SERIES
691XXB
SYNTHESIZED SIGNAL GENERATOR

SCPI PROGRAMMING MANUAL

Anritsu

490 JARVIS DRIVE
MORGAN HILL, CA 95037-2809

P/N: 10370-10346
REVISION: A
PRINTED: JANUARY 1999
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Product Name: Synthesized CW / Sweep / Signal Generator

Model Number: 690XXB; 691XXB; 693XXB
680XXC; 681XXC; 683XXC

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 73/23/EEC as amended by Council directive 93/68/EEC

Electromagnetic Interference:

Emissions: CISPR 11:1990/EN55011: 1991 Group 1 Class A

Immunity:
EN 61000-4-2:1995/EN50082-1: 1997 - 4kV CD, 8kV AD
EN 61000-4-3:1997/EN50082-1: 1997 - 3V/m
ENV 50204/EN50082-1: 1997 – 3V/m
EN 61000-4-4:1995/EN50082-1: 1997 - 0.5kV SL, 1kV PL
EN 61000-4-5:1995/EN50082-1: 1997 - 1kV L-L, 2kV L-E

Electrical Safety Requirement:

Product Safety: IEC 1010-1:1990 + A1/EN61010-1: 1993

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Chapter 1
General GPIB Information

1-1 SCOPE OF MANUAL

This manual provides information for remote operation of the Series 691XXB Synthesized Signal Generator using commands sent from an external controller via the IEEE-488 General Purpose Interface Bus (GPIB). It includes the following:

- A general description of the GPIB and the bus data transfer and control functions.
- A listing of the IEEE-488 Interface Function Messages recognized by the signal generator with a description of its response.
- A complete listing and description of all the Standard Commands for Programmable Instruments (SCPI) commands that can be used to control signal generator operation with examples of command usage.

This manual is intended to be used in conjunction with the Series 691XXB Synthesized Signal Generator Operation Manual, P/N 10370-10344. Refer to that manual for general information about the 691XXB, including equipment set up and front panel (manual mode) operating instructions.

Electronic Manual This manual is available on CD ROM as an Adobe Acrobat Portable Document Format (∗.pdf) file. The file can be viewed using Acrobat Reader, a free program that is also included on the CD ROM. The file is "linked" such that the viewer can choose a topic to view from the displayed "bookmark" list and "jump" to the manual page on which the topic resides. The text can also be word-searched. Contact Anritsu Customer Service for price and availablility.

GPIB Programming Manual In addition to the SCPI programming commands described in this manual, the 691XXB GPIB interface also accepts and implements a set of 691XXB GPIB Product-Specific ("NATIVE") commands. These GPIB commands are listed and described in the Series 691XXB Synthesized Signal Generator GPIB Programming Manual, P/N 10370-10345.

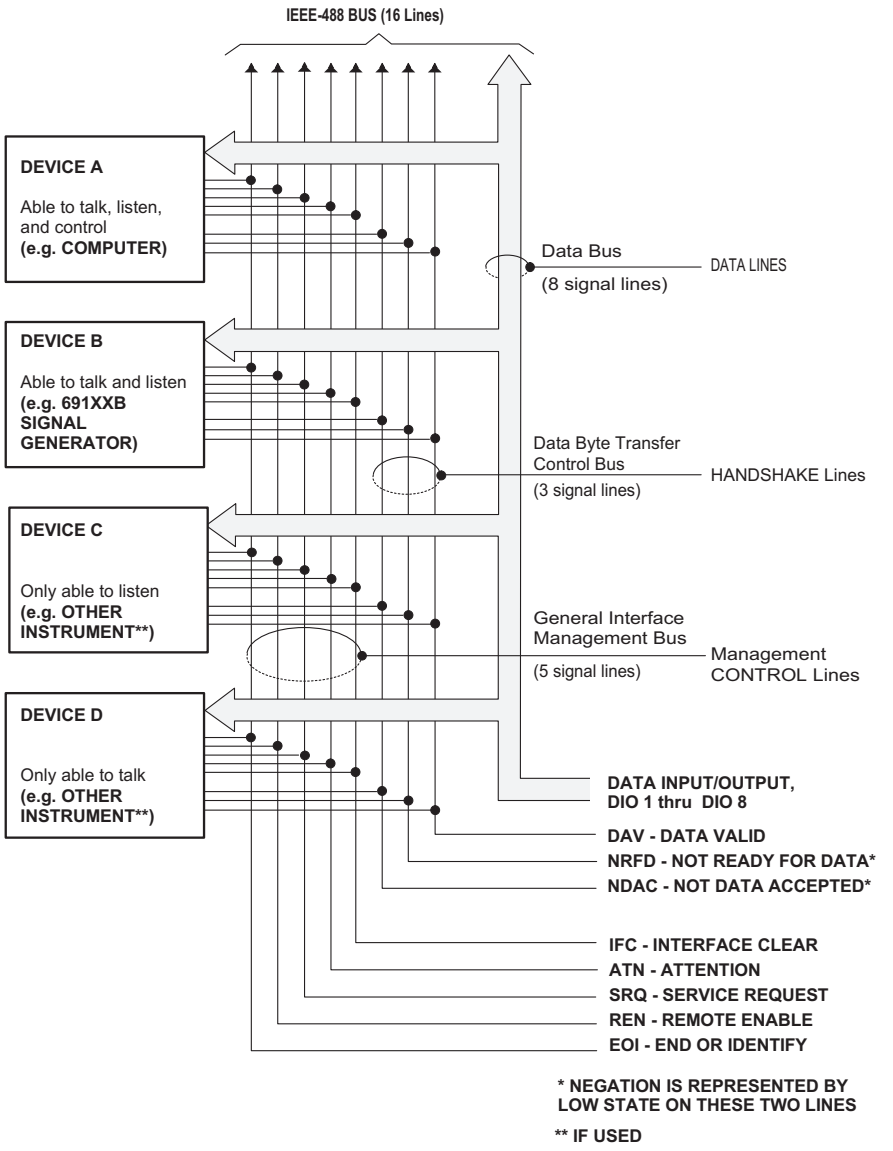

Figure 1-1. *Interface Connections and GPIB Bus Structure*

1-2 INTRODUCTION

This chapter provides a general description of the GPIB and the bus data transfer and control functions. It also contains a listing of the 691XXB's GPIB interface function subset capability and response to IEEE-488 interface function messages.

The GPIB information presented in this chapter is general in nature. For complete and specific information, refer to the following documents: ANSI/IEEE Std 488.1-1987 *IEEE Standard Digital Interface for Programmable Instrumentation* and ANSI/IEEE Std 488.2-1987 *IEEE Standard Codes, Formats, Protocols and Common Commands*. These documents precisely define the total specification of the mechanical and electrical interface, and of the data transfer and control protocols.

1-3 IEEE-488 INTERFACE BUS DESCRIPTION

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 1-1. 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.

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.

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 1-1 lists these designations.

Table 1-1. *Interface Bus Signal Line Designations*

Bus Type	Signal Line Name	Function
Data Bus	DIO1–DIO8	Data Input/Output, 1 thru 8
Data Byte Transfer Control Bus	DAV	Data Available
	NRFD	Not Ready For Data
	NDAC	Not Data Accepted
General Interface Management Bus	ATN	Attention
	IFC	Interface Clear
	SRQ	Service Request
	REN	Remote Enable
	EOI	End Or Identify

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.

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 1-2. For further information, refer to ANSI/IEEE Std 488.1.

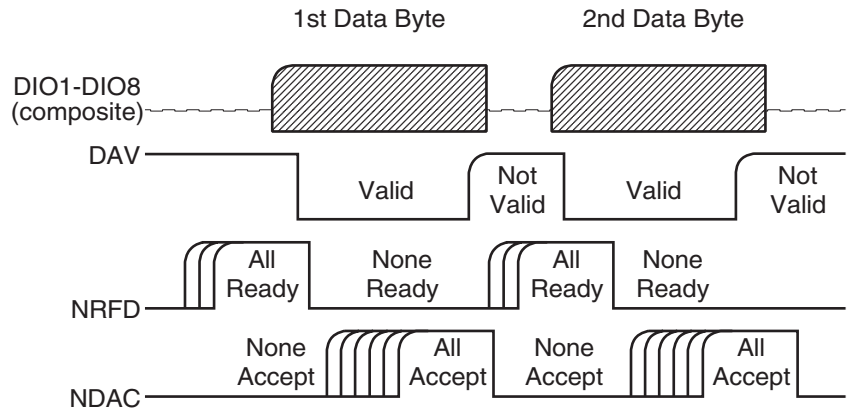

Figure 1-2. *Typical GPIB Handshake Operation*

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.

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.

Device Interface Function Capability

An interface function is the GPIB system element which provides the basic operational facility through which a device can receive, process, and send messages. Each specific interface function may only send or receive a limited set of messages within particular classes of messages. As a result, a set of interface functions is necessary to achieve complete communications among devices on the GPIB. ANSI/IEEE Std 488.1 defines each of the interface functions along with its specific protocol.

ANSI/IEEE Std 488.2 specifies the minimum set of IEEE 488.1 interface capabilities that each GPIB device must have. This minimum set of interface functions assures that the device is able to send and receive data, request service, and repond to a device clear message. Table 1-2 lists the interface function capability of the series 691XXB signal generator.

Table 1-2. *691XXB Interface Function Capability*

Function Identifier	Function	691XXB Capability
AH1	Acceptor Handshake	Complete Capability
SH1	Source Handshake	Complete Capability
T6	Talker	No Talk Only (TON)
L4	Listener	No Listen Only (LON)
SR1	Service Request	Complete Capability
RL1	Remote/Local	Complete Capability
PP1	Parallel Poll	Complete Capability
DC1	Device Clear	Complete Capability
DT1	Device Trigger	Complete Capability
C0, 1, 2, 3, 28	Controller Capability Options	C0, No Capability; C1, System Controller; C2, Send IFC and Take Charge; C3, Send REN; C28, Send IF Messages
E2	Tri-State Drivers	Three-state bus drivers

Message Types

There are three types of information transmitted over the GPIB—interface function messages, device-specific commands, and data and instrument status messages.

Interface Function Messages
The controller manages the flow of information on the GPIB using interface function messages, usually called *commands* or *command messages*. Interface function messages perform such functions as initializing the bus, addressing and unaddressing devices, and setting device modes for remote or local operation.

There are two types of commands—multiline and uniline. Multiline commands are bytes sent by the active controller over the data bus (DIO1-DIO8) with ATN set TRUE. Uniline commands are signals carried by the individual interface management lines.

The user generally has control over these commands; however, the extent of user control depends on the implementation and varies with the specific GPIB interface hardware and software used with the external controller.

Device-Specific Commands
These commands are keywords or mnemonic codes sent by the external controller to control the setup and operation of the addressed device or instrument. The commands are normally unique to a particular instrument or class of instruments and are described in its documentation.

Device-specific commands are transmitted over the data bus of the GPIB to the device in the form of ASCII strings containing one or more keywords or codes.They are decoded by the device's *internal controller* and cause the various instrument functions to be performed.

Data and Instrument Status Messages
These messages are sent by the device to the external controller via the GPIB. They contain measurement results, instrument status, or data files that the device transmits over the data bus in response to specific requests from the external controller. The contents of these messages are instrument specific and may be in the form of ASCII strings or binary data.

In some cases data messages will be transmitted from the external controller to the device. For example, messages to load calibration data.

An SRQ (service request) is an interface function message sent *from the device* to the external controller to request service from the controller, usually due to some predetermined status condition or error. To send this message, the device sets the SRQ line of the General Interface Management Bus true, then sends a status byte on the data bus lines.

An SRQ interface function message is also sent by the device in response to a serial poll message from the controller, or upon receiving an Output Status Byte(s) command from the controller. The protocols associated with the SRQ functions are defined in the ANSI/IEEE Std 488.2 document.

The manner in which interface function messages and device-specific commands are invoked in programs is implementation specific for the GPIB interface used with the external controller. Even though both message types are represented by mnemonics, they are implemented and used in different ways.

Normally, the interface function messages are sent automatically by the GPIB driver software in response to invocation of a software function. For example, to send the IFC (Interface Clear) interface fuction message, one would call the ibsic function of the National Instruments software driver. On the other hand, the command *RST (Reset) is sent in a command string to the addressed device. In the case of the National Instruments example, this would be done by using the ibwrt function call.

1-4 691XXB GPIB OPERATION

All Series 691XXB Synthesized Signal Generator functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external controller via the GPIB. When in the remote (GPIB) mode, the signal generator functions as both a listener and a talker. The GPIB interface function capability of the 691XXB is listed in Table 1-2 (page 1-10).

Setting GPIB Operating Parameters

The 691XXB leaves the factory with the GPIB address value set to 5 and the data delimiting terminator set to carriage return and line feed (CR/LF). A different address value can be entered from the front panel using the Configure GPIB menu. Using this same menu, the data delimiting terminator can be changed to carriage return (CR) only. Refer to Chapter 2 of the Series 691XXB Synthesized Signal Generator Operation Manual for the procedure.

Selecting the Interface Language

Series 691XXB Synthesized Signal Generators with Option 19 can be remotely operated using one of two external interface languages—Native or SCPI. The Native interface language uses a set of 691XXB GPIB Product Specific commands to control the instrument; the SCPI interface language uses a set of the Standard Commands for Programmable Instruments commands to control the unit. Selecting which of these external interface languages is to be used can be made from the front panel using the Configure GPIB menu. Refer to Chapter 2 of the Series 691XXB Synthesized Signal Generator Operation Manual for the procedure.

Response to GPIB Interface Function Messages

Table 1-3 (page 1-14) lists the GPIB Interface Function Messages that the 691XXB will recognize and respond to. With the exception of the Device Clear and Selected Device Clear messages, these messages affect only the operation of the 691XXB GPIB interface. The 691XXB response for each message is indicated.

Interface function messages are transmitted on the GPIB data lines and interface management lines as either unaddressed or addressed commands. The manner in which these messages are invoked in programs is implementation dependent. For programming information, refer to the documentation included with the GPIB Interface used for the external controller.

Table 1-3. *691XXB Response to GPIB Interface Function Messages*

Interface Function Message	Addressed Command	691XXB Response
Device Clear (DCL) Selected Device Clear (SDC)	No Yes	Resets the 691XXB to its default state. (Equivalent to sending the ∗RST command.)
Go To Local (GTL)	Yes	Returns the 691XXB to local (front panel) control.
Group Execute Trigger (GET)	Yes	Executes a string of commands, if programmed.
Interface Clear (IFC)	No	Stops the 691XXB GPIB interface from listening or talking. (The front panel controls are not cleared.)
Local Lockout (LLO)	No	Disables the front panel menu RETURN TO LOCAL soft-key.
Remote Enable (REN)	No	Places the 691XXB under remote (GPIB) control when it has been addressed to listen.
Serial-Poll Enable (SPE)	No	Outputs the serial-poll status byte.
Serial-Poll Disable (SPD)	No	Disables the serial-poll function.
Parallel-Poll Configure (PPC)	Yes	Responds to a parallel-poll message (PPOLL) by setting assigned data bus line to the logical state (1,0) that indicates its correct SRQ status.
Parallel-Poll Unconfigure (PPU)	No	Disables the parallel-poll function.

Chapter 2
Programming with SCPI Commands

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Chapter 2
Programming with SCPI Commands

2-1 INTRODUCTION

This chapter provides an introduction to SCPI programming that includes descriptions of the command types, hierarchial command structure, data parameters, and notational conventions. Information on 691XXB status system and trigger system programming is also provided.

2-2 INTRODUCTION TO SCPI PROGRAMMING

The *Standard Commands for Programmable Instruments (SCPI)* defines a set of standard programming commands for use by all SCPI compatible instruments. SCPI is intended to give the ATE user a consistent environment for program development. It does so by defining controller messages, instrument responses, and message formats for all SCPI compatible instruments. The IEEE-488 (GPIB) interface for the 691XXB was designed to conform to the requirements of SCPI 1993.0. The set of SCPI commands implemented by the 691XXB GPIB interface provides a comprehensive set of programming functions covering all the major functions of the 691XXB signal generator.

SCPI Command Types

SCPI commands, which are also referred to as SCPI instructions, are messages to the instrument to perform specific tasks. The 691XXB command set includes:

- "Common" commands (IEE488.2 mandated commands)
- SCPI required commands
- SCPI optional commands (per SCPI 1993.0)
- SCPI compliant commands that are unique to the 691XXB.

The SCPI conformance information for the 691XXB command set is contained in Appendix B — SCPI Conformance Information.

Common Commands

∗CLS	∗RST
∗ESE	∗SRE
∗ESE?	∗SRE?
∗ESR?	∗STB?
∗IDN?	∗TST?
∗OPC	∗WAI
∗OPC?	

SCPI Required Commands

```
:STATus
    :OPERation
        [:EVENt]?
        :CONDition?
        :ENABle
    :PRESet
    :QUEStionable
        [:EVENt]?
        :CONDition?
        :ENABle
:SYSTem
    :ERRor?
    :VERSion?
```

Common Commands

The required common commands are IEEE-488.2 mandated commands that are defined in IEEE-488.2 and must be implemented by all SCPI compatible instruments. These commands (see table at left) are identified by the asterisk (∗) at the beginning of the command keyword. These commands are used to control instrument status registers, status reporting, synchronization, and other common functions. The common commands and their syntax are described in detail in Chapter 3, paragraph 3-2.

Required and Optional SCPI Commands

The required SCPI commands are listed in the table at left and are described in detail in Chapter 3, paragraphs 3-11 and 3-12. The optional SCPI commands and 691XXB unique commands comprise the remainder (major portion) of the 691XXB command set. They control the majority of the programmable functions of the 691XXB. They are described in detail in Chapter 3 starting at paragraph 3-3.

Query Commands

All commands, unless specifically noted in the syntax descriptions in Chapter 3, have a query form. As defined in IEEE-488.2, a query is a command with a question mark symbol appended (examples: ∗ESR?, and :FREQuency:CENTer?). When a query form of a command is received, the current setting associated with the command is placed in the output buffer.

Command Names

Typical SCPI commands consist of one or more keywords, parameters, and punctuation. SCPI command keywords can be a mixture of upper and lower case characters. Except for common commands, each keyword has a long and a short form. In this manual, the long form is presented with the short form in upper case and the remainder in lower case. For example, the long form of the command keyword to control the instrument display is: DISPlay.

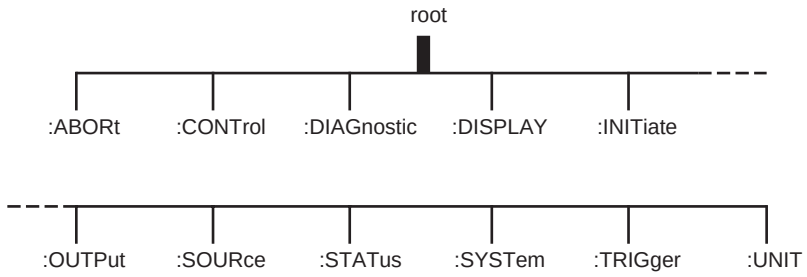
The short form keyword is usually the first four characters of the long form (example: DISP for DISPlay). The exception to this is when the long form is longer than four characters and the fourth character is a vowel. In such cases, the vowel is dropped and the short form becomes the first three characters of the long form. Example: the short form of the keyword POWer is POW.

Some command keywords may have a numeric suffix to differentiate between multiple instrument features such as dual channel inputs. For example: keywords EXTernal1 and EXTernal2 (or EXT1 and EXT2) are used to differentiate between the 691XXB front panel and rear panel MODULATION connectors.

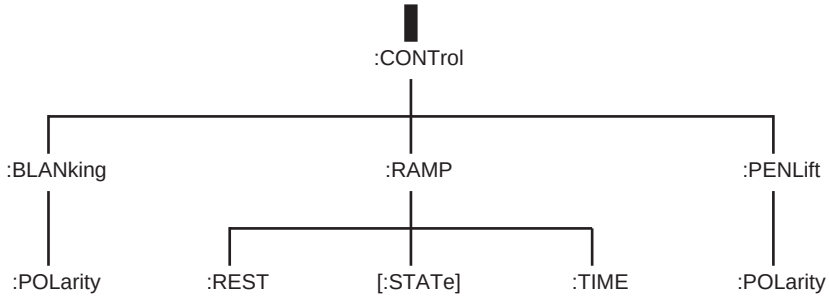
As with any programming language, the exact command keywords and command syntax must be used. The syntax of the individual commands is described in detail in Chapter 3. Unrecognized versions of long form or short form commands, or improper syntax, will generate an error. Error reporting is described in Chapter 4.

Hierarchical Command Structure

All SCPI commands, except the common commands, are organized in a hierarchical structure similar to the inverted tree file structure used in most computers. The SCPI standard refers to this structure as "the Command Tree." The command keywords that correspond to the major instrument control functions are located at the top of the command tree. The command keywords for the 691XXB SCPI command set are shown in the diagram below.



All 691XXB SCPI commands, except the ABORt command, have one or more subcommands (keywords) associated with them to further define the instrument function to be controlled. The subcommand keywords may in turn also have one or more associated subcommands (keywords). Each subcommand level adds another layer to the command tree. The command keyword and its associated subcommand keywords form a portion of the command tree called a command *subsystem*. The :CONTrol command subsystem is shown below.



An overall command tree for the 691XXB SCPI command set is shown in Figure A-1 of Appendix A.

Data Parameters

Data parameters, referred to simply as "parameters", are the quantitative values used as arguments for the command keywords. The parameter type associated with a particular SCPI command is determined by the type of information required to control the particular instrument function. For example, Boolean (ON/OFF) type parameters are used with commands that control switch functions.

The command descriptions Chapter 3 specify the type of data parameter to be used with each command. The most commonly used parameter types are numeric, extended numeric, discrete, and Boolean.

Numeric
Numeric parameters comprise integer numbers, or any number in decimal or scientific notation and may include polarity signs. This includes <NR1>, <NR2>, and <NR3> numeric data as defined in Parameter Notations on page 2-9. This type of numeric element is abbreviated as <NRf> throughout this document.

Extended Numeric
Extended numeric parameters include values such as MAXimum and MINimum.

Discrete
Discrete parameters, such as INTernal and EXTernal, are used to control program settings to a predetermined finite value or condition.

Boolean
Boolean parameters represent binary conditions and may be expressed as ON, OFF, or 1, 0.

Unit Suffixes

Unit suffixes are not required for data parameters, provided the values are scaled for the global default units. The 691XXB SCPI default units are: Hz (Hertz) for frequency related parameters and S (seconds) for time related parameters. For example, the command below sets the 691XXB output frequency to 3 GHz.

```
:SOURce:FREQuency:CW  3000000000
```

The global default units may be changed via use of the :UNIT Subsystem commands described in Chapter 3, paragraph 3-15.

2-3 NOTATIONAL CONVENTIONS

The SCPI interface standardizes command syntax and style which simplifies the task of programming across a wide range of instrumentation. As with any programming language, the exact command keywords and command syntax must be used. Unrecognized commands, or improper syntax, will generate an error (refer to Chapter 4 for error reporting).

General Notations

The syntax conventions that are used for all SCPI command keywords and data parameter descriptions in this manual are described below.

- **:** A colon links command keywords together to form commands. The colon is not an actual part of the keyword but is a signal to the SCPI interface parser. A colon must precede a root keyword immediately following a semicolon. (See Notational Examples on page 2-10.)
- **;** A semicolon separates commands if multiple commands are placed on a single program line. (See Notational Examples on page 2-10.)
- **[]** Square brackets enclose one or more *optional* parameters.
- **{}** Braces enclose one or more parameters *that may be included one or more times*.
- **|** A vertical bar indicates "or" and is used to separate alternative parameter options. Example: ON|OFF is the same as ON or OFF.
- **<>** Angle brackets enclose parameter descriptions.
- **::** means "is defined as." For example: <a>::=<b><c> indicates that <b><c> can replace <a>.
- ***sp*** space(s), referred to as whitespace, *must* be used to separate keywords from their associated data parameters. It *must not* be used between keywords, or inside keywords.
- **XXX** indicates a root command name.

For further information about SCPI command syntax and style, refer to the *Standard Commands for Programmable Instruments (SCPI) 1993.0* document.

Parameter Notations

The following syntax conventions are used for all data parameter descriptions in this manual.

<arg> ::=a generic command argument consisting of one or more of the other data types.

<bNR1> ::=boolean values in <NR1> format; numeric 1 or 0

<boolean> ::=ON|OFF. Can also be represented as 1 or 0, where 1 means ON and 0 means OFF. Boolean parameters are always returned as 1 or 0 in <NR1> format by query commands.

<integer> ::=an unsigned integer without a decimal point (implied radix point)

<NR1> ::=a signed integer without a decimal point (implied radix point).

<NR2> ::=a signed number with an explicit radix point.

<NR3> ::=a scaled explicit decimal point numeric value with and exponent (e.g., floating point number)

<NRf> ::=<NR1>|<NR2>|<NR3>

<nv> ::=SCPI numeric value: <NRf>|MIN|MAX|UP |DOWN|DEF|NAN|INF|NINF or other types

<char> ::=<CHARACTER PROGRAM DATA>. Examples: CW, FIXed, UP, and DOWN.

<string> ::=<STRING PROGRAM DATA>. ASCII characters surrounded by double quotes, example: “OFF”

<block> ::=IEEE-488.2 block data format

<NA> ::=Not Applicable

Notational Examples

The following is an example showing command syntax (It is not an actual command):

[SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] :STEP[:INCRement] *sp* **dBm|DOWN|UP**

Command statements read from left to right and from top to bottom. In the command statement above, the :STEP keyword immediately follows the :AMPLitude keyword *with no separating space*. A space (*sp*) is used between the command string and its argument (a <nv> type data parameter).

Note that the first keyword in the command string does not require a leading colon; however, it is good practice to always use a leading colon for *all* keywords. Note also that the :SOURce keyword is optional. This is a SCPI convention for all voltage or signal source type instruments that allows shorter command statements to be used.

The following is an example of a multiple command statement that uses two seperate commands in a single statement. Note the semicolon used to join the commands. (Also note the leading colon used immediately after the semicolon.)

:FREQuency:STARt 10E6;:FREQuency:STOP 20E9

2-4 SCPI INTERFACE LANGUAGE SELECTION

The Series 691XXB Synthesized Signal Generator can be remotely operated using one of two external interface languages—Native or SCPI. Before programming with SCPI commands it is necessary to select SCPI as the external interface language.

Front Panel Selection

SCPI can be selected as the 691XXB interface language from the front panel Configure GPIB menu.

To access the Configure GPIB Menu, first press the **SYSTEM** main menu key on the front panel to access the System Menu. At the menu display, press **Config** to access the System Configuration Menu. Then, press **GPIB** . The Configure GPIB Menu is displayed.

The Configure GPIB menu has an additional menu displays. Language selection is made from the first additional menu. To access the additional menu, press **More** . At the menu, press **SCPI/Native** to select SCPI. The language selection will appear on the display.

Remote Selection

SCPI can be selected as the 691XXB interface language during remote operations.

To change the interface language from Native to SCPI use the command

```
SYST:LANG "SCPI"
```

Do ***not*** use the long form of the command and do ***not*** use a leading colon (:) with the command. The command :SYSTem:LANGuage "SCPI" results in a syntax error.

NOTE

When the series 691XXB signal generator is remotely operated using the SCPI interface language, cycling the power returns the instrument to a reset condition.

2-5 STATUS SYSTEM PROGRAMMING

The 691XXB status system (shown in Figure 2-1) consists of the following SCPI-defined status-reporting structures:

- The Instrument Summary Status Byte Group
- The Standard Event Status Group
- The Operational Status Group
- The Questionable Status Group

The following paragraphs describe the registers that make up a status group and explain the status information that each status group provides.

Status Group Registers

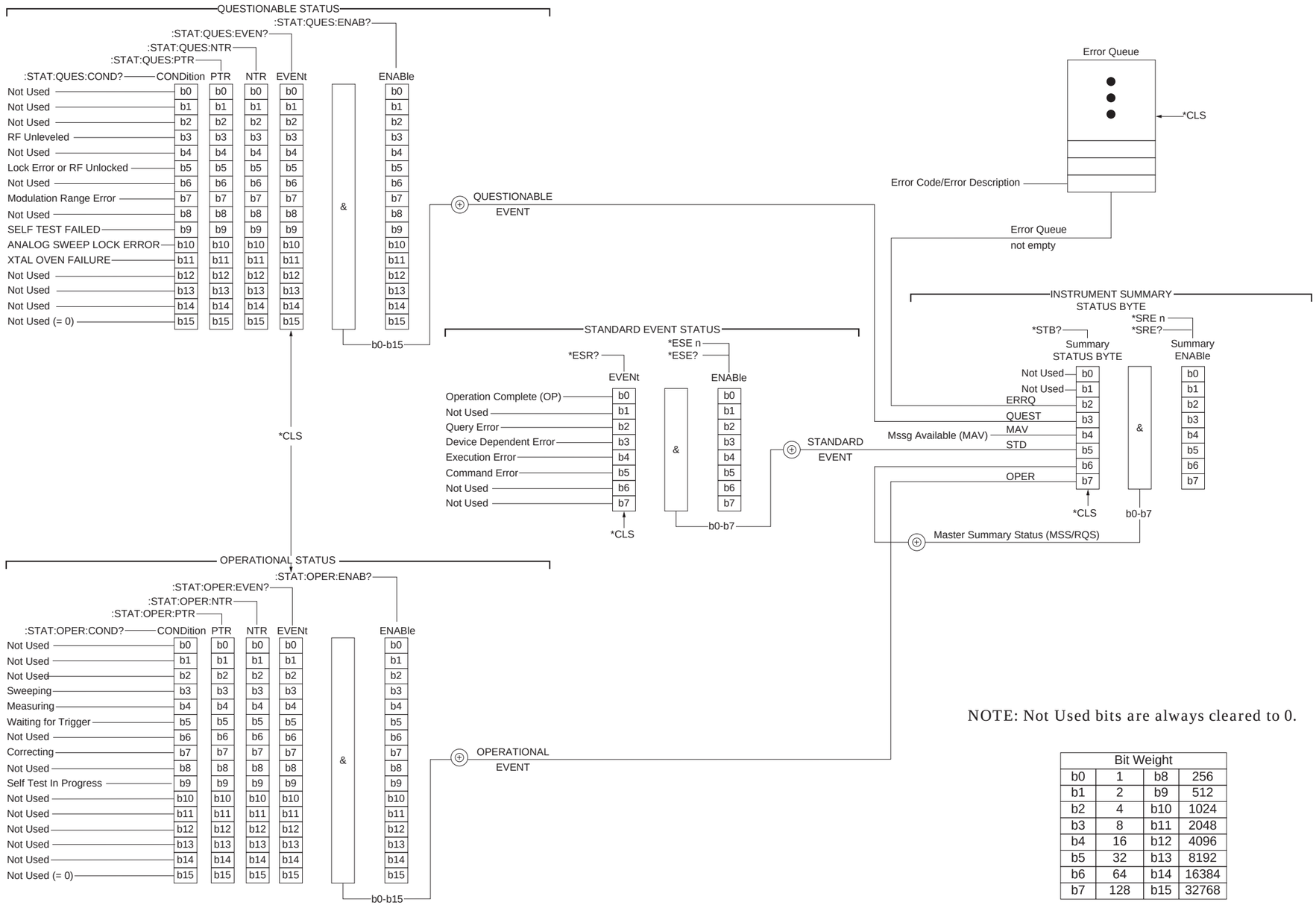
In general, a status group consists of a condition register, a transition filter, an event register, and an enable register. Each component is briefly described in the following paragraphs.

Condition Register
The condition register is continuously updated to reflect the current status of the 691XXB. There is no latching or buffering for this register, it is updated in real time. Reading the contents of a condition register does not change its contents.

Transition Filter
The transition filter is a special register that specifies which types of bit state changes in the condition register will set corresponding bits in the event register. Negative transition filters (NTR) are used to detect condition changes from True (1) to False (0); postive transition filters (PTR) are used to detect condition changes from False (0) to True (1). Setting both positive and negative filters True allows an event to be reported anytime the condition changes. Transition filters are read-write. Transition filters are unaffected by queries or ∗CLS (clear status) and ∗RST commands.

The command :STATus:PRESet sets all negative transition filters to all 0's and sets all positive transition filters to all 1's.

Event Register
The event register latches transition events from the condition register as specified by the transition filter. Bits in the event register are latched, and once set they remain set until cleared by a query or a ∗CLS command. Event registers are read only.



NOTE: Not Used bits are always cleared to 0.

Bit Weight			
b0	1	b8	256
b1	2	b9	512
b2	4	b10	1024
b3	8	b11	2048
b4	16	b12	4096
b5	32	b13	8192
b6	64	b14	16384
b7	128	b15	32768

Figure 2-1. *691XXB Status-Reporting Structure*

Enable Register

The enable register specifies the bits in the event register that can produce a summary bit. The 691XXB logically ANDs corresponding bits in the event and enable registers, and ORs all the resulting bits to obtain a summary bit. Summary bits are recorded in the Summary Status Byte. Enable registers are read-write. Querying an enable register does not affect it.

The command :STATus:PRESet sets the Operational Status Enable register and the Questionable Status Enable register to all 0's.

Status Group Reporting

The state of certain 691XXB hardware and operational events and conditions can be determined by programming the status system. As shown in Figure 2-1, the three lower status groups provide status information to the Summary Status Byte group. The Summary Status Byte group is used to determine the general nature of an event or condition and the other status groups are used to determine the specific nature of the event or condition.

NOTE

Programming commands for the status system, including examples of command usage, can be found in Chapter 3.

The following paragraphs explain the information that is provided by each status group.

Summary Status Byte Group

The Summary Status Byte group, consisting of the Summary Enable register and the Status Byte, is used to determine the general nature of a 691XXB event or condition. The bits in the Status Byte provide the following information:

Bit	Description
0,1	Not Used. These bits are always set to 0.
2	Set to indicate the Error Queue contains data. The Error Query command can then be used to read the error message(s) from the queue.
3	Set to indicate the Questionable Status summary bit has been set. The Questionable Status Event register can then be read to determine the specific condition that caused the bit to be set.
4	Set to indicate that the 691XXB has data ready in its output queue.
5	Set to indicate that the Standard Event Status summary bit has been set. The Standard Event Status register can then be read to determine the specific event that caused the bit to be set.
6	Set to indicate that the 691XXB has at least one reason to require service. This bit is also called the Master Summary Status Bit (MSS). The individual bits in the Status Byte are ANDed with their corresponding Service Request Enable Register bits, then each bit value is ORed and input to this bit.
7	Set to indicate that the Operational Status summary bit has been set. The Operational Status Event register can then be read to determine the specific condition that caused the bit to be set.

Standard Event Status Group

The Standard Event Status group, consisting of the Standard Event Status register (an Event register) and the Standard Event Status Enable register, is used to determine the specific event that set bit 5 of the Summary Status Byte. The bits in the Standard Event Status register provide the following information:

Bit	Description
0	Set to indicate that all pending 691XXB operations were completed following execution of the "∗OPC" command.
1	Not Used. The bit is always set to 0.
2	Set to indicate that a query error has occurred. Query errors have SCPI error codes from –499 to –400.
3	Set to indicate that a device-dependent error has occurred. Device-dependent errors have SCPI error codes from –399 to –300 and 1 to 32767.
4	Set to indicate that a execution error has occurred. Execution errors have SCPI error codes from –299 to –200.
5	Set to indicate that a command error has occurred. Command errors have SCPI error codes from –199 to –100.
6,7	Not Used. The bits are always set to 0.

Operational Status Group

The Operational Status group, consisting of the Operational Condition register, the Operational Positive Transition register, the Operational Negative Transition register, the Operational Event register, and the Operational Event Enable register, is used to determine the specific condition that set bit 7 in the Summary Status Byte. The bits in the Operational Event register provide the following information:

Bit	Description
0-2	Not Used. The bits are always set to 0.
3	Set to indicate that a sweep is in progress.
4	Set to indicate that the 691XXB is measuring.
5	Set to indicate that the 691XXB is in an armed "wait for trigger" state.
6	Not Used. The bit is always set to 0.
7	Set to indicate that the 691XXB is performing a correction.
8	Not Used. The bit is always set to 0.
9	Set to indicate that 691XXB self-test is in progress.
10-14	Not Used. The bits are always set to 0.
*15	Always 0. The use of Bit 15 is not allowed by SCPI.

Questionable Status Group

The Questionable Status group, consisting of the Questionable Condition register, the Questionable Positive Transition register, the Questionable Negative Transition register, the Questionable Event register, and the Questionable Event Enable register, is used to determine the specific condition that set bit 3 in the Summary Status Byte. The bits in the Questionable Event register provide the following information:

Bit	Description
0-2	Not Used. The bits are always set to 0.
3	Set to indicate an RF unleveled condition.
4	Not Used. The bit is always set to 0.
5	Set to indicate a phase-lock error or RF unlocked condition.
6	Not Used. The bit is always set to 0.
7	Set to indicate a modulation range error.
8	Not Used. The bit is always set to 0.
9	Set to indicate that self-test failed.
10	Set to indicate an analog sweep phase-lock error.
11	Set to indicate a failure of the crystal oven.
12-14	Not Used. The bits are always set to 0.
*15	Always 0. The use of Bit 15 is not allowed by SCPI.

2-6 TRIGGER SYSTEM PROGRAMMING

The 691XXB trigger system is used to synchronize signal generator actions with software trigger commands. The 691XXB follows the layered trigger model used in SCPI instruments. The following paragraphs describe operation and programming of the signal generator trigger system. The structure and components of the 691XXB trigger model are shown in Figure 2-2.

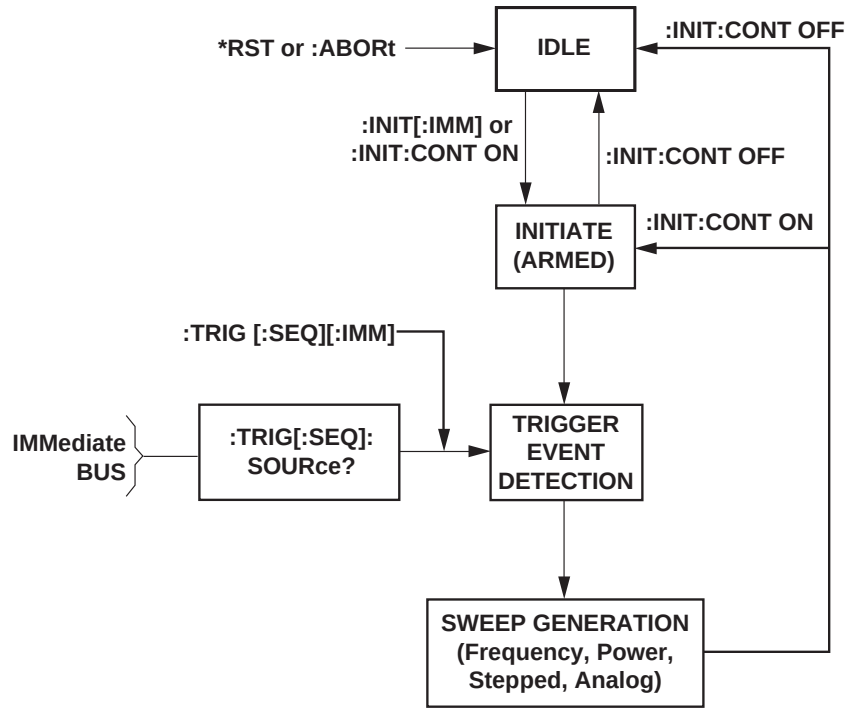


Figure 2-2. *691XXB Trigger Model*

Trigger System Operation

Turning power on, or sending ∗RST or :ABORt forces the trigger system into the *idle* state. The trigger system remains in the *idle* state until it is initiated. Trigger system initiation can happen on a continuous basis (:INITiate:CONTinuous ON) or on a demand basis (:INITiate:CONTinuous OFF). When the command :INITiate:CONTinuous is set to OFF, the trigger system is initiated by the :INITiate[:IMMediate] command. Note that ∗RST sets :INITiate:CONTinuous to OFF.

Once initiated, the trigger system enters an *armed* (wait for trigger) state. The trigger signal selected by the command :TRIGger[:SEQuence]:SOURce is examined until a TRUE condition is detected. The trigger signal selections are:

IMMediate	the trigger signal is always TRUE.
BUS	the trigger signal is either the GPIB <GET> (Group Execute Trigger) message or the ∗TRG command.
HOLD	the trigger signal is never TRUE.

When a TRUE condition is detected, sweep generation of the selected sweep starts.

The command :TRIGger[:SEQuence][:IMMediate] provides a one-time override of the normal downward path in the trigger-event-detection state by forcing a TRUE trigger signal regardless of the setting for :TRIGger[:SEQuence]:SOURce.

Upon sweep completion, if :INITiate:CONTinuous is set OFF, the trigger system returns to the *idle* state. If :INITiate:CONTinuous is set to ON, the trigger system returns to the *armed* (wait for trigger) state.

Auto Trigger Mode
Setting the command :INITiate:CONTinuous to ON and the command :TRIGger[:SEQuence]:SOURce to IMMediate, places the trigger system in an auto trigger mode. This causes continuous generation of the selected sweep.

ABORt
The :ABORt command resets any sweep in progress and immediately returns the trigger system to the *idle* state. Unlike ∗RST, :ABORt does not change the settings programmed by other commands.

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Programming Commands

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Chapter 3 Programming Commands

3-1 INTRODUCTION

This chapter contains information on all SCPI programming commands accepted and implemented by the Series 691XXB Synthesized Signal Generator.

3-2 COMMON COMMANDS

Common commands are used to control instrument status registers, status reporting, synchronization, data storage, and other common functions. All common commands are identified by the leading asterisk in the command word. The common commands are fully defined in IEEE 488.2.

IEEE 488.2 Mandated Commands

The 691XXB implements the following IEEE-488.2 mandated common commands.

∗CLS (Clear Status Command)
Clear the Status Byte, the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register, the error queue, the OPC pending flag, and any other registers that are summarized in the Status Byte.

∗ESE *sp* **<nv> (Standard Event Status Enable Command)**
Sets the Standard Event Status Enable Register bits. The binary weighted <NR1> data parameter used with this command must have a value between 0 to 255. Refer to “Status System Programming” in Chapter 2.

∗ESE? (Standard Event Status Enable Query) ?
Returns the value of the Standard Event Status Enable Register in <NR1> format. Refer to “Status System Programming” in Chapter 2.

∗ESR? (Standard Event Status Register Query)
Returns the value of the Standard Event Status Register in <NR1> format. *This command clears the Standard Event Status Register.* Refer to “Status System Programming” in Chapter 2.

∗IDN? (Identification Query)
This query returns an instrument identification string in IEEE- 488.2 specified <NR1> format (four fields separated by commas). The fields are: <Manufacturer>, <Model>, <Serial #>, <Firmware revision level>; where the actual model number, serial number, and firmware version of the 691XXB queried will be passed.

∗OPC (Operation Complete Command)
Enables the Operation Complete bit in the Standard Event Status Register after all pending operations are complete.

∗OPC? (Operation Complete Query)
Places an ASCII "1" in the Output Queue and sets the MAV bit true in the Status Byte when all pending operations are completed (per IEEE-488.2 section 12.5.3). Message is returned in <NR1> format.

∗RST (Reset Command)
Resets the 691XXB to a pre-defined condition with all user programmable parameters set to their default values. These default parameter values are listed under each SCPI command in this manual. This command does not affect the Output Queue, Status Byte Register, Standard Event Register, or calibration data.

NOTE

This command clears the current front panel setup. If this setup is needed for future testing, save it as a stored setup using the ∗SAV command before issuing the ∗RST command.

∗SRE *sp* **<nv> (Service Request Enable Command)**
Sets the Service Request Enable Resister bits. The integer data parameter used with this command must have a value between 0 to 255. A zero value resets the register. Refer to "Status System Programming" in Chapter 2.

∗SRE? (Service Request Enable Query)
Returns the value of the Service Request Enable Register in <NR1> format. Bit 6 is always zero.

∗STB? (Read Status Byte Query)
Returns the content of the Status Byte Register (bits 0–5 and 7). Bit 6 is the Master Summary Status bit value. This command does not reset the status byte values.

∗TST? (Self-Test Query)
Causes the 691XXB to perform a full internal self-test. Status messages which indicate self-test results are placed in the error queue in the order they occur. Bits in the status register are also affected.

Returns the number of errors placed in the error queue. 0 means the unit passed self-test.

CAUTION

691XXB self-test requires RF output power to be on. ***Always*** disconnect sensitive equipment from the unit before performing a self-test.

∗WAI (Wait-to-Continue Command)
This command suspends the execution of any further commands or queries until all operations for pending commands are completed. For example, the command ∗TRG;∗WAI permits synchronous sweep operation. It causes the 691XXB to start a sweep and wait until the sweep is complete before executing the next command.

Optional Common Commands

The 691XXB implements the following IEEE 488.2 optional common commands:

∗OPT? (Option Identification Query)
This command returns a string identifying any device options.

∗RCL *sp* <n> (Recall Stored State)
This command restores the 691XXB to a front panel setup state that was previously saved to local (instrument) memory using the ∗SAV command (below). The ∗RCL *sp* <n> command restores setup <n>, where n shall be in the range of 0 to 9.

∗SAV *sp* <n> (Save Current State)
Saves the current front panel setup parameters in local (instrument) memory. The new stored setup state will be assigned the Setup Number specified by <n>, where n shall be in the range of 0 to 9.

∗TRG (Trigger Command)
Triggers instrument if :TRIGger:SOURce command data parameter is BUS. Refer to INITiate and TRIGger subsystem commands.

Performs the same function as the Group Execute Trigger <GET> command defined in IEEE 488.1.

3-3 SUBSYSTEM COMMANDS

Subsystem commands control all signal generator functions and some general purpose functions. All subsystem commands are identified by the colon used between keywords, as in :INITiate:CONTinuous.

The following information is provided for each subsystem command.

- The path from the subsystem root command.
- The data parameters used as arguments for the command. This includes the parameter type, the available parameter choices, the range for numeric parameters, and the default parameter that is set by the ∗RST command.
- A description of the purpose of the command.
- The query form of the command (if applicable).
- An example of the use of the command.
- Where necessary, notes are included to provide additional information about the command and its usage.

An overall command tree for the 691XXB SCPI command set is shown in Figure A-1 of Appendix A.

3-4 ABORT COMMAND (SUBSYSTEM)

The :ABORt command is a single command subsystem. There are no subcommands or associated data parameters, as shown below. The :ABORt command, along with the :TRIGger and :INITiate commands, comprise the "Trigger Group" of commands.

:ABORt

Parameters: None

Description: Forces the trigger system to the *idle* state. Any sweep in progress is aborted as soon as possible.

Query Form: None

Example: :ABORt
Sets 691XXB trigger system to idle state.

Associated commands: :TRIGger and :INITiate

3-5 CONTROL SUBSYSTEM

The :CONTrol subsystem sets the state of the following rear panel control outputs; RETRACE BLANK OUT, PENLIFT OUT, and HORIZ OUT. The subsystem commands and parameters are described below.

KEYWORD	PARAMETER FORM	NOTES
:CONTrol		
:BLANking		
:POLarity	**NORMal | INVerted**	Default: NORmal
:PENLift		
:POLarity	**NORMal | INVerted**	Default: NORmal
:RAMP		
:REST	**STARt | STOP**	Default: STOP
[:STATe]	**<boolean>**	Default: OFF
:TIME	**<numeric_value>**	Default: 30 ms

:CONTrol

:BLANking

:POLarity

Parameters: NORMal | INVerted
Type: <char>
Default: NORMal

Description: Sets the level of the retrace blanking signal output (rear panel AUX I/O connector, pin 6) during sweep retrace as follows:
NORMal cause the blanking signal to be a +5V level.
INVerted causes the blanking signal to be a –5V level.

Query Form :CONTrol:BLANking:POLarity?

Examples: :CONTrol:BLANking:POLarity *sp* INVerted
Set a –5V level for the rear panel blanking signal output during sweep retrace.

:CONTrol:BLANking:POLarity?
Requests the currently programmed level for the rear panel blanking signal output during sweep retrace.

:CONTrol

:PENLift

:POLarity

Parameters: NORMal | INVerted

Type: <char>

Default: NORMal

Description: Sets the internal penlift relay contacts to control the state of the penlift relay output (optionally available at the rear panel) as follows:
NORMal sets the relay contacts to be normally open.
INVerted sets the relay contacts to be normally closed.

Query Form: :CONTrol:PENLift:POLarity?

Examples: :CONTrol:PENLift:POLarity *sp* INVerted

Set the penlift relay contacts to be normally closed.

:CONTrol:PENLift:POLarity?

Requests the currently programmed state of the penlift relay contacts.

:CONTrol

:RAMP

:REST

Parameters: STARt | STOP

Type: <char>

Default: STOP

Description: Sets the sweep rest point for the rear panel HORIZ OUT sweep ramp as follows:
STARt sets the sweep to rest at the bottom of the sweep ramp.
STOP sets the sweep to rest at the top of the sweep ramp.

Query Form: :CONTrol:RAMP:REST?

Examples: :CONTrol:RAMP:REST *sp* STOP

Set the sweep to rest at the top of the sweep ramp.

:CONTrol:RAMP:REST?

Requests the currently programmed rest point for the sweep ramp.

:CONTrol

:RAMP

[:STATe]

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Turns the rear panel HORIZ OUT sweep ramp signal on/off.

Query Form: :CONTrol:RAMP[:STATe]?

Examples: :CONTrol:RAMP:STATe *sp* ON

Turns the rear panel HORIZ OUT *sweep ramp signal on.*

:CONTrol:RAMP:STATe?

Requests the currently programmed state of the HORIZ OUT *sweep ramp signal.*

:CONTrol

:RAMP

:TIME

Parameters: sweep time (in seconds) | MIN | MAX

Type: <nv>

Range: 30 ms to 99 sec

Default: 30 ms

Description: Sets the rear panel HORIZ OUT sweep ramp signal time by changing the analog sweep time. [:SOURce]:SWEep:TIME will also be changed. May not be changed while the unit is sweeping.

Query Form: :CONTrol:RAMP:TIME

Examples: :CONTrol:RAMP:TIME *sp* 100 ms

Sets the rear panel HORIZ OUT *sweep ramp signal time to 100 ms.*

:CONTrol:RAMP:TIME?

Requests the currently programmed time for the HORIZ OUT *sweep ramp signal.*

3-6 DIAGNOSTIC SUBSYSTEM

The :DIAGnostic subsystem consists of the query command described below.

KEYWORD
:DIAGnostic
:SNUM?

:DIAGnostic

:SNUM?

Description: Allows the serial number of the instrument to be read.

Query Form :DIAGnostic:SNUM?

3-7 DISPLAY SUBSYSTEM

The :DISPlay subsystem controls the display of all frequency, power level, and modulation parameters on the front panel data display.

KEYWORD	PARAMETER FORM	NOTES
:DISPlay		
[:WINDow]		
:TEXT		
:STATe	<boolean>	Default: ON

:DISPlay
[:WINDow]
:TEXT
:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: Turns the display of the frequency, power level, and modulation parameters on the front panel data display on/off.

Query Form :DISPlay:TEXT:STATe?

Example: :DISPlay:TEXT:STATe *sp* OFF

Turns off the display of the frequency, power level, and modulation parameters on the 691XXB front panel data display (Secure mode of operation).

3-8 INITIATE SUBSYSTEM

The :INITiate subsystem controls the state of the 691XXB trigger system. The subsystem commands and parameters are described below. The :INITiate commands, along with the :ABORt and :TRIGger commands, comprise the Trigger Group of commands.

KEYWORD	PARAMETER FORM	NOTES
:INITiate		
[:IMMediate]	**(none)**	
:CONTinuous	**<boolean>**	Default: OFF

:INITiate

[:IMMediate]

Parameters: none

Description: Places the 691XXB trigger system into the *armed* state from the *idle* state. If trigger system is not in idle state, or if :INITiate:CONTinuous is ON, will produce error –213.

Query Form None

Example: :INITiate:IMMediate
Sets 691XXB trigger to the armed state.

Associated commands: :ABORt and :TRIGger

NOTES:

When :INITiate or :TSWeep is received by the 691XXB, all sweep-related parameters are checked for compatibility and bounds. The system will not arm is any errors exist. These errors are reported in the error queue.

:INITiate

:CONTinuous

Parameters: ON | OFF | 1 | 0
Type: <boolean>
Default: OFF

Description: Continuously rearms the 691XXB trigger system after completion of a triggered sweep.

Query Form: :INITiate:CONTinuous?

Examples: :INITiate:CONTinuous *sp* ON
Sets 691XXB trigger to continuously armed state.

Associated commands: :ABORt and TRIGger

NOTE:

:INITiate:CONTinuous ON has the same action as :INITiate:IMMediate plus it sets an internal flag that causes the trigger system to rearm after completing a triggered action.

If :TRIGger:SOURce IMMediate, :INITiate will start a sweep if one is not already in progress. In this case, to abort and restart a sweep either send :ABORt;:INITiate or :TSWeep .

If the trigger system is not idle, :INITiate will cause the error:
–213,"Init ignored, trigger not idle"

3-9 OUTPUT SUBSYSTEM

The :OUTPut subsystem controls the 691XXB RF output power. The commands are used to turn the RF output power on/off and to set the state of the RF output power during frequency changes in CW and step sweep modes and during sweep retrace. The subsystem commands and parameters are described below.

KEYWORD	PARAMETER FORM	NOTES
:OUTPut		
[:STATe]	<boolean>	Default: OFF
:PROTection	<boolean>	Default: ON
:RETRace	<boolean>	Default: OFF
:IMPedance?		

:OUTPut [:STATe]

Parameters: ON | OFF | 1 | 0
Type: <boolean>
Default: OFF (see note below)

Description: Turns 691XXB RF output power on/off.

Query Form :OUTPut[:STATe]?

Example: :OUTPut:STATe sp ON
Turns 691XXB RF output power on.

NOTE:

The SCPI programming mode reset default for RF output power state is OFF.

The 691XXB Native GPIB programming mode reset default for the RF output power state is ON.

:OUTPut

:PROTection

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: ON causes the 691XXB RF output to be turned off (blanked) during frequency changes in CW or step sweep mode. OFF leaves RF output turned on (unblanked).

Query Form :OUTPut:PROTection?

Example: :OUTPut:PROTection *sp* OFF

Causes the 691XXB RF output signal to be left on during frequency changes in CW or step sweep mode.

:OUTPut:PROTection?

Requests the currently programmed state of the 691XXB RF output during frequency changes in CW or step sweep mode.

:OUTPut

:PROTection

:RETRace

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: ON causes the 691XXB RF output to be turned off during sweep retrace. OFF leaves RF output turned on.

Query Form :OUTPut:PROTection:RETRace?

Example: :OUTPut:PROTection:RETRace *sp* ON

Turns the 691XXB RF output off during sweep retrace.

:OUTPut:PROTection:RETRace?

Requests the currently programmed state of the 691XXB RF output during sweep retrace.

:OUTPut

:IMPedance?

Description: Queries the 691XXB RF output impedance. The impedance is nominally 50 ohms and is not settable.

Query Form :OUTPut:IMPedance?

3-10 SOURCE SUBSYSTEM

The [:SOURce] subsystem provides control of a majority of the 691XXB functions. The subsystem commands are used to control the frequency, power level, and modulation of the RF output signal. The [:SOURce] subsystem commands and parameters are listed in the table contained on this and the following two pages. The subsytem commands are described in detail on following pages.

Note that the [:SOURce] keyword is optional for all command statements in the :SOURce subsystem. This is a SCPI convention for signal source type instruments that allows shorter command statements to be used.

:SOURce Subsystem Commands (1 of 3)

KEYWORD	PARAMETER FORM	NOTES
[:SOURce]		
:AM		
:LOGSens	**<numeric_value>**	Default: 3 dB/V
:SENSitivity	**<numeric_value>**	Default: 50 PCT/V
:EXTernal		
:IMPedance	**50 | 600 | MIN | MAX**	Default: 600
:SOURce	**EXTernal1 | EXTernal2**	Default: EXTernal1
:STATe	**<boolean>**	Default: OFF
:TYPE	**LINear | LOGarithmic**	Default: LINear
:CORRection		
[:STATe]	**<boolean>**	Default: OFF
:CSET		
:SELect	**NONE | USER1 | USER2 | USER3 | USER4 | USER5**	Default: NONE
:FM		
:MODE	**LOCKed | UNLocked**	Default: UNLocked
BWIDth	**MIN | MAX**	Default: MIN
EXTernal		
:IMPedance	**50 | 600 | MAX | MIN**	Default: 600
:SOURce	**EXTernal1 | EXTernal2**	Default: EXTernal1
:SENSitivity	**<numeric_value>**	Default: 1 MHz/V
:STATe	**<boolean>**	Default: OFF
:FREQuency		
[:CW | :FIXed]	**<numeric_value>**	Default: (MIN+MAX)/2
STEP		
[:INCRement]	**<numeric_value>**	Default: 0.1 GHz
CENTer	**<numeric_value>**	Default: (MIN+MAX)/2
:MODE	**CW |FIXed| SWEep[1] | SWCW | ALSW | LIST[1] | LIST2 | LIST3 | LIST4**	Default: CW
:SPAN		Default: MAX–MIN
:FULL	**<numeric_value>**	

:SOURce Subsystem Commands (2 of 3)

KEYWORD	PARAMETER FORM	NOTES
[:SOURce]		
:FREQuency		
:STARt	**<numeric_value>**	Default: MIN
:STOP	**<numeric_value>**	Default: MAX
:MULTiplier	**<numeric_value>**	Default: 1
:LIST<n>		Where: 1 ≤ **n** ≤ 4
:INDex	**<numeric_value>**	Default: 0
:FREQuency	**<numeric_value>{,<numeric_value>}**	Default: 5 Ghz
:POINts?		
:POWer	**<numeric_value>{,<numeric_value>}**	Default: 0 dBm
:POINts?		
:DWELl	**<numeric_value>**	Default: 50 ms
:STARt	**<numeric_value>**	Default: 0
:STOP	**<numeric_value>**	Default: 1999
:CALCulate		
:MARKer<n>		Where: 1 ≤ **n** ≤ 10
:AOFF		
:FREQuency	**<numeric_value>**	
:STATe	**<boolean>**	Default: OFF
:INTensity	**<boolean>**	Default: OFF
:VIDeo	**<boolean>**	Default: OFF
:POLarity	**POSitive | NEGative**	Default: POSitive
:POWer		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	**<numeric_value>**	Default: 0 dBm
:STEP		
[:INCRement]	**<numeric_value>**	Default: 0.1 dB
ALTernate	**<numeric_value>**	Default: 0 dBm
:ALC		
:SOURce	**INTernal | DIODe[1] | DIODe[2] | FIXed | PMETer[1] | PMETer[2]**	Default: INTernal
:ATTenuation	**<numeric_value>**	Default: 0 dB
:STEP		
[:INCRement]	**<numeric_value>**	Default: 10 dB
:AUTO	**<boolean>**	Default: ON
:DISPlay		
:OFFSet	**<numeric_value>**	Default: 0 dB
:STATe	**<boolean>**	Default: OFF

:SOURce Subsystem Commands (3 of 3)

KEYWORD	PARAMETER FORM	NOTES
[:SOURce]		
:POWer		
:SLOPe	**<numeric_value**	Default: 128
:STEP		
[:INCRement]	**<numeric_value>**	Default: 1
:STATe	**<boolean>**	Default: OFF
:PIVot	**<numeric_value>**	Default: 2 GHz
:MODE	**CW | FIXed | SWEep[1] | SWEep2 | ALSW | LIST[1] | LIST2 | LIST3 | LIST4**	Default: FIXed
:CENTer	**<numeric_value>**	Default: (MIN+MAX)/2
:SPAN	**<numeric_value>**	Default: (See Command)
:FULL		
:STARt	**<numeri_ value>**	Default: MIN
:STOP	**<numeric_value>**	Default: MAX
:PULM		
:INTernal		
:FREQuency	**400 Hz | 1 KHz | 7.8125 KHz | 27.8 KHz**	Default: 400 Hz
:POLarity	**NORMal | INVerted**	Default: NORMal
:SOURce	**INTernal | EXTernal1 | EXTernal2**	Default: INTernal
:STATe	**<boolean>**	Default: ON
:SWEep<n>		SWEep1 = freq sweep; SWEep2 = power sweep (see text). Default: 1
:DIRection	**UP | DOWN**	Default: UP
:GENeration	**ANAlog | STEPped**	Default: (See Command)
:DWELl	**<numeric_value>**	Default: 1 ms
:AUTO	**<boolean>**	Default: ON
:POINts	**<numeric_value>**	Default: (See Command)
[:FREQuency]		
:STEP	**<numeric_value>**	Default: 1,999,900 Hz
:POWer		
:SPACing	**LINear | LOGarithmic**	Default: LINear
:STEP	**<numeric_value>**	Default: (See Command)
:TIME	**<numeric_value>**	Default: (See Command)
:LLIMint	**<numeric_value>**	Default: 2 ms
:AUTO	**<boolean>**	Default: ON

The [:SOURce]:AM command and its subcommands comprise the AM Subsystem within the :SOURce subsystem. These commands control the Amplitude Modulation function of the 691XXB.

[:SOURce]

:AM

:LOGSens

Parameters: sensitivity (in dB/V)
Type: <NRf>
Range: 0 to 25 dB/V
Default: 3 dB/V

Description: Sets the AM sensitivity for the AM Log mode.

Query Form: [:SOURce]:AM:LOGSens?

Example: [:SOURce]:AM:LOGSens *sp* 20 dB/V
Set the AM sensitivity for the AM Log mode to 20 dB/V.

[:SOURce]:AM:LOGSens?
Requests the currently programmed AM sensitivity value for the AM Log mode.

[:SOURce]

:AM

:SENSitivity

Parameters: sensitivity (in Pct/V)
Type: <NRf>
Range: 0 to 100 %/V
Default: 50 %/V

Description: Sets the AM sensitivity for the AM Linear mode.

Query Form: [:SOURce]:AM:SENSitivity?

Example: [:SOURce]:AM:SENSitivity *sp* 80 Pct/V
Set the AM sensitivity for the AM Linear mode to 80 %/V.

[:SOURce]:AM:SENSitivity?
Requests the currently programmed AM sensitivity value for the AM Linear mode.

[:SOURce]

:AM

:EXTernal

:IMPedance

Parameters: 50 | 600 | MIN | MAX

Type: <nv>

Range: MIN = 50; MAX = 600

Default: 600

Description: Sets the input impedance of the selected (front panel or rear panel) AM IN connector. The two valid numeric values are 50 and 600 (ohms). The extended numeric values MIN or MAX may also be used.

Query Form [:SOURce]:AM:EXTernal:IMPedance?

Example: [:SOURce]:AM:EXTernal:IMPedance *sp* 600

Sets the input impedance of the selected AM IN *connector to 600 ohms.*

[:SOURce]

:AM

:SOURce

Parameters: EXTernal1 | EXTernal2

Type: <char>

Default: EXTernal1

Description: Selects either the front panel AM IN connector (EXTernal1), or the rear panel AM IN connector (EXTernal2) as the signal source for the external AM modulating signal.

Query Form [:SOURce]:AM:EXTernal:SOURce?

Example: [:SOURce]:AM:SOURce *sp* EXTernal2

Selects the rear panel AM IN *connector as the active AM modulating signal source.*

[:SOURce]

:AM

:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Enable/disable amplitude modulation of 691XXB RF output signal.

Query Form [:SOURce]:AM:STATe?

Example: [:SOURce]:AM:STATe *sp* ON

Sets AM modulation on.

[:SOURce]:AM:STATe?

Requests currently programmed AM modulation state (on/off).

[:SOURce]

:AM

:TYPE

Parameters: LINear | LOGarithmic
Type: <char>
Default: LINear

Description: Selects the AM operating mode.

Query Form [:SOURce]:AM:TYPE?

Example: [:SOURce]:AM:TYPE *sp* LOGarithmic
Selects the AM Log mode.

The [:SOURce]:CORRection command and its subcommands comprise the Correction Subsystem within the :SOURce subsystem. These commands are used to select and apply level flatness correction to the 691XXB RF output. (Refer to "Leveling Operations" in Chapter 3 of the 691XXB Synthesized Signal Generator Operation Manual.)

[:SOURce]

:CORRection

[:STATe]

Parameters: ON | OFF | 1 | 0
Type: <boolean>
Default: OFF

Description: Turns the selected user level flatness correction power-offset table on/off.

Query Form [:SOURce]:CORRection[:STATe]?

Example: [:SOURce]:CORRection:STATe *sp* ON
Turns on the selected user level correction power-offset table.

NOTE:

If :CORRection:CSET:SELect is NONE, sending the command :CORRection:STATe ON returns an error.

[:SOURce]

:CORRection

:CSET

:SELect

Parameters: NONE | USER1 | USER2 | USER3 | USER4 | USER5

Type: <char>

Default: NONE

Description: Selects the user level flatness correction power-offset table to be applied to the 691XXB output by the command [:SOURce]:CORRection:STATe ON.

Query Form [:SOURce]:CORRection:CSET:SELect?

Example: [:SOURce]:CORRection:CSET:SELect *sp* USER3

Selects user level flatness correction power-offset table #3.

The [:SOURce]:FM command and its subcommands comprise the FM Subsystem within the :SOURce subsystem. These commands control the Frequency Modulation function of the 691XXB.

[:SOURce]

:FM

:MODE

Parameters: LOCKed | UNLocked

Type: <char>

Default: UNLocked

Description: Sets the synthesis mode employed in generating the FM signal. If LOCKed is set, the YIG phase-locked loop is used in synthesizing the FM signal.

If UNLocked is set, the YIG phase-lock loop is disabled and the FM signal is obtained by applying the modulating signal to the tuning coils of the YIG-tuned oscillator.

Query Form: [:SOURce]:FM:MODE?

Example: [:SOURce]:FM:MODE *sp* LOCKed

Set the synthesis mode used to generate the FM signal to Locked.

[:SOURce]

:FM

:BWIDth

Parameters: MIN | MAX

Type: <nv>

Range: MIN = narrow mode; MAX = wide mode

Default: MIN

Description: Sets the bandwidth for the FM function to narrow (25 MHz) or wide (100 MHz).

Query Form [:SOURce]:FM:BWIDth?

Example: [:SOURce]:FM:BWIDth *sp* MAX

Set the FM function bandwidth to 50 MHz.

[:SOURce]

:FM

:EXTernal

:IMPedance

Parameters: 50 | 600 | MIN | MAX

Type: <nv>

Range: MIN = 50; MAX = 600

Default: 600

Description: Sets the input impedance of the selected (front panel or rear panel) FM IN connector. The two valid numeric values are 50 and 600 (ohms). The extended numeric values MIN or MAX may also be used.

Query Form [:SOURce]:FM:EXTernal:IMPedance?

Example: [:SOURce]:FM:EXTernal:IMPedance *sp* 600

Sets the input impedance of the selected FM IN *connector to 600 ohms.*

[:SOURce]

:FM

:SOURce

Parameters: EXTernal1 | EXTernal2

Type: <char>

Default: EXTernal1

Description: Selects either the front panel FM IN connector (EXTernal1), or the rear panel FM IN connector (EXTernal2) as the signal source for the external FM modulating signal.

Query Form [:SOURce]:FM:SOURce?

Example: [:SOURce]:FM:SOURce *sp* EXTernal2

Selects the rear panel FM IN *connector as the active FM modulating signal source.*

[:SOURce]

:FM

:SENSitivity

Parameters: sensitivity (in Hz/V)

Type: <NR1>

Range: ±10 kHz/V to ±20 MHz/V in Locked and Unlocked Narrow modes;
±100 kHz/V to ±100 MHz/V in Unlocked Wide mode

Default: 1 MHz/Volt

Description: Sets the external FM sensitivity.

Query Form [:SOURce]:FM:SENSitivity?

Example: [:SOURce]:FM:SENSitivity *sp* 20 MHZ/V
Set FM sensitivity to 20 MHz/Volt.

[:SOURce]

:FM

:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Enable/disable frequency modulation of the 691XXB RF output signal.

Query Form [:SOURce]:FM:STATe?

Example: [:SOURce]:FM:STATe *sp* ON

Sets frequency modulation on.

[:SOURce]:FM:STATe?

Requests currently programmed frequency modulation state (on/off).

The [:SOURce]:FREQuency command and its subcommands make up the Frequency Subsystem within the :SOURce subsystem. These commands control the frequency characteristics of the 691XXB.

[:SOURce]

:FREQuency

[:CW | :FIXed]

Parameters: frequency (in Hz) | UP | DOWN | MIN | MAX

Type: <nv>

Range: MIN to MAX (see notes below)

Default: (MIN + MAX) / 2

Description: Sets the RF output frequency of the 691XXB to the value entered. Parameters UP | DOWN increment/decrement the frequency by the value set by [:SOURce] :FREQuency:STEP:INCRement command.

Query Form: [:SOURce]:FREQuency[:CW]?

Examples: [:SOURce]:FREQuency:CW *sp* 3 GHZ
or: :FREQ *sp* 3 GHZ

Sets the RF output frequency of the 691XXB to 3 GHz.

[:SOURce]:FREQuency:CW?

Requests the current value of the frequency parameter.

NOTES:

Keywords :CW and :FIXed are equivalent and may be used interchangeably; they also are optional and may be omitted.

MIN ≤ frequency ≥ MAX; values for the MINimum and MAXimum frequencies for each 691XXB model are listed in the table on the following page.

The query [:SOURce]:FREQuency:CW? *sp* MAX will return the upper frequency to which the particular model 691XXB may be programmed. Similarly, the query [:SOURce]:FREQuency:CW? *sp* MIN will return the lower frequency limit.

Model 691XXB MINimum and MAXimum Frequencies

Model	MINimum	MAXimum
69117B	10 MHz	8.4 GHz
69137B	2 GHz	20 GHz
69147B	10 MHz	20 GHz
69167B	10 MHz	40 GHz
69177B	10 MHz	50 GHz
69187B	10 MHz	60 GHz
69197B	10 MHz	65 GHz

[:SOURce]

:FREQuency

[:CW | :FIXed]

:STEP

[:INCRement]

Parameters: frequency (in Hz)

Type: <NRf>

Range: 1 KHz to (MAX – MIN) (see note below)

Default: 0.1 GHz

Description: Sets the step increment size used with the :FREQuency:CW command.

Query Form: [:SOURce]:FREQuency[:CW]:STEP [:INCRement]?

Examples: [:SOURce]:FREQuency:CW:STEP :INCRement *sp* 1 MHz
or: :FREQ:STEP *sp* 1 MHz

Set the step increment value for the frequency parameter to 1 MHz.

[:SOURce]:FREQuency:CW:STEP:INCRement?
or: :FREQ:STEP?

Requests the current step increment value of the frequency parameter.

NOTE:

For 691XXBs equipped with Option 11, the minimum value for frequency step increment is 0.1 Hz. (The frequency resolution for standard models is 1.0 kHz; for models with Option 11 it is 0.1 Hz.)

[:SOURce]

:FREQuency

:CENTer

Parameters: frequency (in Hz)
Type: <NRf>
Range: MIN to MAX (See Notes)
Default: (MIN + MAX) / 2

Description: Sets the 691XXB RF output center frequency to the value entered. :CENTER and :SPAN frequencies are coupled values. Entering the value for one will cause the other to be recalculated. (See notes under :FREQuency :SPAN)

Query Form: [:SOURce]:FREQuency:CENTer?

Examples: [:SOURce]:FREQuency:CENTer *sp* 4GHZ
Set the 691XXB RF output center frequency to 4GHz.

[:SOURce]:FREQuency:CENTer?
Requests the current value of the RF output center frequency.

NOTES:

Stepped Sweep Center Range = MIN to MAX, where:
MIN = MIN + minimum step size
MAX = MAX – minumum step size

Analog Sweep Center Range = MIN to MAX, where;
MIN = MIN + (minimum analog span)/2
MAX = MAX – (minimum analog span)/2

[:SOURce]

:FREQuency

:MODE

Parameters: CW | FIXed | SWEep[1] | SWCW | ALSW | LIST[1] | LIST2 | LIST3 | LIST4

Type: <char>

Default: CW

Description: Specifies which command subsystem controls the 691XXB frequency, as follows:

CW | FIXed	=	[:SOURce]:FREQuency:CW | FIXed
SWEep[1]	=	[:SOURce]:SWEep[1] (see notes)
SWCW	=	(see notes)
ALSW	=	(see notes)
LIST<n>	=	[:SOURce]:LIST<n> (see notes)

:SWEep and :SWEep1may be used interchangeably.

Query Form: [:SOURce]:FREQuency:MODE?

Examples: [:SOURce]:FREQuency:MODE *sp* CW

Specifies that the 691XXB RF frequency output is to be controlled by [:SOURce]:FREQuency:CW | FIXed *commands.*

[:SOURce]:FREQuency:MODE?

Requests the currently selected programming mode for frequency control.

NOTES:

In SWEep[1] mode, frequency will be determined by programmed values for the following :FREQuency subsystem commands: :CENTer and :SPAN, or, :STARt and :STOP.

In LIST mode, frequency is determined by programmed values for :LIST<n>:FREQuency, where LIST<n> = LIST[1], LIST2, LIST3, or LIST4. :LIST and :LIST1 may be used interchangeably.

Setting ALSW will cause the 691XXB to do alternate sweeping when properly triggered.

Setting FIXed will return CW upon query.

Setting SWCW will set CW and turn on CW ramp, the same as the command statement :FREQuency:MODE CW;:CONTrol:RAMP ON
A query returns CW.

[:SOURce]

:FREQuency

:SPAN

Parameters: frequency (in Hz)
Type: <NRf>
Range: 1 KHz to (MAX – MIN)
Default: MAX – MIN

Description: Sets sweep span for SWEep[1] to value entered. :SPAN and :CENTer are coupled values (see notes below).

Query Form: [:SOURce]:FREQuency:SPAN?

Examples: [:SOURce]:FREQuency:SPAN *sp* 2 GHZ
or: :FREQ:SPAN *sp* 2 GHZ
Set the SWEep[1] *sweep span to 2 GHz.*

[:SOURce]:FREQuencySPAN:?
Requests the current value for SWEep[1] *sweep span.*

NOTES:

:SPA, :CENTer, :STARt, and :STOP are coupled values. Entering the value for :SPAN causes the values for :STARt and :STOP to be recalculated.

At ∗RST, :SPAN = Fmax – Fmin

[:SOURce]

:FREQuency

:SPAN

:FULL

Parameters: None

Description: Sets frequency span for SWEep[1] to (MAX – MIN) (see notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: None

Example: [:SOURce]:FREQuency:SPAN:FULL

Set the SWEep[1] *frequency span to its maximum value.*

[:SOURce]

:FREQuency

:SPAN2

Parameters: frequency (in Hz)
Type: <NRf>
Range: 1 KHz to (MAX – MIN)
Default: MAX – MIN

Description: Sets sweep span for the alternate sweep to value entered. :SPAN and :CENTer are coupled values (see notes below).

Query Form: [:SOURce]:FREQuency:SPAN2?

Examples: [:SOURce]:FREQuency:SPAN2 *sp* 2 GHZ
or: :FREQ:SPAN2 *sp* 2 GHZ
Set the sweep span for the alternate sweep to 2 GHz.

[:SOURce]:FREQuencySPAN2:?
Requests the current value of the sweep span for the alternate sweep.

NOTES:

:SPAN, :CENTer, :STARt, and :STOP are coupled values. Entering the value for :SPAN causes the values for :STARt and :STOP to be recalculated.

At ∗RST, :SPAN = Fmax – Fmin

[:SOURce]

:FREQuency

:SPAN2

:FULL

Parameters: None

Description: Sets frequency span for the alternate sweep to (MAX – MIN)
(see notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: None

Example: [:SOURce]:FREQuency:SPAN:FULL
Set the frequency span for the alternate sweep to its maximum value.

[:SOURce]

:FREQuency

:STARt

Parameters: frequency (in Hz) | MIN

Type: <nv>

Range: MIN to MAX (See Notes)

Default: MIN

Description: Sets start frequency for SWEep[1] to the value entered. (MINimum is defined in the notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: [:SOURce]:FREQuency:STARt?

Examples: [:SOURce]:FREQuency:STARt *sp* 2.5 GHZ

Set the start frequency for SWEep[1] *to 2.5 GHz .*

[:SOURce]:FREQuency:STARt?

Requests the current value for SWEep[1] *start frequency.*

NOTES:

Stepped Sweep Start Range = MIN to MAX, where:
MAX = MAX – 2 × minimum frequency step size

Analog Sweep Start Range = MIN to MAX, where;
MAX = MAX – minimum analog span

[:SOURce]

:FREQuency

:STARt2

Parameters: frequency (in Hz) | MIN

Type: <nv>

Range: MIN to MAX (See Notes)

Default: MIN

Description: Sets start frequency for the alternate sweep to the value entered. (MINimum is defined in the notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: [:SOURce]:FREQuency:STARt2?

Examples: [:SOURce]:FREQuency:STARt2 *sp* 3.5 GHZ

Set the start frequency for the alternate sweep to 3.5 GHz .

[:SOURce]:FREQuency:STARt2?

Requests the current value for the alternate sweep start frequency.

NOTES:

Stepped Sweep Start Range = MIN to MAX, where:
MAX = MAX – 2 × minimum frequency step size

Analog Sweep Start Range = MIN to MAX, where;
MAX = MAX – minimum analog span

[:SOURce]

:FREQuency

:STOP

Parameters: frequency (in Hz) | MAX

Type: <nv>

Range: MIN to MAX (See Notes)

Default: MAX

Description: Sets stop frequency for SWEep[1] to the value entered. (MAXimum is defined in the notes under [:SOURce] :FREQuency:CW | FIXed).

Query Form: [:SOURce]:FREQuency:STOP?

Examples: [:SOURce]:FREQuency:STOP *sp* 15 GHZ

Set the stop frequency for SWEep[1] *to 15 GHz.*

[:SOURce]:FREQuency:STOP?

Requests the current value for SWEep[1] *stop frequency.*

NOTES:

Stepped Sweep Stop Range = MIN to MAX, where:
MIN = MIN + 2 × minimum frequency step size

Analog Sweep Stop Range = MIN to MAX, where;
MIN = MIN + minimum analog span

[:SOURce]

:FREQuency

:STOP2

Parameters: frequency (in Hz) | MAX

Type: <nv>

Range: MIN to MAX (See Notes)

Default: MAX

Description: Sets stop frequency for the alternate sweep to the value entered. (MAXimum is defined in the notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: [:SOURce]:FREQuency:STOP2?

Examples: [:SOURce]:FREQuency:STOP2 *sp* 13 GHZ

Set the stop frequency for the alternate sweep to 13 GHz.

[:SOURce]:FREQuency:STOP2?

Requests the current value for the alternate sweep stop frequency.

NOTES:

Stepped Sweep Stop Range = MIN to MAX, where:
MIN = MIN + 2 × minimum frequency step size

Analog Sweep Stop Range = MIN to MAX, where;
MIN = MIN + minimum analog span

[:SOURce]

:FREQuency

:MULTiplier

Parameters: reference multiplier value | MIN | MAX

Type: <nv>

Range: 0.1 to 14; MIN = 0.1; MAX = 14

Default: 1

Description: Sets the value of the reference multiplier for the frequency scaling function. This command affects all entered and displayed frequencies, but does not affect the output of the instrument.

Query Form: [:SOURce]:FREQuency:MULTiplier?

Examples: [:SOURce]:FREQuency:MULTiplier *sp* 4

Set the frequency scaling reference multiplier value to 4.

[:SOURce]:FREQuency:MULTiplier?

Requests the current value for the frequency scaling reference multiplier.

NOTES:

The frequency scaling coupling equation is:
Entered/Displayed Frequency = (Hardware Frequency x Multiplier)

At ∗RST, the reference multiplier value is set to 1.

The [:SOURce]:LIST command and its subcommands comprise the List Subsystem within the :SOURce subsystem. These commands control the List Sweep function of the 691XXB (see notes below).

[:SOURce]

LIST<n> (1 ≤ **n** ≤ 4 = selected list; see notes)

:INDex

Parameters: list index number | MIN | MAX
Type: <nv>
Range: 0 to 1999; MIN = 0; MAX = 1999
Default: 0

Description: Sets index of selected list to value entered.

Query Form: [:SOURce]:LIST<n>:INDex?

Examples: [:SOURce]:LIST2:INDex sp 122
Sets list 2 index number to 122

[:SOURce]:LIST3:INDex?
Requests the currently programmed index value for list 3.

NOTES:

In list sweep mode, up to four lists (LIST[1], LIST2, LIST3, and LIST4) of 2000 non-sequential frequency/power level sets can be stored and accessed. A list index (0 thru 1999) identifies each frequency/power level set in a list. When commanded, the 691XXB generates a phase-locked stepped sweep of the active list between the specified list start index and list stop index, dwelling at each list index for the specified dwell time.

LIST[1] is the same list that is available via local (front panel) control. This list is stored in non-volatile RAM to preserve any settings sfter the signal generator is powered off.

LIST2, LIST3, and LIST4 are stored in volatile RAM and all settings are lost when power to the 691XXB is turned off. At power up, these lists are set to their default state of 2000 index entries of 5 GHz at 0 dBm.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:FREQuency

Parameter: frequency (in Hz) | MIN | MAX

Type: <nv>{,<nv>}

Range: MIN to MAX (see note below)

Default: 5 GHz

Description: Sets the list frequencies of the selected list starting at the list index specifed by :LIST<n>:INDex or at list index 0 if no list index is specified.
Any number of frequencies can follow this command.

Query Form: [:SOURce]:LIST<n>:FREQuency?

Examples:
```
[:SOURce]:LIST2:INDex sp 122
[:SOURce]:LIST2:FREQuency sp 8 GHZ,
3 GHZ, 11 GHZ
```
Sets list 2 index to 122, then sets the frequency of list index 122 to 8 GHz, list index 123 to 3 GHz, and list index 124 to 11 GH z.

```
[:SOURce]:LIST3:INDex sp 1235
[:SOURce]:LIST3:FREQuency?
```
Requests the frequency set at list 3 index 1235.

NOTE

MIN ≤ frequency ≥ MAX; values for the MINimum and MAXimum frequencies for each 691XXB model are listed in the table on page 3-43.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:FREQuency

:POINts?

Parameters Returned: number of frequency points

Type: <NR1>

Description: Querys the number of frequency points in the selected list. The number of points is 2000 and is not settable.

Query Form: [:SOURce]:LIST<n>:FREQuency:POINts?

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:POWer

Parameters: power level (in dBm) | MIN | MAX

Type: <nv>{,<nv>}

Range: MIN to MAX (see note below)

Default: 0 dBm

Description: Sets the list power levels of the selected list srarting at the list index specified by :LIST<n>:INDex or at list index 0 if no list index is specified.
Any number of power levels can follow this command.

Query Form: [:SOURce]:LIST<n>:POWer?

Examples: [:SOURce]:LIST2:INDex *sp* 122
[:SOURce]:LIST2:POWer *sp* 2 dBm, 9 dBm, –3 dBm

Sets list 2 index to 122, then sets the power level of list index 122 to 2 dBm, list index 123 to 9 dBm, and list index 124 to –3 dBm.

[:SOURce]:LIST3:INDex *sp* 1235
[:SOURce]:LIST3:POWer?

Requests the power level set at list 3 index 1235.

NOTE:

MIN ≤ power level ≥ MAX; values for MINimum and MAXimum power levels for each 691XXB model are listed in the table on page 3-72.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:POWer

:POINts?

Parameters Returned: number of power level points

Type: <NR1>

Description: Querys the number of power level points in the selected list. The number of points is 2000 and is not settable.

Query Form: [:SOURce]:LIST<n>:POWer:POINts?

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:DWELl

Parameters: dwell time (in seconds) | MIN | MAX

Type: <nv>

Range: 0 ms to 99 sec

Default: 50 ms

Description: Sets the dwell time for each step in a sweep of the selected list to the value entered.

Query Form: [:SOURce]:LIST<n>:DWELl?

Examples: [:SOURce]:LIST2:DWELl *sp* 40 MS

Set dwell time for each step in a sweep of list 2 to 40 ms.

[:SOUce]:LIST3:DWELl?

Requests the currently programmed value for list 3 sweep step dwell time.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:STARt

Parameters: list index number | MIN | MAX

Type: <nv>

Range: 0 to 1999; MIN = 0; MAX = 1999

Default: 0

Description: Sets list start index for a sweep of the selected list to the value entered.

Query Form: [:SOURce]:LIST<n>:STARt?

Examples: [:SOURce]:LIST2:STARt *sp* 85

Set the list start index for a sweep of list 2 to 85.

[:SOURce]:LIST3:STARt?

Requests the currently programmed value for the list start index for a sweep of list 3.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = selected list)

:STOP

Parameters: list index number | MIN | MAX

Type: <nv>

Range: 0 to 1999; MIN = 0; MAX = 1999

Default: 1999

Description: Sets list stop index for a sweep of the selected list to the value entered.

Query Form: [:SOURce]:LIST<n>:STOP?

Examples: [:SOURce]:LIST2:STOP *sp* 1385

Set the list stop index for a sweep of list 2 to 1385.

[:SOURce]:LIST3:STOP?

Requests the currently programmed value for the list stop index for a sweep of list 3.

[:SOURce]

:LIST<n> (1 ≤ **n** ≤ 4 = active list)

:CALCulate

Parameters: None

Description: Performs all the calculations necessary to set the frequencies and power levels for the active list (see notes below).

Query Form: None

Example: [:SOURce]:FREQuency:MODE sp LIST2
[:SOURce]:LIST2:CALCulate
Performs the calculations to set the frequencies and power levels for list 2.

NOTES:

Durnig initial sweep of the active list, the 691XXB performs calculations to set the frequencies and power levels. This causes the initial list sweep to take longer than each subsequent sweep. The command, [:SOURce]:LIST<n>:CALCulate (where n = active list), examines every index in the active list and performs all the calculations necessary to set the frequencies and power levels. This lets the initial list sweep be as fast as each subsequent sweep.

The list calculations are for the current index entries of the active list only. Any changes to the index entries of the active list or the selection of a different active list requires the calculations to be performed again.

The calculations are stored only in volatile RAM and are lost when power to the 691XXB is turned off.

The [:SOURce]:MARKer command and its subcommands comprise the Marker Subsystem within the :SOURce subsystem. These commands control the Frequency Marker function of the 691XXB.

[:SOURce]

:MARKer<n> (see note)

:AOFF

Parameters: None

Description: Turns *all* markers off. This command is an event, therefore there is no data parameter and no query form.

Query Form: None

Examples: [:SOURce]:MARKer:AOFF
Turn all markers off.

NOTE:

A numeric suffix <n> may be appended to any of the MARKer command headers. This specifies which of the 10 markers (1 to 10) is being altered by the command. In some cases, the command function is global to all 10 markers, such as the command :MARKers<n>:AOFF (all markers off). In these cases, the <n> in the command header is ignored.

[:SOURce]

:MARKer<n> (1 ≤ **n** ≤ 10 = selected marker; see notes)

:FREQuency

Parameters: frequency (in Hz) | MIN | MAX

Type: <nv>

Range: MIN to MAX

Default: See default values in notes below

Description: Sets frequency of selected marker to value entered. (MINimum and MAXimum are defined in the notes under [:SOURce]:FREQuency:CW | FIXed).

Query Form: [:SOURce]:MARKer<n>:FREQuency?

Examples: [:SOURce]:MARKer3:FREQuency *sp* 2 GHZ

Set the frequency of marker #3 to 2 GHz.

[:SOURce]:MARKer5:FREQuency?

Requests the current frequency value of marker #5.

NOTES:

:MARKer (or :MARK) is equivalent to :MARKer1 (or :MARK1).

When 691XXB is powered up, or when ∗RST command is issued: markers 1 – 10 are set to their default frequency values as follows:

MARKER:	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
FREQ (GHz):	2.0	8.4	2.0	5.0	8.0	8.4	8.4	8.4	8.4	3.5

Marker 10 accesses what is displayed as Marker 0 on the 691XXB front panel data display.

[:SOURce]

:MARKer<n> (1 ≤ **n** ≤ 10 = selected marker)

:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Turns selected marker on/off (tags/untags the selected marker).

Query Form: [:SOURce]:MARKer<n>:STATe?

Examples: [:SOURce]:MARKer4:STATe *sp* ON

Turn marker #4 on.

[:SOURce]:MARKer7:STATe?

Requests current state of marker #7.

[:SOURce]

:MARKer<n>

:INTensity

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Turns intensity markers on/off. Intensity markers are available only in analog sweep frequency mode; i.e. only with :SWEep[1] mode of operation (refer to :FREQuency: MODE command). For further information about frequency markers, refer to Frequency Markers in Chapter 3 of the Series 691XXB Synthesized Signal Generator Operation Manual.

Query Form: [:SOURce]:MARKer:INTensity?

Examples: [:SOURce]:MARKer:INTensity *sp* ON

Turns on intensity markers. Turns off video markers if previously active.

NOTE:

[:SOURce]:MARKer:INTensity and [:SOURce]:MARKer:VIDeo are mutually exclusive commands. That is, turning on one turns the other off. Turning both off turns off all markers.

[:SOURce]

:MARKer<n>

:VIDeo

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Turns video markers on/off. Video markers are available in both analog and step sweep frequency mode. For further information about frequency markers, refer to Frequency Markers in Chapter 3 of the Series 691XXB Synthesized Signal Generator Operation Manual.

Query Form: [:SOURce]:MARKer:VIDeo?

Examples: [:SOURce]:MARKer:VIDeo *sp* ON

Turns on video markers. Turns off intensity markers if previously active.

NOTE:

[:SOURce]:MARKer:INTensity and [:SOURce]:MARKer:VIDeo are mutually exclusive commands. That is, turning on one turns the other off. Turning both off turns off all markers.

[:SOURce]

:MARKer<n>

:POLarity

Parameters: POSitive | NEGative

Type: <char>

Default: POSitive

Description: Selects +5V or –5V pulse output for each video marker as follows:
POSitive selects a +5V pulse output for each marker.
NEGative selects a –5V pulse output for each marker.
This command is active *only* in the video marker mode (see :MARKer :VIDeo command).

Query Form: [:SOURce]:MARKer:POLarity?

Examples: [:SOURce]:MARKer:POLarity *sp* NEGative
Specifies –5V pulse output for each video marker.

[:SOURce]:MARKer:POLarity?
Requests current polarity of the pulse output for each video marker.

The [:SOURce]:POWer command and its subcommands comprise the Power Subsystem within the :SOURce subsystem. These commands control the RF power output level of the 691XXB.

[:SOURce]

:POWer

[:LEVel]

[:IMMediate]

[:AMPLitude]

Parameters: power level (in dBm) | UP | DOWN | MIN | MAX

Type: <nv>

Range: MIN to MAX (see notes below)

Default: 0 dBm

Description: Sets the power output level of the unswept RF output signal (see notes below).

Query Form: [:SOURce]:POWer[:LEVel][:IMMediate] [:AMPLitude]?

Examples: [:SOURce]:POWer:LEVel:IMMediate :AMPLitude *sp* 10 dBm

Sets the RFpower output level to +10 dBm.

[:SOURce]:POWer:LEVel:IMMediate :AMPLitude?

Requests the value currently programmed for the 691XXB RF power output.

[:SOURce]:POWer? MAX

Requests the maximum RF power output value that can be programmed for the particular 691XXB model.

NOTES:

The MINimum and MAXimum RF output power levels that can be entered for each 691XXB model are listed in the table on the following page. Note that these power levels are the limits of what can be entered, but *do not guarantee leveled operation*.

For units equipped with an attenuator (Option 02), changes in RF power output level >10 dB may change attenuator setting (see command [:SOURce]:POWer:ATTenuation:AUTO).

Use related command :OUTPut[:STATe] *sp* ON | OFF to turn the 691XXB RF power output on/off.

Model 691XXB MINimum and MAXimum Power Levels

Model	W/O Step Attenuator ①		W/ Step Attenuator (Option 2) ②	
	MINimum	MAXimum	MINimum	MAXimum
69117B	–20 dBm	+20 dBm	–130 dBm	+20 dBm
69137B	–20 dBm	+20 dBm	–130 dBm	+20 dBm
69147B	–20 dBm	+20 dBm	–130 dBm	+20 dBm
69167B	–20 dBm	+20 dBm	–130 dBm	+20 dBm
With Option 15A (High Power) Installed				
69117B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69137B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69147B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69167B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69177B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69187B	–10 dBm	+30 dBm	–120 dBm	+30 dBm
69197B	–10 dBm	+30 dBm	Not Available	

① or units with a step attenuator (Option 2) and :POWer:ATTenuation:AUTO OFF

② :POWer:ATTenuation:AUTO ON

[:SOURce]

:POWer

[:LEVel]

[:IMMediate]

[:AMPLitude]

:STEP

[:INCRement]

Parameters: power level (in dB)

Type: <NRf>

Range: Model dependent (see notes below)

Default: 0.1 dB

Description: Sets the step increment size used with the :POWer:LEVel:IMMediate:AMPLitude command.

Query Form: [:SOURce]:POWer[:LEVel][:IMMediate] [:AMPLitude]:STEP[:INCRement]?

Examples: [:SOURce]:POWer:LEVel:IMMediate :AMPLitude:STEP:INCRement *sp* 5 dBm

Set the step increment value for RF power output level parameter to 5 dBm.

[:SOURce]:POWer:LEVel:IMMediate :AMPLitude:STEP:INCRement?

Requests the current step increment value for the RF power output parameter.

NOTES:

For standard 691XXB models, a maximum step size up to 33 dB may be used (up to 149 dB for models with option 2 step attenuator). For 691XXB models with option 15A, a maximum step size up to 27 dB can be used (up to 141 dB with option 2 step attenuator). However, the step size, in conjunction with the initial RF power output setting, must not produce a programmed power level below the minimum leveled output power for the particular 691XXB model. Refer to Appendix B — Performance Specifications — in the Series 691XXB Synthesized Signal Generator Operation Manual.

[:SOURce]

:POWer

[:LEVel]

:ALTernate

Parameters: power level (in dBm) | MIN | MAX

Type: <nv>

Range: MIN to MAX (see notes below)

Default: 0 dBm

Description: Sets the power output level for the alternate sweep if the command :POWer:MODE ALSW is set.

Query Form: [:SOURce]:POWer[:LEVel]:ALTernate?

Examples: [:SOURce]:POWer:LEVel:ALTernate *sp* 5 dBm

Sets the RF power level for the alternate sweep to +5 dBm.

[:SOURce]:POWer:LEVel:ALTernate?

Requests the currently programmed value for the alternate sweep.

NOTES:

The MINimum and MAXimum RF output power levels that can be entered for each 691XXB model are listed in the table on page 3-72. Note that these power levels are the limits of what can be entered, but *do not guarantee leveled operation*.

For units equipped with an attenuator (Option 02), changes in RF power output level >10 dB may change attenuator setting (see command [:SOURce]:POWer:ATTenuation:AUTO).

Use related command :OUTPut[:STATe] *sp* ON | OFF to turn the 691XXB RF power output on/off.

[:SOURce]

:POWer

:ALC

:SOURce

Parameters: INTernal | DIODe[1] | DIODe2 | PMETer[1] | PMETer2 | FIXed

Type: <char>

Default: INTernal

Description: Selects (1) whether the ALC loop controls the output power level and (2) the source of the feedback signal for the ALC.

FIXed places the instrument in a fixed gain power level mode (ALC off). RF output power is unleveled; use the [:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] command to set the output power to the desired level.

The other parameters turn on the ALC function and select the source of the ALC feedback signal. INTernal specifies the ALC feedback signal from the instrument's internal level detector. The remaining parameter choices select an external detector or power meter signal as the feedback signal source for the ALC, as follows:

DIODe[1]	=	Detector output connected to the front panel EXTERNAL ALC input
PMETer[1]	=	Power Meter output connected to the front panel EXTERNAL ALC input
DIODe2	=	Detector output connected to the rear panel EXT ALC IN input
PMETer2	=	Power Meter output connected to the rear panel EXT ALC IN input

Query Form: [:SOURce]:POWer:ALC:SOURce?

Examples: [:SOURce]:POWer:ALC:SOURce *sp* PMETer2

Select external power meter output connected to the rear panel EXT ALC IN *input as the feedback signal for the ALC.*

[:SOURce]?:POWer:ALC:SOURce?

Requests the currently programmed source of the feedback signal for the ALC.

[:SOURce]

:POWer

:ATTenuation

Parameters: attenuation (in dB) | UP | DOWN | MIN | MAX

Type: <nv>

Range: 0 – 110 dB (0 - 90 dB for 69177B and 69187B models)

Default: 0 dB

Description: *This command applies only to 691XXBs equipped with an internal step attenuator (Option 02).* This command sets the step attenuator (in 10 dB steps) throughout its 110 dB range (90 dB range for 69177B and 69187B models); see notes below.

This command decouples the step attenuator from the automatic leveling control (ALC) system (see the command :POWer:ATTenuation:AUTO OFF).

Query Form: [:SOURce]:POWer:ATTenuation?

Examples: [:SOURce]:POWer:ATTenuation *sp* 100

Sets the 691XXB step attenuator setting to 100 dB.

[:SOURce]:POWer:ATTenuation?

Requests the currently programmed value for the step attenuator setting.

WARNING

If POWer:ATTenuation:AUTO was set ON, the command POWer:ATTenuation <arg> will momentarily set output power and attenuation to 0 before going to the programmed attenuation. If this could possibly damage equipment, set :OUTput[:STATe] OFF before issuing this command.

NOTES:

Values entered for the parameter must be exact multiples of 10 db.Parameters UP and DOWN can be used to increase/decrease the step attenuator setting in 10 dB steps.
MIN = 0 dB attenuation, MAX = 110 dB attenuation.

If the 691XXB does not have a step attenuator installed, sending this command will result in –241,"Hardware missing;Attenuator" .

[:SOURce]

:POWer

:ATTenuation

:STEP

[:INCRement]

Parameters: attenuator step increment size (in dB)

Type: <NR1>

Range: 0 dB | 10 dB

Default: 10 dB

Description: Sets the attenuator step increment size used with the :POWer:ATTenuation command. The step size can only be set to 0 dB or 10 dB.

Query Form: [:SOURce]:POWer:ATTenuation:STEP [:INCRement]?

Examples: [:SOURce]:POWer:ATTenuation:STEP :INCRement *sp* 10

Sets the step increment value to 10 dB.

[:SOURce]:POWer:ATTenuation:STEP :INCRement?

Requests the current step increment size for the step attenuator.

[:SOURce]

:POWer

:ATTenuation

:AUTO

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: *This command applies only to 691XXBs equipped with an internal step attenuator (Option 02).* Setting to ON couples the step attenuator to the ALC system; setting to OFF decouples the step attenuator from the ALC system.

Query Form: [:SOURce]:POWer:ATTenuation:AUTO?

Examples: [:SOURce]:POWer:ATTenuation:AUTO *sp* ON

Couple the step attenuator to the ALC system.

[:SOURce]:POWer:ATTenuation:AUTO?

Requests the currently programmed coupling state for the step attenuator.

WARNING

POWer:ATTenuation:AUTO OFF/ON sets the output power and attenuation to 0. If this could possibly damage equipment, set :OUTput[:STATe] OFF before issuing this command.

NOTES:

In 691XXBs without a step attenuator, this command's value is always OFF. Attempting to set it ON results in the error message –241,"Hardware missing;Attenuator".

[:SOURce]

:POWer

:DISPlay

:OFFSet

Parameters: power level display offset (in dB)

Type: <NRf>

Range: –100.00 to +100.00 dB

Default: 0 dB

Description: Sets the offset value for the power level display offset function (see :POWer:DISPlay:OFFSet:STATe).

Query Form: [:SOURce]:POWer:DISPlay:OFFSet?

Examples: [:SOURce]:POWer:DISPlay:OFFSet *sp* 10 dB

Sets the power level display offset value to +10 dB.

[:SOURce]:POWer:DISPlay:OFFSet?

Requests the current power level display offset value.

[:SOURce]
:POWer
:DISPlay
:OFFSet
:STATe

Parameters: ON | OFF | 1 | 0
Type: <boolean>
Default: OFF

Description: Turns the power display offset function on/off. When the function it turned on, the offset value, set by the command :POWer:DISPlay:OFFSet <arg>, is added to the displayed RF output power level. A negative offset value decreases the displayed power level.

Query Form: [:SOURce]:POWer:DISPlay:OFFSet:STATe?

Examples: [:SOURce]:POWer:DISPlay:OFFSet :STATe *sp* ON

Turns on the power display offset function.

[:SOURce]:POWer:DISPlay:OFFSet:STATe?

Requests the current state of the power display offset function.

[:SOURce]

:POWer

:SLOPe

Parameters: slope characteristic value | UP | DOWN | MIN | MAX | DEF

Type: <nv>

Range: 0 to 255; MIN = 0; MAX = 255

Default: 128

Description: Sets the value of the slope characteristic parameter for the ALC power slope function (refer to "Leveling Operations" in Chapter 3 of the 691XXB Operation Manual). This parameter is a relative number that defines the slope characteristic; a value of 128 produces a 0 dB/V slope.

Parameters UP | DOWN increment/decrement the characteristic parameter by the value set by the [:SOURce]:POWer:SLOPe:STEP[:INCRement] command.

Query Form: [:SOURce]:POWer:SLOPe?

Examples: [:SOURce]:POWer:SLOPe *sp* 140

Sets the value of the slope characteristic for the power slope function to 140.

[:SOURce]:POWer:SLOPe?

Requests the current value of the slope characteristic for the power slope function.

[:SOURce]
:POWer
:SLOPe
:STEP
[:INCRement]

Parameters: slope step increment size
Type: <NR1>
Range: 0 to 255
Default: 1

Description: Sets the step increment size used with the :POWer :SLOPe command (ALC power slope function).

Query Form: [:SOURce]:POWer:SLOPe:STEP[:INCRement]?

Examples: [:SOURce]:POWer:SLOPe:STEP :INCRement *sp* 5

Sets the step increment size to 5 for the ALC power slope function parameter.

[:SOURce]:POWer:SLOPe:STEP:INCRement?

Requests the current step increment size for the ALC power slope parameter.

[:SOURce]

:POWer

:SLOPe

:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: OFF

Description: Turns ALC power slope function on/off (refer to "Leveling Operations" in Chapter 3 of the 691XXB Synthesized Signal Generator Operation Manual).

Query Form: [:SOURce]:POWer:SLOPe:STATe?

Examples: [:SOURce]:POWer:SLOPe:STATe *sp* ON

Turns the ALC power slope function on.

[:SOURce]

:POWer

:SLOPe

:PIVot

Parameters: frequency (in Hz)

Type: <NR1>

Range: Frequency range of the 691XXB model

Default: 2 GHz

Description: Sets the frequency where the ALC power slope function correction is zero (pivot point). The frequency range for this function is model dependent (see notes under [:SOURce]:FREQuency[:CW | :FIXed]).

Query Form: [:SOURce]:POWer:SLOPe:PIVot?

Examples: [:SOURce]:POWer:SLOPe:PIVot *sp* 5 GHZ

Sets the ALC power slope function pivot point to 5 GHz.

[:SOURce]

:POWer

:MODE

Parameters: CW | FIXed | SWEep[1] | SWEep2 | ALSW | LIST[1] | LIST2 | LIST3 | LIST4

Type: <char>

Default: FIXed

Description: Specifies which set of commands controls the 691XXB RF output power level determining function, as follows:

CW | FIXed	=	[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]
SWEep[1]	=	[:SOURce]:SWEep[1] (see notes)
SWEep2	=	[:SOURce]:SWEep2 (see notes)
ALSW	=	[:SOURce]:POWer[:LEVel]:ALTernate
LIST<n>	=	[:SOURce]:LIST<n> (see notes)

Query Form: [:SOURce]:POWer:MODE?

Examples: [:SOURce]:POWer:MODE *sp* CW

Specifies that the 691XXB RF output power level is to be controlled by [:SOURce]:POWer:CW | FIXed *commands.*

[:SOURce]:POWer:MODE?

Requests the currently selected programming mode for RF output power level control.

NOTES:

In SWEep[1] and SWEep2 modes, RF output power level is determined by programmed values for the following :POWer subsystem commands: :CENTer and :SPAN, or, :STARt and :STOP.

In LIST mode, RF output power level is determined by programmed values for :LIST<n>:POWer where LIST<n> is LIST[1], LIST2, LIST3, or LIST4. :LIST or :LIST1 may be used interchangeably.

When [:SOURce]:POWer:Mode is set to CW, the query [:SOURce]:POWer:MODE? will return FIXed.

[:SOURce]

:POWer

:CENTer

Parameters: power level (in dBm)
Type: <NRf>
Range: MIN to MAX (see notes below)
Default: (MIN + MAX) / 2

Description: Sets the RF output power level at the center of the power sweep to the value entered. See notes below.

Query Form: [:SOURce]:POWer:CENTer?

Examples: [:SOURce]:POWer:CENTer *sp* –20 dBm

Set the RF output power level at the center of the power sweep span to –20 dBm.

[:SOURce]:POWer:CENTer?

Requests the currently programmed value for the RF output power level at the center of the power sweep span.

NOTES:

The MINimum and MAXimum RF output power levels that can be entered for each 691XXB model are listed in the table on page 3-72. Note that these power levels are the limits of what can be entered, but *do not guarantee leveled operation*.

:CENTer and :SPAN are coupled values. Setting the value for one will cause the other to be recalculated. See notes for the command :POWer:SPAN.

[:SOURce]

:POWer

:SPAN

Parameters: power level (in dBm)

Type: <NRf>

Range: MIN to MAX (see text).

Default: Leveled power span of the instrument

Description: Sets sweep span for power sweep to value entered. See notes below.

Query Form: [:SOURce]:POWer:SPAN?

Examples: [:SOURce]:POWer:SPAN *sp* 10 dBm

Set the power sweep span to 10 dBm.

[:SOURce]:POWer:SPAN:?

Requests the current value for power sweep span.

NOTES:

:SPAN, :CENTer, :STARt, and :STOP are coupled values. Entering the value for :SPAN cause the values for :STARt and :STOP to be recalculated.

When the 691XXB is powered up, or when ∗RST command is issued, :SPAN is set to the leveled power span of the instrument, and :CENTer is set to (MIN + MAX) / 2.

The MINimum and MAXimum RF output power levels that can be entered for each 691XXB model are listed in the table on page 3-72. Note that these power levels are the limits of what can be entered, but *do not guarantee leveled operation*.

[:SOURce]
:POWer
:SPAN
:FULL

Parameters: None

Description: Sets the power sweep span to (MAX – MIN). See notes under :POWer:SPAN command.

Query Form: None

Example: [:SOURce]:POWer:SPAN:FULL
Set the power sweep span to its maximum value.

[:SOURce]

:POWer

:STARt

Parameters: power level (in dBm) | MIN

Type: <nv>

Range: MIN to MAX

Default: MIN

Description: Sets start RF output power level for the power sweep to the value entered. See notes under :POWer:SPAN command.

Query Form: [:SOURce]:POWer:STARt?

Examples: [:SOURce]:POWer:STARt *sp* –10 dBm

Set the start RF output power level for the power sweep to –10 dBm.

[:SOURce]:POWer:STARt?

Requests the currently programmed start RF output power level for the power sweep.

[:SOURce]
:POWer
:STOP

Parameters: power level (in dBm) | MAX
Type: <nv>
Range: MIN to MAX
Default: MAX

Description: Sets stop RF output power level for the power sweep to the value entered. See notes under :POWer:SPAN command.

Query Form: [:SOURce]:POWer:STOP?

Examples: [:SOURce]:POWer:STOP *sp* 10 dBm

Set the stop RF output power level for the power sweep to +10 dBm.

[:SOURce]:POWer:STOP?

Requests the currently programmed stop RF output power level for the power sweep.

The [:SOURce]:PULM command and its subcommands make up the Pulse Modulation Subsystem within the :SOURce subsystem. These commands control the square wave (pulse) modulation function of the 691XXB.

[:SOURce]

:PULM

:INTernal

:FREQuency

Parameters: 400 HZ | 1 KHZ | 7.8125 KHZ | 27.8 KHZ

Type: <nv>

Default: 400 HZ

Description: Selects the frequency of the internal square wave modulation signal.

Query Form: [:SOURce]:PULM:INTernal:FREQuency?

Examples: [:SOURce]:PULM:INTernal:FREQuency *sp* 27.8 KHZ

Selects 27.8 kHz as the frequency of the internal square wave modulation signal.

[:SOURce]:PULM:INTernal:FREQuency?

Requests the value currently programmed for the internal square wave modulation signal frequency.

NOTES:

The parameter value used with this command must be be one of the frequency values shown above.

[:SOURce]

:PULM

:POLarity

Parameters: NORMal | INVerted

Type: <char>

Default: NORMal

Description: Sets the input signal polarity sense for the front and rear panel square wave modulation input signal connectors (⌐└IN) as follows:

NORMal specifies positive-true operation; a TTL high level will turn on the RF output signal

INVerted specifies negative-true operation; a TTL low level will turn on the RF output signal

Query Form: [:SOURce]:PULM:POLarity?

Examples: [:SOURce]:PULM:POLarity *sp* INVerted

Sets the input signal polarity sense for the front and rear panel square wave modulation inputs to negative-true.

[:SOURce]:PULM:POLarity?

Requests currently programmed polarity sense of front and rear panel square wave modulation input signal connectors.

[:SOURce]

:PULM

:SOURce

Parameters: INTernal | EXTernal1 | EXTernal2

Type: <char>

Default: INTernal

Description: Selects the square wave (pulse) modulation signal source, as follows:
INTernal selects the internal square wave modulation signal
EXTernal1 selects the front panel modulation input signal (see note)
EXTernal2 selects the rear panel modulation input signal (see note)

Query Form: [:SOURce]:PULM:SOURce?

Examples: [:SOURce]:PULM:SOURce *sp* EXTernal2

Selects the rear panel square wave modulation input as the modulation signal source.

[:SOURce]:PULM:SOURce?

Requests the currently programmed signal source for square wave modulation.

NOTES:

When external modulation is used, the modulating signal may be either a square wave or a pulse waveform (TTL compatible). Refer to Appendix B — Performance Specifications — in the Series 691XXB Synthesized Signal Generator Operation Manual.

[:SOURce]

:PULM

:STATe

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: Turns the 691XXB square wave (pulse) modulation function on/off.

Query Form: [:SOURce]:PULM:STATe?

Examples: [:SOURce]:PULM:STATe *sp* OFF

Turns off the 691XXB square wave modulation function.

[:SOURce]:PULM:STATe?

Requests the currently programmed state for the square wave modulation function.

The [:SOURce]:SWEep command and its subcommands comprise the Sweep Subsystem within the :SOURce subsystem. These commands control the standard stepped and analog frequency sweep functions and the step power level sweep function of the 691XXB.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2; see note)

:DIRection

Parameters: UP | DOWN
Type: <char>
Default: UP

Description: Selects the direction of sweep, in the power level sweep mode only. (Sweep direction is always in the UP direction for frequency sweeps.)

Query Form: [:SOURce]:SWEep:DIRection?

Examples: [:SOURce]:SWEep:DIRection *sp* DOWN
Set the power level sweep from a high level to a low level.

[:SOURce]:SWEep:DIRection?
Requests the currently programmed sweep direction.

NOTE:

:SWEep1 (or :SWEep) signifies frequency sweep; :SWEep2 signifies power sweep.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:GENeration

Parameters: ANALog | STEPped

Type: <char>

Default: SWEep1 is ANALog; SWEep2 is STEPped

Description: Selects between analog and stepped frequency sweeps, in the SWEep[1] (frequency sweep) mode only.

Query Form: [:SOURce]:SWEep:GENeration?

Examples: [:SOURce]:SWEep:GENeration *sp* ANAlog

Set SWEep[1] *for analog frequency sweep.*

[:SOURce]:SWEep:GENeration?

Requests the currently programmed frequency sweep mode.

NOTE:

SWEep2 (power level sweeps) are *always* stepped sweeps.

Sweep Mode Compatibility and Action Chart

Mode		Sweep		Frequency Action	Power Action
:FREQ	:POW	:SWE:GEN	:SWE2:GEN		
CW	FIX	x	x	CW, F1	Fixed, L0
SWCW	FIX	x	x	CW, F1, Ramp on	Fixed, L0
SWE	FIX	ANAL	x	Analog Sweep, F1-F2	Fixed, L0
SWE	FIX	STEP	x	Stepped Sweep, F1-F2	Fixed, L0
SWE	SWE	STEP	x	Stepped Sweep F1-F2 :SWE:POINts :SWE:STEP	Step Power after each Freq Sweep L1-L2 :SWE:POINts :SWE:POW:STEP
SWE	SWE2	ANAL	STEP	Analog Sweep F1-F2	Step Power after each Freq Sweep L1-L2 :SWE2:POINts :SWE2:POW:STEP
SWE	SWE2	STEP	STEP	Stepped Sweep F1-F2 :SWE:POINts :SWE:STEP	Step Power after each Freq Sweep L1-L2 :SWE2:POINts :SWE2:POW:STEP
CW	SWE	STEP	x	CW, F0	Step Power Sweep L1-L2
SWCW	SWE	STEP	x	CW, F0, Ramp on	Step Power Sweep L1-L2
CW	SWE2	x	STEP	CW, F0	Step Power Sweep L1-L2
SWCW	SWE2	x	STEP	CW, F0, Ramp on	Step Power Sweep L1-L2
ALSW	FIX	x	x	Alternate X Sweep F1-F2 F3-F4	Fixed L0 Trigger n L0 Trigger n+1
ALSW	ALSW	ANAL	x	Alternate Analog Sweep F1-F2 F3-F4	Alternate values L0 Trigger n L1 Trigger n+1
ALSW	ALSW	STEP	x	Alternate Stepped Sweep F1-F2 F3-F4	Alternate values L0 Trigger n L1 Trigger n+1

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:DWELl

Parameters: dwell time (in seconds) | MIN | MAX

Type: <nv>

Range: 1 ms to 99 sec

Default: 1 ms

Description: Sets the dwell time for each step in a stepped frequency sweep or power level sweep to the value entered. See notes below.

Query Form: [:SOURce]:SWEep:DWELl?

Examples: [:SOURce]:SWEep:DWELl *sp* 100 MS

Set dwell time for each step in the sweep to 100 milliseconds.

[:SOURce]:SWEep:DWELl?

Requests the currently programmed value for sweep step dwell time.

NOTES:

The value entered for dwell time cannot be less than :TIME/:POINts.

When encountered, the command :SWEep:DWELl <arg> command sets :SWEep:DWELl:AUTO to off.

Interaction between Dwell, Sweep Time, and Points

:SWEep:XXXX:AUTO switches		Interaction
:DWELl	**:TIME**	
OFF	OFF	No coupling between :SWEep:DWELl, :SWEep:TIME, and :SWEep:POINts.
OFF	ON	:SWEep:TIME is always set to the minimum value that is compatible with other settings, as follows: If :SWEep:GENeration ANALog, then :SWEep:TIME = the larger of :SWEep:TIME:LLIMit or 30 ms If :SWEep:GENeration STEPped, then :SWEep:TIME = (:DWELl × :POINts)
ON	OFF	When :SWEep:TIME or :SWEep:POINts are changed, :SWEep:DWELl is set to the larger of (:DWELl = :TIME/:POINts) or :DWELl Min.
ON	ON	:SWEep:TIME is always set to minimum. In stepped sweep mode, :SWEep:DWELl is adjusted to its minimum value, then :SWEep:TIME is computed. If :SWEep:GENerator ANALog, then :SWEep:TIME = the larger of :SWEep:TIME:LLIMit or 30 ms SWEep:DWELl is unaffected by changes in :TIME or:POINts If :SWEep:GENerator STEPped, then :SWEep:DWELl = :DWELl Min (the larger of .001 or :TIME:LLIMit/:POINts) :SWEep:TIME = :DWELl Min × :POINts

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:DWELl

:AUTO

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: ON signifies that :DWELl ≈ :TIME/:POINts. See note below.

Query Form: [:SOURce]:SWEep:DWELl:AUTO?

Examples: [:SOURce]:SWEep:DWELl:AUTO *sp* ON

Set :SWEep:DWELl *to its default value.*

[:SOURce]:SWEep:DWELl:AUTO?

Requests the currently programmed :SWEep:DWELl *setting (on/off).*

NOTES:

:DWELl = (:TIME/:POINts – internal settling time)

:DWELl, :SPAN, :TIME, :STEP, and :POINts are all interrelated. Entering too large a value for :DWELl may invalidate the setting for :TIME.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:POINts

Parameters: number of points | MIN | MAX

Type: <nv>

Range: 2 to 10,001 (MAXimum) for Stepped Frequency sweeps

Default: 10,001 for SWEep1
The default value for SWEep2 depends on the power range of the particular 691XXB model (see notes).

Description: Sets the number of points in each sweep in the stepped frequency sweep or power level sweep to the value entered. See notes below.

Query Form: [:SOURce]:SWEep:POINts?

Examples: [:SOURce]:SWEep:POINts *sp* 500
Set the number of points for each sweep to 500.

[:SOURce]:SWEep:POINts?
Requests the currently programmed value for points/sweep.

NOTES:

The default values for SWEep2 points and time are set up to give the maximum number of points at the minimum step size for the particular 691XXB model. The default values are dependent on the instrument's available power range.

:POINts and :STEP are coupled values. Entering the value for one will cause the other to be recalculated, per formula below. Entering a new value for either parameter will not change :SPAN.

:POINts = (:SPAN/:STEP) + 1

An error will be generated if the :POINts value entered results in a step size (1) less than 1 kHz (or 0.1 Hz for models with Option 11) for a stepped frequency sweep or (2) less than 0.01 dB for a power level sweep.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 1)

[:FREQuency]

:STEP

Parameters: frequency (in Hz) | MIN | MAX

Type: <nv>

Range: (see notes below)

Default: $\frac{\text{MAX} - \text{MIN}}{10{,}000}$

Description: Sets the step size for each step in SWEep[1] (frequency) linear stepped sweep to the value entered. See notes below.

Query Form: [:SOURce]:SWEep:FREQuency:STEP?

Examples: [:SOURce]:SWEep:FREQuency:STEP *sp* 5 GHz

Set the step size for each step in the linear stepped frequency sweep to 5 GHz.

[:SOURce]:SWEep:FREQuency:STEP?

Requests the currently programmed step size for each step in the linear stepped frequency sweep.

NOTES:

:SWEep2 is not valid for this command; only :SWEep[1] will be recognized.

This parameter is not used if :SWEep:SPACing is LOGarithmic.

:POINts and :STEP are coupled values. Entering the value for one will cause the other to be recalculated; see notes under :SWEep:POINts command.

The maximum frequency sweep step size is equal to maximum frequency span for the particular 691XXB model/(minimum points – 1). For the model 69147B with option 11 (0.1 Hz Frequency Resolution), the minimum step size is 0.1 Hz and the maximum step size is 19,990,000,000 Hz.

Refer to notes under :FREQuency:CW | :FIXed command for the frequency span values for each 691XXB model.

An error will be generated if the :STEP size value entered exceeds the value for :SPAN.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:POWer

:STEP

Parameters: power level (in dB) | MIN | MAX

Type: <nv>

Range: MINimum = 0.01 dB
MAXimum is model dependent (see notes below)

Default: 0.01 dB for SWEep1
0.02 dB for SWEep2

Description: Sets the step size for each step in a power level sweep to the value entered. See notes below.

Query Form: [:SOURce]:SWEep<n>:POWer:STEP?

Examples: [:SOURce]:SWEep2:POWer:STEP *sp* 10 dB

Set the step size for each step in the SWEep2 *power level sweep to 10 dB.*

[:SOURce]:SWEep2:POWer:STEP?

Requests the currently programmed step size for each step in the SWEep2 *power level sweep.*

NOTES:

:STEP and :POINts are coupled values. Entering the value for one will cause the other to be recalculated; see notes under :SWEep:POINts command.

For standard 691XXB models, a maximum step size up to 33 dB may be used (up to 149 dB for models with option 2 step attenuator). For 691XXB models with option 15A, a maximum step size up to 27 dB can be used (up to 141 dB with option 2 step attenuator). However, the step size, in conjunction with the initial RF power output setting, must not produce a programmed power level below the minimum leveled output power for the particular 691XXB model. Refer to Appendix B — Performance Specifications — in the Series 691XXB Synthesized Signal Generator Operation Manual.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 1)

:SPACing

Parameters: LINear | LOGarithmic
Type: <char>
Default: LINear

Description: Selects the type of SWEep[1] stepped frequency sweep (see notes)

Query Form: [:SOURce]:SWEep:SPACing?

Examples: [:SOURce]:SWEep:SPACing *sp* LOGarithmic
Selects logarithmic type stepped frequency sweep.

[:SOURce]:SWEep:SPACing?
Requests the currently programmed type of stepped frequency sweep.

NOTES:

In LINear stepped sweep mode, the frequency sweep is linearly incremented by the step size from the start frequency to the stop frequency. The size of each step of the linear stepped sweep can be set using either the :SWEep[:FREQuency]:STEP command or the :SWEep:POINts command.

In LOGarithmic stepped sweep mode, step size increases logarithmically with frequency and is determined by a logarithmic curve fitted between the sweep start and stop frequencies. The number of steps is set using the :SWEep:POINts command.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:TIME

Parameters: sweep time (in seconds) | MIN | MAX

Type: <nv>

Range: 30 ms to 99 sec

Default: 30 ms for SWEep1
The default value for SWEep2 depends on the power range of the particular 691XXB model (see notes).

Description: Sets the sweep time for the associated SWEep[1] or SWEep2 sweep to the value entered. See notes below.

Query Form: [:SOURce]:SWEep<n>:TIME?

Examples: [:SOURce]:SWEep1:TIME *sp* 100 MS
Set the sweep time for SWEep1 *sweep to 100 ms.*

[:SOURce]:SWEep2:TIME?
Requests the currently programmed time for SWEep2 *sweep.*

NOTES:

The default values for SWEep2 points and time are set up to give the maximum number of points at the minimum step size for the particular 691XXB model. The default values are dependent on the instrument's available power range.

When :SWEep<n>:TIME <arg> is implemented, :SWEep<n>:TIME :AUTO is set to OFF.

:TIME, :DWELl, :SPAN, :STEP, and :POINts are all interrelated. Entering too large a value for any of the four other parameters may invalidate the entered value for :TIME.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:TIME

:LLIMit

Parameters: sweep time (in seconds) | MIN | MAX

Type: <nv>

Range: 2 ms to 98.998 sec

Default: 2 ms

Description: Sets the lower limit for :SWEep<n>:TIME to the value entered. No sweep time will be shorter than this value. See notes below.

Query Form: [:SOURce]:SWEep<n>:TIME:LLIMit?

Examples: [:SOURce]:SWEep1:TIME:LLIMit *sp* 80 MS

Set the lower limit for SWEep1 *sweep time to 80 ms.*

[:SOURce]:SWEep2:TIME:LLIMit?

Requests the currently programmed lower limit for SWEep2 *sweep time.*

NOTES:

When :SWEep<n>:TIME:AUTO is set ON, the internally computed sweep time will not be smaller than the sweep duration set with the :SWEep<n>:Time:LLIMit command.

:SWEep2:TIME:LLIMit will be set to the same value as :SWEep:TIME :LLImit and vice versa.

[:SOURce]

:SWEep<n> (1 ≤ **n** ≤ 2)

:TIME

:AUTO

Parameters: ON | OFF | 1 | 0

Type: <boolean>

Default: ON

Description: ON specifies that the sweep time for the associated sweep (SWEep[1] or SWEep2) is to be calculated internally and is dependent on the sweep SPAN value. See note below.

Query Form: [:SOURce]:SWEep:TIME:AUTO?

Examples: [:SOURce]:SWEep:TIME:AUTO *sp* ON

Specifies that the SWEep[1] *sweep time is to be calculated internally.*

[:SOURce]:SWEep:TIME:AUTO?

Requests the currently programmed mode for sweep time determination.

NOTE:

When the 691XXB is powered up, or when ∗RST command is issued, :SWEep:TIME:AUTO is set to ON.

3-11 STATUS SUBSYSTEM

The :STATus subsystem controls the SCPI-defined status-reporting stuctures of the 691XXB. The subsystem commands and parameters are described below.

KEYWORD	PARAMETER FORM	NOTES
:STATus		
:OPERation		
[:EVENt]?		
:CONDition?		
:ENABle	**<numeric value>**	Default: 0
:PTRansition	**<numeric value>**	Default: 32767
:NTRansition	**<numeric value>**	Default: 0
:PRESet		
:QUEStionable		
[:EVENt]?		
:CONDition?		
:ENABle	**<numeric value>**	Default: 0
:PTRansition	**<numeric value>**	Default: 32767
:NTRransition	**<numeric value>**	Default: 0
:QUEue		
[:NEXT]?		

:STATus
:OPERation
[:EVENt]?

Parameters Returned: event register contents

Type: <NR1>

Description: Returns the the contents of the 691XXB Operational Event register. *When executed, this command clears the Operational Event register.*

Example: :STATus:OPERation:EVENt?

Requests that the contents of the the Operational Event register be returned.

:STATus

:OPERation

:CONDition?

Parameters Returned: condition register contents

Type: <NR1>

Description: Returns the the contents of the 691XXB Operational Condition register. When executed, this command does *not* clear the Operational Condition register.

Example: :STATus:OPERation:CONDition?

Requests that the contents of the the Operational Condition register be returned.

:STATus

:OPERation

:ENABle

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 0 (All 0's)

Description: Sets the bits of the Operational Enable register associated with the Operational Event register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:OPERation:ENABle?

Example: :STATus:OPERation:ENABle *sp* 8

Set the 691XXB Operational Enable register to a value of 8. (This will unmask the Sweeping *status bit).*

Example: :STATus:OPERation:ENABle?

Requests the current value of the 691XXB Operational Enable register.

:STATus

:OPERation

:PTRansition

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 32767 (All 1's)

Description: Sets the bits of the positive transition filter for the Operational Condition register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:OPERation:PTRansition?

Example: :STATus:OPERation:PTRansition *sp* 512

Sets the 691XXB Positive Transition Filter for the Operational Condition register to a value of 512. When the filter detects a False to True transition in bit 9 of the Operational Condition register, indicating that 691XXB self-test is in progress, bit 9 of the Operational Event register will be set to "1".

Example: :STATus:OPERation:PTRansition?

Requests the current value of the 691XXB Positive Transition Filter for the Operational Condition register.

:STATus

:OPERation

:NTRansition

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 0 (All 0's)

Description: Sets the bits of the negative transition filter for the Operational Condition register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:OPERation:NTRansition?

Example: :STATus:OPERation:NTRansition *sp* 8

Sets the 691XXB Negative Transition Filter for the Operational Condition register to a value of 8. When the filter detects a True to False transition in bit 3 of the Operational Condition register, indicating that the 691XXB is finished sweeping, bit 3 of the Operational Event register will be set to "1".

Example: :STATus:OPERation:PTRansition?

Requests the current value of the 691XXB Negative Transition Filter for the Operational Condition register.

:STATus

:PRESet

Parameters: None

Description: This command is an event that configures the SCPI and device-dependent status reporting structures so that device-dependent events are summarized and reported. This command performs the following functions:

- Sets the Operational Enable register to all 0's.
- Sets the Operational Positive Transition Filter to all 1's.
- Sets the Operational Negative Transition Filter to all 0's.
- Sets the Questionable Enable register to all 0's.
- Sets the Questionable Positive Transition Filter to all 1's.
- Sets the Questionable Negative Transition Filter to all 0's.

Query Form None

Example: :STATus:PRESet

Configure the status reporting structures for device-dependent event reporting.

:STATus

:QUEStionable

[:EVENt]?

Parameters Returned: event register contents

Type: <NR1>

Description: Returns the the contents of the 691XXB Questionable Event register. *When executed, this command clears the Questionable Event register.*

Example: :STATus:QUEStionable:EVENt?

Requests that the contents of the the Questionable Event register be returned.

:STATus

:QUEStionable

:CONDition?

Parameters Returned: condition register contents

Type: <NR1>

Description: Returns the the contents of the 691XXB Questionable Condition register. When executed, this command does *not* clear the Questionable Condition register.

Example: :STATus:QUEStionable:CONDition?

Requests that the contents of the the Questionable Condition register be returned.

:STATus

:QUEStionable

:ENABle

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 0 (All 0's)

Description: Sets the bits of the Questionable Enable register associated with the Questionable Event register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:QUEStionable:ENABle?

Example: :STATus:QUEStionable:ENABle *sp* 32
Set the 691XXB Questionable Enable register to a value of 32. (This will unmask the Lock Error or RF Unlocked *status bit).*

Example: :STATus:QUEStionable:ENABle?
Requests the current value of the 691XXB Questionable Enable register.

:STATus

:QUEStionable

:PTRansition

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 32767 (All 1's)

Description: Sets the bits of the positive transition filter for the Questionable Condition register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:QUEStionable:PTRansition?

Example: :STATus:QUEStionable:PTRansition *sp* 512

Sets the 691XXB Positive Transition Filter for the Questionable Condition register to a value of 512. When the filter detects a False to True transition in bit 9 of the Questionable Condition register, indicating that 691XXB self-test failed, bit 9 of the Questionable Event register will be set to "1".

Example: :STATus:QUEStionable:PTRansition?

Requests the current value of the 691XXB Positive Transition Filter for the Questionable Condition register.

:STATus

:QUEStionable

:NTRansition

Parameters: mask
Type: <NRf>
Range: 0 – 32767
Default: 0 (All 0's)

Description: Sets the bits of the negative transition filter for the Questionable Condition register to the binary weighted integer value specified by the mask parameter.

Query Form :STATus:QUEStionable:NTRansition?

Example: :STATus:QUEStionable:NTRansition *sp* 8

Sets the 691XXB Negative Transition Filter for the Questionable Condition register to a value of 8. When the filter detects a True to False transition in bit 3 of the Questionable Condition register, indicating that the RF is no longer unleveled, bit 3 of the Questionable Event register will be set to "1".

Example: :STATus:QUEStionable:PTRansition?

Requests the current value of the 691XXB Negative Transition Filter for the Questionable Condition register.

:STATus

:QUEue

[:NEXT]?

Parameters Returned: error code, error message string

Type: <NR1><string>

Description: Returns and deletes the oldest uncleared error code and error description from the error queue. Optional device dependent information about the error event may also be included. See notes below. The error codes and error description information for the 691XXB are listed in Chapter 4.

Example: :STATus:QUEue:NEXT?

Requests that the oldest error code/error description be returned from the error queue.

NOTES:

As errors are detected, they are placed in the error queue. The queue is first in, first out and can hold a maximum of 10 messages.

If the error queue is not empty, bit 2 of the Summary Status Byte is set.

A query returns only the oldest error code and associated error description information from the error queue. To return all error codes and associated description information, use repetitive queries until an error value of zero is returned, or until bit 2 of the status byte is 0.

If the error queue overflows, the last error message in the queue is replaced by the error –350, "Queue overflow"

3-12 SYSTEM SUBSYSTEM

The :SYSTem subsystem commands are used to implement functions that are not related to 691XXB performance. These include error query, interface language selection, system preset, and version query. The subsystem commands and parameters are described below.

KEYWORD	PARAMETER FORM	NOTES
:SYSTem		
:ERRor?		
:LANGuage	<string>	
:PRESet		
:VERSion?		

:SYSTem

:ERRor?

Parameters Returned: error code, error message string

Type: <NR1><string>

Description: Returns and deletes the oldest uncleared error code and error description from the error queue. Optional device dependent information about the error event may also be included. See notes below. The error codes and error description information for the 691XXB are listed in Chapter 4.

Example: :SYSTem:ERRor?

Requests that the oldest error code/error description be returned from the error queue.

NOTES:

As errors are detected, they are placed in the error queue. The queue is first in, first out and can hold a maximum of 10 messages.
If the error queue is not empty, bit 2 of the Summary Status Byte is set.

A query returns only the oldest error code and associated error description information from the error queue. To return all error codes and associated description information, use repetitive queries until an error value of zero is returned, or until bit 2 of the status byte is 0.

If the error queue overflows, the last error message in the queue is replaced by the error –350, “Queue overflow”

:SYSTem

:LANGuage

Parameters: "SCPI" | "NATIVE" | "TMSL"

Type: <string>

Default: Dependent upon the selection made at the 691XXB front panel Configure GPIB menu.

Description: Selects the instrument's external interface language. "TMSL" is an alias for "SCPI". Entering either will return "SCPI" when queried. The double quotes are required and will be returned with the query reply.

"NATIVE" changes the instrument's external interface language to the 691XXB GPIB mode. Any commands issued within 1 second of the change may be garbled or lost.

Query Form: :SYSTem:LANGuage?

Examples: :SYSTem:LANGuage *sp* "NATIVE"

Selects "NATIVE" (691XXB GPIB mode) as the external interface language.

:SYSTem:LANGuage?

Requests the current selection for 691XXB external interface language.

NOTES:

When changing from NATIVE to SCPI interface language, use the command SYST:LANG "SCPI" . Do ***not*** use the long form of the command and do ***not*** use a leading colon (:) with the command. The command :SYSTem:LANGuage "SCPI" results in a syntax error.

:SYSTem

:PRESet

Parameters: None

Description: This command is synonomous with ∗RST and is included for programming compatibility with other instruments.

Query Form: None

Example: :SYSTem:PRESet

Sets all user programmable 691XXB parameters to their default values.

:SYSTem

:VERSion?

Parameters Returned: version number (see note)

Type: <NR2>

Description: Returns the SCPI version number that the instrument software complies with.

Example: :SYSTem:VERSion?

Requests the SCPI version number that the instrument software complies with.

NOTE:

The query response shall have the form *YYYY.V* where the *Y*s represent the year-version (i.e.1993) and the *V* represents the approved revision number for that year.

3-13 TRIGGER SUBSYSTEM

The :TRIGger subsystem commands are used to control the sweep triggering functions of the 691XXB. The subsystem commands and parameters are described below. The :TRIGger command, along with the :ABORt and :INITiate commands, comprise the Trigger Group of commands.

KEYWORD	PARAMETER FORM	NOTES
:TRIGGer		
[:SEQuence | :STARt]		
[:IMMediate]		
:SOURce	BUS | IMMediate | HOLD	Default: BUS

:TRIGger

[:SEQuence | :STARt]

[:IMMediate]

Parameters: None

Description: Causes the previously selected sweep to be triggered immediately if trigger system is in armed state due to previous :INITiate:IMMediate command. See notes below.

Query Form: None

Example: :TRIGger:SEQuence:IMMediate

Trigger selected sweep immediately if 691XXB is in trigger armed state.

Associated commands: :ABORt and :INITiate

NOTES:

Keyword :SEQuence is equivalent to keywords :SEQuence1 or :START.These keywords may be used interchangeably.

:TRIGger

[:SEQuence | :STARt]

:SOURce

Parameters: BUS | IMMediate | HOLD

Type: <char>

Default: BUS

Description: Selects the trigger source for the previously selected sweep. The source selections are:
BUS – The source is the group execute trigger command from the GPIB. The trigger will occur when either a <GET> or ∗TRG command is received.
IMMediate – The trigger signal is always true.
HOLD – Do not trigger on any sweep.

Query Form :TRIGger:SEQuence:SOURce?

Example: :TRIGger:SEQuence:SOURce *sp* IMMediate
Select the trigger signal to be true.

Example: :TRIGger:SEQuence:SOURce?
Requests the currently programmed sweep trigger source.

NOTES:

Only one trigger source can be specified at a time, and all others will be ignored.

Sending :TRIGger:SOURce IMM;INITiate:CONTinuous ON places the selected sweep in auto trigger mode.

3-14 :TSWeep COMMAND

The :TSWeep command is a convenience command. It is equivalent to sending :ABORt;:INITiate[:IMMediate].

3-15 UNIT SUBSYSTEM

The :UNIT subsystem commands set the default units for the frequency and time parameters that are used with all 691XXB SCPI commands described in this manual. The units selected apply to the designated command parameters for both command and response. The subsystem commands and parameters are described below.

KEYWORD	PARAMETER FORM	NOTES
:UNIT		
:FREQuency	**HZ | KHZ | MHZ | GHZ**	Default: HZ
:TIME	**S | MS | US | NS**	Default: S

:UNIT

:FREQuency

Parameters: HZ | KHZ | MHZ | GHZ
Type: <char>
Default: HZ

Description: Selects the global default frequency unit for all frequency related parameters used with all 691XXB SCPI commands.

Query Form :UNIT:FREQuency?

Example: :UNIT:FREQuency *sp* GHZ
Select GHz as the default frequency unit for all 691XXB frequency related command parameters.

Example: :UNIT:FREQuency?
Requests the currently selected frequency unit.

:UNIT

:TIME

Parameters S | MS | US | NS

Type: <char>

Default: S

Description: Selects the global default for all time related parameters used with all 691XXB SCPI commands.

S = second
MS = millisecond
US = microsecond
NS = nanosecond

Query Form :UNIT:TIME?

Example: :UNIT:TIME *sp* MS

Select millisecond as default time unit for all 691XXB time related command parameters.

Example: :UNIT:TIME?

Requests the currently selected time unit.

Chapter 4
Error Messages

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Chapter 4
Error Messages

4-1 INTRODUCTION

This chapter lists and describes each of the error messages related to 691XXB signal generator operation. In addition, it provides information about the error message elements, the error query command, the error queue, and the classes of error messages.

4-2 ERROR QUERY

The :SYSTem:ERRor? query command is a request for the next entry in the instrument's error queue. Error messages in the queue contain an integer in the range [–32768, 32768] denoting an error code and associated descriptive text. Negative codes are reserved by the SCPI standard and defined first in this chapter. Positive error codes are instrument-dependent. An error code value of zero indicates that no error has occurred (see paragraph 4.3).

The :SYSTem:ERRor? query command is required of all SCPI implementations. The :STATus:QUEue[:NEXT]? query command when implemented is an alias to :SYSTem:ERRor?.

The instrument responds to the :SYSTem:ERRor? query command with an error message in the following format:

<error code>,"<error description>;<device-dependent info>"

The <error code> is a unique error descriptor. Certain standard error codes are described in this chapter. The <error description> is a short description of the error, (optionally) followed by further information about the error. Short descriptions of the standard error codes are given in this chapter. The <device-dependent information> part of the response may contain information which will allow the user to determine the exact error and context. For example:

–241,"Hardware missing;Attenuator"

The maximum string length of <error description> plus <device-dependent information> is 255 characters. The <error description> shall be sent exactly as indicated in this chapter including case.

4-3 ERROR QUEUE

As errors are detected, error messages are placed in a queue. This queue is first in, first out and can hold a maximum of 10 messages. If the queue overflows, the last error message in the queue is replaced with the error message

–350, “Queue overflow”

Any time the queue overflows, the least recent error messages remain in the queue, and the most recent error message is discarded. Reading an error message from the head of the queue removes that error message from the queue, and opens a position at the tail of the queue for a new error message, if one is subsequently detected.

When all error messages have been read from the queue, further error queries shall return

0, “No error”

The error queue shall be cleared when any of the following occur (IEEE 488.2, section 11.4.3.4):

- Upon power up.
- Upon receipt of a ∗CLS command.
- Upon reading the last error message from the queue.

4-4 ERROR CODES

The system-defined error codes are chosen on an enumerated (“1 of N”) basis. The SCPI-defined error codes and the <error description> portions of the query response are listed here. The first error described in each class (for example –100, –200, –300, –400) is a “generic” error. In selecting the proper error code to report, more specific error codes are preferred, and the generic error is used if the others are inappropriate.

4-5 NO ERROR

This message indicates that the device has no errors.

Error Code	Error Description [description/explanation/examples]
0	"No error" The queue is completely empty. Every error in the queue has been read or the queue was purposely cleared by power-on, ∗CLS, etc.

4-6 COMMAND ERRORS

An <error code> in the range [–199, –100] indicates that an IEEE 488.2 syntax error has been detected by the instrument's parser. The occurrence of any error in this class should cause the command error bit (bit 5) in the standard event status register to be set. One of the following events has occurred:

- An IEEE 488.2 syntax error has been detected by the parser. That is, a controller-to-device message is received which is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates the device listening formats or whose type is unacceptable to the device.
- An unrecognized header was received. Unrecognized headers include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.
- A Group Execute Trigger (GET) was entered into the input buffer inside of an IEEE 488.2<PROGRAM MESSAGE>.

Events that generate command errors shall not generate execution errors, device-specific errors, or query errors; see the other error definitions in this chapter.

Error Code	Error Description [description/explanation/examples]
–102	"Syntax error" An unrecognized command or data type was encountered; for example, a string was received when the device does not accept strings.
–104	"Data type error" The parser recognized a data element different than one allowed; for example, numeric or string data was expected but block data was encountered.
–105	"GET not allowed" A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7).
–108	"Parameter not allowed" More parameters were received than expected for the header; for example, the ∗SAV command only accepts one parameter, so receiving ∗SAV 0,1 is not allowed.
–109	"Missing parameter" Fewer parameters were received than required for the header; for example, the ∗SAV common command requires one parameter, so receiving ∗SAV is

not allowed.

–110 "Command Header Error"
An error was detected in the header. This error message should be used when the device cannot detect the more specific errors described for errors –111 through –119.

–111 "Header Separator Error"
A character which is not a legal header separator was encountered while parsing the header; for example, no white space followed the header, thus ∗GMC”MACRO” is an error.

–112 "Program mnemonic too long"
The header contains more than 12 characters (see IEEE 488.2, 7.6.1.4.1).

–113 "Undefined header"
The header is syntactically correct, but it is undefined for this specific device; for example, ∗XYZ is not defined for any device.

–114 "Header suffix out of range"
The value of the numeric suffix attached to a program mnemonic makes the header invalid.

–120 "Numeric data error"
This error, as well as errors –121 through –129, are generated when parsing a data element which appears to be numeric, including the nondecimal types. This particular error message should be used if the device cannot detect a more specific error.

–121 "Invalid character in number"
An invalid character for the data type being parsed was encountered; for example, an alpha in a decimal numeric or a “9” in octal data.

–123 "Exponent too large"
The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

–124 "Too many digits"
The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

–128 "Numeric data not allowed"
A legal numeric data element was received, but the device does not accept one in this position for the header.

–130 "Suffix error"
This error, as well as errors –131 through –139, are generated when parsing a suffix. This particular error message should be used if the device cannot detect a more specific error.

–131 "Invalid suffix"
The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.

–134 "Suffix too long"
The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

–138 "Suffix not allowed"
A suffix was encountered after a numeric element which does not allow suffixes.

–140 "Character data error"
This error, as well as errors 141 through 149, are generated when parsing a character data element. This particular error message should be used if the device cannot detect a more specific error.

–141 "Invalid character data"
Either the character data element contains an invalid character or the particular element received is not valid for the header.

–144 "Character data too long"
The character data element contains more than 12 characters (see IEEE 488.2, 7.7.1.4).

–148 "Character data not allowed"
A legal character data element was encountered where prohibited by the device.

–150 "String data error"
This error, as well as errors –151 through –159, are generated when parsing a string data element. This particular error message should be used if the device cannot detect a more specific error.

–151 "Invalid string data"
A string data element was expected, but was invalid for some reasons (see IEEE 488.2, 7.7.5.2); for example, an END message was received before the terminal quote character.

–158 "String data not allowed"
A legal string data element was encountered but was not allowed by the device at this point in parsing.

–160 "Block data error"
This error, as well as errors –161 through –169, are generated when parsing a block data element. This particular error message should be used if the device cannot detect a more specific error.

–161 "Invalid block data"
A block data element was expected, but invalid for some reason (see IEEE 488.2, 7.7.6.2); for example, an END message was received before the length was satisfied.

–168 "Block data not allowed"
A legal block data element was encountered but was not allowed by the device at this point in parsing.

–170 "Expression error"
This error, as well as errors –171 through –179, are generated when parsing an expression data element. This particular error message should be used if the device cannot detect a more specific error.

–171 "Invalid expression"
The expression data element was invalid (see IEEE 488.2, 7.7.7.2); for example, unmatched parentheses or an illegal character.

–178 "Expression data not allowed"
A legal expression data element was encountered but was not allowed by the device at this point in parsing.

–180 "Macro error"
This error, as well as errors –181 through –189, are generated when defining a macro or executing a macro. This particular error message should be used if the device cannot detect a more specific error.

–181 "Invalid outside macro definition"
Indicates that a macro parameter placeholder ($<number) was encountered outside of a macro definition.

–183 "Invalid inside macro definition"
Indicates that the program message unit sequence, sent with a ∗DDT or ∗DMC command, is syntactically invalid (see IEEE 488.2, 10.7.6.3).

–184 "Macro parameter error"
Indicates that a command inside the macro definition had the wrong number or type of parameters.

4-7 EXECUTION ERRORS

An <error code> in the range [–299,–200] indicates that an error has been detected by the instrument's execution control block. The occurrence of any error in this class should cause the execution error bit (bit 4) of the standard event status register to be set. One of the following events has occurred:

- A <PROGRAM DATA> element following a header was evaluated by the device as outside its legal input range or is otherwise inconsistent with the device's capability.
- A valid program message could not be properly executed due to some device condition.

Execution errors shall be reported by the device after rounding and expression evaluation operations have taken place. Rounding a numeric data element, for example, shall not be reported as an execution error. Events that generate execution errors shall not generate command errors, device-specific errors, or query errors; see the other error definitions in this chapter.

Error Code	Error Description [description/explanation/examples]
–200	"Execution error" This is a generic syntax error for devices that cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.
–201	"Invalid while in local" Indicates that a command is not executable while the device is in local due to a hard local control (see IEEE 488.2, 5.6.1.5); for example, a device with a rotary switch receives a message which would change the switches state, but the device is in local so the message cannot be executed.
–202	"Settings lost due to rtl" Indicates that a setting associated with a hard local control (see IEEE 488.2, 5.6.1.5) was lost when the device was changed to LOCS from REMS or to LWLS from RWLS.
–210	"Trigger error" A trigger error occurred in the signal generator.
–211	"Trigger Ignored" Indicates that a GET, ∗TRG, or triggering signal was received and recognized by the device but was ig-

nored because of device timing considerations; for example, the device was not ready to respond. Note: a DTO device always ignores GET and treats ∗TRG as a command error.

–212 "Arm ignored"
Indicates that an arming signal was received and recognized by the device but was ignored.

–213 "Init ignored"
Indicates that a request for measurement initiation was ignored as another measurement was already in progress.

–214 "Trigger deadlock"
Indicates that the trigger source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.

–215 "Arm deadlock"
Indicates that the arm source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.

–220 "Parameter error"
Indicates that a program data element related error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –221 to –229.

–221 "Settings conflict"
Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2, 6.4.5.3 and 11.5.1.1.5).

–222 "Data out of range"
Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the device (see IEEE 488.2, 11.5.1.1.5).

–223 "Too much data"
Indicates that a legal program data element of block, expression, or string type was received that contained more data than the device could handle due to memory or related device-specific require-

ments.

–224 "Illegal parameter value"
Used where exact value, from a list of possibles, was expected.

–230 "Data corrupt or stale"
Possibly invalid data; new reading started but not completed since last access.

–231 "Data questionable"
Indicates that measurement accuracy is suspect.

–240 "Hardware error"
Indicates that a legal program command or query could not be executed because of a hardware problem in the device. Definition of what constitutes a hardware problem is completely device-specific. This error message should be used when the device cannot detect the more specific errors described for errors –241 through –249.

–241 "Hardware missing"
Indicates that a legal program command or query could not be executed because of missing device hardware; for example, an option was not installed. Definition of what constitutes missing hardware is completely device specific.

–250 "Mass storage error"
Indicates that a mass storage error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –251 through –259.

–251 "Missing mass storage"
Indicates that a legal program command or query could not be executed because of missing mass storage; for example, an option that was not installed. Definition of what constitutes missing mass storage is device-specific.

–252 "Missing media"
Indicates that a legal program command or query could not be executed because of missing media; for example, no disk. Definition of what constitutes missing media is device-specific.

–253 "Corrupt media"
Indicates that a legal program command or query

could not be executed because of corrupt media; for example, bad disk or wrong format. Definition of what constitutes corrupt media is device-specific.

–254 "Media full"
Indicates that a legal program command or query could not be executed because the media was full; for example, there is no room on the disk. The definition of what constitutes a full media is device-specific.

–255 "Directory full"
Indicates that a legal program command or query could not be executed because the media directory was full. The definition of what constitutes a full media directory is device-specific.

–256 "File name not found"
Indicates that a legal program command or query could not be executed because the file name on the device media was not found; for example, an attempt was made to read or copy a nonexistent file. The definition of what constitutes a file not being found is device-specific.

–257 "File name error"
Indicates that a legal program command or query could not be executed because the file name on the device media was in error; for example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

–258 "Media protected"
Indicates that a legal program command or query could not be executed because the media was protected; for example, the write-protect tab on a disk was present. The definition of what constitutes protected media is device-specific.

–260 "Expression error"
Indicates that an expression program data element related error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –261 through –269.

–261 "Math error in expression"
Indicates that a syntactically legal expression program data element could not be executed due to a math error; for example, a divide-by-zero was at-

tempted. The definition of math error is device -specific.

–270 "Macro error"
Indicates that a macro-related execution error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –271 through –279.

–271 "Macro syntax error"
Indicates that a syntactically legal macro program data sequence, according to IEEE 488.2, 10.7.2, could not be executed due to a syntax error within the macro definition (see IEEE 488.2, 10.7.6.3).

–272 "Macro execution error"
Indicates that a syntactically legal macro program data sequence could not be executed due to a some error in the macro definition (see IEEE 488.2, 10.7.6.3).

–273 "Illegal macro label"
Indicates that the macro label defined in the ∗DMC command was a legal string syntax, but could not be accepted by the device (see IEEE 488.2, 10.7.3 and 10.7.6.2); for example, the label was too long, the same as a common command header, or contained invalid header syntax.

–274 "Macro parameter error"
Indicates that the macro definition improperly used a macro parameter placeholder (see IEEE 488.2, 10.7.3).

–275 "Macro definition too long"
Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle (see IEEE 488.2, 10.7.6.1).

–276 "Macro recursion error"
Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive (see IEEE 488.2, 10.7.6.6).

–277 "Macro redefinition not allowed"
Indicates that a syntactically legal macro label in the ∗DMC command could not be executed because the macro label was already defined (see IEEE

488.2, 10.7.6.4).

–278 "Macro header not found"
Indicates that a syntactically legal macro label in the ∗GMC? query could not be executed because the header was not previously defined.

–280 "Program error"
Indicates that a downloaded program-related execution error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –281 through –289.

–281 "Cannot create program"
Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

–282 "Illegal program name"
The name used to reference a program was invalid; for example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

–283 "Illegal variable name"
An attempt was made to reference a nonexistent variable in a program.

–284 "Program currently running"
Certain operations dealing with programs may be illegal while the program is running; for example, deleting a running program might not be possible.

–285 "Program syntax error"
Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

–286 "Program runtime error"

4-8 DEVICE-SPECIFIC ERRORS

An <error code> in the range [–399,–300] or [1, 32767] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error; some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the standard event status register to be set. The meaning of positive error codes is device-dependent and may be enumerated or bit mapped; the <error message> string for positive error codes is not defined by SCPI and available to the device designer. Note that the string is not optional; if the designer does not wish to implement a string for a particular error, the null string should be sent (for example, 42,""). The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the standard event status register to be set. Events that generate device-specific errors shall not generate command errors, execution errors, or query errors; see the other error definitions in this chapter.

Error Code	Error Description [description/explanation/examples]
–300	"Device-specific error" This is the generic device-dependent error for devices that cannot detect more specific errors. This code indicates only that a Device-Dependent Error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.
–310	"System error" Indicates that some error, termed “system error” by the device, has occurred. This code is device-dependent.
–311	"Memory error" Indicates that an error was detected in the device's memory. The scope of this error is device-dependent.
–312	"PUD memory lost" Indicates that the protected user data saved by the ∗PUD command has been lost.
–313	"Calibration memory lost" Indicates that nonvolatile calibration data used by the ∗CAL? command has been lost.
–314	"Save/recall memory lost" Indicates that the nonvolatile data saved by the ∗SAV? command has been lost.

–315	"Configuration memory lost" Indicates that nonvolatile configuration data saved by the device has been lost. The meaning of this error is device-specific.
–330	"Self-test failed"
–350	"Queue overflow" A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

4-9 QUERY ERRORS

An <error code> in the range [–499,–400] indicates that the output queue control of the instrument has detected a problem with the message exchange protocol described in IEEE 488.2, chapter 6. The occurrence of any error in this class should cause the query error bit (bit 2) in the standard event status register to be set. These errors correspond to message exchange protocol errors described in IEEE 488.2, section 6.5. One of the following is true:

- An attempt is being made to read data from the output queue when no output is either present or pending.
- Data in the output queue has been lost.

Events that generate query errors shall not generate command errors, execution errors, or device-specific errors; see the other error definitions in this chapter.

Error Code	Error Description [description/explanation/examples]
–400	"Query error" This is the generic query error for devices that cannot detect more specific errors. This code indicates only that a Query Error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.
–410	"Query INTERRUPTED" Indicates that a condition causing an INTERRUPTED Query error occurred (see IEEE 488.2, 6.3.2.3); for example, a query followed by a DAB or GET before a response was completely sent.
–420	"Query UNTERMINATED" Indicates that a condition causing as UNTERMINATED Query error occurred (see IEEE 488.2, 6.3.2.2); for example, the device was addressed to talk and an incomplete program message was received.
–430	"Query DEADLOCKED" Indicates that a condition causing a DEADLOCKED Query error occurred (see IEEE 488.2, 6.3.1.7); for example, both input and output buffer are full and the device cannot continue.
–440	"Query UNTERMINATED after indefinite response" Indicates that a query was received in the same program message after a query requesting an indefinite response was executed (see IEEE 488.2, 6.5.7.5.7).

4-10 PARSER ERRORS

An <error code> in the range [201, 212] is generated by the instrument's parser in response to the error condition described.

Error Code	Error Description [description/explanation/examples]
201	"Query only" Indicates the command is a query command only.
202	"No query allowed" Indicates that a query form of the command is not available.
203	"Parameter(s) not expected" Indicates that the command does not take any parameter(s).
204	"Constant not allowed in STATUS subsystem"
207	"Enumeric value not in union" Indicates an illegal parameter was sent with the command.
208	"Illegal number of parameters" Indicates an illegal number of parameters was sent with the command.
210	"Run out of memory handle" Indicates an internal parser problem.
211	"Unit not matched" Indicates the parameter unit does not match any defined unit for this parameter.
212	"Unit not required" Indicates no unit is required with this parameter.

4-11 SELF-TEST ERRORS

An <error code> in the range [100, 199] indicates that a failure has occurred during instrument self-test. The error messages are placed in the error queue in the order they occur.

Error Code	Error Description [description/explanation/examples]
100	"Failed: DVM ground offset" Indicates self-test failed because of a calibration-related problem.
101	"Failed: DVM +10V ref." Indicates self-test failed because of either a calibration-related problem or a defective +10 Volt reference.
102	"Failed: DVM –10V ref." Indicates self-test failed because of either a calibration-related problem or a defective –10 Volt reference.
105	"Failed: Power Supply Voltages(s) out of regulation" Indicates one or more of the voltages from the power supply is out of regulation.
106	"Not locked: Power supply" Indicates the power supply is not phase-locked to the 400 kHz reference frequency.
107	"Failed; Sweep time circuitry" Indicates the sweep timing is out of tolerance or has failed.
108	"Not ready: Crystal oven cold" Indicates the 100 MHz crystal oven or the Option 16 high-stability 10 MHz crystal oscillator has not reached operating temperature.
109	"Not locked: Ext 10MHZ" Indicates the reference loop is not phase-locked to the external 10 MHz reference.
110	"Not locked: High Stability crystal" Indicates the reference loop is not phase-locked to the high stability 10 MHz crystal oscillator.
111	"Not locked: Fine Loop" Indicates one or more of the oscillators within the fine loop is not phase-locked.

112	"Not locked: Coarse Loop" Indicates the coarse loop oscillator is not phase-locked.
113	"Not locked: YIG Loop" Indicates the YIG loop is not phase-locked.
114	"Not locked: Down Converter" Indicates the local oscillator in the down converter assembly is not phase-locked.
115	"Failed: Not Locked indicator" Indicates failure of the not phase-locked indicator circuit.
116	"Failed: FM loop gain circuit" Indicates the FM loop has failed or the loop gain is out of tolerance.
117	"Failed: Linearizer circuit" Indicates failure of the Linearizer circuit on the A12 PCB.
118	"Failed: Marker Switch Point circuit" Indicates failure of the Marker Switch Point circuit on the A12 PCB.
119	"Failed: Center Frequency circuit" Indicates failure of the Center Frequency circuit on the A12 PCB.
120	"Failed: Delta-F Ramp circuit" Indicates failure of the ΔF Ramp circuit on the A12 PCB.
121	"Failed: Unleveled indicator" Indicates failure of the not leveled detector circuit on the A10 PCB.
122	"Failed: Level reference" Indicates failure of the level reference circuit on the A10 PCB.
123	"Failed: Detector log amp" Indicates failure of the level detector log amplifier circuit on the A10 PCB.
124	"Unleveled and not locked: Full band" Indicates failure of both YIG-tuned oscillators.

125 "Unleveled and not locked: 8.4-20 GHz range"
Indicates failure of the 8.4 to 20 GHz YIG-tuned oscillator.

126 "Unleveled and not locked: 2-8.4 GHz range"
Indicates failure of the 2 to 8.4 GHz YIG-tuned oscillator.

127 "Failed: A10 Detector input circuit"
Indicates failure of the level detector input circuit on the A10 PCB.

128 "Failed: 0.01-2 GHz range unleveled"
Indicates failure of the Down Converter leveling circuitry.

129 "Failed: Switched filter or level detector"
Indicates failure of either the switched filter or level detector circuitry.

130 "Failed: 2-3.3 GHz Switched filter section or level detector"
Indicates failure of either the 2 to 3.3 GHz switched filter path or the level detector circuitry.

131 "Failed: 3.3-5.5 GHz Switched filter section or level detector"
Indicates failure of either the 3.3 to 5.5 GHz switched filter path or the level detector circuitry.

132 "Failed: 5.5-8.4 GHz Switched filter section or level detector"
Indicates failure of either the 5.5 to 8.4 GHz switched filter path or the level detector circuitry.

133 "Failed: 8.4-13.25 GHz Switched filter section or level detector"
Indicates failure of either the 8.4 to 13.25 GHz switched filter path or the level detector circuitry.

134 "Failed: 13.25-20 GHz Switched filter section or level detector"
Indicates failure of either the 13.25 to 20 GHz switched filter path or the level detector circuitry.

135 "Failed: A9 modulator or driver"
Indicates failure of either the modulator in the switched filter assembly or the modulator driver circuitry on the A9 PCB.

138	"Failed: Freq extension unit or driver" Indicates failure of the frequency extension unit (FEU) or FEU driver circuitry on the A9 PCB.
139	"Failed: 33-40 GHz section of freq extension unit" Indicates failure of the 33 to 40 GHz section of the FEU.
140	"Failed: 26.5-33 GHz section of freq extension unit" Indicates failure of the 26.5 to 33 GHz section of the FEU.
141	"Failed: 20-26.5 GHz section of freq extension unit" Indicates failure of the 20 to 26.5 GHz section of the FEU.
142	"Failed: Sample and hold circuit" Indicates failure of the sample and hold circuitry on the A10 PCB.
143	"Failed: Slope DAC or associated circuit" Indicates failure of the level slope DAC circuitry on the A10 PCB.
144	"Failed: RF was off when self test started" Indicates that some tests were not performed because the RF Output was selected OFF when self-test was started.
145	"Failed: A12 +10V ref." Indicates failure of the +10 Volt reference circuit on the A12 PCB.
146	"Failed: A12 –10V ref." Indicates failure of the –10 Volt reference circuit on the A12 PCB.
199	"Self Test Complete"

Appendix A
Overall
Command Tree

A-1 INTRODUCTION

This appendix provides an overall command tree for the Series 691XXB Synthesized Signal Generator SCPI command set. The command tree is shown in Figure A-1. Refer to Chapter 3 for information on the individual SCPI commands.

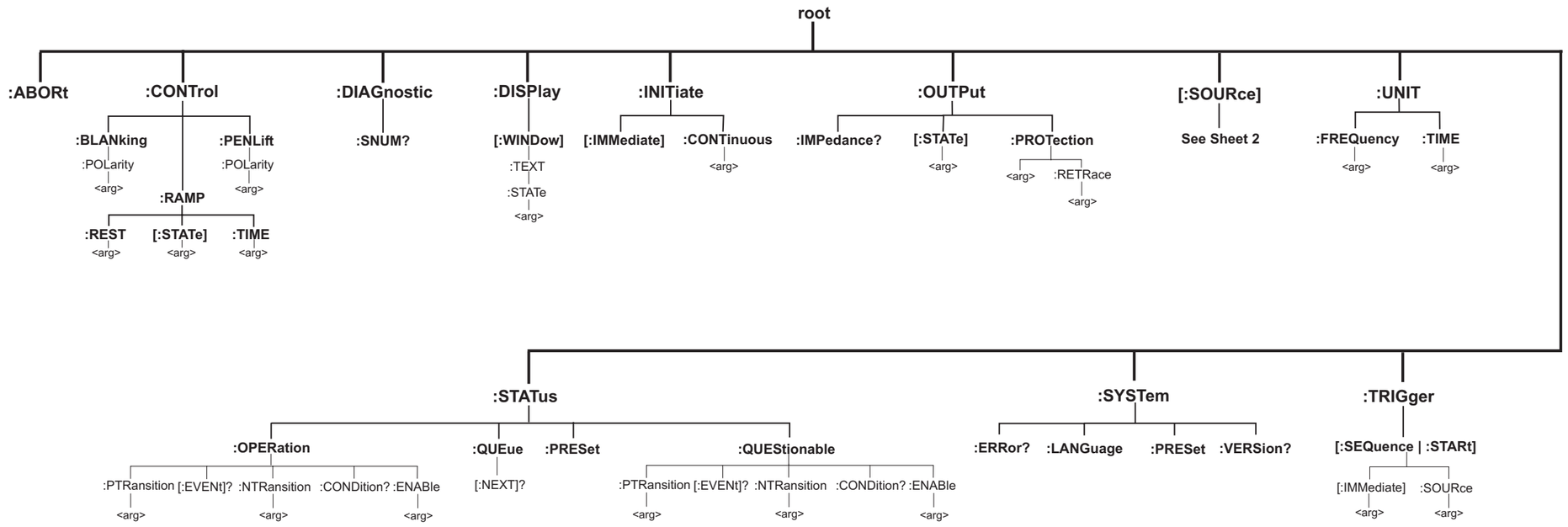

Figure A-1. *Overall 691XXB SCPI Command Tree (Sheet 1 of 2)*

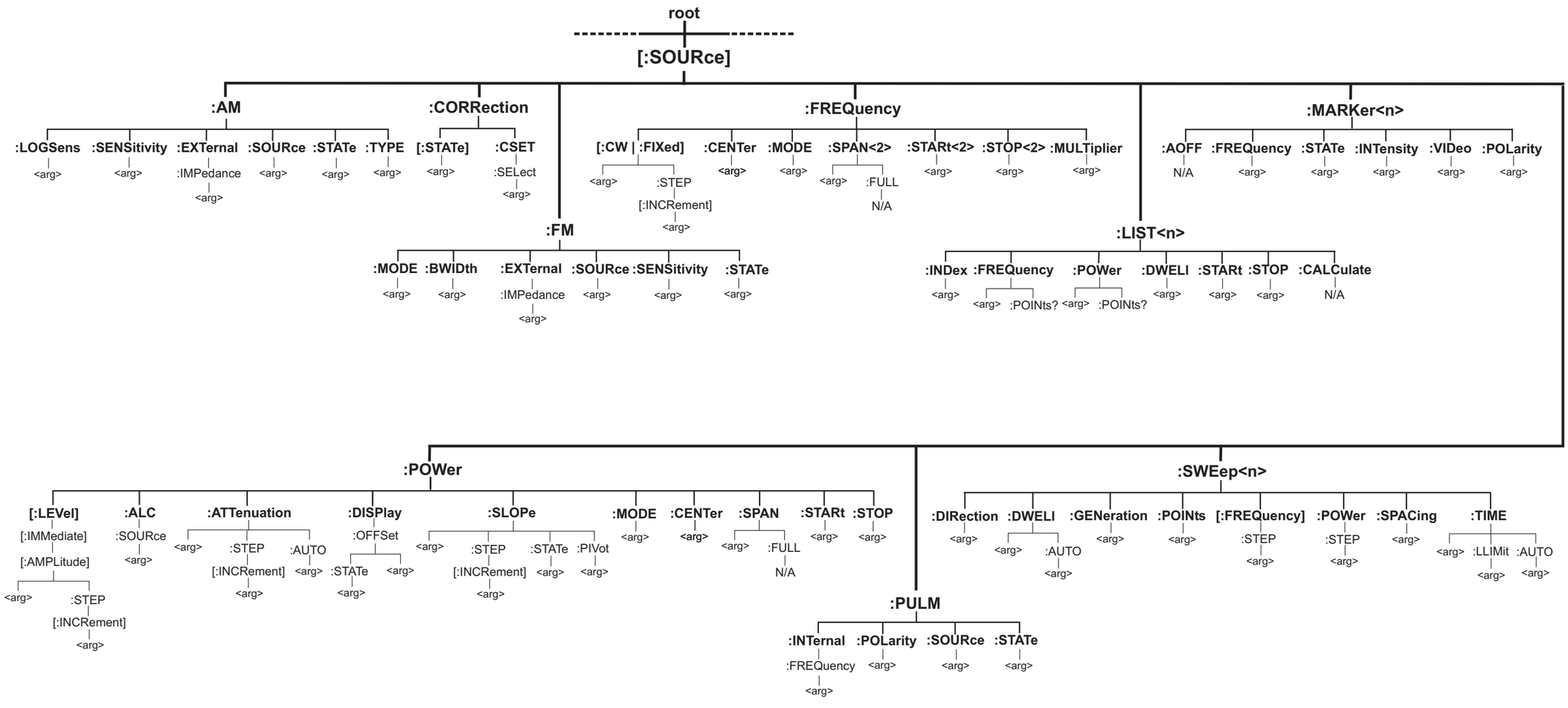

Figure A-1. *Overall 691XXB SCPI Command Tree (Sheet 2 of 2)*

Appendix B
SCPI
Conformance Information

B-1 INTRODUCTION

This appendix provides SCPI conformance information for the 691XXB SCPI command set in the form of a command summary. (The 691XXB SCPI command set commands and queries are described individually in Chapter 3 – Programming Commands.)

The SCPI version that the 691XXB software supports is *Standard Commands for Programmable Instruments (SCPI)* 1993.0. The first part of the table lists the SCPI Common Commands along with the conformance information for each command. The categories used for these commands are: IEEE 488.2 Required, and IEEE 488.2 Optional. The remainder of the table lists all SCPI commands and queries in the command set. The conformance categories used are: SCPI Confirmed and Non-SCPI.

NOTE

In the table, a question mark enclosed in parentheses [**(?)**] at the end of an entry indicates that the the particular command exists in both command and query forms.

691XXB SCPI Command Conformance (1 of 5)

SCPI Command	Status
∗CLS	IEEE 488.2 Required
∗ESE <nv>	IEEE 488.2 Required
∗ESE?	IEEE 488.2 Required
∗ESR?	IEEE 488.2 Required
∗IDN?	IEEE 488.2 Required
∗OPC	IEEE 488.2 Required
∗OPC?	IEEE 488.2 Required
∗RST	IEEE 488.2 Required
∗SRE <nv>	IEEE 488.2 Required
∗SRE?	IEEE 488.2 Required
∗STB?	IEEE 488.2 Required

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SCPI Command	Status
∗TST?	IEEE 488.2 Required
∗WAI	IEEE 488.2 Required
∗OPT?	IEEE 488.2 Optional
∗RCL <n>	IEEE 488.2 Optional
∗SAV <n>	IEEE 488.2 Optional
∗TRG	IEEE 488.2 Optional
:ABORt	SCPI Confirmed
:CONTrol:BLANking:POLarity(?)	Non-SCPI
:CONTrol:PENLift:POLarity(?)	Non-SCPI
:CONTrol:RAMP:REST(?)	Non-SCPI
:CONTrol:RAMP[:STATe](?)	Non-SCPI
:CONTrol:RAMP:TIME(?)	Non-SCPI
:DIAGnostic:SNUM?	Non-SCPI
:DISPlay[:WINDow]:TEXT:STATe(?)	SCPI Confirmed
:INITiate[:IMMediate]	SCPI Confirmed
:INITiate:CONTinuous(?)	SCPI Confirmed
:OUTPut[:STATe](?)	SCPI Confirmed
:OUTPut:PROTection(?)	Non-SCPI
:OUTPut:PROTection:RETRace(?)	Non-SCPI
:OUTPut:IMPedance?	Non-SCPI
[:SOURce]:AM:LOGSens(?)	Non-SCPI
[:SOURce]:AM:SENSitivity(?)	SCPI Confirmed
[:SOURce]:AM:EXTernal:IMPedance(?)	SCPI Confirmed
[:SOURce]:AM:SOURce(?)	SCPI Confirmed
[:SOURce]:AM:STATe(?)	SCPI Confirmed
[:SOURce]:AM:TYPE(?)	SCPI Confirmed
[:SOURce]:CORRection[:STATe](?)	SCPI Confirmed
[:SOURce]:CORRection:CSET:SELect(?)	SCPI Confirmed
[:SOURce]:FM:MODE(?)	SCPI Confirmed
[:SOURce]:FM:BWIDth(?)	Non-SCPI

691XXB SCPI Command Conformance (3 of 5)

SCPI Command	Status
[:SOURce]:FM:EXTernal:IMPedance(?)	SCPI Confirmed
[:SOURce]:FM:SOURce(?)	SCPI Confirmed
[:SOURce]:FM:SENSitivity(?)	SCPI Confirmed
[:SOURce]:FM:STATe(?)	SCPI Confirmed
[:SOURce]:FREQuency[:CW|FIXed](?)	SCPI Confirmed
[:SOURce]:FREQuency[:CW|FIXed] :STEP[:INCRement](?)	Non-SCPI
[:SOURce]:FREQuency:CENTer(?)	SCPI Confirmed
[:SOURce]:FREQuency:MODE(?)	SCPI Confirmed
[:SOURce]:FREQuency:SPAN(?)	SCPI Confirmed
[:SOURce]:FREQuency:SPAN:FULL	SCPI Confirmed
[:SOURce]:FREQuency:STARt(?)	SCPI Confirmed
[:SOURce]:FREQuency:STOP(?)	SCPI Confirmed
[:SOURce]MARKer<n>:AOFF	SCPI Confirmed
[:SOURce]:FREQuency:MULTiplier(?)	SCPI Confirmed
[:SOURce]:LIST<n>:INDex(?)	Non-SCPI
[:SOURce]:LIST<n>:FREQuency(?)	SCPI Confirmed
[:SOURce]:LIST<n>:FREQuency:POINts?	SCPI Confirmed
[:SOURce]:LIST<n>:POWer(?)	SCPI Confirmed
[:SOURce]:LIST<n>:POWer:POINts?	SCPI Confirmed
[:SOURce]:LIST<n>:DWELl(?)	Non-SCPI
[:SOURce]:LIST<n>:STARt(?)	Non-SCPI
[:SOURce]:LIST<n>:STOP(?)	Non-SCPI
[:SOURce]:LIST<n>:CALCulate	Non-SCPI
[:SOURce]MARKer<n>:FREQuency(?)	SCPI Confirmed
[:SOURce]MARKer<n>:STATe(?)	SCPI Confirmed
[:SOURce]MARKer<n>:INTensity(?)	Non-SCPI
[:SOURce]MARKer<n>: VIDeo(?)	Non-SCPI
[:SOURce]MARKer<n>:POLarity(?)	Non-SCPI
[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude](?)	SCPI Confirmed

691XXB SCPI Command Conformance (4 of 5)

SCPI Command	Status
[:SOURce]:POWer[:LEVel][:IMMediate] [:AMPLitude]:STEP[:INCRement](?)	Non-SCPI
[:SOURce]:POWer[:LEVel]:ALTernate(?)	Non-SCPI
[:SOURce]:POWer:ALC:SOURce(?)	SCPI Confirmed
[:SOURce]:POWer:ATTenuation(?)	SCPI Confirmed
[:SOURce]:POWer:ATTenuation:STEP[:INCRement](?)	Non-SCPI
[:SOURce]:POWer:ATTenuation:AUTO (?)	SCPI Confirmed
[:SOURce]:POWer:DISPlay:OFFSet (?)	Non-SCPI
[:SOURce]:POWer:DISPlay:OFFSet:STATe(?)	Non-SCPI
[:SOURce]:POWer:SLOPe(?)	Non-SCPI
[:SOURce]:POWer:SLOPe:STEP[:INCRement](?)	Non-SCPI
[:SOURce]:POWer:SLOPe:STATe(?)	Non-SCPI
[:SOURce]:POWer:SLOPe:PIVot(?)	Non-SCPI
[:SOURce]:POWer:MODE(?)	SCPI Confirmed
[:SOURce]:POWer:CENTer(?)	SCPI Confirmed
[:SOURce]:POWer:SPAN(?)	SCPI Confirmed
[:SOURce]:POWer:SPAN:FULL	SCPI Confirmed
[:SOURce]:POWer:START(?)	SCPI Confirmed
[:SOURce]:POWer:STOP(?)	SCPI Confirmed
[:SOURce]:PULM:INTernal:FREQuency(?)	SCPI Confirmed
[:SOURce]:PULM:POLarity(?)	SCPI Confirmed
[:SOURce]:PULM:SOURce(?)	SCPI Confirmed
[:SOURce]:PULM:STATe(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:DIRection(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:GENeration(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:DWELl(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:DWELl:AUTO(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:POINts(?)	SCPI Confirmed
[:SOURce]:SWEep<n>[:FREQuency]:STEP(?)	Non-SCPI
[:SOURce]:SWEep<n>:POWer:STEP(?)	Non-SCPI
[:SOURce]:SWEep<n>:SPACing(?)	SCPI Confirmed

691XXB SCPI Command Conformance (5 of 5)

SCPI Command	Status
[:SOURce]:SWEep<n>:TIME(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:TIME:LLIMit(?)	SCPI Confirmed
[:SOURce]:SWEep<n>:TIME:AUTO(?)	SCPI Confirmed
:STATus:OPERation[:EVENt]?	SCPI Confirmed
:STATus:OPERation:CONDition?	SCPI Confirmed
:STATus:OPERation:ENABle(?)	SCPI Confirmed
:STATus:OPERation:PTRansition(?)	SCPI Confirmed
:STATus:OPERation:NTRansition(?)	SCPI Confirmed
:STATus:PRESet	SCPI Confirmed
:STATus:QUEStionable[:EVENt]?	SCPI Confirmed
:STATus:QUEStionable:CONDition?	SCPI Confirmed
:STATus:QUEStionable:ENABle(?)	SCPI Confirmed
:STATus:QUEStionable:PTRansition(?)	SCPI Confirmed
:STATus:QUEStionable:NTRansition(?)	SCPI Confirmed
:STATus:QUEue[:NEXT]?	SCPI Confirmed
:SYSTem:ERRor?	SCPI Confirmed
:SYSTem:LANGuage(?)	SCPI Confirmed
:SYSTem:PRESet	SCPI Confirmed
:SYSTem:VERSion?	SCPI Confirmed
:TRIGGer[:SEQuence|:STARt][:IMMediate]	SCPI Confirmed
:TRIGGer[:SEQuence|:STARt]:SOURce(?)	SCPI Confirmed
:TSWeep	Non-SCPI
:UNIT:FREQuency(?)	Non-SCPI
:UNIT:TIME(?)	SCPI Confirmed

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