapter 7, "Data Transfer Commands" for the error terms returned by the OCx series commands.

    Send "**LSB;FMB;OC1**"
  - ☐ Get number of bytes contained in the data string and store the header read from the 372XXA into calHeader (string of characters). See GetNumBytes(), page 3-13.

    numBytes = GetNumBytes(address, calHeader)
  - ☐ Read calibration data values
    calData is an 82 element double precision floating point array.

    Receive(calData, numBytes, STOPend)

- □ Check if all data was transferred

  if (numBytes ISNOTEQUALTO IBCNT) then
  gpiberr("Could not receive data.")

- □ Store number of calibration data bytes transferred

  calDataSize = IBCNT

- □ Calculate number of frequency points in the data trace if desired. POINTSIZE is 8 bytes for data transfer using the **FMB** format. See Chapter 7, "Data Transfer Commands." The division by two is because each data point represents a complex data pair (real, imaginary).

  numFreqs = (CalDataSize / 2) / POINTSIZE

- ■ Send Calibration Coefficient Data to instrument

- □ Simulate a Transmission Calibration
  Command the 372XXA to apply transmission calibration coefficients to data (**AFT**), then input the calibration coefficient array for transmission error term (**IC1**), in 64 bit Floating Point format (**FMB**), Least Significant Byte order (**LSB**, for use with PCs only). Use "NULLend" (see Chapter 2, paragraph 2-9.)

  Send "**AFT;LSB;FMB;IC1** "

  NOTE
  Note the space after the **IC1** command; it is needed to separate it from the calibration coefficient data array, which follows.

- □ Send cal coefficient #1 data transfer header (same one that was received from the **OC1** transfer). Use "NULLend" (see Chapter 2, paragraph 2-9.)

  calHeaderSize = LENGTHOFSTRING(calHeader)
  Send(calHeader, calHeaderSize, NULLend)

  NOTE
  Consult your compiler documentation for a function that returns length of a string.

- □ Check for proper transfer

  if (CalHeaderSize ISNOTEQUALTO IBCNT) then
  gpiberr("Data not sent properly")

- □ Send cal coefficient #1 data. Use "NLend" (see Chapter 2, paragraph 2-9.)

  Send(calData, calDataSize)

- Check for proper transfer

  if (calDataSize ISNOTEQUALTO IBCNTI then
  gpiberr("Data not sent properly")

- Wait for operation to complete (page 3-14)

  WaitForInstr()

- Turn on/apply error correction

  Send "**CON**"

3-6 *EXAMPLE 4: ASCII STRING TRANSFER*

This is an example sequence showing data string input to the 372XXA. The string sent below is used to set hardcopy data output labels.

The 372XXA requires the double quote characters (" ") to delimit ASCII strings being sent to it. That is, to send a string called *mystring* you would actually send *"mystring"*. This presents a problem since programming languages also delimit a character string with double quotes. In order to send the 372XXA a quote (") as a regular character, you must precede it with the backslash (\) character in the C language and with a quote character (") in BASIC.

NOTE

A 372XXA ASCII string may also be delimited using a single quote character (') at the beginning an end of the string. In which case, the backslash (\) for C and the double quote (") in BASIC are not required.

- Define DUT Model in the data label.
  The following command sequence needs to be sent to the 372XXA:

  LMS "4_8_FILTER"

  - If using C use this syntax

    Send "**LMS \"4_8_FILTER\"**"

  - If using BASIC use this syntax

    Send "**LMS ""4_8_FILTER""**"

  - Here the same command sequence can be sent with the single quotes (' ') without the need for additional character as above.

    Send "**LMS '4_8_FILTER'**"

- If shutting down the GPIB immediately after this series of commands, then you must also make the controller wait for the 372XXA to completely receive this data before shut down.

  WaitForInstr()

3-7 EXAMPLE 5: DISK OPERATIONS

This example sequence lists and explains 372XXA commands for 372XXA internal disk operations.

- Sweep, and store channel 1 trace data to memory

  Send "**CH1;S11;CH3;S21;WFS;CH1;STD**"

- Store trace memory data to hard disk
  The following command sequence needs to be sent to the 372XXA:

  Send "**SAVNRMH 'ch1_s21'**"

NOTE
The **SAVNRMH** command will append the .nrm file extension and save the file ch1_s21.nrm on disk.

- Wait for operations to complete (page 3-12)

  WaitForInstr()

- Output channels 1 Tabular Data to instrument floppy disk

  Send "**SAVDAT 'ch1_s21'**"

NOTE
The **SAVDAT** command will append the .dat file extension and save the file ch1_s21.nrm on disk.

- Wait for operations to complete

  WaitForInstr()

- Save Front Panel and Calibration setup to hard disk

  Send "**SAVCALH 'setup1'**"

NOTE
The **SAVCALH** command will append the .cal and save setup1.cal on disk.

- Wait for operations to complete

  WaitForInstr()

- Reset system to default state

  Send "***RST**"

- Recal Front Panel and Calibration setup from hard disk

  Send "**RCLCALH 'setup1'**"

NOTE
The **RCLCALH** command will append the .cal and recall setup1.cal from disk.

- Wait for operations to complete

  WaitForInstr()

- Recall channel trace/noramlization data from hard disk to CH3

  Send "**CH3;RCLNRMH 'ch1_s21';WFS**"

NOTE

The **RCLNRMH** command will append the .nrm file extension and recall the file ch1_s21.nrm from disk.

- Wait for operations to complete

  WaitForInstr()

- Delete channel 1 trace/normalization data file from hard disk

  Send "**DELNRMH 'ch1_s21'**"

NOTE

The **DELNRMH** command will append the .dat file extension and delete the file ch1_s21.nrm from disk.

- Wait for operations to complete

  WaitForInstr()

3-8 EXAMPLE PROCEDURE, WaitForInstr()

This example sequence provides coding for the Wait for Instr () procedure used earlier in this chapter's example sequences.

NOTE

Do not use this procedure if the instrument was commanded to output data that has yet to be read by the program since the ***OPC?** query will, in itself, output data (the character "1")when done with previous operation.

- Set GPIB time out limit to insure enough time is allowed for instrument operations to complete. See ibtmo() in the NI488 documentation for details.

  ibtmo(instrument_handle, T1000s)

- Send the Operation Complete query

  Send "***OPC?**"

- Wait for instrument to output the ASCII character "1"

  numBytes=1
  Receive(buffer, numBytes, STOPend)

- Restore default time out limit

  ibtmo(instrument_handle, T10s)

3-9 EXAMPLE FUNCTION, GetNumBytes(address, headerstring)

This example sequence provides coding for the GetNumBytes() function used earlier in this chapter's example sequences.

GetNumBytes() reads the 372XXA output buffer and returns the number of data bytes to be transfered in the ensuing <Arbitrary Block> data string (see Chapter 7, "Data Transfers".) It does this by reading out and decoding the string data header. It will copy the header read out of the 372XXA into headerString so the calling program can use it in cases where the same data block will be sent back to the 372XXA, i.e. **OC1/IC1**.

NOTE

Consult your programming language documentation for string functions to copy, concatenate, and return value of string.

- Read the first byte in the instrument output buffer. Buffer is a temporary array of characters of size 10.

```
numBytes = 1
Receive(buffer, numBytes, STOPend)
```

- Check to be sure it is the "#" character then copy it to headerString

```
if (buffer[0] ISNOTEQUALTO '#') then
  gpiberr("Invalid data string")
else COPY(buffer, headerString)
```

- Read second header byte from the instrument output buffer and append it (concatenate) to headerString

```
numBytes = 1
Receive(buffer, numBytes, STOPend)
CONCATENATE(buffer, headerstring)
```

- Save the buffer value as a number...

```
numBytes = VALUEOF(buffer)
```

NOTE

This number is the next set of bytes to read. Those bytes when taken as a number will yield the number of actual data bytes contained in the binary string.

- Read the number of bytes indicated by numBytes and append them (concatenate) to headerString

```
Receive(buffer, numBytes, STOPend)
CONCATENATE(buffer, headerString)
```

- Save the buffer value as a number
  numBytes = VALUEOF(buffer)

NOTE:
numBytes is the number of bytes, of actual data requested, waiting in the output buffer of the 372XXA.

- Return number of bytes to calling program

  Return numBytes

NOTE
At this point headerString is exactly the same as the data transfer header output by the 372XXA. Recall that this is useful to the calling program in cases where the same data read out is to be sent back to the instrument.

3-10 EXAMPLE PROCEDURE, TakeCalData()

This example sequence provides coding for the TakeCalData() procedure used earlier in this chapter's example sequences.

The TakeCalData() procedure will wait for the operator to press a key on the computer then measure the cal standard installed.

- Wait for operator to press a key on computer when he is ready

  WAITUNTIL (key is pressed)

NOTE
Consult your compiler documentation for a function that waits for a key to be pressed.

- Take cal data then go on to next calibration step

  Send "**TCD;NCS**"

- Wait for operation to complete (page 3-12)

  WaitForInstr()

Part 2 GPIB Function Groups

This part consists of six chapters that relate the 372XXA GPIB commands to functional groups. Tables within each group provide command descriptions and relationships to front panel keys and their associated menu functions.

Chapter 4 *– describes the commands and suffix mnemonics that relate to Measurement Functions.*

Chapter 5 *– describes the commands that relate to Calibration Functions.*

Chapter 6 *– describes the commands that relate to Markers and Limits Functions.*

Chapter 7 *– describes the commands that relate to Remote-Only Functions.*

Chapter 8 *– describes the commands that relate to System Functions.*

Chapter 9 *– describes the commands that relate to Special Applications Functions.*

Chapter 4
Measurement Functions

Table of Contents

Chapter 4
Measurement Functions

4-1 INTRODUCTION

This chapter describes the measurement function commands (and suffix mnemonics) that control the channel control, measurement control, display control, and enhancement group functions.

NOTE

See Chapter 9, Special Applications Functions for Time Domain, Multiple Source Control, and Rear Panel Output functions.

4-2 DATA ENTRY SUFFIX CODES

Many 372XXA GPIB commands require a following numeric value (or values) that quantify the 372XXA operational parameters being controlled (i.e., frequency, power, etc). These numeric values are scaled to the following units as appropriate:

DECIBELS	METERS	SECONDS
DEGREES	OHMS	VOLTS
HERTZ		

All numeric data entries can be followed by an optional suffix mnemonic (see example). The suffix mnemonics for the 372XXA are listed in Table 4-1. These mnemonics define a weighting factor that is ap-

Table 4-1. *Numeric Data Suffix Mnemonics*

Code	Parameter Type	Weighting Factor	Code	Parameter Type	Weighting Factor
DB, DBL, DBM	Power	1.0	NS, NSC	Time	10E-9
DEG	Phase	1.0	PS, PSC	Time	10E-12
RAD	Phase	$180^\circ/\pi$	M, MTR	Distance	1.0
HZ	Frequency	1.0	CM, CMT	Distance	10E-2
KHZ	Frequency	10E+3	MM, MMT	Distance	10E-3
MHZ	Frequency	10E+6	OHM	Impedance	1.0
GHZ	Frequency	10E+9	V, VLT	Voltage	1.0
REU	Real	1.0	MV	Voltage	10E-3
IMU	Imaginary	1.0	XM3	Unitless	10E-3
S	Time	1.0	XX1	Unitless	1.0
MS	Time	10E-3	XX3	Unitless	10E+3
US, USC	Time	10E-6			

plied to the associated numeric data value. (They perform the same function as the data entry termination keys on the 372XXA front panel.) Furthermore, suffix mnemonics imply unit type, thus enhancing the readability of application programs.

Example: "SRT 2 **GHz**"

4-3 CHANNELS GROUP

The commands listed in Table 4-1 perform two separate sets of functions:

- Select the the currently active channel (CH1–CH4). The active channel is that channel to which any subsequent channel-based commands are applied.
- Select single or multi-channel display mode (commands D13, D14, D24, DSP, T13, and T24). Commands T13 and T24 each produce a single display frame containing overlaid traces for the two channels specified.

NOTE
Flowcharts showing the 372XXA front panel keys and associated menu sequencing are provided in Appendix B.

Table 4-2. *Channel Command Group*

Front Panel Key/Function	Command	Description
Ch1 key	CH1	Selects channel 1 as active channel.
Ch2 key	CH2	Selects channel 2 as active channel.
Ch3 key	CH3	Selects channel 3 as active channel.
Ch4 key	CH4 CHX?	Selects channel 4 as active channel. Active channel query.
Channels Menu key	D13	Selects dual channel display, channels 1 & 3.
	D14	Selects quad display, all four channels.
	D24	Selects dual channel display, channels 2 & 4.
	DSP	Selects single channel display, using the currently active channel.
	DSP?	Channel display mode query.
	T13	Selects overlaid dual channel (1 & 3) display (one display frame).
	T24	Selects overlaid dual channel (2 & 4) display (one display frame).

4-4 DISPLAY GROUP

The commands listed in Table 4-3 are used to:

- Select the measurement type for the active channel, i.e., S11, S12, S21, or S22.
- Set up the graph type on the active channel. The usage of most of these commands is quite simple, with the exception of SME, ISE, SMC and ISC.

NOTE
All the commands in the Display Group act on the currently selected active channel (see paragraph 4-3, Channels Group).

Both the SME and ISE commands require an associated data value to be included with the command (Table 4-3). The allowable data values for these commands are: 0, 10, 20, and 30. The example below selects a 20 dB expanded Smith chart on the active channel.

Example: "SME 20 DBL"

Commands SMC and ISC also require an associated data value to be included with the command. The allowable data values for these commands are 0 and 3. The example below selects a 3 dB compressed Smith chart on the active channel.

Example: "SMC 3 DBL"

Commands SCL, REF and OFF

SCL Command — This command sets the scaling-per-division characteristics of the graph on the active channel. The associated data value determines the resultant scaling factor. The SCL command can also be used to set the scaling on Smith chart type display as follows:

VALUE	SCALING
–3	Sets a 3 dB compressed scale
0	Sets the normal Smith chart scale
10	Sets a 10 dB expanded scale
20	Sets a 20 dB expanded scale
30	Sets a 30 dB expanded scale

REF Command — This command selects the graticule line of the active channel data display on which to place the "REFERENCE LINE." The Reference Line is the graticule line to which the caret points on the 372XXA display, or graph. (Lines 0, 4, and 8 are the bottom, middle, and top of the graph respectively.)

NOTE
There is no reference line defined for Smith charts, inverted Smith charts, and linear polar or log polar displays.

OFF Command — This command sets the value of the offset associated with the "REFERENCE LINE" in the data graph display.

Changing the scaling-per-division (SCL), the Reference Line position (REF), or the offset value (OFF) in the bottom (secondary) graph of a two graph display is accomplished by using the appropriate suffix mnemonic for that graph, as shown in the table below. For example: to set the scaling value for the phase display of a log/phase type graph, use:

"SCL 20 **DEG**".

Command	Graph Type		
	Log Mag / Phase	**Lin Mag / Phase**	**Real / Imaginary**
SCL / OFF	DEG / RAD	DEG / RAD	IMU
REF	DEG	DEG	IMU

Table 4-3. *Display Group Commands (1 of 3)*

Front Panel Key/Function	Command	Description
Set Scale key, Set Scaling function	APR *value*	Sets group delay aperture for display on active channel.
	APR?	Group delay aperture for active channel display query.
	ASP *value*	Sets polar stop sweep position angle.
	ASP?	Polar stop sweep position angle query.
	AST *value*	Sets polar start sweep position angle.
	AST?	Polar start sweep position angle query.
	OFF *value*	Sets offset for display on active channel.
	OFF?	Offset for display on active channel query.
	PHO *value*	Sets phase offset for display on active channel.
	PHO?	Phase offset for display on active channel query.
	REF *value*	Sets reference line for display on active channel.
	REF?	Reference line for display on active channel. query.
	SCL *value*	Sets resolution for display on active channel.
	SCL?	Resolution for display on active channel query.
Autoscale key	ASC	Autoscale display for active channel.
Graph Type key	DLA	Selects group delay display for active channel.
	GRF?	Graph type query
	IMG	Selects imaginary display for active channel.
	ISC	Selects inverted compressed Smith chart for active channel.
	ISE	Selects inverted expanded Smith chart for active channel.
	ISM	Selects normal inverted Smith chart for active channel.
	LIN	Selects linear magnitude display for active channel.

Table 4-3. Display Control Commands (2 of 3)

Front Panel Key/Function	Command	Description
Graph Type key (Continued)	LPH	Selects linear magnitude and phase display for active channel.
	MAG	Selects log magnitude display for active channel.
	MPH	Selects log magnitude and phase display for active channel.
	PCP	Selects measurement phase polar chart mode.
	PCS	Selects sweep position polar chart mode.
	PCX?	Polar chart position/phase mode query mode.
	PHA	Selects phase display for active channel.
	PLG	Selects log polar display for active channel.
	PLR	Selects linear polar display for active channel.
	REL	Selects real display for active channel.
	RIM	Selects real and imaginary display for active channel.
	SMC	Selects compressed Smith chart for active channel.
	SME	Selects expanded Smith chart for active channel.
	SMI	Selects normal Smith chart for active channel.
	SWR	Selects SWR display for active channel.
S-Parameter key	S11	Measures S_{11} on active channel.
	S12	Measures S_{12} on active channel.
	S21	Measures S_{21} on active channel.
	S22	Measures S_{22} on active channel.
	SXX?	S parameter shown on active channel query.
Ref Plane key Set Dielectric function	DIA	Selects air (1.000649) as the dielectric.
	DIE *value*	Sets active dielectric to *value*.
	DIM	Selects microporous teflon (1.69) as the dielectric.
	DIX?	Dielectric constant query.
	DIP	Selects polyethylene (2.26) as the dielectric.
	DIT	Selects teflon (2.1) as the dielectric.
Ref Plane key Set Reference Plane function	RDA	Automatically calculates reference delay for active channel.
	RDD *value*	Sets reference delay in distance for active channel.
	RDD?	Reference delay in distance for active channel query.
	RDT *value*	Sets reference delay in time for active channel.
	RDT?	Reference delay in time for active channel. query.

NOTE

Commands RDD, RDT, and RDA (above) only affect the active channel reference delay; while commands DIA, DIT, DIP, DIM, and DIE change the system dielectric constant—which is a global change. The command RDA should be used after a full sweep has occurred (see WFS).

Table 4-3. Display Control Commands (3 of 3)

Front Panel Key/Function	Command	Description
Trace Memory key, Trace Math function	ADD	Selects complex addition as trace math for active channel.
	DIV	Selects complex division as trace math for active channel.
	MIN	Selects complex subtraction as trace math for active channel.
	MUL	Selects complex multiplication as trace math for active channel.
	MTH?	Trace math type query.
Trace Memory key	DAT	Displays complex measurement data on active channel.
	DAT?	Trace memory display mode query
	DNM	Displays data normalized to trace memory on active channel.
	DTM	Displays measurement data and trace memory on active channel.
	MEM	Displays trace memory on active channel.
	STD	Stores trace to memory.

NOTE

Before using the commands MEM, DTM or DNM to view a display that involves trace memory, or to store trace memory to disk, the data from the selected channel must first be stored to memory using the STD command. See Figure 4-1 (below) for an example on how to use the trace memory commands.

Front Panel Key/Function	Command	Description
Trace Memory key, Disk Operations function	SAVNRM	Saves trace memory to the floppy disk.
	SAVNRMH	Saves trace memory to the hard disk.
	RCLNRM	Recalls trace memory from the floppy disk.
	RCLNRMH	Recalls trace memory from the hard disk.

Example: `"WFS;STD;DIV;DNM"`

This example code causes the 372XXA to:

- Wait a full sweep until data is valid (WFS).
- Store data to memory (STD).
- Select complex division as the trace math (DIV).
- Display the data normalized to memory using the current trace math setting (DNM).

NOTE

The SAVNRM and RCLNRM commands that are used to store and retrieve the active channel trace memory to and from the disk are described in Chapter 8, System Functions, Disk Function Commands

Figure 4-1. *Example for Use of Trace Memory Commands*

4-5 MEASUREMENT GROUP

The commands listed in Table 4-4 control sweep and test signal functions. This includes frequency, power, attenuation, Hold functions, and Trigger/IF calibration.

Table 4-4. Measurement Control Commands (1 of 3)

Front Panel Key/Function	Command	Description
Hold Key and function	AH0	Turn automatic DUT protection off
	AH1	Turn automatic DUT protection on
	AHX?	Output automatic DUT protection onoff status
	BH0	Sets bias off while in hold.
	BH1	Sets bias on while in hold.
	BHX?	Bias while in hold query.
	CTN	Continues sweeping *from* current point.
	HLD	Holds instrument *at* current point.
	RH0	Sets RF off while in hold.
	RH1	Sets RF on while in hold.
	RHX?	RF on/off during hold query.
	TRS	Restarts the sweep (continuous sweep mode) or triggers a single sweep (in hold mode).
	WFS	Wait for a full sweep.
Setup Menu key and Sweep Setup function	CNTR	Enter center frequency
	CNTR?	Output center frequency
	CWF *value*	Turns CW on and sets it to a frequency between start and stop frequency.
	CWF?	CW mode frequency query.
	CWON	Turns CW on at the frequency last set.
	CWON?	CW mode on/off query.
	LAX?	Current sweep (phase/lock) direction query.
	SPAN	Enter frequency span
	SPAN?	Output frequency span
	SRT *value*	Sets start to any frequency in the instrument's range.
	SRT?	Start frequency query.
	STP *value*	Sets stop to any frequency in the instrument's range.
	STP?	Stop frequency query.
	SWP	Places the 372XXA into a continuous swept mode (turns CW mode off).
	SWP?	Sweep mode query.

Table 4-4. Measurement Control Commands (2 of 3)

Front Panel Key/Function	Command	Description
Data Points key and function	CWP	Enter number of points drawn in CW sweep mode. Values are 1 – 1601.
	CWP?	Number of trace data points to be drawn in CW mode query.
	NP1601, FHI	Sets data points to 1601 points.
	NP801	Sets data points to 801 points.
	NP401, FME	Sets data points to 401 points.
	NP201	Sets data points to 201 points.
	NP101, FLO	Sets data points to 101 points.
	NP51	Sets data points to 51 points.

NOTE

Use ONP command (output number of points - see Chap 7) to query the current data points setting

Front Panel Key/Function	Command	Description
Setup Menu key, Test Signals function	PW2 *value*	Sets source 2 power level in dBm. *value* depends on power range of source.
	PW2?	External source power query.
	P1P?	Outputs approximate power (dBm) at Test Port 1.
	PWR *value*	Sets internal source power level in dB.
	PWR?	Internal source power query.
	SA1 *value*	Sets source attenuator for port 1.
	SA1?	source attenuator for port 1 query.
	TA2 *value*	Sets signal input attenuator for port 2.
	TA2?	Signal input attenuator for Port 2 query.
(flat test port power calibration)	PSP	Selects the number of power measurement sweeps (1 – 5) that are to be performed during a flat test port power calibration. (See also: Chapter 5, Flat Test Port Calibration.)
	PSP?	Number of power measurement sweeps query.
	PTS	Selects the number of frequency points (1 – 125) to be skipped between each measured point on the power measurement sweep. (See also: Chapter 5, Flat Test Port Calibration.)
	PTS?	Number of points to skip query.
	SFC	Starts the flat test port calibration sequence. (See also: Chapter 5, Flat Test Port Calibration.)
	FP0	Causes the flat test port power correction data to be used during normal measurement mode. (See also: Chapter 5, Flat Test Port Calibration.)
	FP1	Turns off the flat test port power correction for normal measurement mode. (See also: Chapter 5, Flat Test Port Calibration.)
	FPX?	Flat power mode correction ON/OFF status query.

Table 4-4. Measurement Control Commands (3 of 3)

Front Panel Key/Function	Command	Description
Setup Menu key, Marker Sweep function	M1C-M6C	Sets sweep CW frequency to marker 1-6 .
	M1E-M6E	Sets sweep/zoom end frequency, time or distance to marker 1-6.
	M1S-M6S	Sets sweep/zoom start frequency, time or distance to marker 1-6.
Setup Menu key, Discrete Fill function	FIL	Fills a defined frequency range.
	FRI	Sets discrete frequency fill range increment frequency.
	FRP	Sets discrete frequency fill range number of points.
	FRS	Sets discrete frequency fill range start frequency.
	FRC	Clear all defined discrete frequency ranges.
	DFC	Start discrete fill definition
	DFD	Done specifying discrete frequency ranges.
	DFQ *value*	Enter single discrete frequency *value*.

NOTE

The DFQ, FRS, FRI, FRP, FIL, DFC, and DFD commands can also be used to specify frequencies inside of calibration setup sequences. Usage of any of these commands will cause prior calibration data to be lost.

Front Panel Key/Function	Command	Description
Setup Menu key	SETUP	Displays the setup menu.
Options Menu key, Triggers function	HC0	Disable Internal I.F. Calibration.
	HC1	Enable Internal I.F. Calibration.
	HCT	Trigger an Internal I.F. Calibration.
	HCX?	Internal IF calibration enabled/disabled query.
	TEX	Select External Measurement Triggering via rear panel connector.
	TIN	Select Internal Measurement Triggering.
	TXX?	Trigger source query.

NOTE

The HC0 command should be used to disable the internal I.F. calibration when external triggering is used (so that triggers are not missed while the instrument performs an I.F. calibration). The HC1 command can later be used to enable and initiate an immediate I.F. calibration.

4-6 ENHANCEMENT GROUP

The commands listed in Table 4-5 control the data enhancement functions of the 372XXA, which include IF bandwidth, averaging, and smoothing. These functions are the same as those controlled by the 372XXA front panel Enhancement key group.

NOTE

Most of the commands associated with the Options Menu Key are contained in Chapter 9, Special Applications Functions. However, the Triggers and I.F. Cal commands are contained in Table 4-4 in paragraph 4-5, Measurement Control.

Table 4-5. *Enhancemant Functions Control Commands*

Front Panel Function/Key-Group	Command	Description
Avg/Smooth Menu key Data Enhancement function	AOF	Turns off averaging.
	AOF?	Averaging on/off query.
	AON	Turns on averaging.
	AVG *value*	Turns on averaging and sets number of averages to *value*. The maximum averaging value is 4095.
	AVG?	Averaging numbers query.
	SOF	Turns off smoothing.
	SOF?	Smoothing on/off query.
	SON *value*	Turn on smoothing and sets smoothing percentage to *value* (%). The maximum smoothing value is 20 (%).
	SON?	Smoothing number query
Video IF BW key Select Video Bandwidth function	IFA, IF4	Selects maximum I.F. bandwidth (10 kHz).
	IFM, IF1	Selects minimum I.F. bandwidth (10 Hz).
	IFN, IF3	Selects normal I.F. bandwidth (1 kHz).
	IFR, IF2	Selects reduced I.F. bandwidth (100 Hz).
	IFX?	I.F. bandwidth query.

Chapter 5
Calibration Functions

Table of Contents

Chapter 5
Calibration Functions

5-1 INTRODUCTION

This chapter describes the 372XXA error correction (calibration) functions. It describes the commands used to perform the following:

- □ Specify the calibration method, type, standards, and parameters.
- □ Control the calibration data-taking process.

NOTES

- See Measurement/Test Signals Group for a description of the flat test port power calibration commands.
- The 372XXA VNA calibration functions require operator intervention. However, it is possible to use the external controller to guide the operator through the calibration process using a suitable program containing the calibration commands described in this chapter.

5-2 RELATED COMMANDS

Related, non-calibration commands used during the calibration process are described in Table 5-1. The use of these commands, in relation to calibration activities, is described throughout this chapter, where appropriate. These command sets are fully described in their respective chapters as indicated in Table 5-1.

NOTE

See **ICx** and **OCx** series commands in the Data Transfer group (Chapter 7) for information on inputting and outputting calibration terms coefficients (error terms).

Table 5-1. *Related Commands*

Command	Command Function Group
FHI, FLO, FME NP51–NP1601	Measurement Group, Data Points (Ch 4)
SRT, STP, CWF, DFQ, DFD, FRS, FRI, FRP, FIL, FRC	Measurement Group, Frequency (Ch 4)
IFV, ICx, OCx	Data Tranfer Group (Ch 7)
*OPC, *OPC?	IEEE 488.2 Group, Synchronization (Ch 7)

Command	Command Function Group
All	Measurement, Test Signals (Ch 4)
All	Display, Graph Type (Ch 4)
All	Display, Scaling (Ch 4)
AVG, AOF. AON	Enhancement, Averaging (Ch 4)
IFA, IFN, IFR, IFM, IF1–IF4	Enhancement, Video IF Bandwidth (Ch 4)
CH1–CH4	Channels Group (Ch 4)

5-3 REQUIRED COMMAND SEQUENCE

A program used to control the calibration process *must* follow a specific order for the GPIB calibration commands that are used. Table 5-2 lists this acceptable order.

Table 5-2. Calibration Command Ordering

Order	Item	Typical Commands Used
1	Calibration Type	C12, C8R, C8T, CRB, CRF, CRR, CBT, CFT, CRT
2	Calibration Method	SCM, OCM, LCM
3	Line Type	LTC, LTW, LTU
4	Isolation Usage	ISN, ISF
5	Data Points	NOC, DFC, TDC, CWC
6	Frequency:*	
	Sweep	SRT, STP
	Discrete Fill	DFQ, DFD, FRS, FRI, FRP, FIL, FRC,
	User Defined List**	IFV
	CW	
7	Test Port Connector	P1C, P2C
	Connector Type	CMS, CFS, CMK, CFK, CMV, CFV, CMC, CFC, CM2, CF2, CMN, CFN, CM3, CF3, CNG
	User Defined Connector	CND, COO, COS, CC0, CC1, CC2, CC3
	Offset-Short Values	SH1, SH2
8	Reflection Pairing	MAT, MIX
9	Load Type/Parameters	SLD, BBL, BBZ
10	Through Parameters	TOL, TLZ
11	LRL Band	LR2, LR3
12	LRL Parameters	RM1, RRP, LL1, LL2, LL3, LM2, LM3, BPF, ROL, RLZ, RGZ
13	Reference Impedance	LLZ
14	Test Signals*	PWR, SA1, TA2
15	Flat Test Port Calibration *	PSP, PTS, SFC, FP0, FP1
16	Microstrip Parameters	U10, U15, U25, USW, SBT, SBD, USE, USZ
17	Waveguide Param's	WKI, WKD, WCO, WSH1, WSH2
18	Begin Calibration (Data Collection)	BEG
19	Take Cal Data	TCD, TC1, TC2
20	Next Cal Step	NCS

* Refer to Chapter 4, "Measurement Group" for details on these commands.
** See Chapter 7, Measurement Points Data Transfer Commands) CWF

5-4 FUNCTIONAL COMMANDS LISTING

Commands used for special types of calibrations are described in Table 5-3. The commands are used to invoke options and non-standard calibration procedures, and to simulate a calibration process. (Refer to Figures B-1 through B-4 in Appendix B for fron panel menu numbers, e.g. C1, C2, C2D, etc.)

Table 5-3. Functional Commands Listing (1 of 3)

Front Panel Key/Menu	Command	Function	Description
Begin Cal, Menu C1	NOC	Specify Normal Sweep Calibration	This command sets up a normal frequency range calibration.
Begin Cal, Menu C2D	DFC	Specify Discrete Frequency Calibration	This command sets up a calibration at discrete frequencies only. Use discrete fill commands to input frequency list for calibration. Refer to Chapter 4, Measurement Functions, paragraph 4-4. Alternatively, the IFV command allows for a frequency list input of calibration frequencies. Refer to "Data Transfer Commands Group (Chapter 7)," for more details.
Begin Cal, Menu C1	CWC	Specify CW Calibration	This command sets up a *continuous wave* (CW) calibration. Use CWF to input CW frequency.
Begin Cal, Menu C5C	P1C, P2C	Set up to Specify Port 1 (PIC) or Port 2 (P2C) Standards	This command specifies Port 1 or Port 2 as the port to which subsequent connector-related commands will apply. Example: **"P1C;CFK;P2C;CMK"** This sequence of commands sets up a female K connector for port 1 (P1C CFK) and a male K connector for port 2 (P2C CMK).
Begin Cal, Menu C4_P1 or _P2	CND	Other Connector Specification	This command allows a non-standard connector to be specified. This is the same as selecting OTHER from the front panel menu. When specifying the CND command, the connector offset for the open and/or short device and the capacitance coefficients for the open device also need to be entered to characterize the connector.
Begin Cal, Menu C6	SLD, BBL	Specify Sliding Load or Broad Band Load for Calibration	Thie SLD command specifies a sliding load. The data-taking process for the load includes six slide positions. If any frequencies are below 2 GHz, you *must* also use a broadband load.
Begin Cal, Menu C18A	LM2, LM3		These commands are used to select a match for the second or the third device respectively during a LRM type calibration.

Table 5-3. Functional Commands Listing (2 of 3)

Front Panel Key/Menu	Command	Function	Description
None	A12, A8T, A8R, ARF, AFT, ARB, ARR, ABT, ART	Calibration simulation	These commands simulate the completion of a calibration. The Axx series commands must be followed with the corresponding calibration error term coefficients using the ICx commands (see Chapter 7). The Axx series commands match up with corresponding calibration type commands. For example, A12 simulates C12, A8T simulates C8T, etc. **NOTE** If you attempt to apply a calibration without first having entered calibration coefficient data, the error correction may not be applied (as indicated by the Apply Cal LED being momentarily turned on, then off).
Apply Cal	CON, COF	Turn on/off vector error correction	These commands are not used during calibration. They are used during normal measurements to apply the current calibration error correction to the measured data (CON) or to turn off error correction calibration (COF).
Begin Cal	BEG, TC1, TC2, TCD, NCS, KEC, RPC	Calibration Sequencing and Control commands	These commands are used to start and control the data-taking process. KEC will keep existing calibration error corrections and return to the measurement mode. Command TC1 takes calibration data for the current (calibration) standard for port 1 using a separate forward measurement sweep. Command TC2 performs the same function for port 2 using a separate (reverse) sweep. (Note that command TCD performs these identical operations, using consecutive forward and reverse measurement sweeps.) Using the TC1 and TC2 commands allows one calibration standard of each type to be used for both ports.
Begin Cal Menus C16 and C16A	U10, U15, U25	Calibration Kit selection commands	These commands are used to select 10, 15, or 25 mil UTF calibration kits respectively. These calibration kits are used to perform a 372XXA calibration for microstrip device measurements.

5-5 EXAMPLE PROGRAM

The following is an example of how to set up a calibration sequence for the 372XXA VNA:

"SCM;LTC;C12;DFC;FRS 1.0 GHZ;FRI 100 MHZ;FRP 41 XX1; FIL;DFD;P1C;CFK;P2C;CMK;BBL;BEG"

This example code sets up a calibration using standard calibration mode (SCM), coax cable media (LTC), and 12-term calibration type (C12). A discrete set of points is defined for frequency operation starting at 1 GHz (FRS 1.0 GHZ), spaced 100 MHz apart (FRI 100 MHZ), at 41 consecutive points (FRP 41 XX1). This range is confirmed or "filled" (FIL), then completed (DFD).

The Port 1 test port connector is defined as a female type K connector (P1C CFK) and the Port 2 test port connector is defined as a male K type connector (P2C CMK). Broadband loads are selected as the default load type (BBL). The BEG command instructs the 372XXA to begin the calibration-data-taking-process.

The calibration control program should contain commands to control the data-collection portion of the calibration process. Typical commands used for this process are:

- Take Calibration Data for Current Standard (**TCD**, or **TC1**, or **TC2**)
- Go on to the Next Calibration Step (**NCS**)
- Averaging On and Set to Value (**AVG**)
- Set IF Bandwidth to 10 Hz (**IF1**)
- Set IF Bandwidth to 100 Hz (**IF2**)
- Set IF Bandwidth to 1 KHz (**IF3**)
- Set IF Bandwidth to 10 KHz (**IF4**)
- Any Graph Type Specification or Scaling Change
- Active Channel Specification (**CH1–CH4**)

The TCD (or **TC1**, or **TC2**) and **NCS** commands control the data-taking process. Commands **AVG, IFN, IFR, IFA**, and **IFM** control the data-enhancement function used for a particular measurement (refer to Chapter 3, paragraph 5-6, Enhancement Commands).

Before the **TCD** (or **TC1**, or **TC2**) and **NCS** commands are invoked in the program, the system operator must be instructed to perform the *exact* steps necessary to setup the calibration sequence for the type of 372XXA calibration to be used. An example program segment to continue the 12-term calibration started in the previous example is shown on the next page. This example program segment is written in HP-BASIC.

The calibration control program should determine if the 372XXA is ready for the next step of the calibration sequence before prompting the system operator to connect new calibration standards to the test ports. This can be done by monitoring the status byte of the 372XXA or by waiting for the operation to complete after executing the **NCS** command.

For example, the commands in the following example instruct the 372XXA to take calibration data (**TCD**), go to the next calibration step (**NCS**), then output the number "1" (***OPC?**). When the controller is able to read the number "1" from the 372XXA, the calibration step is complete.

```
260 OUTPUT 706;"TCD;NCS;*OPC?"
270 ENTER 706; N$ ! READ AND DISCARD ASCII '1' WHEN STEP IS COMPLETE
280 DISP "CALIBRATION STEP COMPLETE"
```

5-6 FLAT TEST PORT CALIBRATION

Signal source power correction data produced during this type of 372XXA calibration is used to flatten the signal power output from the test set port(s) over a specified frequency range. This feature is used to provide flat test stimulus signals to the device-under-test while performing normal measurements.

This process requires operator intervention. The system operator is guided through a sequence of operations and measurements that make up the flat test port calibration sequence. Before attempting to write a GPIB controlled program to produce this calibration sequence, first become thoroughly familiar with the manual procedure.

Flat test port calibrations require considerable time to perform. The time required is dependent upon the number of points selected; For these calibrations, the GPIB timeout value must be increased accordingly, or the control program must generate an appropriate time delay before executing subsequent commands. See the documentation for your GPIB controller for timeout-setting procedures.

The commands listed in Table 5-4 are used to invoke and control flat test port calibrations. (Refer to Figures B-1 through B-4 in Appendix B to correlate front panel menus and menu numbers, e.g. **C1, C2, C2D**, etc.)

Table 5-4. Flat Test Port Power Commands

Front Panel Key/Menu	Commands	Description
Begin Cal, Menu CAL_SU8	PSP	Selects the number of power measurement sweeps (1 – 5) that are to be performed during the calibration. The external power meter measures the power at each frequency point during each sweep. The data for each frequency point measured is averaged. The more sweeps used, the flatter the signal will be; however, significantly more time will be required.
	PSP?	Output number of sweeps for flat test port power correction.
	PTS	Selects the number of frequency points (1 – 65) to be skipped between each measured point on the power measurement sweep. It therefore determines the number of points measured on each sweep .
	PTS?	Skipped points for flat test port power calibration query.
	SFC	Starts the flat test port calibration sequence.
Begin Cal, Menu CAL_SU2	FP1	Causes the flat test port power correction data to be used during normal measurement mode.
	FP0	Turns off the flat test port power correction for normal measurement mode.
	FPX?	Flat power ON/OFFstatus query.

5-7 CALIBRATION COMMANDS, LISTING

Table 5-5 provides a listing of the commands used to perform measurement calibrations. Unless otherwise noted, all front panel menus mentioned in Table 5-5 are accessed by first pressing the Begin Cal key. (Refer to Figures B-1 through B-4 in Appendix B to correlate front panel menus and menu numbers, e.g. C1, C2, C2D, etc)

Table 5-5. Calibration Commands (1 of 5)

Front Panel Key/Menu	Command	Description
Menu C5, 5A	A8R	Simulate 8-term (reverse-path) calibration
	A8T	Simulate 8-term (forward-path) calibration
	A12	Simulate 12-term calibration
	ABT	Simulate transmission-frequency response (forward and reverse paths) calibration
	AFT	Simulate transmission-frequency response (forward path) calibration
	ARB	Simulate reflection (forward and reverse paths) calibration
	ARF	Simulate reflection (forward-path) calibration
	ARR	Simulate reflection (reverse path) calibration
	ART	Simulate transmission-frequency response (reverse path) calibration
	C8R	Select 8-term (reverse-path) calibration
	C8T	Select 8-term (forward-path) calibration

Table 5-5. Calibration Commands (2 of 5)

Front Panel Key/Menu	Command	Description
Menu C5, 5A (Continued)	C12	Select 12-term calibration
	CBT	Select transmission frequency response (forward and reverse paths) calibration
	CFT	Select transmission frequency response (forward path) calibration
	CRB	Select reflection (forward and reverse path) calibration
	CRT	Select transmission frequency response (reverse path) calibration
	CRF	Select reflection (forward path) calibration
	CRR	Select reflection (reverse path) calibration
	BBZ	Enter broadband load impedance for calibration
Menu C3	BBL	Select broadband load for calibration
Begin Cal key	BEG	Begin calibration data-collection steps
Menu C18B	BPF	Break point frequency for 3 line LRL only
Menu C12_P1 or _P2	CC0 –CC3	Enter capacitance coefficients 0-3 for open for user-specified connector
Menu C4_P1 or _P2 or C4A_P1 or _P	CF2	Select female 2.4 mm connector for current port
	CF3	Select female GPC-3.5 connector for current port
	CFC	Select female TNC connector for current port
	CFK	Select female K connector for current port
	CFN	Select female Type N connector for current port
	CFS	Select female SMA connector for current port
	CFV	Select female V connector for current port
Menu C4_P1 or _P2 or C4A_P1 or _P	CM2	Select male 2.4 mm connector for current port
	CM3	Select male GPC-3.5 connector for current port
	CMC	Select male TNC connector for current port
	CMK	Select male K connector for current port
	CMN	Select male Type N connector for current port
	CMS	Select male SMA connector for current port
	CMV	Select male V connector for current port
	CMX?	Calibration method query
	CND	Select user-specified connector for current port
	CNG	Select GPC-7 connector for current port
Apply Cal key and menu	COF	Turn off vector error correction
	CON	Turn on vector error correction
	CON?	Vector error correction on/off query
Menu C12A_P1 or _P2	COO	Enter offset for open for user-specified connector
	COS	Enter offset for short for user-specified connector

Table 5-1. Calibration Commands (3 of 5)

Front Panel Key/Menu	Command	Description
Menu C2D	CSF?	Calibration start frequency query
	CTF?	Calibration stop frequency query
Menu C1	CWC	Select CW frequency calibration data points
Menu C11	CXX?	Calibration type query
Menu C1	DFC	Select discrete frequency calibration data points
	DFD	Done specifying discrete frequency ranges
	DFQ	Enter single discrete frequency
Menu C2D	FIL	Fill defined discrete frequency range
Menu CAL_SU2	FP0	Turn flat test port correction data usage off
	FP1	Turn flat test port correction data usage on
C2D	FRC	Clear all defined frequency ranges
	FRI	Set discrete frquency fill range increment frequency
	FRP	Set discrete frequency fill range number of points
	FRS	Set discrete frequency fil range start frequency
Menu C5D	ISF	Exclude isolation
Menu C5D	ISN	Include isolation
Menu C11	KEC	Keep existing calibration data
Menu C11A	LCM	Select LRL calibration method
Menu C18A	LL1	Enter length of line 1 for LRL calibration
Menu C18A	LL2	Enter length of line 2 for LRL calibration
Menu C18A	LL3	Enter length of line 3 for 3 line LRL calibration
Menu C17	LLZ value	Enter reference impedance for calibration
Menu C18B	LM2	Select a match for the second device during a LRM type calibration
Menu C18B	LM3	Select a match for the third device during a LRM type calibration
Menu C18B	LR2	Specify 2 line LRL
Menu C18B	LR3	Specify 3 line LRL
Menu C11A	LTC	Select coaxial transmission line for calibration
Menu C11A	LTU	Select microstrip transmission line for calibration
Menu C11A	LTW	Select waveguide transmission line for calibration
Menu C11	LTX?	Calibration transmission line type query
Menu C11A	MAT	Select matched calibration reflection measurement sequence
Menu C11A	MIX	Select mixed calibration reflection measurement sequence (standard)
Menu C11 and others	NCS	Go on to next calibration step
Menu C2	NOC	Select normal calibration data points

Table 5-5. Calibration Commands (4 of 5)

Front Panel Key/Menu	Command	Description
Menu C11A	OCM	Select offset short calibration method
Menu C3	P1C	Select port 1 for connector specification
	P1C?	Port 1 connector specification query
	P1P?	Port 1 power query
Menu C3	P2C	Select port 2 for connector specification
Menu CAL_SU8	PSP	Select number of power measurement sweeps for flat test port calibration
	PTS	Select number of frequency points to be skipped during power measurement sweep for flat test port calibration
Menu CAL_SU8	PTS?	Skippped points for flat-test-port-power calibration query
Menu C19	RGZ	Select reflective device greater than Z0 (LRL)
Menu C19	RLZ	Select reflective device less than Z0 (LRL)
Menu C18	RM1	Select reference plane at line 1 midpoint (LRL)
Menu C19	ROL	Enter reflective device offset length for LRL calibration
Menu C11	RPC	Repeat previous calibration
Menu C18	RRP	Select reference plane at reflection plane (LRL)
Menu C16A	SBD	Enter substrate dielectric for microstrip calibration
Menu C16A	SBT	Enter substrate thickness for microstrip calibration
Menu C11A	SCM	Select standard calibration method
Menu CAL_SU8	SFC	Start flat test port calibration sequence
Menu C14	SH1	Set offset short 1 offset length
Menu C14	SH2	Set offset short 2 offset length
Menu C3A	SLD	Select sliding load for calibration
Menu C5C	TC1	Take calibration data for current standard on test port 1 (only)
Menu C5C	TC2	Take calibration data for current standard on test port 2 (only)
Menu C5C	TCD	Take calibration data for current standard (both test ports)
Menu C1	TDC	Select time domain harmonic frequency calibration data points
Menu C20	TLZ	Enter throughline impedance for calibration
Menu C20	TOL	Through offset length
Menu C16	U10	Select 10 mil UTF calibration kit for calibration for microstrip device measurements
Menu C16	U15	Select 15 mil UTF calibration kit for calibration for microstrip device measurements
Menu C16	U25	Select 25 mil UTF calibration kit for calibration for microstrip device measurements
Menu C16A	USE	Enter effective dielectric for microstrip calibration
Menu C16A	USW	Enter microstrip width for microstrip calibration
Menu C16A	USZ	Enter microstrip impedance for microstrip calibration
Menu C15A	WCO	Set waveguide cutoff frequency for user-defined kit

Table 5-5. Calibration Commands (5 of 5)

Front Panel Key/Menu	Command	Description
Menu C15	WKD	Select user-defined waveguide calibration kit
Menu C15	WKI	Select installed waveguide calibration kit
Menu C15A	WSH1	Set waveguide short 1 offset length
	WSH2	Set waveguide short 2 offset length

Chapter 6
Markers and Limits Functions

Table of Contents

Chapter 6 Markers and Limits Functions

6-1 INTRODUCTION

This chapter describes markers and limits commands. These commands perform the same functions as the 372XXA front panel Markers/Limits key group.

NOTE

A diagram showing the 372XXA front panel keys and associated menu sequencing flow diagrams are provided in Appendix B.

6-2 MARKERS

The commands listed in Table 6-1 (next page) control the location and display of the markers and the functions related to the markers. A full description of each command mnemonic is contained in Chapter 10, Command Dictionary.

A marker is turned on whenever any of the following conditions occur:

- ☐ When the marker is set to a value.

  Example: `"MK2 20 GHZ"`

- ☐ When the marker is selected for readout.

  Example: `"MR2"`

- ☐ When the marker is selected as the delta reference marker (left).

  Example: `"DR2 4.5632 GHZ"`.

MMN and MMX Commands — The MMN and MMX commands move the active marker to the minimum and maximum trace values on the active channel, respectively. There must be an active marker selected for these command to execute.

Example: `"WFS;MR1;MMX"`

This code instructs the 372XXA to:

Wait for a full sweep of data to be present (WFS).

Turn on marker 1 and select it for readout (MR1).

Move marker 1 to the maximum value of the trace on the active channel (MMX).

Table 6-1. Marker Commands (1 of 2)

Front Panel Function	Command	Description
Set Markers	AMKR	Select active marker on all channels marker mode
	BWL3	Set 3 dB for bandwidth loss value
	BWLS (value)	Enter bandwidth loss value
	BWLS?	Output bandwidth loss value
	DRF	Turns delta reference mode on.
	DRO	Turns delta reference mode off.
	DRO?	Delta reference marker mode on/off query
	DRX?	Delta reference marker number query
	DSF0	Disable automatic filter shape factor calculation
	DSF1	Enable automatic filter shape factor calculation
	DSFX?	Output automatic filter shape factor calculation enabledisable status
	DSQ0	Disable automatic filter Q calculation
	DSQ1	Enable automatic filter Q calculation
	DSQX?	Output automatic filter Q calculation enable/disable status
	FLTBW?	Output filter bandwidth
	FLTC?	Output filter center frequency
	FLTL?	Output filter loss at reference value
	FLTQ?	Output filter Q
	FLTS?	Output filter shape factor
	FMKR	Select filter parameters marker mode
	M1C-M6C M1E-M6E M1S-M6S	Sets marker 1-6 sweep CW frequency. Sets marker 1-6 sweep/zoom end frequency, time or distance. Sets marker 1-6 sweep/zoom start frequency, time or distance.
	MK1 (*value*) –MK6 (*value*)	Turns on marker 1-6 and sets to frequency (or time/ distance) value (which is limited to current sweep/zoom range).
	MK1?–MK6?	Marker 1-6 frequency query
	MMN	Sets active marker to minimum trace value
	MMX	Sets active marker to maximum trace value
	MO1-MO6	Turns off marker 1-6
	MOF	Sets Marker display off
	MON	Sets Marker display on
	MON?	Markers displays on/off query
	MSFH (value)	Enter high loss value for shape factor calculation
	MSFH?	Output high loss value for shape factor calculation
	MSFL (value)	Enter low loss value for shape factor calculation

Table 6-1. Marker Commands (2 of 2)

Set Markers (continued)	MSFL?	Output low loss value for shape factor calculation
	MSR0	Select 0 as ref for marker search and bandwidth calculation
	MSRD	Select delta ref marker as ref for marker search and bandwidth calculation
	MSRM	Select max as ref for marker search and bandwidth calculation
	MSRX?	Output ref selection for marker search and bandwidth calculation
	NMKR	Select normal markers on active channel marker mode
	SMKR	Select marker search marker mode
	SRCH (value)	Enter marker search value
	SRCH?	Output marker search value
	XMKR?	Output marker mode
Select Delta Reference Marker	DR1-DR6	Selects marker 1 - 6 as delta reference marker.
Turn Marker On	MR1-MR6	Turns marker 1-6 on and makes it the active marker.
	MR1?-MR6?	Outputs marker 1-6 on/off status
	MRX?	Output active marker number
	MKRC	Select interpolated marker functionality
	MKRD	Select discrete marker functionality
	MKRX?	Output interpolated/discrete marker functionality
	MKSL	Marker search left
	MKSR	Marker search right
	MKT0	Turn marker tracking off
	MKT1	Turn marker tracking on
	MKTX?	Output marker tracking on/off status

6-3 LIMITS

The Limits commands perform the functions that are available via the front panel Limits key (Marker/Limits key group). Figure 6-1 shows the relationship between the major limits commands and the single and segmented limits displays. The various limits commands are listed as follows:

The general Limits Control commands are listed in Table 6-2. (next page).

The Non-segmented (single) Limits Commands are described on the next page and listed in Table 6-3.

The Segmented Limit Commands are listed in Table 6-4.

The Limits Pass/Fail Testing Commands are listed in Table 6-5.

NOTE

The Limits commands apply to the currently selected active channel. Refer to commands CH1–CH4 in Chapter 4, "Channel Group."

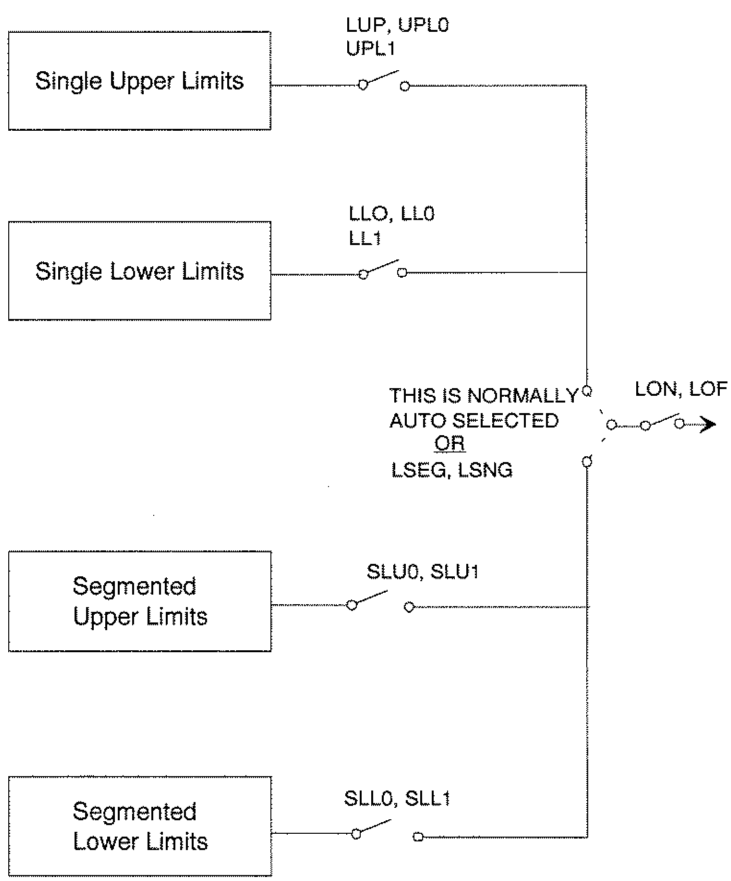


Figure 6-1. *Relationship Between Limits Commands and Limits Displays*

Table 6-2. Limits Control Commands (General)

Front Panel Key/Function	Command	Description
Limits Key, Single or Segmented Limits Functions	LLM?	Output limit line display mode status (non-segmented/segmented).
	LOF	Turns limits display off.
	LON	Turns limits display on.
	LON?	Limits display ON/OFF status query.
	LSEG	Select segmented limit lines display mode.
	LSNG	Select non-segmented limit lines display mode.

Single (Non-Segmented) Limits

The Non-Segmented Limits Commands (Table 6-3) do the following:

- Set up the upper and lower limit values for the active channel.
- Set the limit delta for the limit frequency readout function. The range of values and allowable terminator mnemonics are dependent on the graph type of the active channel, much like the SCL and REF commands.

The LFR, LFP, and LFD commands that define limit frequency readouts, are only available on the following graph types: log magnitude (MAG), log magnitude and phase (MPH), phase (PHA), linear magnitude (LIN), linear magnitude and phase (LPH), standing wave

Table 6-3. Non-Segmented (Single) Limits Commands

Front Panel Key/Function	Command	Description
Limits key, Single Limits function	LFD *value*	Sets limit frequency read-out delta value
	LFD?	Limit frequency readout delta value query.
	LFP	Selects limit frequency read-out for phase displays.
	LFR	Selects limit frequency read-out for active channel.
	LLO *value*	Turns on lower limit and set to value.
	LLO?	Lower limit for active channel query.
	LOL0	Turn off lower limit on active channel.
	LOL1	Turn on lower limit at current value on active channel.
	LOLX?	Lower limit ON/OFF query.
	LUP *value*	Turns on upper limit and set to value.
	LUP?	Upper limit value query for active channel.
	UPL0	Turn off upper limit for the active channel.
	UPL1	Turn on upper limit for the active channel.
	UPLX?	Upper limit ON/OFF query.

ratio (SWR), and group delay (DLA). The active channel must be a frequency domain channel. The LFP command can be used to select phase limit frequency readouts on log magnitude and phase and linear magnitude and phase graph types.

To change values for the LFD, LLO, and LUP commands for the bottom graph of two graph display, use the appropriate suffix mnemonic as shown below:

Graph Type	Appropriate Suffix Mneumonic
Log Mag / Phase	DEG / RAD
Lin Mag / Phase	DEG / RAD
Real / Imag	IMU

Segmented Limits Segmented limits (Table 6-4) allow different upper and lower limit values to be set at up to ten segments across the measurement range.

Table 6-4. *Segmented Limits Commands (1of 2)*

Front Panel Function	Command	Description
Limits key, Segmented Limits function	BEGN	Begin next segment and make it the active segment limit.
	ATTN	Attach next segment and make it the active segmented limit.
	CAS	Clear active segmented limit for vertical/horizontal start/stop definitions.
	DIS	Display active segmented limit. Requires SLA or SLL/SLU as appropriate.
	DIS?	Active segmented limit displaly ON/OFF status query.
	HID	Hide active segmented limit.
	LSX?	Active segment number query.
	LS1–LS10	Select the active segmented lower limit on the active channel
	SLC	Clear all segmented limit definitions.
	SLH *value*	Set segmented limits horizontal offset.
	SLH?	Segmented limits horizontal offset query.
	SLL0	Turn lower segment limits display off.
	SLL1	Turn lower segment limits display on.
	SLLX?	Lower segment limit display on/off status query.

Table 6-4. Segmented Limits Commands (2 of 2)

Front Panel Function	Command	Description
Limits key, Segmented Limits function (Continued)	SLU0	Turn upper segment limits display off.
	SLU1	Turn upper segment limits display on.
	SLUX?	Upper segment limit displaly ON/OFF status query.
	SLV *value*	Set segmented limits vertical offset.
	SLV?	Segmented limits vertical offset query.
	SPH *value*	Set active segmented limit horizontal stop position.
	SPH?	Active segmented limit horizontal stop position query.
	SPV *value*	Set active segmented limit vertical stop position.
	SPV?	Active segmented limit vertical stop position query.
	STH *value*	Set active segmented limit horizontal start position.
	STH?	Active segmented limit horizontal start position query.
	STV *value*	Set active segmented limit vertical start position.
	STV?	Ative segmented limit vertical start position query.
	US1–U10	Select the active segmented upper limit.

Limits Example: This example makes limit 2 the active segment, sets its vertical start to 10 dB, its horizontal start to 10 GHz, its vertical stop to 12 dB, its horizontal stop to 16 GHz, and sets it to display on the 372XXA screen.

"SL02;SPV 10 DBL;STH 10 GHZ;SPV 12 DBL;SPH 16 GHZ; SLA;SLL;DIS"

Limits Pass/Fail Testing

Limits pass/fail testing commands are listed in Table 6-5. These commands are used to produce a beep and/or a TTL voltage at the rear panel External I/O connector when a measurement exceeds any of the set limits (refer to the 372XXA Operation Manual).

NOTE

Pass/fail testing, when turned on, will generate an SRQ (if enabled) whenever a test failure occurs. Refer to Chapter 7, "Status Reporting" for details.

Table 6-5. *Limits Pass / Fail Testing Commands*

Front Panel Function	Command	Description
Limits key, Test Limits function	LB0	Turns off limits pass/fail testing beeper.
	LB1	Turns on limits pass/fail testing beeper.
	LBX?	Output limits pass/fail testing beeper ON/OFF status.
	LPF?	Limit test failure status all channels query
	LPF1?	Limit test failure status on Channel 1 query
	LPF2?	Limit test failure status on Channel 2 query
	LPF3?	Limit test failure status on Channel 3 query
	LPF4?	Limit test failure status on Channel 4 query
	LT0	Turn off limits pass/fail testing.
	LT1	Turn on limits pass/fail testing.
	LT1?	Output limits testing ON/OFF status.
	LTST	Display the limits testing menu
	LVH	Turn on limits pass/fail testing, rear panel TTL high voltage output.
	LVL	Turn on limits pass/fail testing, rear panel TTL low voltage output.
	LVX?	Limits pass/fail testing, TTL level setting query

Chapter 7 Remote-Only Functions

Table of Contents

Table of Contents (Continued)

Chapter 7
Remote-Only Functions

7-1 INTRODUCTION

This chapter describes 372XXA GPIB functions that support operations typically required when in remote mode:

- □ Data transfers (paragraphs 7-2 through 7-8)
- □ Error reporting, including the Service Log (paragraphs 7-9 through 7-11)
- □ Status reporting (paragraphs 7-12, 7-13)
- □ IEEE 488.2 Common commands (paragraph 7-14)
- □ Synchronization commands (paragraph 7-15).

7-2 DATA TRANSFER PROTOCOL BASICS

There are several basic ideas associated with transferring data between your controller and the 372XXA. This paragraph introduces data transfer terminology, message terminator and separator characters, and data transfer methods (protocols) used by the 372XXA.

GPIB Messages

A GPIB message is any information sent over GPIB to a device. This includes instrument commands or data that you send to or receive from the 372XXA.

Program Message (PM)

This is the message string that your controller *sends to* the 372XXA.

The message can contain commands, queries (or other requests for data transfer), and data strings.

Response Message

This is the data your controller *receives from* the 372XXA.

The data can contain ASCII or binary represented numerical values, character strings or other arbitrary ASCII data, and 372XXA internally represented binary strings.

Separation and Termination Methods

Termination and separation protocols of messages transmitted over the GPIB are specified by the IEEE 488.2 GPIB Standard. The 372XXA conforms to those specifications as described below.

Message Elements Separator

A program or response message can consist of one or more elements, called units. Units are separated with the semi-colon (;) character.

Units in a program message are complete valid 372XXA commands or queries. For example, "**CH1;PHA;SRT 2 GHZ;SRT?**" consist of four commands or queries that make channel 1 active, set it to phase display, sets start frequency to 2 GHz, then outputs the start frequency.

A single unit in a response message is the complete data output in response to a single command. For example, the command sequence "**ONP;CHX?**" - Output Number of Points and Output Currently Active Channel, will output a response message that contains two units separated by a semi-colon (;). The first unit of data is the response to the **ONP** command. The second unit of data is the response to the **CHX?** query.

Message Unit Data Separator

The comma (,) character separates multiple ASCII data elements of a single command or response message unit. For example, the command **OM1** - Output Marker 1 Value, will output a complex data value (two values, i.e., dB and degrees) representing the measurement data at the marker. The two values in the complex data will be separated with a comma.

Message Terminator

A complete program or response message is terminated by sending the linefeed character (0A, or decimal 10) at the same time (concurrent with) setting the EOI state on the GPIB. The notation <0A^END> will be used throughout this Programming Manual to reference the message terminator. Simply put, the message terminator signals the end of transmission.

NOTE:

EOI is the GPIB End of Transmission state that is set by the controller, or an instrument, when it is done "talking", i.e. done sending a message on the GPIB and therefore releasing the GPIB for use by another device.

Separation and Termination Example

The following example shows how a program message with multiple units is sent to the 372XXA. Also shown is the response message the 372XXA will send back to the controller.

PROGRAM MESSAGE (to 372XXA):

"CH2;LPH;MK6 2.5 GHZ;OM6;OFV".

This program message makes channel 2 active (**CH2**), sets it to linear magnitude and phase display (**LPH**), activates and sets marker 6 to 2.5 GHz (**MK6 2.5 GHZ**), outputs its value (**OM6**), then outputs the list of current sweep frequencies (**OFV**).

Response message elements:

<marker 6 dB value>**,**<marker 6 degrees value>**;**<frequency list header> <frequency 1>**,**<frequency 2>**,**...**,**<frequency 101>**<0A^EOI>**

NOTE:
The (< >) characters in this message elements list are not actually transmitted in the response message; they are shown here in the text to distinguish the various data fields from each other.

A representative response from a Model 37225A:

**1.00620877743E+00,-3.65609092712E+01;#418
174.00000000000E+7,1.74600000000E+08,...
...,1.35000000000E+100A**

Response Description:

OM6 outputs 2 ASCII data items (dB,degrees). They are sent separated with a comma (**,**).

The output of **OM6** and **OFV** is separated with a semicolon (**;**). This was done because the external controller requested two outputs before reading the first one from the 372XXA.

NOTE:
Note that certain data transfer commands require that you read their output before another data output command is sent [see <Arbitrary ASCII> format and <Arbitrary Block> format (Example 3), in paragraph 7-3].

The **OFV** command outputs data using the <Arbitrary Block> format (see description in paragraph 7-3.) The frequency values are preceded by a <frequency list header> (#41817). This is an ASCII text string that is encoded with the number of 8-bit bytes to follow. This data transmission method, used by the **OFV** and other 372XXA block data transfer commands, allows you to prepare an appropriate size memory block to receive the data in your application.

The first frequency value (4.00000000000E+7) is then transmitted immediately after the header followed by a comma. This continues until all 101 frequency values are transmitted.

NOTE:
The commas are used because the values are in ASCII format. If binary format was selected (see **FMA**, **FMB**, **FMC** format commands, paragraph 7-3), the frequency values would have been sent without commas.

The linefeed character (**0A**) signals the end of transmission at the end of the response message. The end of transmission (EOI) is set by the 372XXA at the same time the linefeed is sent and thus the GPIB is released for use by another device.

7-3 DATA TRANSMISSION METHODS

Data transmissions to and from the 372XXA conform to the protocols specified by the IEEE 488.2 GPIB Standard. The 488.2 Standard specifies how any data, such as ASCII numbers, strings, or blocks of data bytes, will be transmitted over the GPIB. This paragraph describes the various transmission methods in use by the 372XXA.

The transmission method names described below (also called notations) will be used throughout the Programming Manual when describing specific 372XXA data transfer commands.

Data transmission notations are easily distinguished in text as they are always shown surrounded by the "less than" and the "greater than" characters (< >). The transmission type notations used in describing various 372XXA data transmissions are:

For ASCII numbers, the notations are:

<NR1>, <NR2>, <NR3>, or <NRf>

For ASCII strings (printable characters and print formatting codes), the notation is:

<ASCII String>

For generic (7-bit) ASCII characters, the notation is:

<ASCII Block>.

For generic binary bytes, (i.e. 8-bit ASCII or binary), the notation is:

<Arbitrary Block>

<NR1>

This notation represents ASCII integer values. A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR1> notation:

1
0
-29,179

<NR2>

This notation represents ASCII floating point values in decimal point format. A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR2> notation:

1.0
-0.00015
12.743,-180.07

<NR3>

This notation represents ASCII floating point values in exponential format (scientific notation). A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR3> notation:

1.0E9
-7.056E3
9.0E-2,3.42E2

<NRf>

This notation is used to signify that data can be in either <NR1>, <NR2>, or <NR3> format as described above.

Examples of values that can be represented by <NRf> notation:

1.0E-9
10.005
-83,4.5E2,-234.9901

<String>

This notation represents a string of 7-bit ASCII characters (including non-printable characters) that is delimited (surrounded) with either single quotes (' ') or double quotes (" "). The string can include text formatting characters such as linefeed, space, or carriage return.

Note that if a double quote character must be sent as part of the string, then it must be followed by an additional double quote. Alternatively, the string can be sent using single quotes (See "cal_file" example below.)

Examples of data represented by <String> notation:

"1/15/98"
"Save ""cal_file"" now."
'Save "cal_file" now.'

<Arbitrary ASCII>

This notation represents undelimited 7-bit ASCII text. The end of the text must be terminated with the 0A character (decimal 10) and concurrent setting (^) of the GPIB End of Transmission State (EOI). This requirement makes it necessary for <Arbitrary ASCII> text to be transmitted only at the end of a program or response message, i.e. at the end of a multiple input or output statement.

Example of data represented by <Arbitrary ASCII> notation:

Wiltron,37247A,123456,1.0<0A^EOI>

The example shows a sample response from the *IDN?, 488.2 common query. In the example, the instrument identifies itself as a Wiltron 37247A, with serial number 123456, and software version 1.0 installed.

Note that decimal 10 (0A character) must be sent with the EOI to signal end of transmission.

<Arbitrary Block>

This notation represents data that is transmitted as 8-bit data bytes (00–FF hex, 0–255 decimal, notation is <DAB>). This is useful for transmitting large blocks of formatted ASCII or binary data or unformatted binary data. The data stream is immediately preceded by a variable length ASCII header that is encoded with the number of data bytes to be sent. The header always starts with the pound (#) character. Figure 7-1 below describes the header and the transmitted data messages.

#n$m_1..m_n$<DAB>$_1$..<DAB>$_m$

Where:

# = The pound sign character. Required for binary data transfer.
n = Number of digits to follow ($m_1..m_n$) that make up the number m.
$m_1..m_n$ = Taken together, this makes up the number m which is the number of data bytes to follow that constitute the requested data.
<DAB> = An 8 bit binary data byte. This is the data (or information) being sent.

NOTE

If n = 0, then m is omitted, and transmission end is signaled by sending the linefeed character (0A, or decimal 10) and concurrent setting (^) of the GPIB End Of Transmission State (EOI) immediately following the last <DAB>.

Figure 7-1. *<Arbitrary Block> Data Format*

EXAMPLE 1 : #3204<DAB$_1$>...<DAB$_{204}$>

Example 1 shows how 204 8-bit bytes are transmitted using the proper header. The header in this example is comprised of 5 characters (#3204). It begins with with the pound character (#). The next character (3) indicates there are 3 digits to follow that indicate the number of bytes being transmitted (204). The next three characters (204) indicate the number of data bytes being transmitted immediately after the header. Next comes the actual data bytes, or information, being transmitted (<DAB$_1$>...<DAB$_{204}$>).

EXAMPLE 2: #512808<DAB$_1$>...<DAB$_{12808}$>

Example 2 shows how 12808 8-bit bytes are transmitted using the proper header. The header in this example is comprised of 7 characters (#512808). It begins with with the pound character (#). The next character (5) indicates there are 5 digits to follow that indicate the number of bytes being transmitted (12808). The next five characters (12808) indicate the number of data bytes being transmitted immediately after the header. Next comes the actual data bytes, or information, being transmitted (<DAB$_1$>...<DAB$_{12808}$>).

NOTE:

Examples 1 and 2 above demonstrate the <Arbitrary Block> form referred to as <*Definite* Length Arbitrary Block>. It is so called because the number of data bytes being transmitted is *known* from the encoded header.

EXAMPLE 3: #0<DAB$_1$>...<DAB$_n$><0A^EOI>

Example 3 shows how an *unknown* number of 8-bit bytes are transmitted using the proper header. The header in this example is comprised of 2 characters (#0). As usual, the header begins with the pound character (#). The next character (0) indicates there is an unknown number of data bytes being transmitted immediately after the header. Next comes the actual data bytes being transmitted (<DAB$_1$>...<DAB$_n$>). The end of the data stream is signaled by sending the linefeed character (0A, or decimal 10) and concurrent setting (^) of the GPIB End of Transmission State (EOI).

NOTES:

- Example 3, above, demonstrates a special form of the <Arbitrary Block> referred to as the <*Indefinite* Length Arbitrary Block>. It is so called because the number of data bytes being transmitted is unknown, and therefore can not be encoded in the header. Instead, the header *always* consists of the pound and zero characters (#0) and end of the data stream is *always* signaled by sending the linefeed character (0A, or decimal 10) and concurrent setting (^) of the GPIB End of Transmission State (EOI). This requirement makes it necessary for <*Indefinite* Length Arbitrary Block> text to be transmitted only at the end of a program or response message, i.e. at the end of a multiple input or output statement.

- When using this method to input data you must not exceed the 372XXA input buffer size (refer to Chapter 1, Table 1-2.)

7-4 SELECTING ASCII OR BINARY DATA FORMAT

The following paragraphs divide 372XXA data transfers into two categories:

- Data transfers *involving* numerical data arrays.
- Data transfers *not involving* numerical data arrays.

Non-Numerical Data Arrays

The formats used for data transfers *not* involving numerical data arrays are preset. They always occur in either binary format or ASCII format, depending on the data.

These data transfers include a variety of information. Examples include: instrument setup strings, marker data, queries, and disk directory listings. See the desired data transfer command description for its applicable data transfer format.

Numerical Data Arrays

Numerical data array transfers are used to transfer the following types of data:

- Measurement data
- Calibration data
- Sweep frequency, time, or distance values.

Each of these data transfer types are individually explained in following paragraphs.

You can select either binary or ASCII format for data transfers involving numerical data arrays. The five commands described below will select and keep the format for all subsequent transfers (these commands are also listed and described in Table 7-1).

ASCII Format:

FMA: ASCII formatted values represented in <NR1>, <NR2>, <NR3>, or <NRf> formats as described in paragraph 7-2. The 372XXA will accept any of the above formats as input. It will *always* output values using <NR3> exponential format with each value represented using 17-18 characters, plus a comma to separate multiple values.

Binary Format:

FMB: Each *eight* consecutive data bytes represent one floating point value in IEEE 754 64 bit format, i.e., a double precision, 8 byte, floating point value.

FMC: Each *four* consecutive data bytes represent one floating point value in IEEE 754 32 bit format, i.e., a single precision, 4 byte, floating point value.

MSB: Byte ordering is *most* significant byte first. For use only with FMB and FMC. This the default byte ordering mode for the 372XXA.

LSB: Byte ordering is *least* significant byte first. For use with FMB and FMC. This is required for transferring data to/from Intel/IBM based computers.

7-5 372XXA DATA TRANSFER COMMANDS LISTINGS

Table 7-1 is an alphabetical listing of all data transfer commands. Tables 7-2 through 7-4 list these commands separately, with each table listing the commands for a particular data transfer type. These tables are located with the explanatory paragraphs.

A Note On Query Commands

Query commands are a special form of data transfer commands. They are used to query (or output) a variety of 372XXA setup parameters. For example, **SRT?** will output the current sweep start frequency. Query command mnemonics typically closely resemble the corresponding setup command mnemonic but with an added question mark (?). For example, **CH1** is used to set the active channel to channel 1, **CHX?** is used to query the currently active channel setting. Query commands are listed in their respective Command Function Group chapter. For example, since **SRT?** queries a Measurement Function, it will be listed in Chapter 4, Measurement Group.

Error And Status Reporting Commands

Commands associated with transferring error and status reporting data are described in detail in paragraphs 7-9 and 7-12 respectively.

Table 7-1. *Alphabetical Listing of All 372XXA Data Transfer Commands (1 of 2)*

Command	Brief Description	Allowable Data Formatting
FMA	Select ASCII data transfer format	N/A
FMB	Select IEEE-754 64-bit data transfer format	N/A
FMC	Select IEEE-754 32-bit data transfer format	N/A
IC1 – IC12	Input calibration coefficient 1-12	FMA, FMB, FMC
ICA , ICB, ICC	Input calibration coefficient 10, 11, 12	FMA, FMB, FMC
ICD	Input corrected data for S-parameter of active channel	FMA, FMB, FMC
ICF	Input information for front panel setup *and* calibration	None - Always Binary
ICL	Input all 12 calibration coefficients	FMA, FMB, FMC
IFD	Input final (display format) data for S-parameter on active channel	FMA, FMB, FMC
IFP	Input information for current front panel setup	None - Always Binary
IFV	Input frequency list	FMA, FMB, FMC
IS1–IS10	Input information for front panel setup string 1-10	None - Always Binary
LSB	Select least significant byte first format for binary data transfers. For use only with FMB and FMC commands	N/A
MSB	Select most significant byte first format for binary data transfers. For use only with FMB and FMC commands	N/A

Table 7-1. Alphabetical Listing of All 372XXA Data Transfer Commands (2 of 2)

Command	Brief Description	Allowable Data Formatting
OAM1	Output channel 1 active marker value	None - Always ASCII
OAM2	Output channel 2 active marker value	None - Always ASCII
OAM3	Output channel 3 active marker value	None - Always ASCII
OAM4	Output channel 4 active marker value	None - Always ASCII
OC1 – OC12	Output calibration coefficient 1–12	FMA, FMB, FMC
OCA, OCB, OCC	Output calibration coefficient 10–12	FMA, FMB, FMC
OCD	Output corrected data for S-parameter of active channel	FMA, FMB, FMC
OCF	Output front panel setup *and* calibration string	None - Always Binary
OCL	Output all 12 calibration coefficients	FMA, FMB, FMC
ODR	Output floppy disk directory	None - Always ASCII
ODRH	Output hard disk directory	None - Always ASCII
ODV	Output distance values for time domain measurements	FMA, FMB, FMC
OFD	Output final (disp. format) data for S-parameter on active channel	FMA, FMB, FMC
OFP	Output current front panel setup string	None - Always Binary
OFV	Output measurement frequency values	FMA, FMB, FMC
OID	Output instrument identification string (see paragraph 7-14, commands *OPT? and *IDN)	None - Always ASCII
OM1 – OM6	Output marker 1-6 value in display format.	None - Always ASCII

NOTE

Use MK1?-MK6? to output marker frequency. Refer to Chapter 6, "Data Analysis", for further details.

Command	Brief Description	Allowable Data Formatting
ONE	Output number of error messages stored in Service Log	None - Always ASCII
ONP	Output number of points currently being measured	None - Always ASCII
ORD	Output raw data for S-parameter on active channel	FMA, FMB, FMC
OS1 – OS10	Output stored front panel setup string 1-10	None - Always Binary
OTV	Output time values for time domain measurements	FMA, FMB, FMC

7-6 SWEEP MEASUREMENT POINTS DATA TRANSFER

The Sweep Measurement Points Data Transfer Commands are listed in Table 7-2. These commands are described in the following paragraphs.

The OFV command

Output Frequency Values, will output the current sweep measurement frequencies.

The OTV command

Output Time Values, and the **ODV** command - Output Distance Values, will output the current time domain sweep measurement points.

The IFV command

Used to input a user defined set of frequencies for measurement or calibration.

CAUTION:

The **IFV** command will delete the existing sweep frequency list and replace it with the newly input list. Therefore all existing calibration data will be lost.

The ONP command

Output Number of Points, can be used to allocate enough memory in your program to receive the measurement frequencies. For example, sending **"ONP;OFV"** to the 372XXA when a 401 data point sweep is in progress will output the ASCII value 401. This value can now be used to set up an array of the correct size to receive the output of the **OFV** command.

Table 7-2. *Sweep Measurement Points Data Transfer Commands*

Command	Brief Description	Allowable Data Formatting
ODV	Output distance values for time domain sweep points	FMA, FMB, FMC
IFV	Input frequency list	FMA, FMB, FMC
OFV	Output measurement frequency values	FMA, FMB, FMC
ONP	Output number of points currently being measured	None - Always ASCII
OTV	Output time values for time domain measurement points	FMA, FMB, FMC

Sweep Measurement Points Data Transfer Example

The following is an example of Sweep Measurement Points Data Transfer commands usage:

"NP101;FMB;LSB;OFV"

These commands will perform the following functions:

NP101 will set up a 101 point sweep.

FMB will output data using 64-bit (eight bytes) floating-point format.

LSB causes data bytes to be output least significant byte first. This is for compatibility with INTEL/IBM based computer/controllers. If using other types of controllers that represent data in most significant byte format, then use the **MSB** command.

OFV uses the <Arbitrary Block> format. It will output the current list of measurement frequencies, f_1 thru f_{101}, using eight bytes each. The ASCII header (#3808), which shows that 808 data bytes follow, precedes the frequency values. The linefeed character (0A, decimal 10) signals the end of the data block.

EXAMPLE:

#3808<f_1, 8 bytes>...<f_{101}, 8 bytes>**0A**

NOTE:

The (< >) characters are not output from the 372XXA. They are used in the text above to distinguish each frequency's 8 byte segments.

7-7 CALIBRATION COEFFICIENTS DATA TRANSFER

The Calibration Coefficients Data Transfer commands are listed in Table 7-3. These commands are described in the following paragraphs.

The **OCx** and **ICx** commands provide for outputting and inputting calibration error terms (coefficients). The **ONCT** command outputs the number of error terms available for the currently set calibration. For example, **ONCT** would output the number 12 for a 12-Term calibration and 2 for a Transmission Frequency Response calibration. The ordering of the calibration error terms for the various calibration types is shown in Chapter 11, Table 11-3. For example, to output the ETF error term from a 12-Term calibration use the **OC4** command.

The **ICx** commands are used to input user defined calibration error terms. The 372XXA must be prepared to accept the appropriate calibration error terms using the Simulate Calibration commands, such as **A12**, **A8T**, etc.. These commands use the same mnemonic syntax as their related calibration selection commands (which are used to actually perform a calibration), except they start with the letter "A" instead of "C". For example, the **A12** command is used to simulate a 12-Term calibration where as the command **C12** is used to actually perform a 12-Term calibration. Similarly, the **A8T** command is used to simulate a 1 Path 2 Port FWD calibration where as the command **C8T** is used to actually perform a 1 Path 2 Port FWD calibration. Refer to Chapter 11, Table 11-3 and to Chapter 5, Calibration Functions for more information about calibration coefficients, and performing calibrations.)

Calibration error terms (coefficients) are output, or expected as input, only for the currently defined set of sweep frequencies. If data points are not at the maximum values set during calibration and/or the frequency range has been zoomed-in (with error correction turned on), not all calibration coefficients will be output or used as input. Refer to paragraph 7-6, Sweep Measurement Points Data Transfer, for details on outputting the current sweep measurement points.

If an attempt is made to transfer an unavailable calibration error term, i.e.,the EXR term from a Reflection Only calibration, the 372XXA will issue an Execution Error (refer to paragraph 7-9, The 372XXA Error Reporting System.)

Calibration Coefficients Data Transfer Example

The following is an example usage of Calibration Coefficients Data Transfer commands:

"NP101;ONCT;FMB;LSB;OC1"

These commands will perform the following functions:

NP101 will set up a 101 point sweep. This is only allowed if the calibration was done with at least 101 points in the sweep.

ONCT will output the number 12, since there are 12 error terms in a 12-term calibration.

The 372XXA will then output a semi-colon (**;**) to separate the **ONCT** output data from the oncoming **OC1** data.

FMB will output the calibration data using 64-bit (eight bytes) floating-point format.

LSB causes data bytes to be output least significant byte first. This is for compatibility with INTEL/IBM based computer/controllers. If using other types of controllers that represent data in most significant byte format, then use the **MSB** command.

OC1 uses the <Arbitrary Block> format. It will output 101 real and imaginary data pairs (202 values). Each two consecutive values, 8 bytes each, represent the error term EDF at each measurement point. The total number of bytes expected (1616) is encoded in the ASCII header (#41616). The linefeed character (0A, decimal 10) signals the end of the data block.

EXAMPLE:

12**;**#41616<f_1 EDF real, 8 bytes> <f_1, EDF imaginary, 8 bytes>
<f_2 EDF real, 8 bytes> <f_2, EDF imaginary, 8 bytes>...
....<f_{101}, EDF real, 8 bytes> <f_{101}, EDF imaginary, 8 bytes>**0A**

NOTES:

- The (< >) characters shown in the example are not output from the 372XXA. They are used in the text above to distinguish each 8 byte data segments.
- Note the number 12, output in response to the **ONCT** command, and the semi-colon separator, that precede the EDF data output.

Your program can now iteratively issue and output the remaining 11 error terms using the commands **OC2, OC3**, ..., **OC12**.

Table 7-3. *Calibration Coefficients Data Transfer Commands*

Command	Brief Description	Allowable Data Formatting
IC1 – IC12	Input calibration coefficient 1-12	FMA, FMB, FMC
ICA, ICB, ICC	Input calibration coefficient 10–12	FMA, FMB, FMC
OC1 – OC12	Output calibration coefficient 1–12	FMA, FMB, FMC
OCA, OCB, OCC	Output calibration coefficient 10, 11, 12	FMA, FMB, FMC
OCL	Output all 12 calibration coefficients	FMA, FMB, FMC
ONCT	Output number of cal terms for current calibration	None - Always ASCII

7-8 MEASUREMENT DATA TRANSFER

The Measurement Data Transfer commands are listed in Table 7-4. These commands are described in the following paragraphs.

Table 7-4. Measurement Data Transfer Commands

Command	Brief Description	Allowable Data Formatting
DPR0	Turn **off** outputting of data pairs for single graph data types only (when using OFD/IFD command)	N/A
DPR1	Turn **on** outputting of data pairs for single graph data types only (when using OFD/IFD commands)	N/A
ICD	Input corrected data for S-parameter on active channel	FMA, FMB, FMC
IFD	Input final (display format) data for S-parameter on active channel	FMA, FMB, FMC
OAM1–OAM4	Output active marker value on channel indicated	None - Always ASCII
OCD	Output corrected data for S-parameter on active channel	FMA, FMB, FMC
OFD	Output final (disp. format) data for S-parameter on active channel	FMA, FMB, FMC
OM1 – OM6	Output marker 1-6 value in display format. NOTE: Use MK1?-MK6? to output marker frequency. Refer to Chapter 6, Data Analysis, for more details.)	None - Always ASCII

The measurement data transfer commands are used to transfer S-parameter values to or from the currently active channel. Only the currently set number of measurement points will be output or expected as input. Refer to paragraph 7-5, Sweep Measurement Points Data Transfer, for details on outputting the current sweep measurement points.

The **OAM1-OAM4, OFD/IFD** and **OM1-OM6** commands - Output/Input Final Display Formatted Data or marker value, transfer data values in the currently selected graph type units. If a dual graph type is displayed, such as Log Magnitude and Phase, the data for each measurement point will be a pair of values. In the case of Log Magnitude and Phase, the data pair would be (dB value, degrees value). If a single graph type is displayed, such as Log Magnitude only, the data for each measurement point will be a single value, in this case (dB value).

The **DPR1** command - Data Pair Format On, modifies the **OAM1-OAM4, OFD/IFD** and **OM1-OM6** commands to transfer a complex data pair *when in a single graph type* display (i.e., Phase only). Necessarily though, since it was not an actually measured value, the additional value will be set to zero. The output values for each graph type selection for both the DPRx modes are listed in Table 7-5 (page 7-19).

NOTE:

The **DPR1** format will remain in effect until the 37200A receives the **DPR0** command - i.e., Data Pair Format Off. **This** mode is the default data transfer format.

For example, if the current graph type is Phase only, "**DPR1;OFD**" would output data pairs in the same format as if Magnitude and Phase dual graph type was currently displayed, but with the magnitude value set to zero (0, degrees value). Similarly, if the current graph type is Log Magnitude only, "**DPR1;OFD**" would output data pairs in the same format as if the Magnitude and Phase dual graph type was currently selected, but with the phase value set to zero (dB value, 0).

Table 7-5. *Output Value vs Graph Display Types*

Graph Display Type	Data Units and Ordering	
	w/DPR0	w/DPR1
Log magnitude	dB	dB, 0
Phase	degrees	0, degrees
Log mag & phase	dB, degrees	dB, degrees
Linear magnitude	Rho or Tau, degrees	Rho or Tau, 0
Linear mag & phase	Rho or Tau, degrees	Rho or Tau, degrees
Smith chart	Ohms	Ohms, j-Ohms
Inverted Smith	Siemens	Siemens, j-Siemens
Group delay	Seconds	Seconds, 0
Log polar	dB, degrees	dB, degrees
Linear polar	Rho or Tau, degrees	Rho or Tau, degrees
Real	Real	Real, 0
Imaginary	Imag	0, imag
Real & Imaginary	Real, imag	Real, imag
SWR	SWR	SWR, 0

The **DPR1** functionality is useful in developing a single data transfer procedure in your application program for processing all data output commands; since they mostly transfer a data pair. This includes the **OAM1-OAM4, OFD**, **IFD**, and **OM1-OM6** measurement data transfer commands discussed here, and the **ICx** and **OCx** series commands (refer to paragraph 7-7, Calibration Coefficient Data Transfer).

NOTE

Use the **MK1?-MK6?** queries to output the marker frequency. Refer to Chapter 4, Data Analysis, for full details on Markers.

The **ORD** command - Output Raw Data, and the **OCD/ICD** commands - Output/Input Corrected Data, all transfer data in real and imaginary pairs (real value, imag value). Raw data is uncorrected measurement data from a sweep without a calibration applied. Corrected data is measurement data which has been corrected according to the currently applied calibration type.

When S-parameter data input to the 372XXA is complete (**ICD** and **IFD**) the 372XXA redraws the parameter on the active channel using this data.

NOTE:
Always place the 372XXA in hold (**HLD**) prior to inputting data using the **IFD** or **ICD** commands. This is to prevent the newly input data from being overwritten by subsequent sweeps.

Measurement Data Transfer example

The following is an example usage of Measurement Data Transfer commands:

"NP101;CH2;MAG;TRS;WFS;HLD;FMC;LSB;OFD"

NP101 will set up a 101 point sweep. If a calibration is applied, this will only be allowed if the calibration was done with at least 101 points.

CH2 makes channel 2 the active channel for all subsequent channel specific commands.

MAG displays S-parameter data in Log Magnitude format on the active channel.

TRS triggers a new sweep.

WFS waits for a full sweep to ensure the data is valid. A full sweep is a complete forward sweep and a complete reverse sweep when a 12-term calibration is applied. It also includes time/distance data processing time if in time domain mode.

NOTES:
- You must wait for two full consecutive sweeps after first connecting a device, and prior to outputting data, when a 12-term calibration is applied, i.e.,"**WFS;WFS**".
- Set your controller's time out value high enough to allow the sweep to complete. Refer to Chapter 2 for more details.

HLD places the 372XXA in hold.

NOTE
Prior to being placed in HOLD, a channel must be displayed on the 372XXA — if calibration is not applied, and if you wish to output data from that channel.

FMC will output data using 32-bit (four bytes) floating-point format. The measurement data can be read directly into a floating point array dimensioned to 101 elements.

LSB causes data bytes to be output least significant byte first. This is for compatibility with INTEL/IBM based computer/controllers. If using other types of controllers that represent data in most significant byte format, then use the **MSB** command.

NOTE

It is good practice to always preface a data transfer command with the desired format command(s) every time it is used, i.e., "`FMC;LSB;OFD`", even if they were already set. This will help make your program more readable and easier to maintain and update in the future.

OFD uses the <Arbitrary Block> format. It will output 101 final measurement data values using the active channel's displayed graph units (dB). Each measurement value is represented using 4 bytes. The ASCII header (#3404), which shows that 404 data bytes follow, precedes the measurement values. The linefeed character (0A, decimal 10) signals the end of the data block. EXAMPLE:

#3404<f_1, dB, 4 bytes> <f_2, dB, 4 bytes>....
....<f_{101}, dB value, 4 bytes>**0A**

NOTE:

The (< >) characters are not output from the 372XXA. They are used in the text above to distinguish each 8 byte data segments.

The following shows the data stream if **"FMA;DPR0;OFD"** had been sent instead of **"FMC;LSB;OFD"**. This produces the data in ASCII format. The **DPR0** is default mode, but it is sent anyway to insure previous data transfers did not change the setting. Note the header is now #41892, signifying that 1892 data bytes follow. EXAMPLE:

#418921.611913055E+01,5.22284173965E+01,..
....,4.74120521545E+01**0A**

The following response shows the data output if **"FMA;DPR1;OFD"** had been sent instead of **"FMC;LSB;OFD"**. Note that inclusion of **DPR1** while in a single graph type display (**MAG**, magnitude in this case) will double the array size, by sending data pairs for each measurement point. Note also that the additional value is set to zero since the data for it was not measured. Refer to text above for complete details. Note the header is now #43731, signifying that 3731 data bytes follow. EXAMPLE:

#437311.611913055E+01,0.00000000000E+00,5.22284173965E+01,
0.00000000000E+00,.....,4.74120521545E+01,0.00000000000E+00**0A**

7-9 THE 372XXA ERROR REPORTING SYSTEM

The 372XXA implements a number of error reporting tools to assist you in detecting, reporting, and handling errors and other events in your application program. These tools will also prove invaluable to you during development of your application program. The tools are summarized below:

- Status Registers that you set to trigger an interrupt (or service request - SRQ) on many events such as GPIB errors, measurement data pass/fail testing, and end of calibration process. Refer to paragraph 7-12, Status Reporting, for complete details.
- A time ordered Service Log that stores errors and other important system information in non-volatile memory. The Service Log can easily be accessed via GPIB and from the front panel.
- A GPIB error message structure that contains the last two GPIB errors encountered. This includes details on the program message element that caused the error.

Error Reporting Actions

The following summarizes the actions taken by the 372XXA when it detects an error:

An audible beep is issued to attract the operators attention.

An error message temporarily appears on the display.

An error message, with date and time and other details, is written in the Service Log (refer to paragraph 7-10 for details.) This is *non-volatile* storage, meaning it will survive a power down of the 372XXA.

An error message string will also be saved internally in the GPIB software's Error Structures (refer to paragraph 7-11 for details.) This is *volatile* memory storage, meaning it will be lost when the 372XXA is powered down.

The appropriate bit in the Standard Events Status Register is set, and if enabled, a Service Request (SRQ) will be generated (refer to paragraph 7-12 for details.)

GPIB Error Messages

Refer to Chapter 12 for a complete list of 372XXA error messages and their descriptions.

372XXA errors reported in the Service Log include four errors which are detected by the internal GPIB Parser software during remote operation:

7204 GPIB Command Error

7205 GPIB Execution Error

7206 GPIB Device Specific Error

7207 GPIB Query Error

These errors are typically generated as a result of incorrectly programming the 372XXA. A detailed description of the errors and the data they provide in the Service Log and the GPIB Error Structures follows.

NOTE:

Use the 372XXA error reporting mechanisms to effectively detect and handle error conditions, both during development and when preparing your finished application program .

Each of the GPIB errors will further provide a more precise sub-message of the specific condition that caused the error. Refer to Chapter 12, Table 12-3 for a complete list of these sub-messages and their descriptions.

"7204 GPIB Command Error"

These are errors in the syntactical correctness of a command, its numeric data entry element, or its data entry terminator code (or suffix mnemonic). As the internal GPIB command parser synchronization can be lost with this type of error, execution of the remainder of the program message is aborted.

If the command error was detected while executing a defined device trigger command sequence (refer to ***DDT** command, Chapter 10), execution of the remainder of the defined device trigger sequence will be aborted.

"7205 GPIB Execution Error"

These errors occur when a syntactically correct command fails to execute properly due to the command's parameters being out of range or not appropriate for the current instrument state.

"7206 GPIB Device Specific Error"

These errors occur when a command that is free of command and execution errors, fails to execute due to some unexpected instrument condition such as running out of memory.

"7207 GPIB Query Error"

These errors occur when the external controller attempts to read data from the 372XXA output buffer when either no data is available or data in the output buffer is lost.

7-10 THE SERVICE LOG

The 372XXA implements a non-volatile record of errors detected during front panel and GPIB operation in a Service Log. The log contains error messages along with the date and time and additional details about the error.

The Service Log can be viewed from the front panel Enhancement key group. Press the Option Menu key, then select DIAGNOSTICS and READ SERVICE LOG soft menus.

Refer to Chapter 8, System Functions, for details on Service Log action commands such as printing, clearing, and saving it to disk.

Service Log Output Commands

Service Log data can be output via GPIB in two ways depending on the degree of detail desired about the errors. The commands listed in Table 7-6 will output all types of error messages. Refer to paragraph 7-11 for outputting *only* GPIB errors and their related details.

NOTE:
The Service Log error messages will remain stored, i.e., they will not be deleted, when output via GPIB commands.

The **ONE** command - Output Number of Errors, can be used to periodically check to refer to if the 372XXA detected a new error without having to use SRQ interrupts. The **OEL** command - Output Error List can then be used to output all the error messages in the Service Log. This is an ASCII text, comma separated list of all the error messages in the Service Log. The output is in <Arbitrary Block> format (refer to paragraph 7-2, Data Transfer Protocol Basics, for details.) In the example below, the list is preceded by the output header (#42960), the words ERROR LOG, the current date and time, then the error list.

EXAMPLE:

#42960ERROR LOG 01/23/95 19:18,
7205 GPIB EXECUTION ERROR, ...

The **OSL** command - Output Service Log, is used to output the complete contents of the Service Log. The output is in ASCII text format, so it can be saved directly to a file for later viewing and analysis. The Service Log output includes:

System identity information such as model, serial number, and software version

System statistics such as total operational hours, initial turn on date and time, and current date and time

List of all error messages with date and time of occurrence and other pertinent information.

Table 7-6. *Error data transfer Commands*

OGE	Output extended description of latest GPIB error	None - Always ASCII
OGL	Output extended description of previous GPIB error	None - Always ASCII
ONE	Output number of error messages stored in Service Log	None - Always ASCII
OEL	Output list of error messages	None - Always ASCII
OSL	Output Service Log	None - Always ASCII

The Service Log output will look similar to the Service Log as viewed from the front panel menus (Option Key, DIAGNOSTICS, READ SERVICE LOG). The only difference is each line of text in the Log as output via **OSL**, will be comma separated from the other lines of text.

GPIB Error Entries Description

This paragraph describes details of Service Log GPIB error entries. Use this information to assist in application program development and to handle GPIB errors in your program.

There are two types of service log entries made in response to GPIB errors (errors 7204, 7205, 7206, 7207):

- ☐ The first type is 4 lines long and is made when a program message is currently being parsed and executed (the error can then be associated with a particular command within the message).
- ☐ The second type is only 3 lines long and is made when there is no currently active program message.

Service Log entries, description:

LINE 1:

The type of error, i.e.

7204 GPIB COMMAND ERROR

7205 GPIB EXECUTION ERROR

7206 GPIB DEVICE DEPENDENT ERROR

7207 GPIB QUERY ERROR

LINE 2:

The date and time of the error:

11/14/95 09:26

LINE 3:

For a 3 line service log entry

This line contains only a verbal description of the error:

No response data available

For a 4 line service log entry

The description is followed by an index number which is used to interpret line 4:

Faulty program mnemonic syntax, 13

LINE 4:

This line (approximately 47 characters long) will contain as much of the currently active program message as is possible. The index number from line 3 represents the position of the parser's command pointer when the error occurred. (1 is the first character).

For example, the program message below generated a command error when the parser reached the beginning of the faulty mnemonic CH5 (only **CH1-CH4** are valid). The parser index is placed at position 13 to indicate the the location of the faulty command referenced to the beginning of the line.

CH1;WFS;ASC;CH5;WFS;ASC

1 13

If the program message is longer than 47 characters, then, as much as possible of the message segment that contained the error will be displayed. The index number in line 3 will be adjusted automatically such that 1 always refers to the first displayed character.

If the error was detected while executing a defined device trigger command sequence (refer to ***DDT** command, Chapter 10), then line 4 will contain as much of the command sequence as possible.

If the error was detected while parsing and converting numeric fields within an <Arbitrary Block> program data element (refer to <Arbitrary Block> in paragraph 7-2), then line 4 will contain as much of the data as possible

7-11 GPIB ERROR STRUCTURES

The 372XXA internal GPIB software task (Parser) maintains a list of the current and the previous GPIB errors that it generated. These two errors along with pertinent details can be output over the GPIB.

Refer to paragraph 7-10, Service Log, if you wish to output all 372XXA errors, including GPIB errors.

NOTE:

Error messages will remain stored, i.e.,they will not be deleted, when output via the GPIB. Use the ***CLS** or **CSB** to clear the errors reported via the **OGE** and **OGL** commands.

The commands **OGE** - Output Current GPIB Error, and **OGL** - Output Previous GPIB Error (Table 7-6) , will output a message in <Arbitrary ASCII> data format (refer to paragraph 7-2 for details.) The data output will contain either 2 or 4 ASCII text fields separated with commas as follows:

<Error Type>,<Error Description>

or,

<Error Type>,<Error Description>,<Index Number>,
<Program Message>

The <Error Type> field will be one of the following:

Command Error

Device Error

Execution Error

Query Error

No errors

The <Error Description> field will contain the same message as reported in LINE 3 of the Service Log GPIB error entry.

The <Index Number> and <Program Message> fields are also included if there is a currently active program message which can be associated with the occurrence of the error. These fields will contain the Index Number and Program Message (refer to LINE 3 and LINE 4 of the Service Log GPIB Error Entry, paragraph 7-10.)

Error Reporting Data Output Example

The following is an example usage of Error Reporting Data Output commands:

"*TST?;ONE;OEL;OGE"

These commands will perform the following functions:

***TST?** will perform a self test and output the pass/fail status (0=pass, 1=fail). If any tests failed, the test number and error message will be written to the Service Log.

ONE will output the number of errors in the Service Log. The **OEL** will output the error message strings. **OSL** will output the complete Service Log text. If the **ONE** indicates there are errors in the Log, you could use the **OSL** command to output a complete copy of the Service Log to file on your computer for later investigation. This is especially useful during a long un-monitored test, where you may want to save all data for failure analysis.

Investigate any errors prior to proceeding with your application program task. If the error is critical, you should contact a qualified Service Person. Note that you can also output and view the Service Log from the front panel (refer to paragraph 7-10, Service Log.)

NOTE:

Errors in the Service Log include certain user errors that may not be actual 372XXA system failures or errors.

For example, some DISK related errors may have been caused by a bad floppy or a floppy of the wrong media type.

Another example is RF POWER UNLEVELED and RF OVERLOAD errors (see Chapter 12), which are produced if the system reset power is exceeded to a point where the system becomes unleveled. This is normal behavior (the 372XXA allows you to set power above reset power to accommodate special needs (refer to **OID** command, Chapter 10, Command Dictionary.)

In fact, the **ONE**, **OEL**, **PWR**, and **P1P?** commands can be used together to check for these errors if you are attempting to find the maximum leveled power setting for a specific frequency range. Refer to Chapter 10, Command Dictionary for command details.

OGE (and **OGL**) can be used to output the GPIB error number, or "No errors" message, if none occurred. This is useful while debugging your application during development for displaying the error on your computer's screen for example. Note that by definition, these errors should not occur on a finished application program or they may be indicative of an error prone application.

7-12 STATUS REPORTING

The following paragraphs describe the 372XXA service request and status reporting model. The 372XXA model implements all mandated and many optional status reporting features specified by the IEEE 488.2 Standard. These include the Standard Event Status Register and two additional event status registers, Service Request Enable Register, and Parallel Poll Enable Register. The 372XXA implements full status and enable registers query capability. A diagram of the 372XXA Status Reporting Model is shown in Figure 7-2 (page 7-29).

Event Status Registers

The 372XXA implements three *Event Status Registers* (ESRs). These are:

Standard Event Status Register (Standard ESR)

Extended Event Status Register (Extended ESR)

Limits Event Status Register (Limits ESR)

ESR bits always reflect the status of their specified 372XXA events (refer to paragraph 7-13, Status Events Description.) The registers are cleared (reset) when output by their respective query or output commands: (***ESR?** - Standard ESR Query, **OEB** - Output Extended ESR, **OLB** - Output Limits ESR). ESRs can also be cleared at any time via the Clear Status commands (***CLS** or **CSB**.)

The overall summary status of each ESR (i.e.,whether or not any of its enabled events have occurred), is reported in the Status Byte Register.

Selecting Events for Status Reporting

The 372XXA *Event Status Enable Registers* (ESERs) allow you to select the specific event, or events, that you want summarized in the Status Byte Register.

The selection of a specific event, or events is done by enabling the desired event's bit. This is done by sending the appropriate ESER command with a binary weighted decimal value of the desired bit pattern.

The following commands are used to set and query ESER values:

***ESE**, ***ESE?** - used to set and query the value of the *Standard* ESER

IEM, **OEM** - used to input and output the value of the Extended ESER

ILM, **OLM** - used to input and output the value of the Limits ESER

Output Queue

The 372XXA Output Queue holds data which was requested by your application program. At any one time, the status of this queue is either empty (no data bytes available), or not-empty (at least one data byte is available.)

The Output Queue status is always reported in the 372XXA Status Byte Register. The Output Queue status bit is automatically set and cleared. The Output Queue is emptied when the last data byte it contains is output to the external controller or when the 372XXA detects a Query Error.

The Status Byte Register

The Status Byte Register is the summary status register of the overall 372XXA status. It can be directly queried for its value. It is also the basis for generating service requests, serial polling operations, and parallel polling operations. The Status Byte Register consists of a single 8-bit byte comprised of:

The Status Byte (bits 0-5, and bit 7), and

The MSS message or the RQS message (bit 6).

The Status Byte (bits 0-5, and bit 7) contain the overall status of the 372XXA. This includes the Output Queue status and the summary status of enabled bits in each event register. Once all enabled bits in an event register are cleared, or the Output Queue is emptied, the corresponding summary bit in the Status Byte Register will be reset.

The Master Summary Status (MSS) message is a single bit summary of the Status Byte (bits 0-5, and bit 7). This means bit 6 will be true if any of the other bits in the Status Byte Register are true, otherwise it will be false. The MSS message is sent in bit 6 when querying the status byte register and when generating the ist message for parallel polling.

The Requesting Service (RQS) message is true if the 372XXA has generated an SRQ, i.e., it requested service. This message is reset automatically when the 372XXA is serial polled. The RQS message is sent in bit 6 if a serial poll is used to output the contents of the Status Byte Register.

Querying the Status Byte Register

The ***STB?** - Status Byte Register Query, allows you to output the contents of the Status Byte Register without having to do a serial poll. When output in this manner, the Status Byte Register will contain the MSS message in bit 6 and the normal Status Byte in bits 0-5, and bit 7.

The ***STB?** query will not change, i.e., reset, the value of the Status Byte (bits 0-5, and bit 7) and the MSS message (bit 6).

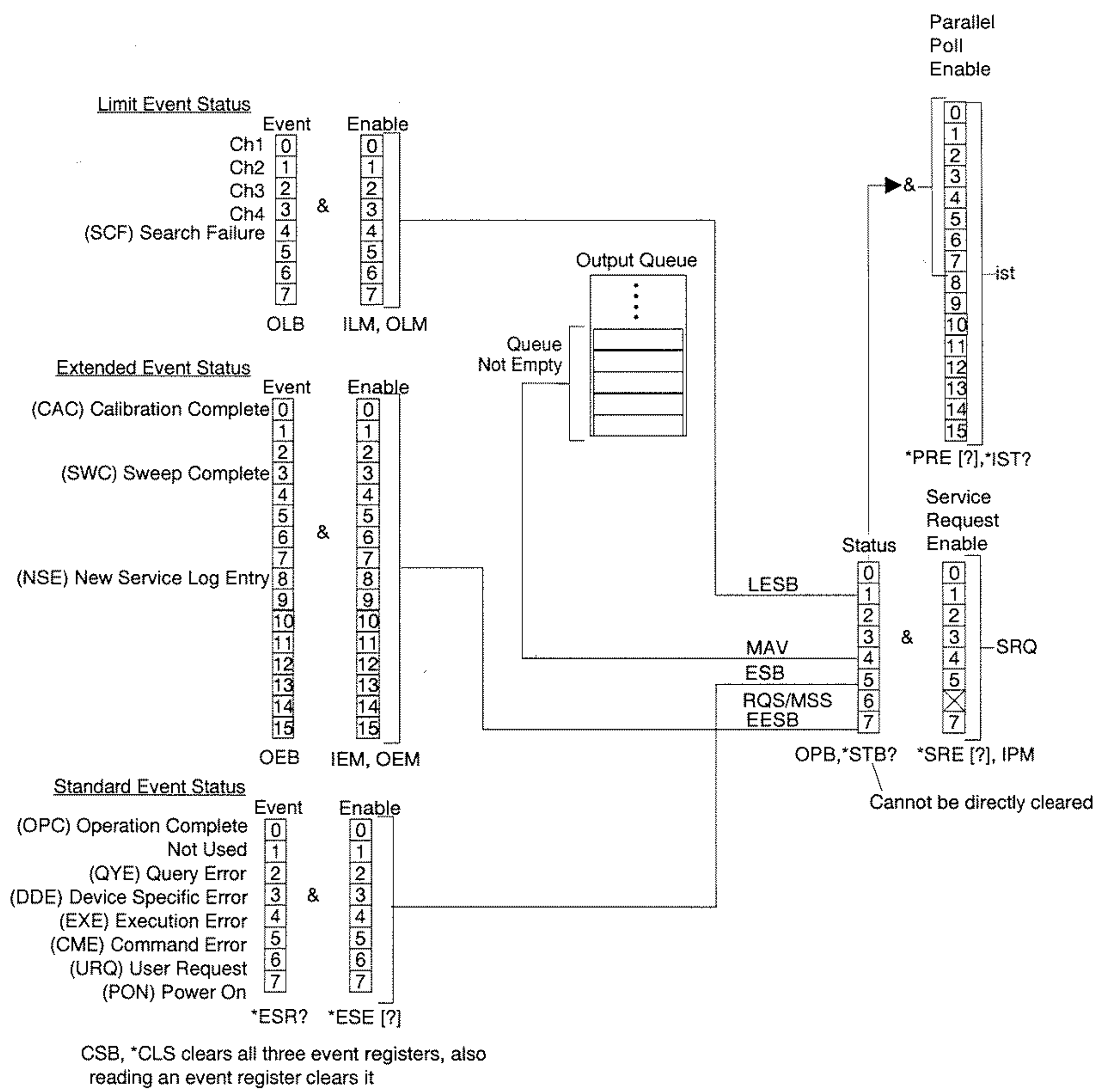


Figure 7-2. *372XXA Status Reporting Model*

Serial Polling the Status Byte Register

Serial Polling the 372XXA can also be used to output the contents of the Status Byte Register. The output will still contain the normal Status Byte in bits 0-5 and 7. The difference is this time the RQS message will be output in bit 6 instead of the MSS message.

It is important to note that serial polling will reset the RQS message in bit 6. This allows the 372XXA to again set the RQS bit true if it has a new reason for requesting service. The value of the Status Byte (bits 0-5, and bit 7) will not be reset or otherwise changed by a serial poll.

SRQ/Service Requests Generation

The 372XXA can be made to request service, i.e. generate an SRQ interrupt, when any of the defined events occur. This is a two step process:

First, you need to enable the desired event (refer to Enabling Status Events)

Second, you need to enable the event's register bit in the Service Request Enable Register.

The ***SRE** and ***SRE?** commands are used to set and query the Service Request Enable Register. Sending "***SRE 0**" to the 372XXA will disable the 372XXA service request.

Parallel Polling the 372XXA

The Parallel Poll Enable Register is used to set the value of the 372XXA parallel poll status bit. This bit corresponds to the 372XXA individual status message (***ist***). The ist message can be output without a parallel poll operation using the *IST? query.

The *ist* message is set true when both of the following are true:

a bit is set true in the Status Byte Register, and,

the corresponding bit is enabled in the Parallel Poll Enable Register.

NOTE:

The MSS message is used in bit 6 of the Status Byte Register (refer to Status Byte Register above.)

The ***PRE** and ***PRE?** commands are used to set and query the Parallel Poll Enable Register. Sending "***PRE 0**" to the 372XXA will set the 372XXA ist message, and therefore the parallel poll status bit, to false, i.e., 0.

Binary Weighted Decimal Values

All the enable commands or query commands described above for status reporting take or return a single argument. This is a binary weighted decimal value representing the sum of all the true (or set) bits in the register.

The binary weighted decimal value of a bit in a register is calculated by raising the number 2 to a power equal to the bit position.

For example, the binary weighted decimal value of bit 4 is arrived at by raising the number 2 to the 4^{th} power ($2^4 = 16$). Similarly, the decimal value of bit 0 is the number 2 raised to the 0 power ($2^0 = 1$).

The total decimal value of a register is the sum of the individual binary weighted decimal values of all enabled, or true bits. In the above example, this would be 16 + 1 = 17.

Status Reporting Commands Example

Following are example usages of Status Reporting commands:

EXAMPLE 1:

"*CLS;TRS;WFS;OEB"

These commands will perform the following functions:

***CLS** will clear all four event status registers.

TRS will trigger a new sweep.

WFS will set bit 4 (SWC) in the Extended Event Status Register when a full sweep is complete.

OEB will output the decimal value of the Extended Event Status Register. This will be the number 8 ($2^4 = 8$).

When a 12-term calibration is applied, a "full sweep" includes a complete forward sweep and a complete reverse sweep, . It also includes time/distance data processing time if in time domain mode.

- Set your controller's time out value high enough to allow the sweep to complete. Refer to Chapter 2 for more details.

EXAMPLE 2:

"*CLS;IEM 8;*SRE 128;TRS;WFS"

These commands will perform the following functions:

***CLS** will clear all four event status registers.

IEM 8 will enable bit 4 (SWC) in the Extended Event Status Register (Extended ESR). This will set bit 7 (the summary status bit for the Extended ESR) in the Status Byte Register when the SWC bit gets set true.

***SRE 128** will cause the 372XXA to issue a service request (SRQ) when the enabled bit in the Extended Event Status Register gets set true.

TRS will trigger a new sweep.

WFS will set bit 4 (SWC) in the Extended Event Status Register when a full sweep is complete. Because of the **IEM** and ***SRE**

that were issued, this will cause the 372XXA to issue a service request (SRQ).

7-13 372XXA STATUS EVENT DESCRIPTIONS

The following paragraphs describe the 372XXA status events functions. Refer to Figure 7-2, 372XXA Status Reporting Model (above) for the definition of bits in each of the three event registers described below. (Refer to paragraph 7-12, Status Reporting, for an operational description of the 372XXA reporting model.)

Standard Event Status Register

This register reports on the following events:

Bit 0:

The Operation Complete bit (OPC) is set true when all pending operations are completed after the ***OPC** command is issued. This is used for synchronization of your application program with 372XXA operations.

Bit 1:

Not used.

Bit 2:

The Query Error bit (QYE) is set true when the 372XXA detects an error when attempting to execute an output or query command. Typically, this is due to requesting output when the Output Queue is empty or if the 372XXA emptied the queue due to an error situation.

The 372XXA will clear (empty) the Output Queue and issue a query error if it receives a program message while data requested by a previous command still remains in the Output Queue.

Bit 3:

The Device Specific Error bit (DDE) is set true when the 372XXA detects an error during execution of a valid 372XXA command and it is not able to complete its execution. An example of this is trying to access a bad floppy disk for read or write.

Bit 4:

The Execution Error bit (EXE) is set true when a valid command's argument is out of the 372XXA range or operational capabilities. This bit is also set when a valid command cannot be executed due to some 372XXA condition such as an option not installed or invalid state for the command.

Bit 5:

The Command Error bit (CME) is set true when the 372XXA Parser detects an invalid command. This is often generated due to unrecognized or invalid command syntax and incorrect use of separators and terminators.

Bit 6:

The User Request bit (URQ) is set true when a front panel key or control is invoked.

Bit 7:

The Power On bit (PON) is set true when the 372XXA is turned on.

Extended Event Status Register

This register reports on the following events:

Bit 0:

The Calibration Complete bit (CAC) is set true when all the steps of an Error Correction Calibration are complete after issuing the **BEG** or **RPC** commands.

Bits 1,2:

Not used.

Bit 3:

The Sweep Complete bit (SWC) is set true when a full sweep is completed after issuing the **WFS** command.

Bits 4-7:

Not used.

Bit 8:

The new service log entry bit (NSE) is set whenever a new error is entered in the service log. It can be used to detect lock failure and unleveled conditions

Bits 9-15

Not used.

Limits Event Status Register

This register reports on the following events:

Bit 0:

The Channel 1 bit (CH1) is set true when a limit line has been exceeded on channel 1 after the LT1 command has been issued.

Bit 1:

The Channel 2 bit (CH2) is set true when a limit line has been exceeded on channel 2 after the **LT1** command has been issued.

Bit 2:

The Channel 3 bit (CH3) is set true when a limit line has been exceeded on channel 3 after the **LT1** command has been issued.

Bit 3:

The Channel 4 bit (CH4) is set true when a limit line has been exceeded on channel 4 after the **LT1** command has been issued.

Bits 4:

The search failure bitr (SCF) is set TRUE when a marker search command (MKSL or MKSE) was issued but the target value was not found.

Bits 5-7:

Not used.

Status Byte Register

This register reports on the following events:

Bit 0:

Not used.

Bit 1:

The Limits Event Status Bit (LESB) is set true if any of the enabled events in the Limits Event Status Register are true.

Bits 2,3:

Not used.

Bit 4:

The Message Available bit (MAV) is set true if the Output Queue contains at least one byte of data. refer to related *OPC?, Operation Complete Query.

Bit 5:

The Standard Event Status Bit (ESB) is set true if any of the enabled events in the Standard Event Status Register are true.

Bit 6:

This bit contains either the Master Summary Status message (MSS) or the Request Service message (RQS), depending on how the Status Byte Register contents are output or used.

Refer to Status Byte Register description in paragraph 7-11.

Bit 7:

The Extended Event Status Bit (EESB) is set true if any of the enabled events in the Extended Event Status Register are true.

7-14 372XXA IEEE 488.2 COMMON COMMANDS

The IEEE 488.2 GPIB Standard specifies a common set of commands to support many standard instrument operations. The mandated and optional common commands implemented in the 372XXA are shown in Table 7-7 below.

These commands are fully described in Chapter 10, Command Dictionary. Further, the commands for status reporting are also described in paragraphs 7-12 and 7-13.

Table 7-7. *IEEE 488.2 Commands*

Command	Function
*CLS	Clear status.
*DDT	Define device trigger command.
*DDT?	Define device trigger query
*ESE	Standard event status enable command.
*ESE?	Standard event status enable query.
*ESR?	Standard event status register query.
*IDN?	Identification query.
*IST?	Individual status query.
*OPC	Operation complete command
*OPC?	Operation complete query.
*OPT?	Options installed query
*PRE	Parallel poll register enable.
*PRE?	Parallel poll register enable query.
*RST	Reset command
*SRE	Service request enable.
*SRE?	Service request enable query.
*STB?	Status byte query
*TRG	Group execute trigger equivalent command
*TST?	Perform self test and output pass/fail result.

7-15 SYNCHRONIZATION COMMANDS

The 372XXA operation can be synchronized with your application program operations using the commands listed in Table 7-8 below. These commands are from various functional groups in the 372XXA GPIB command set. Refer to the appropriate references listed in the table and to Chapter 10, Command Dictionary, for more details.

These commands are helpful in many operations related to outputting data, waiting for the sweep and the display to be updated, and many others. Where applicable, these commands are referenced and shown used in examples throughout the Programming Manual.

Table 7-8. *372XXA Synchronization Operations Commands*

Command	Brief Description	References
WFS	Wait for full sweep	Chapter 4, Table 4-4
*OPC	Operation complete status	Paragraphs 7-13, 7-14
*OPC?	Operation complete query	Paragraphs 7-13, 7-14
TRS	Trigger sweep	Chapter 4, Table 4-4
HLD	Hold Measurement Process	Chapter 4, Table 4-4
LAX?	Output Current Sweep (Phase Lock) direction	Chapter 4, Table 4-4
CTN	Continue sweeping (from HOLD state)	Chapter 4, Table 4-4

7-16 MISCELLANEOUS DATA TRANSFER COMMANDS

The 372XXA Disk Information Data Transfer Commands are listed in Table 7-9, below. The System Setups Commands are listed in Table 7-10.

Table 7-9. *372XXA Disk Information Data Transfer Commands*

Command	Brief Description	Allowable Data Formatting
ODR	Output floppy disk directory	None - Always ASCII
ODRH	Output hard disk directory	None - Always ASCII

Table 7-10. *372XXA System State Commands*

Command	Brief Description	Allowable Data Formatting
ICF	Input information for current front panel setup *and* calibration	None - Always Binary
IFP	Input information for current front panel setup	None - Always Binary
IS1 – IS10	Input information for stored front panel setup 1-10	None - Always Binary
OCF	Output front panel setup *and* calibration string	None - Always Binary
OFP	Output current front panel setup string	None - Always Binary
OS1–OS10	Ouput stored front panel setup string 1–10	None - Always Binary

Chapter 8
System Functions

Table of Contents

Chapter 8
System Functions

8-1 INTRODUCTION

This chapter describes the commands used to implement certain system functions. They consist of hard copy commands, system state commands, save/recall commands, disk function commands, and diagnostics commands

NOTE

Flowcharts showing the 372XXA front panel keys and associated menu sequencing are provided in Appendix B.

8-2 RELATED COMMANDS

Table 8-1 provides a list of commands related to those used for system diagnostics. Refer to Chapter 7, paragraphs 7-9 through 7-11 for further information.

Table 8-1. *Related Commands*

Command	Description
OGE	Outputs extended description of current GPIB error.
OGL	Outputs extended description of previous GPIB error.
OEL	Outputs error messages from Service Log.
ONE	Output number of error messages stored in service log.
OSL	Output service log.

8-3 HARD COPY COMMANDS

The commands concerned with hard copy output are listed in Tables 8-2 and 8-3. These commands are straightforward with the exception of commands PT0–PT9. The PT0–PT9 commands are used to:

- Specify the density of tabular data points output to the printer when using the PTB and PMT commands, and
- Specify the number of data points included in the disk file created with the SAVDAT and SAVDATH commands.

The value implicit in the PT0–PT9 commands (0–9) specifies the number of points that are *skipped* during printing. Therefore, PT0 selects the *densest* printing mode while PT9 gives the *fewest* number of data points. The HD0 command disables headers and page formatting for tabular printouts. The HD1 command enables headers and page formatting.

The hard copy output commands consist of two categories: *action* and *setup:*

- *Action* commands actually initiate a print/plot for the subset of the display specified by the setup commands. These commands are described in Table 8-2.
- *Setup* commands are those that specify the desired size and location of the print/plot and the pen numbers for each element of the plot. These commands are described in Table 8-3.

The LOC, LMS, LID, LDT, and LNM commands require a string of characters to be sent over the GPIB along with the command. A string input to the 372XXA *must* have the double quote characters (" ") or single quote characters (' ') surrounding the desired input.

The SAVDAT and RCLDAT commands enable the user to store tabular data to the disc and recall it for output to the printer with the tabular printout points controlled by commands PT0–PT9.

Table 8-2. *Action Commands for Hard Copy Output*

Front Panel Key/Function	Command	Description
Hard Copy Menu key and function	FFD	Sends form feed command to printer (also stops print/plot).
	PFS	Prints full screen image.
	PGR	Prints graph area screen image.
	PGT	Plots graticule.
	PLD	Plots data area only.
	PLH	Plots header.
	PLM	Plots markers and limits.
	PLS	Plots entire screen.
	PLT	Plots data traces only.
	PMK	Prints tabular data for markers.
	PMN	Plots menu.
	PMT	Prints tabular data for traces and markers.
	PST	Stop print/plot.
	PTB	Prints tabular data for displayed traces.

Table 8-3. Setup Commands for Hard Copy Output

Front Panel Key/Function	Command	Description
Hard Copy Menu key and function	DPN	Defines pen number for data.
	GPN	Defines pen number for graticule.
	HD0	Turns off tabular data headers and page formatting.
	HD1	Turns on tabular data headers and page formatting.
	HPN	Defines pen number for header.
	LDT	Defines label string for Date/Time. String may be up to 15 characters in length.
	LID	Defines label string for device I.D. String may be up to 15 characters in length.
	LMS	Defines label string for model/serial number. String may be up to 15 characters in length.
	LNM	Defines label string for operator's name. String may be up to 15 characters in length.
	LOC	Enter label string for operator's comments. String may be up to 79 characters in length.
	MPN	Defines pen number for markers and limits.
	PBL	Selects quarter-size plot, bottom left corner.
	PBR	Selects quarter-size plot, bottom right corner.
	PFL	Selects full-size plot.
	PT0-PT9	Selects tabular printout points skipped, 0-9.
	PTL	Selects quarter-size plot, top left corner.
	PTR	Selects quarter-size plot, top right corner.
	SPD	Defines pen speed percentage.

8-4 SYSTEM STATE COMMANDS

Table 8-4 lists the system state commands. These commands are used to specify CRT display parameters, information display format, and other parameters that control the operation of the system. The function of approximately half of these commands is to display test set connector type information on the system screen.

Table 8-4. System State Commands (1 of 2)

Front Panel Key/Function	Command	Description
Not available from front panel	BC0	Turns CRT display off.
	BC1	Turns CRT display on.
	BCX?	Output CRT display on/off status.
Utility Menu key, Display Instrument State Parameters	DC1	Displays channel 1 and 2 operating parameters.
	DC3	Displays channel 3 and channel 4 operating parameters.
	DCP, DCP1	Displays calibration parameters, first page.
	DCP2	Displays calibration parameters, second page.
	DFP	Displays front panel instrument state.
	DGS	Displays GPIB status information.
Not available from front panel	FOF	Causes frequency information to be blanked.
	FON	Turns on frequency information display.
	FOX?	Output frequency display blanking ON/OFF status.
Utility Menu key, Calibration Components Utility function	DF2	Displays 2.4 mm female connector information.
	DF3	Displays GPC-3.5 female connector information.
	DFK	Displays K female connector information.
	DFN	Displays type N female connector information.
	DFS	Displays SMA female connector information.
	DFT	Displays TNC female connector information.
	DFV	Displays V female connector information.
	DG7	Displays GPC-7 male connector information.
Utility menu key, Data Drawing function	DD0	Turn off data drawing.
	DD1	Turn on data drawing.
	DD1?	Data drawing ON/OFF query.

Table 8-4. System State Commands (2 of 2)

Front Panel Key/Function	Command	Description
Utility Menu key, Calibration Components Utility function	DM2	Displays 2.4 mm male connector information.
	DM3	Displays GPC-3.5 male connector information.
	DMK	Displays K male connector information.
	DMN	Displays TYPE N male connector information.
	DMS	Displays SMA male connector information.
	DMT	Displays TNC male connector information.
	DMV	Displays V male connector information.
	DWG	Displays waveguide parameters.
Default Program Key*	RST, *RST, RST0, RST1	Resets 372XXA to default parameters. *Note: RST0=Default key + 0 RST1=Default key + 1
Clear/Ret local Key	RTL	Return to local (front panel) control.

8-5 SAVE/RECALL COMMANDS

The Save/Recall commands listed in Table 8-5 allow the system user to save and recall:

- Front panel setup data to and from internal memory.
- Calibration and front panel setup data to/from the disk. See disk commands SAVCAL and RCLCAL, Table 8-6.

Table 8-5. *Front Panel Memory Save/Recall Commands*

Front Panel Key/Function	Command	Description
	SV1-SV10	Saves front panel setup to internal memory, location 1 through 10.
	RC1-RC10	Recalls front panel setup data from internal memory, location 1 through 10.

Table 8-6. *Front Panel and Calibration Setup Disk Save/Recall Commands*

Front Panel Key/Function	Command	Description
Save/Recall Menu key and function	SAVCAL	Saves calibration data and front panel setup to file on floppy disk.
	SAVCALH	Saves calibration data and front panel setup to file on hard disk.
	RCLCAL	Recalls calibration data and front panel setup from file on floppy disk.
	RCLCALH	Recalls calibration data and front panel setup from file on hard disk.

8-6 DISK FUNCTION COMMANDS

The Disk Function commands perform the same functions as the Hard Copy key group Menu key selections. These commands are listed in Table 8-7 (page 8-11). They are used for the following:

- Copying files between disks
- Deleting files from a disk
- Saving files to a disk
- Formatting a floppy disk
- Loading calibration files from a cal kit disk
- Outputting a disk directory listing to the GPIB
- Printing a disk directory listing
- Recalling files from a disk

New Disk Function Commands

Because of the increased number of file types handled by Version 1.02 of the 372XXA software, most disk function command mnemonics were replaced with newer mnemonics that include the Operation Type, File Type, and Target Disk type in the command name.

NOTES

The original commands (Ver 1.02) are still supported to guarantee backwards compatibility. However, always use the new commands for applications programs not requiring backward compatibility.

Refer to Chapter 3 for examples showing usage of Disk Functions Commands.

It should be noted that the three character File Type included in the command name is also the file extension added to the filename prior to accessing the disk. Each command mnemonic is made up of three fields concatenated together as shown below:

[MNEMONIC] = [Operation Type] [File Type] [Target Disk]

Operational Type – The type disk operation performed is indicated by the first three letters of the command mnemonic.

CPY - Copy the file between disks

DEL - Delete the file from a disk

RCL - Recall the file from a disk

SAV - Save the file to a disk

File Type – The file type operated on is indicated by the second three letters of the command mnemonic.

ALC - Hardware ALC calibration data

ALL - Combined hardware calibration data

CAL - Front panel and calibration data

DAT - Tabular data

ELG - Error Log listing

FRE - Hardware frequency calibration data

LOG - Service Log listing

NRM - Trace memory data

Target Disk – The target disk operated on is indicated by the last portion of the command mnemonic, as follows:

For commands of the CPY operation type, the Target Disk is defined by the last two characters of the command as follows:

FH - Copies file from the floppy disk to the hard disk

HF - Copies file from the hard disk to the floppy disk

For commands of the other operation types, the Target Disk field is defined by the last letter of the command (or omission thereof) as follows:

Last letter = H- Performs operation from/to the hard disk

No letter - Performs operation from or to the floppy disk

RCL Operation Type Commands

Most commands of the RCL operation type recall the associated file into internal memory. The following exceptions apply:

RCLDAT and RCLDATH recall the tabular data from disk and send it to the printer for printing.

RCLELG and RCLELGH recall the error log from disk and send it to the printer for printing.

RCLLOG and RCLLOGH recall the service log from disk and send it to the printer for printing.

Filename Considerations

Most disk function commands require that a filename be included after the mnemonic. This filename must conform to the String Program Data format as defined in IEEE488.2. The commands that do **not** require a file name are:

All disk commands dealing with the ALC, ALL and FRE file types. The filename associated with these commands is assumed to be 'HW_CAL'.

INT - Initialize (format) floppy disk

LKT - Load calibration kit information from floppy disk

ODR - Output directory listing of the floppy drive

ODRH - Output directory listing of the hard drive

PDR - Print directory listing of the floppy drive

PDRH - Print directory listing of the hard drive

Rules for generating filenames:

1) Filenames must be enclosed within single or double quotes
2) No file extension is to be included (It is generated automatically by the 372XXA.)
3) 8 characters maximum
4) Alphabetic (A - Z, a - z) and numeric (0 - 9) characters plus the underscore character (_) are permitted. All others are forbidden.
5) The first character must be an alphabetic type
6) All alphabetic characters are converted to upper case before accessing the disk.

Data Disk Command Precautions

The following precautions must be observed when using data disk commands:

- A data disk must be in the floppy drive ***before*** issuing a command which accesses the floppy drive, otherwise an execution error will occur due to the failure of the command.
- The INT command immediately formats the disk loaded in the floppy drive. Any data on the disk will be destroyed. Use this command carefully.

Table 8-7. *Disk Functions Commands (1 of 3)*

Front Panel Key/Function	Command	Description
Hard Copy Menu key, Disk Operations function	CPYALCFH*	Copy ALC Cal file from floppy to hard disk
	CPYALCHF*	Copy ALC Cal file from hard to floppy disk
	CPYALLFH*	Copy Combined Hardware Cal file from floppy to hard disk
	CPYALLHF*	Copy Combined Hardware Cal file from hard to floppy disk
	CPYCALFH	Copy Calibration/Front Panel Setup from floppy to hard disk
	CPYCALHF	Copy Calibration/Front Panel Setup from hard to floppy disk
	CPYDATFH	Copy Tabular Data file from floppy to hard disk
	CPYDATHF	Copy Tabular Data file from hard to floppy disk
	CPYELGFH	Copy Error Log file from floppy to hard disk
	CPYELGHF	Copy Error Log file from hard to floppy disk
	CPYFREFH*	Copy Frequency Cal file from floppy to hard disk
	CPYFREHF*	Copy Frequency Cal file from hard to floppy disk

* Commands marked with an asterisk are for service use only.

Table 8-7. Disk Functions Commands (2 of 3)

Front Panel Key/Function	Command	Description
Hard Copy Menu key, Disk Operations function (Continued)	CPYLOGFH	Copy Service Log file from floppy to hard disk
	CPYLOGHF	Copy Service Log file from hard to floppy disk
	CPYNRMFH	Copy Trace Memory File from floppy to hard disk
	CPYNRMHF	Copy Trace Memory File from hard to floppy disk
	DELALC*	Delete ALC Cal file from floppy disk
	DELALCH*	Delete ALC Cal file from hard disk
	DELALL*	Delete Combined Hardware Cal file from floppy disk
	DELALLH*	Delete Combined Hardware Cal file from hard disk
	DELCAL	Delete Calibration/Front Panel Setup from floppy disk
	DELCALH	Delete Calibration/Front Panel Setup from hard disk
	DELDAT	Delete Tabular Data file from floppy disk
	DELDATH	Delete Tabular Data file from hard disk
	DELELG	Delete Error Log file from floppy disk
	DELELGH	Delete Error Log file from hard disk
	DELFRE*	Delete Frequency Cal file from floppy disk
	DELFREH*	Delete Frequency Cal file from hard disk
	DELLOG	Delete Service Log file from floppy disk
	DELLOGH	Delete Service Log file from hard disk
	DELNRM	Delete Trace Memory File from floppy disk
	DELNRMH	Delete Trace Memory File from hard disk
	INT	Initialize (format) floppy disk NOTE: Formatting may require 3 – 5 minutes to complete
	LKT	Load calibration kit information from floppy disk
	ODR	Output directory listing of the floppy drive
	ODRH	Output directory listing of the hard drive
	PDR	Print directory listing of the floppy drive
	PDRH	Print directory listing of the hard drive
	RCLALC*	Recall ALC Cal file from floppy disk
	RCLALCH*	Recall ALC Cal file from hard disk

* Commands marked with an asterisk are for service use only.

Table 8-7. Disk Functions Commands (3 of 3)

Front Panel Key/Function	Command	Description
Hard Copy Menu key, Disk Operations function (Continued)	RCLALL*	Recall Combined Hardware Cal file from floppy disk
	RCLALLH*	Recall Combined Hardware Cal file from hard disk
	RCLCAL	Recall Calibration/Front Panel Setup from floppy disk
	RCLCALH	Recall Calibration/Front Panel Setup from hard disk
	RCLDAT	Recall Tabular data file from floppy disk to printer
	RCLDATH	Recall Tabular data file from hard disk to printer
	RCLELG	Recall Error Log file from floppy disk to printer
	RCLELGH	Recall Error Log file from hard disk to printer
	RCLFRE*	Recall Frequency Cal file from floppy disk
	RCLFREH*	Recall Frequency Cal file from hard disk
	RCLLOG	Recall Service Log file from floppy disk to printer
	RCLLOGH	Recall Service Log file from hard disk to printer
	RCLNRM	Recall Trace Memory File from floppy disk
	RCLNRMH	Recall Trace Memory File from hard disk
	SAVALC*	Save ALC Cal to floppy disk
	SAVALCH*	Save ALC Cal to hard disk
	SAVALL*	Save Combined Hardware Cal to floppy disk
	SAVALLH*	Save Combined Hardware Cal to hard disk
	SAVCAL	Save Calibration/Front Panel Setup to floppy disk
	SAVCALH	Save Calibration/Front Panel Setup to hard disk
	SAVDAT	Save Tabular Data to floppy disk
	SAVDATH	Save Tabular Data to hard disk
	SAVELG	Save Error Log to floppy disk
	SAVELGH	Save Error Log to hard disk
	SAVFRE*	Save Frequency Cal to floppy disk
	SAVFREH*	Save Frequency Cal to hard disk
	SAVLOG	Save Service Log to floppy disk
	SAVLOGH	Save Service Log to hard disk
	SAVNRM	Save Trace Memory to floppy disk
	SAVNRMH	Save Trace Memory to hard diskp

* Commands marked with an asterisk are for service use only.

Other Disk Function Commands

Disk function commands that were used with 372XXA systems with Version 1.01 Software are listed in Table 8-8. These commands are supported by 372XXA Version 1.02 software to provide program compatibility with older programs written for these units.

Table 8-8. *Other Disk Function Commands (For Compatibility with 372XXA w/ Ver 1.01 Software)*

Command	Description
DEC	Same as DELCAL
DECH	Same as DELCALH
DED	Same as DELDAT
DEDH	Same as DELDATH
DEN	Same as DELNRM
DENH	Same as DELNRMH
RCK	Same as RCLNRM
RCKH	Same as RCLNRMH
RLD	Same as RCLCAL
RLDH	Same as RCLCALH
RTB	Same as RCLDAT
RTBH	Same as RCLDATH
SDK	Same as SAVNRM
SDKH	Same as SAVNRMH
STO	Same as SAVCAL
STOH	Same as SAVCALH
TDD	Same as SAVDAT
TDDH	Same as SAVDATH

8-7 DIAGNOSTICS COMMANDS

The commands listed in Table 8-9 are used to provide diagnostics help in localizing system malfunctions, performing calibration of internal circuits, testing system functions, and managing error reporting and the service log.

NOTE

The diagnostics commands in Table 8-9 are intended for use by only by WILTRON certified service engineers.

Table 8-9. *Diagnostics Commands (1 of 3)*

Front Panel Key/Function	Command	Description
Options Menu key, Diagnostics function	ALC	Performs an internal ALC loop calibration.
	DRL	Sets Diagnostic read latch.
	DVM	Displays DVM channel (analog monitor line).
	DWL	Sets Diagnostic write latch.
	EDG	Ends the diagnostic mode.
	EXD	Displays external A/D input (see command SDG).
	FLC	Performs an internal Source frequency-linearity calibration.
	IFB	Run 1st IF bandpass test.
	LO11	Runs LO1 phase-lock voltage test.
	LO12	Runs LO1 D/A voltage test.
	LO21	Runs LO2 main phase-lock voltage test.
	LO22	Runs LO2 offset phase-lock voltage test.
	LO23	Runs LO2 DDS phase-lock voltage test.
	LO24	Runs LO2 main D/A voltage test.
	LO25	Runs LO2 offset D/A voltage test.
	NRD	Displays non-ratioed parameters on four channels.
	RCLALC	Recall ALC Cal file from floppy disk
	RCLALCH	Recall ALC Cal file from hard disk
	RCLALL	Recall Combined Hardware Cal file from floppy disk
	RCLALLH	Recall Combined Hardware Cal file from hard disk
	RCLFRE	Recall Frequency Cal file from floppy disk
	RCLFREH	Recall Frequency Cal file from hard disk

Table 8-9. Diagnostics Commands (2 of 3)

Front Panel Key/Function	Command	Description
Options Menu key, Diagnostics function (Continued)	SAVALC	Save ALC Cal to floppy disk
	SAVALCH	Save ALC Cal to hard disk
	SAVALL	Save Combined Hardware Cal to floppy disk
	SAVALLH	Save Combined Hardware Cal to hard disk
	SAVFRE	Save Frequency Cal to floppy disk
	SAVFREH	Save Frequency Cal to hard disk
	SDG	Starts the diagnostics troubleshooting mode (see command EDG).
	SDR	Selects standard receiver mode.
	SL1	Selects source lock mode.
	SRC1	Performs the Source linearity voltage test.
	SRC2	Performs the Source power output voltage test.
	ST1	Selects set-on mode.
	TK1	Selects tracking mode.

8-8 PERIPHERALS AND SELF TESTS

Peripheral tests used to support system diagnostics are listed in Table 8-10. All peripheral tests require user interaction and response to messages displayed on the 372XXA screen and front panel displays.

Table 8-10. Peripheral Tests Commands

Command	Description
DGT1–3	Display CRT test patterns 1–3.
PRT?	Performs a printer port test. (A test fixture is required; refer to the 372XXA Maintenance Manual.)
EKT	Performs a keyboard test, using an externally connected keyboard.
FPT	Performs a front panel test.
*TST	Performs a self test and outputs pass/fail status

8-9 SERVICE LOG ACCESS COMMANDS

Commands used to access and control the Service Log functions via the GPIB are listed in Table 8-11.

Table 8-11. Service Log Commands

Front Panel Key/Function	Command	Description
	CSL	Clears all error messages from service log. **CAUTION:** Before using the CSL command, save any Service Log entries present. See SAVLOG and SAVLOGH commands.
	*OPT?	Output installed options.
	PEL	Prints the error list.
	PSL	Prints the service log in the same format as viewed from the front panel menu.
	RCLELG	Recall Error Log file from floppy disk to printer
	RCLELGH	Recall Error Log file from hard disk to printer
	RCLLOG	Recall Service Log file from floppy disk to printer
	RCLLOGH	Recall Service Log file from hard disk to printer
	SAVELG	Save Error Log to floppy disk
	SAVELGH	Save Error Log to hard disk
	SAVLOG	Save Service Log to floppy disk
	SAVLOGH	Save Service Log to hard disk

Chapter 9
Special Applications Functions

Table of Contents

Chapter 9 Special Applications Functions

9-1 INTRODUCTION

This chapter describes commands used to implement special measurement functions. They are associated with the functions controlled by the Domain key in the Measurement key group and the Option Menu key in the Enhancement key group. These include time domain commands, multiple source control commands, and rear panel output control commands.

NOTE
Flowcharts showing the 372XXA front panel keys and associated menu sequencing are provided in Appendix B.

9-2 TIME DOMAIN COMMANDS

The time domain commands for the 372XXA are listed below in Table 9-1. Option 2 (High-Speed Time Domain [Distance] Software option) adds these commands to the 372XXA software.

The time domain commands are used to:

- Specify the domain of a channel.
- Set up operating modes and parameters for the selected processing type of the channel.

Table 9-1. *Time Domain Commands (1 of 3)*

Front Panel Key/Function	Command	Description
Domain key and function	DBP	Select distance bandpass mode for active channel
	DCA	Select automatic D.C. term calculation for lowpass mode
	DCO	Select open for D.C. term for lowpass mode
	DCS	Select short for D.C. term for lowpass mode
	DCV	Enter value for D.C. term for lowpass mode
	DCV?	Output lowpass DC term value
	DCX?	Output lowpass DC term selection
	DCZ	Select line impedance for D.C. term for lowpass

Table 9-1. Time Domain Commands (2 of 3)

Front Panel Key/Function	Command	Description
Domain key and function (Continued)	DDX?	Output active channel domain parameter (frequency, distance, or time)
	DLP*	Select distance lowpass mode for active channel
	DPI	Select distance phasor impulse mode for active channel
	FGT	Select frequency with time gate for active channel
	FQD	Select frequency domain for active channel
	GCT	Set gate center value
	GCT?	Output gate center value
	GDS	Display gate symbols on active channel
	GLS	Select low sidelobe gate shape
	GMS	Select minimum sidelobe gate shape
	GNM	Select nominal gate shape
	GOF	Turn off gating on active channel
	GOF?	Output gating mode on active channel.
	GON	Turn on gating on active channel
	GRT	Select rectangular gate shape
	GSN	Set gate span value
	GSN?	Output gate span value
	GSP	Set gate stop value
	GSP?	Output gate stop value
	GST	Set gate start value
	GST?	Output gate start value
	GSX?	Output gate shape
	LPI	Select lowpass impulse response mode
	LPS	Select lowpass step response mode
	LPSX?	Output lowpass response (impulse or step) for active channel

Table 9-1. Time Domain Commands (3 of 3)

Front Panel Key/Function	Command	Description
Domain key and function (Continued)	MRR	Restore original marker range
	TBP	Select time bandpass mode for active channel
	TDDIST	Set time domain parameter to distance for active channel
	TDDIST?	Output active channel time domain parameter (time or distance)
	TPI0	Turn phasor impulse response OFF for active channel
	TPI1	Turn phasor impulse response ON for active channel
	TDPIX?	Output phasor impulse ON/OFF status for active channel
	TDTIME	Set time domain parameter to time for active channel
	TDX?	Time Domain mode query
	TLP*	Select time lowpass mode for active channel
	TPI	Select time phasor impulse mode for active channel
	WLS	Select low sidelobe window shape
	WMS	Select minimum sidelobe window shape
	WNM	Select nominal window shape
	WRT	Select rectangular window shape
	WSX?	Output window shape
	ZCT	Set zoom range center value
	ZCT?	Output zoom range center value
	ZSN	Set zoom range span value
	ZSN?	Output zoom span value
	ZSP	Set zoom range stop value
	ZSP?	Output zoom range stop value
	ZST	Set zoom range start value
	ZST?	Output zoom range start value

* Do not select a time domain lowpass function via the commands DLP or TLP without first performing a time domain harmonic calibration. See calibration command 'TDC'.

9-3 MULTIPLE SOURCE CONTROL COMMANDS

Table 9-2 lists the multiple source control commands. These commands are used to define up to five different "multiple source control bands". In each, the device under test (DUT), source 1, source 2, and receiver frequency ranges may be different.

The DUT frequency range is entered using any of the frequency entry commands. The MSD command puts the 372XXA in the DEFINE mode, which allows entry of arbitrary frequencies for the DUT. Band equations for source 1, source 2, and the receiver are then set up using the ED1, ED2, EDR, etc, commands. The band equations used are shown below. In these equations, "F" is the DUT frequency range.

For swept operation:

F = *(multiplier / divisor) * (F + offset),*

For CW operation:

F = *(multiplier / divisor) * (offset).*

For a frequency band to be saved, the band equations must produce frequencies within the operating range of the respective system component.

Figure 9-1 shows an example program using multiple source control commands. This program is for a fixed LO, swept IF mixer measurement. The frequency values used are:

DUT range = 2 – 6 GHz
Source 1 = 2 – 6 GHz = (1/1) X (F + 0)
Source 2 = 500 MHz CW = (1/1) X (500 MHz)
Receiver = 1.5 – 5.5 GHz = (1/1) X (F – 500 MHz)

```
10 ! Multiple Source Control Example
20 OUTPUT 706; "MSD; SRT 2 GHZ; STP 6 GHZ"
30 OUTPUT 706; "BD1; BSP 6 GHZ"
40 OUTPUT 706; "ED1; ESW; EML 1 XX1"
50 OUTPUT 706; "EDV 1 XX1; EOS 0 GHZ"
60 OUTPUT 706; "ED2; ECW; EOS 500 MHZ"
70 OUTPUT 706; "EDR; ESW; EML 1 XX1"
80 OUTPUT 706; "EDV 1 XX1; EOS -500 MHZ"
90 OUTPUT 706; "SVB; MS1"
100 END
```

Figure 9-1. *Multiple Source Control Example*

Table 9-2. Multiple Source Control Commands

Front Panel Key/Function	Command	Description
Options Menu key, Multiple Source Control function	BD1 - BD5	Select multiple source control band 1-5. Values are limited to current DUT range.
	BSP	Enter band stop frequency for multiple source control. Terminate entry in GHZ, MHZ, or KHZ.
	BSP?	Stop frequency for current band query.
	BST	Enter band 1 startup frequency for multiple source control. Terminate entry in GHZ, MHZ, or KHZ.
	BST?	Start frequency for current band query.
	CLB	Clear all multiple source control band definitions.
	ECW	Multiple source control equation in CW mode.
	ED1	Edit source 1 multiple source control equation.
	ED2	Edit source 2 multiple source control equation.
	EDR	Edit receiver multiple source control equation.
	EDV *value*	Set multiple source control equation divisor.
	EDV?	Divisor for equation being edited query.
	EML *value*	Set multiple source control equation multiplier.
	EML?	Multiplier for equation being edited query.
	EOS *value*	Set multiple source control equation offset frequency.
	EOS?	Offset frequency for equation being edited query.
	ESW	Multiple source control equation in sweep mode
	EXW?	Multiple source sweep/CW flag for equation being edited query.
	MS0	Multiple source control off
	MS1	Multiple source control on
	MSD	Multiple source control define model
	MSX?	Multiple source ON/OFF/DEFINE mode query.
	SVB	Save multiple source control band definition

9-4 REAR PANEL OUTPUT CONTROL COMMANDS

Table 9-3 lists the commands for controlling the rear-panel voltage output of the 372XXA. The RV1 command enables the output and command RV0 disables it. The orientation of the output can be set to either horizontal (RVH), vertical (RVV), lock direction (RVL), or DC value (RVD).

In the horizontal mode, the voltage output is a digital ramp starting at the voltage start value set by command VST and ending at the voltage stop value set by command VSP. The start value corresponds to the first point of the sweep and the stop value corresponds to last point of the sweep. In the vertical mode, the output voltage is a measure of the instantaneous data point value. The output voltage is related to the scaling of the graph for channel 1. The reference line corresponds to the zero volt value and each graticle line is equal to a ±1 volt value span. The values set by the VST and VSP commands have no effect in the vertical mode.

In the lock direction mode, the start voltage value is output for forward sweeps (lock to Ra). The stop voltage value is output for reverse sweeps (lock to Rb).

In the DC value mode, the rear panel output voltage is set to the DC value programmed with the RPO command.

Table 9-3. Rear Panel Output Control Commands

Front Panel Key/Function	Command	Description
Options Menu key, Rear Panel Output Control function	RPO *value*	Set value for direct rear panel voltage. Values are –10.000V to +10.000V.
	RPO?	Rear panel output voltage value query.
	RV0	Disable the rear panel output voltage updating function.
	RV1	Enable rear panel output voltage updating function.
	RV1?	Rear panel output voltage ON/OFF query.
	RVD	Rear panel output mode = dc value.
	RVH	Select horizontal rear output voltage mode.
	RVL	Select lock direction output voltage mode.
	RVV	Select vertical rear output voltage mode.
	RVX?	Rear panel output voltage (analog out) mode query.
	VSP *value*	Set stop value for rear panel output voltage.
	VSP?	Rear panel output voltage stop value query.
	VST *value*	Set start value for rear panel output voltage.
	VST?	Rear panel output voltage start value query.

Part 3 Programming Reference

This part consists of three chapters that provide programming reference information for the 372XXA VNA.

***Chapter 10** – provides a list of all GPIB commands for the 372XXA. The listing for each command (mnemonic) includes relevant details about the command.*

***Chapter 11** – provides general (non-command specific) tabular information for the 372XXA. Much of this information is presented in Chapters 4 through 10, but is provided in this chapter for easy access.*

***Chapter 12** – provides a list of all Error Messages related to remote- only (GPIB) operation of the 372XXA.*

Chapter 10
Command Dictionary

Table of Contents

APR Sets the group delay aperture on the active channel. **DISPLAY CONTROL (Ch 4)**

Command mnemonic

Command function.

Indicates the Command's "Functional Group" and chapter where located.

Command Syntax String

Syntax: `APR` *`val1 unit(s)`*

val1 0.0 – 20.0

unit(s) XX1, XX3, XM3

Allowable values for the command argument(s), if any. The mnemonic shown in boldface type is the default units suffix

Remarks: Programming hints, how to use the command, and/or expanded description of command.

Data I/O: Description of data input or output due to this command. See paragraph 10-3 and Chapter 7, par 7-2 for details.

Status Reporting: Status Reporting bit(s) or functions unique to this command.

Additional Description Fields as required

Related Commands: Commands that impact or relate to this command.

Figure 10-1. *Typographic Conventions for the Command Listings*

Chapter 10 Command Dictionary

10-1 INTRODUCTION

This chapter provides a listing of GPIB programming commands (mnemonics) used with the Model 372XXA Vector Network Analyzer.

10-2 TYPOGRAPHIC CONVENTIONS

The typographic conventions, abbreviations, and syntax legend used throughout this chapter to define the GPIB commands are described in Figure 10-1 (opposite page).

10-3 DATA I/O FORMATS AND TEMPLATES

The data input and output formats and templates, referred to throughout this chapter, are delimited with the less-than and greater-than characters (< >). These characters are not part of the data; they are only used in this text to distinguish the data elements they represent. See Chapter 7, Remote Only Operations, "Data Transfer" for complete details.

372XXA data formats are summarized below:

<NR1>
This notation represents ASCII integer values. A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR1> notation:

1
0
-29,179

<NR2>
This notation represents ASCII floating point values in decimal point format. A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR2> notation:

1.0
-0.00015
12.743,-180.07

<NR3>
This notation represents ASCII floating point values in exponential format (scientific notation). A comma (,) is used to separate multiple values sent in a single command's input or output string.

Examples of values that can be represented by <NR3> notation:

1.0E9
7.056E3
9.0E2,3.42E2

<NRf>
This notation is used to signify that data can be in either <NR1>, <NR2>, or <NR3> format as described above.

Examples of values that can be represented by <NRf> notation:

1.0E9
10.005
83,4.5E2,234.9901

<String>
This notation represents a string of 7bit ASCII characters (including nonprintable characters) that is delimited (surrounded) with either single quotes (' ') or double quotes (" "). The string can include text formatting characters such as linefeed, space, or carriage return.

Note that if a double quote character must be sent as part of the string, then it must be followed by an additional double quote. Alternatively, the string can be sent using single quotes (See "cal_file" example below.)

Examples of data represented by <String> notation:

"1/15/98"
"Save ""cal_file"" now."
'Save "cal_file" now.'

<Arbitrary ASCII>
This notation represents undelimited 7bit ASCII text. The end of the text must be terminated with the 0A character (decimal 10) and concurrent setting (^) of the GPIB End of Transmission State (EOI). This requirement makes it necessary for <Arbitrary ASCII> text to be transmitted only at the end of a program or response message, i.e. at the end of a multiple input or output statement.

Example of data represented by <Arbitrary ASCII> notation:

Wiltron,37247A,123456,1.0<0A^EOI>

The example shows a sample response from the *IDN?, 488.2 common query. In the example, the instrument identifies itself as a Wiltron 37247A, with serial number 123456, and software version 1.0 installed. Note that decimal 10 (0A character) must be sent with the EOI to signal end of transmission.

<Arbitrary Block>
This notation represents data that is transmitted as 8bit data bytes (00-FF hex, 0-255 decimal, notation is <DAB>). This is useful for transmitting large blocks of formatted ASCII or binary data or unformatted binary data. The data stream is immediately preceded by a variable length ASCII header that is encoded with the number of data bytes to be sent. The header always starts with the pound (#) character. Figure 10-2 below describes the header and the transmitted data messages.

#	n	$m_1..m_n$	<DAB>$_1$..<DAB>$_m$

Where:

# = The pound sign character. Required for binary data transfer.
n = Number of digits to follow ($m_1..m_n$) that make up the number m.
$\mathbf{m_1..m_n}$ = Taken together, this makes up the number m which is the number of data bytes to follow that constitute the requested data.
<DAB> = An 8 bit binary data byte. This is the data (or information) being sent.

NOTE

If n = 0, then m is omitted, and transmission end is signaled by sending the linefeed character (0A, or decimal 10) and concurrent setting (^) of the GPIB End Of Transmission State (EOI) immediately following the last <DAB>.

Figure 10-2. *<Arbitrary Block> Data Format*

10-4 FUNCTIONAL GROUPS

Throughout this chapter, the distinctive, white on black text, in the upper corner of each command's description area, is the functional group to which the command belongs (see Figure 10-1 on page 10-2). The 37200A GPIB Function Groups are described in Chapters 4 through 9; they provide descriptive details and tabular data that apply to the group as a whole.

10-5 RELEVANT TABLES

Data referenced in many places within this chapter.is located in Chapter 11, Instrument Data.

10-6 COMMANDS

The remaining pages in this chapter provide an alphabetical listing of the commands (mnemonics) used to program the Model 372XXA Vector Network Analyzer.

***CLS** Clear all Event Registers summarized in the Status Byte **IEEE 488.2 (Ch 7)**

Syntax: `*CLS`

Status Reporting: Clears the Standard Event Status Register, the Extended Event Status Register, and the Limits Status Register. Also clears the Operation Complete Command and Query states by setting them to idle state, i.e. no operations pending. Also clears the GPIB error message buffers (see OGE, OGL).

***DDT** Define device trigger action **IEEE 488.2 (Ch 7)**

Syntax: `*DDT val1`

val1 Valid 37200A GPIB command sequence in <Arbitrary Block> format

Remarks: Stores a command sequence to be executed when a *TRG command or the 488.1 GET message is received. The sequence length must be 0–255 characters and may not contain the *DDT, *TRG, ICx, ICF, ICL, IFP, IFD, ICD, and IFV commands.

Related Commands: *TRG

***DDT?** Define device trigger query **IEEE 488.2 (Ch 7)**

Syntax: `*DDT?`

Data I/O: The query response is sent using the <Arbitrary Block> format (paragraph 10-3).

***ESE** Set Standard Event Status Enable Register **IEEE 488.2 (Ch 7)**

Syntax: `*ESE val1`

val1 `0-255`

Remarks: Sets the bits of the Standard Event Status Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0.

Data I/O: The value is input in ASCII <NRf> format (paragraph 10-3).

***ESE?** Standard Event Status Enable Register query **IEEE 488.2 (Ch 7)**

Syntax: `*ESE?`

Remarks: Returns the decimal value of the bit pattern of the Standard Event Status Enable Register. The value is 0–255.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

***ESR?** Standard Event Status Register query **IEEE 488.2 (Ch 7)**

Syntax: `*ESR?`

Remarks: Returns the decimal value of the bit pattern of the Standard Event Status Register and clears it. The value is 0–255.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

***IDN?** Identification query **IEEE 488.2 (Ch 7)**

Syntax: `*IDN?`

Remarks: This query returns the 37200A identification string. The string consists of four comma separated fields as follows:

Wiltron,<Model>,<Serial #>,<Software Revision>

The actual model number, serial number, and software revision of the 372XXA queried will be passed. The maximum length of the string is 72 characters.

Data I/O: Outputs an <Arbitrary ASCII> format (paragraph 10-3).

Related commands: OID, *OPT?

***IST?** Individual Status Message (ist) query **IEEE 488.2 (Ch 7)**

Syntax: `*IST?`

Remarks: The ist is the status bit sent by the 37200A in response to a parallel poll. The *IST? query outputs the value of the ist without having to perform a parallel poll. The output value is 1 if ist is TRUE, 0 if it is FALSE.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

Related Commands: *PRE, *PRE?

***OPC** Operation complete status **IEEE 488.2 (Ch 7)**

Syntax: `*OPC`

Status Reporting: Sets the Operation Complete bit 0 in the Standard Event Status Register after all pending operations are complete.

Related Commands: *OPC?

***OPC?** Operation complete query **IEEE 488.2 (Ch 7)**

Syntax: `*OPC?`

Remarks: Ouputs an ASCII “1” after all pending operations are complete.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

Related Commands: *OPC

***OPT?** Options identification query **IEEE 488.2 (Ch 7)**

Syntax: `*OPT?`

Remarks: This query returns the installed, reportable 37200A options identification string. The string consists of comma separated fields containing the option numbers or a 0 if none are installed. The maximum length of the string is 255 characters.

Data I/O: Outputs an <Arbitrary ASCII> format (paragraph 10-3)

Related commands: OID, *IDN?

***PRE** Set Parallel Poll Enable Register **IEEE 488.2 (Ch 7)**

Syntax: `*PRE val1`

val1 `0 - 65535`

Remarks: Sets the bits of the Parallel Poll Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0.

Data I/O: The value is input in ASCII <NRf> format (paragraph 10-3).

***PRE?** Parallel Poll Enable Register query **IEEE 488.2 (Ch 7)**

Syntax: `*PRE?`

Remarks: Returns the decimal value of the bit pattern of the Parallel Poll Enable Register.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

Related Commands: *IST?

***RST** Reset to default state. **IEEE 488.2 (Ch 7)**

Syntax: `*RST`

Remarks: Resets the 372XXA to default state with all user programmable parameters set to their default values. Default state settings are listed in Chapter 11. This command does not affect the Output Queue, any Status or Parallel Poll Registers, or the 372XXA GPIB address setting.

Related Commands: RST, RST0, RST1

***SRE** Set Service Request Enable Register **IEEE 488.2 (Ch 7)**

Syntax: `*SRE val1`

val1 `0-255`

Remarks: Sets the bits of the Service Request Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0. Note that the Master Summary Status (MSS) bit 6 (decimal 64) will be ignored since it represents the summary of all enabled status bits (bits 0-5, 7).

Data I/O: The value is input in ASCII <NRf> format (paragraph 10-3).

***SRE?** Service Request Enable Register query **IEEE 488.2 (Ch 7)**

Syntax: `*SRE?`

Remarks: Returns the decimal value of the bit pattern of the Service Request Enable Register. The value will be 0 - 63, or 128 - 191, with the MSS bit 6 (decimal 64) zeroed out (See *SRE).

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

***STB?** Status Byte query **IEEE 488.2 (Ch 7)**

Syntax: `*STB?`

Remarks: Returns the decimal value of the bit pattern of the Status Byte and the Master Summary Status bit 6. The value will be 0–255.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

***TRG** Trigger **IEEE 488.2 (Ch 7)**

Syntax: `*TRG`

Remarks: The previously defined trigger action using the *DDT command will be placed in the GPIB input buffer, parsed, and executed. This is the instrument specific equivalent of the 488.1 GET, Group Execute Trigger message.

Related Commands: *DDT, *DDT?

***TST?** Perform self test and output pass/fail result. **IEEE 488.2 (Ch 7)**

Syntax: `*TST?`

Remarks: Causes the 37200A to perform an extensive, fully automated internal circuits self test. Detailed error messages indicating self test failures, if any, are placed in the service log in the order they occur. The query returns a "1" if any part of the self test failed, or a "0" when passed.

CAUTION

When commands TST or *TST? are sent to the 372XXA, the VNA output power is momentarily set to the model-dependent Rated Power level during the self test. Ensure that any equipment connected to Port 1 or Port 2 will not be damaged by this power level.

Data I/O: Returns a value in ASCII <NR1> format (paragraph 10-3).

Related Commands: ONE, OEL, OSL, PSL, TST

***WAI** Wait-to-continue **IEEE 488.2 (Ch 7)**

Syntax: `*WAI`

Remarks: Suspends the execution of any further commands or queries until all pending operations are completed. Note that this command is required by the 488.2 Standard but has no effect on 37200A operation. The 37200A executes all commands sequentially, i.e. it will always wait for commands and queries to finish executing prior to processing new commands.

Related Commands: *OPC, *OPC?

A12

Simulate 12-term calibration

CALIBRATION (Ch 5)

Syntax: `A12`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1-IC12, ICL, CON. Also see C12, OC1-OC12, OCL

A8R

Simulate 1 path, 2 port reverse path calibration

CALIBRATION (Ch 5)

Syntax: `A8R`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1-IC5, CON. Also see C8R, OC1-OC5

A8T

Simulate 1 path, 2 port forward path calibration

CALIBRATION (Ch 5)

Syntax: `A8T`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1-IC5, CON. Also see C8T, OC1-OC5

ABT

Simulate transmission-only calibration for both forward and reverse paths

CALIBRATION (Ch 5)

Syntax: `ABT`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1-IC2, CON. Also see CBT, OC1-OC2

ADD Selects addition as trace math for active channel. **DISPLAY (Ch 4)**

Syntax: `ADD`

Remarks: Store trace data to memory. Issue this command then normalize the trace to display the complex addition result of measured data and memory data.

Related Commands: CH1-CH4, STD, DNM

AFT Simulate transmission-only forward path calibration **CALIBRATION (Ch 5)**

Syntax: `AFT`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1, CON. Also see CFT, OC1

ALC Initiates ALC loop internal calibration **DIAGNOSTICS (Ch 8)**

Syntax: `ALC`

Remarks: For service use only.

ANNCOL Enter the color number of annotation and menu text **SYSTEM STATE (Ch 8)**

Syntax: `ANNCOL`

val1: 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: DATCOL, GRTCOL, LAYCOL, MKRCOL, MNUCOL, TRCCOL, ANNCOL?

ANNCOL? Annotation and menu text color number query **SYSTEM STATE (Ch 8)**

Syntax: `ANNCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: DATCOL?, GRTCOL?, LAYCOL?, MKRCOL?, MNUCOL?, TRCCOL?, ANNCOL

AH0 Turn automatic DUT protection off **SYSTEM STATE (Ch 8)**

Syntax: `AH0`

Related Commands: AH1, AHX?

AH1 Turn automatic DUT protection on **SYSTEM STATE (Ch 8)**

Syntax: `AH1`

Related Commands: AH0, AHX?

AHX? Output automatic DUT protection on/off status **SYSTEM STATE (Ch 8)**

Syntax: `AHX?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3) as follows: (0=Automatic DUT Protection is off, 1=Automatic DUT Protection is on)

Related Commands: AH0, AH1

AMKR Select active marker on all channels marker mode **MARKERS (Ch 6)**

Syntax: `AMKR`

Related Commands: FMKR, NMKR, SMKR, XMKR

AOF Turn data averaging OFF **ENHANCEMENT (Ch 4)**

Syntax: `AOF`

Remarks: Restarts the sweep. Does not change the currently set number.

Related Commands: AVG, WFS

AOF? Is data averaging ON or OFF? **ENHANCEMENT (Ch 4)**

Syntax: `AOF?`

Data I/O: Outputs a 1 if ON, 0 if OFF in ASCII <NR1> format (paragraph 10-3).

Related Commands: AOF, AVG

AON Turn data averaging ON **ENHANCEMENT (Ch 4)**

Syntax: `AON`

Remarks: Restarts the sweep, but does not change the averaging value that is currently set.

Related Commands: AVG, AOF, WFS

APR Set group delay aperture for active channel in percent **DISPLAY (Ch 4)**

Syntax: `APR val1 unit(s)`

val1: 0.0 to 20.0
unit(s): XX1, XX3, XM3

Related Commands: CH1-CH4, DLA

APR? Group delay aperture for active channel query **DISPLAY (Ch 4)**

Syntax: `APR?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3)

ARB Simulate reflection-only calibration for both forward- and reverse-paths **CALIBRATION (Ch 5)**

Syntax: `ARB`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the `CON` command to turn on correction.

Related Commands: IC1-IC6, CON. Also see CRB, OC1-OC6.

ARF Simulate reflection only forward path calibration **CALIBRATION (Ch 5)**

Syntax: `ARF`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the CON command to turn on correction.

Related Commands: IC1-IC3, CON. Also see CRF, OC1-OC3

ARR Simulate reflection-only reverse path calibration **CALIBRATION (Ch 5)**

Syntax: `ARR`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the CON command to turn on correction.

Related Commands: IC1-IC3, CON. Also see CRR, OC1-OC3

ART Simulate transmission-only reverse path calibration **CALIBRATION (Ch 5)**

Syntax: `ART`

Remarks: This command sets the error correction type you wish to simulate; it does not perform a calibration. After issuing this command, input the calibration data arrays you wish to apply to the measured data then issue the CON command to turn on correction.

Related Commands: IC1, CON. Also see CRT, OC1

ASC Autoscale the active channel **DISPLAY (Ch 4)**

Syntax: `ASC`

Remarks: For best results, wait for a full sweep before issuing command.

Related Commands: CH1-CH4, WFS

ASP Sets stop-sweep-position angle for polar display on active channel **DISPLAY (Ch 4)**

Syntax: `ASP val1 unit(s)`

val1 –360.00 to 360.00
unit(s): DEG

Related Commands: CH1-CH4, PCP, PCS, AST

ASP? Stop-sweep-position angle for polar display on active channel query **DISPLAY (Ch 4)**

Syntax: `ASP?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

AST Set start-sweep-position angle for polar display on active channel **DISPLAY (Ch 4)**

Syntax: `AST val1 unit(s)`

val1 –360.00 to 360.00
unit(s): DEG

Related Commands: CH1-CH4, PCP, PCS, ASP

AST? Start-sweep-position angle for polar display on active channel query **DISPLAY (Ch 4)**

Syntax: `AST?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

ATTN Attach next segment and make it the active segment **LIMITS (Ch 6)**

Syntax: `ATTN`

Related Commands: CH1-CH4, L01-L10, U01-U10, DIS, BEGN

AVG Turn data averaging ON and set number of averages. **ENHANCEMENT (Ch 4)**

Syntax: `AVG` *`val1 unit(s)`*

val1 1 to 4095
unit(s): XX1, XX3, XM3

Remarks: Restarts the sweep.

Related Commands: AOF

AVG? Number of averages query **ENHANCEMENT (Ch 4)**

Syntax: `AVG?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

BBL Select broadband load for use as calibration standard **CALIBRATION (Ch 5)**

Syntax: `BBL`

Related Commands: SLD

BBZ Enter broadband load impedance for calibration **CALIBRATION (Ch 5)**

Syntax: `BBZ` *`val1 unit(s)`*

val1 1.0 to 9999.99
unit(s): XX1, OHM

BC0

Turn CRT display OFF

SYSTEM STATE (Ch 8)

Syntax: `BC0`

Related Commands: BC1, BCX?

BC1

Turn CRT display ON.

SYSTEM STATE (Ch 8)

Syntax: `BC1`

Related Commands: BC0, BCX?

BCX?

Output CRT display ON/OFF status

SYSTEM STATE (Ch 8)

Syntax: `BCX?`

Data I/O: Outputs a 1 if ON, 0 if off in ASCII <NR1> format (paragraph 10-3).

Related Commands: BC0, BC1

BD1-BD5

Select band 1, 2, 3, 4, or 5 for definition.

MULTIPLE SOURCE (Ch 9)

Syntax: `BDx`

x 1 - 5

Remarks: Only commands in Multiple Source group may be issued between BD*X* and SVB command pairs.

Related Commands: SVB, CLB

BEG Begin calibration standards measurement process. **CALIBRATION (Ch 5)**

Syntax: `BEG`

Remarks: After calibration parameters are configured (see CALIBRATION group), use this command to start measuring calibration standards (data-collection process). The prompt to connect the first standard will be displayed. After prompt's action is carried out, issue commands to take calibration data for that standard and then go to next calibration step.

Status Reporting: Extended Event Status Register bit 0 will be set when all the calibration standards have been measured and the entire calibration process is complete.

Related Commands: TC1, TC2, TCD, NCS, RPC, KEC

BEGN Begin next segment and make it the active segment **LIMITS (Ch 6)**

Syntax: `BEGN`

Related Commands: ATTN

BH0 Turn bias OFF while in hold mode **MEASUREMENT (Ch 4)**

Syntax: `BH0`

Related Commands: BH1, BHX?, HLD

BH1 Turn bias ON while in hold mode **MEASUREMENT (Ch 4)**

Syntax: `BH1`

Related Commands: BH0, BHX?, HLD

BHX?

Bias turned ON or OFF during hold mode query

MEASUREMENT (Ch 4)

Syntax: `BHX?`

Data I/O: Outputs a 1 if ON, 0 if OFF in ASCII <NR1> format (paragraph 10-3).

Related Commands: BH0, BH1

BLU

Select blue as third plane color

SYSTEM STATE (Ch 8)

Syntax: `BLU`

Remarks: This command included for compatibility with Model 360. It sets the menu headers and marker colors to sky blue.

Related Commands: CYN, MNUCOL, MKRCOL.

BPF

Set break point frequency for 3 line LRL calibration

CALIBRATION (Ch 5)

Syntax: `BPF val1 unit(s)`

val1: frequency
unit(s): HZ, KHZ, MHZ, GHZ

BSP

Set stop frequency for current band

MULTIPLE SOURCE (Ch 9)

Syntax: `BSP val1 unit(s)`

val1: frequency
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: Except for band 1, only band stop frequencies can be set. Band start frequencies are automatically set to the previous band's end frequency.

Related Commands: BST, BSP?

BSP? Stop frequency for current band query **MULTIPLE SOURCE (Ch 9)**

Syntax: `BSP?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: BST, BSP

BST Set band 1 start frequency **MULTIPLE SOURCE (Ch 9)**

Syntax: `BST val1 unit(s)`

val1: frequency
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: Only band 1 start frequency can be set. Bands 2-5 automatically start at the end of the previous band.

Related Commands: BSP

BST? Band 1 start frequency query **MULTIPLE SOURCE (Ch 9)**

Syntax: `BST?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

BWL3 Set 3 dB for bandwidth loss value **MARKERS (Ch 6)**

Syntax: `BWL3`

Related Commands: FMKR, BWLS, BWLS?

BWLS Enter bandwidth loss value **MARKERS (Ch 6)**

Syntax: `BWLS val1 unit(s)`

val1: Depends on graph type; refer to Table 10-2 at the end of this chapter.

unit(s): Depends on graph type; refer to Table 10-2 at the end of this chapter.

Related Commands: FMKR, BWL3, BWLS?

BWLS? Output bandwidth loss value — **MARKERS (Ch 6)**

Syntax: `BWLS?`

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: BWL3, BWLS?

C12 Select 12-term calibration — **CALIBRATION (Ch 5)**

Syntax: `C12`

C8R Select 1 path, 2 port reverse path calibration — **CALIBRATION (Ch 5)**

Syntax: `C8R`

C8T Select 1 path, 2 port forward path calibration — **CALIBRATION (Ch 5)**

Syntax: `C8T`

CAS Clear active segmented limit vertical/horizontal definitions — **LIMITS (Ch 6)**

Syntax: `CAS`

CBT Select transmission-only calibration for both forward- and reverse-paths — **CALIBRATION (Ch 5)**

Syntax: `CBT`

CC0-CC3

Enter Open Standard capacitance coefficient (0, 1, 2, or 3) for use with user-defineded connector on selected port

CALIBRATION (Ch 5)

Syntax: `CCx val1 unit(s)`

x: 0 - 3
val1: –9999.99 to 9999.99
unit(s): XX1

Related Commands: P1C, P2C

CF2

Select female 2.4 mm connector for selected port

CALIBRATION (Ch 5)

Syntax: `CF2`

Related Commands: P1C, P2C

CF3

Select female GPC-3.5 connector for selected port

CALIBRATION (Ch 5)

Syntax: `CF3`

Related Commands: P1C, P2C

CFC

Select female TNC connector for selected port

CALIBRATION (Ch 5)

Syntax: `CFC`

Related Commands: P1C, P2C

CFK

Select female K Connector for selected port

CALIBRATION (Ch 5)

Syntax: `CFK`

Related Commands: P1C, P2C

CFN Select female Type N connector for selected port — CALIBRATION (Ch 5)

Syntax: `CFN`

Related Commands: P1C, P2C

CFS Select female SMA connector for selected port — CALIBRATION (Ch 5)

Syntax: `CFS`

Related Commands: P1C, P2C

CFT Select forward path transmission-only calibration — CALIBRATION (Ch 5)

Syntax: `CFT`

CFV Select female V connector for selected port — CALIBRATION (Ch 5)

Syntax: `CFV`

Related Commands: P1C, P2C

CH1-CH4 Make channel (1, 2, 3, or 4) the active channel — CHANNELS (Ch 4)

Syntax: `CHx`

x 1 - 4

Remarks: If channel to be activated is not currently displayed, the sweep will be restarted with the requested active channel displayed. The channel display mode however, (single, dual, dual overlaid, or quad), will be maintained.

Related Commands: CHX?, WFS

CHX? Active channel number query **CHANNELS (Ch 4)**

Syntax: `CHX?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

CLB Clear all band definitions **MULTIPLE SOURCE (Ch 9)**

Syntax: `CLB`

CM Centimeters suffix for numerical data entries. **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `CM`

Related Commands: CMT

CM2 Select male 2.4 mm connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CM2`

Related Commands: P1C, P2C

CM3 Select male GPC-3.5 connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CM3`

Related Commands: P1C, P2C

CMC Select male TNC connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CMC`

Related Commands: P1C, P2C

CMK Select male K connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CMK`

Related Commands: P1C, P2C

CMN Select male Type N connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CMN`

Related Commands: P1C, P2C

CMS Select male SMA connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CMS`

Related Commands: P1C, P2C

CMT Centimeters suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `CMT`

Related Commands: CM

CMV Select Male V connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CMV`

Related Commands: P1C, P2C

CMX? Calibration method query **CALIBRATION (Ch 5)**

Syntax: `CMX?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). Values are: 1=standard OSL, 2=offset-short, 3=LRL/LRM.

CND Select user-defined connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CND`

Remarks: You must enter specifications of the standard devices to be used during the calibration.

Related Commands: P1C, P2C, CC0-CC3, COO, COS

CNG Select GPC-7 connector for selected port **CALIBRATION (Ch 5)**

Syntax: `CNG`

Related Commands: P1C, P2C

CNTR Enter center frequency **MEASUREMENT (Ch 4)**

Syntax: `CNTR` *`val1 unit(s)`*

val1: Can be any frequency from low frequency limit to high frequency limit

unit(s): HZ, KHZ, MHZ, GHZ

Related Commands: CNTR?, SPAN, SPAN?, SRT, SRT?, STP, STP?

CNTR? Output center frequency **MEASUREMENT (Ch 4)**

Syntax: `CNTR?`

Data I/O: Outputs a value in ASCII <NR3> format (paragrah 10-3)

Related Commands: CNTR?, SPAN, SPAN?, SRT, SRT?, STP, STP?

COF Turn vector error correction OFF **CALIBRATION (Ch 5)**

Syntax: COF

Remarks: Restarts the sweep.

Related Commands: CON

CON Turn vector error correction ON **CALIBRATION (Ch 5)**

Syntax: CON

Remarks: Restarts the sweep.

Related Commands: CON

CON? Vector error correction ON/OFF query **CALIBRATION (Ch 5)**

Syntax: CON?

Data I/O: Outputs 1 if ON, 0 if OFF in ASCII <NR1> format (paragraph 10-3).

COO Enter Open Standard offset value for user-defined connector on selected port **CALIBRATION (Ch 5)**

Syntax: COO *val1 unit(s)*

val1: –999.9999 to 999.9999 (meters)
unit(s): M, MTR, MM, MMT, CM, CMT

COS Enter Short Standard offset for user-defineded connector on selected port **CALIBRATION (Ch 5)**

Syntax: COS *val1 unit(s)*

val1: –999.999 to 999.999 (meters)
unit(s): M, MTR, MM, MMT, CM, CMT

CPYALCFH Copy ALC Cal file from floppy to hard disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYALCFH`

Remarks: The ALC file has the fixed name "HW_CAL.ALC".

Related Commands: CPYALCHF

CPYALCHF Copy ALC Cal file from hard to floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYALCHF`

Remarks: The ALC file has the fixed name "HW_CAL.ALC".

Related Commands: CPYALCFH

CPYALLFH Copy Combined Hardware Cal file from floppy to hard disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYALLFH`

Remarks: The Combined Hardware file has the fixed name "HW_CAL.ALL".

Related Commands: CPYALLHF

CPYALLHF Copy Combined Hardware Cal file from hard to floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYALLHF`

Remarks: The Combined Hardware file has the fixed name "HW_CAL.ALL".

Related Commands: CPYALLFH

CPYCALFH Copy specified calibration file from floppy drive to hard drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYCALFH "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Related Commands: CPYCALHF

CPYCALHF Copy specified calibration file from hard drive to floppy drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYCALHF "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Related Commands: CPYCALFH

CPYDATFH Copy specified data file from floppy drive to hard drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYDATFH "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Related Commands: CPYDATHF

CPYDATHF Copy specified data file from hard drive to floppy drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYDATHF "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Related Commands: CPYDATFH

CPYELGFH Copy Error Log file from floppy to hard disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYELGFH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: CPYELGH

CPYELGHF Copy Error Log file from hard to floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYELGHF "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: CPYELGFH

CPYFREFH Copy Frequency Cal file from floppy to hard disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYFREFH`

Remarks: The Frequency Cal file hasthe fixed name "HW_CAL.FRE".

Related Commands: CPYFREHF

CPYFREHF Copy Frequency Cal file from hard to floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYFREHF`

Remarks: The Frequency Cal file hasthe fixed name "HW_CAL.FRE".

Related Commands: CPYFREFH

CPYLOGFH Copy Service Log file from floppy to hard disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYLOGFH "filename"`

Remarks: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".log" file name extension is assumed.

Related Commands: CPYLOGHF

CPYLOGHF Copy service Log file from hard to floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `CPYLOGHF "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".log" file name extension is assumed.

Related Commands: CPYLOGFH

CPYNRMFH Copy specified normalization file from floppy drive to hard drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYNRMFH "filename"`

1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: CPYNRMHF

CPYNRMHF Copy specified normalization file from hard drive to floppy drive. **DISK FUNCTION (Ch 8)**

Syntax: `CPYNRMHF "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: CPYNRMFH

CRB

Select reflection only calibration for both forward and reverse paths

CALIBRATION (Ch 5)

Syntax: `CRB`

CRF

Select forward path reflection-only calibration

CALIBRATION (Ch 5)

Syntax: `CRF`

CRR

Select reverse path reflection-only calibration

CALIBRATION (Ch 5)

Syntax: `CRR`

CRT

Select reverse path transmission-only calibration

CALIBRATION (Ch 5)

Syntax: `CRT`

CSB

Clear ALL status event registers.

STATUS BYTE/SRQ (Ch 7)

Syntax: `CSB`

Related Commands: *CLS

CSF?

Calibration start frequency query

CALIBRATION (Ch 5)

Syntax: `CSF?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

CSL

Clear error list from service log — **DIAGNOSTICS (Ch 8)**

Syntax: `CSL`

Remarks: This command will erase permanently any error messages in the service log. Typically for service use only.

Related Commands: OEL, OSL, SSL, PSL, ONE

CTF?

Calibration stop frequency query — **CALIBRATION (Ch 5)**

Syntax: `CTF?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

CTN

Continue sweeping from current frequency — **MEASUREMENT (Ch 4)**

Syntax: `CTN`

Remarks: Takes the instrument out of hold mode and continues sweeping from the current frequency.

Related Commands: HLD, TRS

CWC

Select CW frequency calibration — **CALIBRATION (Ch 5)**

Syntax: `CWC`

Related Commands: CWF, NOC, TDC, DFC

CWF

Turn CW mode ON and set frequency — **MEASUREMENT (Ch 4)**

Syntax: `CWF val1 unit(s)`

val1: CW freq
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: Restarts the sweep.

Related Commands: WFS, SWP, SRT, STP

CWF? CW mode frequency query **MEASUREMENT (Ch 4)**

Syntax: `CWF?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).

CWON Turn CW mode ON at last frequency set **MEASUREMENT (Ch 4)**

Syntax: `CWON`

Remarks: Restarts the sweep.

Related Commands: CWF

CWON? CW mode ON/OFF query **MEASUREMENT (Ch 4)**

Syntax: `CWON?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).
(0=OFF, 1=ON)

CWP Set number of trace data points to be drawn in CW mode **CW SWEEP (Ch 9)**

Syntax: `CWP val1 unit(s)`

val1: 1 to 1601
unit(s): XX1

Remarks: This is a CW "sweep" mode where the data trace represents consecutive measurements at the same CW frequency. Restarts the sweep.

Related Commands: WFS, DD0, DD1, CWF, SWP

CWP?

Number of trace data points to be drawn in CW mode query

CW SWEEP (Ch 9)

Syntax: `CWP?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3).

CXX?

Output calibration type

CALIBRATION (Ch 5)

Syntax: `CXX?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (0=None, 1=12 term, 2=8 term FWD, 3=8 term REV, 4=Transmission FWD, 5=Transmission REV, 6=Transmission FWD & REV, 7=Reflection FWD, 8=Reflection REV, 9=Reflection FWD & REV)

CYN

Select cyan as third plane color

SYSTEM STATE (Ch 8)

Syntax: `CYN`

Remarks: This command included for compatibility with Model 360. It sets the menu headers and marker colors to cyan.

Related Commands: BLU, MKRCOL, MNUCOL

D13

Display channels 1 and 3 only (Dual display)

CHANNELS (Ch 4)

Syntax: `D13`

Remarks: Restarts the sweep.

Related Commands: WFS, T13

D14

Display all 4 channels (Quad display)

CHANNELS (Ch 4)

Syntax: `D14`

Remarks: Restarts the sweep.

Related Commands: WFS

D24 Display channels 2 and 4 only (Dual display) **CHANNELS (Ch 4)**

Syntax: `D24`

Remarks: Restarts the sweep.

Related Commands: WFS, T24

DAT Display currently measured data for active channel **DISPLAY (Ch 4)**

Syntax: `DAT`

Related Commands: DNM

DAT? Trace memory display mode for active channel query **DISPLAY (Ch 4)**

Syntax: `DAT?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (1=data, 2=memory, 3=data & memory, 4=data with memory mathematically combined)

Related Commands: MTH?

DATCOL Enter the color pallete number for data **SYSTEM STATE (Ch 8)**

Syntax: `DATCOL val1`

val1: 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: ANNCOL, GRTCOL, LAYCOL, MKRCOL, MNUCOL, TRCCOL, DATCOL?

DATCOL? Data color number query — SYSTEM STATE (Ch 8)

Syntax: `DATCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: ANNCOL?, GRTCOL?, LAYCOL?, MKRCOL?, MNUCOL?, TRCCOL?, DATCOL

DB Decibels suffix for numerical data entries — DATA ENTRY SUFFIXES (Ch 4)

Syntax: `DB`

Related Commands: DBL, DBM

DBL Decibels suffix for numerical data entries — DATA ENTRY SUFFIXES (Ch 4)

Syntax: `DBL`

Related Commands: DB, DBM

DBM dBm suffix for numerical data entries — DATA ENTRY SUFFIXES (Ch 4)

Syntax: `DBM`

Related Commands: DB, DBL

DBP Select distance bandpass mode for active channel — TIME DOMAIN (Ch 9)

Syntax: `DBP`

DC1 Display channel 1 and 2 operating parameters **SYSTEM STATE (Ch 8)**

Syntax: `DC1`

DC3 Display channel 3 and 4 operating parameters **SYSTEM STATE (Ch 8)**

Syntax: `DC3`

DCA Select automatic DC term calculation for low-pass mode **TIME DOMAIN (Ch 9)**

Syntax: `DCA`

DCO Select Open for DC term for lowpass mode **TIME DOMAIN (Ch 9)**

Syntax: `DCO`

DCP Display calibration parameters **SYSTEM STATE (Ch 8)**

Syntax: `DCP`

Remarks: `Same as DCP1.`

DCP1 Display calibration parameters, 1st page. **SYSTEM STATE (Ch 8)**

Syntax: `DCP1`

DCP2 Display calibration parameters, 2nd page. **SYSTEM STATE (Ch 8)**

Syntax: `DCP2`

DCS Select Short for DC term for lowpass mode **TIME DOMAIN (Ch 9)**

Syntax: `DCS`

DCV Enter value for DC term for lowpass mode **TIME DOMAIN (Ch 9)**

Syntax: `DCV val1 unit(s)`

val1: –999.999 to 999.999
unit(s): XX1, XX3, XM3

Related Commands: DCV

DCV? Output lowpass DC term value **TIME DOMAIN (Ch 9)**

Syntax: `DCV?`

Data I/O: Outputs the value in ASCII <NR3> format.

Related Commands: DCV

DCX? Output lowpass DC term selection **TIME DOMAIN (Ch 9)**

Syntax: `DCX?`

Data I/O: Outputs value in ASCII <NR3> format, as follows:
(0=value, 1=auto, 2=line impedence, 3=open, 4=short)

Related Commands: DCA, DCO, DCS, DCV, DCZ

DCZ Select line impedance for DC term for lowpass mode **TIME DOMAIN (Ch 9)**

Syntax: `DCZ`

DD0 Turn off data drawing **SYSTEM STATE (Ch 8)**

Syntax: `DD0`

DD1 Turn on data drawing **SYSTEM STATE (Ch 8)**

Syntax: `DD1`

DD1? Data drawing ON/OFF query **SYSTEM STATE (Ch 8)**

Syntax: `DD1?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

DDX? Output active channel domain parameter (frequency distance or time) **TIME DOMAIN (Ch 9)**

Syntax: `DDX?`

Data I/O: Outputs selection value in ASCII <NR3> format, as follows: (0=frequency, 1=time, 2=distance)

Related Commands: TDDIST, TDTIME, TDDIST?

DEC Delete calibration/front panel setup file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DEC "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DECH

DECH Delete calibration/front panel setup file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DECH "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DEC

DED Delete tabular data file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DED "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DEDH

DEDH Delete tabular data file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DEDH "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DED

DEG Degrees terminator for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `DEG`

DELALC Delete ALC Cal File from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELALC`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: DELALCH

DELALCH Delete ALC Cal File from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELALCH`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: DELALC

DELALL Delete Combined Hardware Cal File from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELALL`

Remarks: The Combined Hardware Cal file has the fixed name "HW_CAL.ALL".

Related Commands: DELALLH

DELALLH Delete Combined Hardware Cal File from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELALLH`

Remarks: The Combined Hardware Cal file has the fixed name "HW_CAL.ALL".

Related Commands: DELALL

DELCAL Delete Calibration/Front Panel Setup from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELCAL "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Related Commands: DELCAL

DELCALH Delete Calibration/Front Panel Setup from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELCALH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Related Commands: DELCAL

DELDAT Delete Tabular Data file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELDAT "filename"`

Remarks: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Related Commands: DELDATH

DELDATH Delete Tabular Data file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELDATH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Related Commands: DELDAT

DELELG Delete Error Log file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELELG "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: DELELGH

DELELGH Delete Error Log file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELELGH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: DELELG

DELFRE Delete Frequency Cal file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELFRE`

Remarks: The Frequency Cal file has the fixed name "HW_CAL.FRE".

Related Commands: DELFREH

DELFREH Delete Frequency Cal file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELFREH`

Remarks: The Frequency Cal file has the fixed name "HW_CAL.FRE".

Related Commands: DELFRE

DELLOG Delete Service Log file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELLOG` *"filename"*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".log" file name extension is assumed.

Related Commands: DELLOGH

DELLOGH Delete Service Log file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELLOGH` *"filename"*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".log" file name extension is assumed.

Related Commands: DELLOG

DELNRM Delete Trace Memory file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DELNRM "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: DELNRMH

DELNRMH Delete Trace Memory file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DELNRMH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: DELNRM

DEN Delete trace memory file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `DEN "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DENH

DENH Delete trace memory file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `DENH "val1"`

val1: File name string 8 characters max. First character must be a letter.

Related Commands: DEN

DF2 Display 2.4 mm female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DF2`

DF3 Display GPC-3.5 female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DF3`

DFC Select discrete frequency calibration **CALIBRATION (Ch 5)**

Syntax: `DFC`

Related Commands: CWC, TDC, NOC, IFV, Discrete frequency list commands in MEASUREMENT group: DFQ, DFD, FRS, FRI, FRP, FIL, FRC.

DFD Done specifying discrete frequency ranges **MEASUREMENT (Ch 4)**

Syntax: `DFD`

Remarks: Requires at least 2 points to have been entered. See MEASUREMENT/DISCRETE FREQUENCY LIST description.

DFK Display K female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFK`

DFN Display type N female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFN`

DFP Display front panel instrument state on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFP`

DFQ Enter single discrete frequency **MEASUREMENT (Ch 4)**

Syntax: `DFQ val1 unit(s)`

val1: a value from start sweep freq to stop sweep freq
unit(s): HZ, KHZ, MHZ, GHZ

DFS Display SMA female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFS`

DFT Display TNC female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFT`

DFV Display V female standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DFV`

DG7 Display GPC-7 male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DG7`

DGS Display GPIB status information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DGS`

DGT Display and graphics test on 372XXA CRT **PERIPHERAL TESTS (Ch 8)**

Syntax: `DGT`

Remarks: For service use only (same as DGT1).

DGT1 Display first CRT test pattern on 372XXA CRT **PERIPHERAL TESTS (Ch 8)**

Syntax: `DGT1`

Remarks: For service use only.

DGT2 Display 2nd CRT test pattern on 372XXA CRT **PERIPHERAL TESTS (Ch 8)**

Syntax: `DGT2`

Remarks: For service use only.

DGT3 Display 3rd CRT test pattern on 372XXA CRT **PERIPHERAL TESTS (Ch 8)**

Syntax: `DGT3`

Remarks: For service use only.

DIA Select air as dielectric type **DISPLAY (Ch 4)**

Syntax: `DIA` *`val1 unit(s)`*

Remarks: Value set to air dielectric value (1.000649).

Impacts time domain distance calculations and reference plane position settings.

DIE Set dielectric to value **DISPLAY (Ch 4)**

Syntax: `DIE` *`val1 unit(s)`*

val1: 1 to 999.999
unit(s): XX1, XX3, XM3

Remarks: Impacts time domain distance calculations and reference plane position settings.

DIM Select microporous teflon as dielectric type **DISPLAY (Ch 4)**

Syntax: `DIM`

Remarks: Value set to microporous teflon dielectric value (1.69).

Impacts time domain distance calculations and reference plane position settings.

DIP Select polyethylene as dielectric type **DISPLAY (Ch 4)**

Syntax: `DIP`

Remarks: Value set to polyethylene dielectric value (2.26).

Impacts time domain distance calculations and reference plane position settings.

DIS Display active segmented limit on active channel **LIMITS (Ch 6)**

Syntax: `DIS`

Remarks: Displays the active segmented limit. Requires SLA or SLL, as appropriate.

DIS? Active segmented limits ON/OFF query **LIMITS (Ch 6)**

Syntax: `DIS?`

Data I/O: Outputs an ASCII value in <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

DIT Select teflon (2.1) as dielectric type **DISPLAY (Ch 4)**

Syntax: `DIT`

Remarks: Impacts time domain distance calculations and reference plane position settings.

DIV Select division as trace math for activechannel **DISPLAY (Ch 4)**

Syntax: `DIV`

Remarks: Selects division as trace math for the active channel.

Related Commands: DNM, CH1–CH4

DIX? Dielectric constant query **DISPLAY (Ch 4)**

Syntax: `DIX?`

Data I/O: Outputs an ASCII value in <NR3 > format (paragraph 10-3).

DLA Select group delay display for active channel **DISPLAY (Ch 4)**

Syntax: `DLA`

Related Commands: CH1–CH4

DLP Select distance lowpass mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `DLP`

DM2 Display 2.4 mm male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DM2`

DM3 Display GPC-3.5 male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DM3`

DMK Display K male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DMK`

DMN Display Type N male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DMN`

DMS Display SMA male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DMS`

DMT Display TNC male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DMT`

DMV Display V male standard information on 372XXA CRT **SYSTEM STATE (Ch 8)**

Syntax: `DMV`

DNM Display data normalized to trace memory on active channel **DISPLAY (Ch 4)**

Syntax: `DNM`

Related Commands: DIV, MUL, ADD, MIN, CH1–CH4, STD, WFS

DPI Select distance phasor impulse mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `DPI`

Related Commands: CH1–CH4

DPN Enter pen number for data plotting **HARD COPY (Ch 8)**

Syntax: `DPN` *`val1 unit(s)`*

val1: 1 to 8
unit(s): XX1

DPR0 Turn off outputting of data pairs for single graph data types only. **DATA TRANFER (Ch 7)**

Syntax: DPR0

Remarks: See DPR1 for details.

DPR1

Turn on outputting of data pairs for single graph type displays.

DATA TRANFER (Ch 7)

Syntax: DPR1

Remarks: This is a data formatting command for the OFD/IFD and OM1–OM6 commands that allow for sending of complex data pairs (i.e., mag/phase or real/ imaginary) while using single graph displays (i.e. log mag or real), as if the related dual graph type was selected. The data element not currently measured on the single display will be zeroed out. For example: if the log mag graph type is selected for the active channel and "DPR1;OFD" is issued, the data will be sent out in the same format as if the log mag/phase graph type was active(dB, degrees). The only difference is the *phase* value will be zeroed out (dB, 0).

Similarly, if "DPR1;OFD" is issued while a phase display is selected for the active channel, the data will be output as if the log mag/phase display was selected, except that the *magnitude* value will be zeroed out (0, degrees). See Table 7-7 for data output format information for all display types.

This command is useful in developing a standard data transfer routine in your application program, but will impact throughput speed (for single displays only).

Related Commands: DPR0, OFD, IFD, OM1–OM6

DR1-DR6

Select marker 1-6 as delta reference marker

MARKERS (Ch 6)

Syntax: DRx
x=1 to 6

DRF

Turn delta reference marker mode on

MARKERS (Ch 6)

Syntax: DRF

Related Commands: DR1–DR6

DRL Set diagnostic read latch **DIAGNOSTICS (Ch 8)**

Syntax: `DRL`

Remarks: For service use only.

DRO Turn delta reference marker mode off **MARKERS (Ch 6)**

Syntax: `DRO`

DRO? Delta reference marker mode ON/OFF query **MARKERS (Ch 6)**

Syntax: `DRO?`

Data I/O: Outputs 1 if ON, 0 if OFF in ASCII <NR1 > format (paragraph 10-3).

DRX? Delta reference marker number query **MARKERS (Ch 6)**

Syntax: `DRX?`

Data I/O: Outputs an ASCII value in <NR1> format (paragraph 10-3).

DSF0 Disable automatic filter shape factor calculation **MARKERS (Ch 6)**

Syntax: `DSF0`

Related Commands: DSF1, DSFX?

DSF1 Enable automatic filter shape factor calculation **MARKERS (Ch 6)**

Syntax: `DSF1`

Related Commands: DSF0, DSFX?

DSFX?

Output automatic filter shape factor calculation enable disable status

MARKERS (Ch 6)

Syntax: DSFX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3), (0=Off, 1=On)

Related Commands: DSF0, DSF1

DSP

Select single channel display of active channel

CHANNELS (Ch 4)

Syntax: DSP

Related Commands: CH1–CH4

DSP?

Channel display mode query

CHANNELS (Ch 4)

Syntax: DSP?

Data I/O: Outputs an ASCII value in <NR1> format (paragraph 10-3). (1=single, 13=dual 1&3, 24=dual 2&4, 4=quad, 130=dual overaly 1&3, 240=dual overlay 2&4)

Related Commands: CH1–CH4

DSQ0

Disable automatic filter Q calculation

MARKERS (Ch 6)

Syntax: DSQ0

Related Commands: DSQ1, DSQX?

DSQ1

Enable automatic filter Q calculation

MARKERS (Ch 6)

Syntax: DSQ1

Related Commands: DSQ0, DSQX?

DSQX? Output automatic filter Q calculation enable/disable status **MARKERS (Ch 6)**

Syntax: DSQX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3), (0=Off, 1=On)

Related Commands: DSQ0, DSQ1

DTM Display both measurement data and trace memory on active channel **DISPLAY (Ch 4)**

Syntax: DTM

Related Commands: STD

DVM Display DVM channel **DIAGNOSTICS (Ch 8)**

Syntax: DVM

Remarks: For service use only.

DWG Display waveguide standards parameters **SYSTEM STATE (Ch 8)**

Syntax: DWG

DWL Set diagnostic write latch **DIAGNOSTICS (Ch 8)**

Syntax: DWL

Remarks: For service use only.

ECW Sets multiple source control equation to CW mode. **MULTIPLE SOURCE (Ch 9)**

Syntax: ECW

ED1 Edit Source 1 equation. **MULTIPLE SOURCE (Ch 9)**

Syntax: `ED1`

Remarks: See the command ' s function group.

ED2 Edits source 2 multiple source control equation. **MULTIPLE SOURCE (Ch 9)**

Syntax: `ED2`

Remarks: See the command ' s function group.

EDG End diagnostics mode **DIAGNOSTICS (Ch 8)**

Syntax: `EDG`

Remarks: For service use only.

EDR Edit receiver multiple source control equation **MULTIPLE SOURCE (Ch 9)**

Syntax: `EDR`

Remarks: See the command' s function group.

EDV Set divisor for equation being edited **MULTIPLE SOURCE (Ch 9)**

Syntax: `EDV` *`val1 unit(s)`*

val1: –199 to –1, 1 to 199
unit(s): XX1, XX3, XM3

Remarks: See the command' s function group.

EDV? Divisor for equation being edited query **MULTIPLE SOURCE (Ch 9)**

Syntax: `EDV?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).See the command ' s function group.

EKT External keyboard test **PERIPHERAL TESTS (Ch 8)**

Syntax: `EKT`

Remarks: For service use only.

EML Set multiplier for equation being edited **MULTIPLE SOURCE (Ch 9)**

Syntax: `EML val1 unit(s)`

val1: –199 to –1, 1 to 199
unit(s): XX1, XX3, XM3

Remarks: See the command' s function group.

EML? Multiplier for equation being edited query **MULTIPLE SOURCE (Ch 9)**

Syntax: `EML?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3). See the command' s function group.

EOS Set offset frequency for equation being edited **MULTIPLE SOURCE (Ch 9)**

Syntax: `EOS val1 unit(s)`

val1: –999.9999 GHz to 999.9999 GHz
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: See the command' s function group.

EOS? Offset frequency for equation being edited query **MULTIPLE SOURCE (Ch 9)**

Syntax: `EOS?`

Data I/O: Outputs value in ASCII <NR3 > format (paragraph 10-3).See the command' s function group.

ESW Sets the multiple source control equation in the sweep mode. **MULTIPLE SOURCE (Ch 9)**

Syntax: ESW

Remarks: See the command' s function group.

EXD Display external input **DIAGNOSTICS (Ch 8)**

Syntax: EXD

Remarks: For service use only.

EXW? Multiple source sweep/CW flag for equation being edited query **MULTIPLE SOURCE (Ch 9)**

Syntax: EXW?

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (0=sweep, 1=CW).See the command' s function group.

FFD Send a form feed command to the printer (and stop print/plot action). **HARD COPY (Ch 8)**

Syntax: FFD

FGT Select frequency with time gate mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: FGT

Remarks: Selects frequency with time gate mode for active channel.

Related Commands: CH1–CH4, OPC

FHI Set data points to 1601 **MEASUREMENT (Ch 4)**

Syntax: FHI

Related Commands: WFS, OPC, NP1601, FME, FLO

FIL Fill defined discrete frequency range **MEASUREMENT (Ch 5)**

Syntax: `FIL`

Remarks: See the command' s function group.

FLC Start source frequency calibration **DIAGNOSTICS (Ch 8)**

Syntax: `FLC`

Remarks: For service use only.

FLO Set data points to 101 **MEASUREMENT (Ch 4)**

Syntax: `FLO`

Related Commands: WFS, OPC, NP101, FME, FHI

FLTBW? Output filter bandwidth **MARKERS (Ch 6)**

Syntax: `FLTBW?`

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: BWL3, BWLS,

FLTC? Output filter center frequency **MARKERS (Ch 6)**

Syntax: `FLTC?`

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: BWL3, BWLS

FLTL? Output filter loss at reference value **MARKERS (Ch 6)**

Syntax: FLTL?

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: MSR0, MSRD, MSRM

FLTQ? Output filter Q **MARKERS (Ch 6)**

Syntax: FLTQ?

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: DSQ0, DSQ1

FLTS? Output filter shape factor **MARKERS (Ch 6)**

Syntax: FLTS?

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3).

Related Commands: DSF0, DSF1

FMKR Select filter parameters marker mode **MARKERS (Ch 6)**

Syntax: FMKR

Related Commands: AMKR, NMKR, SMKR, XMKR?

FMA Select ASCII data transfer format **DATA TRANSFER (Ch 7)**

Syntax: FMA

Remarks: Selects ASCII <NR3> as appropiate for succeeding data transfer commands. The ASCII format will stay in effect until either the FMB or FMC (binary format) commands are issued. This command will have no effect on data transfer commands that cannot be output in ASCII format. See the specific command's description to determine formats supported.

Related Commands: FMB, FMC

FMB Select IEEE-754 64-bit binary data transfer format **DATA TRANSFER (Ch 7)**

Syntax: FMB

Remarks: Selects IEEE-754 64-bit (double precision, 8 bytes) binary data transfer format for succeeding data transfer commands. The 64-bit format will stay in effect until either the FMA (ASCII) or FMC (32-bit binary) commands are issued. This command will have no effect on data transfer commands that cannot be output in 64-bit format. See the specific command's description to determine formats supported.

Related Commands: FMA, FMC, LSB, MSB

FMC Select IEEE-754 32-bit binary data transfer format **DATA TRANSFER (Ch 7)**

Syntax: FMC

Remarks: Selects IEEE-754 32-bit (single precision, 4 bytes) binary data transfer format for succeeding data transfer commands. The 32-bit format will stay in effect until either the FMA (ASCII) or FMB (64-bit binary) commands are issued. This command will have no effect on data transfer commands that cannot be output in 32-bit format. See the specific command's description to determine formats supported.

Related Commands: FMA, FMB, LSB, MSB

FME Set data points to 401 **MEASUREMENT (Ch 4)**

Syntax: FME

Related Commands: WFS, OPC, NP401, FHI, FLO

FOF Blank frequency information **SYSTEM STATE (Ch 8)**

Syntax: FOF

Remarks: Blanks any frequency information from the screen and any hard copy output. This command is useful for security reasons since the instrument cannot display frequency data again without the FON command being issued or a reset is invoked.

Related Commands: FON

FON Turns on frequency display and hard copy output **SYSTEM STATE (Ch 8)**

Syntax: FON

Remarks: See FOF for more information.

Related Commands: FOF

FOX? Output frequency blanking ON/OFF query **SYSTEM STATE (Ch 8)**

Syntax: FOX?

Data I/O: Outputs value in ASCII <NR1 > format (paragraph 10-3). (0=OFF, 1=ON)

FP0 Turn trace flatness function OFF **MEASUREMENT (Ch 4)**

Syntax: FP0

FP1 Turn trace flatness function ON **MEASUREMENT (Ch 4)**

Syntax: FP1

FPT Front panel test **PERIPHERAL TESTS (Ch 8)**

Syntax: `FPT`

Remarks: For service use only.

FPX? Flat power correction ON/OFF status query **DIAGNOSTICS (Ch 8)**

Syntax: `FPX?`

Remarks: For service use only.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

FQD Select frequency domain for active channel **TIME DOMAIN (Ch 9)**

Syntax: `FQD`

Related Commands: WFS, OPC

FRC Clear all defined discrete frequency ranges **MEASUREMENT (Ch 4)**

Syntax: `FRC`

Remarks: See command's function group.

FRI Set discrete frequency fill range increment frequency **MEASUREMENT (Ch 4)**

Syntax: `FRI val1 unit(s)`

val1: Start sweep freq to stop sweep freq
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: See command's function group.

FRP Set discrete frequency fill range number of points **MEASUREMENT (Ch 4)**

Syntax: `FRP val1 unit(s)`

val1: 1 to current number of points, 1601 max
unit(s): XX1, XX3, XM3

Remarks: See command's function group.

FRS Set discrete frequency fill range start frequency **MEASUREMENT (Ch 4)**

Syntax: `FRS val1 unit(s)`

val1: Start sweep freq to stop sweep freq
unit(s): HZ, KHZ, MHZ, GHZ

Remarks: See command's function group.

GCT Set gate center value for active channel time/distance domain **TIME DOMAIN (Ch 9)**

Syntax: `GCT val1 unit(s)`

val1: –999.999 to 999.999 µs,
unit(s): time = S, MS, USC, PS, PSC, NS, NSC
distance = M, MTR, MM, MMT, CM, CMT

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x\ \frac{2.99792458\ x\ 10^8}{\sqrt{dielectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?

GCT? Output gate center value **TIME DOMAIN (Ch 9)**

Syntax: GCT?

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: GCT

GDS Show gate symbols display on active channel **TIME DOMAIN (Ch 9)**

Syntax: GDS

GHZ Gigahertz suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: GHZ

GLS Select low sidelobe gate shape **TIME DOMAIN (Ch 9)**

Syntax: GLS

GMS Select minimum sidelobe gate shape **TIME DOMAIN (Ch 9)**

Syntax: GMS

GNM Select nominal sidelobe gate shape **TIME DOMAIN (Ch 9)**

Syntax: GNM

GOF Turn off gating on active channel **TIME DOMAIN (Ch 9)**

Syntax: GOF

Related Commands: GOF?

GOF? Output gating mode on active channel **TIME DOMAIN (Ch 9)**

Syntax: GOF?

Data I/O: Outputs value in ASCII <NR1> format, as follows: (0=off, 1=on, 2=display gate symbols)

Related Commands: GOF

GON Turn on gating on active channel **TIME DOMAIN (Ch 9)**

Syntax: GON

GPN Enter pen number for graticule **HARD COPY (Ch 8)**

Syntax: GPN *val1 unit(s)*

val1: 1 to 8
unit(s): XX1

GRF? Graph type for active channel query **DISPLAY (Ch 4)**

Syntax: GRF?

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (1=log mag, 2=phase, 3=log mag & phase, 4=Smith-impedance, 5=SWR, 6=group delay, 7=Smith-admittance, 8=lin polar, 9=log polar, 10=lin mag, 11=lin mag & phase, 12=real, 13=imaginary, 14=real & imaginary)

GRT Select rectangular gate shape **TIME DOMAIN (Ch 9)**

Syntax: GRT

GRTCOL Enter the color number for the graticule **SYSTEM STATE (Ch 8)**

Syntax: GRTCOL val1

val1: 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: ANNCOL, GRTCOL, LAYCOL, MKRCOL, MNUCOL, TRCCOL, GRTCOL?

GRTCOL? Graticule color number query **SYSTEM STATE (Ch 8)**

Syntax: `GRTCOL?`

Data I/O: Outputs the color palette numbers in ASCII <NR1> format.

Related Commands: ANNCOL?, GRTCOL?, LAYCOL?, MKRCOL?, MNUCOL?, TRCCOL?, GRTCOL

GSN Set gate span value **TIME DOMAIN (Ch 9)**

Syntax: `GSN val1 unit(s)`

val1: 0.0000 to 999.999 µs
unit(s): time = S, MS, USC, PS, PSC, NS, NSC
distance = M, MTR, MM, MMT, CM, CMT

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x\ \frac{2.99792458\ x\ 10^8}{\sqrt{dialectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?

GSN? Output gate span value **TIME DOMAIN (Ch 9)**

Syntax: `GSN?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: GSN

GSP Set gate stop value **TIME DOMAIN (Ch 9)**

Syntax: `GSP val1 unit(s)`

val1: –999.9999 to +999.9999 µs
unit(s): S, MS, USC, PS, PSC, NS, NSC

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$\textit{distance limit} = \textit{time limit} \; x \; \frac{2.99792458 \; x \; 10^8}{\sqrt{\textit{dialectric constant}}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?, GSP?

GSP? Output gate stop value **TIME DOMAIN (Ch 9)**

Syntax: `GSP?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: GSP

GST Set gate start value **TIME DOMAIN (Ch 9)**

Syntax: `GST val1 unit(s)`

val1: –999.9999 to +999.9999 µs
unit(s): S, MS, USC, PS, PSC, NS, NSC

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x\ \frac{2.99792458\ x\ 10^8}{\sqrt{dielectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?

GST? Output gate start value **TIME DOMAIN (Ch 9)**

Syntax: `GST?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: GST

GSX? Output gate shape **TIME DOMAIN (Ch 9)**

Syntax: `GSX?`

Data I/O: Outputs value in ASCII <NR1> format, as follows: (1=rectangular, 2=nominal, 3=low sidelobe, 4=minimum sidelobe)

Related Commands: GLS, GMS, GNM, GRT, GSX?

HC0 Disable internal I.F. calibration **INSTRUMENT STATE**

Syntax: `HC0`

Remarks: Prevents 372XXA from periodically and automatically performing the internal calibration to allow for synchronization between the 372XXA and a physical activity such as antenna rotation.

Turn on IF Cal as soon as measurement is complete to retain maximum measurement accuracy.

Related Commands: HC1, HCX?, HCT

HC1 Enable/trigger internal I.F. calibration **INSTRUMENT STATE**

Syntax: `HC1`

Related Commands: HC0, HCX?, HCT

HCT Trigger an IF calibration **INSTRUMENT STATE**

Syntax: `HCT`

Related Commands: HC0, HC1

HCX? Internal IF calibration enabled/disabled query **INSTRUMENT STATE**

Syntax: `HCX?`

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3). (0=disabled, 1=enabled)

HD0 Turn off tabular data headers and page formatting **HARD COPY (Ch 8)**

Syntax: `HD0`

Remarks: Turns off the tabular data headers and page formatting from tabular data printing or disk saves.

Related Commands: HD1

HD1 Turn on tabular data headers and page formatting **HARD COPY (Ch 8)**

Syntax: HD1

Remarks: Turns on the tabular data headers and page formatting from tabular data printing or disk saves.

Related Commands: HD0

HID Hide active segmented limit on active channel **LIMITS (Ch 6)**

Syntax: HID

Related Commands: DIS, CH1–CH4

HLD Hold sweep at current point **MEASUREMENT (Ch 4)**

Syntax: HLD

Related Commands: CTN, BH0, BH1, RH0, RH1

HLD? Hold mode query **MEASUREMENT (Ch 4)**

Syntax: HLD?

Data I/O: Outputs value in ASCII <NR1> format, as follows: (0=not in hold, 1=in hold)

Related Commands: HLD, CTN

HPN Enter pen number for header **HARD COPY (Ch 8)**

Syntax: HPN *val1 unit(s)*

val1: 1 to 8
unit(s): XX1

HZ Hertz suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `HZ`

IC1–IC12 Input calibration coefficients 1-12 **REMOTE ONLY (Ch 7)**

Syntax: `ICx val1`

x 1 - 12
val1: <Arbitrary Block>

Remarks: Allows entry of the user defined error correction coeffienct selected (1 - 12), see Table 10-1 at the end of this chapter. Prior to entering error terms, set the desired calibration type simulation with the matching Axx series calibration command (see Calibration Group). After inputting the error coefficients, turn on error correction with the CON command.

Data I/O: An array of floating point values whose size is equal to the currently set number of data points. The IC1-IC12 commands input an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Related Commands: ICA–ICC, ICL, FMA, FMB, FMC, LSB, MSB, CON, and Axx series commands in the CALIBRATION group.

ICA, ICB, ICC Input calibration coefficients 10, 11, or 12 **REMOTE ONLY (Ch 7)**

Syntax: `ICx val1`

x A, B, or C
val1: `<Arbitrary Block>`

Remarks: ICA, ICB, and ICC are equivalents of IC10, IC11, and IC12 comands respectively.

ICD Input corrected data for active channel's S-parameter **REMOTE ONLY (Ch 7)**

Syntax: `ICD val1`

val1: `<Arbitrary Block>`

Remarks: Data correction is for normalization and electrical length and, if applicable, time domain. Place the 37200A in hold (HLD) then issue the ICD command.

Data I/O: Inputs a floating point array whose size is equal to twice the number of points in the current sweep (real and imaginary data pairs for each point). The ICD command inputs an <Arbitrary Block> (paragraph 10-3).

Related Commands: FMA, FMB, FMC, LSB, MSB, IFD, OCD, ONP, HLD, WFS, CH1, CH4

ICF Input calibration information and front panel setup **REMOTE ONLY (Ch 7)**

Syntax: `ICF val1`

val1: `<Arbitrary Block>`

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3) previously output using the OCF command. The data is in internal system binary format and must not be edited or altered in any way.

Related Commands: OCF, IFP

ICL Input all calibration coefficients **REMOTE ONLY (Ch 7)**

Syntax: `ICL val1`

val1: `<Arbitrary Block>`

Remarks: Enter all error correction coefficients applicable to the current calibration type; see Table 10-1 at the end of this chapter. Prior to entering error terms, set the calibration type simulation with the corresponding Axx series calibration command (see Calibration Group). After inputting the error coefficients, apply error coeficients to measurement data with the CON command.

Data I/O: An array of floating point values whose size is equal to the currently set number of data points. The ICL command inputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Related Commands: FMA, FMB, FMC, OCL, IC1-IC12, CON

IEM Input Extended Event Status Enable Register **REMOTE ONLY (Ch 7)**

Syntax: `IEM val1`

val1 `0 - 32767`

Remarks: Sets the bits of the Standard Event Status Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0.

Related Commands: OEM, OEB

IF1 Set IF bandwidth to 10 Hz **ENHANCEMENT (Ch 4)**

Syntax: `IF1`

IF2 Set IF bandwidth to 100 Hz **ENHANCEMENT (Ch 4)**

Syntax: `IF2`

IF3 Set IF bandwidth to 1 kHz **ENHANCEMENT (Ch 4)**

Syntax: `IF3`

IF4 Set IF bandwidth to 10 kHz **ENHANCEMENT (Ch 4)**

Syntax: `IF4`

IFA Set IF bandwidth to maximum (10 kHz) **ENHANCEMENT (Ch 4)**

Syntax: `IFA`

Remarks: Same as IF4.

IFB Run 1st IF bandpass test **DIAGNOSTICS (Ch 8)**

Syntax: `IFB`

Remarks: For service use only.

IFD Input final (graph display format) data for S-parameter of active channel **REMOTE ONLY (Ch 7)**

Syntax: `IFD val1`

val1: <Arbitrary Block>

Remarks: Place the 37200A in hold (HLD); then issue the IFD command. Data must match the current graph type as shown in Table 10-2 at the end of this chapter.

Data I/O: Inputs a floating point array whose size is equal to the number of points in the current sweep (the array size is doubled for dual graph displays, i.e. log mag/phase). The IFD command inputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Related Commands: ICD, OFD, FMA, FMB, FMC, LSB, MSB, DPR0, DPR1, HLD, ONP, CH1-CH4

IFM Select minimum I.F. bandwidth (10 Hz) **ENHANCEMENT (Ch 4)**

Syntax: `IFM`

Remarks: Same as IF1.

IFN Select normal I.F. bandwidth (1 kHz) **ENHANCEMENT (Ch 4)**

Syntax: `IFN`

Remarks: Same as IF3.

IFP Input front panel setup **REMOTE ONLY (Ch 7)**

Syntax: `IFP val1`

val1: `<Arbitrary Block>`

Remarks: The 372XXA will validate then change to the new setup.

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3) previously output using the OFP command. The data is in internal system binary format and must not be edited or altered in any way.

Related Commands: OFP, ICF

IFR Select reduced I.F. bandwidth (100 Hz) **ENHANCEMENT (Ch 4)**

Syntax: `IFR`

Remarks: `Same as IF2.`

IFV Input frequency list **REMOTE ONLY (Ch 7)**

Syntax: `IFV val1`

val1: `<Arbitrary Block>`

Remarks: Inputs a list of frequencies for use as current sweep or for calibration setup.

CAUTION

IFV will reset (delete) existing calibration sweep and data.

Data I/O: An array of 2 to 1601 floating point values containing frequencies within the 372XXA range. The IFV command inputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Related Commands: FMA, FMB, FMC, LSB, MSB, DFC, ONP, WFS

IFX? IF bandwidth query **ENHANCEMENT (Ch 4)**

Syntax: `IFX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1-10 Hz, 2=100 Hz, 3=1 kHz, 4=10 kHz)

ILM Input Limits Status Enable Register **REMOTE ONLY (Ch 6)**

Syntax: `ILM val1`

val1 `0-255`

Remarks: Sets the bits of the Standard Event Status Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0.

NOTE
The Limits Testing feature must be turned on (LT1) for the 372XXA to report a limits pass/fail status.

Related Commands: OLM, OLB, LT1

IMG Select imaginary display for active channel **DISPLAY (Ch 4)**

Syntax: `IMG`

IMU Imaginary units terminator for numerical data entries. **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `IMU`

INT Initialize floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `INT`

Remarks: Initializes (formats) floppy disk in floppy drive to IBM/DOS 1.44 MB format. Command can take up to five minutes to complete format.

CAUTION

All data on floppy disk will be erased immediately upon execution of this command.

Related Commands: *OPC, *OPC?

IPM Set Service Request Enable Register. **REMOTE ONLY (Ch 7)**

Syntax: `IPM val1`

val1 `0–255`

Remarks: Behaves exactly the same as the *SRE, 488.2 common command. Sets the bits of the Service Request Enable Register to the binary weighted bit pattern of the decimal value entered. The register is cleared by sending a value of 0. Note that the Master Summary Status (MSS) bit 6 (decimal 64) will be ignored since it represents the summary of all enabled status bits (bits 0-5, 7).

This command is same as *SRE.

IS1–IS10 Input stored front panel setup 1-10 **REMOTE ONLY (Ch 7)**

Syntax: `ISx val1`

x: 1–10
val1: `<Arbitrary Block>`

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3) previously output using the OS1–OS10 commands. The data is in internal system binary format and must not be edited or altered in any way.

Related Commands: OS1–OS10

ISC — Select inverted compressed Smith chart for active channel — DISPLAY (Ch 4)

Syntax: `ISC val1 unit(s)`

val1: 3
unit(s): DBL, XX1

ISE — Select inverted expanded Smith chart for active channel — DISPLAY (Ch 4)

Syntax: `ISE val1 unit(s)`

val1: 10, 20, 30
unit(s): DBL, XX1

ISF — Exclude isolation measurement step during calibration — CALIBRATION (Ch 5)

Syntax: `ISF`

Related Commands: ISN, C12, C8T, C8R

ISM — Select normal inverted Smith chart for active channel — DISPLAY (Ch 4)

Syntax: `ISM`

ISN — Include isolation measurement step during calibration — CALIBRATION (Ch 5)

Syntax: `ISN`

KEC — Keep existing calibration data and return to measurement mode (abort calibration process) — CALIBRATION (Ch 5)

Syntax: `KEC`

KHZ Kilohertz terminator for numerical data entries — **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `KHZ`

LAND Select landscape mode for output plot — **HARD COPY (Ch 8)**

Syntax: `LAND`

Related Commands: PORT

LAX? Current sweep direction query — **MEASUREMENT (Ch 4)**

Syntax: `LAX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=forward (S_{11}, S_{21}), 2=reverse (S_{22}, S_{12}))

LAYCOL Enter the color number for overlay data — **SYSTEM STATE (Ch 8)**

Syntax: `LAYCOL val1`

val1: 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: ANNCOL, GRTCOL, LAYCOL, MKRCOL, MNUCOL, TRCCOL, LAYCOL?

LAYCOL? Overlay color number query — **SYSTEM STATE (Ch 8)**

Syntax: `LAYCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: DATCOL?, GRTCOL?, LAYCOL?, MKRCOL?, MNUCOL?, TRCCOL?, LAYCOL

LB0 Turn off limits pass/fail testing beeper **LIMITS (Ch 6)**

Syntax: `LB0`

Related Commands: LB0, LT0, LBX?

LB1 Turn on limits pass/fail testing beeper **LIMITS (Ch 6)**

Syntax: `LB1`

Remarks: Issues an audible beep if a set limit is exceeded.

Related Commands: LB0, LT0, LBX?

LBX? Limits testing beeper enabled/disabled query **LIMITS (Ch 6)**

Syntax: `LBX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=disabled, 1=enabled)

LCM Select LRL/M (Line Reflect Line/Match) calibration method **CALIBRATION (Ch 5)**

Syntax: `LCM`

Related Commands: SCM, OCM

LDT Enter date (or time) for data printout label **HARD COPY (Ch 8)**

Syntax: `LDT "val1"`

val1: String of up to 15 valid characters.

Related Commands: LMS, LID, LNM

LDT? Output label string for date/time **HARD COPY (Ch 8)**

Syntax: `LDT?`

Data I/O: Outputs string in <Arbitrary ASCII> format.

Related Commands: LDT

LFD Set limit frequency read-out delta value for active channel **LIMITS (Ch 6)**

Syntax: `LFD` *`val1 unit(s)`*

val1: Depends on graph type
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Remarks: Enter the value to offset Limit 2 from the currently set value of Limit 1. Both limits must be on to use this command. The values and suffixes are as appropriate for the graph type displayed.

Related Commands: LFP, CH1–CH4, LFD?

LFD? Output limit frequency readout delta value **LIMITS (Ch 6)**

Syntax: `LFD?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: LFD

LFP Select limit frequency read-out on active channel for phase displays **LIMITS (Ch 6)**

Syntax: `LFP`

Remarks: Phase displays, on a dual graph type like log magnitude and phase, are set using this command.

Related Commands: LFD, CH1–CH4

LFR Select limit frequency read-out for active channel **LIMITS (Ch 6)**

Syntax: `LFR`

Related Commands: LFD, LFP

LID Enter device I.D. for data label **HARD COPY (Ch 8)**

Syntax: `LID "val1"`

val1: String of up to 15 valid characters.

Related Commands: LDT, LMS, LNM. LID?

LID? Output label string for device ID

Syntax: `LID?`

Data I/O: Outputs string in <Arbitrary ASCII> format.

Related Commands: LID

LIN Select linear magnitude display for active channel **DISPLAY (Ch 4)**

Syntax: `LIN`

Related Commands: CH1–CH4

LKS0 Disable lock search mode **DIAGNOSTICS (Ch 8)**

Syntax: `LKS0`

Remarks: For service use only.

LKS1 Enable lock search mode **DIAGNOSTICS (Ch 8)**

Syntax: `LKS1`

Remarks: For service use only.

LKT Load calibration kit information from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `LKT`

LL1 Enter length of line 1 for LRL calibration **CALIBRATION (Ch 5)**

Syntax: `LL1 val1 unit(s)`

val1: 0 to +999.9999
unit(s): M, MTR, MM, MMT, CM, CMT

LL2 Enter length of line 2 for LRL calibration **CALIBRATION (Ch 5)**

Syntax: `LL2 val1 unit(s)`

val1: 0 to +999.9999
unit(s): M, MTR, MM, MMT, CM, CMT

LL3 Enter length of line 3 for 3 line LRL calibration **CALIBRATION (Ch 5)**

Syntax: `LL3 val1 unit(s)`

val1: 0 to +999.9999
unit(s): M, MTR, MM, MMT, CM, CMT

LLM? Output limit line display mode, single or segmented **LIMITS (Ch 6)**

Syntax: `LLM?`

Data I/O: Outputs a value in ASCII <NR1> format, as follows: (0=single, 1=segmented)

LLO Turn on lower limit for active channel and set to value **LIMITS (Ch 6)**

Syntax: `LLO val1 unit(s)`

val1: Depends on graph type (see DISPLAY group)
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Related Commands: LUP, CH1–CH4

LLO? Lower limit setting for active channel query **LIMITS (Ch 6)**

Syntax: `LLO?`

Data I/O Outputs a value in ASCII <NR3 > format (paragraph 10-3).

LLZ Reference impedance for calibration **CALIBRATION (Ch 5)**

Syntax: `LLZ val1 unit(s)`

val1: 0.001 to 1x10E+3
unit(s): XX1 XX3, XM3, OHM

LM2 Select a match for the second device in an LRM type calibration **CALIBRATION (Ch 5)**

Syntax: `LM2`

LM3 Select a match for the third device in an LRM type calibration **CALIBRATION (Ch 5)**

Syntax: `LM3`

LMS Enter model/serial number for data printout label **HARD COPY (Ch 8)**

Syntax: `LMS "val1"`

val1: String up to 15 characters long

Related Commands: LDT, LID, LNM

LMS? Output label string for model/serial number **HARD COPY (Ch 8)**

Syntax: `LMS?`

Data I/O: Outputs string in <Arbitrary ASCII> format.

Related Commands: `LMS`

LNM Enter label string for operator's name **HARD COPY (Ch 8)**

Syntax: `LNM "val1"`

val1: String up to 15 characters long

Related Commands: `LDT, LID, LMS`

LNM? Output label string for operator's name **HARD COPY (Ch 8)**

Syntax: `LNM?`

Data I/O: Outputs string in <Arbitrary ASCII> format.

Related Commands: `LNM`

LO11 Run LO1 phase-lock voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO11`

Remarks: For service use only.

LO12 Run LO1 D/A voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO12`

Remarks: For service use only.

LO21 Run LO2 main phase-lock voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO21`

Remarks: For service use only.

LO22 Run LO2 offset phase-lock voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO22`

Remarks: For service use only.

LO23 Run LO2 DDS phase-lock voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO23`

Remarks: For service use only.

LO24 Run LO2 main D/A voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO24`

Remarks: For service use only.

LO25 Run LO2 offset D/A voltage test **DIAGNOSTICS (Ch 8)**

Syntax: `LO25`

Remarks: For service use only.

LOC Enter label string for operator's comments for data printout **HARD COPY (Ch 8)**

Syntax: `LOC "val1"`

val1: String up to 79 characters long

Related Commands: LDT, LID, LNM, LMS

LOC? Output label string for operator's comment **HARD COPY (Ch 8)**

Syntax: `LOC?`

Data I/O: Outputs string in <Arbitrary ASCII> format.

Related Commands: LOC

LOF Turn off limits display **LIMITS (Ch 6)**

Syntax: `LOF`

Related Commands: LON

LOL0 Turn off lower limit on active channel **LIMITS (Ch 6)**

Syntax: `LOL0`

Related Commands: LON, LOF, LOL1, LLO

LOL1 Turn on lower limit at current value on active channel **LIMITS (Ch 6)**

Syntax: `LOL1`

Related Commands: LON, LOF, LOL0, LLO

LOLX? Lower limit ON/OFF query **LIMITS (Ch 6)**

Syntax: `LOLX`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

LON Turn on normal (non-segmented) limits display **LIMITS (Ch 6)**

Syntax: `LON`

LON? Normal (non-segmented) limits display ON/OFF query **LIMITS (Ch 6)**

Syntax: `LON?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

LPF? Channel 1-4 limit test failure query **LIMITS (Ch 6)**

Syntax: `LPF?`

Data I/O: Outputs a value in ASCII <NR1> format (0 thru 15). (Seeparagraph 10-3.)

LPF1? Channel 1 limit test failure query **LIMITS (Ch 6)**

Syntax: `LPF1?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=No failure, 1=Failed)

LPF2? Channel 2 limit test failure query **LIMITS (Ch 6)**

Syntax: `LPF2?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=No failure, 1=Failed)

LPF3? Channel 3 limit test failure query **LIMITS (Ch 6)**

Syntax: `LPF3?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=No failure, 1=Failed)

LPF4? Channel 4 limit test failure query **LIMITS (Ch 6)**

Syntax: `LPF4?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=No failure, 1=Failed)

LPH Select linear magnitude and phase display for active channel **DISPLAY (Ch 4)**

Syntax: `LPH`

Related Commands: CH1–CH4

LPI Select lowpass impulse response mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `LPI`

Remarks: Requires a calibration that used a harmonically related set of data points - time domain cal

Related Commands: TDC, CH1–CH4

LPS Select lowpass step response mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `LPS`

Remarks: Requires a calibration that used a harmonically related set of data points - time domain cal

Related Commands: TDC, CH1–CH4

LPSX? Output lowpass response (impulse or step) for active channel **TIME DOMAIN (Ch 9)**

Syntax: LPSX?

Data I/O: Outputs a value in ASCII <NR1> format, as follows: (0=impulse, 1=step)

LR2 Specify 2 line LRL calibration **CALIBRATION (Ch 5)**

Syntax: LR2

LR3 Specify 3 line LRL calibration **CALIBRATION (Ch 5)**

Syntax: LR3

LS1–LS10 Make LSx the active segmented lower limit on active channel **LIMITS (Ch 6)**

Syntax: LSx

x 1 - 10

Remarks: All succeeding limit segment commands will apply to LSx.

Related Commands: US1–US10, CH1–CH4, LSX?

LSB Select least significant byte first binary transfer format **REMOTE ONLY (Ch 7)**

Syntax: LSB

Remarks: This is convenient for inputting data to or outputting data from IBM/Intel based computers

Related Commands: MSB, FMB, FMC

LSEG Select segmented limit line display mode **LIMITS (Ch 6)**

Syntax: LSEG

Remarks: Any segmented limit line command selects this mode automatically.

Related Commands: LSNG

LSNG Select single limit line display mode **LIMITS (Ch 6)**

Syntax: `LSNG`

Remarks: Any single limit line command selects this mode automatically.

Related Commands: LSEG

LSX? Output currently active segmented limit **LIMITS (Ch 6)**

Syntax: `LSX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1–10=lower limit 1–10, 100-110=upper limit 1–10)

LT0 Turn off limits pass/fail testing **LIMITS (Ch 6)**

Syntax: `LT0`

LT1 Turn on limits pass/fail testing **LIMITS (Ch 6)**

Syntax: `LT1`

Status Reporting: A limit test failure will set bits 0–3 (for Channels 1–4, respectively) in the Limits Event Status Register.

LT1? Limits pass/fail testing ON/OFF query **LIMITS (Ch 6)**

Syntax: `LT1?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

LTC

Select a coaxial transmission line type calibration — **CALIBRATION (Ch 5)**

Syntax: `LTC`

Remarks: Selects a coaxial transmission line for the calibration.

LTST

Display the limits testing menu — **LIMITS (Ch 6)**

Syntax: `LTST`

Related Commands: LT0, LT1

LTU

Select a microstrip transmission line type calibration — **CALIBRATION (Ch 5)**

Syntax: `LTU`

LTW

Select a waveguide transmission line type calibration — **CALIBRATION (Ch 5)**

Syntax: `LTW`

Remarks: Can only use an offset short or CRL/LRM calibration method withwaveguide calibration.

LTX?

Calibration transmission line type query — **CALIBRATION (Ch 5)**

Syntax: `LTX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=coax, 2=waveguide, 3=microstrip)

LUP

Turn on upper limit and set to value — **LIMITS (Ch 6)**

Syntax: `LUP val1' unit(s)`

val1: Depends on graph type; see Table 10-2 at the end of this chapter.
unit(s): Depends on graph type; see Table 10-2 at the end of this chapter.

Remarks: The values and suffixes are as appropriate for the graph type displayed. That is, DEG, dB, REU, etc.

Related Commands: LON, LOF, UPL0, UPL1

LUP? Upper limit value query for active channel **LIMITS (Ch 6)**

Syntax: `LUP?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

LVH Turn on limits pass/fail testing rear panel TTL high voltage output **LIMITS (Ch 6)**

Syntax: `LVH`

Related Commands: LVL, LVX?

LVL Turn on limits pass/fail testing rear panel TTL low voltage output **LIMITS (Ch 6)**

Syntax: `LVL`

Related Commands: LVH, LVX?

LVX? Limits testing TTL level setting query **LIMITS (Ch 6)**

Syntax: `LVX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=low, 1=high)

M Meters suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `M`

Related Commands: MTR

M1C-M6C Set CW frequency to Marker 1- 6 **MEASUREMENT (Ch 4)**

Syntax: `MxC`

x 1 - 6

Remarks: Marker *x* must be set

Related Commands: MK1–MK6

M1E-M6E Set sweep/zoom end frequency, time, or distance to Marker 1- 6 **MEASUREMENT (Ch 4)**

Syntax: `MxE`

x 1 - 6

Remarks: Marker *x* must be set

Related Commands: MK1–MK6

M1S-M6S Set sweep/zoomstart frequency, time, or distance to Marker 1- 6 **MEASUREMENT (Ch 4)**

Syntax: `MxS`

x 1 - 6

Remarks: Marker *x* must be set

Related Commands: MK1–MK6

MAG — Select log magnitude display for active channel — **DISPLAY (Ch 4)**

Syntax: `MAG`

Related Commands: CH1–CH4

MAT — Select matched reflection device (open/open, short/short) measurement sequence for standard calibration — **CALIBRATION (Ch 5)**

Syntax: `MAT`

Related Commands: MIX

MEM — Display trace memory on active channel — **DISPLAY (Ch 4)**

Syntax: `MEM`

Related Commands: STD, CH1–CH4

MHZ — Megahertz terminator for numerical data entries — **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `MHZ`

MIN — Select subtraction as trace math for active channel — **DISPLAY (Ch 4)**

Syntax: `MIN`

Related Commands: MUL, ADD, DIV, CH1–CH4, MTH?

MIX — Select mixed reflection device (open/short, short/open) measurement sequence for standard calibration — **CALIBRATION (Ch 5)**

Syntax: `MIX`

Related Commands: MAT

MK1-MK6 Turn on marker 1-6 and set to sweep point **MARKERS (Ch 6)**

Syntax: `MKx val1 unit(s)`

x 1– 6
val1: Limited to current frequency, time, or distance sweep/zoomrange
unit(s): time = **S**, MS, USC, PS, PSC, NS, NSC
distance = **M, MTR**, MM, MMT, CM, CMT
frequency = **HZ**, KHZ, MHZ, GHZ

Related Commands: MR1–MR6

MK1?–MK6? Marker 1-6 setting query **MARKERS (Ch 6)**

Syntax: `MKx?`

x 1– 6

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3). The value is in time, distance , or frequency units depending on current sweep domain.

Related Commands: OM1-OM6

MKRC Select interpolated marker functionality **MARKERS (Ch 6)**

Syntax: `MKRC`

Related Commands: MKRD, MKRX?

MKRCOL Enter the color number for the markers, time or distance **SYSTEM STATE (Ch 8)**

Syntax: `MKRCOL val1`

val1 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: ANNCOL, DATCOL, GRTCOL, LAYCOL, MNUCOL, TRCCOL, MKRCOL?

MKRCOL? Markers color number query — **SYSTEM STATE (Ch 8)**

Syntax: `MKRCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: ANNCOL?, DATCOL?, GRTCOL?, LAYCOL?, MNUCOL?, TRCCOL?, MKRCOL

MKRD Select discrete marker functionality — **MARKERS (Ch 6)**

Syntax: `MKRD`

Related Commands: MKRC, MKRX?

MKRX? Output interpolated/discrete marker functionality — **MARKERS (Ch 6)**

Syntax: `MKRX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3) (0=Discrete, 1=Interpolated)

Related Commands: MKRC, MKRD

MKSL Marker search left — **MARKERS (Ch 6)**

Syntax: `MKSL (optional val1 unit(s))`

val1: Depends on graph type
unit(s): `Depends on graph type`

Remarks: If the optional *val1 unit(s)* argument is not supplied, the search marker (marker 2) is moved from its current position to the next most previous occurrence of the search value (see mnemonic SRCH). If the *val1 unit(s)* argument is supplied, the search value is updated to the argument value prior to moving the search marker.

Status Reporting If the search fails to find the search value, the search failure bit (bit 4) in the Limits Event Status Register will be set. An Execution Error will also be reported.

Related Commands: MKSR, SMKR, SRCH, SRCH?

MKSR Marker search right **MARKERS (Ch 6)**

Syntax: `MKSR (optional val1 unit(s))`

val1: Depends on graph type
unit(s): Depends on graph type

Remarks: If the optional val1 unit(s) argument is not supplied, the search marker (marker 2) is moved from its current position to the next occurance of the search value (see mnemonic SRCH). If the val1 unit(s) argument is supplied, the search value is updated to the argument value prior to moving the search marker

Status Reporting If the search fails to find the search value, the search failure bit (bit 4) in the Limits Event Status Register will be set. An Execution Error will also be reported.

Related Commands: MKSL, SMKR, SRCH, SRCH?

MKT0 Turn marker tracking off **MARKERS (Ch 6)**

Syntax: `MKT0`

Related Commands: MKT1, MKTX?

MKT1 Turn marker tracking on **MARKERS (Ch 6)**

Syntax: MKT1

Related Commands: MKT0, MKTX?

MKTX? Output marker tracking on/off status **MARKERS (Ch 6)**

Syntax: MKTX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MKT0, MKT1

MM Millimeters suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: MM

MMN Set active marker to minimum trace value on active channel **MARKERS (Ch 6)**

Syntax: MMN

Related Commands: MMX, CH1–CH4

MMT Millimeter terminator for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: MMT

Related Commands: MM

MMX Set active marker to maximum trace value on active channel **MARKERS (Ch 6)**

Syntax: MMX

Related Commands: MMN, CH1–CH4

MNUCOL Enter the color number for the menu headers **SYSTEM STATE (Ch 8)**

Syntax: `MNUCOL val1`

val1 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 (end of chapter).

Related Commands: ANNCOL, DATCOL, GRTCOL, LAYCOL, MKRCOL, TRCCOL, MNUCOL?

MNUCOL? Menu headers color number query **SYSTEM STATE (Ch 8)**

Syntax: `MNUCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: ANNCOL?, DATCOL?, GRTCOL?, LAYCOL?, MKRCOL?, TRCCOL?, MNUCOL?

MO1-MO6 Turn off marker 1-6 **MARKERS (Ch 6)**

Syntax: `MOx`

x 1– 6

MOF Turn off all marker displays **MARKERS (Ch 6)**

Syntax: `MOF`

MON Turn on all marker displays **MARKERS (Ch 6)**

Syntax: `MON`

MON? Markers displays ON/OFF query **MARKERS (Ch 6)**

Syntax: MON?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

MPH Select log magnitude and phase display for active channel **DISPLAY (Ch 4)**

Syntax: MPH

Related Commands: CH1–CH4

MPN Enter pen number for markers and limits data **HARD COPY (Ch 8)**

Syntax: MPN *val1 unit(s)*

val1: 1 - 8
unit(s): XX1

MR1-MR6 Select Marker 1-6 value read-out **MARKERS (Ch 6)**

Syntax: MRx

x 1– 6

MR1? Output marker 1 on/off status **MARKERS (Ch 6)**

Syntax: MR1?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR1, MO1

MR2? Output marker 2 on/off status **MARKERS (Ch 6)**

Syntax: MR2?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR2, MO2

MR3? Output marker 3 on/off status **MARKERS (Ch 6)**

Syntax: `MR2?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR3, MO3

MR4? Output marker 4 on/off status **MARKERS (Ch 6)**

Syntax: `MR4?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR4, MO4

MR5? Output marker 5 on/off status **MARKERS (Ch 6)**

Syntax: `MR5?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR5, MO5

MR6? Output marker 6 on/off status **MARKERS (Ch 6)**

Syntax: `MR6?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).(0=OFF, 1=ON)

Related Commands: MR6, MO6

MRX? Output active marker number **MARKERS (Ch 6)**

Syntax: `MRX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=No marker, 1 thru 6=The marker number)

Related Commands: MR1, MR2, MR3, MR4, MR5, MR6

MRR Restore original sweep range (unzoom marker sweep) **TIME DOMAIN (Ch 9)**

Syntax: `MRR`

Remarks: Valid only in the Time Domain mode

MS Milliseconds suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `MS`

MS0 Turn multiple source mode OFF **MULTIPLE SOURCE (Ch 9)**

Syntax: `MS0`

Related Commands: MS1, MSD

MS1 Turn multiple source mode ON **MULTIPLE SOURCE (Ch 9)**

Syntax: `MS1`

Related Commands: MS0, MSD

MSB — Select most significant byte first binary data transfer format — **REMOTE ONLY (Ch 7)**

Syntax: `MSB`

Remarks: Default format for byte ordering — not suitable for IBM/Intel based computers

Related Commands: LSB

MSD — Select multiple source DEFINE mode — **MULTIPLE SOURCE (Ch 9)**

Syntax: `MSD`

Related Commands: MS0, MS1

MSFH — Enter high loss value for shape factor calculation — **MARKERS (Ch 6)**

Syntax: `MSFH val1 unit(s)`

val1: Depends on graph type; refer to Table 10-2 at the end of this chapter.

unit(s): Depends on graph type; refer to Table 10-2 at the end of this chapter.

Related Commands: MSFL, MSFH?, FLTS?, DSF0, DSF1

MSFH? — Output high loss value for shape factor calculation — **MARKERS (Ch 6)**

Syntax: `MSFH?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: MSFH

MSFL Enter low loss value for shape factor calculation **MARKERS (Ch 6)**

Syntax: `MSFL val1 unit(s)`

val1: Depends on graph type; refer to Table 10-2 at the end of this chapter.

unit(s): Depends on graph type; refer to Table 10-2 at the end of this chapter.

Related Commands: MSFH, MSFL?, FLTS?, DSF0, DSF1

MSFL? Output low loss value for shape factor calculation **MARKERS (Ch 6)**

Syntax: `MSFL?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: MSFL

MSR0 Select 0 as ref for marker search and bandwidth calculation **MARKERS (Ch 6)**

Syntax: `MSR0`

Related Commands: MSRD, MSRM, MSRX?

MSRD Select delta ref marker as ref for marker search and bandwidth calculation **MARKERS (Ch 6)**

Syntax: `MSRD`

Related Commands: MSR0, MSRM, MSRX?

MSRM

Select max as ref for marker search and band-width calculation

MARKERS (Ch 6)

Syntax: MSRM

Related Commands: MSR0, MSRD, MSRX?

MSRX?

Output ref selection for marker search and bandwidth calculation

MARKERS (Ch 6)

Syntax: MSRX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=Zero dB, 1=Delta Ref Marker, 2=Maximum value)

Related Commands: MSR0, MSRD, MSRM

MSX?

Multiple source ON/OFF/DEFINE mode query

MULTIPLE SOURCE (Ch 9)

Syntax: MSX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON, 2=DEFINE)

MTH?

Trace math type query

DISPLAY (Ch 4)

Syntax: MTH?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=add, 2=substract, 3=multiply, 4=divide)

Related Commands: ADD, DIV, MUL, MIN, DAT?

MTR

Meter terminator for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: MTR

Related Commands: M

MUL Select multiplication as trace math for active channel — **DISPLAY (Ch 4)**

Syntax: MUL

Related Commands: DIV, ADD, MIN, MTH?, CH1–CH4

MV Millivolts suffix for numerical data entries — **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: MV

NCS Go to next calibration step — **CALIBRATION (Ch 5)**

Syntax: NCS

NMKR Select normal markers on active channel marker mode — **MARKERS (Ch 6)**

Syntax: NMKR

Related Commands: AMKR, FMKR, SMKR, XMKR?

NOC Select normal sweep calibration data points — **CALIBRATION (Ch 5)**

Syntax: NOC

Related Commands: SRT, STP, TOC, DFC, CWC

NP101 Set data points to 101 — **MEASUREMENT (Ch 4)**

Syntax: NP101

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, FLO

NP201 Set data points to 201 **MEASUREMENT (Ch 4)**

Syntax: `NP201`

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, ONP

NP401 Set data points to 401 **MEASUREMENT (Ch 4)**

Syntax: `NP401`

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, FME, ONP

NP51 Set data points to 51 **MEASUREMENT (Ch 4)**

Syntax: `NP51`

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, ONP

NP801 Set data points to 801 **MEASUREMENT (Ch 4)**

Syntax: `NP801`

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, ONP

NP1601 Set data points to 1601 **MEASUREMENT (Ch 4)**

Syntax: `NP1601`

Remarks: Restarts the sweep.

Related Commands: NPx series, WFS, *OPC, *OPC?, FHI, ONP

NRD Display non-ratioed parameters on all four channels **DIAGNOSTICS (Ch 8)**

Syntax: `NRD`

Remarks: For service use only.

NS Nanoseconds suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `NS`

Related Commands: NSC

NSC Nanoseconds suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `NSC`

Related Commands: NS

OAM1 Output channel 1 active marker value **REMOTE ONLY (Ch 7)**

Syntax: `OAM1`

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter.)

Data I/O: Outputs ASCII <NR3> formatted data (see paragraph 10-3). The data output consists of one or two elements, whose values will be determined by the graph display type selected.

Related Commands: OM1 thru OM6, OAM2, OAM3, OAM4

OAM2 Output channel 2 active marker value **REMOTE ONLY (Ch 7)**

Syntax: `OAM2`

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter.)

Data I/O: Outputs ASCII <NR3> formatted data (see paragraph 10-3). The data output consists of one or two elements, whose values will be determined by the graph display type selected.

Related Commands: OM1 thru OM6, OAM1, OAM3, OAM4

OAM3 Output channel 3 active marker value **REMOTE ONLY (Ch 7)**

Syntax: `OAM3`

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter.)

Data I/O: Outputs ASCII <NR3> formatted data (see paragraph 10-3). The data output consists of one or two elements, whose values will be determined by the graph display type selected.

Related Commands: OM1 thru OM6, OAM1, OAM2, OAM4

OAM4 Output channel 4 active marker value **REMOTE ONLY (Ch 7)**

Syntax: `OAM4`

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter.)

Data I/O: Outputs ASCII <NR3> formatted data (see paragraph 10-3). The data output consists of one or two elements, whose values will be determined by the graph display type selected.

Related Commands: OM1 thru OM6, OAM1, OAM2, OAM3

OC1–OC12 Output calibration coefficients 1-12 **REMOTE ONLY (Ch 7)**

Syntax: `OCx`

x 1 - 12

Remarks: Outputs error correction coefficient selected (1 - 12), see Table 10-1 at the end of this chapter.

Data I/O: An array of floating point values whose size is equal to twice the currently set number of data points. The OCx commands output an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (2 * NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: OCA–OCC, OCL, FMA, FMB, FMC, LSB, MSB, ONP

OCA, OCB, OCC Output calibration coefficients 10, 11, or 12 **REMOTE ONLY (Ch 7)**

Syntax: `OCx`

x A, B, or C

Block Size: 12 + (2 * NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Remarks: The OCA, OCB, and OCC are equivalents of OC10, OC11, and OC12 respectively.

OCD Output corrected data for active channel's S-parameter **REMOTE ONLY (Ch 7)**

Syntax: OCD

Remarks: Data correction is valid for normalization and electrical length and, if applicable, time domain. Wait for full sweep to be updated (WFS) prior to outputting data.

Data I/O: Outputs a floating point array whose size is equal to twice the number of points in the current sweep (contains real and imaginary data pairs for each point). The OCD command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (2 * NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: FMA, FMB, FMC, LSB, MSB, ORD, OFD, ONP, WFS, CH1-CH4

OCF Output calibration information and front panel setup **REMOTE ONLY (Ch 7)**

Syntax: OCF

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3). This same data can later be input using the ICF command. The data is in internal system binary format and must not be edited or altered in any way.

Block Size: 21690 bytes (NO CALIBRATION)
188371 bytes (CALIBRATION APPLIED)

Related Commands: OFP, ICF

OCL Ouput all calibration coefficients **REMOTE ONLY (Ch 7)**

Syntax: OCL

Remarks: Outputs all error correction coefficients applicable to the current calibration type; see Table 10-1 at the end of this chapter.

Data I/O: An array of floating point values whose size is equal to the currently set number of data points. The OCL command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (2 * NUMBER OF POINTS) * (NUMBER OF CAL TERMS)
*18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: OC1-OC12, OCA, OCB, OCC, ICL, ONCP, ONP

OCM Select offset short calibration method **CALIBRATION (Ch 5)**

Syntax: `OCM`

Related Commands: LCM, SCM

ODR Output floppy disk directory **REMOTE ONLY (Ch 7)**

Syntax: `ODR`

Data I/O: Outputs <Arbitrary Block> formatted list (paragraph 10-3) of comma separated filenames and sizes.

Block Size: 50 + 80 * (NUMBER OF FILES)

ODRH Output hard disk directory **REMOTE ONLY (Ch 7)**

Syntax: `ODRH`

Data I/O: Outputs <Arbitrary Block> formatted list (paragraph 10-3) of comma separated filenames and sizes.

Block Size: 50 + 80 * (NUMBER OF FILES)

ODV Output converted distance values for time domain sweep points **REMOTE ONLY (Ch 7)**

Syntax: ODV

Remarks: The converted distance values depend on the dielectric type set (see DISPLAY group, Dielectric commands).

Data I/O: An array of floating point values whose size is the currently set number of data points. The ODV command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: FMA, FMB, FMC, LSB, MSB, ONP, OTV, OFV

OEB Output Extended Event Status Register **STATUS REPORTING (Ch 7)**

Syntax: OEB

Remarks: Returns the decimal value of the binary bit pattern of the Extended Event Status Register. The value will be 0 - 32767.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

Related Commands: IEM, OEM

OEL Output list of error messages **ERROR REPORTING (Ch 7)**

Syntax: OEL

Data I/O: Outputs <Arbitrary Block> formatted list of error messages separated with commas.

Block Size: 50 + 50 * (NUMBER OF ERRORS)

Related Commands: ONE, OGE, OGL

OEM Output Extended Event Status Enable Register **STATUS REPORTING (Ch 7)**

Syntax: `OEM`

Remarks: Returns the decimal value of the bit pattern of the Extended Event Status Enable Register. The value will be 0 - 32767.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

Related Commands: IEM

OFD Output final (display format) data for active channel's S-parameter **REMOTE ONLY (Ch 7)**

Syntax: `OFD`

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter).
Channels must be displayed for valid data.

Data I/O: Outputs a floating point array whose size is equal to the number of points in the current sweep (the array is doubled for dual graph displays, i.e. log mag/phase). The OFD command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size:

SINGLE GRAPH DPR0 MODE
12 + (NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

DUAL GRAPH OR SINGLE GRAPH DPR1 MODE
12 + (2 * NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: FMA, FMB, FMC, LSB, MSB, DPR0, DPR1, ONP, OCD, ORD, CH1–CH4, WFS

OFF Set scaling offset value on active channel **DISPLAY (Ch 4)**

Syntax: `OFF val1 unit(s)`

val1: Depends on graph type (see DISPLAY group).
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Related Commands: SCL, ASC, CH1–CH4

OFF? Scaling offset value on active channel query **DISPLAY (Ch 4)**

Syntax: `OFF?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

OFP Output current front panel setup **REMOTE ONLY (Ch 7)**

Syntax: `OFP`

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3) for input later using the IFP command. The data is in internal system binary format and must not be edited or altered in any way.

Block Size: 8711 bytes

Related Commands: OCF, IFP

OFV Output frequency values for current sweep **REMOTE ONLY (Ch 7)**

Syntax: `OFV`

Remarks: An array of floating point values whose size is the currently set number of data points. The OFV command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: ONP, FMA, FMB, FMC, LSB, MSB

OGE Output Extended Description of current GPIB error. **ERROR REPORTING (Ch7)**

Syntax: OGE

Remarks: See error handling information in Chapter 7 for interpretation of the output string.

Data I/O: Outputs string in <Arbitrary ASCII> format.

Block Size: 210 bytes, maximum

Related Commands: ONE, OEL

OGL Output Extended Description of previous GPIB error. **ERROR REPORTING (Ch7)**

Syntax: OGL

Remarks: See error handling information in Chapter 7 for interpretation of the output string.

Data I/O: Outputs string in <Arbitrary ASCII> format.

Block Size: 210 bytes, maximum

Related Commands: ONE, OEL.

OHM Ohms suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: OHM

OID Output instrument information string **REMOTE ONLY (Ch 7)**

Syntax: OID

Remarks: Outputs the VNA operation string containing the following fields separated by commas:

<Model>,
<Low Frequency in GHz>,
<High Frequency in GHz>,
<Low Power in dB>,
<Reset Power in dB>,
<Software Revision>

The actual information for the 37200A queried will be returned in each field. The power values indicate the ALC range. Use the PIP? query to output absolute power setting at port1.

NOTE

System power in excess of reset level is available, but not guaranteed to remain level. Excessive system power setting will cause error 5110: RF PWR UNLEVELED and/or error 52XX: RF OVERLOAD to be reported. To determine maximum available power, consult Source Control Specifications in Operation Manual.

Data I/O Outputs an <Arbitrary ASCII> format (paragraph 10-3).

Block Size: 50 bytes, maximum

Related Commands: *IDN?, *OPT?, PIP?

OLB Output limits pass/fail testing status byte. **STATUS REPORTING (Ch 7)**

Syntax: OLB

Remarks: Returns the decimal value of the bit pattern of the Limits Status Register. The value will be 0 - 255.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

Related Commands: ILB

OLM Output limits status byte enable . **REMOTE ONLY (Ch 7)**

Syntax: OLM

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

Related Commands: ILM

OM1–OM6 Output marker 1-6 value for active channel **REMOTE ONLY (Ch 7)**

Syntax: `OMx`

x 1– 6

Remarks: Data units depend on the graph type currently set. (See Table 10-2 at the end of this chapter.)

Data I/O: Outputs ASCII <NR3 > formatted data (see paragraph 10-3). The data output consists of one or two elements, whose values will be determined by the graph display type selected.

Related Commands: CH1–CH4, DPR0, DPR1

ONCT Output number of cal terms for current cal **CALIBRATION (Ch 5)**

Syntax: `ONCT`

Remarks: Outputs the value in ASCII <NR1> format. See Table 10-1 at the end of this chapter.

ONE Output number of error messages stored in service log **ERROR REPORTING (Ch 7)**

Syntax: `ONE`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

Related Commands: OEL, OGE, OGL

ONP Output number of points currently being measured **REMOTE ONLY (Ch 7)**

Syntax: `ONP`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

OPB Output Primary Status Byte **IEEE488.2 (Ch 7)**

Syntax: `OPB`

Remarks: This is the equivalent command to *STB?, 488.2 Status Byte query. Returns the decimal value of the bit pattern of the Status Byte and the Master Summary Status bit 6. The value will be 0 - 255.

Data I/O: Outputs value in ASCII <NR1> format (paragraph 10-3)

Related Commands: *STB?

ORD Output raw data for active channel's parameter **REMOTE ONLY (Ch 7)**

Syntax: `ORD`

Remarks: Outputs the raw data (real and imaginary) pairs before any correction is applied. Wait for full sweep to be updated (WFS) prior to outputting data.

Data I/O: Outputs a floating point array whose size is equal to twice the number of points in the current sweep (contains real and imaginary data pairs for each point). The ORD command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (2 * NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: CH1–CH4, OFD, OCD, ONP, FMA, FMB, FMC, LSB, MSB

OS1–OS10 Output stored front panel setup 1–10 **REMOTE ONLY (Ch 7)**

Syntax: `OSx`

x 1 - 10

Data I/O: <Arbitrary Block> formatted data (paragraph 10-3) for later input using the IS1–IS10 commands. The data is in internal system binary format and must not be edited or altered in any way.

Block Size: 8711 bytes

Related Commands: ISxx, OFP, OCF

OSL Output service log **REMOTE ONLY (Ch 8)**

Syntax: `OSL`

Remarks: This command is useful when troubleshooting system failure or GPIB programming type problems. It is also useful for capturing and archiving error information for errors that occur during Remote Only operation.

Data I/O: Outputs <Arbitrary Block> formatted data that consists of service data and all error messages, with details about each error.

Block Size: 450 + 100 * (NUMBER OF ERRORS)

Related Commands: OEL, PSL, SAVLOG, SAVLOGH, CSL, ONE, OGE, OGL

OTV Output time values for time domain measurement points **ERROR REPORTING (Ch 7)**

Syntax: `OTV`

Data I/O: An array of floating point values whose size is the currently set number of data points. The OTV command outputs an <Arbitrary Block> (paragraph 10-3) containing either ASCII or binary formatted data depending on currently selected format (see format selector commands FMA, FMB, FMC).

Block Size: 12 + (NUMBER OF POINTS) *18 FMA MODE
*8 FMB MODE
*4 FMC MODE

Related Commands: FMA, FMB, FMC, LSB, MSB, ODV, OFV, ONP

P1C Select port 1 for connector specification **CALIBRATION (Ch 5)**

Syntax: `P1C`

Remarks: Specifies port 1 as the port to which subsequent connector related commands will apply.

Related Commands: P2C

P1C? Port 1 connector specification query **CALIBRATION (Ch 5)**

Syntax: `P1C?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=SMA male, 2=SMA female, 3=K male, 4=K female, 5=Type N male, 6=Type N female, 7=GPC3.5 male, 8=GPC3.5 female, 9=GPC7, 10=other & user specified, 11=V male, 12=V female, 13=TNC male, 14=TNC female, 15=2.4mm male, 16=2.4mm female)

P1P? Output power at port 1 query **CALIBRATION (Ch 5)**

Syntax: `P1P?`

Remarks: Absolute power setting in dB. Includes flat test port power correction, when applied.

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: PWR?, SA1?, FP0, FP1

P2C Select port 2 for connector specification **CALIBRATION (Ch 5)**

Syntax: `P2C`

Related Commands: P1C

P2C? Select port 2 for connector specification query **CALIBRATION (Ch 5)**

Syntax: `P2C?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=SMA male, 2=SMA female, 3=K male, 4=K female, 5=Type N male, 6=Type N female, 7=GPC3.5 male, 8=GPC3.5 female, 9=GPC7, 10=other & user specified, 11=V male, 12=V female, 13=TNC male, 14=TNC female, 15=2.4mm male, 16=2.4mm female)

PBL Select 1/4-size plot bottom left corner **HARD COPY (Ch 8)**

Syntax: `PBL`

Remarks: Selects a quarter-size plot, which appears in the bottom left corner of the screen.

Related Commands: PBR, PFL

PBR Select 1/4-size plot bottom right corner **HARD COPY (Ch 8)**

Syntax: `PBR`

Remarks: Selects a quarter-size plot, which appears in the bottom right corner of the screen.

Related Commands: PBL, PFL

PCP Select "measurement phase" polar chart mode **DISPLAY (Ch 4)**

Syntax: `PCP`

Related Commands: PCS, CH1–CH4

PCS Select "sweep position" polar chart mode for active channel **DISPLAY (Ch 4)**

Syntax: `PCS`

Related Commands: PCP, CH1–CH4

PCX? Polar chart position/phase mode query **DISPLAY (Ch 4)**

Syntax: `PCX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=phase, 2=position)

Related Commands: PCP, CH1–CH4

PDR Print directory listing of the floppy drive **DISK FUNCTION (Ch 8)**

Syntax: `PDR`

Remarks: A copy of the directory listing of the floppy drive is sent to the printer.

Related Commands: ODR, ODRH, PDRH

PDRH Print directory listing of the hard drive **DISK FUNCTION (Ch 8)**

Syntax: `PDRH`

Remarks: A copy of the directory listing of the hard drive is sent to the printer.

Related Commands: ODR, ODRH, PDR

PEL Print the error log **DIAGNOSTICS (Ch 8)**

Syntax: `PEL`

Remarks: A formatted list of the error messages in the service log is sent to the printer.

Related Commands: OFL, OSL, PSL

PFL Select full-size plot **HARD COPY (Ch 8)**

Syntax: `PFL`

Related Commands: PBL, PFR

PFS Print full screen image **HARD COPY (Ch 8)**

Syntax: `PFS`

Related Commands: PGR

PGR Print graph area screen image **HARD COPY (Ch 8)**

Syntax: `PGR`

Related Commands: PFS

PGT Plot graticule **DISK FUNCTION (Ch 8)**

Syntax: `PGT`

PHA Select phase display for active channel **DISPLAY (Ch 4)**

Syntax: `PHA`

Related Commands: CH1–CH4

PHO Set phase scaling offset for display on active channel **DISPLAY (Ch 4)**

Syntax: `PHO val1 unit(s)`

val1: –180 to +180
unit(s): DEG

PHO? Phase scale offset on active channel query — **DISPLAY (Ch 4)**

Syntax: `PHO?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

PLD Plot data area only — **HARD COPY (Ch 8)**

Syntax: `PLD`

PLG Select log polar display for active channel — **DISPLAY (Ch 4)**

Syntax: `PLG`

Related Commands: CH1–CH4

PLH Plot header — **HARD COPY (Ch 8)**

Syntax: `PLH`

PLM Plot markers and limits data — **HARD COPY (Ch 8)**

Syntax: `PLM`

PLO? Output plot mode, portrait or landscape — **HARD COPY (Ch 8)**

Syntax: `PLO`

Data I/O: Outputs value in ASCKK <NR1> format, as follows:
(0=portrait, 1=landscape)

Related Commands: PORT, LAND

PLR Select linear polar display for active channel **DISPLAY (Ch 4)**

Syntax: `PLR`

Related Commands: CH1–CH4

PLS Plot entire screen **HARD COPY (Ch 8)**

Syntax: `PLS`

Related Commands: CH1–CH4

PLT Plot data traces only **HARD COPY (Ch 8)**

Syntax: `PLT`

PMK Print tabular data for markers **HARD COPY (Ch 8)**

Syntax: `PMK`

Related Commands: CH1–CH4

PMN Plot menu **HARD COPY (Ch 8)**

Syntax: `PMN`

PMT Print tabular data for traces and markers **HARD COPY (Ch 8)**

Syntax: `PMT`

Related Commands: CH1–CH4

PORT Select portrait mode for output plot **HARD COPY (Ch 8)**

Syntax: `PORT`

Related Commands: LAND, PLO?

PRT? Printer test **PERIPHERAL TESTS (Ch 8)**

Syntax: `PRT?`

Remarks: For service use only. Requires a special test fixture.

Data I/O: Returns a value in ASCII <NR1> format (paragraph 10-3). (0=No failure, 1=Failed)

PS Picoseconds suffix for numerical data entries. **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `PS`

PSC Picoseconds as the data terminator for numerical data entries. **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `PSC`

PSL Print service log **DIAGNOSTICS (Ch 8)**

Syntax: `PSL`

PSP Select number of power measurement sweeps for flat-test-port-power calibration **CALIBRATION (Ch 5)**

Syntax: `PSP` *`val1 unit(s)`*

val1: 1 - 5
unit(s): XX1

Related Commands: PSP?

PSP? Output number of power sweeps for flat power correction **CALIBRATION (Ch 5)**

Syntax: `PSP?`

Data I/O: Outputs the value in ASCII <NR1> format.

Related Commands: PSP

PST Stop print/plot **HARD COPY (Ch 8)**

Syntax: `PST`

PT0-PT9 Select printout points skipped (0-9) during tabular printing and disk output **HARD COPY (Ch 8)**

Syntax: `PTx`

x 0–9

PTB Print tabular data for traces **HARD COPY (Ch 8)**

Syntax: `PTB`

Related Commands: PT0-PT9

PTL Select 1/4-size plot top left corner **HARD COPY (Ch 8)**

Syntax: `PTL`

Related Commands: PTR, PBR, PBL, PFL

PTR Select 1/4-size plot top right corner **HARD COPY (Ch 8)**

Syntax: `PTR`

Related Commands: PTL, PBR, PBL, PFL

PTS Select skippped points for flat-test-port-power calibration **CALIBRATION (Ch 5)**

Syntax: `PTS val1 unit(s)`

val1: 1 to 65
unit(s): XX1

PTS? Skippped points for flat-test-port-power calibration query **CALIBRATION (Ch 5)**

Syntax: `PTS?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

PW2 Set external source power **MEASUREMENT (Ch 4)**

Syntax: `PW2 val1 unit(s)`

val1: Depends on power range of source
unit(s): DBM, XX1, XX3, XM3

PW2? External source power query **MEASUREMENT (Ch 4)**

Syntax: `PW2?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

PWR Adjust internal source power **MEASUREMENT (Ch 4)**

Syntax: PWR val1, unit(s)

val1: Depends on 37200A power range
unit(s): DB, XX1, XX3, XM3

Related Commands: OID, P1P?, PWR?

PWR? Internal source power query **MEASUREMENT (Ch 4)**

Syntax: `PWR?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: OID, PIP?

RAD Radians suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `RAD`

RC1-RC10 Recall front panel setup from internal memory 1-10 **SAVE/RECALL (Ch 8)**

Syntax: `RCx`

x 1–10

RCK Recall trace memory from floppy disk to active channel **DISK FUNCTION (Ch 8)**

Syntax: `RCK "val1"`

val1: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as RCLNRM.

Related Commands: CH1–CH4

RCKH Recall trace memory from hard disk to active channel **DISK FUNCTION (Ch 8)**

Syntax: `RCKH "val1"`

val1: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as RCLNRM.

Related Commands: CH1–CH4

RCLALC Recall ALC Cal file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLALC`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: RCLALCH

RCLALCH Recall ALC Cal file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLALCH`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: RCLALC

RCLALL Recall Combined Hardware Cal file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLALL`

Remarks: The Combined Hardware Cal file has the fixed name "HW_CAL.ALL".

Related Commands: RCLALLH

RCLALLH

Recall Combined Hardware Cal file from hard disk

DISK FUNCTION (Ch 8)

Syntax: `RCLALLH`

Remarks: The Combined Hardware Cal file has the fixed name "HW_CAL.ALL".

Related Commands: RCLALL

RCLCAL

Recall calibration data and front panel setup file from floppy disk

DISK FUNCTION (Ch 8)

Syntax: `RCLCAL "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command RLD.

Related Commands: STO, RCLCALH

RCLCALH

Recall calibration data and front panel setup file from hard disk

DISK FUNCTION (Ch 8)

Syntax: `RCLCALH "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command RLDH.

Related Commands: STOH, RLDH

RCLDAT

Recall tabular data from floppy disk file specified to printer

DISK FUNCTION (Ch 8)

Syntax: `RCLDAT "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Same as command RTB.

Related Commands: RCLDATH

RCLDATH Recall tabular data from hard disk file specified to printer **DISK FUNCTION (Ch 8)**

Syntax: `RCLDATH "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Same as command RTBH.

Related Commands: RCLDAT

RCLELG Recall Error Log file from floppy disk to printer **DISK FUNCTION (Ch 8)**

Syntax: `RCLELG "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: RCLELGH

RCLELGH Recall Error Log file from hard disk to printer **DISK FUNCTION (Ch 8)**

Syntax: `RCLELGH "filename"`

filename 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: RCLELG

RCLFRE Recall Frequency Cal file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLFRE`

Remarks: The Frequency Cal file has the fixed name “HW_CAL.FRE”.

Related Commands: RCLFREH

RCLFREH Recall Frequency Cal file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLFREH`

Remarks: The Frequency Cal file has the fixed name “HW_CAL.FRE”.

Related Commands: RCLFRE

RCLLOG Recall Service Log file from floppy disk to printer **DISK FUNCTION (Ch 8)**

Syntax: `RCLLOG "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The “.log” file name extension is assumed.

Related Commands: RCLLOGH

RCLLOGH Recall Service Log file from hard disk to printer **DISK FUNCTION (Ch 8)**

Syntax: `RCLLOGH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The “.log” file name extension is assumed.

Related Commands: RCLLOG

RCLNRM Recall Trace Memory file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLNRM "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: RCLNRMH

RCLNRMH Recall Trace Memory file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `RCLNRMH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Related Commands: RCLNRM

RDA Perform automatic reference plane position calculation for active channel **DISPLAY (Ch 4)**

Syntax: `RDA`

Remarks: Calculation impacted by dielectric setting.

Related Commands: CH1–CH4, RDD, RDT, DIx commands in DISPLAY Group.

RDD Set reference plane position in distance for active channel **DISPLAY (Ch 4)**

Syntax: `RDD val1 unit(s)`

val1: –999.999 to +999.999

unit(s): M, MTR, MM, MMT, CM, CMT

Remarks: Calculation impacted by dielectric setting.

Related Commands: CH1–CH4, RDA, RDT, DIx commands in DISPLAY Group.

RDD? Reference plane position in distance for active channel query **DISPLAY (Ch 4)**

Syntax: `RDD?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

RDT Set reference plane position in time for active channel **DISPLAY (Ch 4)**

Syntax: `RDT val1 unit(s)`

val1: –999.999 to +999.999
unit(s): SEC, MS, US, NS, PS

Related Commands: CH1–CH4, RDD, RDA

RDT? Reference plane time position for active channel query **DISPLAY (Ch 4)**

Syntax: `RDT?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

REF Set scaling reference line position on active channel for rectilinear graph types **DISPLAY (Ch 4)**

Syntax: `REF val1 unit(s)`

val1: 0–8
unit(s): Depends on graph type; see Table 10-2 at the end of this chapter.

Related Commands: CH1–CH4, OFF, SCL

REF? Scaling reference line position on active channel for rectilinear graph types query **DISPLAY (Ch 4)**

Syntax: `REF?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

REL Select real display for active channel **DISPLAY (Ch 4)**

Syntax: `REL`

Related Commands: CH1–CH4

REU Real data units terminator for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `REU`

RGZ Select reflective device to be greater than Z_0 for LRL calibration **CALIBRATION (Ch 5)**

Syntax: `RGZ`

Related Commands: RLZ

RH0 RF off while in hold **MEASUREMENT (Ch 4)**

Syntax: `RH0`

Related Commands: HLD, RHI, BH0

RH1 RF on while in hold **MEASUREMENT (Ch 4)**

Syntax: `RH1`

Related Commands: HLD, RH0, BH0

RHX?

RF ON/OFF while in hold query **MEASUREMENT (Ch 4)**

Syntax: RHX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

RIM

Select real and imaginary display for active channel **DISPLAY (Ch 4)**

Syntax: RIM

Related Commands: CH1–CH4

RLD

Recall calibration data and front panel setup file from floppy disk **DISK FUNCTION (Ch 8)**

Syntax: RLD *"filename"*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command RCLCAL.

Related Commands: STO, RLDH

RLDH

Recall calibration data and front panel setup file from hard disk **DISK FUNCTION (Ch 8)**

Syntax: RLDH *"filename"*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command RCLCALH.

Related Commands: STOH, RLD

RLZ Set reflective device to be less than Z_0 for LRL calibration — **CALIBRATION (Ch 5)**

Syntax: `RLZ`

Related Commands: RGZ

RM1 Select reference plane at line 1 midpoint (LRL) — **CALIBRATION (Ch 5)**

Syntax: `RM1`

Related Commands: RRP

ROL Enter reflective device offset length for LRL calibration — **CALIBRATION (Ch 5)**

Syntax: `ROL` *`val1 unit(s)`*

val1: –10.000 to +10.000
unit(s): MMT, CMT, MTR, MM, CM, M

RPC Repeat previous calibration — **CALIBRATION (Ch 5)**

Syntax: `RPC`

Remarks: Performs exactly the same as the BEG command EXCEPT it uses existing calibration setup. This command is useful after recalling a saved calibration.

Related Commands: BEG, KEC, TC1, TC2, NCS

RPO Set rear panel output voltage value — **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RPO` *`val1 unit(s)`*

val1: –10.000 to +10.000
unit(s): VLT

RPO? Rear panel output voltage value query **REAR PANEL OUTPUT (Ch 9)**

Syntax: RPO?

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

RRP Select reference plane at reflection plane (LRL) **CALIBRATION (Ch 5)**

Syntax: RRP

Remarks: Selects reference plane to be at the reflection plane for the LRL calibration.

RST Reset default state **SYSTEM STATE (Ch 8)**

Syntax: RST

Remarks: Resets the 372XXA to default state with all user programmable parameters set to their default values. Default state settings are listed in Chapter 11. This command does not affect the Output Queue, Status or Parallel Poll Registers, or the 37200A GPIB address setting.

Remarks: Same as command *RST.

Related Commands: *RST, RST0, RST1

RST0 Reset instrument plus front panel memories and reserved parameters **SYSTEM STATE (Ch 8)**

Syntax: RST0

Remarks: Resets the 37200A to the default state with all user programmable parameters set to their default values. Default state settings are listed in Chapter 11. Additionally, front panel stored setups are cleared, the reserved parameters are set to their default values, and the GPIB address is changed to its default value (6). This command does not effect the Output Queue, Status, or Parallel Poll Registers.

Reserved parameters are those parameters which are initialized at factory turn-on. They are also initialized after a battery-backed RAM failure occurs.

Related Commands: *RST, RST, RST1

RST1 Reset instrument plus front panel memories **SYSTEM STATE (Ch 8)**

Syntax: `RST1`

Remarks: Resets the 37200A to the default state with all user programmable parameters set to their default values. Default state settings are listed in Chapter 11. Additionally, front panel stored setups are cleared. This command does not effect the Output Queue, Status, Parallel Poll Registers, or the GPIB address.

Related Commands: *RST, RST, RST0

RTB Recall tabular data from floppy disk file specified to printer **DISK FUNCTION (Ch 8)**

Syntax: `RTB "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Same as command RCLDAT.

Related Commands: RTBH

RTBH Recall tabular data from hard disk file specified to printer **DISK FUNCTION (Ch 8)**

Syntax: `RTBH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Same as command RCLDATH.

Related Commands: RTBH

RTL Return to local (front panel) control **SYSTEM STATE (Ch 8)**

Syntax: `RTL`

Remarks: This command performs the same function as the RETURN TO LOCAL key. Has no effect if the VNA is in the local lockout mode.

RV0 Turn rear panel output voltage OFF **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RV0`

RV1 Turn rear panel output voltage ON **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RV1`

RV1? Rear panel output voltage ON/OFF query **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RV1?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

RVD Rear panel output mode = dc value **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RVD`

Related Commands: RVH, RVV, RVL, RVX?

RVH Select the horizontal rear output voltage mode **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RVH`

Related Commands: RVD, RVV, RVL, RVX?

RVL Select the lock-direction-output-voltage mode **REAR PANEL OUTPUT (Ch 9)**

Syntax: `RVL`

Related Commands: RVH, RVV, RVD, RVX?

RVV

Select the rear panel output voltage to be vertical

REAR PANEL OUTPUT (Ch 9)

Syntax: `RVV`

Related Commands: RVH, RVD, RVL, RVX?

RVX?

Rear panel output voltage (analog out) mode query

REAR PANEL OUTPUT (Ch 9)

Syntax: `RVX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=horizontal, 2=vertical, 3=lock dir, 4=dc output)

S

Seconds suffix for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: `S`

S11

Measure S_{11} on active channel

DISPLAY (Ch 4)

Syntax: `S11`

Remarks: Measures the forward reflection parameter, S_{11}, on the active channel. Forward reflection is the value of the signal leaving port 1 vs the value of the signal being reflected back into port 1.

Related Commands: S12, S21, S22, CH1-CH4

S12

Measure S_{12} on active channel

DISPLAY (Ch 4)

Syntax: `S12`

Remarks: Measures the reverse transmission parameter, S_{12}, on the active channel. Reverse transmission is the value of the signal leaving port 2 vs the value of the signal being received at port 1.

Related Commands: S11, S21, S22, CH1-CH4

S21 — Measure S_{21} on active channel — **DISPLAY (Ch 4)**

Syntax: `S21`

Remarks: Measures the forward transmission parameter, S_{21}, on the active channel. Forward transmission is the value of the signal leaving port 1 vs the value of the signal being received at port 2.

Related Commands: S11, S12, S22, CH1-CH4

S22 — Measure S_{22} on active channel — **DISPLAY (Ch 4)**

Syntax: `S22`

Remarks: Measures the reverse reflection parameter, S_{22}, on the active channel. Reverse reflection is the value of the signal leaving port 2 vs the value of the signal being reflected back into port 2.

Related Commands: S11, S12, S21, CH1-CH4

SA1 — Set port 1 source attenuator — **MEASUREMENT (Ch 4)**

Syntax: `SA1 val1 unit(s)`

val1: 0 to 70 dB, in 10 dB steps
unit(s): DB, DBL, DBM, **XX1**, XX3, XM3

Remarks: Attenuates the signal output from Port 1.

Related Commands: PWR, P1P?, TA2

SA1? Port 1 source attenuator query **MEASUREMENT (Ch 4)**

Syntax: `SA1?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3).

SAVALC Save ALC Cal to floppy disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVALC`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: SAVALCH

SAVALCH Save ALC Cal to hard disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVALCH`

Remarks: The ALC Cal file has the fixed name "HW_CAL.ALC".

Related Commands: SAVALC

SAVALL Store internal ALC and frequency hardware calibrations to floppy disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVALL`

Remarks: For service use only.

Related Commands: SAVALLH

SAVALLH Store internal ALC and frequency hardware calibrations to hard disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVALLH`

Remarks: For service use only.

Related Commands: SAVALL

SAVCAL

Save calibration data and front panel setup to file on floppy disk

DISK FUNCTION (Ch 8)

Syntax: `STO "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command STO.

Related Commands: RLD

SAVCALH

Save calibration data and front panel setup to file on hard disk

DISK FUNCTION (Ch 8)

Syntax: `STOH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command STOH.

Related Commands: RLDH

SAVDAT

Store tabular data to file on floppy disk

DISK FUNCTION (Ch 8)

Syntax: `TDD "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Stores tabular printout data to an ASCII disk file. All or a subset of the data only will be stored depending on the number of points skipped using the PT*x* commands.

Same as command TDD.

Related Commands: PT0–PT9, TDDH

SAVDATH Store tabular data to file on hard disk **DISK FUNCTION (Ch 8)**

Syntax: `TDDH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Stores tabular printout data to an ASCII disk file. All or a subset of the data only will be stored depending on the number of points skipped using the PT*x* commands.

Same as command TDDH.

Related Commands: PT0–PT9, TDD

SAVELG Save Error Log to floppy disk **DISK FUNCTIONS (Ch8)**

Syntax: `SAVELG "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: SAVELGH

SAVELGH Save Error Log to hard disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVELGH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".elg" file name extension is assumed.

Related Commands: SAVELG

SAVFRE Save Frequency Cal to floppy disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVFRE`

Remarks: The Frequency Cal file has the fixed name "HW_CAL.FRE".

Related Commands: SAVFREH

SAVFREH Save Frequency Cal to hard disk **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVFREH`

Remarks: The Frequency Cal file has the fixed name "HW_CAL.FRE".

Related Commands: SAVFRE

SAVLOG Save service log to floppy drive **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVLOG "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".fre" file name extension is assumed.

Related Commands: SAVFRE

SAVLOGH Save service log to hard drive **DISK FUNCTIONS (Ch 8)**

Syntax: `SAVLOGH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".fre" file name extension is assumed.

Remarks: For service use only.

Related Commands: SAVLOG

SAVNRM Store trace memory to file on floppy disk **DISK FUNCTIONS**

Syntax: `SAVNRM "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Remarks: Same as command SDK.

Related Commands: SAVNRMH

SAVNRMH Store trace memory to file on hard disk **DISK FUNCTIONS**

Syntax: `SAVNRMH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Remarks: Same as command SDKH.

Related Commands: SAVNRM

SBD Enter substrate dielectric value for microstrip calibration **CALIBRATION (Ch 5)**

Syntax: `SBD val1 unit(s)`

val1: 1.0 to 9999.99
unit(s): XX1, XX3, XM3

Related Commands: SBT

SBT Enter substrate thickness for microstrip calibration **CALIBRATION (Ch 5)**

Syntax: `SBT val1 unit(s)`

val1: 0.001 mm to 1.0 m
unit(s): M, MTR, MM, MMT, CM, CMT

Related Commands: SBD

SCL

Set scaling on active channel — DISPLAY (Ch 4)

Syntax: `SCL val1 unit(s)`

val1: Depends on graph type:
Mag Resolution: 0.001–50
Phase Resolution: 0.01–90
Polar Resolution: $1E^{-9}$–999.99
Mag Resolution: 200 max
Smith/Inverted Smith: -30, 10, 20, 30

unit(s): Depends on graph type; refer to Table 10-2 at the end of this chapter.

Related Commands: OFF, REF, ISE, ISC, SME, SMC

SCL?

Active channel scale query — DISPLAY (Ch 4)

Syntax: `SCL?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SCM

Select standard Open/Short/Load calibration method — CALIBRATION (Ch 5)

Syntax: `SCM`

Related Commands: LCM, OCM

SDG

Start diagnostic troubleshooting mode — DIAGNOSTICS (Ch 8)

Syntax: `SDG`

Remarks: For service use only.

SDK Store trace memory to file on floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `SDK "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Remarks: Same as command SAVNRM.

Related Commands: SDKH

SDKH Store trace memory to file on hard disk **DISK FUNCTION (Ch 8)**

Syntax: `SDKH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".nrm" file name extension is assumed.

Remarks: Same as command SAVNRMH.

Related Commands: SDK

SDR Select standard receiver mode **DIAGNOSTICS (Ch 8)**

Syntax: `SDR`

Remarks: For service use only.

SETUP Display the most appropriate setup menu at this time **MEASUREMENT (Ch 4)**

Syntax: `SETUP`

SFC Start flat-test-port-power calibration sequence **CALIBRATION (Ch 5)**

Syntax: `SFC`

SH1, SH2 — Set offset short 1 or 2 offset length for offset short calibration — **CALIBRATION (Ch 5)**

Syntax: `SHx val1 unit(s)`

x — 1, 2
val1: — –999.999 to +999.999
unit(s): — M, MTR, MM, MMT, CM, CMT

Related Commands: OCM, WSH1, WSH2

SL1 — Select source lock mode — **DIAGNOSTICS (Ch 8)**

Syntax: `SL1`

Remarks: For service use only.

SLC — Clear all segmented limit definitions — **LIMITS (Ch 6)**

Syntax: `SLC`

SLD — Select sliding load for calibration — **CALIBRATION (Ch 5)**

Syntax: `SLD`

Remarks: During calibration the data-taking process for the load includes six slide positions. If any calibration frequencies are below 2 GHz, you must also use a broadband load.

Related Commands: BBL

SLH — Set segmented limits horizontal offset — **LIMITS (Ch 6)**

Syntax: `SLH val1 unit(s)`

val1: — Frequency, time, or distance in current sweep range
unit(s): — XM3, XX1, XX3

Related Commands: SLV

SLH? Segmented limits horizontal offset query **LIMITS (Ch 6)**

Syntax: SLH?

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SLL0 Turn lower segmented limits display off **LIMITS (Ch 6)**

Syntax: SLL0

Related Commands: LON, LOF, SLL1

SLL1 Turn lower segmented limits display on **LIMITS (Ch 6)**

Syntax: SLL1

Related Commands: LON, LOF, SLL0

SLLX? Lower segmented limits display ON/OFF query **LIMITS (Ch 6)**

Syntax: SLLX?

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

SLU0 Turn upper segmented limits display off. **LIMITS (Ch 6)**

Syntax: SLU0

Related Commands: LON, LOF, SLU1

SLU1 Turn upper segmented limits display on. **LIMITS (Ch 6)**

Syntax: SLU1

Related Commands: LON, LOF, SLL, SLU0

SLUX? Upper segmented sweep limits display ON/OFF query **LIMITS (Ch 7)**

Syntax: `SLUX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

SLV Set segmented limits vertical offset **LIMITS (Ch 6)**

Syntax: `SLV val1 unit(s)`

val1: Depends on graph type(see DISPLAY group)
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Related Commands: SLH

SLV? Segmented limits vertical offset query **LIMITS (Ch 6)**

Syntax: `SLV?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SMC Select compressed Smith chart for active channel **DISPLAY (Ch 4)**

Syntax: `SMC 3 DBL`

Remarks: Selects the compressed Smith chart for display on the active channel.

Related Commands: CH1–CH4, SME, SMI

SME Select expanded Smith chart for active channel **DISPLAY (Ch 4)**

Syntax: `SME val1 unit(s)`

val1: 10, 20, 30
unit(s): DBL, **XX1**

Related Commands: CH1–CH4, SMC, SMI

SMI Select normal Smith chart for active channel **DISPLAY (Ch 4)**

Syntax: `SMI`

Related Commands: CH1–CH4

SMKR Select marker search marker mode **MARKERS (Ch 6)**

Syntax: `SMKR`

Related Commands: AMKR, FMKR, NMKR, XMKR?

SOF Turn off smoothing **ENHANCEMENT (Ch 4)**

Syntax: `SOF`

Related Commands: SON

SOF? Smoothing ON/OFF query **ENHANCEMENT (Ch 4)**

Syntax: `SOF?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

SON Turn on trace display smoothing and set to percentage (%) of trace **ENHANCEMENT (Ch 4)**

Syntax: `SON val1 unit(s)`

val1: 0 - 20
unit(s): XX1, XX3, XM3

Related Commands: SOF

SON? Smoothing value query **ENHANCEMENT (Ch 4)**

Syntax: `SON?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SPAN Enter frequency span **MEASUREMENT (Ch 4)**

Syntax: `SPAN val1 unit(s)`

val1: Can be any frequency span up to the high frequency limit minus the low frequency limit of the 372XXA
unit(s): HZ, KHZ, MHZ, GHZ

Related Commands: CNTR, CNTR?, SPAN?, SRT, SRT?, STP, STP?

SPAN? Output frequency span **MEASUREMENT (Ch 4)**

Syntax: `SPAN?`

Data I/O: Outputs a value in ASCII <NR3> format (paragraph 10-3)

Related Commands: CNTR, CNTR?, SPAN, SRT, SRT?, STP, STP?

SPD Enter pen speed percentage HARD COPY (Ch 8)

Syntax: `SPD val1 unit(s)`

val1: 10 - 100
unit(s): XX1, XX3, XM3

SPH Set active segmented limit horizontal stop position **LIMITS (Ch 6)**

Syntax: `SPH val1 unit(s)`

val1: Frequency, time, or distance in current sweep range
unit(s): XX1, XX3, XM3

Related Commands: LS01–LS010, US01–US10

SPH?

Active segmented limit horizontal stop position query

LIMITS (Ch 6)

Syntax: `SPH?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SPV

Set active segmented limit vertical stop position

LIMITS (Ch 6)

Syntax: `SPV` *`val1 unit(s)`*

val1: Depends on graph type(see DISPLAY group)
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Related Commands: LS01–LS010, US01–US10

SPV?

Active segmented limit vertical stop position query

LIMITS (Ch 6)

Syntax: `SPV?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SRC1

Source linearity voltage test

DIAGNOSTICS (Ch 8)

Syntax: `SRC 1`

Remarks: For service use only.

SRC2

Source power output voltage test

DIAGNOSTICS (Ch 8)

Syntax: `SRC 2`

Remarks: For service use only.

SRCH? Output marker search value **MARKERS (Ch 6)**

Syntax: `SRCH?`

Data I/O: Outputs the search value in ASCII <NR3> format (paragraph 10-3)

Related Commands: MKSL, MKSR, SMKR, SRCH

SRT Set start frequency **MEASUREMENT (Ch 4)**

Syntax: `SRT` *`val1 unit(s)`*

val1: Can be any frequency from low frequency limit of 372XXA to current sweep stop frequency

unit(s): HZ, KHZ, MHZ, GHZ

Remarks: If a calibration is in place, the lower limit is the calibration start frequency.

Related Commands: STP, CWF

SRT? Start frequency query **MEASUREMENT (Ch 4)**

Syntax: `SRT?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

Related Commands: STP, CWF

ST1 Select set on mode **DIAGNOSTICS (Ch 8)**

Syntax: `ST1`

Remarks: For service use only.

STD Store active channel trace data to memory **DISPLAY (Ch 4)**

Syntax: `STD`

Remarks: Stores the active channel's trace data in memory.

Related Commands: MEM, DNM, DTM, CH1–CH4

STH Set active segmented limit horizontal start position **LIMITS (Ch 6)**

Syntax: `STH` *`val1 unit(s)`*

val1: Frequency, time, or distance
unit(s): XX1, XX3, XM3

Related Commands: STV, LS01–LS010, US01–US10

STH? Active segmented limit horizontal start position query **LIMITS (Ch 6)**

Syntax: `STH?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

STO Save calibration data and front panel setup to file on floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `STO` *`"filename"`*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command SAVCAL.

Related Commands: RLD

STOH Save calibration data and front panel setup to file on hard disk **DISK FUNCTION (Ch 8)**

Syntax: `STOH` *`"filename"`*

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".cal" file name extension is assumed.

Remarks: Same as command SAVCALH.

Related Commands: RLDH

STP Set stop frequency **MEASUREMENT (Ch 4)**

Syntax: `STP val1 unit(s)`

val1: Can be any frequency from current start-sweep frequency to maximum 372XXA frequency
unit(s): **HZ**, KHZ, MHZ, GHZ

Remarks: Upper frequency limit is reduced to the maximum calibrated frequency if a calibration is in place

Related Commands: SRT, CWF

STP? Stop frequency query **MEASUREMENT (Ch 4)**

Syntax: `STP?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

STV Set active segmented limit vertical start position **LIMITS (Ch 6)**

Syntax: `STV val1 unit(s)`

val1: Depends on graph type (see DISPLAY group)
unit(s): Depends on graph type (see Table 10-2 at the end of this chapter).

Related Commands: STH, LS01–LS010, US01–US10

STV? Active segmented limit vertical start position query — LIMITS (Ch 6)

Syntax: `STV?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

SV1-SV10 Save front panel setup to internal memory 1-10 — SAVE/RECALL (Ch 8)

Syntax: SV*x*

x 1–10

Related Commands: RC1–RC10

SVB Save current band definitions — MULTIPLE SOURCE (Ch 9)

Syntax: `SVB`

Remarks: See command's functional group

Related Commands: BD1–BD5, CLB

SWP Return to full sweep mode — MEASUREMENT (Ch 4)

Syntax: `SWP`

Remarks: Use this command to return to sweep mode from CW.

Related Commands: CWF

SWP? Sweep mode query — MEASUREMENT (Ch 4)

Syntax: `SWP?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=CW, 2=discrete fill, 3= normal sweep, 4=harmonic time domain)

SWR Select SWR display for active channel **DISPLAY (Ch 4)**

Syntax: `SWR`

Related Commands: CH1–CH4

SXX? S parameter on active channel query **DISPLAY (Ch 4)**

Syntax: `SXX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (11=S_{11}, 21=S_{21}, 22=S_{22}, 12=S_{12})

T13 Display overlaid channels 1 and 3 only **CHANNELS (Ch 4)**

Syntax: `T13`

Remarks: Restarts the sweep.

Related Commands: WFS, D13

T24 Display overlaid channels 2 and 4 only **CHANNELS (Ch 4)**

Syntax: `T24`

Remarks: Restarts the sweep.

Related Commands: WFS, D24

TA2 Set port 2 test attenuator **MEASUREMENT (Ch 4)**

Syntax: `TA2 val1 unit(s)`

val1: 0 to 40 in 10 dB steps
unit(s): DBL, DBM, XX1, XX3, XM3

Remarks: Attenuates the signal coming into port 2 (Option 6).

TA2? Port 2 test attenuator query **MEASUREMENT (Ch 4)**

Syntax: `TA2?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0, 10, 20, 30, 40)

TBP Select time bandpass processing mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `TBP`

Remarks: Selects time bandpass mode for the active channel.

Related Commands: CH1–CH4

TC1 Take calibration data for current standard on test port 1 (only) **CALIBRATION (Ch 5)**

Syntax: `TC1`

Related Commands: TC2, NCS, TCD

TC2 Take calibration data for current standard on test port 2 (only) **CALIBRATION (Ch 5)**

Syntax: `TC2`

Related Commands: TC1, NCS, TCD

TCD Take calibration data for current standard (both test ports) **CALIBRATION (Ch 5)**

Syntax: `TCD`

Related Commands: NC1, NC2, NCS

TDC Select time domain harmonic frequency calibration data points **CALIBRATION (Ch 5)**

Syntax: `TDC`

Remarks: Required for low pass time/distance domain measurements. The resulting frequency sweep will consist of harmonic multiples of the start frequency.

The Stop frequency is the start frequency times the number of data points selected up to the maximum instrument frequency.

Related Commands: NOC, DFC

TDD Store tabular data to file on floppy disk **DISK FUNCTION (Ch 8)**

Syntax: `TDD "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Stores tabular printout data to an ASCII disk file. All or a subset of the data only will be stored depending on the number of points skipped using the PT*x* commands.

Same as command SAVDAT.

Related Commands: PT0–PT9, TDDH

TDDH Store tabular data to file on hard disk **DISK FUNCTION (Ch 8)**

Syntax: `TDDH "filename"`

filename: 1 to 8 allowable characters: letters, numbers, and underscore (_). First character must be a letter. The quotes must be used. The ".dat" file name extension is assumed.

Remarks: Stores tabular printout data to an ASCII disk file. All or a subset of the data only will be stored depending on the number of points skipped using the PT*x* commands.

Same as command SAVDATH.

Related Commands: PT0–PT9, TDD

TDDIST Set time domain parameter to distance for active channnel — TIME DOMAIN (Ch 9)

Syntax: `TDDIST`

Related Commands: TDDIST?

TDDIST? Output active channel time domain parameter (time or distance) — TIME DOMAIN (Ch 9)

Syntax: `TDDIST?`

Data I/O: Outputs value in ASCII <NR1> format, as follows: (1=time, 2=distance)

Related Commands: TDDIST, TDTIME

TDPI0 Turn phasor impulse response off for active channel — TIME DOMAIN (Ch 9)

Syntax: `TDPI0`

Related Commands: TDPI1

TDPI1 Turn phasor impulse response on for active channel — TIME DOMAIN (Ch 9)

Syntax: `TDPI1`

Related Commands: TDPI0

TDPIX? Output phasor impulse on/off status for active channel — TIME DOMAIN (Ch 9)

Syntax: `TDPIX?`

Data I/O: Outputs value in ASCII <NR1> format, as follows: (0=off, 1=on

Related Commands: TDPI0, TDPI1

TDTIME Set time domain parameter to time for active channel **TIME DOMAIN (Ch 9)**

Syntax: `TDTIME`

Related Commands: TDDIST, TDDIST?

TDX? Time Domain mode query **TIME DOMAIN (Ch 9)**

Syntax: `TDX?`

Data I/O: Ouputs a value in ASCII <NR1> format (paragraph 10-3). (0=frequency, 1=frequency w/Gate, 2= LP Impulse, 3=LP Step, 4=BP, 5=BP Phasor Impulse)

TEX Select external measurement triggering via the rear panel connector **MEASUREMENT (Ch 4)**

Syntax: `TEX`

Related Commands: TIN

TIN Select internal measurement triggering **MEASUREMENT (Ch 4)**

Syntax: `TIN`

Related Commands: TEX

TK1 Select tracking mode **DIAGNOSTICS (Ch 8)**

Syntax: `TK1`

Remarks: For service use only.

TLP Select time lowpass mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `TLP`

Related Commands: TDC, CH1–CH4

TLZ Enter throughline impedance for calibration **CALIBRATION (Ch 5)**

Syntax: `TLZ val1 unit(s)`

val1: 1.0 to 9999.99
unit(s): XX1, XX3, XM3, OHM

TOL Select offset length for through line used during calibration **CALIBRATION (Ch 5)**

Syntax: `TOL val1 unit(s)`

val1: –999.9999 to +999.9999
unit(s): M, MTR, MM, MMT, CM, CMT

Related Commands: TDL, TFE, TFL

TPI Select time phasor impulse mode for active channel **TIME DOMAIN (Ch 9)**

Syntax: `TPI`

Related Commands: CH1–CH4

TPN Enter pen number for trace overlay data **HARD COPY (Ch 9)**

Syntax: `TPN val1 unit(s)`

val1: 1 to 8
unit(s): XX1

TRCCOL Enter the color number for memory data **SYSTEM STATE (Ch 8)**

Syntax: `TRCCOL`

val1: 0 - 47

Remarks: Color palette numbers are listed in Table 10-3 at the end of this chapter.

Related Commands: ANNCOL, DATCOL, GRTCOL, LAYCOL, MKRCOL, MNUCOL, TRCCOL?

TRCCOL? Memory data color number query **SYSTEM STATE (Ch 8)**

Syntax: `TRCCOL?`

Data I/O: Outputs the color palette number in ASCII <NR1> format.

Related Commands: ANNCOL?, DATCOL?, GRTCOL?, LAYCOL?, MKRCOL?, MNUCOL?, TRCCOL

TRS Trigger/restart sweep **MEASUREMENT (Ch 4)**

Syntax: `TRS`

Remarks: Restarts the sweep (continuous sweep mode) or triggers a single sweep (in hold mode).

Related Commands: WFS, HLD, CTN

TST Perform self test and output pass/fail result **IEEE 488.2 (Ch 7)**

Syntax: `TST`

Remarks: Causes the 37200A to perform an extensive, fully automated internal circuits self test. Detailed error messages indicating self test failures, if any, are placed in the service log in the order they occur. The query returns a "1" if any part of the self test failed, or a "0" when passed.

CAUTION

When commands TST or *TST? are sent to the 372XXA, the VNA output power is momentarily set to the model-dependent Rated Power level during the self test. Ensure that any equipment connected to Port 1 or Port 2 will not be damaged by this power level.

Data I/O: Returns a value in ASCII <NR1> format (paragraph 10-3).

Related Commands: ONE, OEL, OSL, PSL, *TST?

TXX? Trigger source query — MEASUREMENT (Ch 4)

Syntax: `TXX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=internal, 2=external, 3=GPIB)

Related Commands: TIN, TEX

U10 Select 10 mil calibration kit for microstrip calibration — CALIBRATION (Ch 5)

Syntax: `U10`

Related Commands: U15, U25

U15 Select 15 mil calibration kit for microstrip calibration — CALIBRATION (Ch 5)

Syntax: `U15`

Related Commands: U10, U25

U25 Select 25 mil calibration kit for microstrip calibration — CALIBRATION (Ch 5)

Syntax: `U25`

Related Commands: U10, U15

UPL0 Turn off upper limit for the active channel **LIMITS (Ch 6)**

Syntax: `UPL0`

Related Commands: UPL1, LUP, LON, LOF

UPL1 Turn on upper limit for the active channel **LIMITS (Ch 6)**

Syntax: `UPL1`

Related Commands: UPL0, LUP, LON, LOF

UPLX? Upper limit ON/OFF query **LIMITS (Ch 7)**

Syntax: `UPLX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (0=OFF, 1=ON)

US Microseconds suffix for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `US`

US1– US10 Make USx the active segmented upper limit on the active channel **LIMITS (Ch 6)**

Syntax: `USx`

x 1 - 10

Remarks: Makes USx the active segmented upper limit.

Related Commands: CH1–CH4, LS1–LS10, LSx?

USC

Microseconds terminator for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: `USC`

USE

Enter effective dielectric for microstrip calibration

CALIBRATION (Ch 5)

Syntax: `USE val1 unit(s)`

val1: 1.0 to 9999.99
unit(s): XX1, XX3, XM3

Related Commands: USW, USZ

USW

Enter microstrip width for microstrip calibration

CALIBRATION (Ch 5)

Syntax: `USW val1 unit(s)`

val1: 0.001 mm to 1.0 m
unit(s): M, MTR, MM, MMT, CM, CMT

Related Commands: USE, USZ

USZ

Enter microstrip impedance for microstrip calibration

CALIBRATION (Ch 5)

Syntax: `USZ val1 unit(s)`

val1: 1.0 to 9999.99
unit(s): XX1, XX3, XM3, OHM

Related Commands: USE, USW

V Volts suffix **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `V`

VLT Volts terminator for numerical data entries **DATA ENTRY SUFFIXES (Ch 4)**

Syntax: `VLT`

VSP Select rear panel output voltage voltage stop value **REAR PANEL OUTPUT (Ch 9)**

Syntax: `VSP val1 unit(s)`

val1: −10.000 to +10.000 volts
unit(s): V, VLT

Related Commands: VST

VSP? Rear panel output voltage stop value query **REAR PANEL OUTPUT (Ch 9)**

Syntax: `VSP?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

VST Select rear panel output voltage start value **REAR PANEL OUTPUT (Ch 9)**

Syntax: `VST val1 unit(s)`

val1: −10.000 to +10.000 volts
unit(s): V, VLT

Related Commands: VSP

VST? Rear panel output voltage start value query **REAR PANEL OUTPUT (Ch 9)**

Syntax: `VST?`

Data I/O: Outputs a value in ASCII <NR3 > format (paragraph 10-3).

WCO

Set cutoff frequency for user-defined-waveguide calibration kit

CALIBRATION (Ch 5)

Syntax: `WCO val1 unit(s)`

val1: 0 to current start frequency
unit(s): HZ, KHZ, MHZ, GHZ

WFS

Wait full sweep until all display data is valid

MEASUREMENT (Ch 4)

Syntax: `WFS`

Remarks: This command is useful before autoscaling, normalizing, or finding the minimum/maximum values (with markers). It is *required* when outputting data from the 37200A to ensure that all data points in the sweep are valid.

WFS is effective for dual sweeps containing forward and reverse parameters and also for insuring time domain processing is complete.

Status Reporting: Sets bit 4 in the Extended Event Status Register when complete.

Related Commands: TRS, HLD

WKD

Select user-defined waveguide calibration kit

CALIBRATION (Ch 5)

Syntax: `WKD`

Related Commands: WKI

WKI

Select installed waveguide calibration kit

CALIBRATION (Ch 5)

Syntax: `WKI`

Related Commands: WKD

WLS Select low sidelobe window shape for active channel

TIME DOMAIN (Ch 9)

Syntax: `WLS`

Related Commands: WMS, WNM, WRT, CH1–CH4

WMS Select minimum sidelobe window shape for active channel

TIME DOMAIN (Ch 9)

Syntax: `WMS`

Related Commands: WLS, WMS, WRT, CH1–CH4

WNM Select nominal window shape

TIME DOMAIN (Ch 9)

Syntax: `WNM`

Related Commands: WLS, WMS, WRT, CH1–CH4

WRT Select rectangular window shape

TIME DOMAIN (Ch 9)

Syntax: `WRT`

Related Commands: WLS, WMS, WRT, CH1–CH4

WSH1 Set waveguide short offset 1 for user defined kit

CALIBRATION (Ch 5)

Syntax: `WSH1 val1 unit(s)`

val1: –999.999 to +999.999
unit(s): M, CM, MM

Related Commands: WSH2

WSH2

Set waveguide short offset 2 for user defined kit

CALIBRATION (Ch 5)

Syntax: `WSH2 val1 unit(s)`

val1: –999.999 to +999.999
unit(s): M, CM, MM

Related Commands: WSH1

WSX?

Output window shape

TIME DOMAIN (Ch 9)

Syntax: `WSX?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3). (1=rectangular, 2=nominal, 3=low sidelobe, 4=minimum sidelobe)

XM3

Unitless terminator (X∗10E–3) for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: `XM3`

XMKR?

Output marker mode

MARKERS (Ch 6)

Syntax: `XMKR?`

Data I/O: Outputs a value in ASCII <NR1> format (paragraph 10-3) as follows:
(0=Markers on active channel mode,
1=Active marker all channels mode,
2=Filter parameter measurement mode,
3=Marker search marker mode)

Related Commands: AMKR, FMKR, NMKR, SMKR

XX1

Unitless terminator (X1) for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: `XX1`

XX3

Unitless terminator (X∗10E+3) for numerical data entries

DATA ENTRY SUFFIXES (Ch 4)

Syntax: `XX3`

ZCT

Set zoom range center value for time domain sweep

TIME DOMAIN (Ch 9)

Syntax: `ZCT` *`val1 unit(s)`*

val1: –999.999 to +999.999

unit(s): PSC, NSC, USC, PS, NS, MS, S, MMT, CMT, MTR, MM, CM ,M

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x\ \frac{2.99792458\ x\ 10^8}{\sqrt{dielectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?, ZSN, ZSP, ZST, MRR, ZCT?

ZCT?

Output zoom range center value

TIME DOMAIN (Ch 9)

Syntax: `ZCT?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: ZCT

ZSN

Set zoom range span value

TIME DOMAIN (Ch 9)

Syntax: `ZSN` *`val1 unit(s)`*

val1: 0 to 999.999

unit(s): PSC, NSC, S, US, USC, PS, NS, MS, MMT, CMT, MTR, MM, CM ,M

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x \frac{2.99792458\ x\ 10^8}{\sqrt{dielectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?, ZCT, ZSP, ZST, ZSN?

ZSN? Output zoom range span value **TIME DOMAIN (Ch 9)**

Syntax: `ZSN?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: ZSN

ZSP Set zoom range stop value **TIME DOMAIN (Ch 9)**

Syntax: `ZSP val1 unit(s)`

val1: –999.999 to +999.999
unit(s): PSC, NSC, S, US, USC, PS, NS, MS, MMT, CMT, MTR, MM, CM ,M

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$distance\ limit = time\ limit\ x \frac{2.99792458\ x\ 10^8}{\sqrt{dielectric\ constant}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1* is assumed to be a time value. If the time domain parameter is distance, *val1* is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?, ZSN, ZCT, ZST, MRR, ZSP?

ZSP? Output zoom range stop value **TIME DOMAIN (Ch 9)**

Syntax: `ZSP?`

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: ZSP

ZST Set zoom range start value **TIME DOMAIN (Ch 9)**

Syntax: `ZST val1 unit(s)`

val1: –999.999 to +999.999
unit(s): PSC, NSC, S, US, USC, PS, NS, MS, MMT, CMT, MTR, MM, CM ,M

Remarks: The *val1* limits listed above are for time only. To derive distance limits, use the equation:

$$\textit{distance limit} = \textit{time limit}\ x\ \frac{2.99792458\ x\ 10^8}{\sqrt{\textit{dialectric constant}}}$$

Use the query command DIX? to output the value for dielectric constant.

If the time domain parameter is time, *val1 is assumed to be a time value. If the time domain parameter is distance, val1 is assumed to be a distance value. Use the query command TDDIST? to get the time domain parameter.*

Related Commands: DIA, DIT, DIM, DIP, DIE, DIX?, TDDIST?, ZSN, ZSP, ZCT, MRR

ZST? Output zoom range start value **TIME DOMAIN (Ch 9)**

Syntax: ZST?

Data I/O: Outputs value in ASCII <NR3> format.

Related Commands: ZST

Table 10-1. Calibration Coefficient (Error Term) Input/Output Ordering by Calibration Type

Calibration (Related Commands)**	Calibration Coefficient (Error Term)*											
	1	2	3	4	5	6	7	8	9	10	11	12
12-Term (C12, A12)	EDF	ESF	ERF	ETF	ELF	EXF	EDR	ESR	ERR	ETR	ELR	EXR
1 Path 2 Port FWD (C8T, A8T)	EDF	ESF	ERF	ETF	EXF							
1 Path 2 Port REV (C8R, A8R	EDR	ESR	ERR	ETR	EXR							
Reflection Only Port 1 (CRF, ARF)	EDF	ESF	ERF									
Reflection Only Port 2 (CRR, ARR)	EDR	ESR	ERR									
Reflection Only Both Ports (CRB, ARB)	EDF	ESF	ERF	EDR	ESR	ERR						
Transmission Frequency Response FWD (CFT, AFT)	ETF	EXF										
Transmission Frequency Response REV (CRT, ART)	ETR	EXR										
Transmission Frequency Response FWD&REV (CBT, ABT)	ETF	EXF	ETR	EXR								

* See OCx and ICx Series commands.

** The commands listed in parenthesis are used to set and/or simulate calibration process (refer to Chapter 5, Calibration).

Table 10-2. *Output Values and Graph Display Types*

Graph Display Type	Units per Division	Reference Value (OFF Command)	Related Suffix Units*
Log magnitude	0.001–50	–999.999 to +999.999	DB
Phase	0.01–45	–999.999 to +999.999 –360 to +360	DEG, RAD
Log mag & phase	0.001–50, 0.01–45	–999.999 to +999.999 –360 to +360	DB, DEG, RAD
Linear magnitude	$1E^{12}$ to –999.999	–999.999 to +999.999	V, XX1, XX3, XM3
Linear mag & phase	$1E^{12}$ to –999.999 0.01–454	–999.999 to +999.999 –360 to +360	V, XX1, XX3, XM3 DEG, RAD
Smith chart	–3, 0, 10, 20, 30	N/A	DB
Inverted Smith	–3, 0, 10, 20, 30	N/A	DB
Group delay	$1E^{15}$ to 999.999 sec	999.999 sec	SEC, MS, US, NS, PS
Log polar	0.001–50, –360 to +360	0.001–50, –999.999 to –999.99	DB DEG, RAD
Linear polar	$1E^{-12}$ to 200, –360 to +360	$5E^{-12}$ to 200, –360 to +360	V, XX1, XX3, XM3 DEG, RAD
Real	$1E^{-12}$ to +999.999	–999.999 to +999.999	REU
Imaginary	$1E^{-12}$ to +999.999	–999.999 to +999.999	IMU
Real & Imaginary	$1E^{-12}$ to +999.999	–999.999 to +999.999	REU IMU
SWR	$1E^{-12}$ to +999.999	0 to $1E^{6}$	XX1, XX3, XM3

* Suffixes may be used for data input commands, i.e. scale or limit line setting commands.
RAD suffix equates to $180/\pi$ degrees

Table 10-3 Color Palette Numbers to be used with Model 372XXA

Palette No.	Color	Palette Number	Color	Palette No.	Color
0	Black	16	Goldenrod	32	Cyan
1	Dim Grey	17	Med. Goldenrod	33	Cadet Blue
2	Light Grey	18	Wheat	34	Sky Blue
3	Grey	19	Khaki	35	Steel Blue
4	Salmon	20	Yellow Green	36	Slate Blue
5	Firebrick	21	Green Yellow	37	Blue
6	Brown	22	Pale Green	38	Medium Blue
7	Pink	23	Lime Green	39	Blue Violet
8	Orange red	24	Green	40	Medium Orchid
9	Orange	25	Spring Green	41	Thistle
10	Red	26	Forest Green	42	Plum
11	Coral	27	Sea Green	43	Magenta
12	Gold	28	Aquamarine	44	Purple
13	Sienna	29	Med. Aquamarine	45	Maroon
14	Tan	30	Turquoise	46	Violet red
15	Yellow	31	Dark Turquoise	47	White

Chapter 11
Instrument Data

Table of Contents

Chapter 11
Instrument Data

11-1 INTRODUCTION

This chapter provides general tabular information for the Model 372XXA VNA. Much of this information is presented in previous chapters, but is repeated here for easy access. The subject of each table in this chapter is listed on the chapter Contents page.

11-2 GPIB RESET CONFIGURATION

The 372XXA will be set to the default front panel setup conditions listed in Table 11-1 upon receipt of the *RST common command. Additionally, GPIB Remote-Only functions are set or cleared as listed in Table 11-2.

Table 11-1. *Default Front Panel Settings (1 of 2)*

Function	Default Setting
Active Menu	Sweep Setup
Measurement	*Maximum Sweep Range:* Model Dependent *Source Power:* Model Dependent *Data Points:* Normal (401 points) *Measurement:* Sweep Mode, restarted *Hold:* Hold/Continue, RF and bias off in hold mode
Channel	Quad (four-channel) display Channel 1 active
Display	*Channel 1:* S11, 1:1 Smith Chart *Channel 2:* S12, Log Magnitude and Phase *Channel 3:* S21, Log Magnitude and Phase *Channel 4:* S22, 1:1 Smith Chart *Scale:* 10 dB/Division or 90°/Division *Offset:* 0.000dB or 0.00 degree *Reference Position:* Midscale *Electrical Delay:* 0.00 seconds *Dielectric:* Air (1.000649) *Normalization:* Off *Normalized Trace Data:* Erased
Enhancement	*Video IF Bandwidth:* Normal *Averaging:* Off, 1 average *Smoothing:* Off, 0%
Calibration	*Correction:* Off and Calibration erased *Trace Mode:* Off *Connector:* Model dependent *Load:* Broadband

Table 11-1. Default Front Panel Settings (2 of 2)

Function	Default Setting
Markers/Limits	*Markers On/Off:* All off *Markers Enabled/Disabled:* All enabled Marker Frequency: All set to the start-sweep frequency (or start -time distance Δ *Reference:* Off *Limits:* All set to reference position value
System State and Save/Recall	*Identification and Options Data:* Unchanged *GPIB Addresses:* Unchanged *Frequency Blanking :* Disengaged, *Internal Memory Saved:* Unchanged *Installed Cal Coefficients:* Unchanged
Output	*Output Type:* Printer (full screen, clear headers) *Marker and Sweep Data:* Enabled *Printout:* Every point *Headers:* Cleared and disabled
Diagnostics	*Service Log/Error Messages:* Unchanged *Internal Hardware Calibrations Data:* Unchanged *Troubleshooting:* Recovered from (that is, turned off)
Triggering	*Mode:* Internal *Automatic I.F. Cal:* On

Table 11-2. GPIB Remote-Only Functions Status

Memories Saved:	Memories Cleared/Changed:
Information reported via the *IDN? and *OPT? query commands. SRQ Standard Event Status Extended Event Status Limits Pass/Fail Status Enable Registers Standard, Extended, And Limits GPIB Input and Output Buffers	Trigger action for *TRG and Group Execute Trigger is set to null. Operation Complete State: Idle Data Transfer Format Defaults: FMA, MSB, DPR0

11-3 CALIBRATION COEFFICIENTS

Table 11-3 lists the calibration coefficients that are generated during the 372XXA calibration process using the Calibration Coefficients Commands (OCx - 1Cx). Refer to Chapter 7, "Calibration Coefficients Data Transfer."

Table 11-3. *Calibration Coefficient (Error Term) Input/Output Ordering by Calibration Type*

Calibration (Related Commands)**	Calibration Coefficient (Error Term)*											
	1	2	3	4	5	6	7	8	9	10	11	12
12-Term (C12, A12)	EDF	ESF	ERF	ETF	ELF	EXF	EDR	ESR	ERR	ETR	ELR	EXR
1 Path 2 Port FWD (C8T, A8T)	EDF	ESF	ERF	ETF	EXF							
1 Path 2 Port REV (C8R, A8R	EDR	ESR	ERR	ETR	EXR							
Reflection Only Port 1 (CRF, ARF)	EDF	ESF	ERF									
Reflection Only Port 2 (CRR, ARR)	EDR	ESR	ERR									
Reflection Only Both Ports (CRB, ARB)	EDF	ESF	ERF	EDR	ESR	ERR						
Transmission Frequency Response FWD (CFT, AFT)	ETF	EXF										
Transmission Frequency Response REV (CRT, ART)	ETR	EXR										
Transmission Frequency Response FWD&REV (CBT, ABT)	ETF	EXF	ETR	EXR								

* See OCx and ICx Series commands.

** The commands listed in parenthesis are used to set and/or simulate calibration process (refer to Chapter 5, Calibration).

11-4 NUMERIC DATA SUFFIX MNEMONICS

Table 11-4 lists the numeric data suffix mnemonics for the Model 372XXA VNA. These mnemonics are used when entering numeric data with GPIB commands (usage of these codes is optional). Refer to Chapter 4, "Data Entry Suffix Codes".

Table 11-4. *Numeric Data Suffix Mnemonics*

Code	Parameter Type	Weighting Factor	Code	Parameter Type	Weighting Factor
DB, DBL, DBM	Power	1.0	NS, NSC	Time	10E-9
DEG	Phase	1.0	PS, PSC	Time	10E-12
RAD	Phase	180/π	M, MTR	Distance	1.0
HZ	Frequency	1.0	CM, CMT	Distance	10E-2
KHZ	Frequency	10E+3	MM, MMT	Distance	10E-3
MHZ	Frequency	10E+6	OHM	Impedance	1.0
GHZ	Frequency	10E+9	V, VLT	Voltage	1.0
REU	Real	1.0	MV	Voltage	10E-3
IMU	Imaginary	1.0	XM3	Unitless	10E-3
S	Time	1.0	XX1	Unitless	1.0
MS	Time	10E-3	XX3	Unitless	10E+3
US, USC	Time	10E-6			

11-5 OUTPUT VALUES AND GRAPH DISPLAY TYPES

Table 11-5 lists the various characteristics that are related to the different graph types used by the 372XXA screen displays. This information relates to various input commands described throughout Chapters 4 through 9.

Table 11-5. *Graph Display Type Related Data*

Graph Display Type	Units per Division	Reference Value (OFF Command)	Related Suffix Units*
Log magnitude	0.001–50	–999.999 to +999.999	DB
Phase	0.01–45	–999.999 to +999.999 –360 to +360	DEG, RAD
Log mag & phase	0.001–50, 0.01–45	–999.999 to +999.999 –360 to +360	DB, DEG, RAD
Linear magnitude	$1E^{12}$ to –999.999	–999.999 to +999.999	V, XX1, XX3, XM3
Linear mag & phase	$1E^{12}$ to –999.999 0.01–454	–999.999 to +999.999 –360 to +360	V, XX1, XX3, XM3 DEG, RAD
Smith chart	–3, 0, 10, 20, 30	N/A	DB
Inverted Smith	–3, 0, 10, 20, 30	N/A	DB
Group delay	$1E^{15}$ to 999.999 sec	999.999 sec	SEC, MS, US, NS, PS
Log polar	0.001–50, –360 to +360	0.001–50, –999.999 to –999.99	DB DEG, RAD
Linear polar	$1E^{-12}$ to 200, –360 to +360	$5E^{-12}$ to 200, –360 to +360	V, XX1, XX3, XM3 DEG, RAD
Real	$1E^{-12}$ to +999.999	–999.999 to +999.999	REU
Imaginary	$1E^{-12}$ to +999.999	–999.999 to +999.999	IMU
Real & Imaginary	$1E^{-12}$ to +999.999	–999.999 to +999.999	REU IMU
SWR	$1E^{-12}$ to +999.999	0 to $1E^{6}$	XX1, XX3, XM3

* Suffixes may be used for data input commands, i.e. scale or limit line setting commands.
RAD suffix equates to 180/π degrees

11-6 COLOR PALETTE NUMBERS

Table 11-6 lists the Color Palette numbers (codes) that are used with the GPIB commands that control data graph and menu colors for 372XXA screen displays.

Table 11-6 Color Palette Numbers to be used with Model 372XXA

Palette No.	Color	Palette Number	Color	Palette No.	Color
0	Black	16	Goldenrod	32	Cyan
1	Dim Grey	17	Med. Goldenrod	33	Cadet Blue
2	Light Grey	18	Wheat	34	Sky Blue
3	Grey	19	Khaki	35	Steel Blue
4	Salmon	20	Yellow Green	36	Slate Blue
5	Firebrick	21	Green Yellow	37	Blue
6	Brown	22	Pale Green	38	Medium Blue
7	Pink	23	Lime Green	39	Blue Violet
8	Orange red	24	Green	40	Medium Orchid
9	Orange	25	Spring Green	41	Thistle
10	Red	26	Forest Green	42	Plum
11	Coral	27	Sea Green	43	Magenta
12	Gold	28	Aquamarine	44	Purple
13	Sienna	29	Med. Aquamarine	45	Maroon
14	Tan	30	Turquoise	46	Violet red
15	Yellow	31	Dark Turquoise	47	White

Chapter 12
Error Messages

Table of Contents

Chapter 12
Error Messages

12-1 INTRODUCTION

This chapter provides a listing of error messages that appear on the 372XXA display or that are written to the internal software Service Log.

12-2 OPERATIONAL ERROR MESSAGES

Table 12-1 provides a listing and description of the operational error messages. For the most part, these errors are displayed only on the 372XXA display and are caused by incorrectly operating the 372XXA.

12-3 DISK RELATED ERROR MESSAGES

Table 12-2 provides a listing and description of the disk-related-error messages. The numbered errors in this group are also written to the Service Log, since they may indicate system problems.

12-4 GPIB RELATED ERROR MESSAGES

Table 12-3 provides a listing and description of GPIB-related error messages. These errors are entered in the Service Log and output as part of the response of OGE/OGL commands.

12-5 SERVICE LOG ERROR MESSAGES

Table 12-4 provides a listing of the error messages that are written to the internal system service log. These messages are mostly hardware related. Because they may warn of system problems, you should refer to the 372XXA Maintenance Manual for further action by a qualified service engineer. Some of these messages may occur as a result of incorrectly programming the 372XXA. This includes the GPIB errors, 7204–7207, and errors in the 5000 range, RF Power. The RF Power errors may be triggered when setting the 372XXA power to a value greater than its reset level. This feature of the 372XXA lets you take advantage of all available power; however, accuracy cannot be guaranteed when power is unleveled.

Table 12-1. Operational Error Messages (1 of 2)

Error Message	Description	Corrective Action
ATTENUATOR UNAVAILABLE	Option 6 Port 2 Test Step Attenuator is not installed.	Install Option 6 Step Attenuator,
DIFFERENT H/W SETUP. RECALL ABORTED	Model and/or options is (are) different from the recalled setup.	Reconfigure system to duplicate the hardware setup that was used to store the saved data.
DIFFERENT S/W VERSION, RECALL ABORTED	Saved state not compatible with software version or options.	Load compatible software (S/W) version and retry.
FREQUENCIES HAVE REACHED UPPER LIMIT	Frequencies being defined in Multiple Source mode have reached upper limits of Sources.	Redefine frequencies to not exceed limits of Sources.
MEMORY LOCATION CORRUPTED	Requested memory location is corrupted.	None. If problem reoccurs after storing a new setup, contact WILTRON Customer Service.
NO BANDS ARE STORED	No frequency bands have been defined and stored.	Define and store frequency bands to turn on Multiple Source mode.
NO STORED MEMORY DATA	No data is stored in memory for display or trace math.	Store or re-save measurement data.
OPTION NOT INSTALLED	Selected an option that is not installed.	None.
OUT OF CAL RANGE	Entered values out of the selected calibration range.	Change calibration range or re-enter values that are within the current range.
OUT OF H/W RANGE	Entered value is out of the instrument's hardware range.	Re-enter values that are within range.
OUT OF RANGE	Entered value is out of range.	Re-enter values that are within range.
RECEIVER OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places receiver frequency out of range when attempting to store band.	Redefine frequency.
SOURCE 1 OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places Source 1 frequency out of range when attempting to store band.	Redefine frequency.
SOURCE 2 OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places Source 2 frequency out of range when attempting to store band.	Redefine frequency.

Table 12-1. Operational Error Messages (2 of 2)

Error Message	Description	Corrective Action
STANDARD CAL NOT VALID FOR WAVEGUIDE	Cannot use the standard method when calibrating with waveguide.	Use the Offset Short method with waveguide.
START F FOLLOWS PREVIOUS STOP F	Start frequency of current band immediately follows stop frequency of previous band. Cannot be modified.	None.
START MUST BE LESS THAN STOP	Entered start frequency is greater than the stop frequency.	Re-enter frequency values such that the start frequency is lower than the stop frequency.
STEP IS TOO LARGE	Entered harmonic frequency extends the stop out of range.	Re-enter so that harmonic frequency is within range.
STOP IS OVER RANGE	Entered value exceeds the instrument's stop frequency.	Re-enter stop frequency.
SYSTEM NOT CALIBRATED	372XXA is uncalibrated for the selected measurement values.	Perform a measurement calibration.
TOO FEW POINTS, 2 MINIMUM	Entered too few discrete fill points, 2 is minimum.	Re-enter data points.
TOO MANY POINTS, 1601 MAXIMUM	Entered too many discrete fill points, 1601 points are the maximum allowed.	Re-enter data points.
UNDEFINED DIVIDE BY ZERO	Denominator cannot be zero in equation.	Make denominator a value other than zero.
WINDOW TOO SMALL	Attempted to set time domain range smaller than allowed	Re-enter larger time range.
OUT OF WINDOW RANGE	Attempted to set time domain range larger than allowed	Re-enter values within allowed range.

Table 12-2. Disk-Related-Error Messages (1 of 1)

Error Message	Description	Corrective Action
7140 GENERAL FLOPPY DRIVE FAIL	Invalid disk media or format.	Use 1.44 MB diskette and/or format in the 372XXA.
7142 FLOPPY DISK READ ERROR	Read error when accessing disk file.	Use 1.44 MB diskette and/or format in the 372XXA.
7143: FLOPPY DISK WRITE ERROR	Error in writing to disk file.	Use 1.44 MB diskette and/or format in the 372XXA.
7147 FLOPPY DISK UNAVAILABLE	Floppy disk is not available.	Install floppy diskette and/or check floppy disk drive.
7170: GENERAL HARD DISK FAIL	General error in accessing hard disk.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7172: HARD DISK READ ERROR	Read error when accessing disk file.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7173: HARD DISK WRITE ERROR	Error in writing to disk file.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7177: HARD DISK UNAVAILABLE	Hard disk is not available.	Install hard disk drive and/or check operation of hard disk.
8140: GENERAL DISK BUFFER ERROR	Out of RAM.	Press the System State, Default Program key, and retry. This will reset the 372XXA to the factory default state.
FILE NOT FOUND	Disk file not found.	None.
FLOPPY DISK HAS NO ROOM FOR FILE	Floppy diskette is full.	Delete files or install new diskette.
FLOPPY DISK NOT READY	Floppy disk is not ready (or not installed.).	Install diskette in floppy drive.
FLOPPY DISK WRITE PROTECTED	Write protect tab in place on floppy diskette.	Remove write-protect tab.
HARD DISK HAS NO ROOM FOR FILE, DELETE EXISTING FILES(S) TO CREATE SPACE	Hard disk is full.	Delete unneeded files.

Table 12-3. GPIB-Related Error Messages (1 of 8)

Error Message	Description
These errors are entered in the Service Log and output as part of the response of OGE/OGL commands for GPIB commands. The list is subdivided into the type of GPIB error: 7204..., 7205..., 7206..., and 7207.	
7204 GPIB COMMAND ERROR DESCRIPTIONS	
Faulty program mnemonic syntax	Generated when the program mnemonic found was not one of the currently defined program mnemonics for the 372XXA.
Faulty suffix mnemonic syntax	Generated when the suffix mnemonic found was not one of the currently defined suffix mnemonics for the 372XXA.
Faulty mnemonic syntax	Generated when the mnemonic found was not one of the currently defined program or suffix mnemonics for the 372XXA.
Missing Program Message Separator	Generated when the required semicolon preceding the next program mnemonic was not found.
Expected NRf data	Generated when a mnemonic is used that requires a trailing NRf numeric data element. The data element was either missing or the first character of the data element was not one of the acceptable NRf characters.
NRf mantissa too long	The maximum allowable number of characters in the NRf numeric element mantissa is 255.
Exponent magnitude too large	The maximum allowable exponent magnitude in an NRf element is +/— 32000.
Faulty NRf syntax	Can be any number of syntactical errors such as more than one decimal point, inclusion of a decimal point in the exponent field, an invalid character imbedded in the numeric or no exponent value following the 'E'.
Expected String Program Data	Generated when a mnemonic is used that requires a trailing string data element. The date element was either missing or no open quote character was found.
Missing close quote character	Generated when a mnemonic is used that requires a trailing string data element. The open quote character was found, but the close quote character was not.
Expected Arbitrary Block data	Generated when a mnemonic is used that requires a trailing arbitrary block data element and the trailing element was not an arbitrary block data element. Or in some cases, the arbitrary block was empty.
Faulty Arbitrary Block	Generated when a defined length arbitrary block data element is terminated early with an EOI or an indefinite length arbitrary block data element is not properly terminated.
Missing Program Data Separator	Two data elements of a program mnemonic that requires multiple program data elements, are not properly separated from each other by a comma.

Table 12-3. GPIB-Related Error Messages (2 of 8)

Error Message	Description
GET received during PM reception	Generated when the GPIB Command 'Group Execute Trigger' is received during the reception of a program message but before its proper termination with the end message. The partial program message up to but not including the 'Group Execute Trigger' will be executed. Execution of the Group Execute Trigger and any subsequent program message elements received before the end message will be skipped.
7205 GPIB EXECUTION ERROR DESCRIPTIONS	
Not permitted in a DDT command sequence	When executing a defined device trigger command sequence, a forbidden command was detected.
Too much Arbitrary Block data	The arbitrary block supplied contained more data than was necessary for the currently defined 372XXA state. This can occur when graph types, start/stop frequencies or data points are changed.
Insufficient Arbitrary Block data	The arbitrary block supplied did not have enough data for the currently defined 372XXA state. This can occur when graph types, start/stop frequencies or data points are changed.
Invalid parameter for current graph type	An attempt was made to program a non-existent parameter for the current graph type. For instance, a Smith chart does not have a reference or reference line position (mnemonics OFF and REF).
Parameter out of range	An attempt was made to program an out of integer range value for a parameter. This error is detected by the GPIB MANAGER when converting and rounding to the appropriate integral size (signed/unsigned char/short or long).
Parameter value not permitted	A parameter value was not found in the list of permissible values for that parameter.
CW marker sweep not permitted in time domain	The mnemonics M1C, M2C, M3C, M4C, M5C and M6C are forbidden in time domain.
Parameter unavailable in frequency domain	The mnemonic ODV and OTV are forbidden in frequency domain.
Port 2 Test Attenuator (OPT 6) not installed	The mnemonic TA2 is forbidden when the attenuator is not installed.
Time Domain (OPT 2) not installed	An attempt was made to use one of the time domain mnemonics when the option is not installed.
Return to Local not permitted in Local Lockout	The mnemonic RTL failed due to being in the Local Lockout mode.
Calibration does not exist	An attempt was made to turn on flat power correction or vector error correction when the corresponding calibration does not exist.
Cal term not available	An attempt was made to get a calibration term which does not exist for the current calibration type.

Table 12-3. GPIB-Related Error Messages (3 of 8)

Error Message	Description
Invalid cal term for calibration type	An attempt was made to program a calibration term which does not exist for the current calibration type.
Front panel setup not valid	An attempt was made to get a front panel setup that did not contain a correct/valid state.
Normalization data not valid	An attempt was made to reference normalization data when there was no normalization data currently stored.
Command sequence too long	An attempt was made to define a device trigger command sequence which had more than 255 characters.
Unable to display menu	An attempt was made to display a menu which could not be displayed for the current 372XXA state.
String too long	An attempt was made to enter a string for the following mnemonics which exceeded the specified maximum length. LTD, LID, LMS and LNM - maximum length is 15 characters. LOC - maximum length is 79 characters.
Must specify a calibration type first	In order to perform a calibration, the calibration type must be specified by the use of one of the Cxx mnemonics (i.e. C12, C8T, etc.) PRIOR to the issuance of the mnemonics CWC, TDC or BEG.
Parameter value unchanged	An attempt was made to change a start/stop frequency or number of data points to a value outside of the current calibrated range with correction turned on.
Parameter change not permitted	An attempt was made to perform an illegal state change or action based on the current 372XXA state. This includes attempting to store an undefined band definition. Or certain changes from the calibration state or the calibration define state when defining discrete frequencies.
Parameter value out of range Parameter out of hardware range	An attempt was made to set a parameter to a value outside of the permissible range of values for the parameter.
Standard cal method not valid for waveguide	In a waveguide type of calibration, the standard (OSL) cal method is forbidden.
Out of calibrated range	An attempt was made to change a parameter not permitted to be changed with correction on.
Start must be must be less than stop	An attempt was made to set a new start frequency, distance or time greater than or equal to the current stop frequency, distance or time. Or to set a new stop frequency, distance or time less than or equal to the current start frequency, distance or time.
Tune mode requires a 12 term calibration	Perform a 12 term calibration prior to turning on tune mode.

Table 12-3. GPIB-Related Error Messages (4 of 8)

Error Message	Description
Current and cal frequencies different	The flat power calibration setup does not match the current setup.
Stored data is invalid	An attempt was made to reference normalized data when normalized data was invalid.
Parameter change not permitted on current state	An attempt was made to change a parameter while IF cal was active. It is not expected that this message will ever be seen. If you see this message, notify the factory.
Calibration may not be valid	An attempt was made to repeat the previous calibration when there was no record of a previous calibration.
Calibration does not exist	An attempt was made to turn on flat power correction or vector error correction when the corresponding calibration does not exist.
Current calibration is erased	When turning on Multiple Source Mode with vector error correction on, the calibration is destroyed. Not really an error. Message is issued as a warning.
Time Domain and CW mode not permitted	An attempt was made to turn on a time domain mode in CW. This is not permitted.
Not permitted in Time Domain	An attempt was made to select a group delay display or CW mode when in time domain mode or to select a dual overlay display with a frequency/time domain mismatch.
Time Domain not allowed	An attempt was made to turn on a time domain mode but the current 372XXA state does not permit it.
Permitted only in diagnostic mode	Must put the 372XXA into the diagnostics mode via the SDG command before using this mnemonic.
Graph types not appropriate for dual overlay	While in dual overlay mode, and attempt was made to change one of the active graph types to a type which conflicts with dual overlay, or to change one of the active channels into or out of time domain which sets up a dual overlay conflict. Or an attempt was made to select dual overlay mode when there would be a graph type conflict for a frequency/time domain conflict.
New Discrete Fill not allowed in current state	Cannot set up a new discrete fill definition while performing a calibration or when correction is turned on. Also cannot do this when group delay is the graph type on the active channel.
Low Pass mode requires a harmonic sweep	Perform a TD harmonic sweep calibration prior to using this mnemonic.
Receiver out of range by equation	Problems with the internal source, external source or receiver equations in multiple source mode.
New start less than previous stop	An attempt was made to set the start frequency for the new multiple source mode band definition to a frequency less than the stop frequency of the previous band.

Table 12-3. GPIB-Related Error Messages (5 of 8)

Error Message	Description
Bad filename	The supplied filename was bad. The filename can have 8 characters maximum. No extensions. The filename must start with and alpha type character (A thru Z). After that the allowable characters are alpha, numeric (0 thru 9) and underscore (_).
Conflict with rotary knob	You should not be using the rotary knob and the GPIB at the same time.
Too many data points for external source	A 6700B series external source can handle 501 data points. A 68000 series external source can handle 999 data points.
Recalled setup corrupted Hardware mismatch in recalled setup Software mismatch in recalled setup	These are problems with the recalled setup.
Too many data points for Discrete Fill	The maximum number of data points in discrete fill is 1601.
Not enough data points for Discrete Fill	The minimum number or data points in discrete fill is 2.
Discrete Fill end frequency out of range	The number of points for discrete fill puts the end frequency out of range.
Step is too large	When setting up a time domain harmonic sweep, cannot get 2 data points because the start frequency is too high for the approximate stop frequency. In a group delay display, the delay aperture percent of sweep is less than one step size.
Range too small	An attempt was made to set a distance or time span value too small. This can also be done via inappropriate values for start and stop.
Start or stop out of range	An attempt was made to set a distance or time start or stop value out of range. This can also be done via inappropriate values for center and span.
No bands defined	An attempt was made to turn on multiple source mode with no band definitions.
Out of frequencies for new band definition Source out of range by equation External source out of range by equation	The current set of multiple source mode bands use up all the frequency range of the 372XXA. Therefore, no more bands can be defined.
File is read only	An attempt was made to write to a write protected file.
File not found	An attempt was made to access a non-existent file.
Floppy drive not ready	An attempt was made to access the floppy drive with no floppy disk installed.
Floppy disk full Hard disk full	An attempt was made to write to a floppy disk or the hard disk when no space was left on the disk.

Table 12-3. GPIB-Related Error Messages (6 of 8)

Error Message	Description
Floppy disk write protected	An attempt was made to write to a write protected floppy disk.
Recalled setup or data file corrupt	An attempt to recall a setup from internal memory, the GPIB or disk failed due to software revision or hardware mismatch or checksum error.
New frequency list not allowed in current state	Cannot set up a new discrete fill definition while performing a calibration or when correction is turned on. Also, cannot do this when group delay is the graph type on the active channel.
State change not permitted	An attempt was made to perform an illegal state change or action based on the current instrument state. This includes attempting to store (1) an undefined band definition, (2) certain changes from the calibration state, or (3) the cal define state when defining discrete frequencies.
Faulty label or file name	The label or file name associated with the current mnemonic is faulty.
Illegal characters in filename	The first character in a filename must be an alpha type. The remaining characters can be alpha, numeric, or underscores. An extension is not permitted.
Filename too long	The maximum ledngth for filenames is 8 characters. An extension is not permitted.
Floppy disk read error Floppy disk write error Hard disk read error Hard disk write error	Read or write error(s) occurred while attempting to access the indicated disk.
Floppy disk not found Hard disk not found General disk buffer error General floppy drive failure Floppy disk init failure General hard disk failure Hard disk control failure Hard disk init failure Unknown disk error	Other error messages which suggest that the indicated drive is in need of service.
7205 GPIB QUERY ERROR DESCRIPTIONS	
No Response data available	Generated if the controller attempts to read response data from the 372XXA and none is available.
No Response data after PM completion	This is the same as the 'no response data available' case above except that a program message was currently being parsed and executed when the controller attempted to read data. Detection of this error was deferred until the parser/execution block was finished with the current program message and it was observed that no response data was generated.

Table 12-3. GPIB-Related Error Messages (7 of 8)

Error Message	Description
Response after Indefinite Response discarded	This error is generated when the 372XXA's output queue has already received an Arbitrary ASCII response data element and an attempt is made to place another response data element of any kind into the queue. The new response data element is discarded.
Interrupted - Response data discarded	This error is detected when the output queue contains unread response data and the controller sends a new program message. The response data is discarded.
Unterminated - Partial PM will be executed	This error is detected when the 372XXA's input queue is currently receiving a program message but has not yet received the end message, and the controller attempts to read response data from the 372XXA. The partial program message in the input queue is executed as if it were properly terminated.
Deadlock - Response data discarded	This error is detected when both of the 372XXA's input and output queues are full and the controller attempts to send another data byte. In order to prevent bus deadlock, the contents of the output queue are discarded.
7205 GPIB DEVICE DEPENDENT ERROR DESCRIPTIONS	
Q_SEND failure in [a procedure name]	An unsuccessful attempt was made to send a message to a task. The procedure name is the place in the software where the error was detected.
Q_RECEIVE failure in [a procedure name]	A failure was detected while waiting for the reception of a message from a task. The procedure name is the place in the software where the error was detected.
Unable to allocate memory in [a procedure name]	An attempt was made to allocate some temporary memory in order to accomplish a task directed in the program message. The procedure name is the place in the software where the error was detected.
Unable to release memory in [a procedure name]	An attempt was made to return some temporary memory within a task and the return failed for some reason. The procedure name is the place in the software where the error was detected.
Unable to get service/error log	An unsuccessful attempt was made to get a copy of the service or error log.
Unable to get calibration term	An unsuccessful attempt was made to get a calibration term.
Unable to get raw or corrected data	An unsuccessful attempt was made to get raw or corrected data.
Unable to get final data	An unsuccessful attempt was made to get final data.
Unable to get setup or data	An unsuccessful attempt was made to get the frequency list from the database.
Unable to get setup	An unsuccessful attempt was made to get a front panel setup.

Table 12-3. GPIB-Related Error Messages (8 of 8)

Error Message	Description
Unable to store setup	An unsuccessful attempt was made to save a front panel setup.
Unable to get frequency list	An unsuccessful attempt was made to get setup, trace, or tabular datat from the database.
Unable to store label	An unsuccessful attempt was made to store a label in the database.
Calibration step failure	An error occurred while waiting for completion of a data collection sequence in calibration.

Table 12-4. Service Log Error Messages (1 of 3)

Error Message	Error Message
0000 – 0099 Status Messages or Pass/Fail Result of a Peripheral or Self Test	0412 REF IF 10V REF FAIL
0000 INFORMATIONAL MESSAGE	0413 REF IF LEV STATUS FAIL
0000 SELF TEST INFO MESSAGE	0414 REF PHS CONTROL FAIL
0094 PRNT INTERFACE TEST PASSED	0500 A TO D CONVERSION FAIL
0095 PRNT INTERFACE TEST FAILED	0511 A TO D COMM FAIL
0096 GPIB INTERFACE TEST PASSED	0512 A TO D 8 BIT D TO A FAIL
0097 GPIB INTERFACE TEST FAILED	0513 A TO D 12 BIT A TO D FAIL
0098 SELF TEST PASSED	0514 A TO D STEERING DAC FAIL
0099 SELF TEST FAILED	0515 A TO D CONV ACCURACY FAIL
0100 – 3999 Primarily Indicate a Self Test Failure	0516 A TO D SAMPL HOLD FAIL
0111 LO1 COMM FAIL	0517 IF SYNC FAIL
0112 LO1 PRE TUNE DAC FAIL	0518 PWR SUPPLY SYNC FAIL
0113 LO1 PHS LCK IND FAIL	0519 A TO D EXT ANAL OUTP FAIL
0114 PHS LCK ERR VOL OUT OF TOL	0520 PWR SUPPLY +5V FAIL
0115 LO1 LCK TIME FAIL	0521 PWR SUPPLY +9V FAIL
0211 LO2 COMM FAIL	0522 PWR SUPPLY +12V FAIL
0212 LO2 MAIN PREST DAC FAIL	0524 PWR SUPPLY +18V FAIL
0213 LO2 OFFS PREST DAC FAIL	0525 PWR SUPPLY -18V FAIL
0214 MAIN PHS LCK ERR VOL FAIL	0526 PWR SUPPLY +27V FAIL
0215 OFFST PHS LCK ERR VOL FAIL	0527 PWR SUPPLY -27V FAIL
0216 DDS PHS LCK ERR VOL FAIL	0611 TB IF COMM FAIL
0217 MAIN PHS LCK IND FAIL	0612 TB IF 10V REF FAIL
0218 OFFST PHS LCK IND FAIL	0613 TB IF LEVEL STATUS FAIL
0219 DDS PHS LCK IND FAIL	0614 TB PHS CONTROL FAIL
0220 LO2 LCK TIME FAIL	0711 LO3 COMM FAIL
0221 LO2 SRC TRACKING FAIL	0712 LO3 REF OSC FAIL
0311 TA IF COMM FAIL	0713 LO3 48.4 LCK IND FAIL
0312 TA IF 10V REF FAIL	0714 LO3 48.4 LCK ERR VOL FAIL
0313 TA IF LEVEL STATUS FAIL	0715 LO3 CAL REF PHS FAIL
0314 TA PHS CONTROL FAIL	0811 SL SIG SEP COMM FAIL
0411 REF IF COMM FAIL	0812 DAC ADJUSTMENT FAIL
	0813 TRANSFER SWITCH CNTRL FAIL

Table 12-4. Service Log Error Messages (2 of 3)

Error Message	Error Message
0814 SRC LCK POL CONTROL FAIL	2121 SRC F TUNE PATH BND7 FAIL
0815 DIRECT MODE ATTEN FAIL	2122 SRC F TUNE PATH BND8 FAIL
0911 A9 VME BUS INTERFACE FAIL	2123 SRC F TUNE PATH BND9 FAIL
0912 BBRAM CHECK FAIL	2124 SRC F TUNE PATH BND10 FAIL
0913 SRAM CHECK FAIL	2125 SRC PWR LEVEL DAC FAIL
0914 SCSI DEVICE FAIL	2126 SRC DETECTOR ZERO CAL FAIL
0915 MCCHIP FAIL	2127 SRC ALC CAL BND1 FAIL
0915 MCCHIP TIMER 1 FAIL	2128 SRC ALC CAL BND2 FAIL
0916 MCCHIP TIMER 2 FAIL	2129 SRC ALC CAL BND3 FAIL
0917 MCCHIP TIMER 3 FAIL	2130 SRC ALC CAL BND4 FAIL
0918 MCCHIP TIMER 4 FAIL	2131 SRC ALC CAL BND5 FAIL
0919 CLOCK NOT RUNNING	2132 SRC ALC CAL BND6 FAIL
1311 A13 VME BUS INTERFACE FAIL	2133 SRC ALC CAL BND7 FAIL
1312 EXT KEYBD CNTRL FAIL	2134 SRC ALC CAL BND8 FAIL
1313 FLOPPY DISK CNTRL FAIL	2135 SRC ALC CAL BND9 FAIL
1411 A14 VME BUS INTERFACE FAIL	2136 SRC ALC CAL BND10 FAIL
1511 A15 VME BUS INTERFACE FAIL	2137 SRC A1 FM PATH TUNE FAIL
1512 VRAM CHECK FAIL	2138 SRC A2 FM PATH TUNE FAIL
1611 HARD DISK CONTROL FAIL	4100 LO1 CAL FAIL
1811 AUXILLARY IO FAIL	4200 LO2 CAL FAIL
1912 FRONT PANEL CNTRL FAIL	4301 SRC FREQ CAL MEAS UNSTABLE
1913 ROTARY KNOB FAIL	4302 SRC FREQ FM MAIN CAL FAIL
2111 SRC COMM FAIL	4303 SRC FREQ FM SENS CAL FAIL
2112 SRC FTUNE DAC FAIL	4304 SRC FREQ CAL VERIFY FAIL
2113 SRC STATE MACHINE DAC FAIL	4401 SRC ALC LOG AMP CAL FAIL
2114 SRC FM CAL FAIL	4402 SRC ALC CAL VERIFY FAIL
2115 SRC F TUNE PATH BND1 FAIL	4500 IF CAL FAIL
2116 SRC F TUNE PATH BND2 FAIL	4600 GAIN RANGING ERROR
2117 SRC F TUNE PATH BND3 FAIL	4700 STATE MACHINE FAIL
2118 SRC F TUNE PATH BND4 FAIL	***5000 – 5999 Indicate Run-Time RF Power Problems***
2119 SRC F TUNE PATH BND5 FAIL	5110 RF PWR UNLEVELED
2120 SRC F TUNE PATH BND6 FAIL	

Table 12-4. *Service Log Error Messages (3 of 3)*

Error Message
5210 REF A CHAN RF OVERLOAD
5220 REF B CHAN RF OVERLOAD
5230 TA CHAN RF OVERLOAD
5240 TB CHAN RF OVERLOAD
6000 – 6999 Indicate Phase Lock Problems
6001 - 6128 PHASE LOCK FAILURE
7000 – 7999 Indicate Run-Time Digital Section Problems
7100 FILE MARKED READ ONLY
7140 GENERAL FLOPPY DRIVE FAIL
7142 FLOPPY DISK READ ERROR
7143 FLOPPY DISK WRITE ERROR
7146 FLOPPY DISK CHANGED
7147 FLOPPY DISK UNAVAILABLE
7169 FLOPPY INIT FAIL
7170 GENERAL HARD DISK FAIL
7172 HARD DISK READ ERROR
7173 HARD DISK WRITE ERROR
7177 HARD DISK UNAVAILABLE
7199 HARD DISK INIT FAIL
7200 IEEE 488.2 GPIB BUS ERROR
7201 ABORTED MESSAGES
7202 NOTHING TO SAY
7203 NO LISTENER ON BUS
7204 GPIB COMMAND ERROR
7205 GPIB EXECUTION ERROR

Error Message
7206 GPIB DEVICE SPECIFIC ERROR
7207 GPIB QUERY ERROR
7210 DEDICATED GPIB BUS ERROR
7220 PLOTTER NOT RESPONDING
7221 PLOTTER NOT READY
7222 PLOTTER OUT OF PAPER
7223 PLOTTER PEN UP
7230 POWER METER NOT RESPONDING
7240 FRQ COUNTER NOT RESPONDING
7250 EXT SOURCE NOT RESPONDING
7310 PRINTER NOT RESPONDING
7311 PRINTER NOT READY
7312 PRINTER OUT OF PAPER
7320 AUX I/O PORT ERROR
7330 SERIAL PORT ERROR
7340 ETHERNET PORT ERROR
7350 EXT TRIG RATE TOO FAST
7410 EXT KYBD ERROR
8000 – 8999 Indicate Run-Time Processing System Problems
8100 PWR FAIL
8110 GENERAL VME BUS FAIL
8120 GENERAL MEMORY FAIL
8121 NON-VOLATILE MEMORY FAIL
8130 PROCESSING FAIL
8140 GENERAL DISK BUFFER ERR

Part 4 Supplemental Data

This part consists of four appendices that provide supplemental data that will aid in understanding the 372XXA programming material.

Appendix A *– contains a primer for the IEEE 488 GPIB. This primer is intended to assist new users in understanding GPIB basics.*

Appendix B *– provides front panel menu flowcharts that allows readers to see the overall 372XXA front panel menu structure and understand how certain menu functions are implemented using GPIB programming. Also includes a fold-out diagram of the 372XXA front panel.*

Appendix C *– provides a quick reference to all 372XXA GPIB commands. Each reference lists the command name, a brief description of the command function, and a reference to the pertinent Chapter in this manual.*

Appendix D *– provides compatibility information for crossing 372XXA GPIB commands to 360B GPIB commands.*

Appendix A
Introduction to the IEEE 488 Bus

Table of Contents

Appendix A Introduction to the IEEE 488 Bus

A-1 INTRODUCTION

This appendix contains general descriptions of the IEEE 488 Bus, generally known as the General Purpose Interface Bus (GPIB).

A-2 IEEE 488.2 STANDARD

The IEEE 488.2 Standard specifies the use of protocols, formats, and certain common commands for use with the GPIB. The applicable information regarding IEEE 488.2 usage for the 372XXA is documented throughout the 372XXA Programming Manual where used.

A-3 IEEE 488.1 BUS OVERVIEW

The IEEE-488 General Purpose Interface Bus (GPIB) is an instrumentation interface for integrating instruments, computers, printers, plotters, and other measurement devices into systems. The GPIB uses 16 signal lines to effect transfer of information between all devices connected on the bus.

The following requirements and restrictions apply to the GPIB.

- No more than 15 devices can be interconnected by one contiguous bus; however, an instrumentation system may contain more than one interface bus.
- The maximum total cumulative cable length for one interface bus may not exceed twice the number of devices connected (in meters), or 20 meters whichever is less.
- A maximum data rate of 1 Mb/s across the interface on any signal line.
- Each device on the interface bus must have a unique address, ranging from 00 to 30.

The devices on the GPIB are connected in parallel, as shown in Figure A-1. The interface consists of 16 signal lines and 8 ground lines in a shielded cable. Eight of the signal lines are the data lines, DIO 1 thru DIO 8. These data lines carry messages (data and commands), one byte at a time, among the GPIB devices. Three of the remaining lines are the handshake lines that control the transfer of message bytes between devices. The five remaining signal lines are referred to as interface management lines.

The following paragraphs provide an overview of the GPIB including a description of the functional elements, bus structure, bus data transfer process, interface management bus, device interface function requirements, and message types.

A-4 IEEE 488 BUS FUNCTIONAL ELEMENTS

Effective communications between devices on the GPIB requires three functional elements; a talker, a listener, and a controller. Each device on the GPIB is categorized as one of these elements depending on its current interface function and capabilities.

Talker A talker is a device capable of sending device-dependent data to another device on the bus when addressed to talk. Only one GPIB device at a time can be an active talker.

Listener A listener is a device capable of receiving device-dependent data from another device on the bus when addressed to listen. Any number of GPIB devices can be listeners simultaneously.

Controller A controller is a device, usually a computer, capable of managing the operation of the GPIB. Only one GPIB device at a time can be an active controller. The active controller manages the transfer of device-dependent data between GPIB devices by designating who will talk and who will listen.

System Controller The system controller is the device that always retains ultimate control of the GPIB. When the system is first powered-up, the system controller is the active controller and manages the GPIB. The system controller can pass control to a device, making it the new active controller. The new active controller, in turn, may pass control on to yet another device. Even if it is not the active controller, the system controller maintains control of the Interface Clear (IFC) and Remote Enable (REN) interface management lines and can thus take control of the GPIB at anytime.

A-5 IEEE 488 BUS STRUCTURE

The GPIB uses 16 signal lines to carry data and commands between the devices connected to the bus. The interface signal lines are organized into three functional groups.

- Data Bus (8 lines)
- Data Byte Transfer Control Bus (3 lines)
- General Interface Management Bus (5 lines)

The signal lines in each of the three groups are designated according to function. Table A-1 lists these designations.

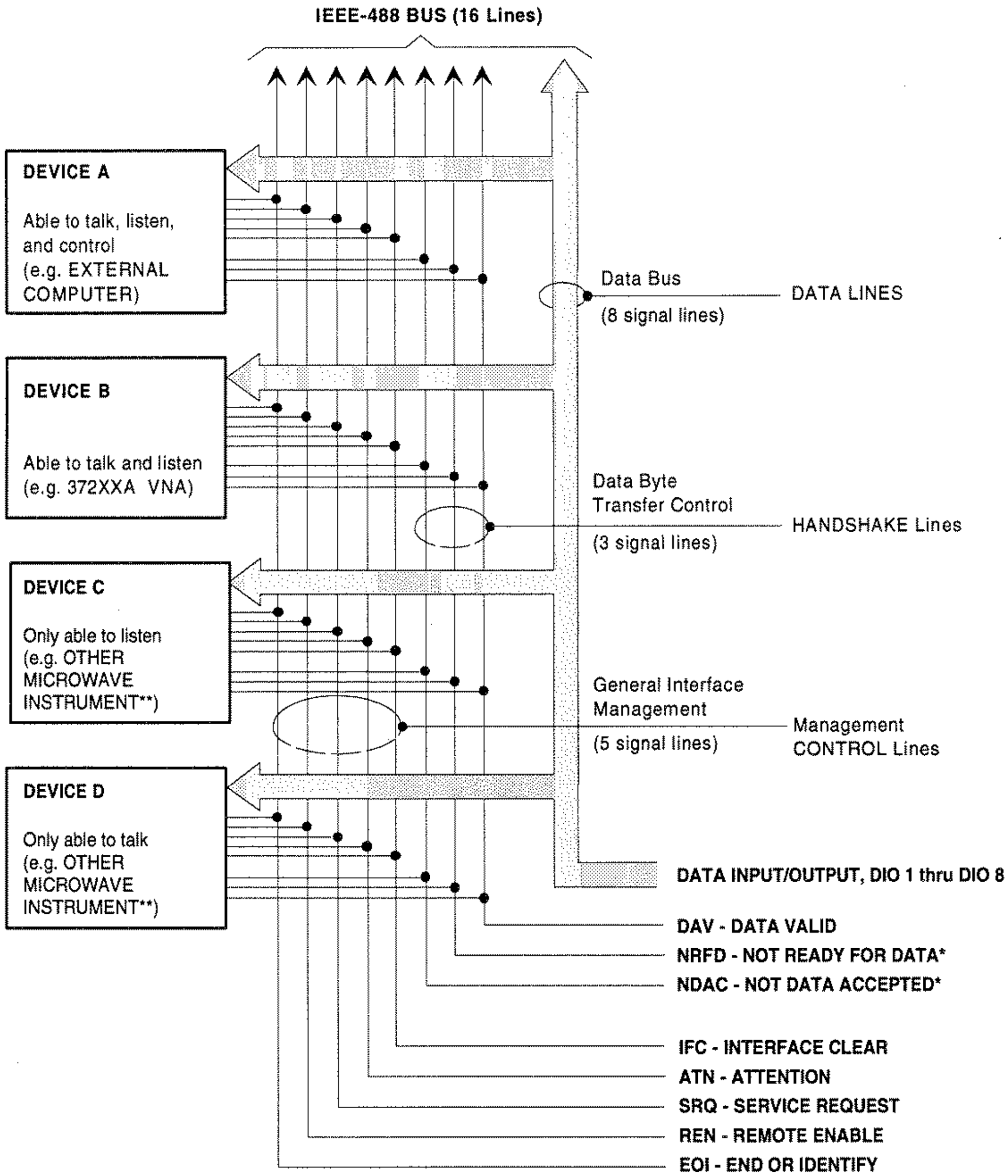
Table A-1. *Interface Bus Signal Line Designations*

Bus Type	Signal Line Name	Function
Data Bus	DIO1–DIO8	Data Input/Output, 1 thru 8
Data Byte Transfer and Control	DAV NRFD NDAC	Data Available Not Ready For Data Not Data Accepted
General Interface Control	ATN IFC SRQ REN EOI	Attention Interface Clear Service Request Remote Enable End Or Identify

A-6 IEEE 488 DATA BUS DESCRIPTION

The data bus is the conduit for the transfer of data and commands between the devices on the GPIB. It contains eight bi-directional, active-low signal lines—DIO 1 thru DIO 8. Data and commands are transferred over the data bus in byte-serial, bit-parallel form. This means that one byte of data (eight bits) is transferred over the bus at a time. DIO 1 represents the least-significant bit (LSB) in this byte and DIO 8 represents the most-significant bit (MSB). Bytes of data are normally formatted in seven-bit ASCII (American Standard Code for Information Interchange) code. The eighth (parity) bit is not used.

Each byte placed on the data bus represents either a command or a data byte. If the Attention (ATN) interface management line is TRUE while the data is transferred, then the data bus is carrying a bus command which is to be received by every GPIB device. If ATN is FALSE, then a data byte is being transferred and only the active listeners will receive that byte.



* Negation is represented by low state on these two lines

** The configuration shown in this diagram depicts an external computer connected via GPIB to a 372XXA Vector Network Analyzer and other microwave instruments (if used).

Figure A-1. *Interface Connections and Bus Structure*

A-7 DATA BYTE TRANSFER CONTROL BUS DESCRIPTION

Control of the transfer of each byte of data on the data bus is accomplished by a technique called the three-wire handshake, which involves the three signal lines of the Data Byte Transfer Control Bus. This technique forces data transfers at the speed of the slowest listener, which ensures data integrity in multiple listener transfers. One line (DAV) is controlled by the talker, while the other two (NRFD and NDAC) are wired-OR lines shared by all active listeners. The handshake lines, like the other GPIB lines, are active low. The technique is described briefly in the following paragraphs and is depicted in Figure A-2. For further information, refer to ANSI/IEEE Std 488.1.

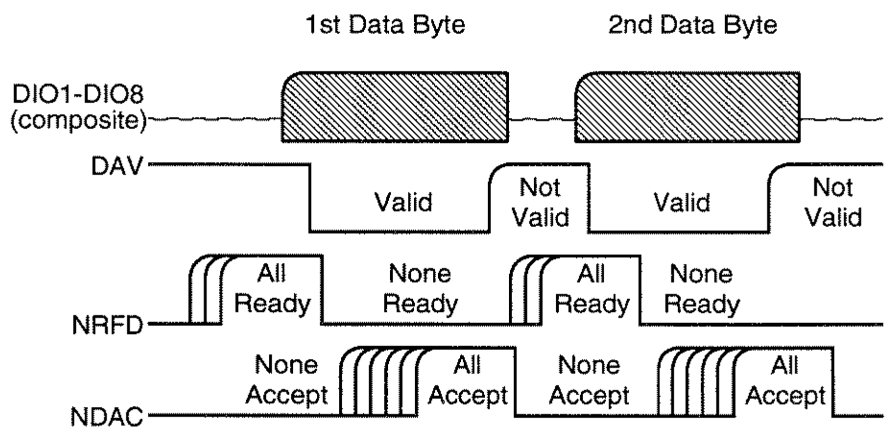


Figure A-2. *Typical GPIB Handshake Operation*

DAV

Data Valid
This line is controlled by the active talker. Before sending any data, the talker verifies that NDAC is TRUE (active low) which indicates that all listeners have accepted the previous data byte. The talker then places a byte on the data lines and waits until NRFD is FALSE (high), which indicates that all addressed listeners are ready to accept the information. When both NRFD and NDAC are in the proper state, the talker sets the DAV line TRUE (active low) to indicate that the data on the bus is valid (stable).

NRFD — Not Ready For Data
This line is used by the listeners to inform the talker when they are ready to accept new data. The talker must wait for each listener to set the NRFD line FALSE (high), which they will do at their own rate. This assures that all devices that are to accept the data are ready to receive it.

NDAC — Not Data Accepted
This line is also controlled by the listeners and is used to inform the talker that each device addressed to listen has accepted the data. Each device releases NDAC at its own rate, but NDAC will not go FALSE (high) until the slowest listener has accepted the data byte.

A-8 GENERAL INTERFACE MANAGEMENT BUS DESCRIPTION

The general interface management bus is a group of five signal lines used to manage the flow of information across the GPIB. A description of the function of each of the individual control lines is provided below.

ATN — Attention
The active controller uses the ATN line to define whether the information on the data bus is a command or is data. When ATN is TRUE (low), the bus is in the command mode and the data lines carry bus commands. When ATN is FALSE (high), the bus is in the data mode and the data lines carry device-dependent instructions or data.

EOI — End or Identify
The EOI line is used to indicate the last byte of a multibyte data transfer. The talker sets the EOI line TRUE during the last data byte.

The active controller also uses the EOI line in conjunction with the ATN line to initiate a parallel poll sequence.

IFC — Interface Clear
Only the system controller uses this line. When IFC is TRUE (low), all devices on the bus are placed in a known, quiescent state (unaddressed to talk, unaddressed to listen, and service request idle).

REN — Remote Enable
Only the system controller uses this line. When REN is set TRUE (low), the bus is in the remote mode and devices are addressed either to listen or to talk. When the bus is in remote and a device is addressed, it receives instructions from the GPIB

rather than from its front panel. When REN is set FALSE (high), the bus and all devices return to local operation.

SRQ

Service Request
The SRQ line is set TRUE (low) by any device requesting service by the active controller.

Appendix B
Front Panel Keys and Menus

Table of Contents

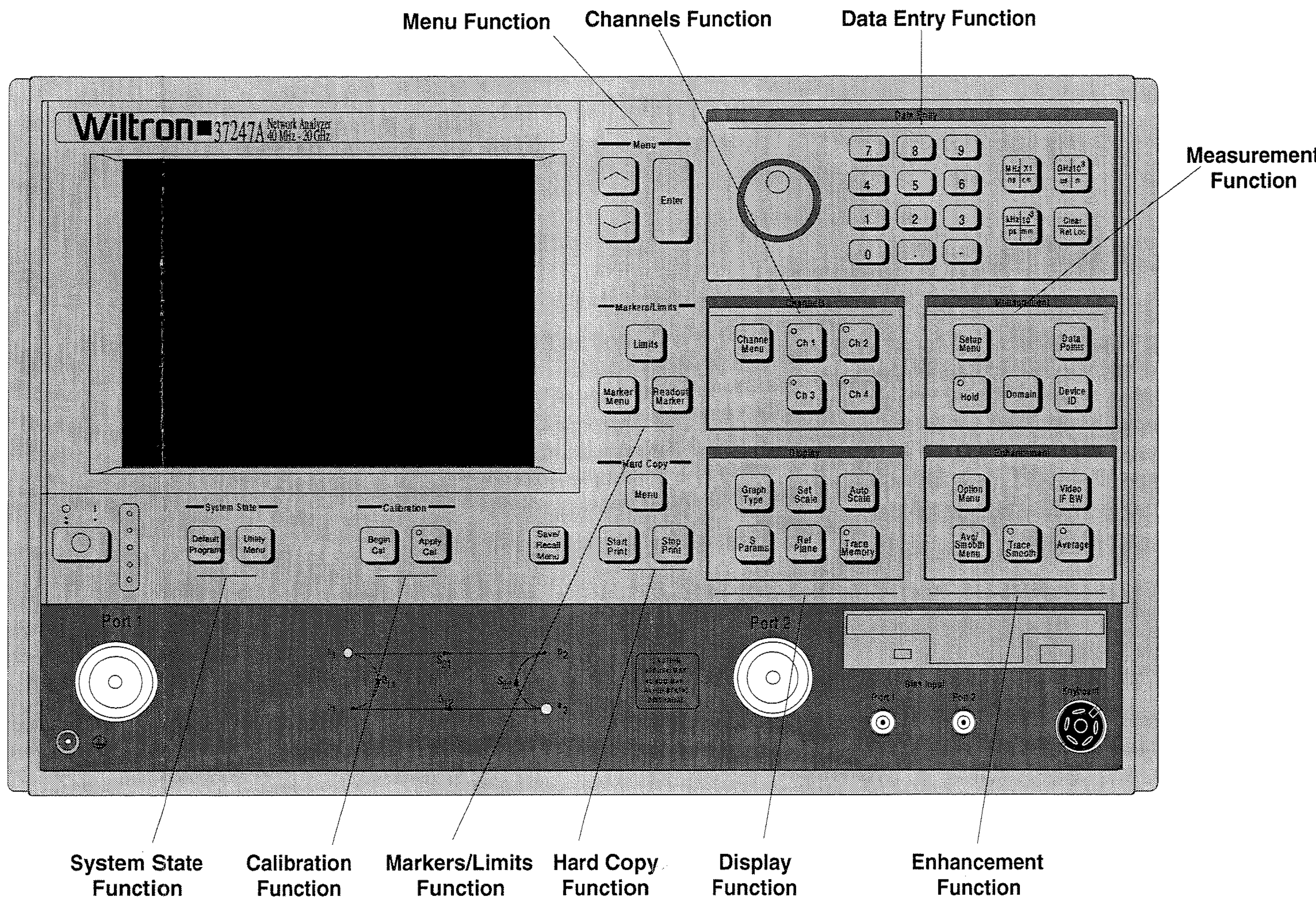


Figure B-1. Model 372XXA Front Panel Functional Groups

Appendix B Front Panel Keys and Menus

B-1 INTRODUCTION

Front panel operation of the 372XXA is via a system of functionally related menus. The top level menu in each of the functional groups appears after its related front panel key has been pressed. These keys and menus are described in the Model 372XXA Operation Manual (OM), Wiltron Part Number 10410-00149. Because having a knowledge of how these functionally related groups are structured is important from a programming perspective, the hierachial menu flowcharts that appear in the OM are reproduced in this appendix

B-2 CALIBRATION KEY-GROUP, DESCRIPTIONS AND MENU FLOW

The Calibration keys (Figure B-1, facing page) are described below. The calibration menus are diagrammed according to the method of calibration performed: Standard, Offset-Short, or LRL/LRM. The menu sequencing is complex and looping and can be said to have two parts: setup and calibration. The setup flow for the three calibration methods is diagrammed in Figures B-2 thru B-4. Each setup flow chart leads to the main calibration sequence, which is diagramed in Figure B-5.

MENU CAL_APPLIED

APPLY
CALIBRATION

FULL 12-TERM
(S11, S21
S22, S12)

APPLY ON (OFF)
CALIBRATION

TUNE MODE ON (OFF)

NO. OF FWD (REV)
SWEEPS BETWEEN
REV (FWD) SWEEPS
XXXXX SWEEPS
(XXXXX REMAINING)

PRESS <APPLY CAL>
TO TURN ON/OFF

PRESS <ENTER>
TO TURN ON/OFF

BEGIN CAL Key: This key displays a menu that lets you initiate the calibration sequence. That is, to begin a sequence of steps that corrects for errors inherent in a measurement setup.

APPLY CAL Key: This key displays a menu (left) that lets you turn on and off the error correction that may be applied to the displayed channel(s) using the currently valid error-correction indicator.

NOTE

Pressing the Clear key while in a calibration setup or sequencing will let you abort the calibration and return to the first setup menu.

Standard Calibration Setup Flow– Description

1. Pressing the Begin Cal key calls Menu C11.

2. With one exception, the flow is from left to right in the direction of the arrow head. The exception occurs in Menu C1, for the TIME DOMAIN choice. Here the flow direction reverses to Menu C2C then returns to a left-to-right flow on to Menu C3 or C3D.

3. Arrowheads that point both left and right indicate that the flow returns to the right-most menu after a choice had been made.

4. The group of menus to the left of Menu C3 and C3D are the initial selection set and are essentially the same for all three calibration types: Standard, Offset-Short, and LRL/LRM.

5. The group of menus that follow Menu C3 or C3D are, for the most part, type specific. The selection of Menu C3 or C3D depends upon the choice made in Menu C11A: COAXIAL or MICROSTRIP. For the Standard Calibration, the WAVEGUIDE selection in Menu C11A is not implemented.

rather than from its front panel. When REN is set FALSE (high), the bus and all devices return to local operation.

SRQ

Service Request
The SRQ line is set TRUE (low) by any device requesting service by the active controller.

Appendix B Front Panel Keys and Menus

B-1 INTRODUCTION

Front panel operation of the 372XXA is via a system of functionally related menus. The top level menu in each of the functional groups appears after its related front panel key has been pressed. These keys and menus are described in the Model 372XXA Operation Manual (OM), Wiltron Part Number 10410-00149. Because having a knowledge of how these functionally related groups are structured is important from a programming perspective, the hierachial menu flowcharts that appear in the OM are reproduced in this appendix

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MENU CAL_APPLIED

APPLY
CALIBRATION

FULL 12-TERM
(S11, S21
S22, S12)

APPLY ON (OFF)
CALIBRATION

TUNE MODE ON (OFF)

NO. OF FWD (REV)
SWEEPS BETWEEN
REV (FWD) SWEEPS
XXXXX SWEEPS
(XXXXX REMAINING)

PRESS <APPLY CAL>
TO TURN ON/OFF

PRESS <ENTER>
TO TURN ON/OFF

BEGIN CAL Key: This key displays a menu that lets you initiate the calibration sequence. That is, to begin a sequence of steps that corrects for errors inherent in a measurement setup.

APPLY CAL Key: This key displays a menu (left) that lets you turn on and off the error correction that may be applied to the displayed channel(s) using the currently valid error-correction indicator.

NOTE

Pressing the Clear key while in a calibration setup or sequencing will let you abort the calibration and return to the first setup menu.

Standard Calibration Setup Flow– Description

1. Pressing the Begin Cal key calls Menu C11.

2. With one exception, the flow is from left to right in the direction of the arrow head. The exception occurs in Menu C1, for the TIME DOMAIN choice. Here the flow direction reverses to Menu C2C then returns to a left-to-right flow on to Menu C3 or C3D.

3. Arrowheads that point both left and right indicate that the flow returns to the right-most menu after a choice had been made.

4. The group of menus to the left of Menu C3 and C3D are the initial selection set and are essentially the same for all three calibration types: Standard, Offset-Short, and LRL/LRM.

5. The group of menus that follow Menu C3 or C3D are, for the most part, type specific. The selection of Menu C3 or C3D depends upon the choice made in Menu C11A: COAXIAL or MICROSTRIP. For the Standard Calibration, the WAVEGUIDE selection in Menu C11A is not implemented.

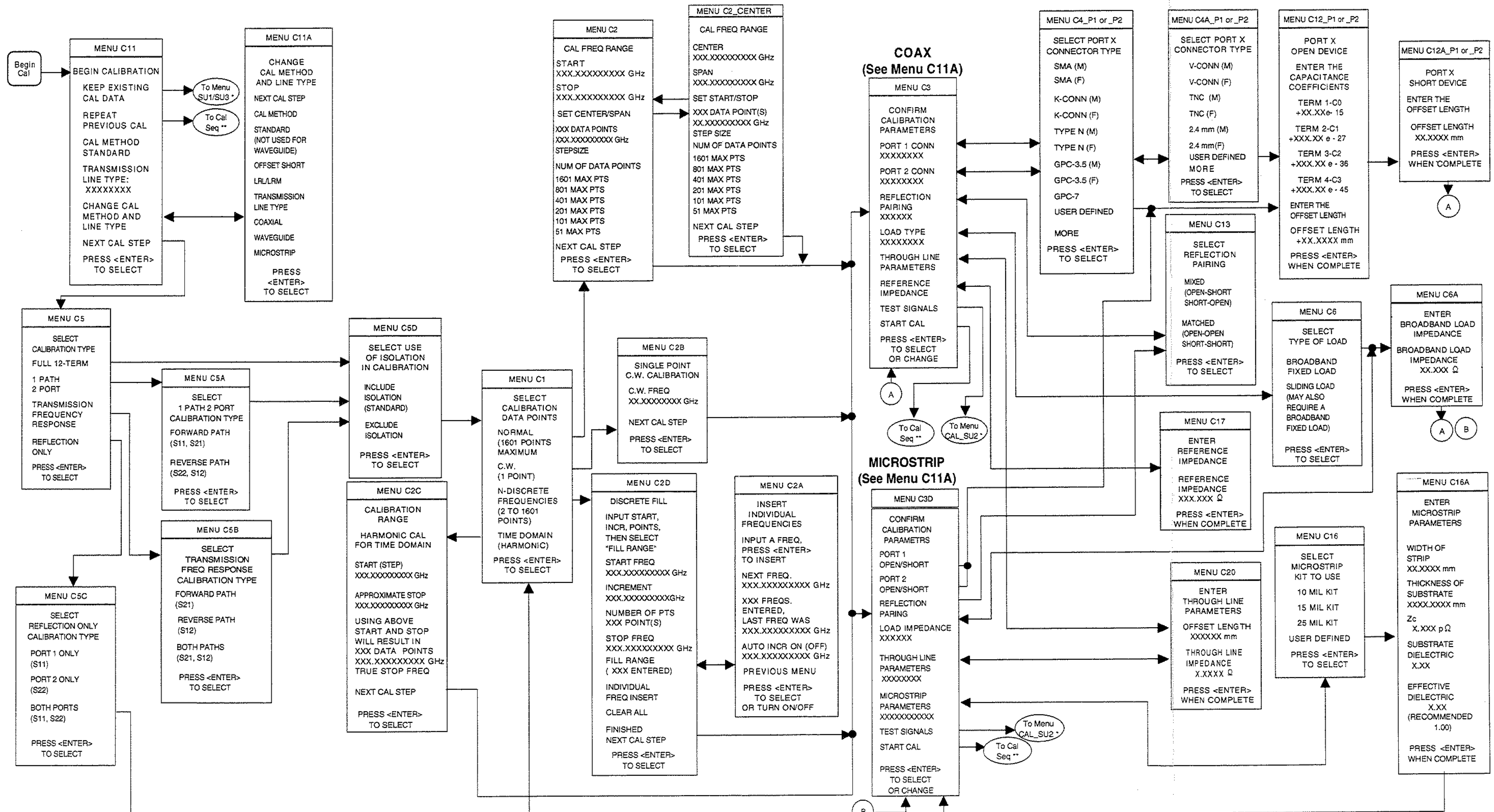


Figure B-2. Menu Sequencing, Standard Calibration

* Setup Menu SU1/SU3 – See Figure B-6
** Cal Seq (Calibration Sequence) – See Figure B-5

Offset-Short Calibration Setup Flow – Description

1. Pressing the Begin Cal key calls Menu C11.

2. With one exception, the flow is from left to right in the direction of the arrow head. The exception occurs in Menu C1, for the TIME DOMAIN choice. Here the flow direction reverses to Menu C2C then returns to a left-to-right flow on to Menu C3A, C3C, or C3B.

3. Arrowheads that point both left and right indicate that the flow returns to the right-most menu after a choice had been made.

4. The group of menus to the left of Menu C3A, C3C, or C3B are the initial selection set and are essentially the same for all three calibration types: Standard, Offset-Short, and LRL/LRM.

5. The group of menus that follow Menu C3A, C3C, or C3B are, for the most part, type specific. The selection of Menu C3A, C3C, or C3B depends upon the choice made in Menu C11A: COAXIAL, WAVEGUIDE, or MICROSTRIP.

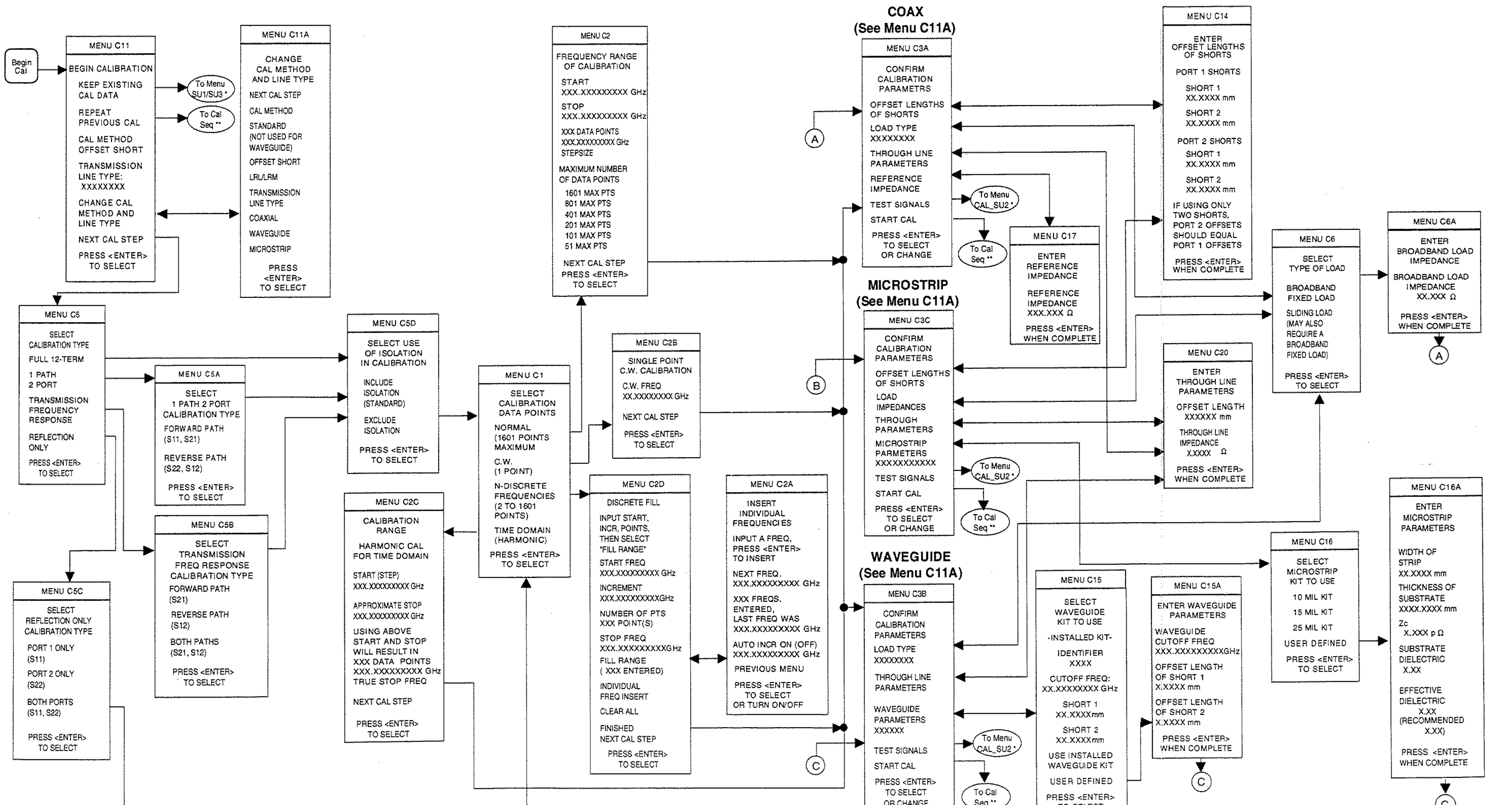


Figure B-3. Menu Sequencing, Offset-Short Calibration
* Menu SU1/SU3 – See Figure B-6
** Cal Seq (Calibration Sequence) – See Figure B-5

LRL/LRM Calibration Setup flow – Description

1. Pressing the Begin Cal key calls Menu C11.

2. With one exception, the flow is from left to right in the direction of the arrow head. The exception occurs in Menu C1, for the TIME DOMAIN choice. Here the flow direction reverses to Menu C2C then returns to a left-to-right flow on to Menu C3E, C3G, or C3F.

3. Arrowheads that point both left and right indicate that the flow returns to the right-most menu after a choice had been made.

4. The group of menus to the left of Menu C3E, C3G, or C3F are the initial selection set and are essentially the same for all three calibration types: Standard, Offset-Short, and LRL/LRM.

5. The group of menus that follow Menu C3E, C3G, or C3F are, for the most part, type specific. The selection of Menu C3E, C3G, or C3F depends upon the choice made in Menu C11A: COAXIAL, WAVEGUIDE, or MICROSTRIP.

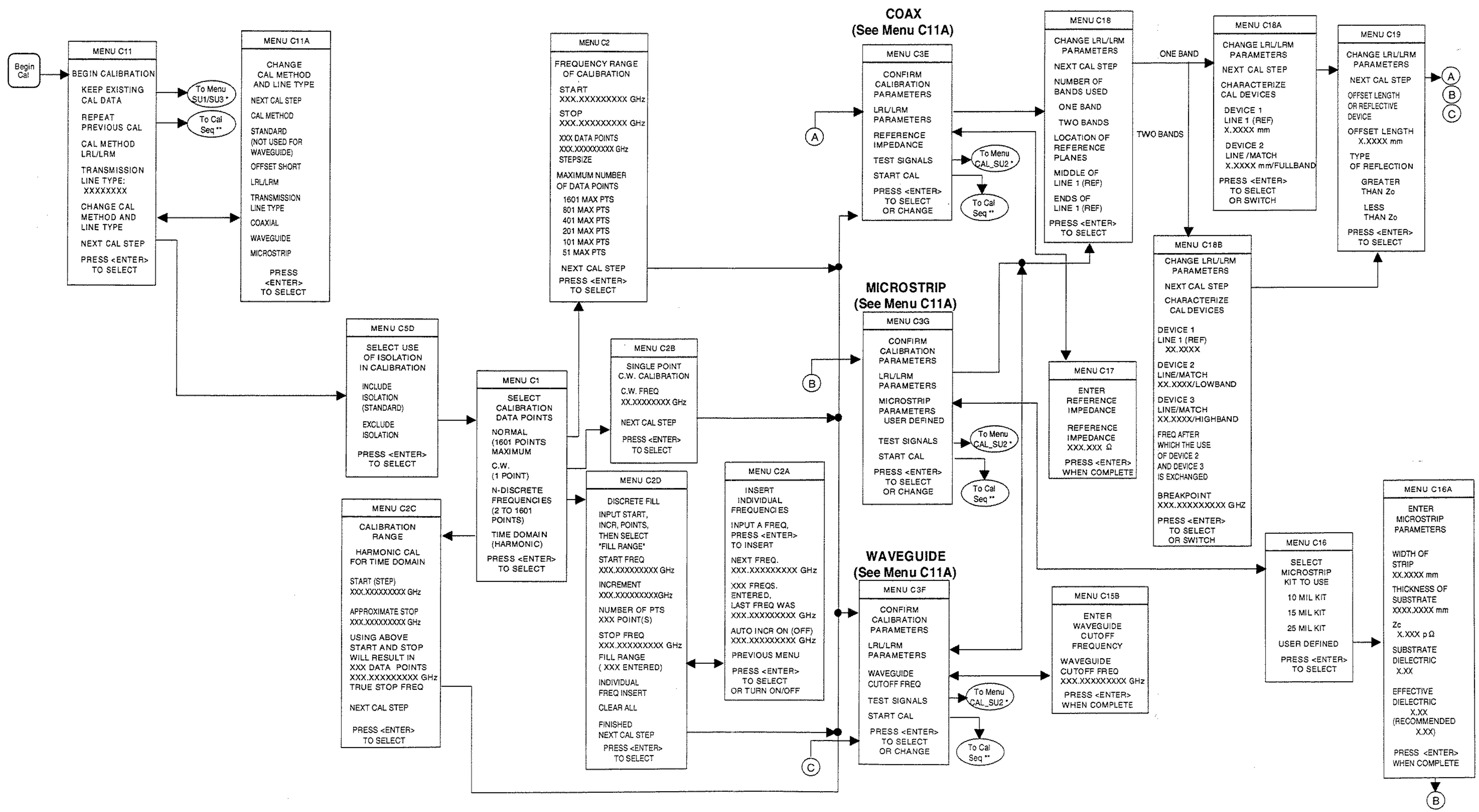


Figure B-4. Menu Sequencing, LRL/LRM Calibration

* Menu SU1/SU3 – See Figure B-6
** Cal Seq (Calibration Sequence) – See Figure B-5

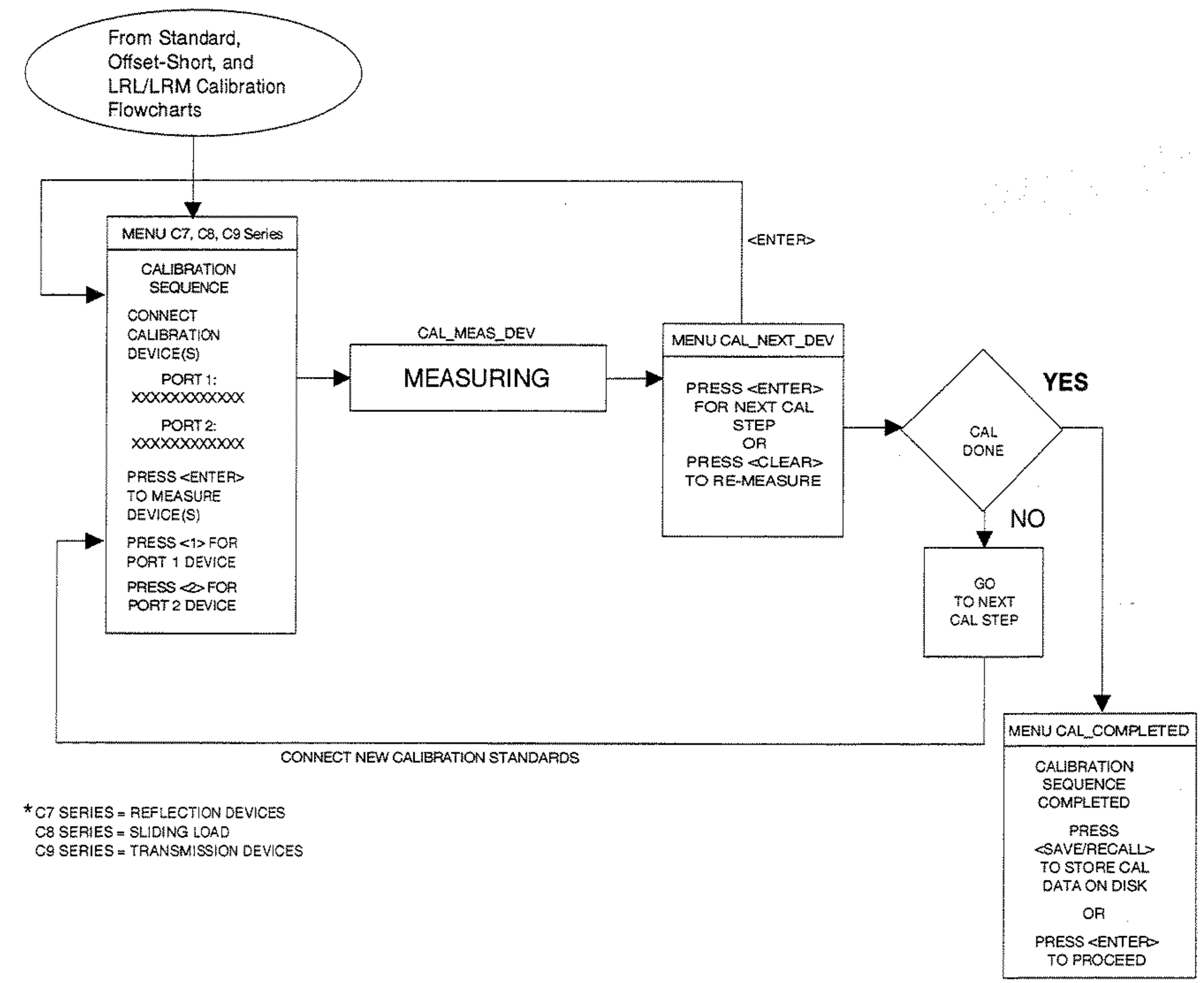
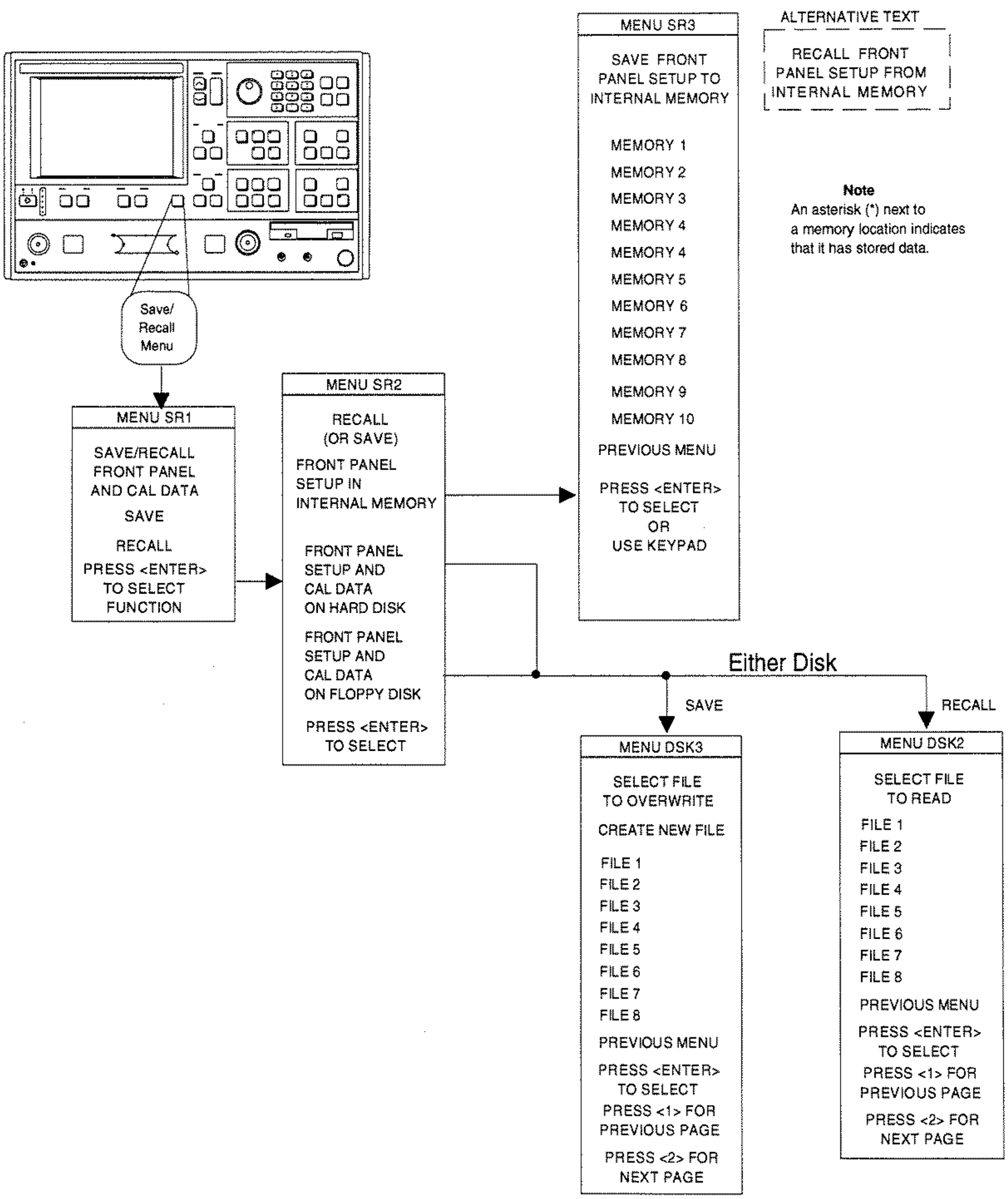


Figure B-5. *Calibration Sequence Menus*

B-3 SAVE/RECALL MENU KEY, DESCRIPTION AND MENU FLOW

Pressing this key displays the first of a menu set (below) that lets you save or recall control panel setups and calibration data.



B-4 MEASUREMENT KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the Measurement key-group are described below. Flowcharts of the Setup Key and Data Points key menus are shown in Figure B-6. As described for the calibration menus, the flow is left-to-right and the double arrowheaded lines indicate that the flow returns to the calling menu once a selection has been made.

Setup Menu Key: Pressing this key calls Sweep Setup Menu SU1 or SU3. Depending upon which menu items you select, additional menus may also be called.

Data Points Key: Pressing this key calls Menu SU9 or SU9A. Menu SU9 provides for data point selection. Menu SU9A is called if the C.W. MODE selection in Menu SU1 is on.

Hold Key: If the instrument is sweeping, pressing this key results in an immediate halt of the sweep at the current data point. The LED on the button lights, indicating that the Hold Mode is active.

If you restart the sweep after performing any disk operations in the Hold Mode (sweep stopped at some data point), the sweep restarts from the beginning. The instrument may be taken out of the hold mode as follows:

- By using any of the options described in Menu SU4, Select Function for Hold Button.
- By pressing the Default Program button. This causes the 372XXA to revert to a predefined state.
- By pressing the Begin Cal key. This causes the 372XXA to resume sweeping and begin the Calibration Menu sequence.

NOTE

See the description for Menu SU4 for a discussion of the interaction between the Hold Mode and the selection of "Single Sweep" or "Restart Sweep"

Domain Key: If the Time Domain option is installed, making a selection other than "Frequency Domain" lets you display measured data in the time domain. It also calls a further sequence of Time Domain Menus.

Device ID Key: Pressing this key calls a menu that lets you enter a name for the test device. This key has the same effect as selecting "Device ID" in the PM2 menu.

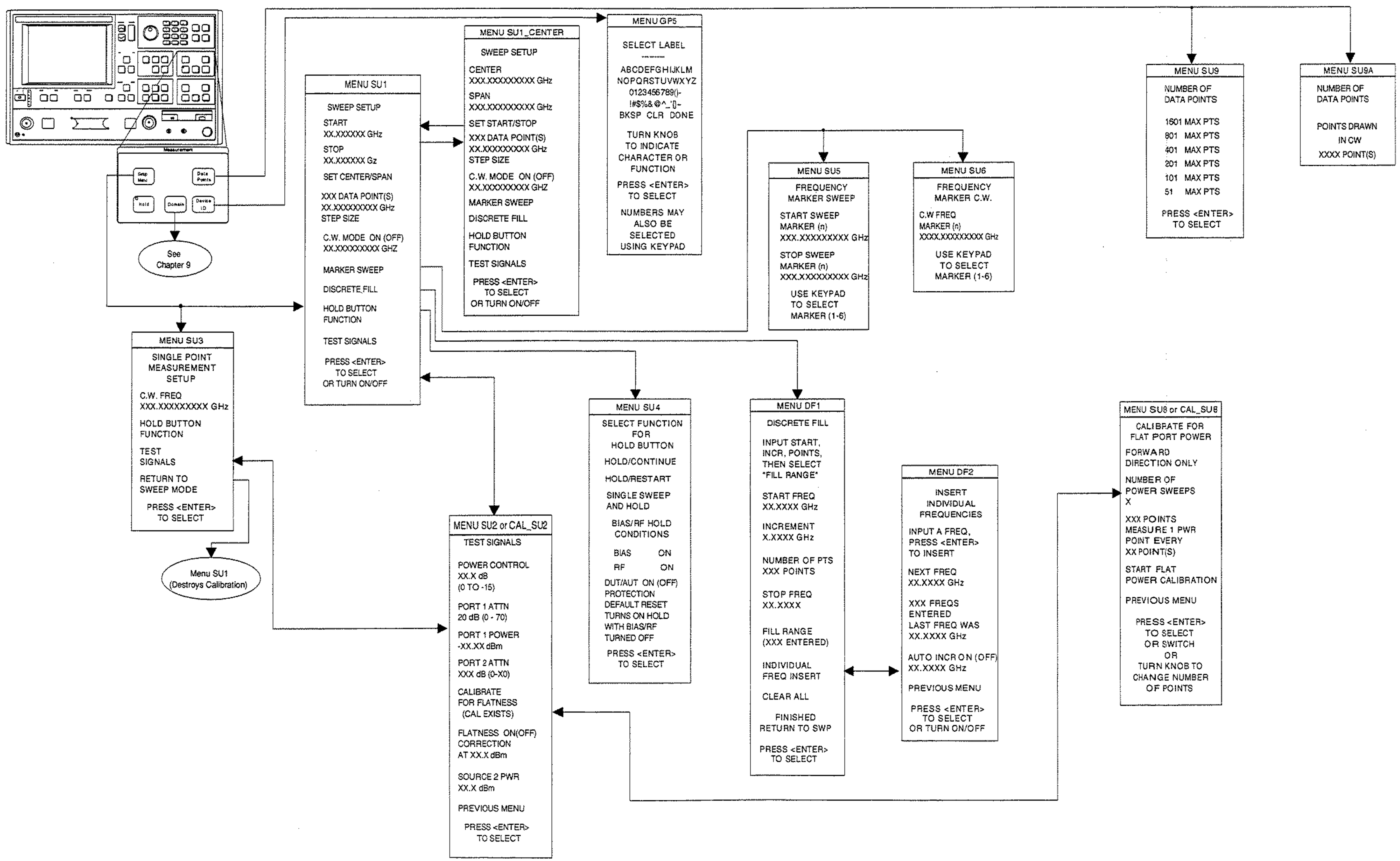


Figure B-6. *Measurement Keys Menus*

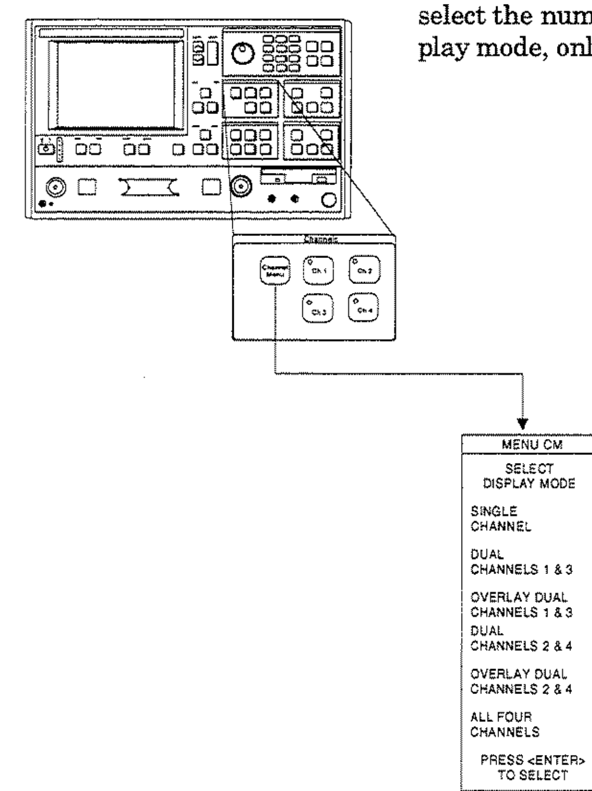
B-5 CHANNELS KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the Channels key-group are described below.

Ch 1-4 Keys: These keys (left) define the active channel. One (and only one) must always be active as indicated by the associated LED. Pressing a button makes the indicated channel active. If channel indicated by the key is already active, pressing the key has no effect.

The active channel will be the channel acted upon by the S Params, Graph Type, Ref Plane, Trace Memory, Set Scale, Auto Scale, Markers/Limits and Domain keys. When in the single channel display mode, the active channel will be the one displayed.

Channel Menu : Pressing this key calls menu CM (below). Here, you select the number of channels to be displayed. When in the single display mode, only the active channel will be displayed.



B-6 DISPLAY KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the Display key-group are described below. Menu flow diagrams are shown in Figure B-7. F

Graph Type Key: Pressing this key calls menu GT1 or GT2. These menus let you select the type of display to appear on the active channel for the selected S-Parameter.

Set Scale Key: Pressing this key calls the appropriate scaling menu (SS1, SS2, SS3, etc.) depending upon the graph type being displayed on the active channel for the selected S-Parameter.

Auto Scale Key: Pressing this key autoscales the trace or traces for the active channel. The new scaling values are then displayed on the menu (if it is displayed) and graticule. The resolution will be selected from the normal sequence of values you have available using the knob. When the active channel has a Real and Imaginary type display, the larger of the two signals will be used to autoscale both the real and imaginary graphs. Both graphs will be displayed at the same resolution.

S Params Key: Pressing this key calls menu SP. This menu allows you to select the S-Parameter to be displayed by the active channel for the selected S-Parameter.

Ref Plane Key: Pressing this key calls menu RD1. This menu lets you input the reference plane in time or distance. You do this by selecting the appropriate menu item. For a correct distance readout, the dielectric constant must be set to the correct value. This is accomplished by selecting **SET DIELECTRIC**, which calls menu RD2.

On menu RD1, selecting **AUTO** automatically adjusts the reference delay to unwind the phase for the active channel.

The 372XXA unwinds the phase as follows:

- First, it sums the phase increments between each pair of measured data points, then it takes the average "Pdelta" over the entire set of points.
- Next, it corrects the phase data by applying the following formula:

$$P_{correct} = P_{measured} - NxP_{delta}$$

Where P = phase

Assuming there are fewer than 360 degrees of phase rotation between each data point, the operation described above removes any net phase offset. The endpoints of the phase display then fall at the same phase value.

Trace Memory Key: Pressing this key brings up menu NO1. This menu—which relates to the active channel—allows you to store data to memory, view memory, perform operations with the stored memory, and view both data and memory simultaneously. Four memories exist, one for each channel. This allows each channel to be stored and normalized independent of the other channels. Data from the trace memory may be stored on the disk or recalled from it.

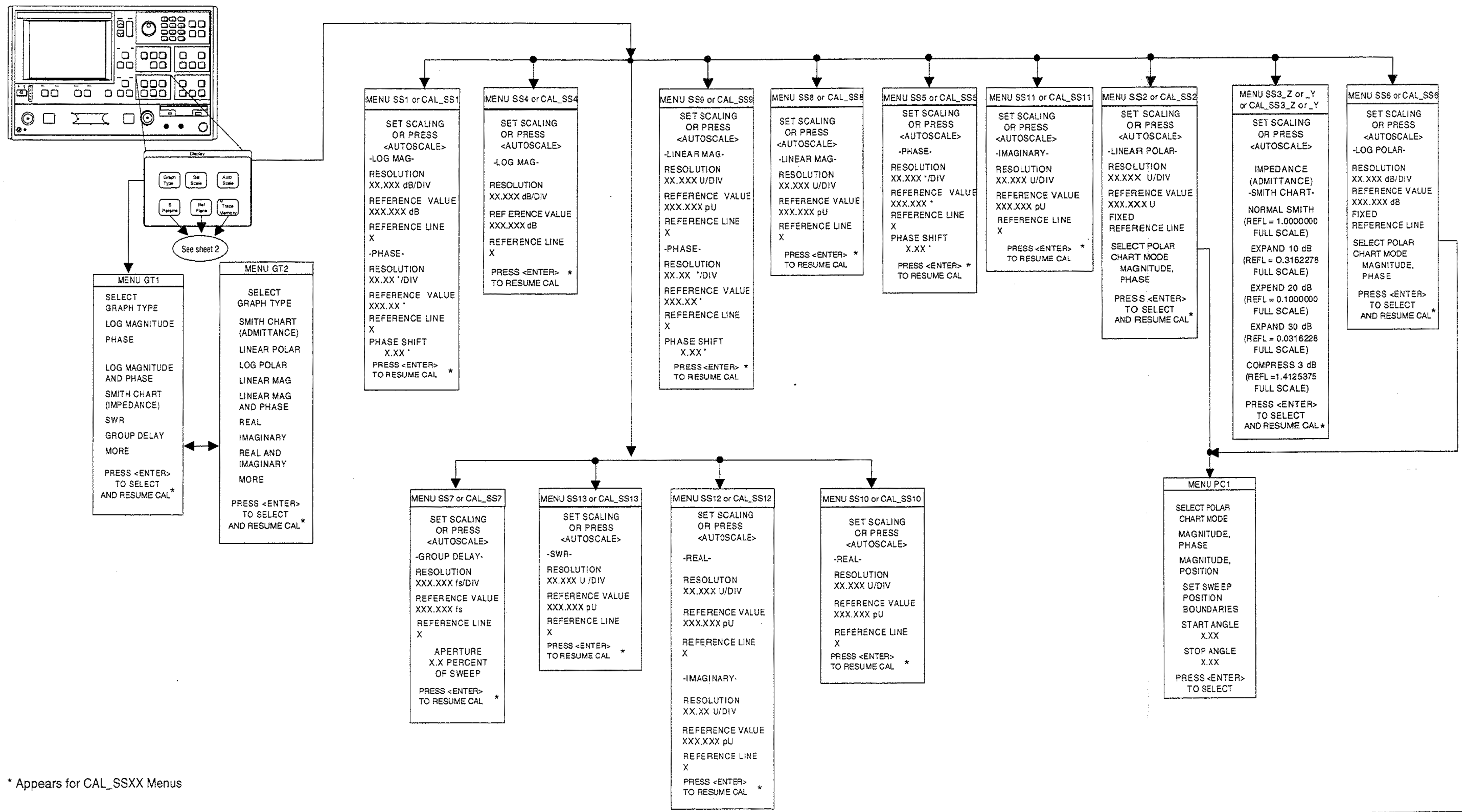


Figure B-7. *Display Keys Menus (1 of 2)*

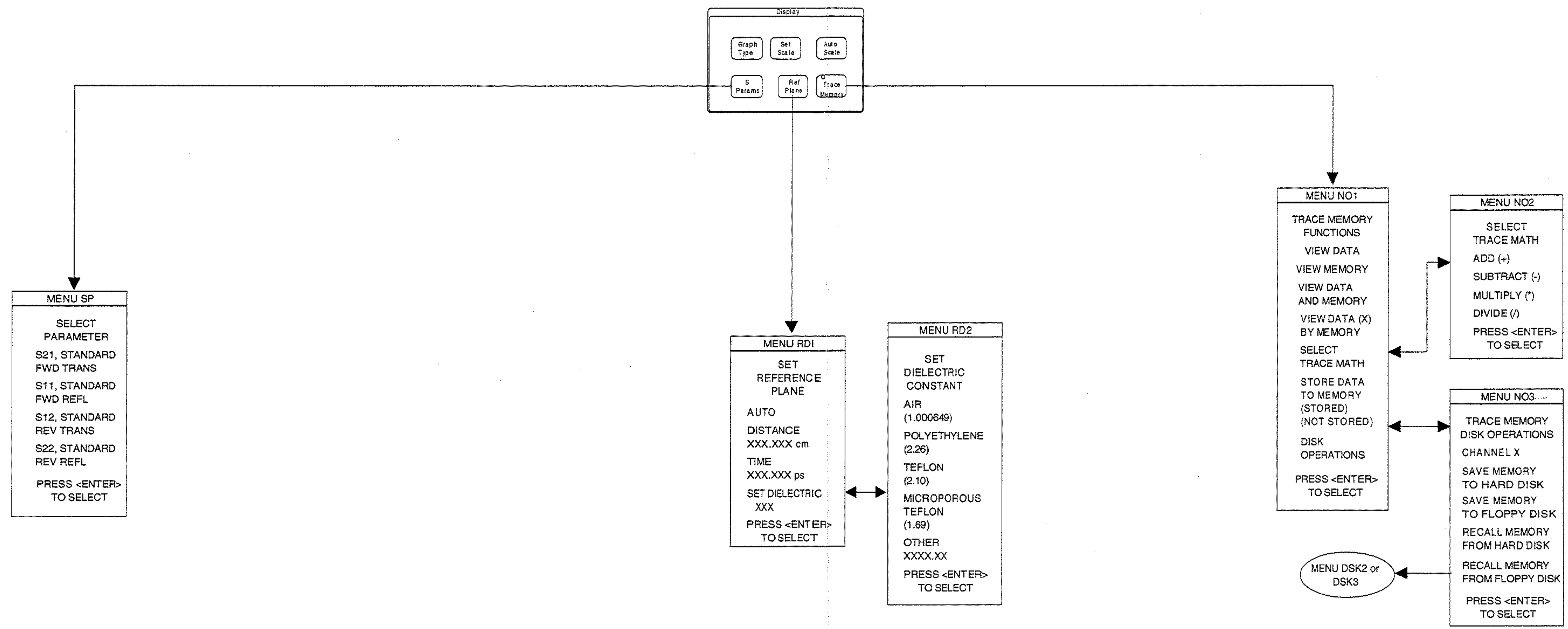


Figure B-7. *Display Key-Group Menus (2 of 2)*

B-8 ENHANCEMENT KEY-GROUP, DESCRIPTION AND MENU FLOW

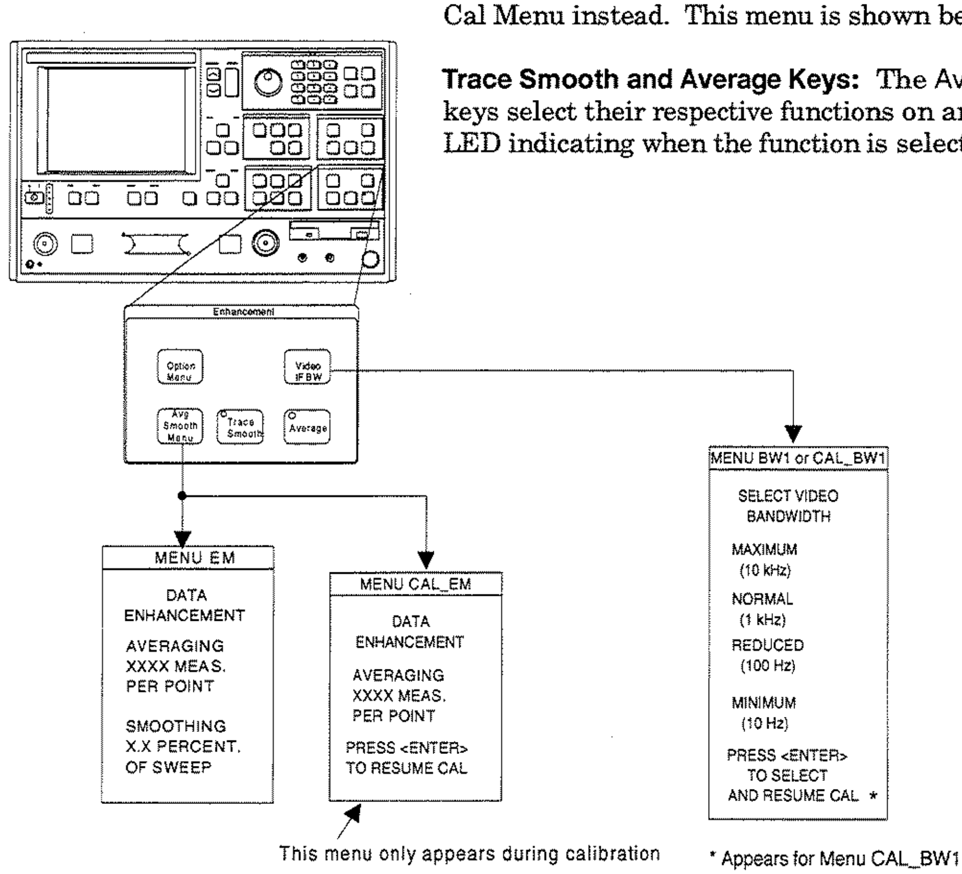
The individual keys within the Enhancement key-group are described below.

Option Menu Key: This key brings up the OPTNS menu. Depending on choices selected, this menu causes other menus to appear. A menu flow diagram for this key is shown in Figure B-8.

Video IF BW Key: Pressing this produces a menu that lets you choose between four different IF bandwidths. This menu is shown below.

Avg/Smooth Menu Key: Pressing this key brings up the EM Menu. When pressed during the calibration sequence, it brings up the EM Cal Menu instead. This menu is shown below.

Trace Smooth and Average Keys: The Average and Trace Smooth keys select their respective functions on and off with the appropriate LED indicating when the function is selected.



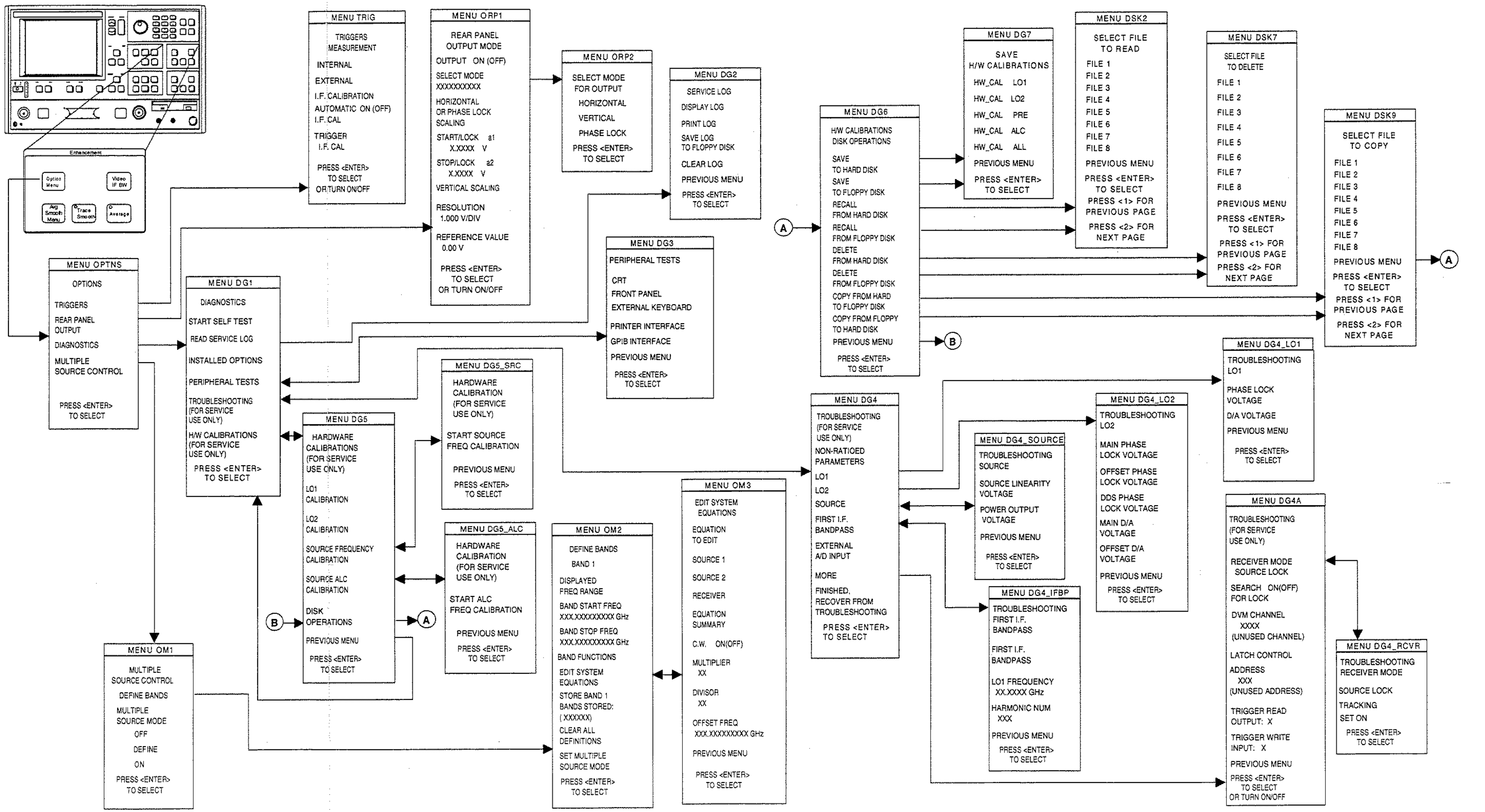


Figure B-8. *Enhancement Keys Menus (Options Menu*

B-8 HARD COPY KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the Hard Copy key-group are described below.

Menu Key: Pressing this key brings up menu PM1. This menu allows you to define what will happen every time you press the Start Print key. A menu flow diagram is shown in Figure B-9.

Start Print Key: Pressing this key starts outputting the measured data as defined by the setup defined by the selected Menu key.

Stop Print Key: Pressing this key can result in any of the following actions if the printer is selected

- ☐ If the 372XXA is not outputting data, the key sends a form feed command to the printer.
- ☐ If the printer is active, the key aborts the printing and sends a form feed command to the printer. Aborting the printing clears the print buffer.
- ☐ If the printer is not selected and another form of output is active, Pressing this key aborts printing but *does not* send a form feed to the printer.

Plotting Functions The 372XXA can plot an image of either the entire screen or subsets of it. Plots can be either full size or they can be quarter size and located in any of the four quadrants. You can select different pens for plotting different parts of the screen. You cannot, however, plot tabular data.

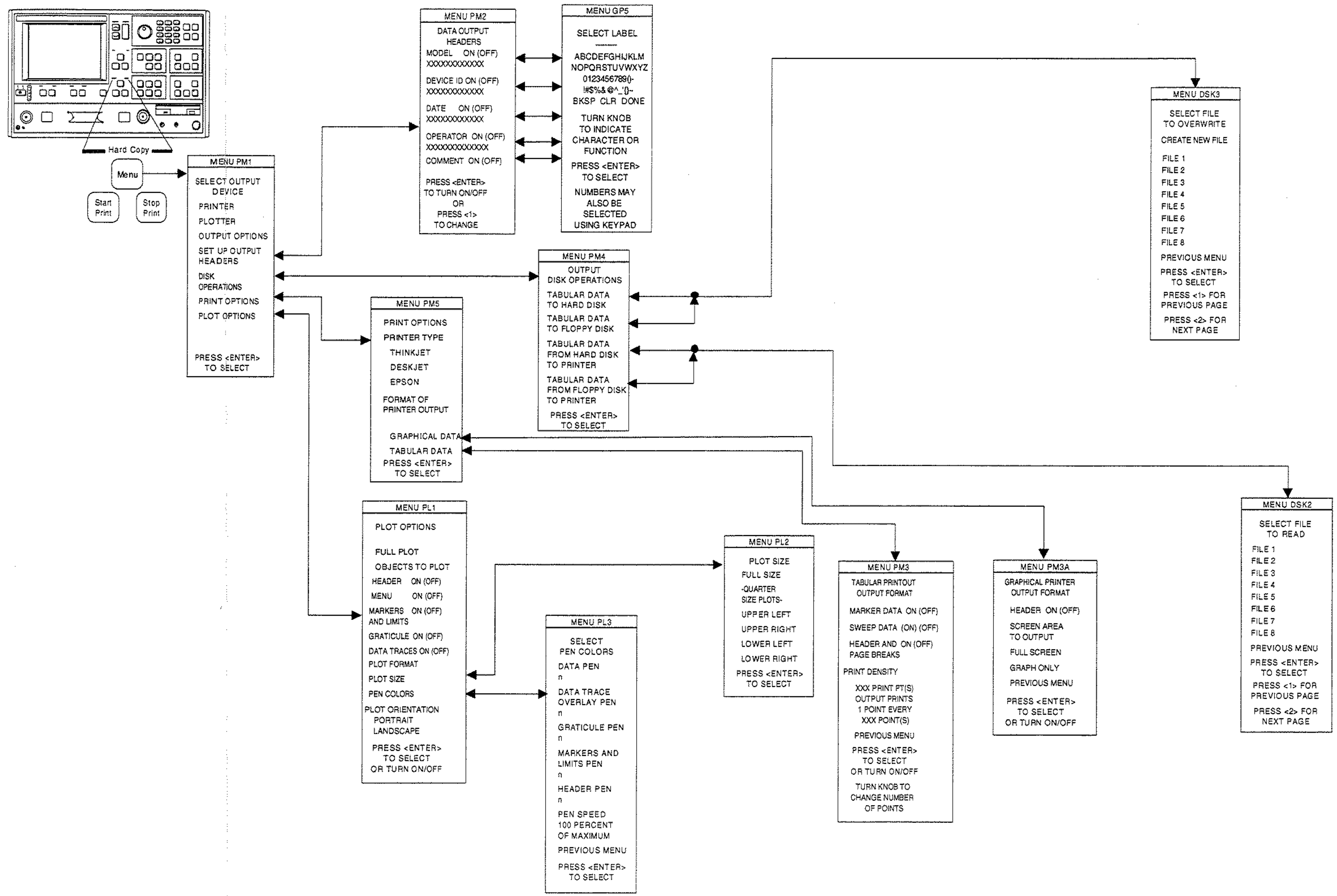


Figure B-9. Hard Copy Keys Menus

B-10 SYSTEM STATE KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the System State key-group are described below. The menu flow for the Utility Menu key is shown in Figure B-10.

Default Program Key: Pressing this key brings up the default menu. If pressed again, it recalls the factory selected default values for the control panel controls. The values are defined in Table B-1.

Pressing this key then the 1 key resets front panel key states and internal memories 1 thru 10.

Pressing this key then the 0 key resets front panel key states, internal memories 1 thru 10, and certain hardware settings. Refer to paragraph B-5 for additional information on this function.

CAUTION

Use of this key will destroy control panel and calibration setup data, unless they have been saved to disk.

Utility Menu *Key*: Pressing this key calls menu U1. This menu accesses subordinate menus to perform system, disk, and service utilities. The only functions performed directly from the U1 Menu are "Blank Frequency Information." and "Data Drawing."

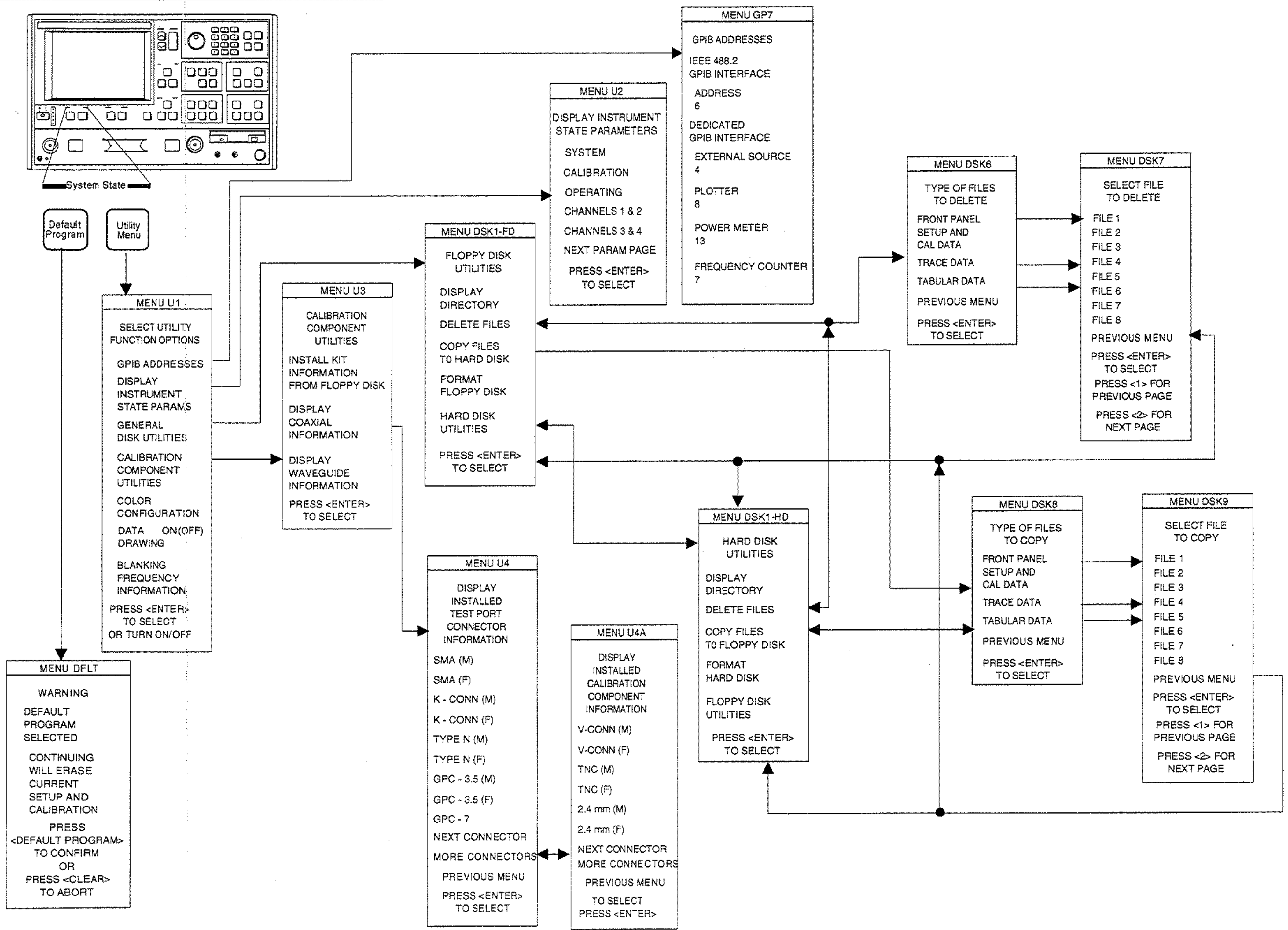


Figure B-10. *System State Key Menus*

Table B-1. *Default Settings*

Function	Default Setting
Instrument State	Measurement Setup Menu Displayed
Measurement	Maximum sweep range of source and test set *Source Power:* Model Dependent *Resolution:* Normal (401 points)
Channel	Quad (four-channel) display Channel 1 active
Display	*Channel 1:* S11, 1:1 Smith Chart *Channel 2:* S12, Log Magnitude and Phase *Channel 3:* S21, Log Magnitude and Phase *Channel 4:* S22, 1:1 Smith Chart *Scale:* 10 dB/Division or 90/Division *Offset:* 0.000dB or 0.00 degree *Reference Position:* Midscale *Electrical Delay:* 0.00 seconds *Dielectric:* Air (1.000649) *Normalization:* Off *Normalization Sets:* Erased
Enhancement	*Video IF Bandwidth:* Normal *Averaging:* Off *Smoothing:* Off
Calibration	*Correction:* Off and Calibration erased *Connector:* Model dependent *Load:* Broadband
Markers/Limits	*Markers On/Off:* All off *Markers Enabled/Disabled:* All enabled Marker Frequency: All set to the start-sweep frequency (or start -time distance Δ *Reference:* Off *Limits:* All set to reference position value (all off all enabled)
System State	*GPIB Addresses:* Unchanged *Frequency Blanking :* Disengaged, *Error(s): GPIB SRQ errors are cleared, Service Log errors are not cleared* *Measurement:* Restarted

B-11 MARKERS/LIMITS KEY-GROUP, DESCRIPTION AND MENU FLOW

The individual keys within the Markers/Limits key-group are described below. The menu flow for the Marker Menu key is shown on the facing page.

Marker Menu Key: Pressing the Marker Menu key calls Menu M1. This menu lets you toggle markers on and off and set marker frequencies, times, or distances.

Readout Marker Key: Pressing this key calls different menus, depending upon front panel key selections, as described below.

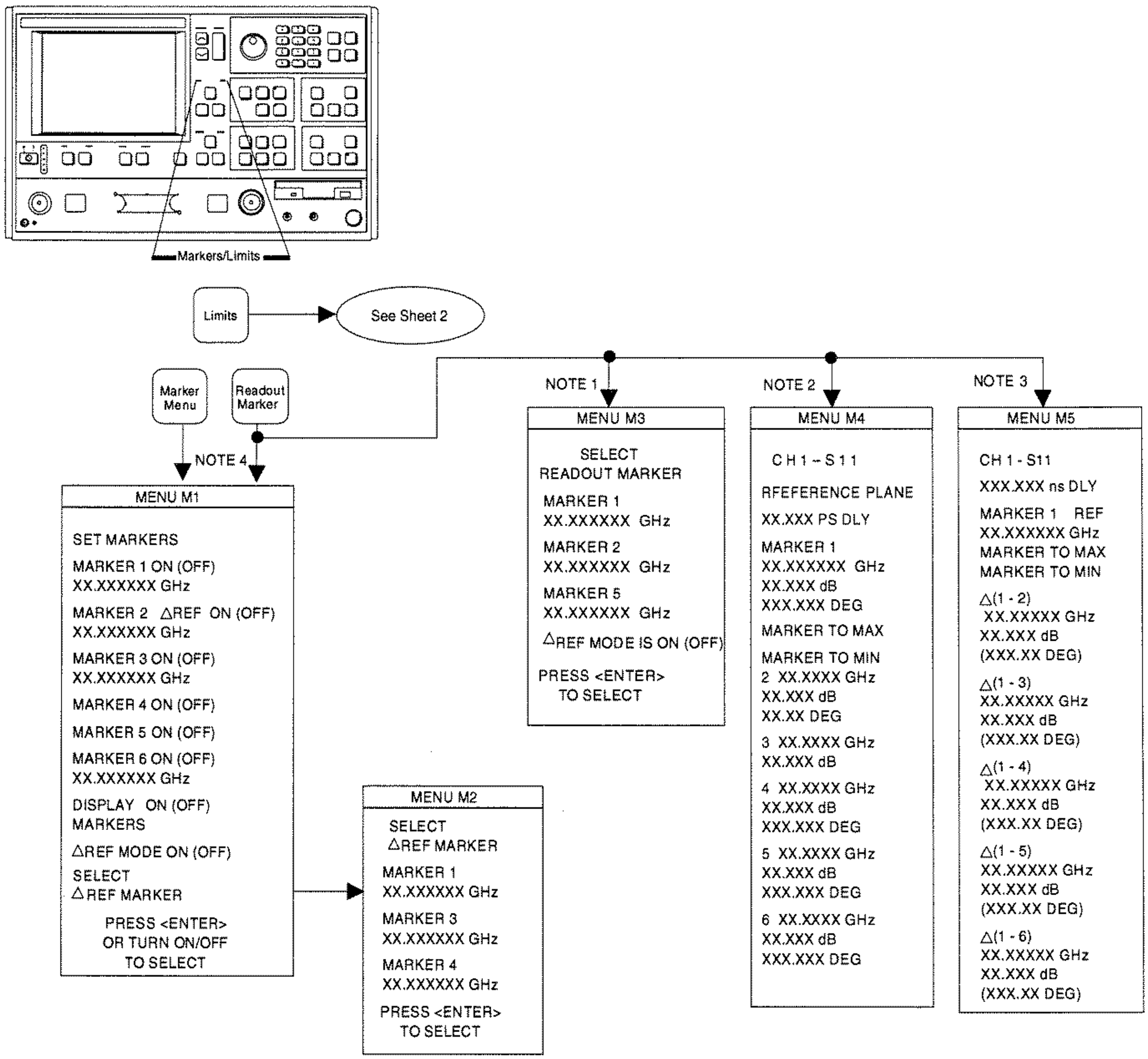
- It calls menu M1 if there are no markers available within the selected frequency range.
- It calls menu M3 (1) if the Δ Reference mode is off and there is no selected marker, or (2) if the selected marker is not in the sweep range. It also calls menu M3 (1) if the Δ Reference mode is on and the Δ Reference marker is not in the sweep range, or (2) if no Delta ref marker has been selected.
- It calls menu M4 if the ΔReference mode is off and the selected marker is in the current sweep range (or time/distance).
- It calls menu M5 if the ΔReference mode and marker are both on and and the ΔReference marker is in the selected sweep range (or time/distance).

Limit Frequency Readout Function The 372XXA has a Limit-Frequency Readout function. This function allows dB values to be read at a specified point (such as the 3 dB point) on the data trace. This function is only available for certain rectilinear graph-types.

The graph-type and their menu call letters are listed below

- Log Magnitude, Menu LF1
- Phase, Menu LF2
- Group Delay, Menu LF3
- Linear Magnitude, Menu LF4
- SWR, Menu LF5
- Real, Menu LF6
- Imaginary, menu LF7

Limits Key Pressing this key calls the appropriate Limit menu, based on the graph type selected using the Graph Type key and menu.



NOTE 1: Menu M3 appears
(1) If the Delta Reference mode is off and there is no selected marker or if the selected marker is not within the sweep range.
(2) If the Delta Reference mode is on and the Delta Reference marker is not within the sweep range or if no Delta Reference marker is selected.

NOTE 2: Menu M4 appears if the Delta Reference mode is off and the selected marker is within the current sweep range.

NOTE 3: Menu M5 appears if the Delta Reference mode and marker are both on and the Delta Reference marker is within the selected sweep range.

NOTE 4: Menu M1 appears if no markers are available within the selected frequency range.

Figure B-11. *Markers / Limits Key-Group Menus (1 of 3)*

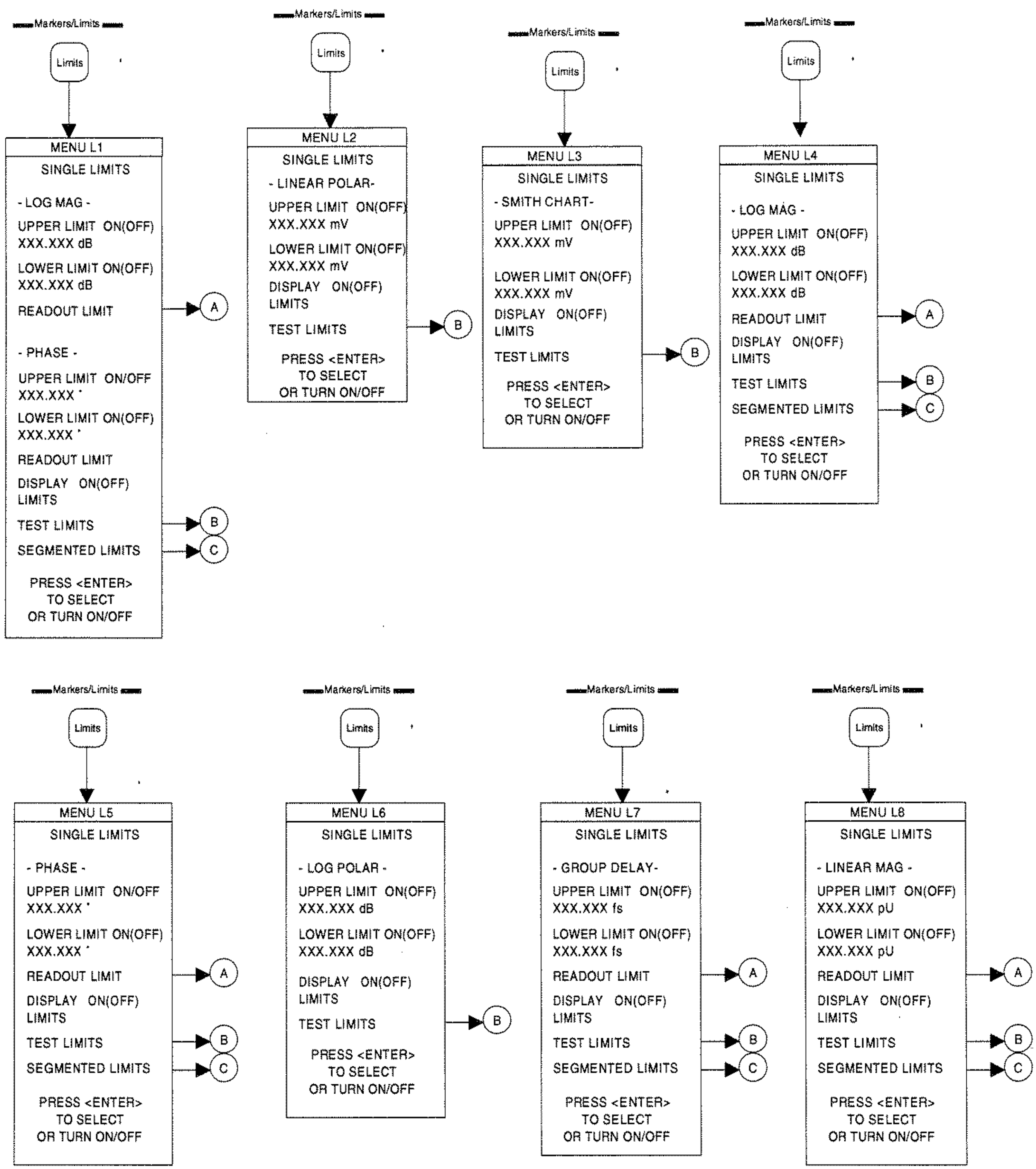


Figure B-11. *Markers / Limits Key-Group Menus (2 of 3)*

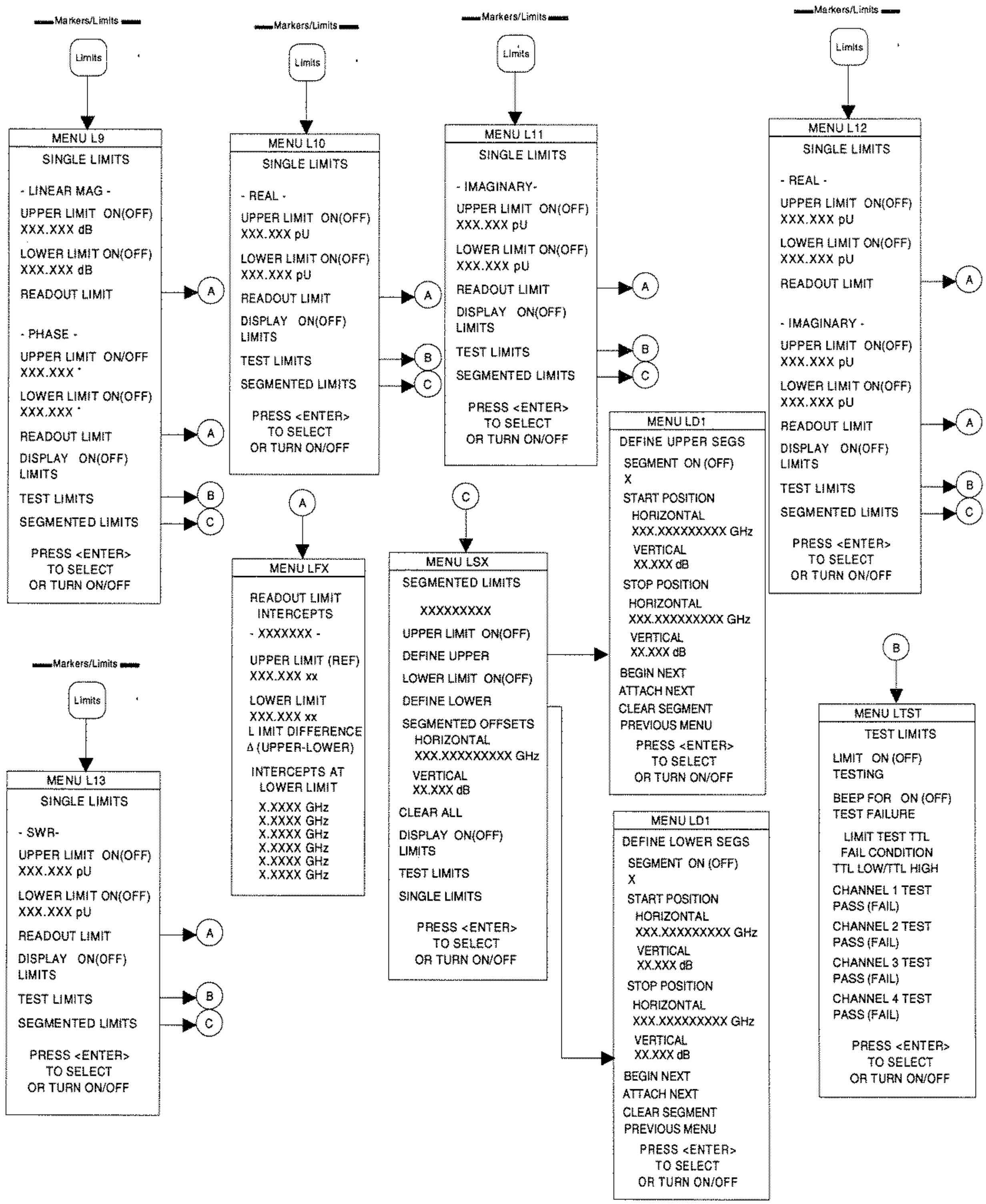


Figure B-11. *Markers/Limits Key-Group Menus (3 of 3)*

Appendix D 360B Compatibility Information

Table of Contents

Appendix D
360B Compatibility Information

D-1 INTRODUCTION

This appendix provides GPIB compatibility information between the 372XXA family of Vector Network Analyzers and the 360B Vector Network Analyzers. The information is presented in the next several paragraphs and on a command by command basis in Table D-1.

The information presented here is useful when developing an application targeted to operate on both the 372XXA and 360B. It will also prove useful when updating existing 360B application programs.

D-2 GENERAL

The primary driving factor in the degree of compatibility between the two families is the fact that 372XXA remote operations conform to the IEEE 488.2-1992 GPIB Standard.

The second set of compatibility issues are those due to differences in design of like features, i.e. features that exist both on the 360B and the 372XXA. Please note that the majority of GPIB commands implementing these front panel functions and like measurement features on the two VNA families are identical both in syntax and functionality.

The third area of compatibility is the differences in the feature set, or measurement capabilities, implemented in the 360B vs. the 372XXA.

D-3 REMOTE OPERATIONS DIFFERENCES

The key differences between the 372XXA and the 360B VNA remote operation implementations are in GPIB communication and data transfer protocols, service request (SRQ) generation and status reporting, synchronization, and use of IEEE 488.2 common commands. A summary of the key differences is provided below.

Refer to Chapters 1, 2, 7, and the remainder of the 372XXA Programming Manual for details and examples of how the 372XXA implements the following items. Refer to the 360B Programming Manual for complete 360B details.

The remote operation differences are:

The terminator character for the 372XXA is the linefeed (LF) character. The 360B terminator is selectable, either the carriage return (CR) character only, or both the CR/LF.

The separator character, the semi-colon (;) character, for commands and multiple response messages is required for the 372XXA. The 360B optionally uses a space and/or the semi-colon for this separation. The comma (,) character is mandatory for separating multiple data elements of a single commands data response in the 372XXA. The 360B uses the comma and the LF as needed, but for the most part this behavior is the same between the two instrument families.

Suffix terminator mnemonics, i.e. GHZ, can optionally be used with 372XXA data entry commands to indicate a weight for the value entered or to provide clarity and readability of your program. The 360B requires the use of terminator codes.

Block data transfers on the 372XXA, whether ASCII or binary, typically require a header which has encoded in it the number of bytes to follow in the data string. This header is not always used in the same manner, and it differs from a similar header used by the 360B.

ASCII string delimiters can be single or double quotes (' ' or " ") on the 372XXA. The 360B only uses double quotes.

Single numeric data elements are only transmitted using ASCII representation on the 372XXA. The 360B uses ASCII or binary depending on the command. This mostly impacts status reporting commands that send and receive register, or byte, values.

Service Request (SRQ) and Status reporting structures and operation on the 372XXA are as defined by the IEEE 488.2 Standard. This includes implementation of the additional event status registers specific to 372XXA features. The 360B differs greatly in this area. The following paragraphs expand more on status reporting as it is used for synchronization and error reporting.

Reset, Self Test, Instrument Identification, and Group Execute Trigger functionality are also quite different from 360B operation. This is because the 372XXA implementation is as defined by the IEEE 488.2 Standard.

In addition to the IEEE 488.2 defined identification commands, the 372XXA implements the 360B **OID** command - Output Identification String, but uses commas to separate the data fields.

The ***TST?** - Self Test Query, defined by the IEEE 488.2 and implemented in the 372XXA, runs an extensive hands-off self test and outputs a "0" or a "1" to indicate pass or fail respectively. However, it also writes information about any failed tests to the non-volatile Service Log. The 360B implements the **TST** command which only outputs error codes. See Section D-4, Design Differences, Error Reporting, below for more details on the Service Log).

372XXA synchronization with an application program is well defined by the IEEE 488.2 Standard via the Output Queue and the Status Reporting Structures. Specifically, by use of the ***OPC** - Operation Complete common command, ***OPC?** - Operation Complete common query, and bit 4 (MAV - Message Available) in the Status Byte Register. The external controller time out setting is a factor if using the ***OPC?** and waiting for its output.

The 372XXA status structures also provide for other, more application specific, synchronization mechanisms to include bits 0 and 3 of the Extended Event Status Register, and bits 0-3 of the Limits Event Status Register.

360B synchronization with an application program is provided via using the **ONP** - Output Number of Points command and proper setting of the external controller time out value. This command is used on the 360B in basically the same manner as the ***OPC?** query is used on the 372XXA. It is placed at the end of a command string to force the application program to wait for its output before continuing execution.

The 360B status structures provided for other, application specific, synchronization to include bits 0, 1, and 7 of the Primary Status Byte.

D-4 DESIGN DIFFERENCES

A summary of the key differences in design of similar features between the 372XXA and the 360B VNA families is provided below. Refer to the appropriate chapters in the 372XXA and the 360B Programming Manual for complete details about the specific items described below.

Active Menu:
The 360B switched to the front panel menu currently being manipulated by a GPIB mnemonic. This does not occur on the 372XXA.

Number of Measurement Points:
The 360B supported a variable number of up to 501 measurement points in Maximum, 168 points in Normal, and 85 in Minimum. The actual number of points selected by each category varied depending on the currently defined sweep to include whether a discrete fill sweep is in place.

The 372XXA provides for selecting the specific desired number of data points: 51, 101, 201, 401, 801, or 1601. The number of points defined in a discrete fill sweep cannot be varied.

Single and Dual Graph Data Outputs:
The 372XXA will output (or input) only the displayed data values, i.e.. outputting a single graph data display such as magnitude will produce an array of magnitude data only. This behavior can be modified by using the **DPR1** - Set Data Pair Output Format command, to allow for

developing a single data transfer procedure in your application program. As it was not measured, the value of the non-displayed data element will be set to zero. Of course, if the actual measurement data pair is desired you simply select the desired dual graph type prior to measuring the DUT. This feature allows you to optimize application program development time and complexity vs. data transfer throughput if you only desire a single data set.

The 360B always measures and outputs complex data pairs even if currently sweeping and measuring a single graph type such as magnitude.

Error Reporting:
The 360B Error Structures save power-up self test messages and error messages currently displayed on the screen. The most recent 20 errors can be output via GPIB or viewed on the front panel display. These error structures are not saved on power down, i.e.. they are saved in normal volatile RAM.

Status bits 2-4 in the Primary Status Byte are set to indicate Syntax, Out of Range, and Action Not Possible GPIB errors. Status bits 0-2 in the Secondary Status Byte are set to indicate Disk, Power-up Self Test, and Hardware failures.

The 372XXA implements a non-volatile Service Log for storing all, non-operator, system errors and failure messages. It also saves, in volatile RAM, the last two GPIB errors in the GPIB Error Structures. The GPIB errors include those reported by the 360B plus all other GPIB errors to include Query (Data I/O), Device Specific, Execution, and Command errors.

The Service Log and the GPIB error structures contain the error code and message, time/date stamp, and useful information about the errors. The information includes the actual program string and the location of the specific mnemonic that produced the error, if applicable.

The errors in the Service Log and the last two GPIB errors in the Error Structures can be accessed via the GPIB and from the front panel.

NOTE:

The Service Log also contains a record of the latest system errors or failures, and where necessary, a profile of internal system hardware and software settings at the time the error occurred. This is used by Service Engineers to quickly troubleshoot and restore a system to proper operation should it ever fail.

Status bits 2-5 in the Standard Event Status Register will be set to indicate one of four GPIB error conditions. There are not Status bits set as a result of non-GPIB error conditions, i.e.. Hardware failure, Self Test failure, or Disk failures as is the case with the 360B.

Instrument State Queries:
The 360B implements the **OCF** command which outputs the complete instrument setup string. This string can be parsed to retrieve many individual instrument setup parameters. The **OAP** command also supports to a limited degree the querying of the currently active parameter's value.

The 372XXA implements the **OCF** command but, unlike the 360B, it *does not* support parsing of the **OCF** output string. It also does not implement the **OAP** command.

Instead, the 372XXA implements a rich set of query commands for most of the system setup parameters. These commands typically take on the base setup parameter's syntax (or a very close resemblence if several commands are related to a particular setup) and adds a question mark (?) at the end of the command.

Calibration Type Selection:
The 360B Forward Only Transmission and Reflection Frequency Response calibrations (see 360B **CFR**,**CRL**) are now subsets of the 372XXA Reflection Only Port 1 Calibration (**CRF**) and the Transmission Frequency Response Forward Calibration (**CFT**).

D-5 FEATURE SET DIFFERENCES

This section provides a listing of major feature set differences between the 372XXA and the 360B VNA families.

Please note that any commands listed are only provided to help you find the general area of discussion in the appropriate 360B and 372XXA Programming Manuals. The commands listed, if any, are not the complete set implementing the specific feature. Refer to the appropriate Operations and Programming Manuals of the 372XXA and the 360B for complete details regarding a specific feature or command function of interest.

360B Features not supported on the 372XXA

Data Collection Mode (commands **TIB**, **CCD**, **CFD**, **CRD**, and **OCS**.)

User Parameter (Non S-parameter) Measurement Mode.

NOTE:
The USx series commands were completely redefined on the 372XXA to support Segmented Limits.

Millimeter Wave, Noise Figure, and Pulse Test Sets and add-on modules, and Test Set Multiplexer.

Port 1 Test Attenuator and Port 2 Source Attenuator.

Video In/Out Switching.

Set-on Receiver and Source Tracking Modes.

NOTE:
The commands for these modes have been redefined to support Diagnostic Modes on the 372XXA. Do not use these commands on the 372XXA.

372XXA Features Not Present on the 360B

The following features are not supported on the 360B:

- Segmented Limits.
- Limits Testing.
- Flexible Reverse Parameter Calibrations (S12, S22, and S12/S22.)
- Internal Hard Disk.
- Non-volatile memory Service Log.
- GPIB Error Reporting Structures.
- Peripheral Port (GPIB, Printer, External Keyboard) Testing.
- Additional Internal Memory State Save/Recall Registers (10 total.)
- Expanded Calibration Support to include Reverse S-parameters. Calibrations can now be done for forward, reverse, or both S-paramters in 8 different combinations.

D-6 372XXA/360B COMMANDS TABLE

Table D-1 alphabetically lists all 372XXA GPIB commands, the corresponding 360B commands (also in alphabetical order), the degree of compatibility between them, and related commands and remarks.

This table also serves as a guide to the 360B commands implemented on the 372XXA. If a desired 360B command is not listed in the table, then it is not implemented on the 372XXA.

The Compatibility Codes column in table D-1 references one of the three codes described below:

N
This code indictates a *new command* on the 372XXA. The command does not exist in the 360B command set.

S
This code indictates the *same command* exists on the 372XXA and the 360B. The command is identical both in syntax and function.

SM
This code indictates a command that has the same syntax as the 360B but has been modified in functionality on the 372XXA. The command is identical in syntax but its functionality, implementation, and/or behavior have been modified on the 372XXA from that of the 360B.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
*CLS	Clear status bytes and structures	N		Same as CSB
*DDT	Define device trigger command	N		See 360B DEF,END
*DDT?	Define device trigger query	N		
*ESE	Standard Event Status Enable Command	N		
*ESE?	Standard Event Status Enable query	N		
*ESR?	Standard Event Status Register query	N		
*IDN?	Instrument identification query	N		
*IST?	Ist message Status query	N		
*OPC	Operation Complete Command	N		
*OPC?	Operation Complete query	N		
*OPT?	Options installed query	N		
*PRE	Parallel Poll Register Enable	N		
*PRE?	Parallel Poll Register Enable query	N		
*RST	Reset Command	N		Same as RST
*SRE	Service Request Enable	N		See IPM,IEM, and for 360B, also see: SQ1,SQ0
*SRE?	Service Request Enable query	N		
*STB?	Status Byte query	N		See OPB
*TRG	Group Execute Trigger equivalent command	N		
*TST?	Self test and query	N		See TST
*WAI	Wait to Continue	N		
A12	Simulate 12-term calibration	S	A12	
A8R	Simulate 1-path 2-port calibration reverse path	N		
A8T	Simulate 1-path 2-port calibration forward path	S	A8T	
ABT	Simulate trans freq response calibration forward and reverse	N		

* Command Compatibility Code Descriptions:
N = New command for the 372XXA.
S = Same command for both the 360B and the 372XXA.
SM = Same command for both the 360B and the 372XXA, but functionality or behavior is modified on the 372XXA.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
ADD	Select addition as Trace Math for active channel	S	ADD	
AFT	Simulate trans freq response calibration forward path	S	AFT	
AH0	Turn automatic DUT protection off	N		
AH1	Turn automatic DUT protection on	N		
AHX?	Output automatic DUT protection onoff status	N		
ALC	Perform ALC loop internal calibration	N		
AMKR	Select active marker on all channels marker mode	N		
ANNCOL	Enter the color number for annotation and menu text	N		
ANNCOL?	Annotation and menu text color number query	N		
AOF	Turn averaging off	S	AOF	
AOF?	Output averaging on/off status	N		
AON	Turn averaging on	N		See AVG
APR	Enter Group delay aperture setting on active channnel	S	APR	
APR?	Output group delay aperture setting on active channel	N		
ARB	Simulate reflection only calibration both ports	N		
ARF	Simulate reflection only calibration port 1	S	ARF	
ARR	Simulate reflection only calibration port 2	N		
ART	Simulate trans freq response calibration reverse parameter	N		
ASC	Autoscale the active channel display	S	ASC	
ASP	Set polar stop sweep position angle	S	ASP	
ASP?	Output polar stop sweep position angle	N		
AST	Set polar start sweep position angle	S	AST	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
AST?	Output polar start sweep position angle	N		
ATTN	Attach next segment and make the active segment	N		
AVG	Turn on Averaging and set to value	S	AVG	
AVG?	Output Averaging count	N		
BBL	Select broadband load for calibration	S	BBL	
BBZ	Enter broadband load impedance for calibration	N		
BC0	Turn CRT display off	S	BC0	
BC1	Turn CRT display on	S	BC1	
BCX?	Output CRT display status	N		
BD1	Select band 1 for definition	S	BD1	
BD2	Select band 2 for definition	S	BD2	
BD3	Select band 3 for definition	S	BD3	
BD4	Select band 4 for definition	S	BD4	
BD5	Select band 5 for definition	S	BD5	
BEG	Begin taking calibration data	SM	BEG	Also sets CAC bit 0 on 372XXA Extended Event Status Register
BEGN	Begin next segment and make the active segment	N		
BH0	Turn bias off while in Hold	S	BH0	
BH1	Turn bias on while in Hold	S	BH1	
BHX?	Output bias on/off during Hold status	N		
BLU	Select blue as third plane color	S	BLU	
BPF	Enter break point frequency for 3 line LRL calibration	S	BPF	
BSP	Enter band stop frequency	S	BSP	
BSP?	Output band stop frequency	N		
BST	Enter band start frequency	S	BST	
BST?	Output band start frequency	N		
BWL3	Set 3 dB for bandwidth loss value	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
BWLS	Enter bandwidth loss value	N		
BWLS?	Output bandwidth loss value	N		
C12	Select 12 term calibration	S	C12	
C8R	Select 1-path 2-port calibration reverse path	N		
C8T	Select 1-path 2-port calibration forward path	S	C8T	
CAS	Clear active segmented limit vertical/horizontal definitions	N		
CBT	Select trans freq response calibration forward and reverse	N		
CC0	Enter capacitance coefficient 0 for open	S	CC0	
CC1	Enter capacitance coefficient 1 for open	S	CC1	
CC2	Enter capacitance coefficient 2 for open	S	CC2	
CC3	Enter capacitance coefficient 3 for open	S	CC3	
CF2	Select female 2.4mm connector for current port	S	CF2	
CF3	Select female GPC-3.5 connector for current port	S	CF3	
CFC	Select female TNC connector for current port	S	CFC	
CFK	Select female K connector for current port	S	CFK	
CFN	Select female Type N connector for current port	S	CFN	
CFS	Select female SMA connector for current port	S	CFS	
CFT	Select trans freq response calibration forward path	S	CFT	
CFV	Select female V connector for current port	S	CFV	
CH1	Select Channel 1 as active channel	S	CH1	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
CH2	Select Channel 2 as active channel	S	CH2	
CH3	Select Channel 3 as active channel	S	CH3	
CH4	Select Channel 4 as active channel	S	CH4	
CHX?	Output Active channel	N		
CLB	Clear all multiple source band definitions	S	CLB	
CM	Centimeters data entry suffix (scales by 1E-2)	N		Same as CMT
CM2	Select male 2.4mm connector for current port	S	CM2	
CM3	Select male GPC-3.5 connector for current port	S	CM3	
CMC	Select male TNC connector for current port	S	CMC	
CMK	Select male K connector for current port	S	CMK	
CMN	Select male N connector for current port	S	CMN	
CMS	Select male SMA connector for current port	S	CMS	
CMT	Same as CM	S	CMT	
CMV	Select male V connector for current port	S	CMV	
CMX?	Output calibration method	N		
CND	Select user specified connector for current port	S	CND	
CNG	Select GPC-7 connector for current port	S	CNG	
CNTR	Enter center frequency	N		
CNTR?	Output center frequency	N		
COF	Turn Off Vector Error Correction	S	COF	
CON	Turn On Vector Error Correction	S	CON	
CON?	Output error correction on/off status	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
COO	Enter offset for open for user specified connector	S	COO	
COS	Enter offset for short for user specified connector	S	COS	
CPYALCFH	Copy ALC Cal file from floppy to hard disk	N		
CPYALCHF	Copy ALC Cal file from hard to floppy disk	N		
CPYALLFH	Copy Combined Hardware Cal file from floppy to hard disk	N		
CPYALLHF	Copy Combined Hardware Cal file from hard to floppy disk	N		
CPYCALFH	Copy Calibration/Front Panel Setup from floppy to hard disk	N		
CPYCALHF	Copy Calibration/Front Panel Setup from hard to floppy disk	N		
CPYDATFH	Copy Tabular Data file from floppy to hard disk	N		
CPYDATHF	Copy Tabular Data file from hard to floppy disk	N		
CPYELGFH	Copy Error Log file from floppy to hard disk	N		
CPYELGHF	Copy Error Log file from hard to floppy disk	N		
CPYFREFH	Copy Frequency Cal file from floppy to hard disk	N		
CPYFREHF	Copy Frequency Cal file from hard to floppy disk	N		
CPYLOGFH	Copy Service Log file from floppy to hard disk	N		
CPYLOGHF	Copy Service Log file from hard to floppy disk	N		
CPYNRMFH	Copy Trace Memory File from floppy to hard disk	N		
CPYNRMHF	Copy Trace Memory File from hard to floppy disk	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
CRB	Select reflection only calibration both ports	N		
CRF	Select reflection only calibration port 1	S	CRF	
CRR	Select reflection only calibration port 2	S		
CRT	Select trans freq response calibration reverse path	S		
CSB	Same as *CLS	S	CSB	
CSF?	Output cal start frequency	N		
CSL	Clear service log	N		
CTF?	Output cal stop frequency	N		
CTN	Continue sweeping from current point	S	CTN	
CWC	Select CW frequency calibration data points	S	CWC	
CWF	Turn CW on and set frequency	S	CWF	
CWF?	Output CW frequency set	N		
CWON	Turn CW on at last frequency set	N		See CWF
CWON?	Output CW on/off status	N		
CWP	Enter number of points drawn in CW	S	CWP	
CWP?	Output number of points drawn in CW	N		
CXX?	Output calibration type	N		
CYN	Select cyan as third plane color	S	CYN	
D13	Select dual channel display, channels 1 & 3	S	D13	
D14	Select quad display, all four channels	S	D14	
D24	Select dual channel display, channels 2 & 4	S	D24	
DAT	Display data only on active channel	S	DAT	
DAT?	Output trace memory display mode	N		
DATCOL	Enter the color number for data	N		
DATCOL?	Data color number query	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
DB	Sets Power data type	N		Same as DBL
DBL	Same as DB	S	DBL	
DBM	Sets Power data type	S	DBM	
DBP	Select Distance Bandpass mode for active channel	S	DBP	
DC1	Display channel 1 and 2 operating parameters	S	DC1	
DC3	Display channel 3 and 4 operating parameters	S	DC3	
DCA	Select Automatic DC term calculation for lowpass	S	DCA	
DCO	Select Open for DC term for lowpass	S	DCO	
DCP	Same as DCP1	S	DCP	
DCP1	Display Calibration Parameters 1st page	N		Same as DCP
DCP2	Display Calibration Parameters 2nd page	N		
DCS	Select Short for DC term for lowpass	S	DCS	
DCV	Enter value for DC term for lowpass	S	DCV	
DCV?	Output lowpass DC term value	N		
DCX?	Output lowpass DC term selection	N		
DCZ	Select Line Impedance for DC term for lowpass	S	DCZ	
DD0	Turn Data drawing off	S	DD0	
DD1	Turn Data drawing on	S	DD1	
DD1?	Output Data Drawing on/off status	N		
DDX?	Output active channel domain parameter (frequency, distance, or time)	N		
DEC	Same as DELCAL	S	DEC	
DECH	Same as DELCALH	N		
DED	Same as DELDAT	S	DED	
DEDH	Same as DELDATH	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
DEG	Sets Phase data type	S	DEG	
DELALC	Delete ALC Cal file from floppy disk	N		
DELALCH	Delete ALC Cal file from hard disk	N		
DELALL	Delete Combined Hardware Cal file from floppy disk	N		
DELALLH	Delete Combined Hardware Cal file from hard disk	N		
DELCAL	Delete Calibration/Front Panel Setup from floppy disk	N		Same as DEC
DELCALH	Delete Calibration/Front Panel Setup from hard disk	N		
DELDAT	Delete Tabular Data file from floppy disk	N		Same as DED
DELDATH	Delete Tabular Data file from hard disk	N		
DELELG	Delete Error Log file from floppy disk	N		
DELELGH	Delete Error Log file from hard disk	N		
DELFRE	Delete Frequency Cal file from floppy disk	N		
DELFREH	Delete Frequency Cal file from hard disk	N		
DELLOG	Delete Service Log file from floppy disk	N		
DELLOGH	Delete Service Log file from hard disk	N		
DELNRM	Delete Trace Memory File from floppy disk	N		Same as DEN
DELNRMH	Delete Trace Memory File from hard disk	N		
DEN	Same as DELNRM	S	DEN	
DENH	Same as DELNRMH	N		
DF2	Display 2.4mm female connector information	S	DF2	
DF3	Display GPC-3.5 female connector information	S	DF3	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
DFC	Select discrete frequency calibration data points	S	DFC	
DFD	Done specifying discrete frequency ranges	S	DFD	
DFK	Display K female connector information	S	DFK	
DFN	Display N female connector information	S	DFN	
DFP	Display Front panel instrument state	S	DFP	
DFQ	Enter Single discrete frequency	S	DFQ	
DFS	Display SMA female connector information	S	DFS	
DFT	Display TNC female connector information	S	DFT	
DFV	Display V female connector information	S	DFV	
DG7	Display GPC-7 Male connector information	S	DG7	
DGS	Display GPIB status information	S	DGS	
DGT	Same as DGT1	N		
DGT1	Display 1st CRT test pattern	N		
DGT2	Display 2nd CRT test pattern	N		
DGT3	Display 3rd CRT test pattern	N		
DIA	Select Air as active dielectric	S	DIA	
DIE	Enter a dielectric value	S	DIE	
DIM	Select microporous teflon as active dielectric	S	DIM	
DIP	Select polyethylene as active dielectric	S	DIP	
DIS	Display active segmented limit	N		
DIS?	Output active segmented limit on/off status	N		
DIT	Select Teflon as active dielectric	S	DIT	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
DIV	Select Division as Trace Math for active channel	S	DIV	
DIX?	Output dielectric constant	N		
DLA	Select Group Delay display for active channel	S	DLA	
DLP	Select Distance lowpass mode for active channel	S	DLP	
DM2	Display 2.4mm male connector information	S	DM2	
DM3	Display GPC-3.5 male connector information	S	DM3	
DMK	Display K male connector information	S	DMK	
DMN	Display N male connector information	S	DMN	
DMS	Display SMA male connector information	S	DMS	
DMT	Display TNC male connector information	S	DMT	
DMV	Display V male connector information	S	DMV	
DNM	Display data normalized to Trace Memory on active channel	S	DNM	
DPI	Select Distance phasor impulse mode for active channel	S	DPI	
DPN	Enter pen number for data	S	DPN	
DPR0	Visible data only OFD format	N		
DPR1	Data pair always OFD format	N		
DR1	Select Marker 1 as Delta Reference Marker	S	DR1	
DR2	Select Marker 2 as Delta Reference Marker	S	DR2	
DR3	Select Marker 3 as Delta Reference Marker	S	DR3	
DR4	Select Marker 4 as Delta Reference Marker	S	DR4	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
DR5	Select Marker 5 as Delta Reference Marker	S	DR5	
DR6	Select Marker 6 as Delta Reference Marker	S	DR6	
DRF	Turn Delta reference mode On	S	DRF	
DRL	Diagnostic read latch	N		
DRO	Turn Delta reference mode Off	S	DRO	
DRO?	Output delta reference mode on/off status	N		
DRX?	Output the Delta reference marker	N		
DSF0	Disable automatic filter shape factor calculation	N		
DSF1	Enable automatic filter shape factor calculation	N		
DSFX?	Output automatic filter shape factor calculation enabledisable status			
DSP	Select single channel display	S	DSP	
DSP?	Output channel display mode	N		
DSQ0	Disable automatic filter Q calculation	N		
DSQ1	Enable automatic filter Q calculation	N		
DSQX?	Output automatic filter Q calculation enable/disable status	N		
DTM	Display Measurement data and Trace Memory on active channel	S	DTM	
DVM	Set DVM channel	N		
DWG	Display Waveguide parameters	S	DWG	
DWL	Diagnostic write latch	N		
ECW	Select CW operation for component being edited	S	ECW	
ED1	Edit Source 1 equation	S	ED1	
ED2	Edit Source 2 equation	S	ED2	
EDG	End diagnostics mode	N		
EDR	Edit receiver equation	S	EDR	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
EDV	Set divisor for equation being edited	S	EDV	
EDV?	Output divisor for equation being edited	N		
EKT	External keyboard test	N		
EML	Set multiplier for equation being edited	S	EML	
EML?	Output multiplier for equation being edited	N		
EOS	Set offset frequency for equation being edited	S	EOS	
EOS?	Output offset frequency for equation being edited	N		
ESW	Select sweep operation for component being edited	S	ESW	
EXD	Display external a/d input	N		
EXW?	Output multiple source sweep flag for equation being edited	N		
FFD	Form Feed to Printer/Stop print/plot	S	FFD	
FGT	Select frequency with time gate for active channel	S	FGT	
FHI	Same as NP1601	SM	FHI	1601 on 372XXA, up to 501 on 360B Not valid during discrete fill on 372XXA
FIL	Fill defined discrete frequency range	S	FIL	
FLC	Source frequency linearity internal calibration	N		
FLO	Same as NP101	SM	FLO	101 on 372XXA, up to 86 on 360B. Not valid during discrete fill on 372XXA
FLTBW?	Output filter bandwidth	N		
FLTC?	Output filter center frequency	N		
FLTL?	Output filter loss at reference value	N		
FLTQ?	Output filter Q	N		
FLTS?	Output filter shape factor	N		
FMA	Select ASCII data transfer format	S	FMA	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
FMB	Select IEEE754 64 bit data transfer format	S	FMB	
FMC	Select IEEE754 32 bit data transfer format	S	FMC	
FME	Same as NP401	SM	FME	401 on 372XXA, up to 168 on 360B. Not valid during discrete fill on 372XXA
FMKR	Select filter parameters marker mode	N		
FOF	Blank frequency information	S	FOF	
FON	Display frequency information	S	FON	
FOX?	Output frequency information on/off status	N		
FP0	Turn flat power correction off	S	FP0	
FP1	Turn flat power correction on	S	FP1	
FPT	Front panel keypad test	N		
FPX?	Output flat power correction on/off status	N		
FQD	Select Frequency Domain for active channel	S	FQD	
FRC	Clear all defined discrete frequency ranges	S	FRC	
FRI	Set discrete frequency fill range increment frequency	S	FRI	
FRP	Set discrete frequency fill range number of points	S	FRP	
FRS	Set discrete frequency fill range start frequency	S	FRS	
GCT	Enter gate center value time or distance	S	GCT	
GCT?	Output gate center value	N		
GDS	Gate symbols displayed on active channel	S	GDS	
GHZ	Sets Frequency data type and scales by 1E9	S	GHZ	
GLS	Select low sidelobe gate shape	S	GLS	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
GMS	Select minimum sidelobe gate shape	S	GMS	
GNM	Select nominal gate shape	S	GNM	
GOF	Turn Off Gating on active channel	S	GOF	
GOF?	Output gating mode on active channel	N		
GON	Turn On Gating on active channel	S	GON	
GPN	Enter pen number for graticule	S	GPN	
GRF?	Output graph type for active channel	N		
GRT	Select Rectangular gate shape	S	GRT	
GRTCOL	Enter the color number for the graticule	N		
GRTCOL?	Graticule color number query	N		
GSN	Enter gate span value time or distance	S	GSN	
GSN?	Output gate span value	N		
GSP	Enter gate stop value time or distance	S	GSP	
GSP?	Output gate stop value	N		
GST	Enter gate start value time or distance	S	GST	
GST?	Output gate start value	N		
GSX?	Output gate shape	N		
HC0	Disable Internal IF calibration	S	HC0	
HC1	Enable Internal IF calibration and trigger an IF calibration	S	HC1	
HCT	Trigger an IF calibration	N		See HC1
HCX?	Output Internal IF calibration enabled/disabled	N		
HD0	Turn off tabular data headers and page formatting	S	HD0	
HD1	Turn on tabular data headers and page formatting	S	HD1	
HID	Hide active segmented limit	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
HLD	Instrument Hold	S	HLD	
HLD?	Hold mode query	N		
HPN	Enter pen number for header	S	HPN	
HZ	Sets Frequency data type	N		
IC1	Input Calibration Coefficient 1	SM	IC1	Data header is different and the header is also used in FMA mode on 372XXA
IC10	Input Calibration Coefficient 10	N		Same as ICA
IC11	Input Calibration Coefficient 11	N		Same as ICB
IC12	Input Calibration Coefficient 12	N		Same as ICC
IC2	Input Calibration Coefficient 2	SM	IC2	Data header is different and the header is also used in FMA mode on 372XXA
IC3	Input Calibration Coefficient 3	SM	IC3	Data header is different and the header is also used in FMA mode on 372XXA
IC4	Input Calibration Coefficient 4	SM	IC4	372XXA: Data header is different and the header is also used in FMA mode. Inputs ETF term (vs. EXF on 360B) in 12-T and 1-Path 2-Port-FWD calibrations.
IC5	Input Calibration Coefficient 5	SM	IC5	372XXA: Data header is different and the header is also used in FMA mode. Inputs EXF term (vs. ETF on 360B) in 1-Path 2-Port-FWD calibration.
IC6	Input Calibration Coefficient 6	SM	IC6	372XXA: Data header is different and the header is also used in FMA mode. Inputs EXF term (vs. ETF on 360B) in 12-T calibration.
IC7	Input Calibration Coefficient 7	SM	IC7	Data header is different and the header is also used in FMA mode on 372XXA
IC8	Input Calibration Coefficient 8	SM	IC8	Data header is different and the header is also used in FMA mode on 372XXA

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
IC9	Input Calibration Coefficient 9	SM	IC9	Data header is different and the header is also used in FMA mode on 372XXA
ICA	Same as IC10	SM	ICA	372XXA: Data header is different and the header is also used in FMA mode. Inputs ETR term (vs. EXR on 360B) in 12-T calibration.
ICB	Same as IC11	SM	ICB	Data header is different and the header is also used in FMA mode on 372XXA
ICC	Same as IC12	SM	ICC	372XXA: Data header is different and the header is also used in FMA mode. Inputs EXR term (vs. ETR on 360B) in 12-T calibration.
ICD	Input corrected data for active channel parameter	SM	ICD	Data header is different and the header is also used in FMA mode on 372XXA
ICF	Input Front Panel Setup and Calibration data	SM	ICF	Data header is different on 372XXA
ICL	Input all applicable calibration coefficients for cal type	SM	ICL	Data header is different on 372XXA
IEM	Input extended status byte mask	SM	IEM	Inputs an ASCII integer and Extended Byte is redefined on 372XXA
IF1	Select 10 HZ IF bandwidth	N		Same as: IFM on 372XXA
IF2	Select 100 HZ IF bandwidth	N		Same as: IFR on 372XXA, IFM on 360B
IF3	Select 1 KHZ IF bandwidth	N		Same as: IFN on 372XXA, IFR on 360B
IF4	Select 10 KHZ IF bandwidth	N		Same as: IFA on 372XXA, IFN on 360B
IFA	Same as IF4	N		
IFB	Test 1st IF band pass	N		
IFD	Input final data for active channel parameter	SM	IFD	372XXA: Data header is different and the header is also used in FMA mode. Inputs single values in single graph displays

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
IFM	Same as IF1	SM	IFM	Sets 10 HZ on 372XXA, 100 HZ on 360B
IFN	Same as IF3	SM	IFN	Sets 1 KHZ IFBW on 372XXA, 10 KHZ on 360B
IFP	Input current front panel setup	SM	IFP	Data header is different on 372XXA
IFR	Same as IF2	SM	IFR	Sets 100 HZ IFBW on 372XXA, 1 KHZ on 360B
IFV	Input frequency values	SM	IFV	Data header is different on 372XXA
IFX?	IF bandwidth query	N		
ILM	Input limits status byte mask	N		
IMG	Select Imaginary display for active channel	S	IMG	
IMU	Sets Imaginary data type	S	IMU	
INT	Initialize (format) floppy disk	S	INT	
IPM	Same as *SRE	SM	IPM	Inputs an ASCII integer and Primary Byte is redefined on 372XXA
IS1	Input front panel setup 1	SM	IS1	Data header is different on 372XXA
IS10	Input front panel setup 10	N		
IS2	Input front panel setup 2	SM	IS2	Data header is different on 372XXA
IS3	Input front panel setup 3	SM	IS3	Data header is different on 372XXA
IS4	Input front panel setup 4	SM	IS4	Data header is different on 372XXA
IS5	Input front panel setup 5	N		
IS6	Input front panel setup 6	N		
IS7	Input front panel setup 7	N		
IS8	Input front panel setup 8	N		
IS9	Input front panel setup 9	N		
ISC	Select inverted compressed Smith Chart for active channel	S	ISC	
ISE	Select inverted expanded Smith chart for active channel	S	ISE	
ISF	Exclude isolation	S	ISF	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
ISM	Select normal inverted Smith chart for active channnel	S	ISM	
ISN	Include isolation	S	ISN	
KEC	Keep existing calibration data	S	KEC	
KHZ	Sets Frequency data type and scales by 1E3	S	KHZ	
LAND	Select landscape mode for output plot	N		
LAX?	Output lock direction	N		
LAYCOL	Enter the color number for overlay data	N		
LAYCOL?	Overlay data color number query	N		
LB0	Turn limits testing beep on failure off	N		
LB1	Turn limits testing beep on failure on	N		
LBX?	Output limits testing beeper enable status	N		
LCM	Select LRL calibration method	S	LCM	
LDT	Enter label string for date/time	SM	LDT	Up to 15 characters on 372XXA
LDT?	Output label string for date/time	N		
LFD	Enter limit frequency readout delta value	S	LFD	
LFD?	Output limit frequency readout delta value	N		
LFP	Select limit frequency read-out for phase displays	S	LFP	
LFR	Select limit frequency readout for active channel	S	LFR	
LID	Enter label string for device ID	SM	LID	Up to 15 characters on 372XXA
LID?	Output label string for device ID	N		
LIN	Select Linear magnitude display for active channel	S	LIN	
LKS0	Disable lock search mode	N		
LKS1	Enable lock search mode	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
LKT	Load calibration kit information from floppy disk	S	LKT	
LL1	Enter length of line 1 for LRL calibration	S	LL1	
LL2	Enter length of line 2 for LRL calibration	S	LL2	
LL3	Enter length of line 3 for LRL calibration	S	LL3	
LLM?	Output limit line display mode, single or segmented	N		
LLO	Turn on lower limit and set to value	S	LLO	
LLO?	Output lower limit value for active channel	N		
LLZ	Enter line impedance for LRL calibration	S	LLZ	
LM2	Select a match for the second device during a LRM type calibration	S	LM2	
LM3	Select a match for the third device during a LRM type calibration	S	LM3	
LMS	Enter label string for model/serial number	SM	LMS	Up to 15 characters on 372XXA
LMS?	Output label string for model/serial number	N		
LNM	Enter label string for operator's name	SM	LNM	Up to 15 characters on 372XXA
LNM?	Output label string for operator's name	N		
LO11	LO1 phase lock voltage test	N		
LO12	LO1 d/a voltage test	N		
LO21	LO2 main phase lock voltage test	N		
LO22	LO2 offset phase lock voltage test	N		
LO23	LO2 dds phase lock voltage test	N		
LO24	LO2 main d/a voltage test	N		
LO25	LO2 offset d/a voltage test	N		
LOC	Enter label string for operator's comment	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
LOC?	Output label string for operator's comment	N		
LOF	Limits display Off	S	LOF	
LOL0	Turn lower limit off	N		
LOL1	Turn lower limit on at current value	N		
LOLX?	Output lower limit on/off status	N		
LON	Limits Display On	S	LON	
LON?	Output Limits Display on/off status	N		
LPF?	Output limit test failure status all channels	N		
LPF1?	Output limit test failure status on channel 1	N		
LPF2?	Output limit test failure status on channel 2	N		
LPF3?	Output limit test failure status on channel 3	N		
LPF4?	Output limit test failure status on channel 4	N		
LPH	Select linear magnitude and phase display for actiive channel	S	LPH	
LPI	Select lowpass impulse response for active channel	S	LPI	
LPS	Select lowpass step response for active channel	S	LPS	
LPSX?	Output lowpass response (impulse or step) for active channel	N		
LR2	Specify 2 line LRL calibration	S	LR2	
LR3	Specify 3 line LRL calibration	S	LR3	
LS1	Set lower segmented limit 1 as the active segment	N		
LS10	Set lower segmented limit 10 as the active segment	N		
LS2	Set lower segmented limit 2 as the active segment	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
LS3	Set lower segmented limit 3 as the active segment	N		
LS4	Set lower segmented limit 4 as the active segment	N		
LS5	Set lower segmented limit 5 as the active segment	N		
LS6	Set lower segmented limit 6 as the active segment	N		
LS7	Set lower segmented limit 7 as the active segment	N		
LS8	Set lower segmented limit 8 as the active segment	N		
LS9	Set lower segmented limit 9 as the active segment	N		
LSB	Select least significant byte first binary transfer	SM	LSB	Default binary mode for 360B, MSB is default for 372XXA
LSEG	Select segmented limit line display mode	N		
LSNG	Select single limit line display mode	N		
LSX?	Output active segmented limit	N		
LT0	Turn limits testing off	N		
LT1	Turn limits testing on	N		
LT1?	Output limits testing enable status	N		
LTC	Select coaxial transmission line for calibration	S	LTC	
LTST	Display the limits testing menu	N		
LTU	Select microstrip transmission line for calibration	S	LTU	
LTW	Select waveguide transmission line for calibration	S	LTW	
LTX?	Output line type	N		
LUP	Turn on upper limit and set to value	S	LUP	
LUP?	Output upper limit value for active channel	N		
LVH	Set limits testing ttl level high	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
LVL	Set limits testing ttl level low	N		
LVX?	Output limits testing ttl level status	N		
M	Sets Distance data type	N		Same as MTR
M1C	Marker 1 CW frequency	S	M1C	
M1E	Marker 1 sweep/zoom end frequency, time, or distance	S	M1E	
M1S	Marker 1 sweep/zoom start frequency, time, or distance	S	M1S	
M2C	Marker 2 CW frequency	S	M2C	
M2E	Marker 2 sweep/zoom end frequency, time, or distance	S	M2E	
M2S	Marker 2 sweep/zoom start frequency, time, or distance	S	M2S	
M3C	Marker 3 CW frequency	S	M3C	
M3E	Marker 3 sweep/zoom end frequency, time, or distance	S	M3E	
M3S	Marker 3 sweep/zoom start frequency, time, or distance	S	M3S	
M4C	Marker 4 CW frequency	S	M4C	
M4E	Marker 4 sweep/zoom end frequency, time, or distance	S	M4E	
M4S	Marker 4 sweep/zoom start frequency, time, or distance	S	M4S	
M5C	Marker 5 CW frequency	S	M5C	
M5E	Marker 5 sweep/zoom end frequency, time, or distanance	S	M5E	
M5S	Marker 5 sweep/zoom start frequency, time, or distance	S	M5S	
M6C	Marker 6 CW frequency	S	M6C	
M6E	Marker 6 sweep/zoom end frequency, time, or distance	S	M6E	
M6S	Marker 6 sweep/zoom start frequency, time, or distance	S	M6S	
MAG	Select log magnitude display for active channel	S	MAG	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
MAT	Select matched reflective devices during cal	S	MAT	
MEM	Display Trace Memory on active channel	S	MEM	
MHZ	Sets Frequency data type and scales by 1E6	S	MHZ	
MIN	Select Subtraction as Trace Math for active channel	S	MIN	
MIX	Select mixed reflective devices during calibration	S	MIX	
MK1	Turn on Marker 1 and set to frequency, time or distance	S	MK1	
MK1?	Output Marker 1 frequency, time or distance	N		
MK2	Turn on Marker 2 and set to frequency, time or distance	S	MK2	
MK2?	Output Marker 2 frequency, time or distance	N		
MK3	Turn on Marker 3 and set to frequency, time or distance	S	MK3	
MK3?	Output Marker 3 frequency, time or distance	N		
MK4	Turn on Marker 4 and set to frequency, time or distance	S	MK4	
MK4?	Output Marker 4 frequency, time or distance	N		
MK5	Turn on Marker 5 and set to frequency, time or distance	S	MK5	
MK5?	Output Marker 5 frequency, time or distance	N		
MK6	Turn on Marker 6 and set to frequency, time or distance	S	MK6	
MK6?	Output Marker 6 frequency, time or distance	N		
MKRC	Select interpolated marker functionality	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
MKRCOL	Enter the color number for the markers, time or distance	N		
MKRCOL?	Markers color number query	N		
MKRD	Select discrete marker functionality	N		
MKRX?	Output interpolated/discrete marker functionality	N		
MKSL	Marker search left	N		
MKSR	Marker search right	N		
MKT0	Turn marker tracking off	N		
MKT1	Turn marker tracking on	N		
MKTX?	Output marker tracking on/off status	N		
MM	Sets Distance data type and scales by 1E-3	N		
MMN	Set active Marker to minimum trace value	S	MMN	
MMT	Same as MM	S	MMT	
MMX	Set active marker to maximum trace value	S	MMX	
MNUCOL	Enter the color number for the menu headers	N		
MNUCOL?	Menu header color number query	N		
MO1	Turn Off marker 1	S	MO1	
MO2	Turn Off marker 2	S	MO2	
MO3	Turn Off marker 3	S	MO3	
MO4	Turn Off marker 4	S	MO4	
MO5	Turn Off marker 5	S	MO5	
MO6	Turn Off marker 6	S	MO6	
MOF	Turn Marker display Off	S	MOF	
MON	Turn Marker display On	S	MON	
MON?	Output marker display on/off status	N		
MPH	Select log magnitude and phase display for active channel	S	MPH	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
MPN	Enter pen number for markers and limits	S	MPN	
MR1	Select Readout marker 1	S	MR1	
MR1?	Output marker 1 on/off status	N		
MR2	Select Readout marker 2	S	MR2	
MR2?	Output marker 2 on/off status	N		
MR3	Select Readout marker 3	S	MR3	
MR2?	Output marker 2 on/off status	N		
MR4	Select Readout marker 4	S	MR4	
MR4?	Output marker 4 on/off status	N		
MR5	Select Readout marker 5	S	MR5	
MR5?	Output marker 5 on/off status	N		
MR6	Select Readout marker 6	S	MR6	
MR6?	Output marker 6 on/off status	N		
MRR	Restore original Marker range	S	MRR	
MRX?	Output active marker number	N		
MS	Sets Time data type and scales by 1E-3	N		
MS0	Turn Multiple Source mode Off	S	MS0	
MS1	Turn Multiple Source mode On	S	MS1	
MSB	Select most significant byte first binary transfer	SM	MSB	Default binary mode for 372XXA, LSB is default for 360B
MSD	Select multiple Source define mode	S	MSD	
MSFH	Enter high loss value for shape factor calculation	N		
MSFH?	Output high loss value for shape factor calculation	N		
MSFL	Enter low loss value for shape factor calculation	N		
MSFL?	Output low loss value for shape factor calculation	N		
MSR0	Select 0 as ref for marker search and bandwidth calculation	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
MSRD	Select delta ref marker as ref for marker search and bandwidth calculation	N		
MSRM	Select max as ref for marker search and bandwidth calculation	N		
MSRX?	Output ref selection for marker search and bandwidth calculation	N		
MSX?	Output multiple source mode on/off/define	N		
MTH?	Output trace math math type	N		
MTR	Same as M	S	MTR	
MUL	Select Multiplication as trace Math for active channel	S	MUL	
MV	Sets Voltage data type and scales by 1E-3	N		
NCS	Go to next calibration step	S	NCS	
NOC	Select Normal Calibration data points	S	NOC	
NMKR	Select normal markers on active channel marker mode	N		
NP101	Set data points to 101	N		
NP1601	Set data points to 1601	N		
NP201	Set data points to 201	N		
NP401	Set data points to 401	N		
NP51	Set data points to 51	N		
NP801	Set data points to 801	N		
NRD	Display non-ratioed parameters on 4 channels	N		Diagnostics Mode use only on 372XXA. Do not use for measurements.
NS	Sets Time data type and scales by 1E-9	N		
NSC	Same as NS	S	NSC	
OAM1	Output channel 1 active marker value	N		
OAM2	Output channel 2 active marker value	N		
OAM3	Output channel 3 active marker value	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
OAM4	Output channel 4 active marker value	N		
OC1	Output Calibration Coefficient 1	SM	OC1	Data header is different and the header is also used in FMA mode on 372XXA
OC10	Output Calibration Coefficient 10	N		Same as OCA
OC11	Output Calibration Coefficient 11	N		Same as OCB
OC12	Output Calibration Coefficient 12	N		Same as OCC
OC2	Output Calibration Coefficient 2	SM	OC2	Data header is different and the header is also used in FMA mode on 372XXA
OC3	Output Calibration Coefficient 3	SM	OC3	Data header is different and the header is also used in FMA mode on 372XXA
OC4	Output Calibration Coefficient 4	SM	OC4	372XXA: Data header is different and the header is also used in FMA mode. Outputs ETF term (vs. EXF on 360B) in 12-T and 1-Path 2-Port-FWD calibrations.
OC5	Output Calibration Coefficient 5	SM	OC5	372XXA: Data header is different and the header is also used in FMA mode. Outputs EXF term (vs. ETF on 360B) in 1-Path 2-Port-FWD calibration.
OC6	Output Calibration Coefficient 6	SM	OC6	372XXA: Data header is different and the header is also used in FMA mode. Outputs EXF term (vs. ETF on 360B) in 12-T calibration.
OC7	Output Calibration Coefficient 7	SM	OC7	Data header is different and the header is also used in FMA mode on 372XXA
OC8	Output Calibration Coefficient 8	SM	OC8	Data header is different and the header is also used in FMA mode on 372XXA
OC9	Output Calibration Coefficient 9	SM	OC9	Data header is different and the header is also used in FMA mode on 372XXA

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
OCA	Same as OC10	SM	OCA	372XXA: Data header is different and the header is also used in FMA mode. Outputs ETR term (vs. EXR on 360B) in 12-T calibration.
OCB	Same as OC11	SM	OCB	Data header is different and the header is also used in FMA mode on 372XXA
OCC	Same as OC12	SM	OCC	372XXA: Data header is different and the header is also used in FMA mode. Outputs EXR term (vs. ETR on 360B) in 12-T calibration.
OCD	Output corrected data for active channel parameter	SM	OCD	Data header is different and the header is also used in FMA mode on 372XXA
OCF	Output Front Panel Setup and Calibration data	SM	OCF	Data header is different on 372XXA
OCL	Output all applicable calibration coefficients for cal type	SM	OCL	Data header is different on 372XXA
OCM	Select Offset short calibration method	S	OCM	
ODR	Output directory listing of the floppy drive	SM	ODR	Outputs an ASCII list on 372XXA and directory information is redefined
ODRH	Output directory listing of the hard drive	N		
ODV	Output distance values for time domain	SM	ODV	Data header is different and the header is also used in FMA mode on 372XXA
OEB	Output extended status byte	SM	OEB	Outputs an ASCII integer on 372XXA and Extended Byte is redefined
OEL	Output error log	N		See 360B TST
OEM	Output extended status byte mask	N		
OFD	Output final data for active channel parameter	SM	OFD	372XXA:Data header is different and the header is also used in FMA mode. Outputs single values in single graph displays
OFF	Set offset level on active channel display	S	OFF	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
OFF?	Output offset level on active channel display	N		
OFP	Output current Front Panel Setup	SM	OFP	Data header is different on 372XXA
OFV	Output Frequency values	SM	OFV	Data header is different and the header is also used in FMA mode on 372XXA
OGE	Output extended description of current gpib error	N		
OGL	Output extended description of previous gpib error	N		
OHM	Sets Impedance data type	N		
OID	Output instrument identification string	SM	OID	Comma separated fields on 372XXA
OLB	Output limits status byte	N		
OLM	Output limits status byte mask	N		
OM1	Output Marker 1 value	SM	OM1	Outputs single value in single graph displays
OM2	Output Marker 2 value	SM	OM2	Outputs single value in single graph displays
OM3	Output Marker 3 value	SM	OM3	Outputs single value in single graph displays
OM4	Output Marker 4 value	SM	OM4	Outputs single value in single graph displays
OM5	Output Marker 5 value	SM	OM5	Outputs single value in single graph displays
OM6	Output Marker 6 value	SM	OM6	Outputs single value in single graph displays
ONCT	Output number of cal terms for current cal	N		
ONE	Output number of lines in the error log	N		
ONP	Output Number of points currently being measured	S	ONP	
OPB	Same as *STB?	SM	OPB	Outputs an ASCII integer on 372XXA and Primary Byte is redefined

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
ORD	Output Raw data for active channel parameter	SM	ORD	Data header is different and the header is also used in FMA mode on 372XXA
OS1	Output front panel Setup number 1	SM	OS1	Data header is different on 372XXA
OS10	Output front panel Setup number 10	N		
OS2	Output front panel Setup number 2	SM	OS2	Data header is different on 372XXA
OS3	Output front panel Setup number 3	SM	OS3	Data header is different on 372XXA
OS4	Output front panel Setup number 4	SM	OS4	Data header is different on 372XXA
OS5	Output front panel Setup number 5	N		
OS6	Output front panel Setup number 6	N		
OS7	Output front panel Setup number 7	N		
OS8	Output front panel Setup number 8	N		
OS9	Output front panel Setup number 9	N		
OSL	Output service log	N		
OTV	Output time values for time domain	SM	OTV	Data header is different and the header is also used in FMA mode on 372XXA
P1C	Select Port 1 for connector specification	S	P1C	
P1C?	Output port 1 connector type	N		
P1P?	Output approximate power level at port 1	N		
P2C	Select Port 2 for connector specification	S	P2C	
P2C?	Output port 2 connector type	N		
PBL	Select 1/4 size plot, bottom left corner	S	PBL	
PBR	Select 1/4 size plot, bottom right corner	S	PBR	
PCP	Select measurement phase polar chart mode	S	PCP	
PCS	Select sweep position polar chart mode	S	PCS	
PCX?	Output Polar chart mode	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
PDR	Print directory listing of the floppy drive	N		
PDRH	Print directory listing of the hard drive	N		
PEL	Print the error log	N		
PFL	Select Full-size plot	S	PFL	
PFS	Print Full screen image	S	PFS	
PGR	Print graph area screen image	S	PGR	
PGT	Plot graticule	S	PGT	
PHA	Select phase display for active channel	S	PHA	
PHO	Set Phase Offset for display channel	S	PHO	
PHO?	Output phase Offset for display channel	N		
PLD	Plot data area only	S	PLD	
PLG	Select log polar display for active channel	S	PLG	
PLH	Plot header	S	PLH	
PLM	Plot Markers and Limits	S	PLM	
PLO?	Output plot mode, portrait or landscape	N		
PLR	Select linear polar display for active channel	S	PLR	
PLS	Plot entire screen	S	PLS	
PLT	Plot data traces only	S	PLT	
PMK	Print tabular data for Markers	S	PMK	
PMN	Plot Menu	S	PMN	
PMT	Print Tabular data for Traces and Markers	S	PMT	
PORT	Select portrait mode for output plot	N		
PRT?	Printer peripheral test and query	N		
PS	Sets Time data type and scales by 1E-12	N		Same as PSC
PSC	Same as PS	S	PSC	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
PSL	Print the service log	N		
PSP	Number of power sweeps for flat power correction	S	PSP	
PSP?	Output number of power sweeps for flat power correction	N		
PST	Stop Print/Plot	S	PST	
PT0	Set Tabular Printout points skipped to 0	S	PT0	
PT1	Set Tabular Printout points skipped to 1	S	PT1	
PT2	Set Tabular Printout points skipped to 2	S	PT2	
PT3	Set Tabular Printout points skipped to 3	S	PT3	
PT4	Set Tabular Printout points skipped to 4	S	PT4	
PT5	Set Tabular Printout points skipped to 5	S	PT5	
PT6	Set Tabular Printout points skipped to 6	S	PT6	
PT7	Set Tabular Printout points skipped to 7	S	PT7	
PT8	Set Tabular Printout points skipped to 8	S	PT8	
PT9	Set Tabular Printout points skipped to 9	S	PT9	
PTB	Print tabular data for Traces	S	PTB	
PTL	Select 1/4 size plot, top left corner	S	PTL	
PTR	Select 1/4 size plot, top right corner	S	PTR	
PTS	Number of points to be skipped during flat power correction	S	PTS	
PTS?	Output number of points to be skipped during flat power correction	N		
PW2	Set external source power level	S	PW2	
PW2?	Output external source power level	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
PWR	Set internal source power level	S	PWR	
PWR?	Output internal source power level	N		
RAD	Sets Phase data type and scales by 180/pi	N		
RC1	Recall Front Panel Setup number 1 from memory	S	RC1	
RC10	Recall Front Panel Setup number 10 from memory	N		
RC2	Recall Front Panel Setup number 2 from memory	S	RC2	
RC3	Recall Front Panel Setup number 3 from memory	S	RC3	
RC4	Recall Front Panel Setup number 4 from memory	S	RC4	
RC5	Recall Front Panel Setup number 5 from memory	N		
RC6	Recall Front Panel Setup number 6 from memory	N		
RC7	Recall Front Panel Setup number 7 from memory	N		
RC8	Recall Front Panel Setup number 8 from memory	N		
RC9	Recall Front Panel Setup number 9 from memory	N		
RCK	Same as RCLNRM	S	RCK	
RCKH	Same as RCLNRMH	N		
RCLALC	Recall ALC Cal file from floppy disk	N		
RCLALCH	Recall ALC Cal file from hard disk	N		
RCLALL	Recall Combined Hardware Cal file from floppy diskN			
RCLALLH	Recall Combined Hardware Cal file from hard disk	N		
RCLCAL	Recall Calibration/Front Panel Setup from floppy disk	N		Same as RLD

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
RCLCALH	Recall Calibration/Front Panel Setup from hard disK	N		
RCLDAT	Recall Tabular data file from floppy disk to print	N		Same as RTB
RCLDATH	Recall Tabular data file from hard disk to printer	N		
RCLELG	Recall Error Log file from floppy disk to printer	N		
RCLELGH	Recall Error Log file from hard disk to printer	N		
RCLFRE	Recall Frequency Cal file from floppy disk	N		
RCLFREH	Recall Frequency Cal file from hard disk	N		
RCLLOG	Recall Service Log file from floppy disk to printer	N		
RCLLOGH	Recall Service Log file from hard disk to printer	N		
RCLNRM	Recall Trace Memory File from floppy disk	N		Same as RCK
RCLNRMH	Recall Trace Memory File from hard disk	N		
RDA	Select Automatic Reference delay calculation	S	RDA	
RDD	Set reference delay in distance for active channel	S	RDD	
RDD?	Output reference delay in distance for active channnel	N		
RDT	Set reference delay in time for active channel	S	RDT	
RDT?	Output reference delay in time for active channel	N		
REF	Set reference line for display on active channel	S	REF	
REF?	Output reference line for display on active channel	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
REL	Select real display for active channel	S	REL	
REU	Sets Real data type	S	REU	
RGZ	Select reflective device greater than Z0	S	RGZ	
RH0	Set RF Off while in Hold	S	RH0	
RH1	Set RF On while in Hold	S	RH1	
RHX?	Output RF on/off during Hold status	N		
RIM	Select Real and Imaginary display for active channel	S	RIM	
RLD	Same as RCLCAL	S	RLD	
RLDH	Same as RCLCALH	N		
RLZ	Select Reflective device less than Z0	S	RLZ	
RM1	Select reference plane at line 1 midpoint	S	RM1	
ROL	Enter reflective device offset length	S	ROL	
RPC	Repeat previous calibration	S	RPC	
RPO	Set rear panel dc voltage value	S	RPO	
RPO?	Output rear panel dc voltage to gpib	N		
RRP	Select reference plane at reflection plane	S	RRP	
RST	Same as *RST	S	RST	
RST0	Reset instrument plus front panel memories and reserved parameters	N		
RST1	Reset instrument plus front panel memories	N		
RTB	Same as RCLDAT	S	RTB	
RTBH	Same as RCLDATH	N		
RTL	Return to Local	S	RTL	
RV0	Turn Rear panel output voltage Off	S	RV0	
RV1	Turn Rear panel output voltage On	S	RV1	
RV1?	Output Rear panel output voltage on/off status	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
RVD	Set Rear panel output mode to dc value	N		
RVH	Set Rear panel output mode to horizontal	S	RVH	
RVL	Set Rear panel output mode to lock direction	S	RVL	
RVV	Set Rear panel output mode to vertical	S	RVV	
RVX?	Output rear panel output mode	N		
S	Sets Time data type	N		
S11	Measure S11 on active channel	S	S11	
S12	Measure S12 on active channel	S	S12	
S21	Measure S21 on active channel	S	S21	
S22	Measure S22 on active channel	S	S22	
SA1	Enter Port 1 source attenuator setting	S	SA1	
SA1?	Output Port 1 source attenuator setting	N		
SAVALC	Save ALC Cal to floppy disk	N		
SAVALCH	Save ALC Cal to hard disk	N		
SAVALL	Save Combined Hardware Cal to floppy disk	N		
SAVALLH	Save Combined Hardware Cal to hard disk	N		
SAVCAL	Save Calibration/Front Panel Setup to floppy disk	N		Same as STO
SAVCALH	Save Calibration/Front Panel Setup to hard disk	N		
SAVDAT	Save Tabular Data to floppy disk	N		Same as TDD
SAVDATH	Save Tabular Data to hard disk	N		
SAVELG	Save Error Log to floppy disk	N		
SAVELGH	Save Error Log to hard disk	N		
SAVFRE	Save Frequency Cal to floppy disk	N		
SAVFREH	Save Frequency Cal to hard disk	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
SAVLOG	Save Service Log to floppy disk	N		
SAVLOGH	Save Service Log to hard disk	N		
SAVNRM	Save Trace Memory to floppy disk	N		Same as SDK
SAVNRMH	Save Trace Memory to hard disk	N		
SBD	Enter substrate dielectric for microstrip calibration	S	SBD	
SBT	Enter substrate thickness for microstrip calibration	S	SBT	
SCL	Set Scale Resolution on active channel	SM	SCL	Can also be used to scale Smith/Inverted Smith on 372XXA
SCL?	Output Scale Resolution on active channel	N		
SCM	Select standard calibration method	S	SCM	
SDG	Start diagnostics mode	N		
SDK	Same as SAVNRM	S	SDK	
SDKH	Same as SAVNRMH	N		
SDR	Select standard receiver mode	SM	SDR	Diagnostic Mode use only on 372XXA. Do not use for measurements
SETUP	Display setup menu	N		
SFC	Start flat test port calibration	S	SFC	
SH1	Set offset short 1 offset length	SM	SH1	Use WSH1 for Waveguide calibration on 372XXA.
SH2	Set offset short 2 offset length	SM	SH2	Use WSH2 for Waveguide calibration on 372XXA.
SL1	Select Source lock mode with GPIB source control OSM		SL1	Diagnostic Mode use only on 372XXA. Do not use for measurements
SLC	Clear all segmented limits definitions	N		
SLD	Select sliding load for calibration	S	SLD	
SLH	Set segmented limits horizontal offset	N		
SLH?	Output segmented limits horizontal offset	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
SLL0	Turn lower segmented limits display off	N		
SLL1	Turn lower segmented limits display on	N		
SLLX?	Output lower segmented limits display on/off status	N		
SLU0	Turn upper segmented limits display off	N		
SLU1	Turn upper segmented limits display on	N		
SLUX?	Output upper segmented limits display on/off status	N		
SLV	Set segmented limits vertical offset	N		
SLV?	Output segmented limits vertical offset	N		
SMC	Select compressed Smith chart for active channel	S	SMC	
SME	Select expanded Smith chart for active channel	S	SME	
SMI	Select normal smith chart for active channel	S	SMI	
SMKR	Select marker search marker mode	N		
SOF	Turn Off smoothing	S	SOF	
SOF?	Output smoothing on/off status	N		
SON	Turn On smoothing and set to value	S	SON	
SON?	Output smoothing value	N		
SPAN	Enter frequency span	N		
SPAN?	Output frequency span	N		
SPD	Enter pen speed percentage	S	SPD	
SPH	Set active segmented limit horizontal stop position	N		
SPH?	Output active segmented limit horizontal stop posiion	N		
SPV	Set active segmented limit vertical stop position	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
SPV?	Output active segmented limit vertical stop position	N		
SRC1	Source linearity voltage test	N		
SRC2	Source power voltage test	N		
SRCH	Enter marker search value			
SRCH?	Output marker search value			
SRT	Start Frequency	S	SRT	
SRT?	Output Start Frequency	N		
ST1	Select set on mode with GPIB source control on	SM	ST1	Diagnostic Mode use only on 372XXA. Do not use for measurements
STD	Store trace to memory on active channel	S	STD	
STH	Set active segmented limit horizontal start position	N		
STH?	Output active segmented limit horizontal start position	N		
STO	Same as SAVCAL	S	STO	
STOH	Same as SAVCALH	N		
STP	Stop Frequency	S	STP	
STP?	Output Stop Frequency	N		
STV	Set active segmented limit vertical start position	N		
STV?	Output active segmented limit vertical start position	N		
SV1	Save front panel setup number 1 to memory	S	SV1	
SV10	Save front panel setup number 10 to memory	N		
SV2	Save front panel setup number 2 to memory	S	SV2	
SV3	Save front panel setup number 3 to memory	S	SV3	
SV4	Save front panel setup number 4 to memory	S	SV4	

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
SV5	Save front panel setup number 5 to memory	N		
SV6	Save front panel setup number 6 to memory	N		
SV7	Save front panel setup number 7 to memory	N		
SV8	Save front panel setup number 8 to memory	N		
SV9	Save front panel setup number 9 to memory	N		
SVB	Save current band definitions	S	SVB	
SWP	Return to normal sweep mode	S	SWP	
SWP?	Output Sweep Mode	N		
SWR	Select SWR display for active channel	S	SWR	
SXX?	Output S-parameter displayed on active channel	N		
T13	Select overlaid channel 1 and 3 display	S	T13	
T24	Select overlaid channel 2 and 4 display	S	T24	
TA2	Enter Port 2 test attenuator setting	S	TA2	
TA2?	Output Port 2 test attenuator setting	N		
TBP	Select time bandpass mode for active channel	S	TBP	
TC1	Take calibration data for port 1	S	TC1	
TC2	Take calibration data for port 2	S	TC2	
TCD	Take calibration data on one or both ports as necessary	S	TCD	
TDC	Select time domain harmonic frequency cal data points	S	TDC	
TDD	Same as SAVDAT	S	TDD	
TDDH	Same as SAVDATH	N		
TDDIST	Set time domain parameter to distance for active channel	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
TDDIST?	Output active channel time domain parameter (time or distance)	N		
TDL	Through DC coefficient for loss	S	TDL	
TDPI0	Turn phasor impulse response off for active channel	N		
TDPI1	Turn phasor impulse response on for active channelN	N		
TDPIX?	Output phasor impulse on/off status for active channel	N		
TDTIME	Set time domain parameter to time for active channel	N		
TDX?	Output domain mode for active channel	N		
TEX	Select external measurement triggering	S	TEX	
TFE	Through frequency exponent for loss	S	TFE	
TFL	Through frequency coefficient for loss	S	TFL	
TIN	Select internal measurement trigger	S	TIN	
TK1	Select tracking mode with GPIB source control On	SM	TK1	Diagnostic Mode use only on 372XXA. Do not use for measurements
TLP	Select time lowpass mode for active channel	S	TLP	
TLZ	Enter through line impedance for calibration	N		
TOL	Enter through offset length for calibration	S	TOL	
TPI	Select time phasor impulse mode for active channel	S	TPI	
TPN	Enter pen number for trace overlay data	N		
TRCCOL	Enter the color number for memory data	N		
TRCCOL?	Memory data color number query	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
TRS	Trigger/Restart Sweep	SM	TRS	Always restarts sweep in forward direction in dual direction sweeps on 372XXA.
TST	Same as *TST?	SM	TST	372XXA executes a Self Test, the outputs 0/1 (pass/fail). 360B only outputs current sweep errors.
TXX?	Output trigger source	N		
U10	Select 10 mil UTF calibration kit	S	U10	
U15	Select 15 mil UTF calibration kit	S	U15	
U25	Select 25 mil UTF calibration kit	S	U25	
UPL0	Turn upper limit off	N		
UPL1	Turn upper limit on at current value	N		
UPLX?	Output upper limit on/off status	N		
US	Sets Time data type and scales by 1E-6	N		Same as USC
US1	Set upper segmented limit 1 as the active segment	SM	US1	Completely redefined on 372XXA. Refer to 360B Programming Manual.
US10	Set upper segmented limit 10 as the active segment	N		
US2	Set upper segmented limit 2 as the active segment SM	SM	US2	Completely redefined on 372XXA. Refer to 360B Programming Manual.
US3	Set upper segmented limit 3 as the active segment SM	SM	US3	Completely redefined on 372XXA. Refer to 360B Programming Manual.
US4	Set upper segmented limit 4 as the active segment SM	SM	US4	Completely redefined on 372XXA. Refer to 360B Programming Manual.
US5	Set upper segmented limit 5 as the active segment	N		
US6	Set upper segmented limit 6 as the active segment	N		
US7	Set upper segmented limit 7 as the active segment	N		

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
US8	Set upper segmented limit 8 as the active segment	N		
US9	Set upper segmented limit 9 as the active segment	N		
USC	Same as US	S	USC	
USE	Enter effective dielectric for microstrip calibration	S	USE	
USW	Enter microstrip width for microstrip calibration	S	USW	
USZ	Enter microstrip impedance for microstrip calibration	S	USZ	
V	Sets Voltage data type	N		Same as VLT
VLT	Same as V	S	VLT	
VSP	Stop voltage value	S	VSP	
VSP?	Output stop voltage value	N		
VST	Start voltage value	S	VST	
VST?	Output start voltage value	N		
WCO	Set waveguide cutoff frequency for user defined kit	S	WCO	
WFS	Wait full sweep until all display data is valid	SM	WFS	Issue twice for first DUT sweep in 12T-cal on 372XXA.
WKD	Select user defined waveguide calibration kit	S	WKD	
WKI	Select installed waveguide calibration kit	S	WKI	
WLS	Select low sidelobe window shape	S	WLS	
WMS	Select minimum sidelobe window shape	S	WMS	
WNM	Select nominal window shape	S	WNM	
WRT	Select rectangular window shape	S	WRT	
WSH1	Set waveguide short offset 1 for user defined kit	N		Same as SH1 on 360B.
WSH2	Set waveguide short offset 2 for user defined kit	N		Same as SH2 on 360B.

* Refer to compatibility Code descriptions at bottom of page D-9.

Table D-1. 372XXA/360B Commands Compatibility

372XXA Command	Description	Compatibility Code *	360B Commands	Compatibility/Modification Remarks
WSX?	Output window shape	N		
XMKR?	Output marker mode	N		
XM3	Sets Unitless data type and scales by 1E3	S	XM3	
XX1	Sets Unitless data type	S	XX1	
XX3	Sets Unitless data type and scales by 1E-3	S	XX3	
ZCT	Enter zoom range center value time or distance	S	ZCT	
ZCT?	Output zoom range center value	N		
ZSN	Enter zoom range span value time or distance	S	ZSN	
ZSN?	Output zoom range span value	N		
ZSP	Enter zoom range stop value time or distance	S	ZSP	
ZSP?	Output zoom range stop value	N		
ZST	Enter zoom range start value time or distance	S	ZST	
ZST?	Output zoom range start value	N		

* Refer to compatibility Code descriptions at bottom of page D-9.