87236 Series
USB Peak/Average Power Sensor
Programming Manual



Ceyear Technologies Co., Ltd.

This manual applies to the following models of the USB peak/average power sensor based on the firmware version of 1.0 and higher.

- 87236D USB Peak/Average Power Sensor
- 87236E USB Peak/Average Power Sensor
- 87236F USB Peak/Average Power Sensor
- 87236L USB Peak/Average Power Sensor

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Foreword

Thank you for choosing and using the 87236 series peak/average power sensor developed and produced by Ceyear Technologies Co., Ltd.! This product features quality, precision and excellence, and has a high cost performance among similar products.

We will take the responsibility to maximally meet your needs and provide you with high-quality measuring instruments and first-class after-sales service. We aim to provide "high quality and considerate service", and operate on the principle of making customers satisfactory with our products and services.

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Ceyear Technologies Co., Ltd.

Manual authorization

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The warranty period of this product is 18 months from the date of shipment. The instrument manufacturer will repair or replace the damaged components according to the user's requirements and actual conditions within the warranty period. For specific maintenance issues, refer to the contract.

Product quality certificate

This product is guaranteed to meet the metrics in this manual from the date of shipment. The calibration and measurement are completed by measuring bodies with national qualification, with relevant data to be provided for reference by users.

Quality/environmental management

This product complies with the quality and environmental management systems during R&D, manufacturing and testing. Ceyear Technologies Co., Ltd. is qualified and has passed ISO 9001 and ISO 14001 management systems.

Safety precautions

NOTICE

Notice mark, indicating some important information which will not cause danger. It reminds the user to pay attention to a certain operation process, operating instructions or the like. Failure to observe the rules or operate correctly may cause damage to the instrument or loss of important data. Proceed to the next step only after fully understanding and meeting the notice conditions indicated.

TIPS

The "Tips" symbol indicates information tips. It reminds the user to pay attention to the instrument or certain operation process, operation method or the like. The purpose is to guide the instrument operator to use the instrument correctly.

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1. Manual navigation

This chapter introduces the programming manual functions, chapter structure and main contents of the 87236 series USB peak/average power meter, as well as the instrument-related documents provided to users.

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- Related documents.....2

1.1. About this manual

This manual introduces the methods for remote control of the 87236 series USB peak/average power sensor and application of SCPI. Meanwhile, in order to make it convenient for users to quickly master the programming methods, some programming examples are listed, and the basic concept of I/O function library is introduced. To facilitate your skillful use of such instrument, please read carefully and follow this manual in advance for correct operation.

SCPI (standard commands for programmable instruments) define the standards and methods for remote control of the instrument, and are the programming language for programming control electronic test and measuring instruments. SCPI are based on the IEEE 488.2 standard and form. Please refer to http://www.scpiconsortium.org for details. The manual details the programming control command of 87236 Series

.

The chapters of the programming manual include:

- Remote control

  The methods for remote control of the instrument are summarized to make users get familiar with remote control quickly. It is divided into three parts: programming control fundamentals, introducing programming control-related concepts, software configuration, programming control port, SCPI, etc.; instrument port configuration method, introducing the connection method and software configuration method for programming control ports of the 87236 series USB peak/average power sensor; I/O function library, introducing the basic concept of instrument driver and basic installation instructions of IVI-COM/IVI-C driver.

- Programming control commands

  Common commands, instrument commands and compatible commands are introduced, and the functions, parameters and examples of SCPI are described.

- Programming examples

  The basic programming examples and advanced programming examples are provided in the way of text description and example code, and the explanation is

provided to make it convenient for users to quickly master the programming method of the USB peak/average power sensor.

- Error description

  Error message description and method to obtain after-sales services are included.

- Annex

  Necessary reference information related to programming control of the 87236 series USB peak/average power sensor is provided, including zoom table of SCPI and zoom table of error message.

1.2 Related documents

The product documentation for the 87236 series USB peak/average power meter includes:

- Quick start guide
- User's manual
- Programming Manual
- Online help

Quick start guide

This manual introduces the basic methods for configuration and start-up measurement of the instrument to enable users to quickly understand the characteristics of the instrument, and master the basic setting and operation methods. Main chapters include:

- Getting prepared
- Typical applications
- Get help

User's manual

This manual describes the functions and operation methods of the analyzer in detail, including configuration, measurement, programming control and maintenance, etc. The purpose is to guide the user to fully understand the functional characteristics of the product and master common test methods of the instrument. Main chapters include:

- Manual navigation
- Overview
- Quick start
- Operation guide
- Menus
- Remote control
- Troubleshooting and repair
- Specifications and test methods

- Annex

Programming manual

This manual introduces remote programming fundamentals, SCPI fundamentals, SCPI, programming examples and I/O driver function library in detail. The purpose is to guide the user to quickly and comprehensively master the programming control commands and methods of the instrument. Main chapters include:

- Remote control
- Programming control commands
- Programming examples
- Error description
- Annex

Online help

Online help is integrated in the instrument, providing fast text navigation help to make it convenient for users in local and remote control operation. Both the hard keys on the front panel of the instrument or the user interface tool bar offer corresponding shortcut keys to activate this function. Main chapters are identical to those of the user's manual.

2. Remote control

This chapter introduces the remote control basics, remote control interface and configuration methods of the 87236, and briefly introduces the concept and classification of I/O instrument driver library. The purpose is to facilitate users to start to achieve remote control. Specific contents include:

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2.1 Remote control fundamentals

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2.1.1 Programming control interface

Instruments with remote control function generally support two kinds of remote control interface: LAN, GPIB, RS-232 and USB, and the type of port supported by the specific model of instrument is determined by the function of the instrument.

The programming control interface and related VISA addressing string are described in the table below:

Table 2.1 Remote control interface type and VISA addressing string

Programming control interface	VISA addressing string	Description
LAN (local area network)	VXI-11 protocol: TC PIP::Addressograph[::LAN_device_name][::INSTR] Raw socket protocol: TC PIP::Addressograph::port::SOCKET	The controller realizes remote control by connecting the instrument with the network port on the rear panel of the instrument. For details of the protocol, please refer to: 2.1.1.1 LAN interface
GPIB (IEC/IEEE Bus Interface)	GPIB::primary address[::INSTR]	The controller realizes remote control by connecting the instrument with the port on the rear panel of the instrument. The bus interface standard IEC 625.1/IEEE 418 is met. For details, please refer to: 2.1.1.2 GPIB interface
RS-232 (RecommendedStandard-232)		Instrument rear panel port. For details, please refer to: 2.1.1.3 RS-232 Interface
USB (Universal Serial Bus)	USB::<vendor ID>::<product_ID>::<serial_number>[::INSTR]	Instrument rear panel port. For details, please refer to: 2.1.1.4 USB interface

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2.1.1.1 LAN interface

An instrument with a network interface (hereinafter referred to as instrument) can be controlled remotely by computers in 10Base-T and 100Base-T. Various instruments are combined into a system in LAN and controlled uniformly by computers in it. In order to realize remote control in LAN, it shall be equipped with port connector, network card and relevant network protocol in advance, and provided with relevant network services.

Meanwhile, the controller computer in the network shall also be equipped with instrument control software and VISA library in advance. The three operating modes of the network card are:

- 10Mbit/s Ethernet IEEE802.3;
- 100Mbit/s Ethernet IEEE802.3u;
- 1Gbit/s Ethernet IEEE802.3ab.

The controller computer and the instrument shall be connected to the common TCP/IP protocol network through the network port. The cable between the computer and the instrument is a commercial RJ45 cable (category 5 twisted pair cable with or without shielding). During data transmission, the transmission speed of LAN is faster when data packet transmission is applied. Generally, the length of the cable between the computer and the instrument shall not exceed 100m (100Base-T and 10Base-T). For more information about LAN communications, please refer to http://www.ieee.org.http://www.ieee.org/

Knowledges about the LAN interface are introduced below:

1) IP address

Physical connection of the network shall be guaranteed for remote control on the instrument via the LAN. It is just required to set the address to the subnet in which the host computer is located via the network configuration interface of the instrument. For example, if the IP address of the host computer is 192.168.12.0, the IP of the instrument shall be set to 192.168.12.XXX, whereas XXX is the figure between 1 and 255.

When establishing a network connection, only the IP address is required. The VISA addressing string is as follows:

TC PIP::host address[::LAN device name][::INSTR] or

TCPIP:: host address: port:: SOCKET

Where:

- TCPIP represents the network protocol used;
- host address represents the IP address of instrument or the name of instrument, and is used for identifying and controlling the controlled instrument;
- LAN device name defines the handle number of the protocol and subset (optional);
  - VXI-11 protocol is selected for device 0;
  - More recent high speed LAN instrument protocol is selected for high speed LAN instrument 0;
- INSTR represents the instrument resource type (optional);
- port represents the socket port number;
- SOCKET represents the raw network socket resource class.

Example:

- The IP address of the instrument is 192.1.2.3, and the effective resource string of the VXI-11 protocol is:

TCPIP::192.1.2.3::INSTR

- To establish a raw socket connection, use:
  TCPIP::192.1.2.3::5025::SOCKET

TIPS

Method of recognizing multiple instruments in the programming control system

If multiple instruments are connected in the network, the individual IP address and related resource string are used to distinguish. The host computer applies its own VISA resource string for instrument identification.

2) VXI-11 protocol

The VXI-11 standard is based on the ONC RPC (Open Network Computing Remote Procedure Call) protocol, which is the network/transport layer of the TCP/IP protocol. The TCP/IP network protocol and associated network services are pre-configured for communication. Such connection-oriented communication, which follows the sequential exchange and can identify the interruption of the connection, ensures no loss of information.

3) Socket communication

The TCP/IP protocol connects the instrument to the network via LAN sockets. As a basic method used in computer network programming, the socket allows applications using different hardware and operation systems to communicate over a network. With this method, two-way communication between the instrument and the computer is realized through ports.

As a software class programming specially, the socket defines the IP address, device port number and other necessary information for network communication, and integrates some basic operations in network programming. Sockets can be used after installing packaged libraries in the operation system. Two commonly used socket libraries are the Berkeley socket library for UNIX the Winsock library for Windows.

Sockets in the instrument are compatible with Berkeley sockets and Winsock through the application program interface (API). In addition, it is compatible with the API of other standard sockets. When SCPI are used to control the instrument, the socket program established in the program issues the command. Before using a LAN socket, the socket port number of the instrument must be set. The socket port number of the instrument is 5025.

2.1.1.2 GPIB interface

As an instrument programming control interface widely used at present, GPIB interface is connected to different types of instruments through GPIB cable, so as to build a test system with the host computer. In order to realize remote control, the host computer shall be equipped with GPIB bus card, driver and VISA library in advance. During communication, the host computer first addresses the controlled instrument through the GPIB bus address. The user may set the GPIB address and ID query string, and the GPIB communication language may be in the form of SCPI by default.

GPIB and its associated interface operations are defined and described in detail in ANSI/IEEE Standard 488.1-2003 and ANSI/IEEE Standard IEEE Standard 488.2-1992. For details of the standards, please refer to the IEEE website: http://www.ieee.org/http://www.ieee.org.

GPIB processes information in bytes at the data transmission speed of up to 8MBps, which is fast. Since the data transmission rate is limited by the distance between the device/system and the computer, the following points shall be noted when connecting GPIB:

- Up to 15 instruments may be built through GPIB interface.
- The total length of the transmission cable shall not be more than 15 m or twice the number of instruments in the system. In general, the maximum length of the transmission cable between the devices shall not exceed 2 m;
- If multiple instruments are connected in parallel, a "live" cable is required;
- The end of the IEC bus cable shall be connected to the instrument or controller computer.

2.1.1.3 RS-232 interface

RS-232 is a traditional method to realize programming control. Because it only sends and receives one bit of data at a time, the transmission rate is slower than GPIB or LAN, which is not commonly used at present. Similar to GPIB and LAN, instrument parameters, such as baud rate, need to be set when establishing communication in order to match the parameters with the host computer. RS-232 transmits SCPI characters in ASCII form.

2.1.1.4 USB interface

To implement USB programming control, a computer and signal generator need to be connected via a USB slave port with the VISA library installed in advance. VISA automatically detects and configures the instrument to establish a USB connection without the need to enter the instrument address string or install a separate driver.

USB address:

Addressing string format: USB::<vendor ID>::<product ID>::<serial number>[::RAW]
Where:

- <vendor ID> represents the manufacturer code;
- <product ID> represents the instrument code;
- <serial number> represents the serial number of the instrument;

Example:

USB::13209::14336::SN100001::INSTR
13209: Manufacturer designator, which can be expressed as 0x3399 in hexadecimal;
14336: Instrument designator, which can be expressed as 0x3800 in hexadecimal;
SN100001: serial number of the instrument.

2.1.2 Message

The messages transmitted on the data cable are divided into the following two categories:

1) **Interface message**

During communication between the instrument and the host computer, the attention cable shall be pulled down first, and then the interface message will be transmitted to the instrument through the data cable. Only instruments with GPIB bus function can send interface message.

2) **Instrument message**

For the detailed structure and syntax of the instrument message, refer to Section "2.1.3 SCPI". The instrument message can be divided into two types as per the transmission direction, namely, command and instrument response. Unless otherwise stated, all programming control interfaces apply instrument message in the same way.

a) Commands:

Commands (programming messages) are messages sent by the host computer to the instrument for the remote control of instrument functions and the query of state information. Commands are divided into the following two categories:

- Based on the impact on the instrument:

  -- Setting commands: change the set state of the instrument, such as reset or setting frequency.

  -- Query commands: query and return data, for example: identify the instrument or query the parameter value. Query commands end with the suffix question mark.

- Based on the definition in the standard:

  -- common commands: with functions and syntax to be defined by IEEE488.2, they are applicable to all types of instruments (if realized)

  It is used for management of standard state register, resetting,

self-detection, etc.

-- Instrument control commands: instrument characteristic commands, used to realize instrument functions, such as setting frequency.

The syntax also follows the specifications of SCPI.

b) Instrument responses:

Instrument responses (response message and service request) are the query result information sent by the instrument to the computer. Such information includes measurement results, instrument state, etc.

2.1.3 SCPI

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2.1.3.1 Introduction to SCPI

SCPI (standard commands for programmable instruments) are a command set for all instruments established based on Standard IEEE488.2. The main purpose is to make the same function have the same programming control command to achieve the universality of programming control commands.

SCPI consist of a command header and one or more parameters. The command header is separated from the parameters by spaces and contains one or more key fields. A command with direct suffix question mark is a query command. Commands are divided into common commands and instrument commands that have different syntactic structures. SCPI have the following characteristics:

1) Programming control commands are oriented to test function rather than describing instrument operation;
2) Programming control commands reduce the repetition of similar test function realization process, and ensure the compatibility of programming.
3) Programming control messages are defined in layers that are hardware independent of the communication physical layer;
4) Programming control commands are independent of programming methods and languages. The test program of SCPIs is easy to transplant;
5) Programming control commands are scalable and can adapt to different scale of measurement control;
6) SCPI have been a "living" standard for their scalability.

If you are interested in learning more about SCPI, please refer to:

IEEE Standard 488.1-2003, IEEE Standard Digital Interface for Programmable Instrumentation. New York, NY, 1998.

IEEE Standard 488.2-1992, IEEE Standard Codes, Formats, Protocols and Comment Commands for Use with ANSI/IEEE Std488.1-2003. New York, NY, 1998

Standard Commands for Programmable Instruments(SCPI) VERSION 1999.0.

For programming control command set, classification and description of the 87236, please refer to:

1) "3. Programming control commands" in this manual;

2) "Annex A Zoom table of SCPI classified as per subsystems" of this manual.

2.1.3.2 Description of SCPI

1) General terms

The following terms apply to this section. To better understand the chapters, you shall understand the exact definitions of the terms.

Controller

A controller is any computer used to communicate with the SCPI device. A controller may be a PC, minicomputer, or a plug-in card on a cage. Some AI devices can also be used as controllers.

Device

A device is any device that supports SCPI. Most of the devices are electronic measurement or excitation devices that use GPIB interfaces for communication.

Programming control message

A programming control message is the combination of one or more SCPI that have been correctly formatted. Programming control messages tell the devices how to measure and output the signals.

Response message

A response message is a set of data of specified SCPI formats. Response messages always come from the devices to controllers or listening devices. Response messages tell the controllers about the internal state or measurement values of the devices.

Command

A command is an instruction that satisfies the SCPI standard. The combination of commands controlling the devices forms a message. In general, a command includes keywords, parameters, and punctuation.

Event command

Event-type programming control commands cannot be queried. An event command generally has no corresponding front panel button setting, and its function is to trigger an event at a specific time.

Query

A query is a special type of command. When a control device is queried, a response message appropriate to the controller syntax requirements is returned. A query statement always ends with a question mark.

2) Command type

There are two types of SCPI: common commands and instrument commands. Figure 2.1 shows the difference between the two commands. Common commands, defined by IEEE 488.2, are used to manage macros and state registers and for synchronization and data storage. Because common commands all start with an asterisk, they are easy to be recognized. For example, *IDN? *OPC, *RST are all common commands. Common commands are not part of any instrument commands, and the instrument interprets them in the same way regardless of the current path setting of the commands.

Instrument commands are easy to be recognized because they contain a colon (:). A colon is used in the beginning of an expression or between two keywords, for example: FREQuency[:CW?]. According to the internal function module of the instrument, instrument commands are divided into sub-sets of corresponding subsystem commands. For example, the power subsystem (:POWer) contains power-related commands, while the state subsystem (:STATus) contains commands for the state control register.

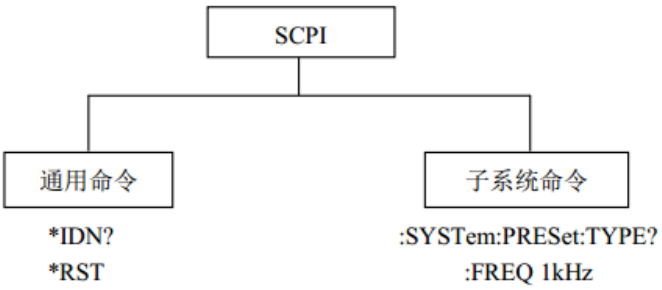

Figure 2.1 Types of SCPI

3) Instrument command syntax

A typical command consists of a keyword prefixed with a colon. The keyword is followed by parameters. The following is an example of a syntax declaration:

[:SENSe:]FREQuency[:CW|FIXed] MAXimum|MINimum

In the example above, the [:CW|FIXed] in the command follow : FREQuency closely without any space. MINimum|MAXimum immediately following [:LEVel] is the parameter. There is a space between the command and the parameter. Other parts of the syntax expression are described in Table 2.2 and Table 2.3.

Table 2.2 Special characters in command syntax

Symbol	Meaning	Example
|	The vertical bar between the keyword and the parameter represents multiple options.	[:SENSe:]BANDwidth|BWIDth HIGH|LOWer BANDwidth and BWIDth are optional; HIGH and LOWer are optional.
[]	A square bracket indicates that the contained keyword or parameter is optional when forming a command. The command will be executed even when such implied keyword or parameter is ignored.	[:SENSe:]BANDwidth? SENSe is optional.
< >	The portion enclosed in angle brackets is not used literally in the command in the literal sense. They represent the part that must be contained.	[:SENSe:]FREQency[:CW|FIXed] <val>[unit] In this command, <val> must be replaced with actual frequency. [unit] is an omittable unit. For example: FREQ 3.5 GHz FREQ 3.5e+009
{ }	The part in braces indicates that the parameter is optional.	MEMory:TABLe:FREQuency <val>{,<val>} For example: MEM:TABL:FREQ 5e7

Table 2.3 Command syntax

Characters, keywords and syntax	Example
Uppercase characters represent the minimum set of characters required to execute a command.	[:SENSe:]FREQuency[:CW|FIXed]?, FREQ is the short format part of the command.
Lowercase character of the command is optional; such flexible format is called "flexible listening". Refer to the section "Parameters and responses of commands" for more information.	:FREQuency :FREQ,:FREQuency or or :FREQUENCY Either of them is correct.
When a colon is between the two command mnemonics, it moves the current path in the command tree down by one level. For more information, please refer to the command path part in section "Command tree".	:TRIGger:MODE? TRIGger is the topmost keyword of this command.

2.1 Remote control fundamentals

If the command contains more than one parameter, adjacent parameters are separated. The parameter is not part of the command path, so it does not affect the path layer.	MEMory:TABLe:FREQuency <val>{,<val>}
The semicolon is used to separate 2 adjacent commands, without affecting current command path.	:FREQ 2.5GHZ; :POW 10DBM
Blank characters, such as <space> or <tab>, are usually ignored as long as they do not appear between keywords or in keywords. However, you must separate the commands and parameters with blank characters, which does not affect the current path.	:FREQuency or :POWer :LEVel6.2 is not allowed. :LEVel and 6.2 must be separated by a space, namely, :POWer:LEVel 6.2.

The simplified syntax specification is shown in Figure 2.2

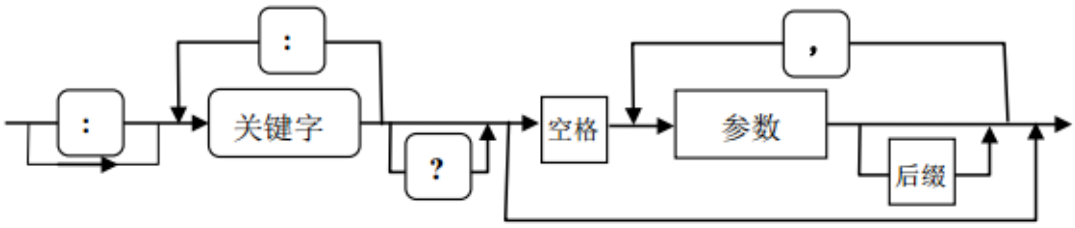

Figure 2.2 Types of SCPI

For example, the syntax expression of "[:SENSe[1]:]FREQuency[:CW|FIXed] <numeric parameter>" can be expressed as follows.

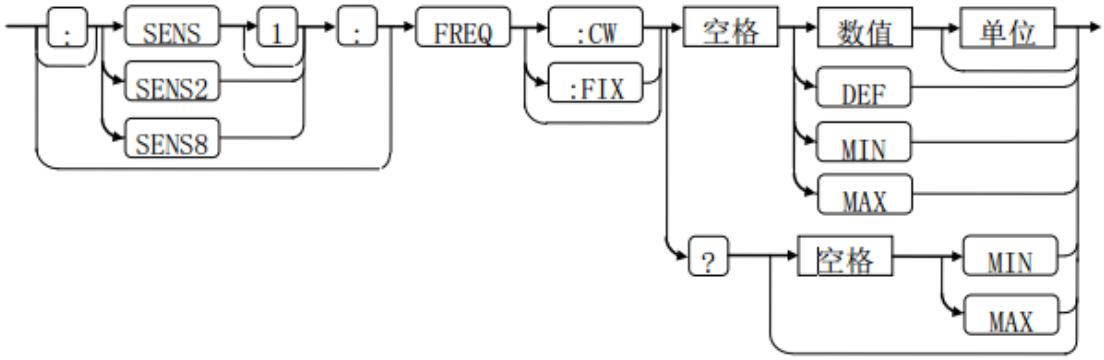

Figure 2.3 Types of SCPI

Remarks:

1) In the above chart, no spaces may be added where spaces are not indicated as required. Spaces may be 1 or more. If the units are omitted, the standard unit of frequency, Hz, and the standard unit of time, seconds, are used.

2) Rounded rectangles indicates the actual characters required for the keywords or commands, such as ":", ",", "?" , "1", etc.; Right-angled rectangles need to be replaced by actual characters, numbers, etc. For example, the "value" cannot appear in the command, and it needs to be replaced by the actual value, such as 5e+007, etc.

3) Without considering the short and long format of the keyword, the frequency of channel A is set to 50 MHz, and the above chart has the following forms (only the short format of the keyword is taken. Since there are many units of frequency, such as Hz, kHz, MHz, GHz, THz, etc., it is no longer given one by one due to space limitations. It is only necessary to replace 5.0e+007 with corresponding units, such as 50 MHz, 5e+007 Hz, 0.05 GHz, etc.).

a)	:SENS1:FREQ:CW 5.0e+007	No keywords omitted
b)	SENS1:FREQ:CW 5.0e+007	The ":" before SENS1 omitted.
c)	SENS:FREQ:CW 5.0e+007	"1" omitted.
d)	FREQ:CW 5.0e+007	SENS omitted.
e)	:SENS1:FREQ:FIX 5.0e+007	No keywords omitted
f)	SENS1:FREQ:FIX 5.0e+007	The ":" before SENS1 omitted.
g)	SENS:FREQ:FIX 5.0e+007	"1" omitted.
h)	FREQ:FIX 5.0e+007	SENS omitted.
i)	:SENS1:FREQ 5.0e+007	CW or FIX omitted
j)	SENS1:FREQ 5.0e+007 omitted.	The ":" before SENS1 and CW or FIX
k)	SENS:FREQ 5.0e+007	"1" and CW or FIX omitted.
l)	FREQ 5.0e+007	SENS and CW or FIX omitted.

4) For channel B and channel 8 frequencies, SENS2 and SENS8 cannot be omitted.

5) MIN and MAX can be used as parameters of the set command or as parameters of the query command. DEF can only be used as a parameter of the set command. The specific values of MIN, MAX, and DEF are related to the instrument.

a) FREQ DEF Set the frequency of channel A to the default value.

b) FREQ? MAX Query the maximum settable frequency of channel A and return a value without unit.

6) If the long and short forms of keywords are considered, and commands with units are not considered, there are 1632 forms of commands in the above chart. Users don't have to care about all forms. As long as it can be used flexibly, it is enough. A simple calculation is performed below, and interested users can calculate by themselves.

a) First calculate the case where SENS is defaulted, noted as N1.
There are 2 forms of FREQ/FREQuency, noted as N11.
There are four forms of CW/FIX/FIXed/Omitted, noted as N12.
There are 7 parameters of the set command:
Value/DEF/DEFault/MIN/MINimum/MAX/MAXimum.
The parameters of the query command are
MIN/MINimum/MAX/MAXimum/Omitted, i.e., there are 12 types of parameters, which are recorded as N13, then
$$N1 = N11 \times N12 \times N13 = 2 \times 4 \times 12 = 96$$

b) Then calculate the case where SENS is not defaulted, noted as N2.
The first ":" has 2 types, omitted and not omitted, noted as N21.
There are 2 types of SENS/SENSe. There are 4 types of suffixes: 1/2/6/Omitted, i.e., there are 8 (2×4) types of SENS keywords, noted as N22.
SENS keyword forms a combination with the following keywords, then
$$N2 = N21 \times N22 = 2 \times 8 \times N1 = 16 \times N1$$

c) Let there be a total of N forms, then
$$N = N1 + N2 = 17 \times N1 = 1632$$

4) Command tree

Most remote control programs apply instrument commands. When parsing such commands, SCPI apply a file system-like structure called command tree, as shown in Figure 2.4:

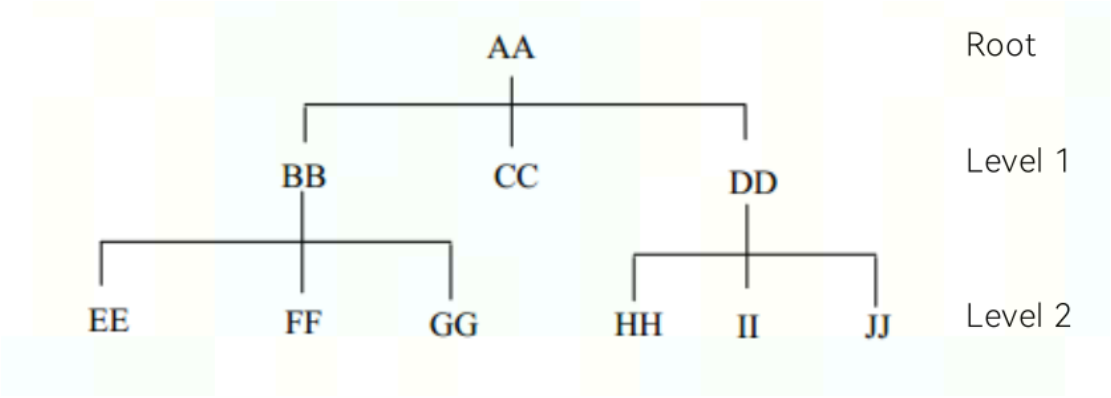

Figure 2.4 Diagram of the simplified command tree

The top command is the root command, or "root" for short. When a command is parsed, follow a specific path to the next level of command according to the tree structure. For example, in :POWer:ALC:SOURce?, : POWer stands for AA, :ALC stands for BB, :SOURce stands for GG, and the entire command path is (:AA:BB:GG).

A software module in instrument software – **command interpreter**, is responsible for parsing each received SCPI. The command interpreter breaks commands into individual command elements by using a series of rules that distinguish the path of the command tree. After parsing the current command, keep the current command path unchanged. The advantage of this is to parse subsequent commands more quickly and efficiently since that the same command keyword may appear in different paths. After starting or *RST (reseting) the instrument, current command path is reset to root.

5) Command parameters and responses

SCPI defines different data formats in the use of programming control and response messages to comply with the principles of "**flexible listening**" and "**precise speaking**". For more information, please refer to IEEE488.2. "**Flexible listening**" means that the formats of the commands and parameters are flexible.

For example, set the frequency offset state command :FREQuency:OFFSet:STATe ON|OFF|1|0.

the following command formats are all used to set the frequency offset function to ON:

:FREQuency:OFFSet:STATe ON, :FREQuency:OFFSet:STATe 1,

:FREQ:OFFS:STAT ON, :FREQ:OFFS:STAT 1.

Each parameter type has one or more corresponding response data types. During query, a data type will be returned for a numerical parameter, and the response data is precise and strict, known as "**precise speaking**".

For example, during query of the power state (:POWer:ALC:STATe?), when it is ON, the response data returned is always 1 during query, regardless of whether the previously sent setting command is :POWer:ALC:STATe 1 or :POWer:ALC:STATe ON.

Table 2.4 Parameter and response types of SCPI

Parameter type	Response data type
Numerical	Real number or integer
Extended numerical	Integer
Discrete	Discrete
Boolean	Digital boolean
String	String
Blocks	Finite-length blocks
	Infinite-length blocks
Non-decimal numeric types	Hexadecimal
	Octal
	Binary

Numerical parameters

Numeric parameters can be used in both instrument-specific commands and common commands. A numeric parameter receives all the usual decimal counting methods, including signs, decimals, and scientific notation. If a device only accepts a specified numeric type, such as an integer, it will automatically round up the received numeric parameters.

Examples of numeric parameters:

0 No decimal point
100 Optional decimal point
1.23 Signed bit
4.56e<space>3 Index marker e can be followed by a space
-7.89E-01 Index marker e can be uppercase or lowercase
+256 Positive lookahead allowed
.5 Decimal points can be used first

Extended numerical parameters

Most measurements related to instrument commands use extended numeric parameters to specify physical quantities. Extended numerical parameters receive all numeric parameters and additional special values. All the extended numeric parameters receive MAXimum and MINimum as parameter values. Whether other special values, such as UP and DOWN, will be received is determined by the ability of the instrument to parse. All effective parameters will be listed in the table of SCPI.

Notice: Extended numeric arguments do not apply to common commands or STATus subsystem commands.

Examples of extended numeric parameters:

101 Numeric parameter
1.2 GHz GHz can be used as an index (E009)

200 MHz MHz can be used as an index (E006)
-100 mV -100 millivolt
10DEG 10°
MAXimum Maximum effective setting
MINimum Minimum effective setting
UP Increase by a step
DOWN Reduce by a step

Discrete parameters

When the number of parameter values to be set are finite, they are identified by discrete parameters. Discrete parameters use mnemonics to represent each valid setting. Like programming control command mnemonics, discrete parameter mnemonics have two formats, long and short, and allow for mixture of upper and lower cases.

In the following examples, discrete parameters and commands are used together.

:TRIGger[:SEQuence]:SOURce BUS|IMMediate|EXTernal

BUS GPIB, LAN, RS-232 trigger
IMMediate Trigger immediately
EXTernal Trigger externally

Boolean parameters

A Boolean parameter represents a true or false binary condition, which can only have four possible values.

Examples of Boolean parameters

ON Logically true
OFF Logically false
1 Logically true
0 Logically false

String parameters

String parameters allow ASCII strings to be sent as parameters. Single quotes and double quotes are used as separators.

The following are example of string parameters:

'This is Valid' "This is also Valid" 'SO IS THIS'

Real response data

Most of the test data are of real number type, and their formats can be basic decimal notation or scientific notation, which are supported by most advanced programming control languages.

Examples of real response data:

1.23E+0
-1.0E+2

+1.0E+2
0.5E+0
0.23
-100.0
+100.0
0.5

Integer response data

An integer response data is a decimal expression of an integer value containing signed bit. When querying the state register, most of the response data returned are of integer type.

Examples of integer response data:

0 Symbol bit optional
+100 Positive lookahead allowed
-100 Negative lookahead allowed
256 No decimal point

Discrete response data

Discrete response data are basically the same as discrete parameters, only that the return format of discrete response data is only a short form in uppercase.

Examples of discrete response data:

INTernal Amplitude stabilization mode: internal
EXTernal Amplitude stabilization mode: external
MMHead Amplitude stabilization mode: millimeter wave source module

Digital bool response data

A binary value 1 or 0 is returned as Boolean response data.

String response data

String response data and string parameters are alike. The main difference is that the separators of string response data are double quotes instead of single quotes. Double quotes can also be embedded in string response data, and there may be no characters between the double quotes.

Here are some examples of string response data:

"This is a string"

"one double quote inside brackets: ("")"

Arbitrary data block

See Section 7.7.6 of IEEE 488.2 for <Arbitrary data block>.

#nNNN...Nddd……ddd<LF>

Data newline character indicating the end of the data block.
Data length (i.e. the number of bytes of d)
Number of bits of data length (i.e. the number of bits of N)
The marker for the start of the data block.

For example: #42004 ..... in <LF> n = 4 and N = 2004.

6) Number system of commands

The value of the command can be entered in binary, decimal, hexadecimal or octal format. When using binary, hexadecimal or octal format, a proper identifier is required before the value. The decimal format (the default format) does not require an identifier. When a value is entered without an identifier in front of it, the device will ensure it to be in decimal format. The following list shows the identifiers required for different formats:

- #B indicates that the number is a binary number;
- #H indicates that the number is a hexadecimal number;
- #Q indicates that the number is an octal number.

The following are various representations of the decimal number 45 in SCPI:

#B101101

#H2D

#Q55

The following example sets the RF output power to 10 dBm (or a value of the equivalent value of the currently selected unit, such as DBUV or DBUVEMF) with a hexadecimal value of 000A.

:POW #H000A

When using a non-decimal format, a measurement unit, such as DBM or mV, is not used with the value.

7) Command line structure

A command line may contain multiple SCPI. To indicate the end of the current command line, the following methods may be used:

- Line feed;
- Line feed and EOI;
- EOI and the last data byte.

Commands on the command line are separated by semicolons, and commands belonging to different subsystems begin with a colon. For example:

MMEM:COPY "Test1", "MeasurementXY";:HCOP:ITEM ALL

The command line contains two commands: the first one belongs to the MMEM subsystem, and the second belongs to the HCOP subsystem. If adjacent commands belong to the same subsystem with repeated command path, they can be expressed in abbreviation. For example:

HCOP:ITEM ALL;:HCOP:IMM

The command line contains two commands: both of them belong to the HCOP subsystem, with the same first level. Therefore, the second command can start from the next level of HCOP, and the colon for starting the command can be omitted. It can be abbreviated as follows:

HCOP:ITEM ALL;IMM

2.1.4 Command sequence and synchronization

IEEE488.2 defines the difference between overlapping and sequential commands:

- Sequential commands are sequences of commands that are executed continuously. Each command is usually executed faster;
- An overlapping command is one that is not executed automatically before the next command is executed. It usually takes longer to process overlapping commands, and programs are allowed to process other events synchronously during the period.

Even if there are multiple setting commands on a command line, they may not be executed in the order they were received. To ensure that commands are executed in a certain order, each command must be sent on a separate command line.

Example: the command line contains setting and query commands

If multiple commands on a command line contain query commands, the query results are unpredictable. A fixed value is returned for the following command:

:FREQ:STAR 1GHZ;SPAN 100;:FREQ:STAR?

Returned value: 1000000000 (1 GHz)

The following command returns an unfixed value:

:FREQ:STAR 1 GHz;STAR?;SPAN 1000000

The returned result may be the current start frequency value because the instrument program will delay execution of the command. If the instrument program executes a command upon its reception, the returned result may also be 1 GHz.

TIPS

Setting commands are sent separately from query commands

General rules: in order to ensure the correctness of returned results of query commands, setting commands and query commands shall be sent in different programming control messages.

2.1.4.1 Prevention of overlapping execution of commands

In order to prevent overlapping execution of commands, multithreading or commands *OPC, *OPC? or *WAI may be applied, which are executed only after the hardware settings are completed. During programming, the computer may force a

period of time to synchronize certain events. The descriptions are shown below:

- **Controller program using multi-threading**

  Multi-threading is used to wait for command completion and synchronization between the user interface and programming control, that is, to wait for *OPC? Completion in separate threading without interfering GUI or programming control threading execution.

- The application of the three commands in synchronous execution is shown in the table below:

Table 2.5 Command usage

Method	Action	Programming method
*OPC	After the command is executed, set it in the operation completion bit of the ESR register.	Set to ESE BIT0; Set to SRE BIT5; Send overlapping commands and *OPC; Wait for service request (SRQ); Service request represents that the overlapping command has been executed.
*OPC?	Stop executing the current command . The command is returned only when it is in the operation completion bit of the ESR register, indicating that the previous command has been processed.	Terminate processing of the current command before executing other commands, and send the command directly after the current command.
*WAI	Before the execution of *WAI, wait for all commands to be sent before proceeding with unfinished commands.	Terminate the processing of the current command before executing other commands, and send the command directly after the current command.

In the case that the processing time of overlapping command is short, the command *WAI or *OPC may be used after the overlapping command to achieve command synchronization. In order to execute other tasks synchronously while the computer or instrument is waiting for the completion of overlapping commands, the following synchronization techniques may be applied:

- **OPC and service request**

1) Set the OPC mask bit of ESE (bit0): *ESE 1;
2) Set the bit5 of SRE: *SRE 32 enable ESB service request;
3) Send overlapping commands and *OPC;
4) Wait for service request.

Service request represents that the overlapping command has been executed.

➢ OPC and service request

1) Set the bit4 of SRE: *SRE 16 enable MAV service request;
2) Send overlapping commands and *OPC?;
3) Wait for service request.

Service request represents that the overlapping command has been executed.

➢ Event state register (ESE)

1) Set the OPC mask bit of ESE (bit0): *ESE 1;
2) Send only overlapping commands instead of *OPC, *OPC or *WAI;
3) Send "*OPC;*ESR?" in timer for cyclic query of the operation state.

The returned value (LSB) 1 indicates completion of the overlapping command.

➢ * OPC? and short timeout

1) Send only overlapping commands instead of *OPC, *OPC or *WAI;
2) Send "<short timeout>; *OPC?" in timer for cyclic query of the operation state;
3) The returned value (LSB) equal to 1 indicates that the execution of the interleave command is complete. In case of timeout, it is during operation.
4) Reset the timeout value to the old value;
5) Send the command "SYStem:ERRor?" to clear the error queue, and delete the message "-410, query interrupt".

The returned value (LSB) 1 indicates completion of the overlapping command.

2.1.5 State reporting system

The state reporting system stores all operating state information for the current instrument, including error message. They are stored in state registers and error queues respectively, and can be queried through a programming control interface.

- Structure of state register.....24
- Structure of SCPI state register.....25
- Description of state register.....27
- Application of state reporting system.....30
- Resetting state reporting system.....32

2.1.5.1 Structure of state register

State registers are described by classification below:

1) STB, SRE

The state byte (STB) register and its related mask register – service request enable register (SRE), comprise the top register of the state reporting system. STB stores the general operating state of the instrument by collecting the information of lower registers.

2) ESR, SCPI state register

STB receives information from the following registers:

- The value resulting from the AND operation between the event state register (ESR) and the event state enable (ESE) mask register.
- SCPI state register includes: STATus:OPERation and STATus:QUEStionable registers (SCPI definition),

which contain the specific operation information of the instrument. All SCPI status registers have the same internal structure (For details, refer to 2.1.5.2 "SCPI status register structure"

3) IST,PPE

Similar with SRQ, IST ("Individual STatus") marks a separate bit consisting of all states of the instrument. The associated parallel poll enable register (PPE) determines the STB data bits for IST marking.

4) Output buffer

It stores the messages returned by the instrument to the controller. It does not belong to the state report system, but determines the MAV position value of the STB.

TIPS

SRE, ESE

SRE may be used as the enable part of STB. Similarly, ESE may be used as the enable part of ESR.

2.1.5.2 SCPI state register structure

Each standard SCPI register consists of five parts. Each part contains 16 bits and is functionally independent. For example, one bit is assigned for each hardware state and valid for all five parts of the register. If Bit15 is set to 0, the value of the register is positive integer data.

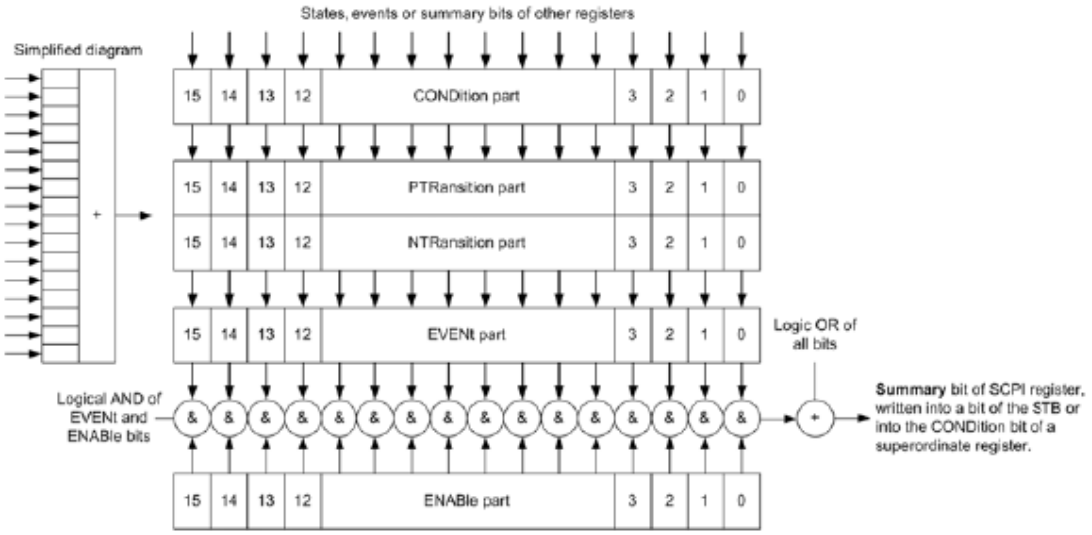

Figure 2.5 Structure of state register

It can be seen from the figure above that the state register consists of five parts, which are respectively described as follows:

- Condition register

In this part, the summary bit of hardware or lower registers are directly written, reflecting the operating state of the current instrument. This register is read only, not writable. It reads but not clearing the value.

- Positive/negative transition register

The two transition registers define the state transition bit of the condition register stored in the event register.

The positive transition register is similar to the transition filter. When a bit of the condition register is transformed from 0 to 1, relevant PTR bit determines whether the event bit is set to 1, as shown below:

-- PTR bit = 1: the event bit is set.

-- PTR bit = 0: the event bit is not set.

The positive transition register is readable and writable. It reads but not clearing the value.

The negative transition register is similar to the transition filter. When a bit of the condition register is transformed from 1 to 0, relevant NTR bit determines whether the event bit is set to 1, as shown below:

-- NTR bit = 1: the event bit is set.

-- NTR bit = 0: the event bit is not set.

The positive transition register is readable and writable. It reads but not clearing the value.

- Event register

This part indicates whether the event has occurred since the last reading and whether the content of the condition register is stored. It represents only the event passed through the transition register. It can only be changed by the instrument and

read by the user. The value will be cleared after reading. The value of this part is often equal to the value of the entire register.

- Enable register

  This part determines whether the related event bit acts on the final summary data. The bits of each enable part is the sum of related enable bits. The logical operation result of this part is or not the summary bit.

  - enable bit = 0: the related event bit does not act on the summary data.
  - enable bit = 1: the related event bit acts on the summary data.

  This part is readable and writable. It reads but not clearing the value.

- Summary bit

  The summary bit of each register consists of the event and the enable part. The result enters the condition part of the upper register. The instrument automatically generates the summary bit for each register so that events can cause different levels of service requests.

2.1.5.3 State register description

The state registers are detailed as follows:

1) State byte (STB) and service request enable register (SRE)

IEEE488.2 defines the state byte (STB). The rough instrument state is reflected by collecting the information of lower registers. Bit6 is equal to the summary data of other state byte bits. The result of a comparison between the state byte and the condition part of the SCPI register may be assumed to be the top in the SCPI hierarchy. The value of state byte may be read through common command "*STB?" or serial query.

The state byte is connected to the service request enable register (SRE). Each bit of the state byte corresponds to a bit in SRE. Bit6 of SRE is ignored. If one of the bits in SRE is set and the related STB bit changes from 0 to 1, a service request (SRQ) will be generated. Common command "*SRE" is used to set SRE, and common command "*SRE?" used to read SRE. The state byte is described in Table 2.6 Description of state byte:

Table 2.6 Description of state byte

Bit	Meaning
0	Not used.
1	Device related.
2	The error queue is not empty Set this bit when a new error is inserted into the error queue. If related SRE bit enables the bit, a service request will be generated when a new error is generated in the error queue, so that the error can be identified and the error message can be queried. Such method effectively reduces errors in programming control.

3	Summary bit of question state register Set this bit only when the event bit of the inquiry state register and the related enable bit are set to 1. This bit represents a question state of the instrument. Specific instrument state information can be obtained by querying the question state register of the state register.
4	MAV bit (message available) Set this bit if the output queue information is readable. This bit is used when the controller queries instrument information.
5	ESB bit Summary bit of the event state register. Set this bit when one of the bits in the event state register is set and the corresponding bit in the event state enable register is enabled. The bit of 1 indicates a serious error in the instrument. The specific error message can be found by querying the event state register.
6	MSS bit (master status summary bit) Set this bit if the instrument triggers a service request.
7	Summary bit of operating state register Set this bit when the event bit of the operating state register and the corresponding enable bit are set to 1. This bit indicates that the instrument has performed an operation, the type of which can be obtained by querying the operating state register.

2) IST flag and parallel poll enable (PPE) register

The IST identifies the combination of the overall instrument state with a single data bit. The flag can be obtained by a parallel poll or by sending the command "*IST?". The associated parallel poll enable register (PPE) determines the STB data bits for IST marking. STB data bits are in phase with PPE data bits, and the usage of bit6 is opposite to bit6 in SRE. The IST flag is equal to the limit of all results. The command "*PRE" may be used to set PPE, and the command "**PRE?" used to read PPE.

3) Event state register (ESR) and event state enable register (ESE)

IEEE488.2 defines ESR. The command "*ESR?" may be used to read the event state register (ESR). ESE belongs to the enable part of SCPI register. If one of the bits is 1 and one of the bits in the corresponding ESR changes from 0 to 1, the ESB bit of STB shall be set to 1. The command "*ESE" may be used to set ESE, and the command "*ESE?" used to read ESE.

Table 2.7 Description of event state byte

Bit	Meaning
0	Operation completed Set this bit when the previous commands have been executed and the

	command *OPC has been received.
1	Not used.
2	Query error Set this bit when the controller reads the instrument data without sending the query command, or sends a new command before reading the query data. It indicates that there is a query error, for which the query cannot be executed.
3	Instrument error Set this bit when there is an instrument error. Error code range: -300 - -399, or positive error code. Specific error message can be found in relevant information in the error queue.
4	Execution error Set this bit when a syntactically correct command is received but cannot be executed, and an error with code ranging from -200 to -300 is generated in the error queue.
5	Command error Set this bit when the syntax of the command received is incorrect. Error code range: -100 - -200. Specific error message can be found in relevant information in the error queue.
6	User request Set this bit when the instrument is switched to manual control mode.
7	Power ON Set this bit when the instrument is powered on.

4) State: operation register

State: The operation register contains information about the current operation of the instrument and information about the previously executed operations. The operation register value can be read by the command "STATus:OPERation:CONDition?" or "STATus:OPERation[:EVENt]?" to read the operation register value. The register is described in Table 2.8 below.

Table 2.8 State: operation register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A calibration state
2	4	Channel B calibration state (for dual-channel only)
3	8	USB interface channel calibration state
4-14	-	Unused
15	-	Always 0

5) State: question register

The register contains instrument state that does not meet specification requirements. The register value may be queried through the command "STAT:QUES:COND" or "STAT:QUES:EVEN". The register is described in Table 2.9 below.

TIPS

Query register

State: the question register has collected the information of all lower sub-registers (for example, bit2 has collected all time related information). Since each path corresponds to a separate sub-register, in case of a state bit error of the question register, it is required to go back to the sub-register of the path to check for the specific error source. By default, the sub-register state being queried belongs to the currently selected path.

Table 2.9 State: question register description

Bit	Value	Definition
0-2	-	Unused
3	8	Power summary
4-7	-	Unused
8	256	Calibration summary
9	512	Power-on self-test
10-14	-	Unused
15	-	Always 0

2.1.5.4 Application of state reporting system

The state reporting system is used to monitor the state of one or more instruments in a test system. In order to correctly realize the function of the state reporting system, the controller in the test system must receive and evaluate the information of all instruments. Standard methods used include:

1) Service request (SRQ) initiated by the instrument;
2) Serial query of all instruments in the bus system, initiated by the controller in the system, in order to find the initiator of the service request and the reason.
3) Parallel query of all instruments;
4) Programming control command to query the state of specific instruments;
5) Query of error queue.

1) Service request

In some cases, the instrument sends a service request (SRQ) to the controller to obtain the controller's service, and the controller initiates an interrupt to enter the corresponding interrupt handler. According to Figure 2.5, an SRQ is typically initiated by one or more state bytes and by bits 2, 3, 4, 5 or 7 of the related enable register (SRE). These bits, in turn, make up advanced registers, error queues or output buffers. In order to use all the service requests as far as possible, all bits in enable registers SRE and ESE shall be set to 1.

Example: use the command *OPC to generate SRQ at the end of the sweep.

a) Recall the function InstrWrite to write the command "*ESE 1", and set to ESE bit0 (operation completed).

b) Recall the function InstrWrite to write the command "*SRE 32", and set to SRE bit5 (ESB).

c) Recall the function InstrWrite to write the command "*INIT;*OPC", and SRQ is generated after the operation is completed.

After instrument setting, the instrument generates a SRQ.

SRQ can only be initiated by the instrument. In case of an instrument error, the controller program shall allow a service request to be made to the instrument and handled by a dedicated interrupt service program.

2) Serial query

Similar to the command *STB, serial query is used to query the state byte of the instrument. Serial query adopts the method of interface message, so the query speed is fast. IEEE 488.2 defines the specific method for serial query. The method is mainly used to quickly obtain the state of one or more instruments connected with the controller in the test system.

3) Parallel query

In the test system, the controller sends an information bit to the data cable through a command, and can query 8 instruments at the same time. The data configured on the data cable of the instrument is a logical "0" or "1". In addition to the conditions under which the SRE register determines the SRQ to be generated, the bits of parallel poll enable register (PPE) and STB register shall be subject to AND operation. The result obtained is sent to the controller of parallel query as the response result after OR operation and NOT operation, or the result may be obtained through the command *IST.

In parallel query, first the instrument shall be set to the parallel query state through the command PPC, which allocates one data cable to the instrument and determines whether the bit is reversed in response. The PPE register is used when executing parallel query. Parallel query is mainly used for the controller to quickly locate which instrument has sent the service request. Therefore, the same values shall be set for the registers SRE and PPE.

4) Query instrument state

The following two commands may be used to query each part of the state register:

- Command *ESR?, *IDN?, *IST?, *STB? is used to query the advanced register;
- The state system command is used to query the SCPI register (for example: State:QUEStionable…).

The returned value of the register being queried is usually in decimal format and is detected by the controller program. For more details on why SRQ is generated, parallel query is usually done after SRQ.

Description of response data bit

The STB and ESR registers contain 8 bits, and the SCPI register contains 16 bits. The returned value of the query state register is in decimal format. The decimal value is equal to the sum of each bit and respective weight.

The relationship between the bit and the weight is shown in the figure below:

数据位	7	6	5	4	3	2	1	0
权 重	128	64	32	16	8	4	2	1

Figure 2.6 Relationship between the bit and the weight

5) Error queue

Each error state of the instrument corresponds to an entry in the error queue, which contains a specific error message text that can be viewed through the error log or queried through the programming control command: SYSTem:ERRor[:NEXT]? or SYSTem:ERRor:ALL?. If there is no error in the error queue, the query returns 0, "No error".

The error queue shall be queried in the controller service request handler because a more accurate description of the cause of the error can be obtained than in the state register. Especially in the test phase of the controller program, the error queue shall be frequently queried to clarify the error command record sent by the controller to the instrument.

2.1.5.5 Resetting the state reporting system

Commands and events for the resetting state reporting system are listed below. In addition to the commands *RST and SYSTem:PRESet, other commands will not change the function settings of the instrument. Similarly, DCL will not change the set state of the instrument. Details are shown in the table below:

Table 2.10 Resetting the state reporting system

Event / Funct	Power ON/OFF (Powered state cleared)		DCL, SDC (Instrument cleared, instrument selected to be cleared)	*RST or SYSTem: PRESet	STATus: PRESet	*CLS
	0	1				
Clear STB, ESR	—	Yes	—	—	—	Yes
Clear SRE, ESE	—	Yes	—	—	—	—
Clear PPE	—	Yes	—	—	—	—
Clear the event part of the register	—	Yes	—	—	—	Yes
Clear the enable part of the operation and question registers. Fill the enable part of other registers with 1.	—	Yes	—	—	Yes	—
Fill the positive transition part with 1. Clear the negative transition part.	—	Yes	—	—	Yes	—
Clear the error queue	Yes	Yes	—	—	—	Yes
Clear the output buffer	Yes	Yes	Yes	—	—	—
Clear the command processing and input buffers	Yes	Yes	Yes	—	—	—

2.1.6 Precautions for programming

1) Please initialize the instrument state before changing settings

When setting the instrument remotely, first initialize the instrument state (for example, send "*RST"), and then implement the required state setting.

2) Command sequence

In general, setting commands and query commands shall be sent separately.

Otherwise, the returned value of query commands will change with the current order of instrument operation.

3) Fault response

Service requests can only be initiated by the instrument. The controller program in the test system shall guide the instrument to initiate service request actively when there is an error, and then enter corresponding interrupt service program for processing.

4) Error queue

Each time the controller program processes a service request, it shall query the error queue of the instrument instead of the state register for a more precise cause of the error. Especially in the test phase of the controller program, the error queue shall be frequently queried to obtain the error command sent by the controller to the instrument.

2.2 Instrument programming control port and configuration

The USB programming control system uses USBTMC to control the 87236.

The USBTMC interface does not require user configuration.

NOTICE

Use of USB programmable interface

Before programming with this instrument, it is necessary to install VISA library in the host computer.

2.3 I/O library

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- Installation and Configuration of I/O Library.....35

2.3.1 Overview of I/O library

I/O library is a pre-written software library for instruments, known as instrument driver. As a software between the computer and the instrument hardware, it consists of the function library, utility program, tool kit, etc. It is a combination of a series of software code modules and corresponds to operation of a plan, such as configuring the instrument, reading from the instrument, writing to the instrument and trigger the instrument, etc. Residing in the computer, it is the bridge and link between the computer and the instrument. By providing a high-level modular library for convenient programming, users no longer need to learn the complex low-level programming protocol for a specific instrument. Application of instrument driver is the key to develop

test and measurement applications quickly.

Functionally, a universal instrument driver generally consists of five parts: functor, interactive developer interface, programmer interface, subprogram interface and I/O interface, as shown in the figure below:

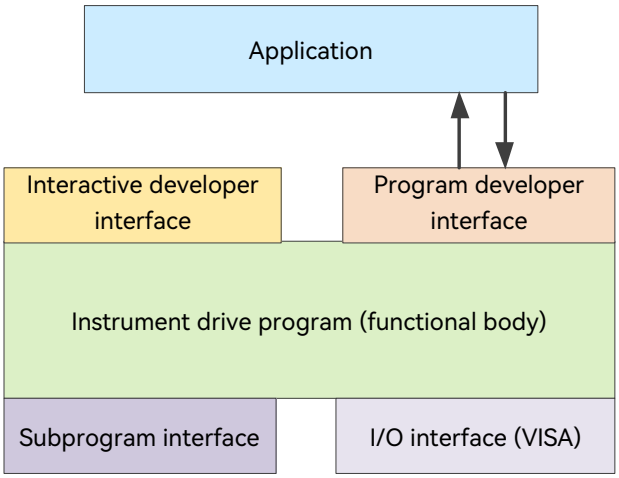

Figure 2.7 Structure model of instrument driver

The details are as follows:

1) Functor. As the main function part of the instrument driver, it may be understood as its framework program.
2) Interactive developer interface. Application development environment that supports instrument driver development is usually provided with graphical interactive developer interface for user convenience. For example, in Labwindows/CVI, the function panel is an interactive developer interface. In the function panel, each parameter of the instrument driver function is represented as a graphical control.
3) Programmer interface. It is a software interface for the application to recall instrument driver function, such as dynamic link library file.dll of instrument driver in Windows system.
4) I/O interface. It completes the actual communication between the instrument driver and the instrument. The bus-specific I/O software, such as GPIB and RS-232, or the common standard I/O software applied cross multiple buses (VISA I/O) can be used.
5) Subprogram interface. It is a software interface for the instrument driver to access other support libraries, such as databases, FFT functions, etc. The subprogram interface is used when the instrument driver needs to recall other software modules, operation systems, programming control code libraries and analysis function libraries to complete its task.

2.3.2 Installation and configuration of I/O library

Along with the application in test field, it has gone through different development

stages from traditional instrument to virtual instrument. In order to solve the interchangeability of instruments and reusability of test program in automatic test system, instrument driver has gone through different development processes. IVI (Interchangeable Virtual Instruments) driver is relative popular and common at present. Based on IVI specification, it defines a new instrument programming interface, inserts the class driver and VPP architecture onto the VISA to make the test application and instrument hardware completely independent, adds such unique functions as instrument simulation, range sensing and state cache, improves the operation efficiency of the system, and realizes instrument exchange.

There are two types of IVI driver: IVI-C and IVI-COM, where the latter adopts the form of COM API based on the component object model (COM) of Microsoft, and the former adopts the form of C API based on ANSI C. Both types are designed according to the instrument class defined in the IVI specification and have the same application development environment, including Visual Studio, Visual Basic, Keysight VEE, LabVIEW, CVI/LabWindows, etc.

TIPS

Port configuration and IO library installation

Before using the computer to control the 87236, please make sure you have the necessary ports and I/O libraries installed and configured correctly.

TIPS

Use of I/O library

The driver function panel, help document and driver function examples will be installed automatically when installing the attached IVI-COM/C driver installation package, so as to facilitate users to develop integrated programming control functions.

2.4. Zeroing

Zeroing is used to deduct channel noise. When shall zeroing be carried out? It is recommended that the 87236 be zeroed in the following cases:

- The temperature change exceeds 5℃;
- Shutdown and restart are implemented;
- 24 hours has elapses;
- The low-power signal is not measured. For example, when measuring a signal 10 dB higher than the minimum power specified in the 87236.

Related programming control commands:

CALibration:ZERO:AUTO
CALibration:ZERO:TYPE

2.4.1 Internal zeroing

The 87236 can be internally zeroed through the instrument switch control, so there is no need to disconnect the power sensor from the DUT or turn off the output signal of the DUT during use, which can speed up the measurement, reduce connector wear, and lower the measurement uncertainty.

For example, if configured for internal zeroing and zeroing is initiated once:
CALibration:ZERO:TYPE INT
CAL:ZERO:AUTO ONCE
For example, if configured to "Allow Auto-Zero" state:
CAL:ZERO:AUTO ON
For example, if configured to "Disable Auto-Zero" state:
CAL:ZERO:AUTO OFF

2.4.2 External zeroing

In the average mode, signals as low as -45 dBm can be measured, when the output of the DUT needs to be turned off and external zeroing is performed.

For example, zeroing:
CALibration:ZERO:TYPE EXT
CAL:ZERO:AUTO ONCE

2.5 Performing measurements

The measurement can be configured as absolute power measurement, differential power measurement, ratio power measurement, relative power measurement, etc. For details, refer to "3.3.3 Measurement sub-system commands".

2.6 Using frequency response offset table

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- Entering frequency offset table.....38
- Selecting frequency offset table.....39
- Enabling frequency offset table.....39
- Measurement applications.....39
- Specific applications.....39

How to use the frequency response offset (hereinafter referred to as frequency

offset) table? The frequency offset table is used to compensate the frequency response in the process of measurement establishment.

2.6.1 Overview

Enable or disable the frequency offset table with [SENSe[1]:]CORRection:CSET2:STATe. When enabled, the frequency offset table provides a quick way to compensate for the frequency response in the test system. It shall be noted that when enabled, the frequency offset is an "additional" frequency response to 87236, that is, the inherent frequency response of the 87236 (stored in the EEPROM of the 87236) is also taken into account. The 87236 can store up to 10 frequency offset tables, each with up to 80 frequency points.

How to use the frequency offset table:

a) Enter frequency offset table
b) Select frequency offset table
c) Enable frequency offset table
d) Measurement applications

2.6.2 Entering frequency offset table

a) Entry steps
- Enter the frequency list: MEMory:TABle:FREQuency <frequency 1>{, <frequency i>}. such as 50 MHz, 1 GHz, 10 GHz, 40 GHz;
- Enter the offset factor corresponding to the frequency list: MEMory:TABle:GAIN <factor 1>{, <factor i>}. For example, 100, 98.8, 101.2, and 110.8 correspond to the offset factors of 50 MHz, 1 GHz, 10 GHz and 40 GHz, respectively;
- Rename the frequency offset table if necessary: MEMory:TABLe:MOVE <original name>, <target name>. For example "User_3", "MyFdo0"

b) Enumerate the name of the frequency offset table: MEMory:CATalog:TABLe? See the description of this command for more information.

c) Rename the frequency offset table: MEMory:TABLe:MOVE <original name>, <target name>.

d) Query the data in the frequency offset table. For example, query the data in the frequency offset table with sequence number 3.
- Query the frequency points in the frequency offset table:MEMory:TABLe3:FREQuency:POINTs?
- Query the frequency list in the frequency offset table:MEMory:TABLe3:FREQuency?
- Query the number of factor points in the frequency offset table: MEMory:TABLe3:GAIN[:MAGNitude]:POINTs?

- Query the factor list in the frequency offset table: MEMory:TABLe3:GAIN[:MAGNitude]?

e) Modify the data in the frequency offset table: see a).

f) Notes

- The frequency list is arranged in ascending order;
- The effective suffix of the frequency list is Hz, kHz, MHz and GHz. Hz by default;
- Ensure that the frequency list is within the effective frequency range of the 87236;
- The name of the frequency offset table is up to 12 bytes and no spaces are allowed.

2.6.3 Selecting frequency offset table

[SENSe[1]:]CORRection:CSET2[:SELect] <frequency offset table name>, e.g., "User_3"

2.6.4 Enabling frequency offset table

[SENSe[1]:]CORRection:CSET2:STATe ON

2.6.5 Measurement applications

- ABOR
- CONF:POW:AC DEF,1,(@1)
- SENS:CORR:CSET2:SEL "MyFdo0"
- SENS:CORR:CSET2:STAT ON
- SENS:FREQ 5 GHz
- INIT1
- FETC?

2.6.6 Specific Applications

a) Suppose the frequency list of frequency offset table is: 500 MHz, 1 GHz, 11 GHz. The list of offset factors is: 100, 10, 10. Let the signal frequency be Freq and the calculated offset factor be Gain.

b) If Freq is outside the range of the frequency offset table, the frequency bias value of the highest or lowest frequency point in the frequency offset table is used. For example, for 18 GHz, the offset factor 102 corresponding to the maximum

frequency point of 10 GHz is used. For example, for 50 MHz, the offset factor 100 corresponding to the minimum frequency point of 500 MHz is used.

c) If Freq is within the valid range of the frequency list, but between two frequencies (Freq1, Freq2), such as 5 GHz, the offset factor is obtained using two-point linear interpolation, and the offset factors corresponding to Freq1 and Freq2 are set to Gain1 and Gain2, respectively. Gain is calculated to be 50 by the following equation.

$$Gain = Gain1 + \frac{Freq - Freq1}{Freq2 - Freq1} \times (Gain2 - Gain1)$$

d) If the power before using the frequency offset table is 1.000mW (noted as Pwr0), and the final displayed power is Pwr, then Pwr = Pwr0/Gain/100 = 2.000mW.

2.7 Setting display resolution

Related programming control commands:

DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution <resolution>

< Resolution> ranges from 1 to 4.

For linear power display, <resolution> represents the number of valid digits displayed; for logarithmic power display, <resolution> represents the number of digits after the decimal point.

2.8 Setting average

2.8.1 Measurement average

The 87236 memory has a digital filter for average power readings. The average count ranges from 1 to 1024. If the average state is turned on, the measurement time will be increased.

Set to auto-average state, that is, set different average counts according to different power level and display resolution. Generally, the lower the power, the greater the average count; the higher the resolution, the larger the average count.

Related programming control commands:

[SENSe[1]:]AVERage[:STATe] <ON/OFF> Set the ON/OFF state of average

For example, turn on the measurement average:

SENS:AVER 1

Turn off the measurement average.

AVER 0

[SENSe[1]:]AVERage:COUNt:AUTO <ON/OFF> Set the ON/OFF state of auto-average

[SENSe[1]:]AVERage:COUNt <average count> Set average count

2.8.2 Video average

Video average, also known as trace average, is used to reduce the effect of noise on the traces. The average count ranges from 1 to 1024. If the video average state is turned on, the measurement time will be increased.

Related programming control commands:

[SENSe[1]:]AVERage2[:STATe] <average switch> Set average switch

For example, turn on the video average:

SENS:AVER2 1

Turn on the video average:

AVER2 0

2.9 Setting Offset

The 87236 can compensate for signal attenuation or gain in test equipment (e.g., compensate for a 20 dB attenuator).

Related programming control commands:

[SENSe[1]:]CORRection:GAIN2 <offset value> Set channel offset value

[SENSe[1]:]CORRection:GAIN2:STATe <ON/OFF> Set the ON/OFF state of channel offset

For example, set the channel offset to 3dB.

SENS:CORR:GAIN2 3

2.10 Setting Measurement Limits

Verify that the measured power is not outside the given range by setting the measurement limits.

Related programming control commands:

:CALCulate[1]|2|3|4:LIMit:LOWer[:DATA] <lower limit> Set lower limit

:CALCulate[1]|2|3|4:LIMit:UPPer[:DATA] <upper limit> Set upper limit

:CALCulate[1]|2|3|4:LIMit:STATe <ON/OFF> Set the ON/OFF state of limit detection

:CALCulate[1]|2|3|4:LIMit:FAIL? Query whether the limit is exceeded

:CALCulate[1]|2|3|4:LIMit:FCOunt? Query whether the limit count is exceeded (FCO)

:CALCulate[1]|2|3|4:LIMit:CLEar[:IMMediate] Clear the failure count (FCO).

2.11 State report

The state report is used to detect the error information, operating state, question state, etc. of the power. The state report adopts the principle of step-by-step reporting, such as calibration operation is reported to operating state, and operating state is reported to state word.

For example, query whether the instrument is being calibrated, whether the instrument is being finished calibrating, whether there is an error in zeroing and calibration, whether the instrument is connected to 87236, whether zeroing is required, and whether the measurement is out of range, etc. The following is a description of "querying whether the instrument is calibrating channel A".

Bit 1 in the register group of STATus:OPERation:CALibrating indicates the calibration state of channel A.

Set the event occurrence of the calibration operation to detect the event when there is a transition from uncalibrated (state 0) to calibrated (state 1), i.e. set the positive transition filter to 1.

STAT:OPER:CAL:PTR 2(Configure the calibration event detection for channel A to be from 0 to 1) Note 1

Report calibration operation events to its higher-level operating state register. That is, the calibration state bit (bit 0) of the STATus:OPERation register group.

STAT:OPER:CAL:ENAB 2 (The parameter can be 4, or 6 if it is necessary to report events for channel B). Note 1

Similarly, if it is necessary to further report the operating state to bit 7 of the "state word", set the corresponding bit (bit 0) of the operation positive transition filter and the corresponding bit (bit 0) of the enable register.

STAT:OPER:CAL:PTR 1(Configure the calibration event detection to be from 0 to 1)

STAT:OPER:ENAB 1 (The parameter can be 2048, or 2049 if the lower detection event needs to be reported).

At this point, the configuration is complete, and the next step is to query whether channel A is being calibrated.

Method 1: Query bit 1 of the calibration operation condition register. If it returns non-zero, it is being calibrated.

STAT:OPER:CAL:COND?

Method 2: Query bit 0 of the operation condition register. If it returns non-zero, it is being calibrated.

STAT:OPER:COND?

Method 3: Query bit 7 of the state word. If it returns non-zero, it is being calibrated.

*STB?

Note 1: If it is necessary to query whether one of the two channels is being calibrated, change parameter 2 to 6 (bit 1 and bit 2 indicate channel A and channel B, respectively).

2.12 Storage/recall

To reduce repetitive setup processes, the instrument can store 10 types of configuration data into non-volatile memory. Error list, program-controlled address (such as IP address, instrument string number), frequency response offset table, zeroing and calibration information, etc. are not stored in this configuration. Except for the error list, which is not stored, everything else is stored in the hard configuration file and does not change with user recalls.

Related programming control commands:

*SAV <NRf>

*RCL <NRf>

<NRf> ranges from 1 to 10.

3. Programming control commands

- Description of commands.....45
- Common commands.....45
- Instrument subsystem commands.....52

3.1 Description of commands

This section provides detailed command reference information for remote control, including:

- Complete syntax format and parameter list;
- Syntax diagram for non-standard SCPI;
- Detailed function description and related command description;
- Supported command formats (settings or queries);
- Parameter description, including: data type, value range and default value (unit);
- Button path;
- Model of instrument in the same class of instrument that is compatible with the command. If not specified, the current command only applies to this series.
- Other instructions.

The sections of common commands and instrument subsystem commands first list the order of command items to make convenient for users to query.

For remote control, the following table describes the command suffixes:

Table 3.1 Description of command suffixes

Suffixes	Value range	Description
<ch>	1..1	Channel
<m>	1..4	Measurement
<t>	1..10	Frequency response offset table

3.2 General commands(IEEE488.2 Commands)

Common commands are used to control instrument state registers, state reports, synchronization, data storage and other common functions. The use and function of common commands apply to different instruments. All common commands may be identified by the first "*" in the command word, and are defined in detail in IEEE488.2. IEEE488.2 common command is interpreted and explained below.

- *CLS.....46
- *DDT.....46
- *ESE.....46
- *ESR?.....48

- *IDN?....48
- *OPC....48
- *OPT....48
- *RCL....49
- *RST....49
- *SAV....49
- *SRE....49
- *STB?....50
- *TRG....50
- *TST?....51
- *WAI....51

TIPS

Command use:

Unless otherwise specified, commands may be used for settings or queries.

If a command is used only for settings or queries, or to start an event, the command description will be explained separately.

*CLS

Function: Clear the instrument state data structure, including SCPI registers (such as question state, operating state, etc.), standard event registers, state words, and error/event queues.

Query: Not supported

Setting: *CLS

Example: *CLS Clear the instrument state

Error message: No

Reset state: No

*DDT

Function: Query or set the operation in response to *TRG general command.
Note: The 87236 does not support this command at the moment. This command is used for expansion.

Query: *DDT?

Setting: *DDT <Arbitrary data block> | <string>
Arbitrary data block is of the form: #nN<action>
The string will be of the form "<action>"
1) Action has the following forms:

FETC?
FETC1?
FETC2?
*TRG
TRIG1
TRIG2 (for dual-channel power meter only)

2) In arbitrary data block, the first value n after # represents the number of bits of the data length, and the next value represents the length of the data block.
Example: #15FETC? -- n = 1, N = 5 (5 bytes in total for FETC?)

Example: *DDT? Query the operation behavior of the instrument when it receives the *TRG command.

*DDT #206FETCh?
*DDT "FETCh?"
*DDT "TRIG1;FETC1"

Error message: No

Reset state: No

*ESE

Function: Query or set the standard event state enable register. 0 for disable, and 1 for enable.
Query: *ESE?
Setting: *ESE <NRf>
NRf denotes the numerical value, a multiple of 2. See Table 3.2 for bit mapping.
Example: *ESE? Query the current setting of this register. The return format is <NR1>, 0-255.
*ESE 60 Enable 4+8+16+32 corresponding bits.

Table 3.2 Standard event bit mapping

Bit	Value	Description
0	1	Operation completed
1	2	Unused
2	4	Query error
3	8	Device-related errors
4	16	Execution error
5	32	Command error
6	64	Unused
7	128	Unused

*ESR?

Function: Query the value of the standard event state register and clear the register. Refer to Table 3.2
Query: *ESR?
Setting: Not supported
Example: *ESR? Query the value of the standard event state register and clear it.
Error message: No
Reset state: No

*IDN?

Function: Query the identification string of 87236.
Related programming control commands ":SYSTem:IDN", ":SYSTem:IDN:AUTO"
If ":SYSTem:IDN:AUTO" is set to "ON", *IDN? returns the user string defined by ":SYSTem:IDN", otherwise returns the string preset by the 87236.
Query: *IDN?
Setting: Not supported
Example: *IDN?
Error message: No
Reset state: No

*OPC

Function: When all waiting operations are completed, set the operation end bit in the standard event state register.
Query: *OPC?
Setting: *OPC
Example: *OPC? Return 1 if the waiting operation completes, otherwise it waits.
Error message: No
Reset state: No

*ESE?

Function: Query the instrument option configuration.

Query: *ESE?
Setting: Not supported
Error message: No
Reset state: No

*RCL

Function: Recall the 87236 state in the specified storage/recall register.
Query: Not supported
Setting: *RCL <NRf>
The range is from 1 to 10
Example: *RCL 8
Error message: If the registers are not located from 1 to 10, it prompts "-222, "Data out of range"".
Reset state: No

*RST

Function: To reset 87236, please refer to SYSTem:PRESet.
Query: Not supported
Setting: *RST

*SAV

Function: Store the instrument state into the specified register.
Query: Not supported
Setting: *SAV <NRf>
The range is from 1 to 10
Example: *SAV 9
Error message: If the registers are not located from 1 to 10, it prompts "-222, "Data out of range"".
Reset state: No

*SRE

Function: Query or set the service request register 0 for disable, and 1 for enable.
Query: *SRE?
Setting: *SRE <NRf>
NRf denotes the numerical value, a multiple of 2. See Table 3.3 for bit mapping.
Example: *SRE? Query the current setting of this register. The

return format is <NR1>, 0-255.

*SRE 188 — Set bits 2, 3, 4, 5 and 7 respectively (4+8+16+32+128).

Table 3.3 Service request register bit mapping

Bit	Value	Description
0	1	Unused
1	2	Device information
2	4	Error/event queue
3	8	Question state
4	16	Information reception
5	32	Event state bit
6	64	Must be 0
7	128	Operating state

*STB?

Function: Query the state word.
Query: *STB?
Setting: Not supported
Example: *STB?
Error message: No
Reset state: No

Bit mapping is as follows:

Table 3.4 State word

Bit	Value	Description
0	1	Unused
1	2	Device information
2	4	Error/event queue
3	8	Question state
4	16	Information reception
5	32	Event state bit
6	64	Service request
7	128	Operating state

*TRG

Function: Trigger all channels waiting for trigger. The function of *TRG can be changed with *DDT.

Query: Not supported
Setting: *TRG
Example: *TRG
Error message: If the trigger source is not BUS, it prompts "-211, "Trigger ignored"".
Reset state: No

*TST?

Function: Execute self-test with longer self-test time.
Query: *TST?
Setting: Not supported
Example: *TST? Returning 0 means pass, and 1 means fail.
Error message: No
Reset state: No

*WAI

Function: Place 87236 in a wait state until either of the following is satisfied:
All waiting operations have been completed
Device clear command received
Restart.
Query: Not supported
Setting: *WAI
Example: *WAI
Error message: No
Reset state: No

3.3 Instrument subsystem command

This section details the subsystem commands of the 87236.

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- Calibration sub-system command (CALibration).....59
- Measurement Subsystem Command (CONFigure/FETCh/READ/MEASure).....61
- Display subsystem command (DISPlay).....76
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- Memory subsystem command (MEMory/MMEMory).....77
- Statistics subsystem command (PSTatistic).....83
- Sensor subsystem command (SENSe).....93
- State subsystem command (STATus).....118
- System Subsystem Command (SYSTem).....152
- Trace subsystem command (TRACe).....169
- Trigger subsystem command(INITiate/ TRIGger).....175
- Unit subsystem command (UNIT).....176
- Service Subsystem Command (SERVice).....185

3.3.1 Calculation subsystem command (CALCulate)

The calculation (CALCulate) subsystem is used for subsequent data processing and shares four independent calculation function blocks that correspond to measurements as follows:

CALC1 (Measurement 1)
CALC2 (Measurement 2)
CALC3 (Measurement 3)
CALC4 (Measurement 4)

Figure 3.1 Correspondence between CALC and measurement

Both sensing (SENSe) subsystems can be used as inputs to the calculation subsystem (FEED), and the calculation diagram is as follows:

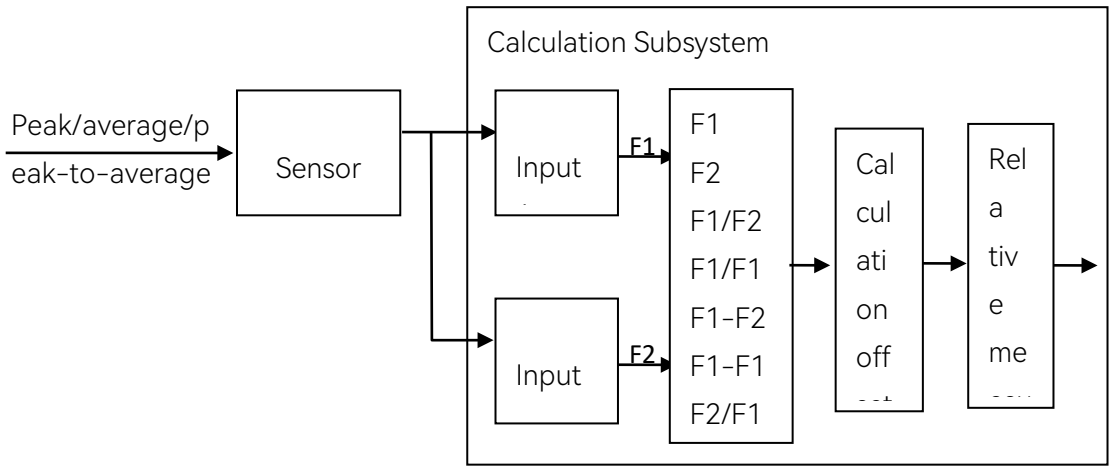

Figure 3.2 Calculation diagram

The calculation offset and relative measurement are calculated when the switch is turned on.

Commands include:

- :CALCulate[1]|2|3|4:FEED[1]|2.....53
- :CALCulate[1]|2-4:GAIN[:MAGNitude].....54
- :CALCulate[1]|2|3|4:GAIN:STATe.....54
- :CALCulate[1]|2|3|4:LIMit:CLEar:AUTO.....55
- :CALCulate[1]|2|3|4:LIMit:CLEar[:IMMediate].....55
- :CALCulate[1]|2|3|4:LIMit:FAIL?.....55
- :CALCulate[1]|2|3|4:LIMit:FCOunt?.....56
- :CALCulate[1]|2|3|4:LIMit:LOWer[:DATA].....56
- :CALCulate[1]|2|3|4:LIMit:STATe.....56
- :CALCulate[1]|2|3|4:LIMit:UPPer[:DATA].....57
- :CALCulate[1]|2|3|4:MATH[:EXPRession].....58
- :CALCulate[1]|2|3|4:MATH[:EXPRession]:CATalogue?.....59
- :CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO.....59
- :CALCulate[1]|2|3|4:RELative[:MAGNitude]:VALue?.....59
- :CALCulate[1]|2|3|4:RELative:STATe.....60

:CALCulate[1]|2|3|4:FEED[1]|2

Function: Query or set the measurement mode. The CALC:MATH:EXPR command is used to determine it from which channel.

Meaning of the suffixes in CALC: 1 for measurement 1, 2 for measurement 2, 3 for measurement 3, and 4 for measurement 4. The same applies below.

Query: :CALCulate[1]|2|3|4:FEED[1]|2?

Setting: :CALCulate[1]|2|3|4:FEED[1]|2 <string>

Parameters in the form of "POW:PEAK", "POW:PTAV", "POW:AVER", "POW:MIN"

Alternatively, it can be followed by ON SWEEP[1]|2|3|4 to indicate which measurement gate it is. For example, "POW:AVER ON SWEEP3" means the average

power in measurement gate 3. If ON SWEEP[1]|2|3|4 is not specified, the measurement gate remains unchanged.

Input 2 (FEED2) is used only for ratio measurements and difference measurements.

Example:

CALC2:FEED?	Query the measurement mode of input 1 of measurement 2.
CALC:FEED2 "POW:AVER ON SWEEP3"	Set input 2 of measurement 1 to the average power in measurement gate 3.

Limit:

Error message If the mode contains ON SWEEP[1]|2|3|4, but the trigger source is not EXT or INT, it prompts "-221, "Settings conflict"".

:CALCulate[1]|2|3|4:GAIN[:MAGNitude]

Function: Query or set the calculation offset value of the specified measurement, in DB and in the range of -100 to 100. After successful setup, the calculation offset switch for this measurement is automatically turned on.

The related command is :CALCulate[1]|2|3|4:GAIN:STATe, which is used to set or query the calculation offset switch.

Query: :CALCulate[1]|2|3|4:GAIN[:MAGNitude]? [MIN|MAX]

Setting: :CALCulate[1]|2|3|4:GAIN[:MAGNitude] <numeric data>

The form of <numeric data>: DEF, MIN, MAX, and NRf, where DEF is only used for setting.

DEF means 0 dB, MIN means -100 dB, and MAX means 100 dB

Example:

CALC:GAIN?	Query the calculation offset of Measurement 1.
CALC2:GAIN? MIN	Query the minimum value of the settable calculation offset of Measurement 2.
CALC3:GAIN MAX	Set the calculation offset of Measurement 3 to the maximum value.
CALC4:GAIN 18	Set the calculation offset of measurement 4 to 18 dB.

Reset state: Set to 0 (DEF).

:CALCulate[1]|2|3|4:GAIN:STATe

Function: Query or set the switch state of the calculation offset in the specified measurement.

The related command is :CALCulate[1]|2|3|4:GAIN[:MAGNitude], which is used to set or query the operation value.

Query: :CALCulate[1]|2|3|4:GAIN:STATe?

Setting: :CALCulate[1]|2|3|4:GAIN:STATe <Boolean data>

Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

CALC:GAIN:STAT?	Query the calculation offset switch state of Measurement 1.
CALC2:GAIN:STAT ON	Enable the calculation offset of Measurement

2.

CALC3:GAIN:STAT 0 Disable the calculation offset of Measurement 3.

Reset state: OFF

:CALCulate[1]|2|3|4:LIMit:CLEar:AUTO

Function: Control when the limit FCO (failure count) is cleared.

Query: :CALCulate[1]|2|3|4:LIMit:CLEar:AUTO?

For the ONCE state, return 1 if no measurement is not started, otherwise return 0

For the OFF state, always return 0

For the ON state, return 1 if the measurement is started, otherwise return 0

Setting: :CALCulate[1]|2|3|4:LIMit:CLEar:AUTO <Boolean data>|ONCE|2

Valid forms of <Boolean data> are: 0, OFF, 1, ON.

For "ON", the FCO is set to 0 when the following operations are performed:

Initialize with the INITiate[:IMMediate] command;

Initialize with the INITiate:CONTinuous ON command;

Measure with the MEASure? command;

Read the measurement with the READ? command.

For "OFF", FCO is not cleared.

For "ONCE" or 2, it is only cleared at the first initialization and then accrued when a limit detection failure is encountered.

Example: CALC1:LIM:CLE:AUTO? Query FCO clearing state of measurement 1.

CALC2:LIM:CLE:AUTO ONCE Set the FCO for clearing measurement 2 on the first initialization.

Reset state: Set to ON.

:CALCulate[1]|2|3|4:LIMit:CLEar[:IMMediate]

Function: Clear the FCO (failure count) of the specified measurement, which can be queried by CALCulate[1]|2|3|4:LIMit:FCOunt?.

Query: Not supported

Setting: :CALCulate[1]|2|3|4:LIMit:CLEar[:IMMediate]

Example: :CALC:LIM:CLE Clear the failure count of measurement 1.

:CALCulate[1]|2|3|4:LIMit:FAIL?

Function: Query whether the specified measurement exceeds the limit. 1 means Yes, 0 means No.

Query: :CALCulate[1]|2|3|4:LIMit:FAIL?

Setting: Not supported

Example: :CALC:LIM:FAIL? Query the detection state of measurement 1.

:CALCulate[1]|2|3|4:LIMit:FCOunt?

Function: Query the limit detection failure count (FCO) of the specified measurement.
The FCO is cleared in the following cases:
a) Reset
b) CALCulate[1]|2|3|4:LIMit:CLEar:IMMediate
c) CALCulate[1]|2|3|4:LIMit:CLEar:AUTO ON

Query: Query: :CALCulate[1]|2|3|4:LIMit:FCOunt?

Setting: Not supported

Example: :CALC:LIM:FCO? Query the detection failure count of measurement 1.

:CALCulate[1]|2|3|4:LIMit:LOWer[:DATA]

Function: Query or set the lower limit of the specified measurement limit.

Query: :CALCulate[1]|2|3|4:LIMit:LOWer[:DATA]? [MIN|MAX]

Setting: :CALCulate[1]|2|3|4:LIMit:LOWer[:DATA] <numeric data>
The form of <numeric data>: DEF, MIN, MAX, and NRf, where DEF is only used for setting.
If the currently set lower limit value is more than or equal to the upper limit value, the upper limit value is automatically adjusted depending on the unit, as shown in Table 3.7.

Example: CALC:LIM:LOW? Query the lower limit of measurement 1.
CALC4:LIM:LOW 0.2 According to the display unit of measurement, set the lower limit of measurement 4 as:
0.2 dBm at dBm
200mW at W
0.2dB at dB
0.2% at %.

Reset state: All measurements are set to -90 dBm or -90 dB.

Table 3.5 Unit of measurement

Measurement mode	Measurement type	CALC:REL:STAT OFF		CALC:REL:STAT ON	
		Linear	Logarithm	Linear	Logarithm
Single channel	Peak, average	Watt	dBm	%	dB
	Peak-to-average ratio	%	dB	%	dB
Ratio	Average, peak, peak-to-average ratio	%	dB	%	dB
Delta	Peak, average	Watt	dBm	%	dB

	Peak-to-average ratio	%	dB	%	dB

Table 3.6 Limit range

	Watt	dBm	%	dB
DEF	1pW	-90	100p%	-120
MIN	1aW	-150	100a%	-180
MAX	1XW	200	100X%	180

Table 3.7 Limit range adjustment

Lower limit value	Upper limit value			
	Watt	dBm	%	dB
$nLow$	$nLow \times 10^{0.001}$	$nLow + 0.01$	$nLow \times 10^{0.001}$	$nLow + 0.01$

:CALCulate[1]|2|3|4:LIMit:STATe

Function: Query or set the ON/OFF state of the specified measurement limit detection.

Query: :CALCulate[1]|2|3|4:LIMit:STATe?

Setting: :CALCulate[1]|2|3|4:LIMit:STATe <Boolean data>

Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

CALC:LIM:STAT?	Query the limit detection ON/OFF state of measurement 1.
CALC2:LIM:STAT ON	Enable the limit detection of measurement 2.
CALC3:LIM:STAT 0	Disable the limit detection of measurement 3.

Limit: When the [SENSe[1]:]MRATe command is set to FAST mode, the limit measurement is disabled, but the setting is allowed, and the setting takes effect after exiting this measurement mode.

Error message:

Reset state: Disable the measurement limit detection.

:CALCulate[1]|2|3|4:LIMit:UPPer[:DATA]

Function: Query or set the upper limit of the specified measurement limit. Refer to CALCulate[1]|2|3|4:LIMit:LOWer[:DATA]

Query: :CALCulate[1]|2|3|4:LIMit:UPPer[:DATA]? [MIN|MAX]

Setting: :CALCulate[1]|2|3|4:LIMit:UPPer[:DATA] <numeric data>

The form of <numeric data>: DEF, MIN, MAX, and NRf, where DEF is only used for setting.

If the currently set upper limit value is less than or equal to the lower limit value, the

lower limit value is automatically adjusted depending on the unit, as shown in Table 3.9.

Example: CALC:LIM:UPP? Query the lower limit of measurement 1.

CALC4:LIM:UPP 8 According to the display unit of measurement, set the upper limit of measurement 4 as:
8dBm at dBm
8W at W
8dB at dB
8% at %.

Reset state: All measurements are set to 90 dBm or 90 dB.

Table 3.8 Limit range

	Watt	dBm	%	dB
DEF	1MW	90	100M%	60
MIN	1aW	-150	100a%	-180
MAX	1XW	200	100X%	180

Table 3.9 Limit range adjustment

Upper limit value	Lower limit value			
	Watt	dBm	%	dB
$nUpp$	$nUpp/10^{0.001}$	$nUpp-0.01$	$nUpp/10^{0.001}$	$nUpp-0.01$

:CALCulate[1]|2|3|4:MATH[:EXPRession]

Function: Query or set the expression of the specified measurement: single channel, difference and ratio

Query: :CALCulate[1]|2|3|4:MATH[:EXPRession]?

Setting: :CALCulate[1]|2|3|4:MATH[:EXPRession] <string>

The form of string is as follows:

For a single-channel power meter, such as the 87236:

"(SENS1)", "(SENS1-SENS1)", "(SENS1/SENS1)"

For a dual-channel power meter, such as the 2438:

"(SENS1)", "(SENS2)",
"(SENS1-SENS1)", "(SENS2-SENS2)",
"(SENS1-SENS2)", "(SENS2-SENS1)",
"(SENS1/SENS1)", "(SENS2/SENS2)",
"(SENS1/SENS2)", "(SENS2/SENS1)",

Example: CALC1:MATH? Query the measurement expression of measurement 1.

	CALC2:MATH "(SENS1/SENS1)"	Set the expression of Measurement 2 to the Channel A/B ratio measurement.

Reset state: For a single channel power meter, such as the 87236, all measurements are set to Channel A ("(SENS1)").
For a dual-channel power meter, such as the 2438, Measurement 1 is A and Measurement 2 is B.

:CALCulate[1]|2|3|4:MATH[:EXPRession]:CATalogue?

Function: Enumerate all measurement expressions, separated by commas.
For a single-channel power meter, the string is:
"(SENS1)", "(SENS1-SENS1)", "(SENS1/SENS1)"
For a dual-channel power meter, the string is:
"(SENS1)", "(SENS2)", "(SENS1/SENS2)", "(SENS2/SENS1)",
"(SENS1-SENS2)", "(SENS2-SENS1)""(SENS1-SENS1)",
"(SENS2-SENS2)", "(SENS1/SENS1)", "(SENS2/SENS2)"

Query: :CALCulate[1]|2|3|4:MATH[:EXPRession]:CATalogue?

Setting: Not supported

Example:	CALC:MATH:CAT?	List all defined mathematical expressions.

:CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO

Function: Set the reference value for relative measurement. In the CALCulate block, the relative value is used for the measured signal only after any mathematical computation and calculation offset are completed. This value shall be set to ONCE to set the reference value for relative measurement. After setting the reference value, the command returns OFF. Set the command to ONCE to set the command CALCulate[1]|2|3|4:RELative:STATe is transformed to ON.
0|OFF does not perform any operation.
1|ON is invalid, 87236 returns an error: invalid parameter.
2|ONCE, valid parameter. Refer to the above for meaning.

Query: :CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO?

Setting: :CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO ONCE

Example:	CALC:REL:AUTO?	Always return 0.
	CALC:REL:AUTO ONCE	Set the reference value for the relative measurement of measurement 1.

Error message: If parameter 1 or ON is selected, it prompts "-224, "Illegal parameter value"".

:CALCulate[1]|2|3|4:RELative[:MAGNitude]:VALue?

Function: Query the reference value for relative measurement.

Query: :CALCulate[1]|2|3|4:RELative[:MAGNitude]:VALue?

Setting: Not supported

Example:	CALC:REL:VAL?	Query the reference value for the relative

measurement of measurement 1.

:CALCulate[1]|2|3|4:RELative:STATe

Function: Query or set the relative measurement ON/OFF state.
When turned on, the relative measurement value set by :CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO is applied to the measurement.
Query: :CALCulate[1]|2|3|4:RELative:STATe?
Setting: :CALCulate[1]|2|3|4:RELative:STATe<Boolean data>
Example: CALC:REL:STAT? Return 1 when the relative measurement of measurement 1 is ON, otherwise return 0.
CALC2:REL:STAT ON Turn on the relative measurement state of measurement 2.
Reset state: Disable relative measurement.

3.3.2Calibration sub-system command (CALibration)

The CALibration subsystem is used to control the automatic zero bias setting and linearity adjustment of the 87236. If there is no RF signal loaded to the 87236, the zeroing setting can be done at any time.

The numeric suffix in CALibration command indicates the measurement channel. CALibration1 and CALibration2 indicate channel A and channel B respectively (the 87236 series only supports channel A.)

Commands include:

- :CALibration[1][:ALL]....60
- :CALibration[1]:AUTO....61
- :CALibration[1]:ZERO:AUTO....61
- :CALibration[1]:ZERO:TYPE....61

:CALibration[1][:ALL]

Function: Zeroing/calibration of the 87236. 1 indicates channel A and can be omitted.
In which cases is zeroing and calibration required?
Temperature change exceeds 5℃
Restart
Measure small power
every 24 hours. For example, measuring a power 10 dB higher than the minimum power of the 87236.
Query: Not supported
Setting: :CALibration[1][:ALL]
Example: CAL Zeroing and calibration
Error message: If there is an error in zeroing, it prompts "-231, "Data questionable;cal error"".
If there is an error in calibration, it prompts "-231, "Data questionable;zero error"".

:CALibration[1]:AUTO

Function: Calibration of the 87236.
Query: :CALibration[1]:AUTO?
Setting: :CALibration[1]:AUTO <Boolean data>|ONCE|2
Valid forms of <Boolean data> are: 0, OFF, 1, ON.
For ON or 1, the 87236 performs an automatic calibration every 10 minutes.
For 0FF or 0, auto-calibration is disabled
For ONCE or 2: Initiate a calibration.
Example: CAL1:AUTO ONCE Calibration of the 87236
Error message: If there is an error in calibration, it prompts "-231, "Data questionable; cal error"";

:CALibration[1]:ZERO:AUTO

Function: Zeroing of the 87236. 1 indicates channel A and can be omitted.
Query: :CALibration[1]:ZERO:AUTO?
Setting: :CALibration[1]:ZERO:AUTO <Boolean data>|ONCE|2
Valid forms of <Boolean data> are: 0, OFF, 1, ON.
For ON or 1, the 87236 enables auto-zero for instant zero drift measurements in real time. Real-time zero drift measurement is only valid for normal measurement mode.
For 0FF or 0, auto-zero is disabled.
For ONCE or 2: Initiate a zeroing.
Example: CAL:ZERO:AUTO ONCE Zero channel A of the 87236
Error message: If there is an error in zeroing, it prompts "-231, "Data questionable;zero error"".

:CALibration[1]:ZERO:TYPE

Function: Query or set the zeroing type.
Query: :CALibration[1]:ZERO:TYPE?
Setting: :CALibration[1]:ZERO:TYPE <character data>
Character data is defined as follows:
INTernal or 0: Internal zeroing
EXTernal or 1: External zeroing
Example: CAL:ZERO:TYPE? Query the zeroing type of the 87236
Example: CAL:ZERO:TYPE EXT Set the zeroing of the 87236 to "external"
Reset state: Internal zeroing.

3.3.3 Measurement sub-system command (CONFigure/FETCh/READ/MEASure)

Generally, unless otherwise specified, the linear power is in W, the logarithmic power is in dBm, the linear power ratio is in %, the logarithmic power ratio is in dB, and the time

is in s.

If the returned value is invalid, NAN (9.91E37) is returned, as defined in IEEE 754.

The differences between the FETCh command, MEASure command, and READ command are as follows:

The FETCh command is to query the displayed value of a given measurement. The execution speed of the FETCh command is not related to the power level and generally returns immediately. The FETCh command may return intermediate results in the power measurement process rather than the actual power value.

The MEASure command starts a measurement and returns the result only after the measurement is completed. Generally, the lower the power, the longer the MEASure command takes.

The READ command completes a new measurement in the stop state, and INIT:CONT must be set to OFF.

Note: If the trigger source is INT or EXT, after entering a new INIT operation, if the trigger conditions are not met and the trigger signal has not been waited for, the effect is that the device will be hung and the programming command will not respond. Therefore, when using the measurement subsystem command, it is important to ensure that the device captures the trigger signal.

Commands include:

- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]....63
- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence....64
- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative....64
- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio....64
- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative....64
- :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative....65
- :FETCh[1]:ARRay:AMEasure:POWer?....65
- :FETCh[1]:ARRay:AMEasure:STATistical?....66
- :FETCh[1]:ARRay:AMEasure:TIME?....66
- :FETCh[1]:DROop?....66
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]?....67
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?....67
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?....68
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?....68
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?....69
- :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?....70
- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]?....70
- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?....71
- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?....71
- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?....72
- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?....72

- :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?.....73
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]?.....73
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?.....74
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?.....74
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?.....75
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?.....75
- :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?.....75

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]

Function: Query or set the power measurement mode of the specified measurement.

Query: :CONFigure[1]|2|3|4?

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC] [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Example:

CONF?	Query the power measurement configuration of measurement 1.
CONF1 DEF, 3, (@1)	Set measurement 1 to absolute power measurement with a resolution of 3, and source channel to A.

Error message

Reset state: Set to measure absolute power with a resolution of 3.

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence

Function: Set the power measurement mode of the specified measurement as difference measurement and turn on relative measurement.

Query: Not supported

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence [<expected value> [, <resolution> [, <source channel list>]]

Set to differential power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:
(@1), (@1), indicating channel A - channel A.

Example:

CONF2:DIFF DEF, 3, (@1), (@1)	Set measurement 2 to differential power measurement (channel A - channel A) with a resolution of 3.

Error message

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative

Function: Set the power measurement mode of the specified measurement as difference measurement and turn on relative measurement.

Query: Not supported

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement, and turn on relative measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A – channel A.

Example: CONF3:DIFF:REL DEF, 3, (@1), (@1)Set measurement 3 to differential power measurement (channel A – channel A) with a resolution of 3 and relative measurement ON.

Error message:

Reset state: No

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio

Function: Set the power measurement mode of the specified measurement as ratio measurement and turn off relative measurement.

Query: Not supported

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Example: CONF4:RAT DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by channel A) with a resolution of 3.

Error message:

Reset state: No

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative

Function: Set the power measurement mode of the specified measurement as ratio measurement and turn on relative measurement.

Query: Not supported

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative [<expected value>[,

<resolution>[, <source channel list>]]]

Set to ratio power measurement, and turn on relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Example: CONF:RAT:REL DEF, 3, (@1), (@1) Set measurement 1 to ratio power measurement (channel A divided by channel A) with a resolution of 3, and turn on relative measurement.

Error message:

:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative

Function: Set the absolute power measurement mode of the specified measurement, and turn on relative measurement.

Query: Not supported

Setting: :CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn on relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Example: CONF:REL DEF, 3, (@1) Set measurement 1 to absolute power measurement with a resolution of 3, source channel to A, and turn on relative measurement.

Error message:

:FETCh[1]:ARRay:AMEasure:POWer?

Function: Query the peak power, average pulse power, overshoot, top power, bottom power, pulse power, etc. of a given channel pulse measurement in the same units as those displayed in the channel trace. The average pulse power can only be measured when a complete waveform can be displayed on the screen. If a parameter is invalid, 9.91e37(NAN) is returned, as below, without further ado.

Query: :FETCh[1]:ARRay:AMEasure:POWer?

The return value indicates peak power, average power, overshoot, top power, bottom power, minimum power, and pulse droop in that order.

Setting: Not supported

Example: FETC:ARR:AME:POW? Query the automatic power measurement value of channel 1.

Limit: Peak measurement mode; the horizontal scale (time base) must be set appropriately

for the above automatic parameters to be measured.

:FETCh[1]:ARRay:AMEasure:STATistical?

Function: Query the statistical timing, statistical count, average power, maximum power, minimum power, etc. of the given channel CCDF statistical measurement in the same units as those displayed in the channel trace.

Query: :FETCh[1]:ARRay:AMEasure:STATistical?

Setting: Not supported

Example: FETC:ARR:AME:STAT? Query the automatic measurement value of power statistics of channel 1.

Limit:

:FETCh[1]:ARRay:AMEasure:TIME?

Function: Query the pulse measurement frequency, cycle, width, off time, duty cycle, rise time, fall time and edge delay of a given channel. For each automatic measurement parameter, it must be possible to display it on the screen in graphical mode in order to make a correct reading. For example, pulse frequency, period, off time and duty cycle measurements must ensure that the screen displays at least one full period, pulse width must ensure that the screen displays at least one full pulse, and rise time and fall time measurements require that they be observable and that the entire edge occupies at least 0.1 div.

Query: :FETCh[1]:ARRay:AMEasure:TIME?

The return values indicate the pulse measurement frequency, period, width, off time, duty cycle, rise time, fall time, and edge delay in that order.

Setting: Not supported

Example: FETC:ARR:AME:TIME? Query the time auto-measurement value of channel 1.

Limit: Peak measurement mode; the horizontal scale (time base) must be set appropriately for the above automatic parameters to be measured.

Reset state: No.

:FETCh[1]:DROop?

Function: Query the pulse droop of the first pulse of a given channel. Its unit is determined by the following command:

TRACe[1]:MEASurement:TILTed|DROop:UNIT

The relevant command is: TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?

TRACe[1]:MEASurement:TILTed|DROop:UNIT

Query: :FETCh[1]:DROop?

Setting: Not supported

Example: FETC:DRO? Query the pulse droop of channel 1.

Limit: Measurement mode; the horizontal scale (time base) must be set appropriately for

the above parameters to be measured.

Reset state:

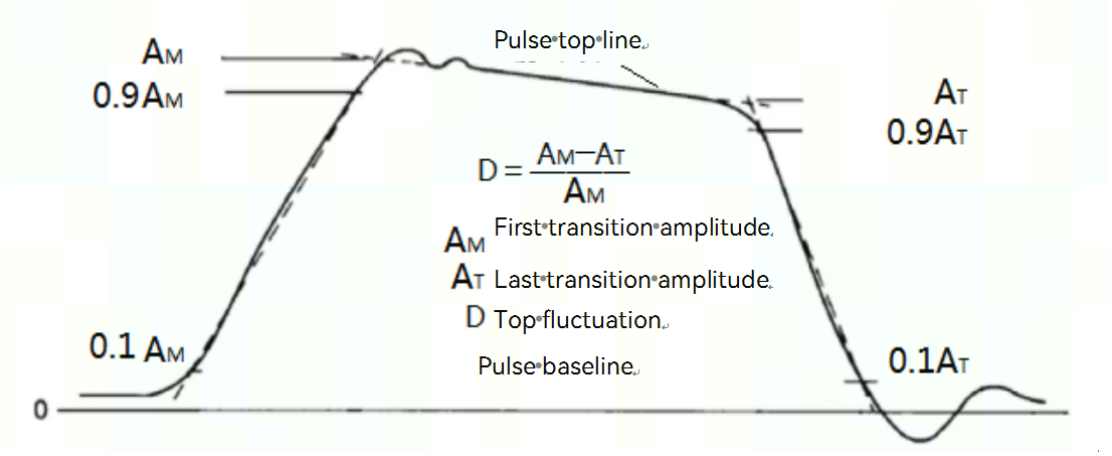

Figure 3.3 Pulse top fluctuation

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]?

Function: Set the specified measurement as absolute power measurement, turn off relative measurement, and return to the measurement value displayed in the current measurement. The measurement unit is specified by UNIT[1]|2|3|4:POWer. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]? [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Setting: Not supported

Example: FETC2? Query that measurement 2 is the absolute power measurement value.

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?

Function: Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS

command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: FETC3:DIFF? DEF, 3, (@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn off relative measurement, and return the power measurement value.

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?

Function: Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement, and turn on relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: FETC3:DIFF:REL? DEF,3,(@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn on relative measurement, and return the power measurement value.

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?

Function: Set the power measurement mode of the specified measurement as ratio

measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio? [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: FETC4:RAT? DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by channel A), and turn off relative measurement, with a resolution of 3. Return the measurement value.

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?

Function: Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: FETC4:RAT:REL? DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by channel A), and turn on relative measurement, with a resolution of 3. Return the measurement value

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the

measurement to be invalid.

:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?

Function: Set the specified measurement as absolute power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. This command does not wait for a measurement to be completed before returning. To get the exact measurement value, use the MEAS command.

Query: :FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Setting: Not supported

Example: FETC2:REL? Query the relative power measurement value of measurement 2.

Error message: If the last measurement is invalid, it prompts -230, "Data corrupt or stale". Running the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]?

Function: Set the specified measurement as absolute power measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]? [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Setting: Not supported

Example: MEAS2? Start one measurement and return to measurement 2 for the absolute power measurement after the measurement is completed.

Error message:

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?

Function: Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: MEAS3:DIFF? DEF, 3, (@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn off relative measurement, start one measurement, and return the power measurement value when the measurement is complete.

Error message:

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?

Function: Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement, and turn on relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: MEAS3:DIFF:REL? DEF, 3, (@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn on relative measurement, start one measurement, and return the power

measurement value when the measurement is complete.

Error message:

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?

Function: Set the power measurement mode of the specified measurement as ratio measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio? [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: MEAS4:RAT? DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by Channel A), and turn off relative measurement, with a resolution of 3. Start a measurement and return the power measurement value when the measurement is completed.

Error message:

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?

Function: Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: MEAS4:RAT:REL? DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by channel A), and turn on relative measurement, with a resolution of 3. Start a measurement and return the power measurement value when the measurement is completed.

Error message:

:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?

Function: Set the specified measurement as absolute power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer. Start a measurement and return the measurement value when the measurement is completed. And the corresponding FETCh command returns the current measurement value, not when the measurement is completed. When composing a test system, please use the MEASure command.

Query: :MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1) indicating Channel A.

Setting: Not supported

Example: MEAS2:REL? Start a measurement and return the relative power measurement of measurement 2 when the measurement is completed.

Error message:

:READ[1]|2|3|4[:SCALar][:POWer][:AC]?

Function: Set the specified measurement as absolute power measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]? [<expected value>[, <resolution>[, <source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1), indicating Channel A.

Setting: Not supported

Example: READ2? Query that measurement 2 is the absolute power measurement value.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

:READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?

Function: Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: READ3:DIFF? DEF, 3, (@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn off relative measurement, and return the power measurement value.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

:READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?

Function: Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to differential power measurement, and turn on relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the source channel list is of the form (@1), (@1), indicating channel A - channel A.

Setting: Not supported

Example: READ3:DIFF:REL? DEF, 3, (@1), (@1) Set measurement 3 to differential power measurement (channel A - channel A) with a resolution of 3, turn on relative measurement, and return the power measurement value.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?

Function: Set the power measurement mode of the specified measurement as ratio measurement, turn off relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: READ4:RAT? DEF, 3, (@1), (@1) Set measurement 4 to ratio power measurement (channel A divided by channel A), and turn off relative measurement, with a resolution of 3. Return the measurement value.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?

Function: Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative? [<expected value>[, <resolution>[, <source channel list>]]]

Set to ratio power measurement, where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form:

(@1), (@1), indicating channel A divided by channel A.

Setting: Not supported

Example: READ4:RAT:REL? DEF, 3, (@1),(@1) Set measurement 4 to ratio power measurement (channel A divided by channel A), and turn on relative measurement, with a resolution of 3. Return the measurement value.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?

Function: Set the specified measurement as absolute power measurement, turn on relative measurement, and return the measurement value. The measurement unit is specified by UNIT[1]|2|3|4:POWer:RATio.

Query: :READ[1]|2|3|4[:SCALar][:POWer][:AC]:RELative? [<expected value>[, <resolution>[,

<source channel list>]]]

Set to absolute power measurement, and turn off relative measurement. where both the expected value and the resolution can be expressed as DEF, indicating no change. The resolution ranges from 1 to 4; the channel list is of the form: (@1) indicating Channel A.

Setting: Not supported

Example: READ2:REL? Query the relative power measurement value of measurement 2.

Error message: If INIT:CONT is set to ON, it prompts -213, "Init ignored".

3.3.4 Display sub-system command (DISPlay)

The DISPlay subsystem is used to control the display of text, graphics and traces.

Commands include:

- :DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution.....76

:DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution

Function: Query or set the display resolution of the specified measurement. WINDow1 indicates the upper window, which can be omitted, and WINDow2 indicates the lower window; NUMeric1 indicates the upper measurement, which can be omitted, and NUMeric2 indicates the lower measurement.

Query: :DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution? [MIN|MAX]

Setting: :DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 1 to 4.

Example: DISP:WIND2:NUM2:RES? Query the display resolution of measurement 4.

DISP:RES 3 Set the display resolution of measurement 1 to 3, i.e. display 3 valid digits for linear display and 2 decimal places (0.01) for logarithmic display.

Reset state: Resolution is 3

3.3.5 Format sub-system command (FORMat)

The format subsystem is used to set the transmission format of the numeric data. This format system is only used for the following query commands:

FETCh?

MEASure?

READ?

- :FORMat[:READings]:BORDer.....77

- :FORMat[:READings][:DATA]……77

:FORMat[:READings]:BORDer

Function: Query or set the transmission order of binary data: normal or byte exchange.
Valid only when FORMat[:READings][:DATA] is set to REAL.
Query: :FORMat[:READings]:BORDer?
Setting: :FORMat[:READings]:BORDer <character data>
Valid values for <character data> are: 0 or NORMal, 1 or SWAPped
Example: FORM:BORD? Query the transmission order.
FORM:BORD SWAP Set the transmission order to byte-swap.
Reset state: Set to NORMal

:FORMat[:READings][:DATA]

Function: Query or set the data transfer format: ASCii and REAL (real numbers)
Query: :FORMat[:READings][:DATA]?
Setting: :FORMat[:READings][:DATA] <character data>
Valid values for <character data> are: 0 or ASCii, 1 or REAL
ASCii: Numerical data is transferred in the form of <NRf>.
REAL: Numerical data is transferred in IEEE 754 64-bit floating point format and is 8 bytes per data.
Example: FORM? Query the data transmission format.
FORM REAL Set the data transmission format to REAL.
Reset state: Set to ASCii

3.3.6 Memory sub-system command (MEMory/MMEMory)

- :MEMory:CATalog[:ALL]?……78
- :MEMory:CATalog:STATe?……78
- :MEMory:CATalog:TABLe?……78
- :MEMory:CLEar[:NAME]……79
- :MEMory:CLEar:TABLe[1]|2|3|4|5|6|7|8|9|10……80
- :MEMory:FREE[:ALL]?……80
- :MEMory:FREE:STATe?……80
- :MEMory:FREE:TABLe?……80
- :MEMory:NSTates?……80
- :MEMory:STATe:CATalog?……80
- :MEMory:STATe:DEFine……81
- :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine……81
- :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency……81
- :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency:POINts?……82

- :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]....82
- :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]:POINts?....82
- :MEMory:TABLe:MOVE....82
- :MEMory:TABLe:SELect....83

:MEMory:CATalog[:ALL]?

Function: Enumerate the user configurations in the 87236, including storage/recall configuration, frequency response offset table (FDO), etc.
The data format is: <value 1>, <value 2> {, <string>}
Where <value 1> indicates the length of bytes used by the user configuration and <value 2> indicates the length of unused bytes.
The form of each <string> is as follows:
<string i>, <type>, <length>
<string i> indicates the name of the user configuration.
<type> indicates the type of user configuration, TABL indicates frequency response offset table, and STAT indicates storage/recall configuration.
<length> indicates the length in bytes of this configuration item.

Query: :MEMory:CATalog[:ALL]?

Setting: Not supported

Example: MEM:CAT? Enumerate all user configurations in the 87236.

Reset state: No

:MEMory:CATalog:STATe?

Function: Enumerate the storage/recall configuration in the 87236.
The data format is: <value 1>, <value 2> {, <string>}
Where <value 1> indicates the length of bytes used by the user configuration and <value 2> indicates the length of unused bytes.
The form of each <string> is as follows:
<string i>, <type>, <length>
<string i> indicates the name of the user configuration.
<type> indicates the type of user configuration, and STAT indicates storage/recall configuration.
<length> indicates the length in bytes of this configuration item.

Query: :MEMory:CATalog:STATe?

Setting: Not supported

Example: MEM:CAT:STAT? Enumerate the storage/recall configuration in the 87236.

:MEMory:CATalog:TABLe?

Function: Enumerate the frequency response offset table in the 87236.
The data format is: <value 1>, <value 2> {, <string>}

Where <value 1> indicates the length of bytes used by the user configuration and <value 2> indicates the length of unused bytes.

The form of each <string> is as follows:

<string i>, <type>, <length>

<string i> indicates the name of the user configuration.

<type> indicates the type of user configuration, and TABL indicates frequency response offset table.

<length> indicates the length in bytes of this configuration item.

Query: :MEMory:CATalog:TABLe?

Setting: Not supported

Example: MEM:CAT:TABL? Enumerate the frequency response offset table in the 87236.

:MEMory:CLEar[:NAME]

Function: It is used to clear the frequency response offset table or storage/recall table specified in the power.

Query: Not supported

Setting: :MEMory:CLEar[:NAME] <string>

<string> indicates the name of frequency response offset table or storage/recall table

Example: MEM:CLE "fdo0" Clear the fdo0 frequency response offset table.

Note: 1) If the specified frequency response offset table is enabled, it is automatically turned off.

2) The English name of the storage/recall state is "State1", "State2" ..... "State10", and the name cannot be changed. The Chinese name of the storage/recall state is "State 1", "State 2" ..... "State 10", and the name cannot be changed.

3) Clear the frequency response offset table if the specified name can be found in the frequency response bias list;

4) Clear the state table if the specified name can be found in the storage/recall states list.

5) If there is a frequency response bias of "State1", then recall MEM:CLE "State1", which will clear the frequency response offset table and state table.

6) In the programming control setting, the state name of the storage/recall has no relationship with the language switch of the interface, i.e., the following two commands both clear the state 1 (English name is recommended).

MEM:CLE "State 1"

MEM:CLE "State1"

Error message: If the specified name does not exist, it prompts "-224, "Illegal parameter value""

Reset state: No

:MEMory:CLEar:TABLe[1]|2|3|4|5|6|7|8|9|10

Function: Clear the specified frequency response offset table.
Query: Not supported
Setting: :MEMory:CLEar:TABLe[1]|2|3|4|5|6|7|8|9|10
Example: MEM:CLE:TABL5 Clear the 5th frequency response offset table. (10 in total)

:MEMory:FREE[:ALL]?

Function: Query the total number of bytes unused in the user configuration space and the number of bytes used.
The return string is of the form: <unused bytes>, <used bytes>
Query: :MEMory:FREE[:ALL]?
Setting: Not supported
Example: MEM:FREE?

:MEMory:FREE:STATe?

Function: Query the total number of bytes unused in the storage/recall space and the number of bytes used.
The return string is of the form: <unused bytes>, <used bytes>
Query: :MEMory:FREE:STATe?
Setting: Not supported
Example: MEM:FREE:STAT?

:MEMory:FREE:TABLe?

Function: Query the total number of unused bytes and the number of bytes used in the frequency response offset table space.
The return string is of the form: <unused bytes>, <used bytes>
Query: :MEMory:FREE:TABLe?
Setting: Not supported
Example: MEM:FREE:TABL?

:MEMory:NSTates?

Function: Query the number of storage/recall states, and always return 10
Query: :MEMory:NSTates?
Setting: Not supported
Example: MEM:NST?

:MEMory:STATe:CATalog?

Function: Enumerate the names of all storage/recall states.
Query: :MEMory:STATe:CATalog?
Setting: Not supported

Example: MEM:STAT:CAT?

:MEMory:STATe:DEFine

Function: Query or set the name of the storage/recall state register.

Query: :MEMory:STATe:DEFine? <string>

The string is the name of the instrument status contained in matching quotation marks.

Setting: :MEMory:STATe:DEFine <string>, <numeric data>

The definition of string is the same as that of query format;

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 1 to 10.

Example:

MEM:STAT:DEF? "State1"	Query the state register number corresponding to the "State1".
MEM:STAT:DEF "MyState",8	Name the state register 8 as "MyState"

:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine

Function: Query or set the name in the specified frequency response offset table.

Query: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine?

Setting: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine <string>

Example:

MEM:TABL6:DEF?	Query the name of the 6th frequency response offset table.
MEM:TABL8:DEF "fdo0"	Name the 8th frequency response offset table as fdo0.

Error message: If the specified name already exists, it prompts "-257, "File name error"".

:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency

Function: Query or set the frequency list in the specified frequency response offset table.

When setting the frequency list, the previous frequency list will be cleared and the frequency list must be sorted in ascending order.

The relevant command is:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]

Query: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency?

Setting: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency <numeric data 1>{, <numeric data n>}

It is necessary to ensure that this frequency list covers the frequency range of the 87236, and if the frequency of the signal under test is outside the range of this list, the value at the lowest or highest frequency will be used.

The maximum number of frequency points is 80.

The effective units of frequency are: Hz, kHz, MHz, and GHz

Example:

MEM:TABL6:FREQ?	Query the frequency list of the 6th frequency response offset table.
MEM:TABL6:FREQ 50 MHz, 40 GHz	Set the frequency of the 6th frequency

response offset table to 50 MHz and 40 GHz.

Error message: If the number of points in the frequency list exceeds 80, it prompts "-108, "Parameter not allowed"".
If the frequency list is not in increasing order, it prompts "-220, "Parameter error""

Reset state: No

:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency:POINts?

Function: Query the frequency points of the frequency response offset table.

Query: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency:POINts?

Setting: Not supported

Example: MEM:TABL6:FREQ:POIN? Query the frequency points of the 6th frequency response offset table.

:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]

Function: Query or set the amplitude gain list in the specified frequency response offset table.
When setting the gain list, the previous gain list will be cleared,
The related command is:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency

Query: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]?

Setting: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude] <numeric data 1>{, <numeric data n>}
The maximum gain points is 80.
It is in PCT, i.e. 100 means 100%
The amplitude gain ranges from 1.0e-009 to 1.0e+009, or -90 dB to 90 dB.

Example: MEM:TABL6:GAIN? Query the gain list of the 6th frequency response offset table.

MEM:TABL6:GAIN 98, 102 Set the gain list of the 6th frequency response offset table to 98% and 102%.

:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]:POINts?

Function: Query the amplitude gain points of the frequency response offset table.

Query: :MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]:POINts?

Setting: Not supported

Example: MEM:TABL6:GAIN:POIN? Query the amplitude gain points of the 6th frequency response offset table

:MEMory:TABLe:MOVE

Function: Rename the specified frequency response offset table. This command requires prior knowledge of the name of the frequency response offset table to be modified.
Related commands MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine
It is recommended to use MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine.

Query: Not supported

Setting: :MEMory:TABLe:MOVE < string 1>, < string 2>
<string 1> indicates the name of the frequency response offset table that needs to be modified
<string 2> indicates the name of the modified frequency response offset table

Example: MEM:TABL:MOVE "fdo0", "fdo1"

Error message: If the frequency response offset table specified by the first parameter does not exist, it prompts "-256, "File name not found""
If the frequency response offset table specified by the second parameter already exists, it prompts "-257, "File name error""
If the length of the second parameter is longer than 16 characters, it prompts "-257, "File name error""

:MEMory:TABLe:SELect

Function: Query or set the current frequency response offset table. This is different from 2434. Calibration table is supported in 2434, and this command can be used to select a calibration table.

Query: :MEMory:TABLe:SELect?

Setting: :MEMory:TABLe:SELect <string>

Example:

MEM:TABL:SEL?	Return the name of the current frequency response offset table.
MEM:TABL:SEL "fdo0"	Set the current frequency response offset table to fdo0.

Error message: If the frequency response offset table specified by the parameter does not exist, it prompts "-224, "Illegal parameter value"".

3.3.7 Statistics sub-system command (PSTatistic)

The statistics subsystem command is used to configure the settings of the Complementary Cumulative Distribution Function (CCDF).

- :PSTatistic[1]:CCDF:COUNt....84
- :PSTatistic[1]:CCDF:DATA?....84
- :PSTatistic[1]:CCDF:DATA:MAX....85
- :PSTatistic[1]:CCDF:DECades....85
- :PSTatistic[1]:CCDF:END:ACTion....86
- :PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]....86
- :PSTatistic[1]:CCDF:GAUSsian[:STATe]....86
- :PSTatistic[1]:CCDF:MARKer[1]|2:DATA?....87
- :PSTatistic[1]:CCDF:MARKer:DELTa?....87
- :PSTatistic[1]:CCDF:MARKer[1]|2:X....87
- :PSTatistic[1]:CCDF:MARKer[1]|2:Y....88
- :PSTatistic[1]:CCDF:POWer?....88

- :PSTatistic[1]:CCDF:PROBability?....88
- :PSTatistic[1]:CCDF:REFerence:DATA?....89
- :PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]....89
- :PSTatistic[1]:CCDF:REFerence:POWer:AVERage?....89
- :PSTatistic[1]:CCDF:REFerence:POWer:PEAK?....90
- :PSTatistic[1]:CCDF:REFerence:POWer:PTAVerage?....90
- :PSTatistic[1]:CCDF:REFerence[:STATe]....90
- :PSTatistic[1]:CCDF:STORe:REFerence....91
- :PSTatistic[1]:CCDF:TABLe?....91
- :PSTatistic[1]:CCDF:TIME....91
- :PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]....92
- :PSTatistic[1]:CCDF:TRACe:POWer:AVERage?....92
- :PSTatistic[1]:CCDF:TRACe:POWer:PEAK?....92
- :PSTatistic[1]:CCDF:TRACe:POWer:PTAVerage?....92
- :PSTatistic[1]:CCDF:TRACe[:STATe]....93
- :PSTatistic[1]:CCDF:Y:MAX....93

:PSTatistic[1]:CCDF:COUNt

Function: Query or set the total number of statistics end.
:PSTatistic[1]:CCDF:END:ACTion
:PSTatistic[1]:CCDF:TIME

Query: :PSTatistic[1]:CCDF:COUNt?

Setting: :PSTatistic[1]:CCDF:COUNt <NRf>
<NRf> ranges from 1e+06 to 4.2e+09

Example:

PST:CCDF:COUN?	Query the total number of statistics end.
PST:CCDF:COUN 1e8	Set the total number of statistics end to 100 M.

Limit:

Reset state: The default is 1e8.

:PSTatistic[1]:CCDF:DATA?

Function: Query the statistical probability list of the 87236. The power range is 0 dB to the maximum power. The number of elements in the list is 501, and the unit is % (for example, 18.9 means 18.9%).
The format of the returned data is <Arbitrary data block>. See Section 7.7.6 of IEEE 488.2,

#nNNN...Nddd……ddd<LF>

- <LF>: Data newline character indicating the end of the data block.
- ddd……ddd: Data length (i.e. the number of bytes of d)
- NNN...N: Number of bits of data length (i.e. the number of bits of N)
- #: The marker for the start of the data block.

For example: #42004 ..... in <LF> n = 4 and N = 2004.

Each data element is formatted as IEEE754 32-bit floating-point data, i.e. 4 bytes.

Query: :PSTatistic[1]:CCDF:DATA?

Setting: Not supported

Example: PST:CCDF:DATA? Query the statistical probability buffer.

Limit:

Note: The binary data block may contain a newline character (0x0A). When using VISA library, after sending this command, it is required to set VI_ATTR_TERMCHAR_EN to VI_FALSE before reading the data. Firstly read the first two bytes (#n) to determine the length of the data block that follows. Then read n bytes, calculate the total number of bytes N behind, and finally read N bytes. N bytes are the real trace data.

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

Reset state: No

:PSTatistic[1]:CCDF:DATA:MAX

Function: Query or set the maximum value of the X-axis of the statistical trace.

Query: :PSTatistic[1]:CCDF:DATA:MAX?

Setting: :PSTatistic[1]:CCDF:DATA:MAX <NRf>
<NRf> ranges from 1 to 50 dB

Example: PST:CCDF:DATA:MAX?
PST:CCDF:DATA:MAX 15

Limit:

Reset state: 50

:PSTatistic[1]:CCDF:DECades

Function: Query or set the "decimal number" of the statistical vertical axis. For example, when set to 6, the range of statistical probability is 1e06, and if the maximum ratio is set to 100%, the minimum ratio is 1e-04 (100%/1e06).
The relevant command is :PSTatistic[1]:CCDF:Y:MAX (set the maximum statistical probability value).

Query: :PSTatistic[1]:CCDF:DECades?

Setting: :PSTatistic[1]:CCDF:DECades <NRf>
<NRf> ranges from 1 to 6.

Example: PST:CCDF:DEC?
PST:CCDF:DEC 6

Limit:

Reset state: The number of decimal places is set to 6.

:PSTatistic[1]:CCDF:END:ACTion

Function: Query or set the statistics end behavior. The end conditions are: the count reaches the set end count, or the statistics timing reaches the set end timing. There are three operations, respectively:
Stop (STOP or 0): The statistics stops when the end conditions are met.
Clear (FLUSh or 1): Clear the statistics buffer when the end conditions are met, and restart the statistics measurement.
Halve (DECimate or 2): Halve the count in the statistics buffer when the end conditions is met, and continue the statistics measurement.

Query: :PSTatistic[1]:CCDF:END:ACTion?

Setting: :PSTatistic[1]:CCDF:END:ACTion <character data>
<character data> is: STOP, FLUSh, DECimate

Example:

PST:CCDF:END:ACT?	Query the statistics end behavior.
PST:CCDF:END:ACT STOP	Set "Stop" statistics to end the behavior.

Limit:

Reset state: End behavior is set to STOP.

:PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]

Function: Set the marker to the Gaussian probability curve.
Related commands:
PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]
PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]
The 87236 does not support this command at the moment.

Query: Not supported

Setting: :PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]

Example:

PST:CCDF:GAUS:MARK	Set the marker 1 to the Gaussian probability curve.
PST:CCDF:GAUS:MARK1	Set the marker 1 to the Gaussian probability curve.
PST:CCDF:GAUS:MARK2	Set the marker 2 to the Gaussian probability curve.

Limit:

Reset state: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".
If the Gaussian curve is not turned on, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:GAUSsian[:STATe]

Function: Query or set the display state of Gaussian probability curve.
The 87236 does not support this command at the moment.

Query: :PSTatistic[1]:CCDF:GAUSsian[:STATe]?

Setting: :PSTatistic[1]:CCDF:GAUSsian[:STATe] <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example: PST:CCDF:GAUS? Query the display state of Gaussian probability curve.
PST:CCDF:GAUS 1 Turn on the Gaussian probability curve display switch.

Limit:

Reset state: Display the Gaussian probability curve.

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:MARKer[1]|2:DATA?

Function: Query the power and probability at the marker in the statistical trace.
Return data in the form of <POWER>, <PCT>,
For example 0, 36.79
0 for power with probability of 36.79

Query: :PSTatistic[1]:CCDF:MARKer[1]|2:DATA?

Setting: Not supported

Example: PST:CCDF:MARK1:DATA? Query the power and probability at marker 1.

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:MARKer:DELTa?

Function: Query two power differences and probability differences (M2-M1).
Return data in the form of <ΔPOWER>, <ΔPCT>,
For example -3, 3.87
The power of Marker 2 minus the power of Marker 1 is -3. The probability that the power of Marker 2 minus Marker 1 is 3.87

Query: :PSTatistic[1]:CCDF:MARKer:DELTa?

Setting: Not supported

Example: PST:CCDF:MARK:DELT?

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:MARKer[1]|2:X

Function: Query or set the horizontal position of the marker. The markers range from 0 to the maximum power of the X-axis.

Query: :PSTatistic[1]:CCDF:MARKer[1]|2:X?

Setting: :PSTatistic[1]:CCDF:MARKer[1]|2:X <NRf>

<NRf> ranges from 0 to the maximum power of the X-axis.

Example: PST:CCDF:MARK2:X? Query the horizontal power of marker 2.
PST:CCDF:MARK1:X 1.6 Set the horizontal power of marker 1 to 1.6 dB.

Limit:

Reset state: The horizontal power of the marker is set to 0.

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:MARKer[1]|2:Y

Function: Query or set the vertical position of the marker (i.e. probability value). The markers range from 0 to 100%.

Query: :PSTatistic[1]:CCDF:MARKer[1]|2:Y?

Setting: :PSTatistic[1]:CCDF:MARKer[1]|2:Y <NRf>
<NRf> range from 0 to 100%.

Example: PST:CCDF:MARK2:Y? Query the probability of marker 2.
PST:CCDF:MARK1:Y 16 Set the probability of marker 1 to 16%.

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:POWer?

Function: Query the power at a given probability point. The input parameter indicates the specified probability.

Query: :PSTatistic[1]:CCDF:POWer? <NRf>
<NRf> range from 0 to 100%.

Setting: Not supported

Example: PST:CCDF:POW? 10 Query the power with a probability of 10%.

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:PROBability?

Function: Query the probability at a given power point. The input parameter indicates the specified power.

Query: :PSTatistic[1]:CCDF:PROBability? <NRf>
<NRf> ranges from 0 to 50 dB.

Setting: Not supported

Example: PST1:CCDF:PROB? 6.78 Query the probability when the power in Channel A is 6.78 dB.

Limit:

Error If the current display mode is not a statistics trace or statistics table, it prompts

message: "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence:DATA?

Function: Query the reference statistical probability list of the 87236. The power range is 0 dB to the maximum power. The number of elements in the list is 501, and the unit is % (for example, 18.9 means 18.9%).

The format of the returned data is <Arbitrary data block>. See Section 7.7.6 of IEEE 488.2,

#nNNN...Nddd……ddd<LF>

- Data newline character indicating the end of the data block.
- Data length (i.e. the number of bytes of d)
- Number of bits of data length (i.e. the number of bits of N)
- The marker for the start of the data block.

For example: #42004 ..... in <LF> n = 4 and N = 2004.

Each data element is formatted as IEEE754 32-bit floating-point data, i.e. 4 bytes.

Query: :PSTatistic[1]:CCDF:REFerence:DATA?

Setting: Not supported

Example: PST:CCDF:REF:DATA? Query the statistical probability list of the reference trace.

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

If there is no reference data, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]

Function: Set the marker to the reference statistics curve.

Related commands:

PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]

PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]

Query: Not supported

Setting: :PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]

Example:

PST:CCDF:REF:MARK	Set marker 1 to the reference statistics curve.
PST:CCDF:REF:MARK1	Set marker 1 to the reference statistics curve.
PST:CCDF:REF:MARK2	Set marker 2 to the reference statistics curve.

Limit:

Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

If the reference curve is not turned on, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence:POWer:AVERage?

Function: Query the average power of the reference statistics curve.

Query: :PSTatistic[1]:CCDF:REFerence:POWer:AVERage?

Setting: Not supported
Example: PST:CCDF:REF:POW:AVER?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".
If there is no reference data, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence:POWer:PEAK?

Function: Query the peak power of the reference statistics curve.
Query: :PSTatistic[1]:CCDF:REFerence:POWer:PEAK?
Setting: Not supported
Example: PST:CCDF:REF:POW:PEAK?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".
If there is no reference data, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence:POWer:PTAVerage?

Function: Query the peak to average ratio of the reference statistics curve.
Query: :PSTatistic[1]:CCDF:REFerence:POWer:PTAV?
Setting: Not supported
Example: PST:CCDF:REF:POW:PTAV?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".
If there is no reference data, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:REFerence[:STATe]

Function: Query or set the display state of the reference statistics curve.
The 87236 does not support this command at the moment.
Query: :PSTatistic[1]:CCDF:REFerence[:STATe]?
Setting: :PSTatistic[1]:CCDF:REFerence[:STATe] <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON
Example: PST:CCDF:REF?
PST:CCDF:REF ON Turn on the reference statistics curve.
Limit:
Reset state: Turn off the display of the reference statistics curve.
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".
If there is no reference data, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:STORe:REFerence

Function: Store statistics curve to the reference statistics curve.
Query: :PSTatistic[1]:CCDF:STORe:REFerence? Query whether the reference curve exists.
Setting: :PSTatistic[1]:CCDF:STORe:REFerence
Example: PST:CCDF:STOR:REF? Query whether the reference curve exists.
PST:CCDF:STOR:REF Store the statistics curve to the reference statistics curve.
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TABLe?

Function: Query the statistical measurement list, including average power, average power probability, power under 6 probabilities (10%, 1%, 0.1%, 0.01%, 0.001%, and 0.0001%), peak average ratio, and sampling count.
Query: :PSTatistic[1]:CCDF:TABLe?
Setting: Not supported
Example: PST1:CCDF:TABL? Query the statistical measurement list.
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TIME

Function: Query or set the statistics end timing (unit: s).
Related commands:
:PSTatistic[1]:CCDF:COUNt
:PSTatistic[1]:CCDF:END:ACTion
Query: :PSTatistic[1]:CCDF:TIME? [MIN|MAX]
Setting: :PSTatistic[1]:CCDF:TIME <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges 0 to 3600 seconds (the valid values are 0, 1, 2, 5, 10, 30, 60, 120, 300, 600, 1800, and 3600. If these values are not true and do not exceed the limit, they will be automatically rounded down to similar values). 0 means that statistics end timing is not considered.
Example: PST:CCDF:TIME? Query the statistical timing.
PST:CCDF:TIME 100 Set the statistics end timing to 60 seconds.
Limit:
Reset state: Set to 0 (disregarding statistics end timing).

:PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]

Function: Set marker to channel statistics curve.
Related commands:
PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]
PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]
Query: Not supported
Setting: :PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]
Example: PST:CCDF:TRAC:MARK Set marker 1 to the channel statistics curve.
PST:CCDF:TRAC:MARK1 Set marker 1 to the channel statistics curve.
PST:CCDF:TRAC:MARK2 Set marker 2 to the channel statistics curve.
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TRACe:POWer:AVERage?

Function: Query the average power of the channel statistics curve.
Query: :PSTatistic[1]:CCDF:TRACe:POWer:AVERage?
Setting: Not supported
Example: PST:CCDF:TRAC:POW:AVER?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TRACe:POWer:PEAK?

Function: Query the peak power of the channel statistics curve.
Query: :PSTatistic[1]:CCDF:TRACe:POWer:PEAK?
Setting: Not supported
Example: PST:CCDF:TRAC:POW:PEAK?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TRACe:POWer:PTAVerage?

Function: Query the peak to average ratio of the channel statistics curve.
Query: :PSTatistic[1]:CCDF:TRACe:POWer:PTAV?
Setting: Not supported
Example: PST:CCDF:TRAC:POW:PTAV?
Limit:
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:TRACe[:STATe]

Function: Query or set the display state of channel statistics curve.
Query: :PSTatistic[1]:CCDF:TRACe[:STATe]?
Setting: :PSTatistic[1]:CCDF:TRACe[:STATe] <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON
Example: PST1:CCDF:TRAC? Query the display status of statistical curve.
PST:CCDF:TRAC ON Turn on the statistical curve.
Limit:
Reset state: Turn on the display of channel statistics curve.
Error message: If the current display mode is not a statistics trace or statistics table, it prompts "-221, "Setting Conflict"".

:PSTatistic[1]:CCDF:Y:MAX

Function: Query or set the "maximum probability value" for statistical display.
Query: :PSTatistic[1]:CCDF:Y:MAX?
Setting: :PSTatistic[1]:CCDF:Y:MAX <NRf>
<NRf> takes the following sets of numbers in close proximity: 0.01, 0.1, 1, 10, and 100. In PCT.
Example: PST:CCDF:Y:MAX?
PST:CCDF:Y:MAX 99 Set the maximum probability value to 100 (99 is taken as close to 100).
Limit:
Reset state: The maximum display probability value is set to 100%.
Error message:

3.3.8 Sensor sub-system command (SENSe)

- [:SENSe[1]:]AVERage[1]|2:COUNt....94
- [:SENSe[1]:]AVERage:COUNt:AUTO....95
- [:SENSe[1]:]AVERage:RESet....95
- [:SENSe[1]:]AVERage:SDETect....95
- [:SENSe[1]:]AVERage[1]|2[:STATe]....96
- [:SENSe[1]:]BANDwidth|BWIDth:VIDeo....96
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[:SENSe[1]:]AVERage[1]|2:COUNt

Function: Query or set the measurement average count and the video average count.
AVERage [1]: measurement average, where consecutive measurements are averaged in order to improve the accuracy of the measurements.
Setting this command will automatically perform the following command settings:
AVERage:COUNt:AUTO OFF
AVERage1:STATe ON

AVERage2: Video average, or trace average, where consecutive traces are averaged without affecting the dynamic range of the signal to reduce the effects of noise.
Setting this command will automatically perform the following command settings:
AVERage2:STATe ON

Query: [:SENSe[1]:]AVERage[1]|2:COUNt? [MIN|MAX]

Setting: [:SENSe[1]:]AVERage[1]|2:COUNt <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1 to 1024.
DEF is 8,
MIN is 1,
MAX is 1024.

Example:

SENS1:AVER:COUN?	Query the measurement average count.
SENS1:AVER2:COUN?	Query the video average count.
SENS1:AVER:COUN? MAX	Query the maximum value of the settable measurement average count.
SENS:AVER:COUN 28	Set the measurement average count to 28.

Reset state: Average count is set to 8.

[:SENSe[1]:]AVERage:COUNt:AUTO

Function: Query or set the measurement auto-average state.

Query: [:SENSe[1]:]AVERage:COUNt:AUTO?

Setting: [:SENSe[1]:]AVERage:COUNt:AUTO <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS1:AVER:COUN:AUTO?	Query the automatic average state.
SENS:AVER:COUN:AUTO 1	Turn on auto average.

Limit:

Error message:

Reset state: Auto average is set to ON.

[:SENSe[1]:]AVERage:RESet

Function: Clear the averaging buffer and restart averaging of the 87236.
The 87236 is equipped with an internal averaging buffer for storing historical measurement data. This command is used to clear this buffer and re-store it.

Query: Not supported

Setting: [:SENSe[1]:]AVERage:RESet

Example:

AVER:RES	Re-average

Limit:

Reset

state:

[:SENSe[1]:]AVERage:SDETect

Function: Query or set the channel step detection state.
In auto average mode, the last four averages are used to compare with the entire filter value, and the digital filter is cleared when the difference between the two averages exceeds 15%. The filter then starts storing the new measurement values. The use of this function is able to shorten the filtering time when the power changes more significantly.

Query: [:SENSe[1]:]AVERage:SDETect?

Setting: [:SENSe[1]:]AVERage:SDETect <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS1:AVER:SDET?	Query the step detection state.
SENS:AVER:SDET 1	Turn on the step detection.

Limit:

Reset state: Step detection is set to ON.

[:SENSe[1]:]AVERage[1]|2[:STATe]

Function: Query or set the measurement average and video average switch state.

Query: [:SENSe[1]:]AVERage[1]|2[:STATe]?

Setting: [:SENSe[1]:]AVERage[1]|2[:STATe] <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS1:AVER?	Query the ON/OFF state of measurement average.
SENS:AVER 1	Turn on the measurement average.

Reset state: Average state is set to ON.

[:SENSe[1]:]BANDwidth|BWIDth:VIDeo

Function: Query or set the measured video bandwidth.

Query: [:SENSe[1]:]BANDwidth|BWIDth:VIDeo?

Setting: [:SENSe[1]:]BANDwidth|BWIDth:VIDeo <character data>
The valid form of <character data> is as follows:
OFF|0: OFF (30M)
LOW|1: Low (5M)
MEDium|2: Medium (15M)
HIGH|3: High (30M)

Example:

SENS1:BAND:VID?	Query the VBW
BWID:VID 1	VBW is low
BAND:VID HIGH	VBW is high

Reset VBW is OFF

state:

[:SENSe[1]:]BUFFer:COUNt

Function: Query or set the buffer size of external trigger measurement, which is only used for external trigger measurement.
Note: This command can only be set when
[:SENSe[1]:]FREQuency[:CW|FIXed]:STEP
is set to 0, otherwise an error will be reported.

Query: [:SENSe[1]:]BUFFer:COUNt?

Setting: [:SENSe[1]:]BUFFer:COUNt <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1 to 80000
DEF is 1.
MIN is 1.
MAX is 80000.

Example:

SENS:BUFF:COUN?	Query the current buffer size of external trigger measurement.
SENS:BUFF:COUN 100	Set the buffer size of external trigger measurement to 100.

Error message: If the trigger source (TRIG:SOUR) is not "External Trigger", it prompts "-221, "Setting Conflict"".
If the number of frequency steps (FREQ:STEP) is not 0, it prompts "-221, "Setting Conflict"".

Reset state: 1

[:SENSe[1]:]BUFFer:MTYPe

Function: Query or set the external trigger buffer measurement type, which is only used for external trigger measurement.

Query: [:SENSe[1]:]BUFFer:MTYPe?

Setting: [:SENSe[1]:]BUFFer:MTYPe <string>
<string> can be the following values:
"AVER": average power measurement mode
"PEAK": peak power measurement mode
"PTAV": peak-to-average ratio measurement mode
"MIN": minimum power measurement mode

Example:

BUFF:MTYP?	Query the current buffer measurement type.
SENS:BUFF:MTYP "PEAK"	Set the buffer measurement mode to "Peak".

Error message: If the trigger source (TRIG:SOUR) is not "External Trigger", it prompts "-221, "Setting Conflict"".
If the parameter is an invalid string, it prompts "-224, "Illegal parameter value"".

If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: Average power measurement mode

[:SENSe[1]:]CORRection:CSET2[:SELect]

Function: Set or query the name of the frequency response offset table for the current device.
The data of the frequency response offset table is shared between the two channels, but the ON/OFF states are separate.

Query: [:SENSe[1]:]CORRection:CSET2[:SELect]?

Setting: [:SENSe[1]:]CORRection:CSET2[:SELect] <string>
<string> indicates the name of the frequency response offset table.

Example:

SENS:CORR:CSET2?	Query the currently selected frequency response offset table.
SENS:CORR:CSET2 "fdo0"	Select the frequency response offset table named "fdo0".

Error message: If the frequency response offset table specified by the parameter does not exist, it prompts "-256, "File name not found"".

Reset state: No effect.

[:SENSe[1]:]CORRection:CSET2:STATe

Function: Query or set the activation state of the frequency response offset table.
The data of the frequency response offset table is shared between the two channels, but the activation states are separate.

Query: [:SENSe[1]:]CORRection:CSET2:STATe?

Setting: [:SENSe[1]:]CORRection:CSET2:STATe <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS1:CORR:CSET2:STAT?	Query the activation state of the frequency response offset table.
SENS:CORR:CSET2:STAT 0	Disable the frequency response offset table.

Error message: If the number of frequency points and the number of amplitude gain (offset) points in the currently selected frequency response offset table are different, it prompts "-226," list length is not the same ""
If the point in the currently selected frequency response offset table is 0, it prompts "-221, "Setting Conflict"".

Reset state: Do not affect the activation state of the frequency response offset table.

[:SENSe[1]:]CORRection:DCYCle[:INPut][:MAGNitude]

Function: Query or set the channel duty cycle value for pulse power measurement.
Pulse power measurements average any aberrations such as overshoot, ringing, etc.

The measurement is a mathematical representation of the pulse power measurement and not a true measurement. The 87236 measures the average power of the pulse signal by dividing it by the duty cycle to obtain a pulse power reading.

Notice: To ensure the accuracy of the measurement, the input signal must be a rectangular pulse, other pulses (such as triangle wave, linear FM pulse) will lead to inaccurate measurement.

The switching ratio of the pulse under test must be much larger than the duty cycle setting.

Query: [:SENSe[1]:]CORRection:DCYCle[:INPut][:MAGNitude]? [MIN|MAX]

Setting: [:SENSe[1]:]CORRection:DCYCle[:INPut][:MAGNitude] <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 0.001 to 100 (unit: %).

DEF is 100,

MIN is 0.001,

MAX is 100.

Example:

SENS:CORR:DCYC?	Query the current duty cycle value of the channel.
CORR:DCYC? MAX	Query the maximum settable duty cycle.
CORR:DCYC 50	Set the channel duty cycle to 50%.

Reset state: 100%

[:SENSe[1]:]CORRection:DCYCle[:INPut]:STATe

Function: Query or set the ON/OFF state of channel duty cycle for pulse power measurement.

Query: [:SENSe[1]:]CORRection:DCYCle[:INPut]:STATe?

Setting: [:SENSe[1]:]CORRection:DCYCle[:INPut]:STATe <Boolean data>

Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS:CORR:DCYC:STAT?	Query the activation state of duty cycle of the channel.
CORR:DCYC:STAT 1	Enable the duty cycle correction for the channel.

Reset state: OFF

[:SENSe[1]:]CORRection:FDOFfset[:INPut][:MAGNitude]?

Function: Query the currently used frequency response offset factor. It is in PCT, i.e. 100 means 100%.

Query: [:SENSe[1]:]CORRection:FDOFfset[:INPut][:MAGNitude]?

Setting: Not supported

Example:

CORR:FDOF?	Query the currently used frequency response offset factor.

Limit: Only for USB channel (8), other channels are not supported.

[:SENSe[1]:]CORRection:GAIN[1]|2|3|4[:INPut][:MAGNitude]

Function: It is used to set or query four kinds of gains for the current device;
The equivalent form of GAIN [1] is CFACtor, which denotes the calibration factor of the 87236. The former conforms to the SCPI specification, while the latter does not. GAIN [1] is not supported in this case;
GAIN2 indicates the channel offset. It is supported in this case. It can be queried or set.
The equivalent form of GAIN3 is DCYCle, which represents the duty cycle.
The equivalent form of GAIN4 is FDOFfset, which represents the frequency response offset factor. GAIN4 is supported in this case. The frequency response offset factor is only available for query.

Query: [:SENSe[1]:]CORRection:GAIN2|4[:INPut][:MAGNitude]? [MIN|MAX]

Setting: [:SENSe[1]:]CORRection:GAIN2[:INPut][:MAGNitude] <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from -100 to 100 (unit: dB)
DEF is 0 dB,
MIN is -100 dB,
MAX is 100 dB.

Example:

SENS:CORR:GAIN2?	Query the channel offset.
CORR:GAIN2? MAX	Query the maximum settable channel offset value.
SENS1:CORR:GAIN4?	Query the frequency response offset value.
CORR:GAIN2 3.6	Set the channel offset to 3.6dB.

Reset state: Channel offset is 0; duty cycle is 100%

[:SENSe[1]:]CORRection:GAIN[1]|2|3|4[:INPut]:STATe

Function: The equivalent form of GAIN [1] is CFACtor, which denotes the calibration factor of the 87236. The former conforms to the SCPI specification, while the latter does not. GAIN [1] is not supported in this case;
GAIN2 indicates the channel offset.
The equivalent form of GAIN3 is DCYCle, which represents the duty cycle. GAIN3 is not supported in this case
The equivalent form of GAIN4 is FDOFfset, which represents the frequency response offset factor. This case does not support the query and setting of GAIN4 state.

Query: [:SENSe[1]:]CORRection:GAIN2[:INPut]:STATe?

Setting: [:SENSe[1]:]CORRection:GAIN2[:INPut]:STATe <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS:CORR:GAIN2:STAT?	Query the activation state of channel offset.

CORR:GAIN2:STAT 1 Enable the channel offset.

Reset state: OFF

[:SENSe[1]:]DETector:FUNCtion

Function: Query or set the detection measurement mode of the 87236.

Query: [:SENSe[1]:]DETector:FUNCtion?

Setting: [:SENSe[1]:]DETector:FUNCtion <character data>

The valid values of the character data are as follows:

AVERage or 0: Average power measurement mode

NORMal or 1: Normal peak measurement mode

Example:

DET:FUNC? Query the measurement method

DET:FUNC AVER Set to average power measurement mode.

Reset state: Average power measurement mode.

[:SENSe[1]:]FREQuency[:CW|FIXed]

Function: Query or set the frequency.

Query: [:SENSe[1]:]FREQuency[:CW|FIXed]? [MIN|MAX]

Setting: [:SENSe[1]:]FREQuency[:CW|FIXed] <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges 1e3 to 1e12 (unit: Hz).

DEF is 1 GHz,

MIN is 1kHz,

MAX is 1000 GHz,

Example:

FREQ? Query the frequency.

FREQ? MAX Query the maximum settable frequency.

SENS:FREQ 8GHz Set the frequency to 8GHz.

Reset state: 1 GHz.

[:SENSe[1]:]FREQuency[:CW|FIXed]:STARt

Function: Query or set the frequency for the start frequency of the external trigger buffer sweep measurement.

Associated commands:

[:SENSe[1]:]FREQuency[:CW|FIXed]:STOP

[:SENSe[1]:]FREQuency[:CW|FIXed]:STEP

The start frequency can be greater than or equal to the stop frequency.

Query: [:SENSe[1]:]FREQuency[:CW|FIXed]:STARt? [MIN|MAX]

Setting: [:SENSe[1]:]FREQuency[:CW|FIXed]:STARt <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are

used for setting only.
<NRf> ranges 1e3 to 1e12 (unit: Hz).
DEF is 1 GHz,
MIN is 1kHz,
MAX is 1000 GHz.

Example:	FREQ:STAR?	Query the start frequency of sweep measurement.
	FREQ:STAR? MAX	Query the maximum settable start frequency of sweep measurement.
	SENS:FREQ:STAR 8GHz	Set the start frequency of sweep measurement to 8GHz.
Reset state:	1 GHz.	

[:SENSe[1]:]FREQuency[:CW|FIXed]:STEP

Function: Query or set the frequency step number for the external trigger buffer sweep measurement.
Associated commands:
[:SENSe[1]:]FREQuency[:CW|FIXed]:STARt
[:SENSe[1]:]FREQuency[:CW|FIXed]:STOP
[:SENSe[1]:]BUFFer:COUNt
The number of frequency steps can be 0. When it is 0, the [:SENSe[1]:]BUFFer:COUNt command can be used to set the buffer measurement size; when it is not 0, the set value of [:SENSe[1]:]BUFFer:COUNt is invalid.
The following equation can be used to calculate the number of frequency steps (Step) (Start, Stop, and Interval are the start frequency, stop frequency and frequency interval respectively. The Interval cannot be 0).

$$Step = (\text{int})\left|\frac{Start - Stop}{Interval}\right| + 1$$

Query: [:SENSe[1]:]FREQuency[:CW|FIXed]:STEP? [MIN|MAX]
Setting: [:SENSe[1]:]FREQuency[:CW|FIXed]:STEP <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 80000.
DEF is 0,
MIN is 0,
MAX is 80000.

Example:	FREQ:STEP?	Query the number of frequency steps.
	FREQ:STEP? MAX	Query the maximum settable frequency steps.
	SENS:FREQ:STEP 100	Set the number of frequency steps to 100.
Reset	0.	

state:

[:SENSe[1]:]FREQuency[:CW|FIXed]:STOP

Function: Query or set the frequency for the stop frequency of the external trigger buffer sweep measurement.
Associated commands:
[:SENSe[1]:]FREQuency[:CW|FIXed]:STARt
[:SENSe[1]:]FREQuency[:CW|FIXed]:STEP
The start frequency can be greater than or equal to the stop frequency.

Query: [:SENSe[1]:]FREQuency[:CW|FIXed]:STOP? [MIN|MAX]

Setting: [:SENSe[1]:]FREQuency[:CW|FIXed]:STOP <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges 1e3 to 1e12 (unit: Hz).
DEF is 1 GHz,
MIN is 1kHz,
MAX is 1000 GHz.

Example:

FREQ:STOP?	Query the end frequency of sweep measurement.
FREQ:STOP? MAX	Query the maximum settable stop frequency of sweep measurement.
SENS:FREQ:STOP 8GHz	Set the end frequency of sweep measurement to 8GHz.

Reset state: 1 GHz.

[:SENSe[1]:]LIST:FREQuency:STARt

Function: Query or set the start frequency of the timeslot list sweep measurement.
Related commands:
[:SENSe[1]:]LIST:FREQuency:STOP

Query: [:SENSe[1]:]LIST:FREQuency:STARt? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:FREQuency:STARt <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges 1e3 to 1e12 (unit: Hz).
DEF is 1 GHz,
MIN is 1kHz,
MAX is 1000 GHz.

Example:

LIST:FREQ:STAR?	Query the start frequency of the timeslot list sweep measurement.
LIST:FREQ:STAR? MAX	Query the maximum settable start frequency of the timeslot list sweep measurement.
SENS:LIST:FREQ:STAR 8GHz	Set the start frequency of the timeslot list sweep

measurement to 8GHz.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 1 GHz.

[:SENSe[1]:]LIST:FREQuency:STOP

Function: Query or set the stop frequency of the timeslot list sweep measurement.
Related commands:
[:SENSe[1]:]LIST:FREQuency:STARt

Query: [:SENSe[1]:]LIST:FREQuency:STOP? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:FREQuency:STOP <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges 1e3 to 1e12 (unit: Hz).
DEF is 1 GHz,
MIN is 1kHz,
MAX is 1000 GHz.

Example:

LIST:FREQ:STOP?	Query the stop frequency of the timeslot list sweep measurement.
LIST:FREQ:STOP? MAX	Query the maximum settable stop frequency of the timeslot list sweep measurement.
SENS:LIST:FREQ:STOP 8GHz	Set the stop frequency of the timeslot list sweep measurement to 8GHz.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 1 GHz.

[:SENSe[1]:]LIST:MTYPe

Function: Query or set the timeslot list sweep measurement type, which is only used for external trigger measurement.

Query: [:SENSe[1]:]LIST:MTYPe?

Setting: [:SENSe[1]:]LIST:MTYPe <string>
<string> can be the following values:
"AVER": average power measurement mode
"PEAK": peak power measurement mode
"PTAV": peak-to-average ratio measurement mode

"MIN": minimum power measurement mode

Example:	LIST:MTYP?	Query the type of the current timeslot list sweep frequency measurement.
	SENS:LIST:MTYP "PEAK"	Set the timeslot list sweep measurement type to "Peak".

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the parameter is an invalid string, it prompts "-224, "Illegal parameter value"".

Reset state: Average power measurement mode

[:SENSe[1]:]LIST:POINts

Function: Query or set the number of points for timeslot list sweep measurement, which is only used for external trigger measurement.
If the start frequency (Start) and the stop frequency (Stop) of the slot list sweep are different, then after determining the frequency step (Step), the following equation can be used to calculate the number of measurement points (Points) (Step cannot be zero):

$$Points = (\text{int})\left|\frac{Start - Stop}{\text{Step}}\right| + 1$$

Query: [:SENSe[1]:]LIST:POINts? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:POINts <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1 to 5000.
DEF is 1,
MIN is 1,
MAX is 5000.

Example:	LIST:POIN?	Query the number of points of the timeslot list sweep measurement.
	LIST:POIN? MAX	Query the maximum settable points of the timeslot list sweep measurement.
	SENS:LIST:POIN 100	Set the number of points for the timeslot list sweep measurement to 100.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 1.

[:SENSe[1]:]LIST:STATe

Function: Query or set the timeslot list sweep measurement state.

Query: [:SENSe[1]:]LIST:STATe?

Setting: [:SENSe[1]:]LIST:STATe <Boolean data>

Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

LIST:STAT?	Query the timeslot list sweep measurement state.
LIST:STAT 1	Enable the timeslot list sweep measurement

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";

If the detection measurement method (SENS:DET:FUNC) is "AVER", it prompts "-221, "Setting Conflict"";

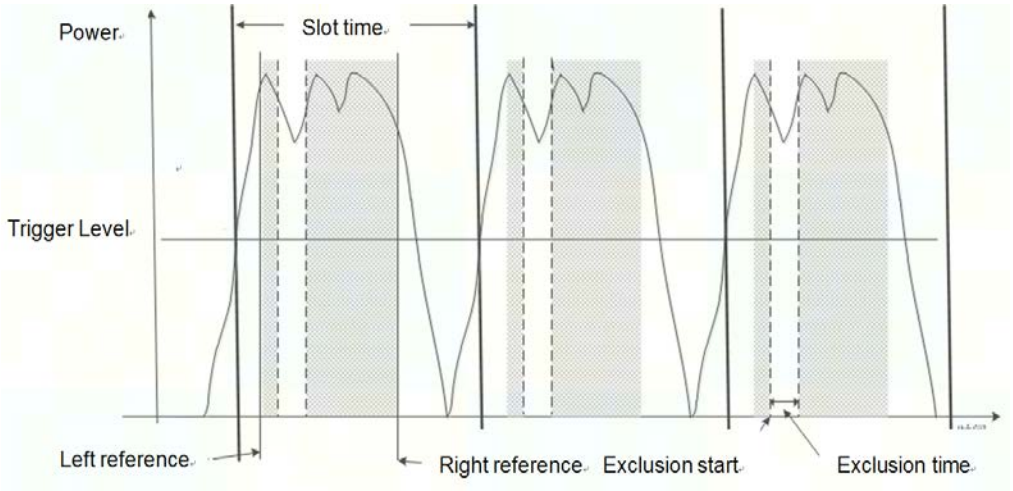
If the trigger source (TRIG:SOUR) is not "External Trigger", it prompts "-221, "Setting Conflict"".

Reset state: OFF

[:SENSe[1]:]LIST:TSCount

Function: Query or set the number of slots for the timeslot list sweep measurement.

The timeslot diagram is shown below:



Query: [:SENSe[1]:]LIST:TSCount? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:TSCount <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 1 to 16.

DEF is 1,

MIN is 1,

MAX is 16.

Example:

LIST:TSC?	Query the number of time slots for the timeslot list sweep measurement.
LIST:TSC? MAX	Query the maximum settable time slots for the

timeslot list sweep measurement.

SENS:LIST:TSC 8 — Set the number of time slots for the timeslot list sweep measurement to 8.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the detection measurement method (SENS:DET:FUNC) is "AVER", it prompts "-221, "Setting Conflict"";
If the product of the time length of the timeslot measurement (LIST:TSL:TIME) and the number of time slots (LIST:TSC) exceeds 1s, it prompts "-221, "Setting Conflict"".

Reset state: 1.

Note: The number of measurement points returned by FETCh?, MEASure?, READ? is the number of sweep measurement points multiplied by the number of time slots. For example, if the number of measurement points is 100 and the number of time slots is 8, then the above command returns 800 measurements each time.

[:SENSe[1]:]LIST:TSLot:EXCLude:OFFSet:TIME

Function: Query or set the start time (offset time) of the "measurement exclusion area" relative to the start position of the slot (see "Exclusion Start" in the slot diagram).

Query: [:SENSe[1]:]LIST:TSLot:EXCLude:OFFSet:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:TSLot:EXCLude:OFFSet:TIME <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 0.1 (unit: s), with an accuracy of 12.5 ns
DEF is 0,
MIN is 0,
MAX is 0.1.

Example:

LIST:TSL:EXCL:OFFS:TIME? — Query the start time of "measurement exclusion area".

LIST:TSL:EXCL:OFFS:TIME? MAX — Query the maximum settable start time of "measurement exclusion area".

LIST:TSL:EXCL:OFFS:TIME 1e-5 — Set the start time of "measurement exclusion area" to 10 us.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";
If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 0s.

[:SENSe[1]:]LIST:TSLot:EXCLude:TIME

Function: Query or set the duration of the "measurement exclusion area" relative to the start

position of the slot (see "Exclusion Duration" in the slot diagram).

Query: [:SENSe[1]:]LIST:TSLot:EXCLude:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:TSLot:EXCLude:TIME <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 0 to 0.1 (unit: s), with an accuracy of 12.5 ns

DEF is 0,

MIN is 0,

MAX is 0.1.

Example:

LIST:TSL:EXCL:TIME?	Query the duration of "measurement exclusion area".
LIST:TSL:EXCL:TIME? MAX	Query the maximum settable duration of "measurement exclusion area".
LIST:TSL:EXCL:TIME 1e-5	Set the duration of "measurement exclusion area" to 10 us.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";

If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 0s.

[:SENSe[1]:]LIST:TSLot:TIME

Function: Query or set the duration of the timeslot measurement (see "Time Slot Duration" in the slot diagram).

Query: [:SENSe[1]:]LIST:TSLot:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:TSLot:TIME <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 12.5e-9 to 1 (unit: s), with an accuracy of 12.5 ns

DEF is 1e-4,

MIN is 12.5e-9,

MAX is 1.

Example:

LIST:TSL:TIME?	Query the duration of timeslot measurement.
LIST:TSL:TIME? MAX	Set the time span of time domain measurement Query the maximum settable time slot measurement length.
LIST:TSL:TIME 1e-3	Set the time slot measurement length to 1ms.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";

If the detection measurement method (SENS:DET:FUNC) is "AVER", it prompts "-221, "Setting Conflict"";

If the product of the time length of the timeslot measurement (LIST:TSL:TIME) and the number of time slots (LIST:TSC) exceeds 1s, it prompts "-221, "Setting Conflict"".

Reset state: 100 us.

[:SENSe[1]:]LIST:TSLot:TREF[1]|2

Function: Query or set the left and right reference values (percentage relative to the slot duration) of the timeslot measurement gate (see "Left reference" and"Right reference" in the slot diagram), TREF1: left reference, TREF2: right reference.

The left reference value is defined as the percentage of the start time of the measurement gate divided by the time slot length, and the right reference value is defined as the difference between the time slot end time and the end time of the measurement gate divided by the time slot length.

This function effectively removes first and last transitions and overshoot of the signal.

Note: The sum of the left and right reference values shall not exceed 100 (in %).

Query: [:SENSe[1]:]LIST:TSLot:TREF[1]|2? [MIN|MAX]

Setting: [:SENSe[1]:]LIST:TSLot:TREF[1]|2 <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 0 to 100, in PCT,

DEF is 0,

MIN is 0,

MAX is 100.

Example:

LIST:TSL:TREF1?	Query the left reference value of the timeslot measurement gate.
LIST:TSL:TREF2? MAX	Query the right reference value of the maximum settable timeslot measurement gate.
LIST:TSL:TREF2 10	Set the left reference value of the timeslot measurement gate to 10%.

Error message: If the current time timeslot list sweep measurement is in progress, it prompts "-221, "Setting Conflict"";

If the detection measurement method (SENS:DET:FUNC) is "AVER", the message "-221, it prompts "Setting Conflict"".

Reset state: 0.

[:SENSe[1]:]MRATe

Function: Query or set the measurement speed.

Query: [:SENSe[1]:]MRATe?

Setting: [:SENSe[1]:]MRATe <character data>

The valid values of the character data are as follows:

NORMal or 0: 20 readings per second at normal speed
DOUBle or 1: 40 readings per second at doubled speed
FAST or 2: 4000 readings per second at fast speed (if the detection measurement mode (SENS:DET:FUNC) is "AVER")
50000 readings per second at fast speed (if the detection measurement mode (SENS:DET:FUNC) is "NORM")
Note: In the fast test mode, the following setting parameters are ignored and processed by"OFF": average state, channel offset state, measurement offset state, relative measurement state, and limit state.

Example:

MRAT?	Query the measurement speed
SENS:MRAT FAST	Set the quick measurement

Reset state: Normal speed

[:SENSe[1]:]PULSe:DISTal

Function: Query and set the distal line in the pulse measurement, which is used to calculate the pulse transition duration (rise time or fall time).
The relevant command is: [:SENSe[1]:]PULSe:PROXimal <numeric data>
:TRACe[1]:DEFine:TRANsition:REFerence <numeric data 1>, <numeric data 2>
The value set by this command is equivalent to <numeric data 2> above.

Query: [:SENSe[1]:]PULSe:DISTal? [MIN|MAX]

Setting: [:SENSe[1]:]PULSe:DISTal <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 100.
DEF is 90,
MIN is 0,
MAX is 100.

Example:

SENS:PULS:DIST?	Query the set value of distal line in the pulse measurement.
PULS:DIST 81	Set the distal line of the pulse to 81%.

Limit:

Reset state: Distal line is set to 90%

Note: Definition of pulse transition time and pulse duration.

1) Definition of pulse transition time

The pulse transition time is commonly referred to as the rise and fall time. The rise time is a fraction of the time it takes for the specified pulse to transition from the "OFF" state to the "ON" state. The fall time is reversed. The percentage of pulse switching time is determined from the proximal line and distal lines. Let the top power of the pulse be P. Generally, the rise time is the time for the pulse to change from 10%×P to 90%×P, when the proximal line is 10% and the distal line is 90%. They

are changed by

[:SENSe[1]:]PULSe:PROXimal and [:SENSe[1]:]PULSe:DISTal respectively.

2) Definition of pulse duration

The pulse duration is the usual pulse width. Generally, the pulse width is the duration from 50% of the first transition of the pulse to 50% of the last transition of the pulse, when the value of the mesial line is 50%. This value can be changed by [:SENSe[1]:]PULSe:MESial.

[:SENSe[1]:]PULSe:MESial

Function: Query and set the mesial line in the pulse measurement, which is used to calculate the pulse duration (i.e. pulse width).
The equivalent command of this command is:TRACe[1]:DEFine:DURation:REFerence

Query: [:SENSe[1]:]PULSe:MESial? [MIN|MAX]

Setting: [:SENSe[1]:]PULSe:MESial <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 100.
DEF is 50,
MIN is 0,
MAX is 100.

Example:

SENS:PULS:MES?	Query the set value of mesial line in the pulse measurement.
PULS:MES 25	Set the mesial line of the pulse to 25%.

Limit:

Reset state: Mesial line is set to 50%

[:SENSe[1]:]PULSe:PROXimal

Function: Query and set the proximal line in the pulse measurement, which is used to calculate the pulse transition duration (rise time or fall time).
The relevant command is: [:SENSe[1]:]PULSe:DISTal <numeric data>
:TRACe[1]:DEFine:TRANsition:REFerence <numeric data 1>, <numeric data 2>
The value set by this command is equivalent to <numeric data 1> above.

Query: [:SENSe[1]:]PULSe:PROXimal? [MIN|MAX]

Setting: [:SENSe[1]:]PULSe:PROXimal <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 100.
DEF is 10,
MIN is 0,
MAX is 100.

Example:

SENS:PULS:PROX?	Query the set value of pulse proximal line.

	PULS:PROX 1	Set the proximal line of the pulse to 1%.
Limit:		
Reset state:	Proximal line is set to 10%	

[:SENSe[1]:]PULSe:UNIT

Function: Query and set the unit of pulse definition.
Based on the fact that power is proportional to the square of voltage, the two units can be converted to each other, e.g.,
for a voltage with a mesial line of 50% (0.5), the conversion to a power is 25% (0.25).

Query: [:SENSe[1]:]PULSe:UNIT?

Setting: [:SENSe[1]:]PULSe:UNIT <WATTS|VOLTS|0|1>
WATTS or 0: set to power unit
VOLTS or 1: set to voltage unit

Example:	SENS:PULS:UNIT?	Query the unit of pulse definition.
	PULS:UNIT 1	Set the unit of pulse definition to "voltage".

Limit: No.

Reset state: The unit of pulse definition is set to power.

[:SENSe[1]:]SWEep:APERture

Function: Query or set the measurement aperture or measurement time interval.
The relevant command is: [:SENSe[1]:]SWEep:APERture:AUTO
After the measurement aperture is set, the auto-measurement aperture state is set to OFF.

Query: [:SENSe[1]:]SWEep:APERture? [MIN|MAX]

Setting: [:SENSe[1]:]SWEep:APERture <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 20e-6 to 1 (unit: s).
DEF is 50ms,
MIN is 20 us,
MAX is 1s.

Example:	SENS:SWE:APER?	Query the current measured aperture.
	SWE:APER 1e-3	Set the measurement aperture to 1ms

Limit:

Reset state: OFF

Error message: .

[:SENSe[1]:]SWEep:APERture:AUTO

Function: Query or set the auto-measurement aperture or measurement interval state.
If it is set to auto-measurement aperture, the measured aperture value will be automatically selected according to the measurement speed, and the corresponding relationship is as follows:
Normal measurement speed, with an aperture of 50ms;
Doubled measurement speed with an aperture of 25ms;
Fast measurement speed with an aperture of 250 us ((SENS:DET:FUNC) for "AVER");
with an aperture of 20 us ((SENS:DET:FUNC) for "NORM");

Query: [:SENSe[1]:]SWEep:APERture:AUTO

Setting: [:SENSe[1]:]SWEep:APERture:AUTO <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example:

SENS:SWE:APER:AUTO?	Query the current auto-measurement aperture state.
SWE:APER:AUTO 1	Set to auto-measurement aperture

Limit:

Reset state: 50ms

Error message: .

[:SENSe[1]:]SWEep[1]|2|3|4:AUTO

Function: Query or set the Auto Gate state of the specified gate.

Query: [:SENSe[1]:]SWEep[1]|2|3|4:AUTO?
Return 0 or 1. 0 means the Auto Gate is disabled; 1 means the Auto Gate is enabled.

Setting: [:SENSe[1]:]SWEep[1]|2|3|4:AUTO <Boolean data> |ONCE|2
Valid forms of <Boolean data> are: 0, OFF, 1, ON
OFF or 0: Disable the Auto Gate;
ON or 1: Enable the Auto Gate;
ONCE or 2: Trigger the Auto Gate once, then disable it.

Example:

SENS:SWE2:AUTO?	Query the Auto Gate state of gate 2.
SENE1:SWE1:AUTO ON	Set Auto Gate of gate 1 to ON.
SWE:AUTO ONCE	Trigger Auto Gate of gate 1 once, then disable Auto Gate.

Limit:

Reset state: Auto Gate is set to OFF

Error message: .

[:SENSe[1]:]SWEep[1]|2|3|4:AUTO:REFernce[1]|2

Function: Query or set the reference ratio of the specified gate.
REF1 and REF2 indicate the position reference ratio (relative to pulse duration) for marker 1 and marker 2, respectively.
as shown in the following figure.

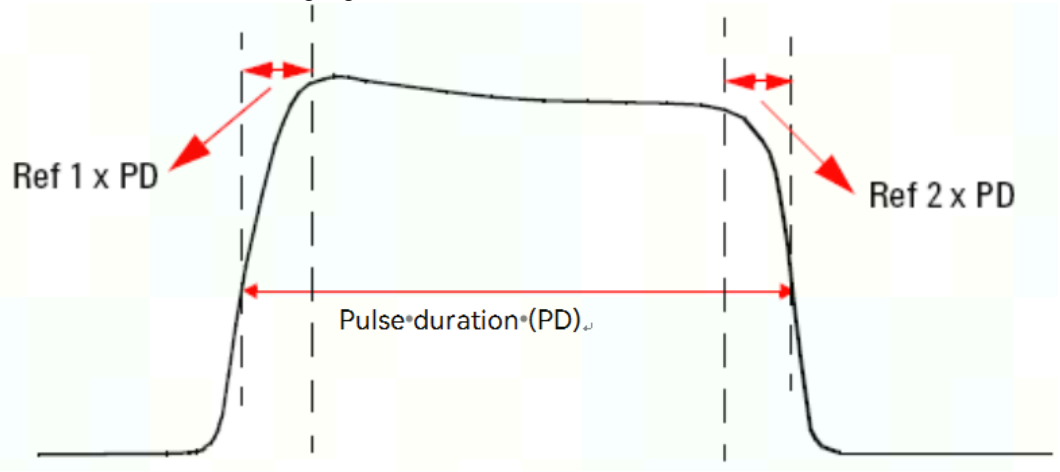


Figure 3.4 Pulse reference ratio

Query: [:SENSe[1]:]SWEep[1]|2|3|4:AUTO:REFernce[1]|2?

Setting: [:SENSe[1]:]SWEep[1]|2|3|4:AUTO:REFernce[1]|2 <NRf>
<NRf> ranges from 0 to 99.9 (unit: PCT). The combined value of REF1 and REF2 must not exceed 99.9.

Example:

SENS:SWE2:AUTO:REF2?	Query the reference ratio of the right marker of gate 2.
SWE:AUTO:REF?	Query the reference ratio of the left marker of gate 1.
SENS1:SWE1:AUTO:REF1 20	Set the reference ratio of the left marker of gate 1 to 20%.

Limit:

Reset state: Both REF1 and REF2 are set to 10 (10%).

Error message: If the sum of the left and right reference ratios set is greater than 99.9, the message "-222, "Data out of range"" will be displayed.

[:SENSe[1]:]SWEep[1]|2|3|4:OFFSet:TIME

Function: Query or set the start time of the specified gate. In this case, unless otherwise stated, time 0 indicates the time of the trigger point.

Query: [:SENSe[1]:]SWEep[1]|2|3|4:OFFSet:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]SWEep[1]|2|3|4:OFFSet:TIME <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from -1 to 1 (unit: s), and is related to the horizontal scale (time base)
DEF is 0,
The value of MIN is related to the time base,
The value of MAX is related to the time base. in s.

Example:	SENS:SWE2:OFFS:TIME?	Query the start time of gate 2.
	SENS1:SWE1:OFFS:TIME?	Query the start time of gate 1.
	SWE:OFFS:TIME? MAX	Query the maximum value of the settable start time of gate 1.
	SENS:SWE:OFFS:TIME DEF	Set the start time of gate 1 to 0 seconds.
	SENS:SWE2:OFFS:TIME 1e-6	Set the start time of gate 2 to 1 μ s.

Limit:

Reset state: Start time is set to 0 for all gates.

Error message:

Note:

[:SENSe[1]:]SWEep[1]|2|3|4:TIME

Function: Query or set the time length of the specified gate.

Query: [:SENSe[1]:]SWEep[1]|2|3|4:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]SWEep[1]|2|3|4:TIME <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 1 (unit: s), and is related to the horizontal scale (time base),
DEF is 0,
MIN is 0,
MAX is 1.

Example:	SENS:SWE2:TIME?	Query the time length of gate 2.
	SENS1:SWE1:TIME?	Query the time length of gate 1.
	SWE:TIME? MAX	Query the maximum value of the settable duration of gate 1.
	SENS:SWE:TIME DEF	Set the duration of gate 1 to 100 μ s.
	SENS:SWE2:TIME 1e-6	Set the duration of gate 2 to 1 μ s.

Limit:

Reset state: The duration of gate 1 is set to 100μs and the others are 0.

Error message:

Note:

[:SENSe[1]:]TRACe:AUToscale

Function: Automatic setting.

Automatically adjust the vertical scale, vertical offset, trigger level, time base and other measurement parameters of channel 1 and channel 2, and find the trigger event at the currently set trigger source. In the case of a valid trigger, the automatic setting is able to display the entire amplitude of the pulse and at least one full period, ensuring the valid calculation of the automatic measurement parameters.

Query: Not supported

Setting: [:SENSe[1]:]TRACe:AUToscale

Example:

TRAC:AUT	Set channel A automatically.
SENS:TRAC:AUT	Automatic setting.

Limit:

Error message: If the given channel is not triggered continuously, it prompts "-221, "Settings conflict"".

Reset state: The vertical scale is set to 10 dB/div.; the horizontal scale (time base) is set to 10 us/div. and the trigger level is set to -5dBm.

[:SENSe[1]:]TRACe:OFFSet:TIME

Function: Query or set the horizontal start time of the trace.

Query: [:SENSe:]TRACe:OFFSet:TIME? [MIN|MAX]

Setting: [:SENSe:]TRACe:OFFSet:TIME <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from -1 to 1 (unit: s).

DEF is 0,

MIN is -1,

MAX is 1.

Example:

SENS:TRAC:OFFS:TIME?	Query the horizontal start time of the trace.
TRAC:OFFS:TIME? MAX	Query the horizontal start time of the maximum settable trace.
SENS1:TRAC:OFFS:TIME 1e-06	Set the horizontal start time of the trace to 1 μs.

Limit:

Note:

Error message: If the current trigger source is EXT, it prompts "-221, "Setting Conflict"";

If the current measurement mode is "AVER", it prompts "-221, "Setting Conflict"";

If the current trace measurement ON/OFF state is OFF, it prompts "-221, "Setting Conflict"";

Reset state: Horizontal start time is set to 0.

[:SENSe[1]:]TRACe:TIME

Function: Query or set the time length of the trace.

Query: [:SENSe[1]:]TRACe:TIME? [MIN|MAX]

Setting: [:SENSe[1]:]TRACe:TIME <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 100 ns to 1 (unit: s).
DEF is 100μs,
MIN is 20 ns,
MAX is 1s.

Example:

SENS:TRAC:TIME?	Query the duration of the trace.
TRAC:TIME? MAX	Query the duration of the maximum settable trace.
SENS1:TRAC:TIME 1e-06	Set the duration of the trace to 1 μs.

Limit:
Note:
Error message: .
Reset state: The duration is set to 100 μs.

[:SENSe[1]:]TRACe:UNIT

Function: Query or set the trace unit.
Query: [:SENSe[1]:]TRACe:UNIT?
Setting: [:SENSe[1]:]TRACe:UNIT < dBm|W|0|1>

Example:

SENS:TRAC:UNIT?	Query the trace unit.
TRAC:UNIT W	Set the trace unit to W.

Limit:
Reset state: The trace unit is set to dBm.

[:SENSe[1]:]TRACe:X:SCALe:PDIV

Function: Query or set the horizontal scale (i.e. time base).
Query: [:SENSe[1]:]TRACe:X:SCALe:PDIV? [MIN|MAX]
Setting: [:SENSe[1]:]TRACe:X:SCALe:PDIV <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1e-8 to 0.1 (unit: s).
DEF is 10 us,
MIN is 10 ns,
MAX is 100ms.
For 2438, the horizontal scale is in 1-2-5 steps; for 87236, the horizontal scale can specify any value within the valid range.

Example:

SENS:TRAC:X:SCAL:PDIV?	Query the horizontal scale.
TRAC:X:SCAL:PDIV 1e-8	Set the horizontal scale of channel A to 10 ns.

Limit:

Note:

Error message: If the waveform is not currently displayed, it prompts "-221, "Settings conflict"".

Reset state: The horizontal scale is set to 10 us.

3.3.9 State subsystem command

The state subsystem command detects the state of the 87236 by monitoring the device state register, the operation state register, and the question register.

- :STATus:DEVice:CONDition?....135
- :STATus:DEVice:ENABle....135
- :STATus:DEVice[:EVENt]?....135
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- :STATus:OPERation:TRIGger[:SUMMary]:ENABle....142
- :STATus:OPERation:TRIGger[:SUMMary][:EVENt]?....142
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- :STATus:OPERation:ULFail[:SUMMary]:CONDition?....143
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- :STATus:OPERation:ULFail[:SUMMary][:EVENt]?.....144
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Table 3.10 Commands or events affecting the state register

State register	*RST	*CLS	Start up	STATus:PRESet
SCPI transition filter (NTR	No effect	No	Preset	Preset
SCPI enable register	No effect	No	Preset	Preset
SCPI event register	No effect	Clear	Clear	No effect
SCPI error/event queue	No effect	No	Preset	Preset
SCPI error/event queue	No effect	Clear	Clear	No effect
IEEE488.2 register ESE SRE	No effect	No	Clear	No effect
IEEE488.2 register SESR STB	No effect	Clear	Clear	No effect

Preset state description: The preset value of PTR is 0x7fff (32767); both NTR and enable registers are cleared.

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- Transition filter.....121
- Device state register description.....121
- Operation state register description.....122
- Calibration operation state register description.....124
- Lower limit detection operation state register description.....125
- Sensing operation state register description.....126
- Trigger operation state register description.....128
- Upper limit detection operation state register description.....129

- Question state register description.....130
- Calibration question state register description.....132
- Power question state register description.....133

3.3.9.1 Command sets

The content of the state register can be queried or set with the following command set:

:CONDition?

Query the value of the condition register of the state register. The return format is < NR1 > . The range is from 0 to 32767. After the query, the value of the condition register remains unchanged.

:ENABle <NRf>|<non-decimal number>

Query or set the event enable register of the state register, and the highest bit (bit15) is always 0.

[:EVENt?]

Query the event register of the state register, and clear the register after the query.

:NTRansition <NRf>|<non-decimal number>

Query or set the negative transition filter of the state register, and the highest bit is always 0.

:PTRansition <NRf>|<non-decimal number>.

Query or set the positive transition filter of the state register, and the highest bit is always 0.

The state registers supported in this case include:

STATus:DEVice
STATus:OPERation
STATus:OPERation:CALibrating[:SUMMary]
STATus:OPERation:LLFail[:SUMMary]
STATus:OPERation:SENSe[:SUMMary]
STATus:OPERation:TRIGger[:SUMMary]
STATus:OPERation:ULFail[:SUMMary]
STATus:QUEStionable
STATus:QUEStionable
STATus:QUEStionable:CALibration[:SUMMary]
STATus:QUEStionable:POWer[:SUMMary]

For example:

:CONDition?can be used to query the calibration operation registerSTATus:OPERation:CALibrating[:SUMMary]

STATus:OPERation:CALibrating[:SUMMary]:CONDition?

The :ENABle can be used to query or set the calibration operation register STATus:OPERation:CALibrating[:SUMMary]

STATus:OPERation:CALibrating[:SUMMary]:ENABle

3.3.9.2 Transition Filter

Refer to Section 9.2 of SCPI-99 for a description of the transition filter. A brief description is given below.

1) Positive transition (PTR): When the condition is set to TRUE by the FALSE event.
2) Negative transition (NTR): When the condition goes from TRUE to FALSE, the event is set to TRUE.
3) Positive transition or negative transition: The event is set to TRUE when the condition goes from FALSE to TRUE or TRUE to FALSE.
4) Clearing the positive transition and negative transition registers will disable event reporting.

3.3.9.3 Device state register description (STATus:DEVice)

Table 3.11 Device state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A detection state
2	4	Channel B detection state (for dual-channel only)
3	8	Channel A error state
4	16	Channel B error state (for dual-channel only)
5	32	USB channel detection state (reserved)
6	64	USB channel error state (reserved)
7-14	-	Unused
15	-	Always 0

1) Bits 1 and 2 indicate the detection state of channel A and channel B, respectively.
   a) Return value of STATus:DEVice:CONDition?: 1 indicates that it is detected, and 0 indicates that it is not detected.
   b) Return value of STATus:DEVice[:EVENt]?: 1 indicates that a connection or removal event has occurred. 0 means not occurred. After the query, the event register will be cleared.
   c) When STATus:DEVice:NTRansition is set to 1, STATus:DEVice[:EVENt] will be set to 1 if shiftis detected.
   d) When STATus:DEVice:PTRansition is set to 1, STATus:DEVice[:EVENt] will be set to 1 if access is detected.
2) Bits 3 and 4 indicate errors for channel A and channel B of the 87236, respectively. 1 means error, and 0 means no error found.

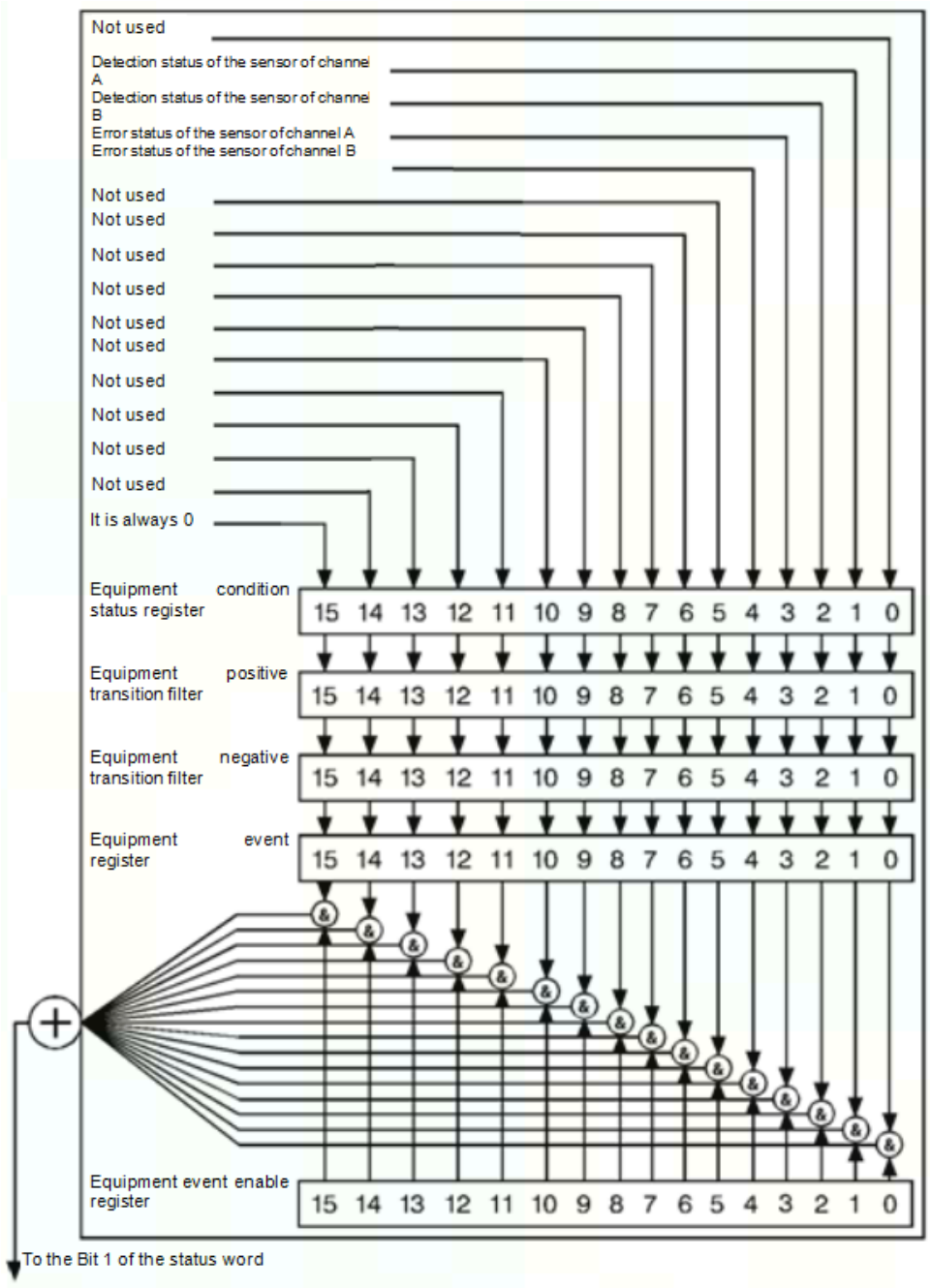


Figure 3.5 Device state register

3.3.9.4 Operating state register description (STATus:OPERation)

Table 3.12 Operation state register description

Bit	Value	Definition
0	1	Calibration summary
1-4	-	Unused
5	32	Trigger waiting summary

6-9	-	Unused
10	1024	Sensing summary
11	2048	Lower-limit detection failure summary (LLF)
12	4096	Upper-limit detection failure summary (ULF)
13-14	-	Unused
15	-	Always 0

Six groups of operation registers are included:

- STATus:OPERation
- STATus:OPERation:CALibrating[:SUMMary]
- STATus:OPERation:LLFail[:SUMMary]
- STATus:OPERation:SENSe[:SUMMary]
- STATus:OPERation:TRIGger[:SUMMary]
- STATus:OPERation:ULFail[:SUMMary]

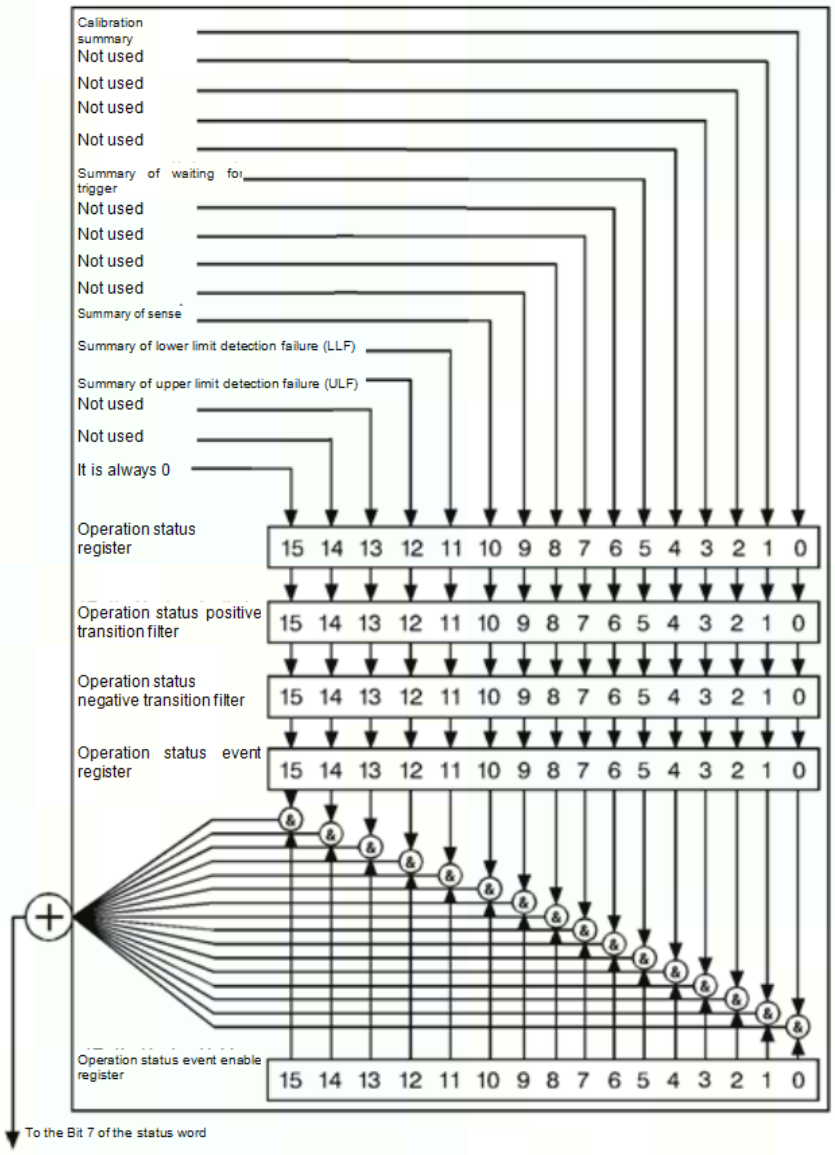


Figure 3.6 Operation state register description

3.3.9.5 Calibration operating state register description (STATus:OPERation:CALibrating[:SUMMary])

Table 3.13 Calibration operation state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A calibration state.
2	4	Channel B calibration state. (for dual-channel only)
3-14	-	Unused
15	-	Always 0

Bit 1 and bit 2 indicate the calibration state of channel A and channel B respectively. 1 indicates that it is being zeroed or calibrated, and 0 indicates that the calibration is completed or not zeroed or calibrated.

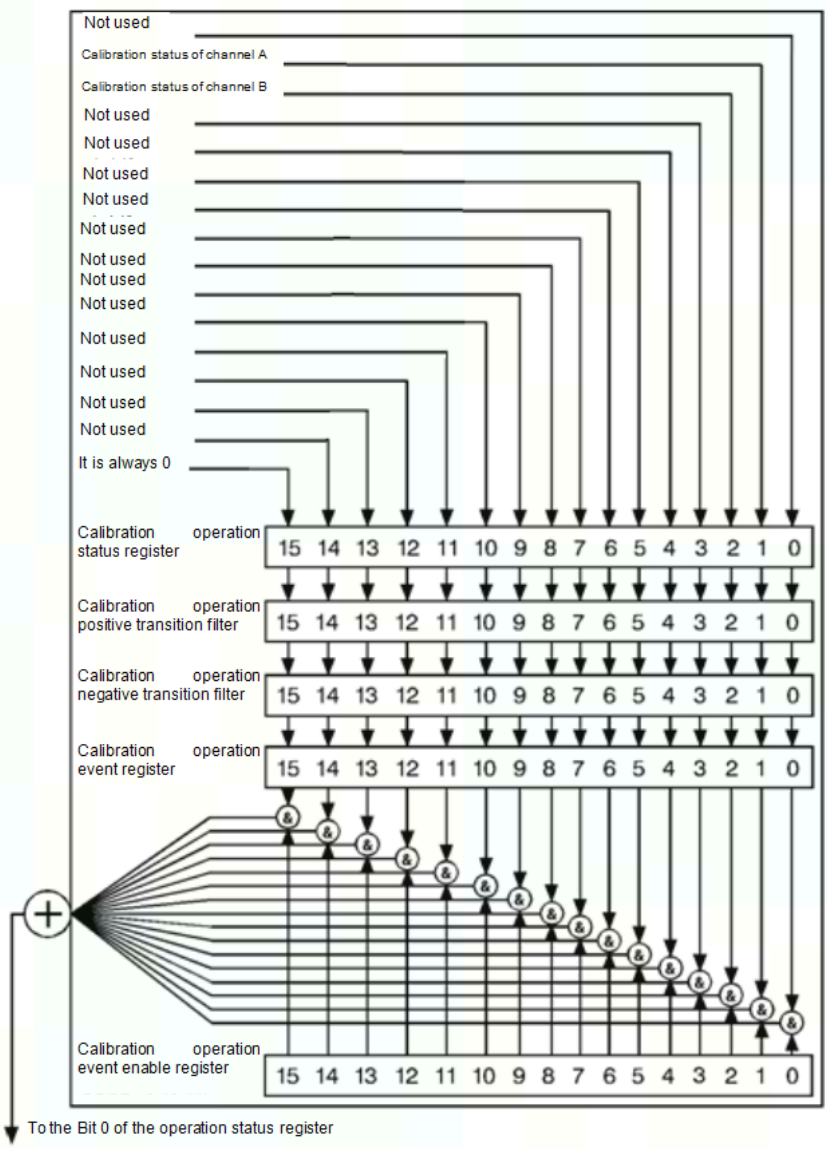


Figure 3.7 Calibration operation state register

3.3.9.6 Lower limit operating state register description (STATus:OPERation:CALibrating[:SUMMary])

Table 3.14 Lower limit detection operation state register description

Bit	Value	Definition
0-2	-	Unused
3	8	Lower limit detection state of measurement 1

Bit	Value	Definition
4	16	Lower limit detection state of measurement 2
5	32	Lower limit detection state of measurement 3
6	64	Lower limit detection state of measurement 4
7-14	-	Unused
15	-	Always 0

Bit 3 to bit 6 indicates the lower limit failure detection state of the corresponding measurement. 1 indicates that the lower limit is exceeded

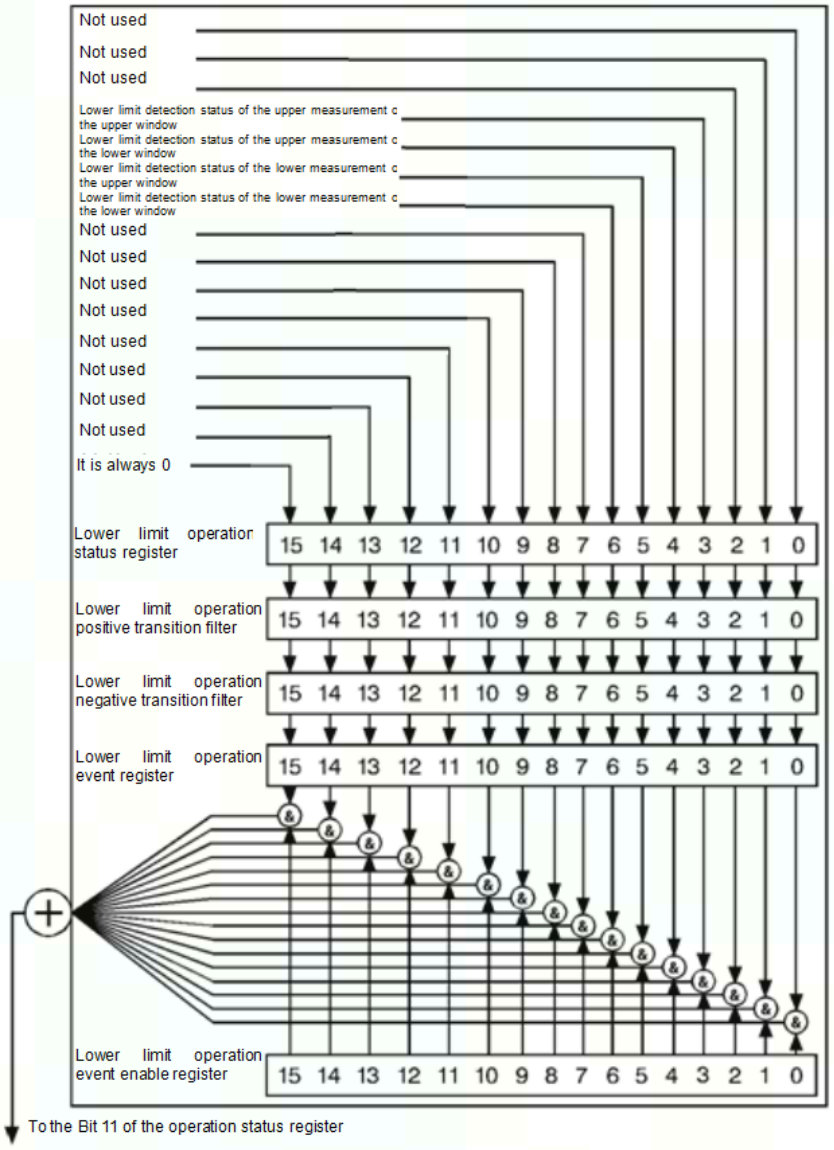


Table 3.8 Lower limit detection operation state register

3.3.9.7 Sensor operating state register description (STATus:OPERation: SENSe[:SUMMary])

Table 3.15 Sensing operation state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A reads EEPROM state
2	4	Channel B reads EEPROM state (for dual-channel only)
3-14	-	Unused
15	-	Always 0

Bits 1 and 2 indicate that channel A and channel B read EEPROM state, respectively, and 1 indicates that the 87236 is being read.

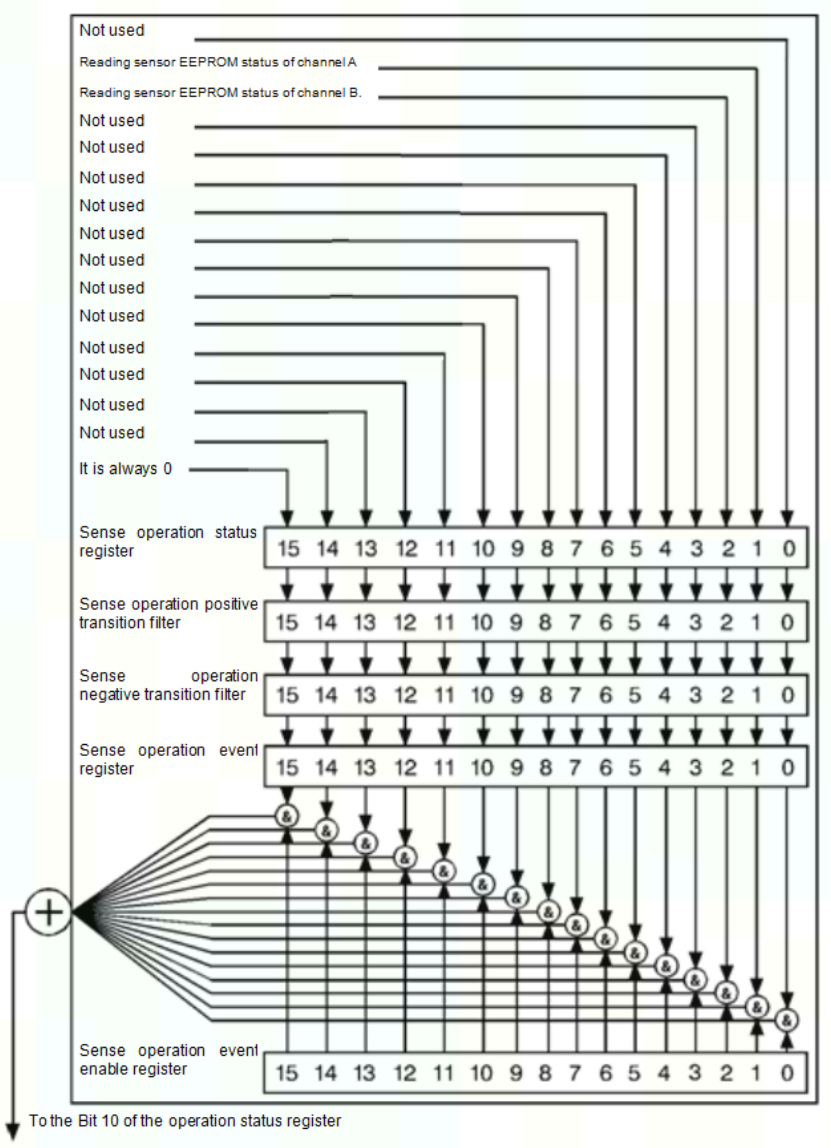


Figure 3.9 Sensing operation state register

3.3.9.8 Trigger operating state register description (STATus:OPERation TRIGger[:SUMMary])

Table 3.16 Trigger operation state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A trigger state
2	4	Channel B trigger state (for dual-channel only)
3-14	-	Unused
15	-	Always 0

Bit 1 and bit 2 indicate the trigger waiting state of channel A and channel B respectively, and 1 indicates that it is waiting for trigger.

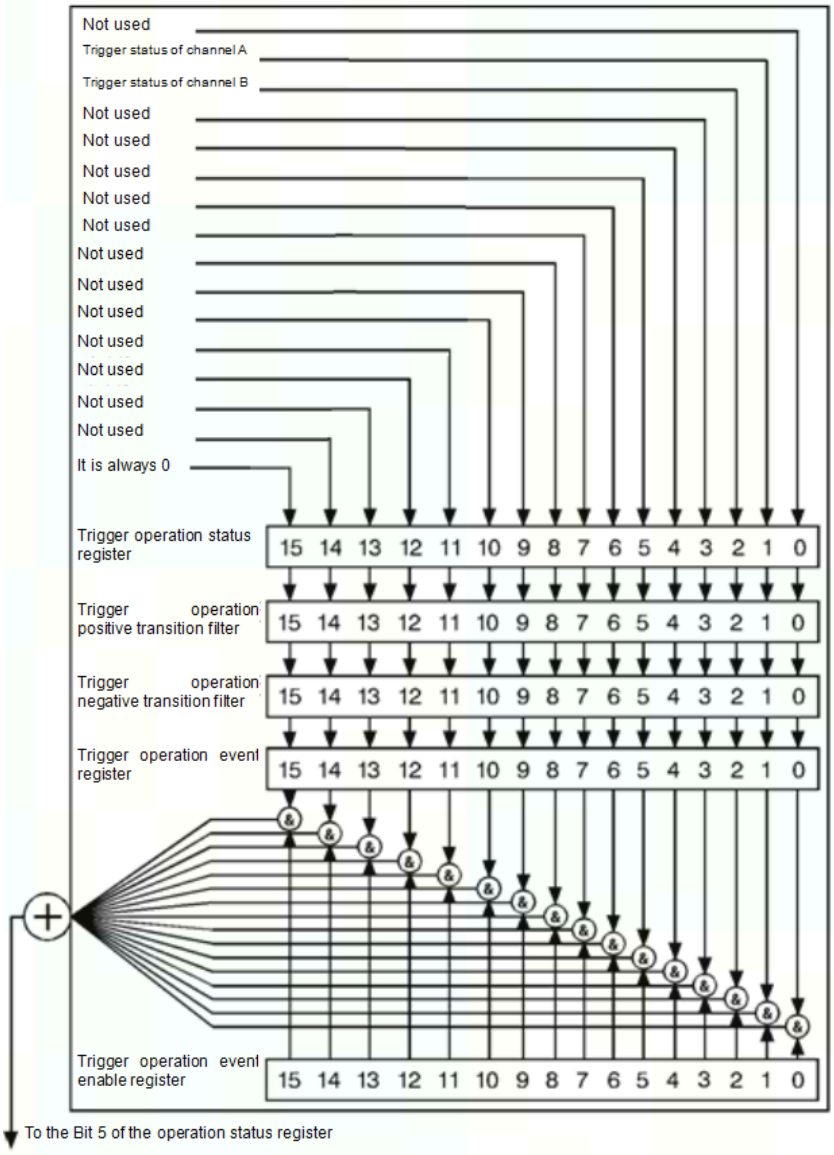


Figure 3.10 Trigger operation state register

3.3.9.9 Upper limit operating state register description (STATus:OPERation:CALibrating[:SUMMary])

Table 3.17 Upper limit detection operation state register description

Bit	Value	Definition
0-2	-	Unused
3	8	Upper limit detection state of measurement 1
4	16	Upper limit detection state of

		measurement 2
5	32	Upper limit detection state of measurement 3
6	64	Upper limit detection state of measurement 4
7-14	-	Unused
15	-	Always 0

Bit 3 to bit 6 indicates the upper limit failure detection state of the corresponding measurement. 1 indicates that the upper limit is exceeded

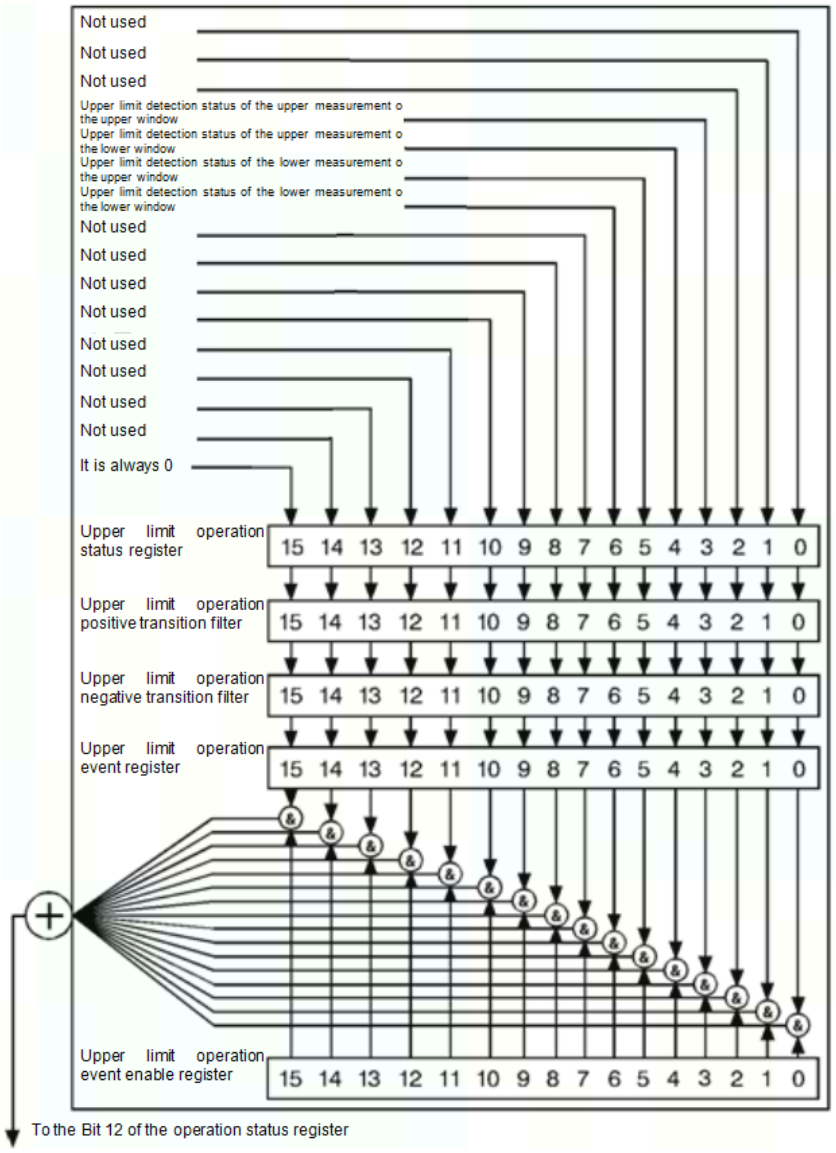


Table 3.11 Upper limit detection operation state register

3.3.12.10 Question state register description (STATus: QUEStionable)

Table 3.18 Question state register description

Bit	Value	Definition
0-2	-	Unused
3	8	Power summary
4-7	-	Unused
8	256	Calibration summary
9	512	Power-on self-test
10-14	-	Unused
15	-	Always 0

Three groups of operation registers are included:

- STATus:QUEStionable
- STATus:QUEStionable:Power[:SUMMary]
- STATus:QUEStionable:CALibration[:SUMMary]

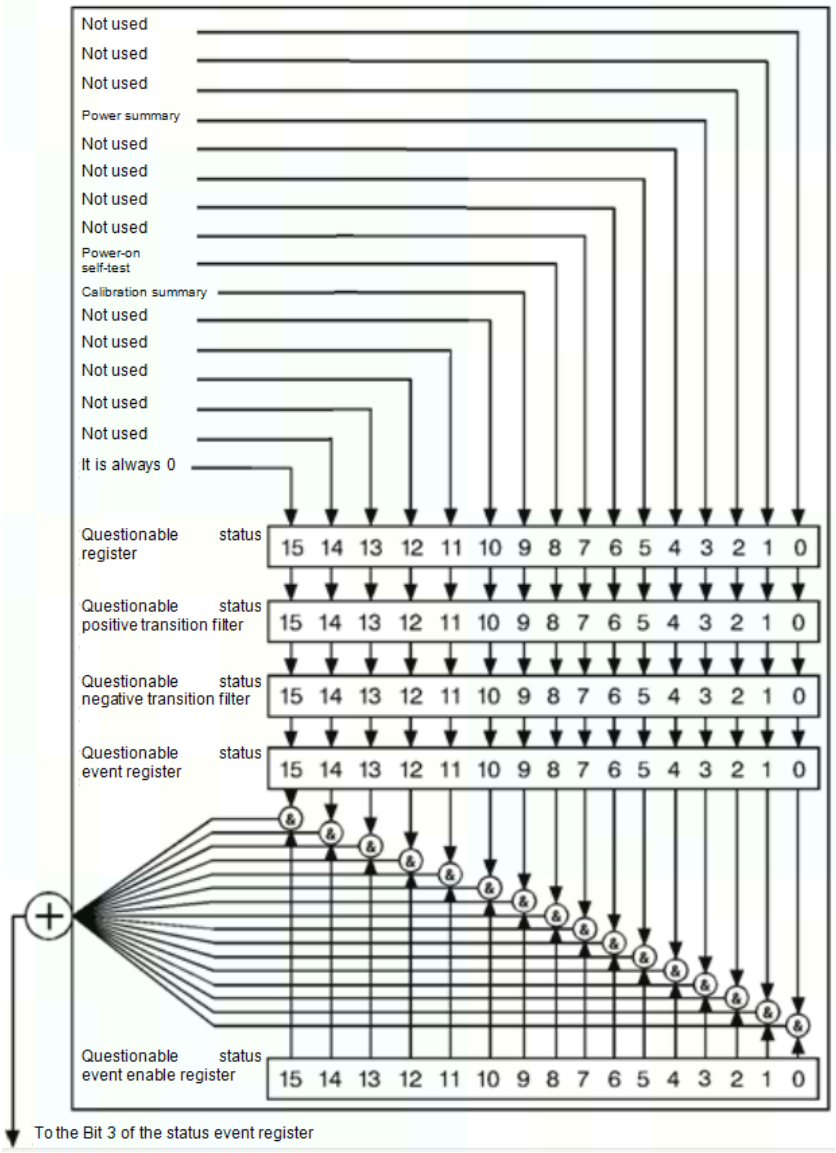


Figure 3.12 Question state register

3.3.9.11 Calibration question operating state register description (STATus QUEStionable:CALibrating[:SUMMary])

Table 3.19 Question state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A zeroing and calibration error
2	4	Channel B zeroing and calibration error (for dual-channel only)
3-14	-	Unused
15	-	Always 0

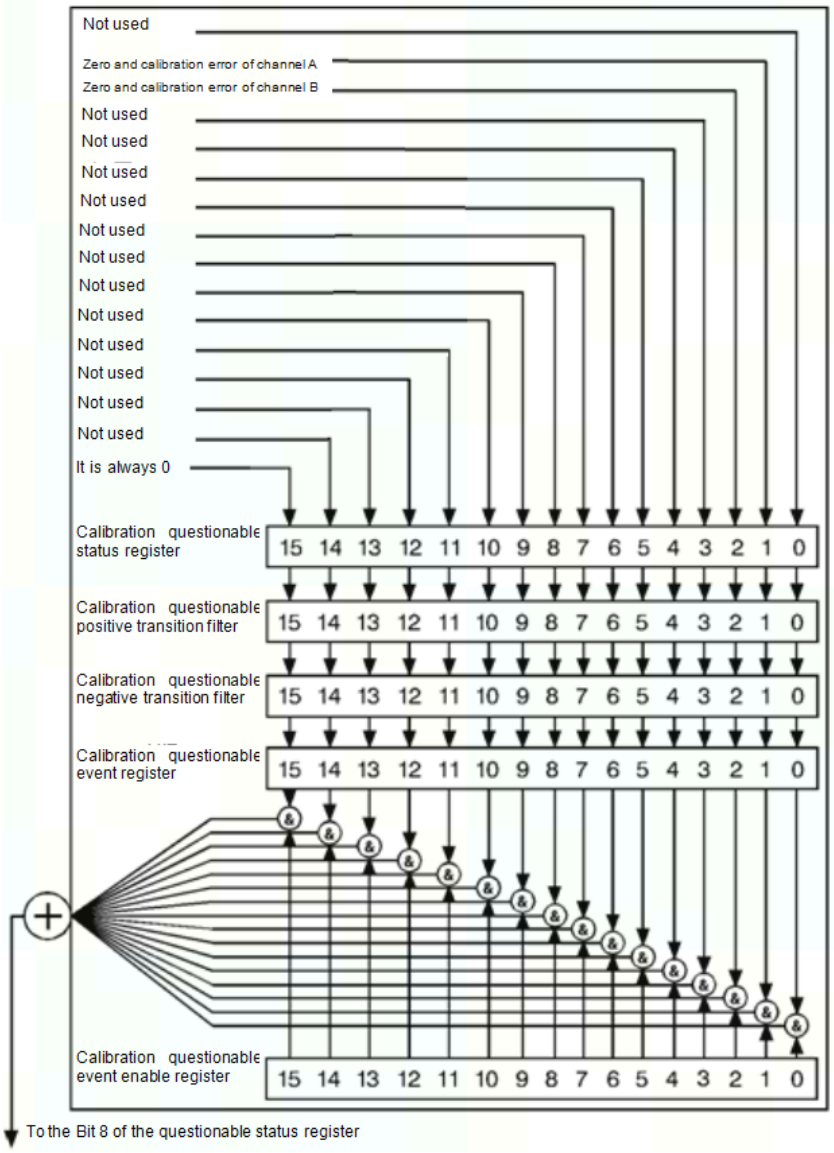


Figure 3.13 Calibration question state register

3.3.9.12 Power question state register description (STATus:QUEStionable:POWer[:SUMMary])

Table 3.20 Power question state register description

Bit	Value	Definition
0	1	Unused
1	2	Channel A input is overloaded
2	4	Channel B input overload (for dual-channel only)
3	8	Channel A needs to be zeroed
4	16	Channel B needs to be zeroed (for dual-channel only)

5	32	Measurement 1 data is invalid, or logarithmically incorrect
6	64	Measurement 2 data is invalid, or logarithmically incorrect
7	128	Measurement 3 data is invalid, or logarithmically incorrect
8	256	Measurement 4 data is invalid, or logarithmically incorrect
9-14	-	Unused
15	-	Always 0

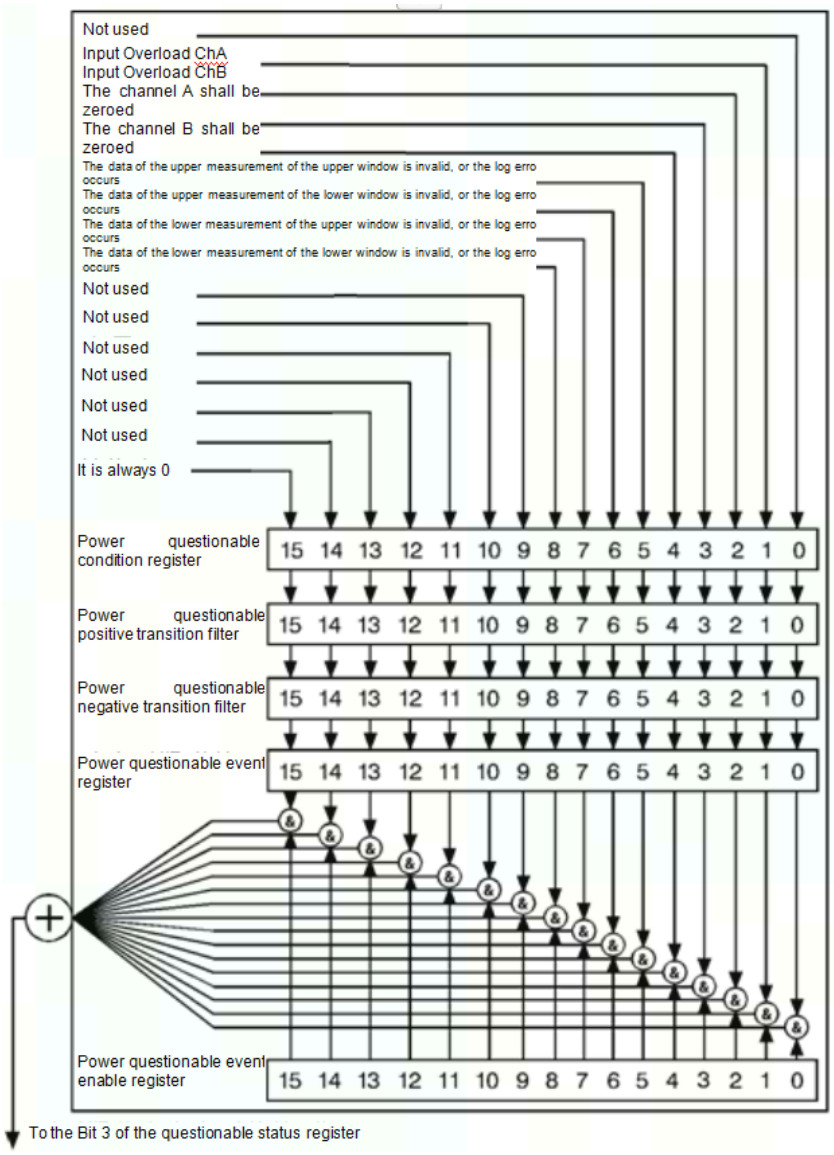


Figure 3.14 Power question state register

:STATus:DEVice:CONDition?

Function: Query the value in the device state condition register.
Query: :STATus:DEVice:CONDition?
Setting: Not supported
Example: STAT:DEV:COND?

:STATus:DEVice:ENABle

Function: Query or set the device state event enable register. Operate by bit. 0 means that reporting state events to bit 1 of the higher level state word is disabled. 1 indicates enable.
Query: :STATus:DEVice:ENABle?
Setting: :STATus:DEVice:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example:

STAT:DEV:ENAB?	Query the device state event enable register.
STAT:DEV:ENAB 6	Enable bit 1 and bit 2, which allows reporting of the 87236 detection events to the state word.
STAT:DEV:ENAB #B0110	The meaning is the same as above, using binary numbers.
STAT:DEV:ENAB #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:DEVice[:EVENt]?

Function: Query the device event register. After the query, 87236 automatically clears the register.
Query: :STATus:DEVice[:EVENt]?
Setting: Not supported
Example: STAT:DEV?

:STATus:DEVice:NTRansition

Function: Query or set the negative transition filter of the device.
Query: :STATus:DEVice:NTRansition?
Setting: :STATus:DEVice:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:DEV:NTR?

STAT:DEV:NTR #H06	Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:DEV:NTR #B0110	The meaning is the same as above, using binary numbers.
STAT:DEV:NTR 6	The meaning is the same as above, using decimal numbers.

:STATus:DEVice:PTRansition

Function: Query or set the positive transition filter of the device.
Query: :STATus:DEVice:PTRansition?
Setting: :STATus:DEVice:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:DEV:PTR?

STAT:DEV:PTR #H06	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:DEV:PTR #B0110	The meaning is the same as above, using binary numbers.
STAT:DEV:PTR 6	The meaning is the same as above, using decimal numbers.

:STATus:OPERation:CALibrating[:SUMMary]:CONDition?

Function: Query the value in the calibration operating state condition register.
Among the returned values, if bit 1 is non-zero, channel A is being zeroed or calibrated; if bit 2 is non-zero, channel B is being zeroed or calibrated. For example, returning 2 indicates that channel A is being zeroed or calibrated.
Query: :STATus:OPERation:CALibrating[:SUMMary]:CONDition?
Setting: Not supported
Example: STAT:OPER:CAL:COND?

:STATus:OPERation:CALibrating[:SUMMary]:ENABle

Function: Query or set the calibration operation event enable register. Operate by bit. 0 means that reporting of state events to bit 0 of the operating state is disabled. 1 indicates enable.
Query: :STATus:OPERation:CALibrating[:SUMMary]:ENABle?
Setting: :STATus:OPERation:CALibrating[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:CAL:ENAB?

STAT:OPER:CAL:ENAB 6	Enable bit 1 and bit 2, which allows reporting of calibration operation events to the operating state.
STAT:OPER:CAL:ENAB #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:CAL:ENAB #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:CALibrating[:SUMMary][:EVENt]?

Function: Query the calibration operation event register. After the query, 87236 automatically clears the register.

Query: :STATus:OPERation:CALibrating[:SUMMary][:EVENt]?
Setting: Not supported
Example: STAT:OPER:CAL?

:STATus:OPERation:CALibrating[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for calibration operation.
Query: :STATus:OPERation:CALibrating[:SUMMary]:NTRansition?
Setting: :STATus:OPERation:CALibrating[:SUMMary]:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:CAL:NTR?

STAT:OPER:CAL:NTR 6	Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:CAL:NTR #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:CAL:NTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:CALibrating[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for calibration operation.
Query: :STATus:OPERation:CALibrating[:SUMMary]:PTRansition?
Setting: :STATus:OPERation:CALibrating[:SUMMary]:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:CAL:PTR?

STAT:OPER:CAL:PTR 6	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:CAL:PTR #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:CAL:PTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:CONDition?

Function: Query the value in the operating state condition register.
Among the returned values, if bit 0 is non-zero, a calibration event is detected; if bit 5 is non-zero, a wait-for-trigger event is detected; if bit 10 is non-zero, an access to or removal event from 87236 is detected; if bit 11 is non-zero, a lower limit detection event is detected; if bit 12 is non-zero, an upper limit detection event is detected.
For example, if a calibration event is detected by this set of registers, the corresponding bits of the calibration operation enable registers (STAT:OPER:CAL:ENAB) need to be set to non-zero. Others are the same.
Query: :STATus:OPERation:CONDition?

Setting: Not supported
Example: STAT:OPER:COND?

:STATus:OPERation:ENABle

Function: Query or set the operating state event enable register. Operate by bit. 0 means that reporting state events to bit 7 of the state word is disabled. 1 indicates enable.
Query: :STATus:OPERation:ENABle?
Setting: :STATus:OPERation:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:ENAB?

STAT:OPER:ENAB 1	Enable bit 1, which allows reporting of operation events into the state word.
STAT:OPER:ENAB #B0001	The meaning is the same as above, using binary numbers.
STAT:OPER:ENAB #H01	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation[:EVENt]?

Function: Query the operating state event register. After the query, 87236 automatically clears the register.
Query: :STATus:OPERation[:EVENt]?
Setting: Not supported
Example: STAT:OPER?

:STATus:OPERation:NTRansition

Function: Query or set the negative transition filter for operating state.
Query: :STATus:OPERation:NTRansition?
Setting: :STATus:OPERation:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:NTR?

STAT:OPER:NTR 1	Negative transition filters the state of bit 0 into the event register.
STAT:OPER:NTR #B0001	The meaning is the same as above, using binary numbers.
STAT:OPER:NTR #H01	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:PTRansition

Function: Query or set the positive transition filter for operating state.
Query: :STATus:OPERation:NTRansition?
Setting: :STATus:OPERation:NTRansition <NRf>|<non-decimal number>

The parameter range is from 0 to 32767.

Example: STAT:OPER:NTR?

STAT:OPER:NTR #H06	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:NTR #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:NTR 6	The meaning is the same as above, using decimal numbers.

:STATus:OPERation:LLFail[:SUMMary]:CONDition?

Function: Query the value in the lower limit detection operating state condition register. Among the return values, if bit 3 is non-zero, it indicates the lower limit detection operation failure state of measurement 1; if bit 4 is non-zero, it indicates the lower limit detection operation failure state of measurement 2; if bit 5 is non-zero, it indicates the lower limit detection operation failure state of measurement 3; if bit 6 is non-zero, it indicates the lower limit detection operation failure state of measurement 4.

Query: :STATus:OPERation:LLFail[:SUMMary]:CONDition?

Setting: Not supported

Example: STAT:OPER:LLF:COND?

:STATus:OPERation:LLFail[:SUMMary]:ENABle

Function: Query or set the event enable register for lower limit detection operation. Operate by bit. 0 means that reporting of state events to bit 11 of the operating state is disabled. 1 indicates enable.

Query: :STATus:OPERation:LLFail[:SUMMary]:ENABle?

Setting: :STATus:OPERation:LLFail[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:LLF:ENAB?

STAT:OPER:LLF:ENAB 8	Enable bit 3, which allows reporting of lower limit operation events to the operating state.
STAT:OPER:LLF:ENAB #B1000	The meaning is the same as above, using binary numbers.
STAT:OPER:LLF:ENAB #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:LLFail[:SUMMary][:EVENt]?

Function: Query the event register for lower limit detection operation. After the query, 87236 automatically clears the register.

Query: :STATus:OPERation:LLFail[:SUMMary][:EVENt]?

Setting: Not supported

Example: STAT:OPER:LLF?

:STATus:OPERation:LLFail[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for lower limit detection operation.
Query: :STATus:OPERation:LLFail[:SUMMary]:NTRansition?
Setting: :STATus:OPERation:LLFail[:SUMMary]:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:LLF:NTR?

STAT:OPER:LLF:NTR 8	Negative transition filters the state of bit 3 into the event register.
STAT:OPER:LLF:NTR #B1000	The meaning is the same as above, using binary numbers.
STAT:OPER:LLF:NTR #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:LLFail[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for lower limit detection operation.
Query: :STATus:OPERation:LLFail[:SUMMary]:PTRansition?
Setting: :STATus:OPERation:LLFail[:SUMMary]:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:LLF:PTR?

STAT:OPER:LLF:PTR 8	Positive transition filters the state of bit 3 into the event register.
STAT:OPER:LLF:PTR #B1000	The meaning is the same as above, using binary numbers.
STAT:OPER:LLF:PTR #H08	The meaning is the same as above, using decimal numbers.

:STATus:OPERation:SENSe[:SUMMary]:CONDition?

Function: Query the value in the sensor operating state condition register.
Among the returned values, if bit 1 is non-zero, channel A reads EEPROM state; If bit 2 is non-zero, channel B reads EEPROM state.
Query: :STATus:OPERation:SENSe[:SUMMary]:CONDition?
Setting: Not supported
Example: STAT:OPER:SENS:COND?

:STATus:OPERation:SENSe[:SUMMary]:ENABle

Function: Query or set the sensor operation event enable register. Operate by bit. 0 indicates that the sensor operating state event is disabled into bit 10 of the operating state. 1 indicates enable.
Query: :STATus:OPERation:SENSe[:SUMMary]:ENABle?
Setting: :STATus:OPERation:SENSe[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:SENS:ENAB?

STAT:OPER:SENS:ENAB 6	Enable bit 1 and bit 2, which allows reporting of sensing operation events to the operating state.
STAT:OPER:SENS:ENAB #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:SENS:ENAB #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:SENSe[:SUMMary][:EVENt]?

Function: Query the sensing operation event register. After the query, 87236 automatically clears the register.
Query: :STATus:OPERation:SENSe[:SUMMary][:EVENt]?
Setting: Not supported
Example: STAT:OPER:SENS?

:STATus:OPERation:SENSe[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for sensing operation.
Query: :STATus:OPERation:SENSe[:SUMMary]:NTRansition?
Setting: :STATus:OPERation:SENSe[:SUMMary]:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:SENS:NTR?

STAT:OPER:SENS:NTR 6	Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:SENS:NTR #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:SENS:NTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:SENSe[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for sensing operation.
Query: :STATus:OPERation:SENSe[:SUMMary]:PTRansition?
Setting: :STATus:OPERation:SENSe[:SUMMary]:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:SENS:PTR?

STAT:OPER:SENS:PTR 6	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:SENS:PTR #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:SENS:PTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:TRIGger[:SUMMary]:CONDition?

Function: Query the value in the trigger operating state condition register.
Among the returned values, if bit 1 is non-zero, channel A is waiting for trigger; If bit 2 is non-zero, channel B is waiting for trigger. For example, returning 2 indicates that channel A is waiting for trigger.

Query: :STATus:OPERation:CALibrating[:SUMMary]:CONDition?

Setting: Not supported

Example: STAT:OPER:CAL:COND?

:STATus:OPERation:TRIGger[:SUMMary]:ENABle

Function: Query or set the trigger operation event enable register. Operate by bit. 0 means that reporting of state events to bit 5 of the operating state is disabled. 1 indicates enable.

Query: :STATus:OPERation:TRIGger[:SUMMary]:ENABle?

Setting: :STATus:OPERation:TRIGger[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:TRIG:ENAB?

STAT:OPER:TRIG:ENAB 6	Enable bit 1 and bit 2, which allows reporting of trigger operation events to the operating state.
STAT:OPER:TRIG:ENAB #B0110	The meaning is the same as above, using binary numbers.
STAT:OPER:TRIG:ENAB #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:TRIGger[:SUMMary][:EVENt]?

Function: Query the trigger operation event register. After the query, 87236 automatically clears the register.

Query: :STATus:OPERation:TRIGger[:SUMMary][:EVENt]?

Setting: Not supported

Example: STAT:OPER:TRIG?

:STATus:OPERation:TRIGger[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for trigger operation.

Query: :STATus:OPERation:TRIGger[:SUMMary]:NTRansition?

Setting: :STATus:OPERation:TRIGger[:SUMMary]:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:TRIG:NTR?

STAT:OPER:TRIG:NTR 6	Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:TRIG:NTR #B0110	The meaning is the same as above, using

binary numbers.

STAT:OPER:TRIG:NTR #H06 — The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:TRIGger[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for trigger operation.

Query: :STATus:OPERation:TRIGger[:SUMMary]:PTRansition?

Setting: :STATus:OPERation:TRIGger[:SUMMary]:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:TRIG:PTR?

STAT:OPER:TRIG:PTR 6 — Positive transition filters the state of bit 1 and bit 2 into the event register.

STAT:OPER:TRIG:PTR #B0110 — The meaning is the same as above, using binary numbers.

STAT:OPER:TRIG:PTR #H06 — The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:ULFail[:SUMMary]:CONDition?

Function: Query the value in the upper limit detection operating state condition register. Among the returned values, if bit 3 is non-zero, it indicates the upper limit detection operation failure state of measurement 1; if bit 4 is non-zero, it indicates the upper limit detection operation failure state of measurement 2; if bit 5 is non-zero, it indicates the upper limit detection operation failure state of measurement 3; if bit 6 is non-zero, it indicates the upper limit detection operation failure state of measurement 4.

Query: :STATus:OPERation:ULFail[:SUMMary]:CONDition?

Setting: Not supported

Example: STAT:OPER:ULF:COND?

:STATus:OPERation:ULFail[:SUMMary]:ENABle

Function: Query or set the event enable register for upper limit detection operation. Operate by bit. 0 means that reporting of state events to bit 12 of the operating state is disabled. 1 indicates enable.

Query: :STATus:OPERation:ULFail[:SUMMary]:ENABle?

Setting: :STATus:OPERation:ULFail[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:OPER:ULF:ENAB? — Query the value of the upper limit detection operation event enable register.

STAT:OPER:ULF:ENAB 8 — Enable bit 3, which allows reporting of upper limit operation events to the operating state.

STAT:OPER:ULF:ENAB #B1000 — The meaning is the same as above, using binary numbers.

STAT:OPER:ULF:ENAB #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:ULFail[:SUMMary][:EVENt]?

Function: Query the event register for upper limit detection operation. After the query, 87236 automatically clears the register.
Query: :STATus:OPERation:ULFail[:SUMMary][:EVENt]?
Setting: Not supported
Example: STAT:OPER:ULF?

:STATus:OPERation:ULFail[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for upper limit detection operation.
Query: :STATus:OPERation:ULFail[:SUMMary]:NTRansition?
Setting: :STATus:OPERation:ULFail[:SUMMary]:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:ULF:NTR?

STAT:OPER:ULF:NTR 8	Negative transition filters the state of bit 3 into the event register.
STAT:OPER:ULF:NTR #B1000	The meaning is the same as above, using binary numbers.
STAT:OPER:ULF:NTR #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:OPERation:ULFail[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for upper limit detection operation.
Query: :STATus:OPERation:ULFail[:SUMMary]:PTRansition?
Setting: :STATus:OPERation:ULFail[:SUMMary]:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:OPER:ULF:PTR?

STAT:OPER:ULF:PTR 8	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:OPER:ULF:PTR #B1000	The meaning is the same as above, using binary numbers.
STAT:OPER:ULF:PTR #H08	The meaning is the same as above, using decimal numbers.

:STATus:PRESet

Function: Preset some state registers as follows, and other registers remain unchanged.
Query: Not supported
Setting: :STATus:PRESet
Example: STAT:PRES

Table 3.21 Operation state register description

Register	Sub register	Preset state
OPERation	ENABle	All 0
	PTR	All 1
	NTR	All 0
QUEStionable	ENABle	All 0
	PTR	All 1
	NTR	All 0
Other	ENABle	All 0
	PTR	All 1
	NTR	All 0

:STATus:QUEStionable:CALibration[:SUMMary]:CONDition?

Function: Query the value in the calibration question state condition register.
Among the returned values, if bit 1 is non-zero, channel A is zeroed and calibrated incorrectly; if bit 2 is non-zero, channel B is zeroed or calibrated incorrectly. For example, returning 2 indicates that channel A is zeroed or calibrated incorrectly.

Query: :STATus:OPERation:CALibrating[:SUMMary]:CONDition?

Setting: Not supported

Example: STAT:OPER:CAL:COND?

:STATus:QUEStionable:CALibration[:SUMMary]:ENABle

Function: Query or set the calibration question event enable register. Operate by bit. 0 indicates that reporting state events to bit 8 of the question state is disabled. 1 indicates enable.

Query: :STATus:QUEStionable:CALibration[:SUMMary]:ENABle?

Setting: :STATus:QUEStionable:CALibration[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:QUES:CAL:ENAB?

STAT:QUES:CAL:ENAB 6	Enable bit 1 and bit 2, which allows reporting of calibration question events to the question state.
STAT:QUES:CAL:ENAB #B0110	The meaning is the same as above, using binary numbers.
STAT:QUES:CAL:ENAB #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:CALibration[:SUMMary][:EVENt]?

Function: Query the calibration question event register. After the query, 87236 automatically clears the register.

Query: :STATus:QUEStionable:CALibration[:SUMMary][:EVENt]?

Setting: Not supported

Example: STAT:QUES:CAL?

:STATus:QUEStionable:CALibration[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for calibration question.

Query: :STATus:QUEStionable:CALibration[:SUMMary]:NTRansition?

Setting: :STATus:QUEStionable:CALibration[:SUMMary]:NTRansition <NRf>|<non-decimal number>

The parameter range is from 0 to 32767.

Example: STAT:QUES:CAL:NTR?

STAT:QUES:CAL:NTR 6	Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:QUES:CAL:NTR #B0110	The meaning is the same as above, using binary numbers.
STAT:QUES:CAL:NTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:CALibration[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for calibration question.

Query: :STATus:QUEStionable:CALibration[:SUMMary]:PTRansition?

Setting: :STATus:QUEStionable:CALibration[:SUMMary]:PTRansition <NRf>|<non-decimal number>

The parameter range is from 0 to 32767.

Example: STAT:QUES:CAL:PTR?

STAT:QUES:CAL:PTR 6	Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:QUES:CAL:PTR #B0110	The meaning is the same as above, using binary numbers.
STAT:QUES:CAL:PTR #H06	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:CONDition?

Function: Query the value in the question state condition register.

Among the returned values, if bit 3 is non-zero, a power question event is detected; if bit 8 is non-zero, a calibration question event is detected; if bit 9 is non-zero, the power-on self-test failed.

For example, if a calibration question event is detected by this set of registers, the

corresponding bit of the calibration question enable register (STAT:QUES:CAL:ENAB) needs to be set non-zero. Others are the same.

Query: :STATus:QUEStionable:CONDition?

Setting: Not supported

Example: STAT:QUES:COND?

:STATus:QUEStionable:ENABle

Function: Query or set the question state event enable register. Operate by bit. 0 means that reporting state events to bit 3 of the state word is disabled. 1 indicates enable.

Query: :STATus:QUEStionable:ENABle?

Setting: :STATus:QUEStionable:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:QUES:ENAB?

STAT:QUES:ENAB 8	Enable bit 1, which allows reporting of calibration question events into the state word.
STAT:QUES:ENAB #B1000	The meaning is the same as above, using binary numbers.
STAT:QUES:ENAB #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable[:EVENt]?

Function: Query the question state event register. After the query, 87236 automatically clears the register.

Query: :STATus:QUEStionable[:EVENt]?

Setting: Not supported

Example: STAT:QUES?

:STATus:QUEStionable:NTRansition

Function: Query or set the negative transition filter for question state.

Query: :STATus:QUEStionable:NTRansition?

Setting: :STATus:QUEStionable:NTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.

Example: STAT:QUES:NTR?

STAT:QUES:NTR 8	Negative transition filters the state of bit 3 into the event register.
STAT:QUES:NTR #B1000	The meaning is the same as above, using binary numbers.
STAT:QUES:NTR #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:PTRansition

Function: Query or set the positive transition filter for question state.
Query: :STATus:QUEStionable:PTRansition?
Setting: :STATus:QUEStionable:PTRansition <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:QUES:PTR?

STAT:QUES:PTR 8	Positive transition filters the state of bit 3 into the event register.
STAT:QUES:PTR #B0110	The meaning is the same as above, using binary numbers.
STAT:QUES:PTR #H08	The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:POWer[:SUMMary]:CONDition?

Function: Query the value in the power question state condition register.
Among the returned values,
If bit 1 is non-zero, the channel A input is overloaded;
If bit 2 is non-zero, the channel B input is overloaded;
If bit 3 is non-zero, the channel A needs to be zeroed;
If bit 4 is non-zero, the channel B needs to be zeroed;
If bit 5 is non-zero, the measurement 1 data is invalid, or logarithmically incorrect;
If bit 6 is non-zero, the measurement 2 data is invalid, or logarithmically incorrect;
If bit 7 is non-zero, the measurement 3 data is invalid, or logarithmically incorrect;
If bit 8 is non-zero, the measurement 4 data is invalid, or logarithmically incorrect.
If, for example, 8 is returned, channel A needs to be zeroed.
Query: :STATus:QUEStionable:POWer[:SUMMary]:CONDition?
Setting: Not supported
Example: STAT:QUES:POW:COND?

:STATus:QUEStionable:POWer[:SUMMary]:ENABle

Function: Query or set the power question event enable register. Operate by bit. 0 indicates that reporting state events to bit 3 of the question state is disabled. 1 indicates enable.
Query: :STATus:QUEStionable:POWer[:SUMMary]:ENABle?
Setting: :STATus:QUEStionable:POWer[:SUMMary]:ENABle <NRf>|<non-decimal number>
The parameter range is from 0 to 32767.
Example: STAT:QUES:POW:ENAB?

STAT:QUES:POW:ENAB 6	Enable bit 1 and bit 2, which allows reporting of power question events to the question state.
STAT:QUES:POW:ENAB #B0110	The meaning is the same as above, using binary numbers.

STAT:QUES:POW:ENAB #H06 The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:POWer[:SUMMary][:EVENt]?

Function: Query the power question event register. After the query, 87236 automatically clears the register.
Query: :STATus:QUEStionable:POWer[:SUMMary][:EVENt]?
Setting: Not supported
Example: STAT:QUES:POW?

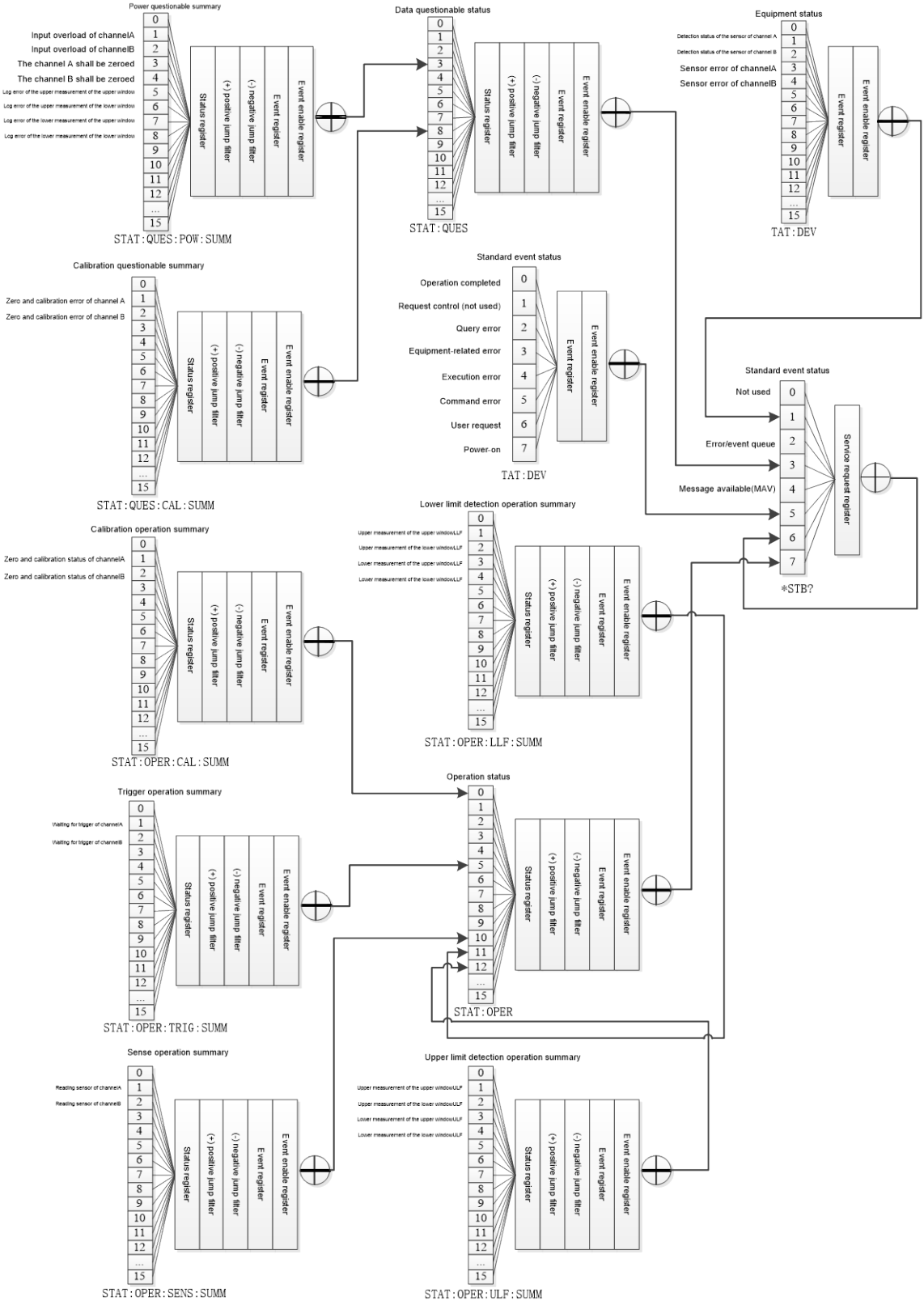
:STATus:QUEStionable:POWer[:SUMMary]:NTRansition

Function: Query or set the negative transition filter for power question.
Query: :STATus:QUEStionable:POWer[:SUMMary]:NTRansition?
Setting: :STATus:QUEStionable:POWer[:SUMMary]:NTRansition <NRf>|< non decimal number >
The parameter range is from 0 to 32767.
Example: STAT:QUES:POW:NTR?
STAT:QUES:POW:NTR 6 Negative transition filters the state of bit 1 and bit 2 into the event register.
STAT:QUES:POW:NTR #B0110 The meaning is the same as above, using binary numbers.
STAT:QUES:POW:NTR #H06 The meaning is the same as above, using hexadecimal numbers.

:STATus:QUEStionable:POWer[:SUMMary]:PTRansition

Function: Query or set the positive transition filter for power question.
Query: :STATus:QUEStionable:POWer[:SUMMary]:PTRansition?
Setting: :STATus:QUEStionable:POWer[:SUMMary]:PTRansition <NRf>|< non decimal number >
The parameter range is from 0 to 32767.
Example: STAT:QUES:POW:PTR?
STAT:QUES:POW:PTR 6 Positive transition filters the state of bit 1 and bit 2 into the event register.
STAT:QUES:POW:PTR #B0110 The meaning is the same as above, using binary numbers.
STAT:QUES:POW:PTR #H06 The meaning is the same as above, using hexadecimal numbers.

Attachment: state block diagram



3.3.10 System sub-system command (SYSTem)

- :SYSTem:ERRor:CODE?.....152
- :SYSTem:ERRor[:NEXT]?.....152
- :SYSTem:HELP:HEADers?.....152
- :SYSTem:IDN.....153
- :SYSTem:IDN:AUTO.....153
- :SYSTem:PRESet.....153
- :SYSTem:VERSion?.....168

:SYSTem:ERRor:CODE?

Function: Return the error code from the error queue of the 87236. When an error is generated, the error code is stored in the error queue. Every time this command is executed, this message will be removed from the error queue. The order of error messages out of the queue is first-in-first-out (FIFO), i.e., the oldest messages go out of the queue first. The error queue can be cleared with the *CLS command. Executing this command when the error queue is empty will return 0. The error queue can hold up to 1000 error messages.

Query: :SYSTem:ERRor:CODE?

Setting: Not supported

Example: SYST:ERR:CODE?

Reset state: No effect.

:SYSTem:ERRor[:NEXT]?

Function: Return the error code and error message from the error queue of the 87236. When an error is generated, the error code and error message are stored in the error queue. Every time this command is executed, this message will be removed from the error queue. The order of error messages out of the queue is first-in-first-out (FIFO), i.e., the oldest messages go out of the queue first. The error queue can be cleared with the *CLS command. Executing this command when the error queue is empty will return "0, "No Error"". The error queue can hold up to 1000 error messages.

Query: :SYSTem:ERRor[:NEXT]?

Setting: Not supported

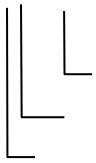
Example: SYST:ERR?

Reset state: No effect.

:SYSTem:HELP:HEADers?

Function: Query the list of commands supported by 87236. The data format is <Arbitrary data

block>. See Section 7.7.6 of IEEE 488.2. #nNNN...Nddd……ddd<LF>



Data newline character indicating the end of the data block.
Data length (i.e. the number of bytes of d)
Number of bits of data length (i.e. the number of bits of N)
The marker for the start of the data block.

The data block is of the form #510331 ..... in <LF> n = 5 and N = 10331.

Query: :SYSTem:HELP:HEADers?
Setting: Not supported
Example: SYST:HELP:HEAD?

:SYSTem:IDN

Function: Query or set the user-defined string of the 87236.

Related programming control commands ":SYSTem:IDN:AUTO", "*IDN?"
Query: :SYSTem:IDN?
Setting: :SYSTem:IDN <string parameters>
Valid forms of string parameters are "A, B, C, D"
Where A stands for the name of the manufacturer, such as Ceyear
B stands for the product model, such as 87236D
C stands for product serial number, such as SN01
D stands for the version number of the product, such as 1.0.0
Example:

SYST:IDN?	Return the current user-defined IDN return string.
SYST:IDN "Ceyear,87236D,001,1.0"	Set the user-defined IDN return string

:SYSTem:IDN:AUTO

Function: Enable or disable user-defined strings,

ON: Allows users to query and set user-defined strings via ":SYSTem:IDN", "*IDN?".

OFF: Disable users to query and set user-defined strings via ":SYSTem:IDN" and"*IDN?".

Related programming control commands ":SYSTem:IDN", "*IDN?"
Query: :SYSTem:IDN:AUTO?
Setting: :SYSTem:IDN:AUTO <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON
Example:

SYST:IDN:AUTO?	Query the ON/OFF state of user-defined string.
SYST:IDN:AUTO 1	Enable user-defined strings.
SYST:IDN:AUTO 0	Disable user-defined strings.

Reset state: OFF

3.3 Instrument subsystem command

:SYSTem:PRESet

Function: Reset 87236 to the state specified by the parameter. A total of 23 states are offered in this case.

Query: Not supported

Setting: :SYSTem:PRESet [character data]

The form of [character data] is as follows (DEFault is the default parameter, i.e. the parameter when no parameters are included.) :

- DEFault.....154
- GSM900.....157
- EDGE.....158
- CDMAone.....158
- CDMA2000.....159
- WCDMA.....159
- BLUetooth.....160
- MCPa.....160
- RADar.....161
- WL802DOT11A.....161
- HIPERLAN2.....161
- WL802DOT11B.....162
- XEVDO.....163
- XEVDV.....163
- TDSCdma.....162
- NADC.....163
- IDEN.....164
- DVB.....165
- WIMAX.....165
- DME.....166
- DMEPRT.....167
- HSDPA.....167
- LTE.....167

Example: SYST:PRES GSM900 Reset state to GSM900.

Reset state: See the table below.

1) DEFault

Table 3.22 Default reset state (DEFault)

Command	Settings	Description
CALC[1]|2|3|4:FEED[1]|2	"POW:AVER"	Set the average

Command	Settings	Description
		measurement mode
CALC[1]|2|3|4:GAIN[:MAGN]	0.000 dB	Set the calculation offset to 0
CALC[1]|2|3|4:GAIN:STAT	OFF	Disable the calculation offset
CALC[1]|2|3|4:LIM:CLE:AUTO	ON	Clear the limit detection state when initializing the measurement
CALC[1]|2|3|4:LIM:LOW[:DATA]	-90 dBm	Lower limit
CALC[1]|2|3|4:LIM:STAT	OFF	Disable the measurement limit detection
CALC[1]|2|3|4:LIM:UPP[:DATA]	90 dBm	Upper limit
CALC[1]|2|3|4:MATH[:EXPR]	SENS1	Measurement expression
CALC[1]|2|3|4:REL[:MAGN]:AUTO	OFF	Disable the reference value of the relative measurement.
CALC[1]|2|3|4:REL:STAT	OFF	Disable relative measurement.
CAL[1]|2:RCAL	No effect	The switch must be calibrated to be unaffected.
DISP[:WIND[1]|2][:NUM[1]|2]:RES	3	Measurement display resolution is set to 3
FORM[:READ]:BORD	NORMal	The byte order of binary data is normal.
FORM[:READ][:DATA]	ASCii	The data format is ASCII
INIT[1]|2:CONT	ON	In trigger waiting state
MEM:TABL:SEL	No effect	Current frequency response offset table
PST:CCDF:GAUS[:STAT]	ON	Turn on the Gaussian probability curve
PST:CCDF:TRAC:MARK[1]|2[:SET]	Set to Channel A	Set the marker to measurement curve A
PST:CCDF:MARK[1]|2:X	0	Horizontal coordinate of the cursor
PST:CCDF:COUNt	100E+06	Statistics end count is

3.3 Instrument subsystem command

Command	Settings	Description
		100M
PST:CCDF:TIME	0	Statistics end timing is OFF.
PST:CCDF:END:ACTion	STOP	Statistics end behavior is set to "Stop"
PST:CCDF:REF[:STAT]	OFF	Close the statistical reference curve
PST:CCDF:DATA:MAX	12dB	X-axis maximum
[SENS[1]]:AVER:COUN	8	Filter length
[SENS[1]]:AVER:COUN:AUTO	ON	Turn on auto average.
[SENS[1]]:AVER:SDET	ON	Turn on the step detection
[SENS[1]]:AVER[:STAT]	ON	Turn on the average
[SENS[1]]:CORR:CSET2[:SEL]	No effect	Currently selected frequency response offset table
[SENS[1]]:CORR:CSET2:STAT	No effect	The ON/OFF state of the currently selected frequency response offset table
[SENS[1]]:CORR:FDOF|GAIN4[:INP][:MAGN]	No effect	Return the frequency response offset value
[SENS[1]]:CORR:GAIN2:STAT	OFF	Disable the channel offset
[SENS[1]]:CORR:GAIN2:[:INPut][:MAGNitude]	0.00 dB	Channel offset is 0
[SENS[1]]:FREQ[:CW|:FIX]	1 GHz	Channel frequency is 1 GHz
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 100 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100 us	Set the display time length of trace to 100 us
TRAC[1]|2:UNIT	dBm	Trace display unit
TRACe[1]|2:DEFine:TRANsition:REFerence	10%, 90%	Pulse transition reference.
TRIG[:SEQ]:DEL	0	Trigger delay

Command	Settings	Description
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	IMM	Trigger Source
UNIT:POW	dBm	Power unit
UNIT:POW:RAT	dB	Rate unit

2) GSM900

Global System for Mobile Communications, commonly known as GSM,

uses a digital modulation method called 0.3GMSK (Gaussian Minimum Shift Keying). 0.3 indicates the ratio of Gaussian filter bandwidth to bit rate. GMSK is a special type of digital FM modulation. Adding or subtracting 67.708 KHz to the RF carrier frequency indicates 1 and 0. The modulation technique that uses two frequencies to represent 1 and 0 is noted as FSK (frequency shift keying).

In GSM, the data rate is chosen to be 270.833 kbit/sec, exactly four times the RF frequency offset, which minimizes the modulation spectrum and improves the channel efficiency.

FSK modulation with a bit rate exactly 4 times the frequency offset is called MSK (minimum frequency shift keying). In GSM, a Gaussian pre-modulation filter is used to further reduce the modulation spectrum. It reduces the speed of frequency conversion, which would otherwise result in radiated energy to adjacent channels. The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.23 GSM900 preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	900 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 20 us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 520 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	1ms	Set the display time length of trace to 1ms
TRIG[:SEQ]:DEL	-20 μs	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

3) EDGE

Enhanced Data for Global Evolution or Enhanced Data for GSM Evolution.

EDGE is a transition technology from GSM to 3G, which mainly uses a new modulation method in GSM systems, namely the state-of-the-art multi-time slot operation and 8PSK modulation technology. Since 8PSK can extend the signal space of the GMSK modulation technique used in existing GSM networks from 2 to 8, this allows each symbol to contain four times more information.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.24 EDGE preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	900 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 20 us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 520 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	1ms	Set the display time length of trace to 1ms
TRIG[:SEQ]:DEL	-40 μs	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

4) CDMAone

CDMAone is a 2G mobile communication standard. The underlying signaling standard is IS-95, a 2G mobile standard developed by Qualcomm and TIA based on CDMA technology. CDG applied for the trademark cdmaOne for this technology, and cdmaOne and its associated standards were the first commercially available mobile communications standards based on CDMA technology.

IS-95 is the number assigned by TIA to the most prominent air interface standard for 2G mobile communications based on CDMA technology, known as Interim Standard 95.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.25 CDMAone preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	850 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 10ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	10ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

5) CDMA2000 and WCDMA

It is the well-known 3G 1X or 1xRTT, which is the core of 3G CDMA2000 technology. The mark 1x customarily refers to CDMA2000 wireless technology that uses a pair of 1.25 MHz radio channels.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.26 CDMA2000 and WCDMA: preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	1.9GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 10ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	10ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

6) BLUetooth

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.27 BLUetooth preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	2.4GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 200 ns Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 366us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	500 us	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

7) MCPa

Multi-Carrier Power Amplifier.

The ideal software radio combines multiple carriers in the transmitting direction into a one-way signal, which is upconverted and then amplified with a type of MCPA for low-noise amplification of the wideband analog mixed signal. Because the difference between the signal and signal envelope amplitude in mixed signals is large, it is particularly sensitive to amplifier nonlinearity. The MCPA uses a forward feedback technique to suppress unwanted intermodulation carriers and obtain effective power utilization. A good selection of devices and the use of circuit CAD optimization techniques are required.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.28 MCPa preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	1.9GHz	Channel frequency

[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 10ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	10ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

8) RADar

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.29 RADAR: preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	10 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 3: 750 ns Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 1 us Gate 2: 250 ns Gate 3: 250 ns Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	2us	Set the display time length of trace
TRIG[:SEQ]:DEL	-252ns	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

9) 802.11a (WL802DOT11A) and HIPERLAN2

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.30 802.11a and HiperLan2 preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	5.2 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 25 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	50 us	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

10) 802.11b/g (WL802DOT11B)

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.31 802.11b/g preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	2.4GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 100 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100 us	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

11) 1xeV-DO (XEVDO), 1xeV-DV (XEVDV) and TDSCdma

Evolution-Data Only, CDMA2000 1xEV Phase 1 Supports downlink (forward link) data rates up to 3.1 Mbps

and uplink (reverse link) rates up to 1.8 Mbps with one radio channel transmitting high-speed data message data.

1xEV-DO is already in commercial operation. The European market is slightly ahead of the U.S. market. In the summer of 2004 Czech mobile operator Eurotel began operating the sinceCDMA2000 1xEV-DO network, and they offered uplink rates of about 1 Mbps. This service costs about 30 euros per month without traffic restrictions. To use this service, you need to spend about 300 euros to buy a Gtran GPC-6420 modem.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.32 1xeV-DO (XEVDO), 1xeV-DV (XEVDV) and TDSCdma preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	1.9GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 10 us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 810 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	1ms	Set the display time length of trace to 1ms
TRIG[:SEQ]:DEL	-40 μs	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

12) NADC

NADC - North American Digital Cellular

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.33 NADC preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	800 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 123.5 us Gate 2: 20.123ms Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1/2: 6.46ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	50ms	Set the display time length of trace to 1ms
TRIG[:SEQ]:DEL	-200 µs	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

13) iDEN

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.34 iDEN preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	64	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	800 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 15ms Gate 2: 90ms Gate 3: 160 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100ms	Set the display time length of trace

TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

14) DVB

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.35 DVB: preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	8	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	660 MHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: 10 us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 15ms Gate 2: 90ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

15) WiMAX

Worldwide Interoperability for Microwave Access.

Combining this technology with microwave devices that require licensing or are license-free will expand the broadband wireless market and improve the perception of enterprises and service providers due to lower costs.

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.36 WiMAX preset state

Command	Settings	Description
[SENS[1]]:FREQ[:CW|:FIX]	3.5 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 2: 102us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 102us Gate 2: 306us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	1ms	Set the display time length of trace
TRIG[:SEQ]:DEL	-200 us	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

16) DME

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.37 DME preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	32	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	1.1 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 1: -2us Gate 2: 8us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 8us Gate 2: 50 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100 us	Set the display time length of trace
TRACe[1]|2:DEFine:TRANsition:REFerence	1%, 81%	Pulse transition reference.

TRIG[:SEQ]:DEL	-3us	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

17) DMEPRT

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.38 DME-PRT preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	32	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	1.1 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	Gate 2: 8us Other: 0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 6us Gate 2: 50 us Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	100 us	Set the display time length of trace
TRACe[1]|2:DEFine:TRANsition:REFerence	0.25%, 9%	Pulse transition reference.
TRIG[:SEQ]:DEL	-2us	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

18) HSDPA

The parts of the following settings that are not enumerated are the same as DEFault.

Table 3.39 HSDPA preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	64	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	1.9GHz	Channel frequency

[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 10ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	0	Set the minimum display time of trace
[SENS[1]]:TRACe:TIME	10ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

19) LTE

The parts of the following settings that are not enumerated are the same as DEFault.

LTE: Long term evolution of general-purpose mobile communications technology. Long Term Evolution, a long-term evolution of the UMTS (Universal Mobile Telecommunications System) technology standard developed by the 3GPP (The 3rd Generation Partnership Project), was formally established and launched at the 3GPP Toronto meeting in December 2004. LTE system introduces key technologies such as OFDM (Orthogonal Frequency Division Multiplexing) and MIMO (Multi-Input&Multi-Output), which significantly increase the spectral efficiency and data transmission rate (under the condition of 64QAM, the theoretical maximum downlink transmission rate of 20 M bandwidth 2XMIMO is 201 Mbps, which is about 150 Mbps after excluding signaling overhead. However, according to the actual networking and terminal capacity constraints, it is generally considered that the downlink peak rate is 100 Mbps and the uplink is 50 Mbps), and it supports a variety of bandwidth allocation: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz.

Table 3.40 LTE preset state

Command	Settings	Description
[SENS[1]]:AVER:COUN	64	Filter length
[SENS[1]]:FREQ[:CW|:FIX]	2 GHz	Channel frequency
[SENS[1]]:SWE[1]|2|3|4:OFFS:TIME	0	Set the start time of gate
[SENS[1]]:SWE[1]|2|3|4:TIME	Gate 1: 1.2ms Gate 2: 10ms Other: 0	Set the duration of gate
[SENS[1]]:TRACe:OFFSet:TIME	-0.2ms	Set the minimum display time of trace

[SENS[1]]:TRACe:TIME	11ms	Set the display time length of trace
TRIG[:SEQ]:DEL	0	Trigger delay
TRIG[:SEQ]:LEV	-5 dBm	Trigger level
TRIG[:SEQ]:SLOP	POS	First transition trigger
TRIG[:SEQ[1]|2]:SOUR	INT1	Trigger Source

:SYSTem:VERSion?

Function: Query the SCPI version number used by 87236. The return form is YYYY.X, where YYYY denotes the year and X denotes the version number. It returns 1999.0 in this case.
Query: :SYSTem:VERSion?
Setting: Not supported
Example: SYST:VERS?

3.3.11 Trace sub-system command (TRACe)

- :TRACe[1][:DATA]?....169
- :TRACe[1]:DEFine:DURation:REFerence....170
- :TRACe[1]:DEFine:TRANsition:REFerence....171
- :TRACe[1]:MEASurement:INSTant:REFerence?....171
- :TRACe[1]:MEASurement:PULSe[1]|2-20:AM|AMPLitude?....172
- :TRACe[1]:MEASurement:PULSe[1]|2-20:AT|ATRailing?....172
- :TRACe[1]:MEASurement:PULSe[1]|2-20:DCYCle?....172
- :TRACe[1]:MEASurement:PULSe[1]|2-20:DURation?....173
- :TRACe[1]:MEASurement:PULSe[1]|2-20:PERiod?....173
- :TRACe[1]:MEASurement:PULSe[1]|2-20:SEParation?....173
- :TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?....173
- :TRACe[1]:MEASurement:REFerence?....173
- :TRACe[1]:MEASurement:TILTed|DROop:UNIT....174
- :TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:DURation?....174
- :TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:OCCurence?....175
- :TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:DURation?....175
- :TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:OCCurence?....175
- :TRACe[1]:STATe....175
- :TRACe[1]:UNIT....175

:TRACe[1][:DATA]?

Function: Query the pulse measurement trace data.
Input parameters are not considered, and the directory of parameters is reserved for

compatibility with the 2438 commands.

The format of return data is <Arbitrary data block> in Section 7.7.6 of IEEE 488.2.

#nNNN...Nddd……ddd<LF>

- Data newline character indicating the end of the data block.
- Data length (i.e. the number of bytes of d)
- Number of bits of data length (i.e. the number of bits of N)
- The marker for the start of the data block.

The format of the data elements of each trace is IEEE754 32-bit floating point data, i.e. 4 bytes. Since the number of points in the trace is always 501, the data block is of the form #42004 ..... In <LF> n = 4 and N = 2004.

Query: :TRACe[1][:DATA]? [character data]

The form of [character data] is: HRESolution; MRESolution; LRESolution

Parameters can be omitted and disregarded.

Setting: Not supported

Example: TRAC? MRES Query the pulse measurement trace data.

Limit: If the trigger source is INT or EXT, after entering a new INIT operation, if the trigger conditions are not met and the trigger signal has not been waited for, the effect is that the device will be hung and the programming command will not respond. Therefore, when using this command, it is important to ensure that the device captures the trigger signal.

Error message: If it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict";

If in trace measurement status TRACe[1]:STATe is not enabled, it prompts -221, "Settings conflict";

If in list status LIST:STAT is enabled, it prompts -221, "Settings conflict";

If the last measurement is invalid, it prompts -230, "Data corrupt or stale", and the INIT command will ensure that the measurement is valid, and changes in measurement parameters (e.g., frequency, channel offset) will cause the measurement to be invalid.

:TRACe[1]:DEFine:DURation:REFerence

Function: Query or set the reference value used to calculate the pulse duration (i.e. pulse width).

Query: :TRACe[1]:DEFine:DURation:REFerence? [MIN|MAX]

Setting: :TRACe[1]:DEFine:DURation:REFerence <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from 0 to 100 and DEF is 50.

Example: TRAC1:DEF:DUR:REF? Query the reference value for channel A to calculate the pulse duration.

TRAC1:DEF:DUR:REF 50 Set the reference value for calculating the

pulse duration to 50%.

Limit:

Reset state: The default value is 50% (DEF).

:TRACe[1]:DEFine:TRANsition:REFerence

Function: Query or set the reference value used to calculate the pulse transition duration (rise time or fall time).

Query: :TRACe[1]:DEFine:TRANsition:REFerence?

Setting: :TRACe[1]:DEFine:TRANsition:REFerence <numeric data 1>, <numeric data 2>
Valid values for numeric data 1 and 2 are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 100.
DEF of <numeric data 1> is 10,
DEF of <numeric data 2> is 90

Example:

TRAC1:DEF:TRAN:REF?	Query the reference value for channel A to calculate the pulse transition duration.
TRAC1:DEF:TRAN:REF 20,80	Set the reference values for channel A to calculate the pulse transition duration to 20% and 80%.
TRAC1:DEF:TRAN:REF DEF,DEF	Set the reference values for calculating the pulse transition duration to 10% and 90%.

Limit:

Reset state: The default values are 10% and 90% respectively

:TRACe[1]:MEASurement:INSTant:REFerence?

Function: Query the moment when the trace waveform intersects with the given reference value. The parameter is a percentage, e.g., 10 means 10%.
Calculate the moment at a given power (denoted as Px), which is noted as tx
Px = Pbot + (Ptop - Pbot) * x / 100
Ptop and Pbot refer to the top power and bottom power respectively, and the units are linear, such as mW. x is in the form of a percentage, ranging from -25 to 125
If Px is calculated to be less than the minimum power in the current power buffer, the minimum power is taken; if Px is calculated to exceed the peak power, the peak power is taken.
Px = max(Pmin, min(Pmax, Px))
If there are multiple moments, only the first moment is returned.
Traverse the entire power buffer to find two points, and denote the power at the two points as P1 and P2, and the time as t1 and t2, respectively, with two cases:
1) so that the power at the first point is less than or equal to Px and the power at the latter point is greater than or equal to Px.

2) so that the power at the first point is greater than or equal to Px and the power at the latter point is less than or equal to Px.
Using linear interpolation tx = t1 + (t2 - t1) * (Px - P1) / (P2 - P1)

Query: :TRACe[1]:MEASurement:INSTant:REFerence? <numeric data>
Valid values for numeric data are: MIN, MAX, <NRf>.
<NRf> ranges from -25 to 125.

Setting: Not supported

Example: TRAC1:MEAS:INST:REF? 28 Query the moment when the trace waveform intersects with the reference value of 28%

Error message: If it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict";
If the list state LIST:STAT is enabled, it prompts -221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:AM|AMPLitude?

Function: Query the power of the first transition of the [1]|2-20th pulse.

Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:AM|AMPLitude?

Setting: Not supported

Example: TRAC:MEAS:PULS:AM? Query the power of the first transition of the pulse.

Limit:

Note: If the measurement is invalid, "+9.91E37" is returned

Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:AT|ATRailing?

Function: Query the power of the last transition of the [1]|2-20th pulse.

Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:AT|ATRailing?

Setting: Not supported

Example: TRAC:MEAS:PULS:AT? Query the power of the last transition of the pulse.

Limit:

Note: If the measurement is invalid, "+9.91E37" is returned

Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:DCYCle?

Function: Query the duty cycle of the [1]|2-20th pulse.

Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:DCYCle?

Setting: Not supported

Example: TRAC:MEAS:PULS:DCYC? Query the duty cycle of the pulse.

Limit:

Note: If the measured duty cycle is invalid, "+9.91E37" is returned
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:DURation?

Function: Query the duration of the [1]|2-20th pulse (i.e. pulse width).
Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:DURation?
Setting: Not supported
Example: TRAC1:MEAS:PULS:DUR? Query the pulse duration.
Limit:
Note: If the measured pulse width is invalid, "+9.91E37" is returned
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:PERiod?

Function: Query the [1]|2-20th pulse period.
Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:PERiod?
Setting: Not supported
Example: TRAC1:MEAS:PULS:PER? Query the pulse period.
Limit:
Note: If the measured period is invalid, "+9.91E37" is returned
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:SEParation?

Function: Query the interval time (or pulse off time) of the [1]|2-20th pulse.
Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:SEParation?
Setting: Not supported
Example: TRAC1:MEAS:PULS:SEP? Query the interval time (pulse off time) of the pulse.
Limit:
Note: If the measurement value is invalid, "+9.91E37" is returned
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?

Function: Query the droop of the [1]|2-20th pulse.
The relevant command is: TRACe[1]:MEASurement:TILTed|DROop:UNIT
:FETCh[1]:DROop?
The relationship between the droop DR and the first transition amplitude AM (in W)

and the last transition amplitude AT (in W) is as follows:

In PCT (%): $\mathrm{DR} = \frac{AM-AT}{AM} \times 100\%$

In dB: $\mathrm{DR} = 10 \times \log\frac{AM}{AT}$

Query: :TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?
Setting: Not supported
Example: TRAC1:MEAS:PULS:TILT? Query the droop of the pulse.
Limit:
Note: If the measurement value is invalid, "+9.91E37" is returned
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:REFerence?

Function: Query the power of a given reference value.

Algorithm: $P_{x\%} = P_{0\%} + x/100 \times (P_{100\%} - P_{0\%})$

The units are all linear.

Query: :TRACe[1]:MEASurement:REFerence? <numeric data>
Valid values for numeric data are: 0 to 100.
Setting: Not supported
Example: TRAC1:MEAS:REF? 100 Query the top power.
Limit:
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:TILTed|DROop:UNIT

Function: Query or set the unit of pulse droop.
The relevant command is:: TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?
Query: :TRACe[1]:MEASurement:TILTed|DROop:UNIT?
Setting: :TRACe[1]:MEASurement:TILTed|DROop:UNIT <character data>
Valid character data are:
DB or 0: Logarithmic display.
Example: TRAC1:MEAS:TILT:UNIT? Query the unit of pulse droop.
TRAC1:MEAS:TILT:UNIT DB Set the unit of pulse droop to dB.
Error message:

:TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:DURation?

Function: Query the pulse negative transition duration (i.e. fall time).
Query: :TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:DURation?

Setting: Not supported
Example: TRAC1:MEAS:TRAN:NEG:DUR? Query the fall time.
Note: If the measurement value is invalid, "+9.91E37" is returned
Limit:
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:OCCurence?

Function: Query the pulse negative transition (i.e. fall) moment.
Query: :TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:OCCurence?
Setting: Not supported
Example: TRAC1:MEAS:TRAN:NEG:OCC?
Limit:
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:DURation?

Function: Query the pulse positive transition duration (i.e. rise time).
Query: :TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:DURation?
Setting: Not supported
Example: TRAC1:MEAS:TRAN:POS:DUR? Query the rise time.
Limit:
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:OCCurence?

Function: Query the pulse positive transition (i.e. rise) moment.
Query: :TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:OCCurence?
Setting: Not supported
Example: TRAC1:MEAS:TRAN:POS:OCC?
Limit:
Error message: if it is in free run mode or average power measurement mode, it prompts "-221, "Setting Conflict".

:TRACe[1]:STATe

Function: Query or set the trace measurement state of the channel.
Query: :TRACe[1]:STATe?
Setting: :TRACe[1]:STATe <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON
Example: TRAC:STAT? Query the channel trace measurement state

TRAC1:STAT 1 Enable the channel trace measurement

Reset state: OFF

:TRACe[1]:UNIT

Function: Query or set the trace unit of a given channel.
Query: :TRACe[1]:UNIT?
Setting: :TRACe[1]:UNIT <DBM|W|0|1>
Example: TRAC1:UNIT DBM Set the trace unit to dBm.
Limit:

3.3.12 Trigger sub-system command (INITiate/ TRIGger)

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- :TRIGger[:SEQuence[1]]:POSition....182
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:ABORt[1]

Function: Stop the measurement of the corresponding channel of the 87236. Restart the measurement after sending INITiate:CONTinuous ON.
Query: Not supported
Setting: ABORt[1]
Example: ABOR Stop measuring channel A.

	ABOR	Stop measuring

Note: 87236 does not set the trigger idle state, i.e. the trigger is always in the wait state.

:INITiate[1]:CONTinuous

Function: Query or set the trigger state of the 87236: single step and continuous
When it is set to single-step (OFF), wait for trigger until it is set to Continuous (ON), or
INITiate:IMMediate is received.
This command is equivalent to INITiate:CONTinuous:SEQuence[1]

Query: :INITiate[1]:CONTinuous?

Setting: :INITiate[1]:CONTinuous <Boolean data>
OFF | 0 Single
ON|1 Continuous

Example:	INIT:CONT?	Query the trigger state: 0 for single step and 1 for continuous.
	INIT:CONT ON	Set channel A to continuous trigger state.

Note: For the parameter OFF, this corresponds to stopping the measurement; for the parameter ON, this corresponds to starting the measurement.

Reset state: Set to ON

:INITiate:CONTinuous:ALL

Function: Query or set the trigger state of all channels of the 87236: single step and continuous
When it is set to single-step (OFF), wait for trigger until it is set to continuous (ON), or INITiate:IMMediate is received.

Query: :INITiate:CONTinuous:ALL?

Setting: :INITiate:CONTinuous:ALL <Boolean data>
OFF | 0 Single
ON|1 Continuous

Example:	INIT:CONT:ALL?	Query the trigger state of all channels. When all channels are continuously triggered, it is 1, otherwise it is 0.
	INIT:CONT:ALL ON	Set all channels to continuous trigger state.

Reset state: Set to ON

:INITiate:CONTinuous:SEQuence[1]

Function: Query or set the trigger state of the 87236: single step and continuous
When it is set to single-step (OFF), wait for trigger until it is set to Continuous (ON), or

INITiate:IMMediate is received.
This command is equivalent to INITiate[1]:CONTinuous

Query: :INITiate:CONTinuous:SEQuence[1]?

Setting: :INITiate:CONTinuous:SEQuence[1] <Boolean data>
OFF | 0 Single
ON|1 Continuous

Example: INIT:CONT:SEQ? Query the trigger state: 0 for single step and 1 for continuous.
INIT:CONT:SEQ1 ON Set channel A to continuous trigger state.

:INITiate[1][:IMMediate]

Function: Set 87236 to "wait for trigger" state. The measurement starts when a trigger event is received.
Equivalent command INITiate:[IMMediate]:SEQuence[1]

Query: Not supported

Setting: :INITiate[1][:IMMediate]

Example: INIT Set 87236 to "wait for trigger" state.

:INITiate[:IMMediate]:ALL

Function: Set all channels of the 87236 to "wait for trigger" state. The measurement starts when a trigger event is received.

Query: Not supported

Setting: :INITiate[:IMMediate][:ALL]

Example: INIT:ALL Set all channels of the 87236 to "wait for trigger" state.

:INITiate[:IMMediate]:SEQuence[1]

Function: Set 87236 to "wait for trigger" state. The measurement starts when a trigger event is received.
Equivalent command:INITiate[1][:IMMediate]

Query: Not supported

Setting: :INITiate[:IMMediate]:SEQuence[1]

Example: INIT:SEQ Set 87236 to "wait for trigger" state.

:INPut:TRIGger:IMPedance

Function: Query or set the trigger input impedance.
Note: The 87236 does not support this command at the moment. This command is used for expansion.

Query: INPut:TRIGger:IMPedance?

Setting: INPut:TRIGger:IMPedance <character data>

Valid forms of character data:
LOW or 0: 50Ω
HIGH or 1: 100kΩ

Example: INP:TRIG:IMP? Query the input impedance
INP:TRIG:IMP HIGH Set the input impedance to high (100kΩ)

:OUTPut:TRIGger[:STATe]

Function: Query or set the trigger output ON/OFF state.
The "Trigger Output" port has the following commands associated with it:
:SERVice:BIST:TBASe:STATe
:SERVice:BIST:VIDeo:STATe
Since there is only one trigger output port, the last input signal of the trigger output port is based on the most recently opened signal, and the other states are switched to "OFF".

Query: :OUTPut:TRIGger[:STATe]?

Setting: :OUTPut:TRIGger[:STATe] <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON.

Example: OUTP:TRIG 0 Disable trigger output.

:TRIGger[1][:IMMediate]

Function: This command puts the 87236 in the trigger waiting state immediately.
The equivalent command is :
INITiate[1]:[IMMediate]
TRIGger[:SEQuence[1]][:IMMediate]

Query: Not supported

Setting: :TRIGger[1][:IMMediate]

Example: TRIG2 Place the 87236 in the trigger waiting state immediately.

:TRIGger:MODE

Function: Query or set the trigger mode of the 87236.

Query: :TRIGger:MODE?

Setting: :TRIGger:MODE <AUTO|NORMal|ALEVel|0|1|2>
AUTO or 0 used to set the automatic trigger mode (If no trigger signal is detected, the 87236 will still be able to measure, but the waveform display may be unstable.) ;
NORMal or 1 used to set the normal trigger mode (if no trigger signal is detected, the 87236 stops measuring until a trigger signal is detected again).
LEVel or 2 used to set the auto-level trigger mode (if no trigger signal is detected, the 87236 automatically searches for the trigger level). ALEVel consists of AUTO and LEVEL jointly. (not supported by 2436).

Example: TRIG:MODE? Query trigger mode (0 means AUTO, 1 means

NORMal, 2 means ALEVel).

TRIG:MODE AUTO — Set to Auto-Trigger.

Limit: The 2436 does not support auto-level trigger mode.

Reset state: The trigger mode is set to Auto-Trigger.

:TRIGger[:SEQuence[1]]:COUNt

Function: Query or set the trigger event detection/measurement cycles count.
For example, a trigger count of 100 means that 100 measurements need to be performed in order to respond to 100 triggers.
The "CALibration[1]:ZERO:AUTO" is set to auto-zero OFF when the trigger count exceeds 1.
When "CALibration[1]:ZERO:AUTO" is set to auto-zero ON, the trigger count returns to the default value of 1.

Query: :TRIGger[:SEQuence[1]]:COUNt? [MIN|MAX]

Setting: :TRIGger[:SEQuence[1]]:COUNt <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1 to 500.
DEF is 1,
MIN is 1,
MAX is 500.

Example:

TRIG:COUN?	Query the trigger count.
TRIG:COUN? MIN	Query the minimum settable trigger count.
TRIG:COUN 100	Set the trigger count to 500.
TRIG:COUN DEF	Set the trigger count to the default value (1 time).

Error message: If the current [SENSe[1]:]MRATe is not in FAST, it prompts "-221, "Setting Conflict"";

Reset state: trigger count is 1.

:TRIGger[:SEQuence[1]]:DELay

Function: Query or set the trigger delay.

Query: :TRIGger[:SEQuence[1]]:DELay? [MIN|MAX]

Setting: :TRIGger[:SEQuence[1]]:DELay <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from -1 to +1 (unit: s).
DEF is 0,
MIN is -1,

MAX is +1.

Example: TRIG:DEL? Query the trigger delay.
TRIG:DEL? MIN Query the minimum settable trigger delay.
TRIG:DEL 1E-4 Set the trigger delay to 100 us.
TRIG:DEL DEF Set the trigger delay to the default value (0 second).

Limit:

Note: For 2436: the trigger delay of two channels share the setting; for 2438: the trigger delay of two channels are independent.

Reset state: Trigger delay is set to 0 second.

:TRIGger[:SEQuence[1]]:HOLDoff

Function: Query or set the holdoff of the 87236, in seconds.

Query: :TRIGger[:SEQuence[1]]:HOLDoff? [MIN|MAX]

Setting: :TRIGger[:SEQuence[1]]:HOLDoff <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 1e-6 to 1 and DEF is 1e-6.

Example: TRIG:HOLD? Query the current trigger holdoff.
TRIG:HOLD 0.01 Set the holdoff to 10ms.

Limit:

Reset state: Holdoff is set to 1e-6 seconds.

:TRIGger[:SEQuence[1]]:HYSTeresis

Function: Query or set the trigger hysteresis of the 87236, in dB.

Query: :TRIGger[:SEQuence[1]]:HYSTeresis? [MIN|MAX]

Setting: :TRIGger[:SEQuence[1]]:HYSTeresis <numeric data>
Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.
<NRf> ranges from 0 to 3 and DEF is 0 (unit: dB).

Example: TRIG:HYST? Query the current trigger hysteresis.
TRIG:HYST 1 Set the trigger hysteresis to 1dB

Limit:

Reset state: 0 dB

:TRIGger[:SEQuence[1]]:IMMediate

Function: This command puts the 87236 in the trigger waiting state immediately.
The equivalent command is:INITiate[1]:[IMMediate]

TRIGger[1][:IMMediate]

Query: Not supported

Setting: :TRIGger[:SEQuence[1]]:IMMediate

Example: TRIG:IMM — Place channel A in the trigger waiting state immediately.

:TRIGger[:SEQuence[1]]:LEVel

Function: Query or set the trigger level.

Query: :TRIGger[:SEQuence[1]]:LEVel? [MIN|MAX]

Setting: :TRIGger[:SEQuence[1]]:LEVel <numeric data>

Valid values for numeric data are: DEF, MIN, MAX, <NRf>, where DEF and <NRf> are used for setting only.

<NRf> ranges from -40 to 20 dBm and the DEF is -5 dBm.

Example: TRIG:LEV? — Query the current trigger level.

TRIG:LEV -3 — Set the trigger level to -3 dBm.

Limit:

Reset state: The trigger level is set to -5 dBm.

:TRIGger[:SEQuence[1]]:LEVel:AUTO

Function: Set 87236 to auto-level trigger state.

Query: :TRIGger[:SEQuence[1]]:LEVel:AUTO?

Setting: :TRIGger[:SEQuence[1]]:LEVel:AUTO <Boolean data>|ONCE|2

Valid forms of <Boolean data> are: 0, OFF, 1, ON.

For "OFF" or "0", the trigger mode is set to auto-trigger: that is, the trigger level is not searched, and if it is not triggered, the waveform will be unstable.

For "ON" or "1", the trigger mode is set to auto-level trigger, which automatically searches the trigger level according to the power of the measured signal.

For "ONCE" or 2, the trigger mode is set to auto-level trigger, and the auto search of trigger level is executed once, and the trigger mode is set to auto trigger after the search is completed.

Example: TRIG:LEVel:AUTO? — Query the auto-level trigger mode (0 means OFF, 1 means ON, 2 means OFF).

TRIG:LEVel:AUTO 2 — Set to auto-level trigger once and turn off auto-level trigger afterwards.

Limit: It is not supported by the 2436, but are supported by the 2438 and the 87236.

Reset state: ON.

:TRIGger[:SEQuence[1]]:POSition

Function: Query or set the delay of the trigger event relative to the initial measurement.

Assuming that the trigger delay time is zero, set the trigger position to LEFT without delay, set to RIGHT will delay 10 horizontal scales, and set to MIDDLE to delay 5 horizontal scales. Note that the TRIGger:DELay command affects the position of the triggered event.

Query: :TRIGger[:SEQuence[1]]:POSition?

The return value is 0 to 2, indicating the left, center and right trigger position respectively.

Setting: :TRIGger[:SEQuence[1]]:POSition <character data>

Valid character data are:

LEFT or 0: Left trigger;

MIDDle or 1: Middle trigger;

RIGHt or 2: Right trigger.

Example:

TRIG:POS?	Query the trigger position.
TRIG:POS MIDD	Set the trigger position to middle trigger.
TRIG:POS 1	Set the trigger position to middle trigger.

Limit: For pulse measurement mode only

Reset state: Set the trigger position to left trigger.

:TRIGger[:SEQuence[1]]:SLOPe

Function: Query or set the trigger slope.

Query: :TRIGger[:SEQuence[1]]:SLOPe?

Setting: :TRIGger[:SEQuence[1]]:SLOPe <character data>

Valid values of character data are:

0 or POSitive: Capture the trigger event at the first transition of the signal.

1 or NEGative: Capture the trigger event at the last transition of the signal.

Example:

TRIG:SLOP?	Query the trigger slope.
TRIG:SLOP NEG	Set the last transition trigger.

Limit:

Reset state: The trigger slope is set to first transition trigger (POSitive).

:TRIGger[:SEQuence[1]]:SOURce

Function: Query or set the trigger source.

The equivalent command is :TRIGger[1]:SOURce

Query: :TRIGger[:SEQuence[1]]:SOURce?

Setting: :TRIGger[:SEQuence[1]]:SOURce <character data>

Valid values of character data are:

BUS: The trigger source is a "*TRG" generic command or a "TRIGger:IMMediate" SCPI.

EXTernal: The trigger source is the trigger input 1 on the rear panel.

HOLD: Trigger hang, trigger 87236 with "TRIGger:IMMediate" command.

IMMediate: Trigger the system to run all the time. If "INITiate:CONTinous" is set to "ON", the 87236 operates in the free-run mode; otherwise, after "INITiate:IMMediate " is sent, it enters the measurement stop state (IDLE state) after one measurement.
INTernal[1] means the trigger source is Channel A.

Example: TRIG:SOUR? Query the trigger source.
TRIG:SOUR INT1 Set the trigger source to Channel A.

Reset state: Trigger source is set to Channel A (INT1).

3.3.13 Unit sub-system command (UNIT)

- :UNIT[1]|2|3|4:POWer.....184
- :UNIT[1]|2|3|4:POWer:RATio.....184

:UNIT[1]|2|3|4:POWer

Function: Query or set the specified measurement power unit. The menu operations are linear and logarithmic.
Absolute power measurements are in W and dBm, corresponding to linear and logarithmic, respectively.
Ratio measurements and relative power measurements are in % and dB, corresponding to linear and logarithmic, respectively.
UNIT1 corresponds to measurement 1;
UNIT2 corresponds to measurement 2;
UNIT3 corresponds to measurement 3;
UNIT4 corresponds to measurement 4;

Query: :UNIT[1]|2|3|4:POWer?

Setting: :UNIT[1]|2|3|4:POWer <character data>
Valid character data are:
DBM or 0: Logarithmic display.
W or 1: Linear display

Example: UNIT2:POW? Query the power unit of measurement 2.
UNIT1:POW W Set the power unit of measurement 1 to W.

:UNIT[1]|2|3|4:POWer:RATio

Function: Query or set the specified measurement ratio measurement power unit. The menu operations are linear and logarithmic.
UNIT1 corresponds to measurement 1;
UNIT2 corresponds to measurement 2;
UNIT3 corresponds to measurement 3;
UNIT4 corresponds to measurement 4;

Query: :UNIT[1]|2|3|4:POWer:RATio?

Setting: :UNIT[1]|2|3|4:POWer:RATio <character data>
Valid character data are:
DB or 0: Logarithmic display.
PCT or 1: Linear display (PCT indicates %)

Example: UNIT2:POW:RAT? Query the power unit of measurement 2.
UNIT1:POW:RAT PCT Set the power unit of measurement 1 to PCT.

3.3.14 Service sub-system command (SERVice)

- :SERVice:BIST:TBASe:STATe.....185
- :SERVice:BIST:VIDeo:STATe.....185
- :SERVice:SENSor[1]:CDATe?.....185
- :SERVice:SENSor[1]:CPLace?.....186
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- :SERVice:SENSor[1]:TYPE?.....187
- :SERVice:SNUMber.....187

:SERVice:BIST:TBASe:STATe

Function: Query or set the state of the internal 10 MHz time base signal output at the "trigger output" port for debugging purposes.
The port has the following commands associated with it.
:SERVice:BIST:TBASe:STATe
:SERVice:BIST:VIDeo:STATe
:OUTPut:TRIGger:[STATe]
Since there is only one trigger output port, the last input signal of the trigger output port is based on the most recently opened signal, and the other states are switched to "OFF".

Query: :SERVice:BIST:TBASe:STATe?

Setting: :SERVice:BIST:TBASe:STATe <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example: SERV:BIST:TBAS:STAT? Query the output state of the time base signal.

Example: SERV:BIST:TBAS:STAT 1 Turn on the output of the time base signal.

Error message:

:SERVice:BIST:VIDeo:STATe

Function: Query or set the state of video output signal output at the "trigger output" port for debugging purposes.
The port has the following commands associated with it.

:SERVice:BIST:TBASe:STATe
:SERVice:BIST:VIDeo:STATe
:OUTPut:TRIGger:[STATe]
Since there is only one trigger output port, the last input signal of the trigger output port is based on the most recently opened signal, and the other states are switched to "OFF".

Query: :SERVice:BIST:VIDeo:STATe?

Setting: :SERVice:BIST:VIDeo:STATe <Boolean data>
Valid forms of <Boolean data> are: 0, OFF, 1, ON

Example: SERV:BIST:VID:STAT? Query the output state of the video output.

Example: SERV:BIST:VID:STAT 1 Turn on the output of the video output.

Error message:

:SERVice:SENSor[1]:CDATe?

Function: Query the calibration date of the 87236. The calibration date is stored in the EEPROM of the 87236.

Query: :SERVice:SENSor[1]:CDATe?

Setting: Not supported

Example: SERV:SENS:CDAT? Query the calibration date of the 87236.

Error message:

:SERVice:SENSor[1]:CPLace?

Function: Query the calibration address of the 87236. The calibration address is stored in the EEPROM of the 87236.

Query: :SERVice:SENSor[1]:CPLace?

Setting: Not supported

Example: SERV:SENS:CPL? Query the calibration address of the 87236.

Error message:

:SERVice:SENSor[1]:FREQuency:MAXimum?

Function: Query the maximum frequency of the 87236. The maximum frequency is stored in the EEPROM of the 87236.

Query: :SERVice:SENSor[1]:FREQuency:MAXimum?

Setting: Not supported

Example: SERV:SENS:FREQ:MAX? Query the maximum frequency of the 87236.

Error message:

:SERVice:SENSor[1]:FREQuency:MINimum?

Function: Query the minimum frequency of the 87236. The minimum frequency is stored in the EEPROM of the 87236.
Query: :SERVice:SENSor[1]:FREQuency:MINimum?
Setting: Not supported
Example: SERV:SENS:FREQ:MIN? Query the minimum frequency of the 87236.
Error message:

:SERVice:SENSor[1]:SNUMber?

Function: Query the string number of the 87236. The string number of the 87236 is stored in the EEPROM of the 87236.
Query: :SERVice:SENSor[1]:SNUMber?
Setting: Not supported
Example: SERV:SENS:SNUM? Query the string number of the 87236.
Error message:

:SERVice:SENSor[1]:TYPE?

Function: Query the type of the 87236. The type of the 87236 is stored in the EEPROM of the 87236.
Query: :SERVice:SENSor[1]:TYPE?
Setting: Not supported
Example: SERV:SENS:TYPE? Query the type of the 87236.
Error message:

:SERVice:SNUMber

Function: Query or set the string number of the 87236.
Query: :SERVice:SNUMber?
Setting: :SERVice:SNUMber <character data>
Temporarily reserved.
Example: SERV:SNUM?

4. Programming examples

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4.1 Examples of basic operation

Take the following as an example to describe the basic method for realizing instrument programming via the VISA library. Take the C++ language as an example.

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4.1.1 VISA library

VISA is the generic name for the standard I/O function library and its associated specifications. VISA library function is a set of functions that can be easily recalled. Its core function can control various types of devices without considering the interface type of devices and the use of different I/O interface software. These library functions are used to write the driver program of the instrument and complete the command and data transmission between the computer and the instrument, so as to realize programming control of the instrument. By initializing the addressing string ("VISA resource string"), a connection to an instrument with a program port (LAN, USB, GPIB and RS-232, etc.) can be established.

To realize remote control, the VISA library must be installed first. The VISA library is encapsulated with the transmission function at the bottom layer with VXI, GPIB, LAN and USB interfaces, so as to facilitate users' direct recall. The programming interface supported by the 87236 is USB. These interfaces, combined with the VISA library and programming language, allow remote control of the 87236. At present, Keysight I/O Library provided by Keysight is often used as the underlying I/O Library.

Figure 4.1 shows the relationship between the programming control interfaces, VISA libraries, programming languages and the 87236 with the USB interface as an example.

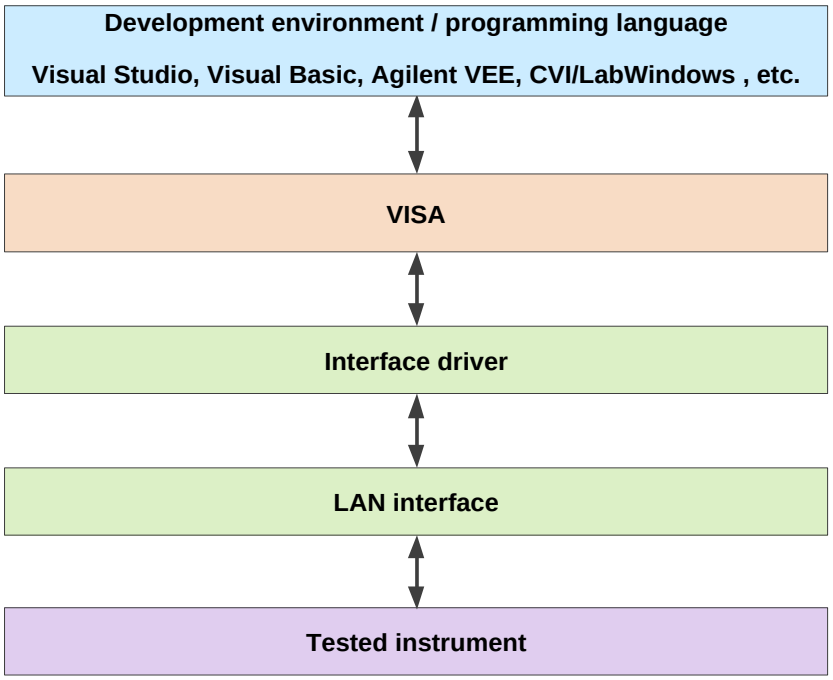

Figure 4.1 Programmable software/hardware layer

4.1.2 Examples of runtime environment

4.1.2.1 Configuration requirements

The programming examples described in this chapter have run successfully on a computer configured as follows.

- IBM compatible PC above Pentium class;
- Windows 2000, Windows XP, Windows 7 or, Windows 8, Windows 10 operating systems.
- Visual Studio 2010/2012/2013/2015/2017 integrated development environment;
- VISA library of NI or Keysight;
- USB cable

4.1.2.2 Files included

To run an example program written in C/C++, you must include the required files in the VC project.

If you use the VISA library, you must:

- Add visa32.lib to the source file;
- Add visa.h to the header file.

If you use the NI-488.2 library, you must:

- Add GPIB-32.OBJ file to the source file;
- Add windows.h file to the header file;
- Add Deci-32.h file to the header file.

For more information about the NI-488.2 library and VISA library, please refer to the websites of NI and Keysight respectively.

4.1.3 Initialization and setting default state

To start the program, the VISA resource manager must be initialized, so as to open and establish the communication connection between the VISA library and instrument. The specific steps are as follows:

4.1.3.1 Generation of global variables

Start by generating global variables that other program modules will recall, such as instrument handle variables. The following example programs shall contain the following global variables:

ViSession iDevHandle;

ViSession iDefaultRM;

const char rgcDevRsc[MAX_RSC_LEN] ="USB0::1204::4112::2019001::0::INSTR";

const int iTmo = 5000;

Where, the constant rgcDevRsc represents the instrument descriptor, "USB0" represents the controller, "1204" represents the vendor ID of the instrument, 4112 is the product ID, and 2020001 is the product serial number.

If the instrument is controlled via the GPIB interface and the GPIB address is "20", then the value of the variable is

const char rgcDevRsc[MAX_RSC_LEN] = "GPIB0::20::INSTR";

If the instrument is controlled via a LAN socket interface with IP address 192.168.1.1 and port number 5025, then the value of the variable is

const char rgcDevRsc[MAX_RSC_LEN] = "TCPIP0::192.168.1.1::5025::SOCKET";

If the instrument is controlled via the LAN interface with IP address 192.168.1.1, then the value of the variable is

const char rgcDevRsc[MAX_RSC_LEN] = "TCPIP0::192.168.1.1::INSTR";

4.1.3.2 Initialization of the controller

/***

The following examples show how to open and establish a communication connection between the VISA library and the instrument (as specified by the instrument descriptor).

4.1 Examples of basic operation

//Initialize the controller: open the default resource manager and return the instrument handle iDevHandle.

**********/

```
void InitController()
{
    ViStatus iStatus;
    iStatus = viOpenDefaultRM(&iDefaultRM);
    iStatus = viOpen(iDefaultRM, rgcDevRsc, VI_NULL, VI_NULL, &iDevHandle);
}
```

4.1.3.3 Initializing the instrument

/**********/

The following example shows how to initialize the default state of the instrument and empty the state register.

/**********/

```
void InitDevice()
{
    ViStatus iStatus;
    ViUInt32 uiRetCnt;
    iStatus = viWrite(iDevHandle, "*CLS\n", strlen("*CLS\n"), &uiRetCnt); //Status Reset
    iStatus = viWrite(iDevHandle, "*RST\n", strlen("*RST\n"), &uiRetCnt); //Instrument Reset
}
```

4.1.4 Sending setting command

/**********/

The following example shows how to set the frequency of the 87236.

/**********/

```
void SimpleSettings()
{
    ViStatus iStatus;
    ViUInt32 uiRetCnt;

    //Set the frequency to 128MHz
    iStatus = viWrite(iDevHandle, "FREQ 1.2e8\n", strlen("FREQ 1.2e8\n"), &uiRetCnt);
}
```

4.1.5 Reading the state of measuring instrument

```
/*****************************************************************************/
```

The following examples show how to read the set state of the instrument.

```
/*****************************************************************************/
void ReadSettings()
{
    ViStatus iStatus; //Status
    ViUInt32 uiRetCnt; //read the returned bytes
    char rgcBuf[256]; //Temporary buffer
    char* pcCmd = NULL; //Command pointer

    //QueryFreq
    pcCmd = "FREQ?\n";
    iStatus = viWrite(iDevHandle, pcCmd, strlen(pcCmd), &uiRetCnt);
    Sleep(10);
    iStatus = viRead(iDevHandle, rgcBuf, sizeof(rgcBuf), &uiRetCnt);
    //Print debugging information
    printf("frequency %s", rgcBuf);
}
```

4.1.6 Command synchronization

```
/*****************************************************************************/
```

The following examples illustrate the methods for command synchronization with sweep process.

```
/*****************************************************************************/
void SweepSync()
{
    ViStatus iStatus; //Status
    ViUInt32 uiRetCnt; //read the returned bytes
    ViEventType eType; //Event Type
    ViEvent eEvent; //Event
    int iStat; //State word
    char rgcOpcOk[256]; //OPC string
    char* pcCmd = NULL; //Command pointer

    /*************************************************************************/
    /* The command INITiate[:IMMediate] is used to start single sweep (when
    continuous sweep is OFF, INIT:CONT OFF)*/
    /* Only at the end of single sweep can the next command in the command
```

```
        buffer be executed                    */                    */
        /*****************************************************************/
        pcCmd = "INIT:CONT OFF\n";
        iStatus = viWrite(iDevHandle, " pcCmd ", strlen(pcCmd), &uiRetCnt);
        //Method 1 for waiting for the sweep to end: use *WAI
        pcCmd = "ABOR;INIT:IMM;*WAI\n";
        iStatus = viWrite(iDevHandle, " pcCmd ", strlen(pcCmd), &uiRetCnt);
        //Method 2 for waiting for the sweep to end: use *OPC?
        pcCmd = "ABOR;INIT:IMM; *OPC?\n";
        iStatus = viWrite(iDevHandle, " pcCmd ", strlen(pcCmd), &uiRetCnt);
        iStatus = viRead(iDevHandle, rgcOpcOk, 2, &uiRetCnt); //wait for *OPC to return
        "1"
        //Main program continues……
    }
```

4.2 Examples of advanced operation

- Examples of USBTMC programming control……194

4.2.1 Examples of USBTMC programming control

- Before using the examples……194
- Example……194

4.2.1.1 Before Using the Examples

If you use VISA library for programming control, you need to install VISA library, such as KeysightIO17.2, NI VISA5.0, etc.

Note that lower versions of the VISA library do not support the USBTMC programming feature.

4.2.1.2 Examples

- Using VISA library and C++ language to implement web programs……194

1) Using VISA library and C++ language to implement web programs

```
/*************************************************************
In this example, USB programming control is implemented via the VISA library.
```

Start VS2005 or above, add the necessary files and add the directory where visa.h is located to the "Include files" path of the project (to add: press "Tools" in the menu, then press "Options", "Projects and Solutions", "VC++ Directory", and then select "Include files" under the "Show directories with the following content", and add the directory where visa.h is located in the list. (For the English version of VS, please refer to the above method to set up, without further explanation.)

Enter the following code into your .cpp file

```
**************************************************************/
#include "stdafx.h"
#include <visa.h>
#include <stdio.h>
#include <stdlib.h>

#define M_USB_VID     1204       //USB Vendor ID
#define M_USB_PID     4112       //Instrument ID
#define M_USB_SN      "ZGK00541" //Instrument Serial Number (No.)

//Description:
ViSession g_uiDefaultRm = 0; //Resource Handle
ViSession g_uiInstrHandle = 0; //Device VISA Handle

void UsbInit(void);
void UsbTest(void);
void UsbClose(void);
//USB test main program
void UsbTestMain(void)
{
    //Initialize (user opens the instrument connection before using the instrument)
    UsbInit();

    //Test (user can communicate with the instrument)
    UsbTest();

    //OFF (close the instrument connection when the user is no longer using the
instrument)
    UsbClose();
}

//USB initialization
void UsbInit(void)
{
    ViStatus iStatus = 0; //State
```

```
    ViChar rgcBuf[256]; //Temporary buffer

    sprintf(rgcBuf, "USB0::%d::%d::%s::0::INSTR", M_USB_VID,M_USB_PID,M_USB_SN);
    iStatus = viOpenDefaultRM(&g_uiDefaultRm); //Open VISA Task
    if (iState)
    {
        printf("The task cannot be opened. Please recheck the device and connect\n").
    }
    else
    {
        iStatus = viOpen(g_uiDefaultRm, rgcBuf, VI_NULL, 5000, &g_uiInstrHandle);
        if (iState)
        {
            printf("The devicee cannot be opened. Please recheck the device and
connect\n");
        }
        else
        {
        }
    }
}
//USB Test
void UsbTest(void)
{
    ViStatus iStatus = 0; //State
    ViChar rgcBuf[256]; //Temporary buffer
    ViByte rgcRead[256]; //Read buffer
    ViReal64 rgdFreq[2]; //Frequency array
    ViUInt32 uiRetCnt; //Return length

    if (0 == g_uiInstrHandle)
    {
        printf("The device is not opened. Please recheck the device and connect\n");
    }
    else
    {
        //1) First query the frequency of channel A, and store it in rgdFreq[0]
        viPrintf(g_uiInstrHandle, "SENS1:FREQ?\n");
        Sleep(10);
        viRead(g_uiInstrHandle, rgcRead, sizeof(rgcRead), &uiRetCnt);
        rgcRead[uiRetCnt] = 0;
        printf((PCHAR)rgcRead);
```

```
            sscanf((PCHAR)&rgcRead[0], "%lf", &rgdFreq[0]);
            sprintf(rgcBuf, "Frequency of channel A: %lg\n", rgdFreq[0]);
            printf(rgcBuf);

            //2) Set the frequency of channel A to 0.78 GHz
            viPrintf(g_uiInstrHandle, "SENS1:FREQ    %lfGHz\n", 16.78);

            //3) Query the frequency of channel A, and store it in rgdFreq[1]
            viPrintf(g_uiInstrHandle, "SENS1:FREQ?\n");
            viScanf(g_uiInstrHandle, "%t", rgcBuf);            //Put the query results into an
array
            printf(rgcBuf);

            sscanf(rgcBuf, "%lf", &rgdFreq[1]);
            sprintf(rgcBuf, "Frequency of channel A: %lg\n", rgdFreq[1]);
            printf(rgcBuf);

            //4) Restore the frequency of channel A
            viPrintf(g_uiInstrHandle, "SENS1:FREQ    %lg\n", rgdFreq[0]);
        }
}
//USB close
void UsbClose(void)
{
        if (0 != g_uiInstrHandle)
        {
            viClose(g_uiInstrHandle); //Close the device
            g_uiInstrHandle = 0;
        }
        if (0 != g_uiDefaultRm)
        {
            viClose(g_uiDefaultRm); //Close default tasks
            g_uiDefaultRm = 0;
        }
}
```

4.2.2 Linux development examples

Currently, there are many versions of Linux systems in the market, and most of them cannot install the VISA library. The example in this section uses the system common read/write command to realize the programmable use of the 87236.

Note: Linux shall support the USBTMC protocol.

```
*************************************************************************
#include <fcntl.h>

#define O_RDWR                  2
#define USB_MAX_BUFFER     4096
#define M_CMD_IDN             "*IDN?"
#define M_CMD_MEASURE       "MEAS?"

int UsbtmcTest()
{
    //If there are multiple devices, it may be "/dev/usbtmc1",.....
    char* pcUsbtmcDev = "/dev/usbtmc0";
    char* pcWritePtr;
    unsigned int uiHandle;
    unsigned long dwReadCnt;
    char cReadBuf[USB_MAX_BUFFER];
    unsigned int iStatus;

    //The device must be turned on before use
    uiHandle = open(pcUsbtmcDev, O_RDWR, 666);

    //Send the command "*IDN?" to the device
    pcWritePtr = M_CMD_IDN;
    iStatus = write(uiHandle, pcWritePtr, strlen(pcWritePtr));
    //Read information from the device
    dwReadCnt = read(uiHandle, cReadBuf, USB_MAX_BUFFER);
    printf("IDN is: %s", cReadBuf);

    //Send the command "MEAS?" to the device
    pcWritePtr = M_CMD_MEASURE;
    iStatus = write(uiHandle, pcWritePtr, strlen(pcWritePtr));
    //Read information from the device
    dwReadCnt = read(uiHandle, cReadBuf, USB_MAX_BUFFER);
    printf("The measurement result is : %s", cReadBuf);
```

```
    //The device must be turned off at the end of use
    close(uiHandle);
}
*************************************************************************
```

4.3 Application Examples

4.3.1 Free-run based for peak and average power measurements

The peak value and average power of the pulse can be measured without capturing the trigger signal, with fast measurement speed and high efficiency, which is suitable for measuring the average power of the signal. The default aperture size is 50ms, which is only applicable to signals with a measurement period of less than 1ms. When the periodic signal is greater than 1ms, it is necessary to set the aperture size to an integral multiple of the periodic signal (it is recommended to be more than 10 times. The larger the setting is, the more stable the measurement is, but the longer the measurement time is).

- SYST:PRES //Reset the device to its default value
- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR IMM //Trigger source set to execute immediately
- CALC1:FEED "POW:AVER" //Configure Measurement 1 to measure the average power of the pulse
- CALC2:FEED "POW:PEAK" //Configure Measurement 2 to measure the peak power of the pulse

  //Execute the following two commands according to the actual test requirements (external zeroing operation is required when measuring small signals)
- CAL:ZERO:TYPE EXT //Set to external zeroing mode
- CAL:ZERO:AUTO ONCE //Cut off the signal input and perform an external zeroing

  //Automatically change the frequency according to the test signal
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- MEAS1? //Perform a measurement and read the average power of the pulse
- FETCH2? //Read the peak power of the pulse

4.3.2 Gate-based measurement of pulse power, average power, peak power and pulse top fluctuation

The "gate" based measurement method can support up to four "gates" for simultaneous

measurement, and users can configure the start and length of the "gate" measurement according to their needs, making the measurement method more flexible.

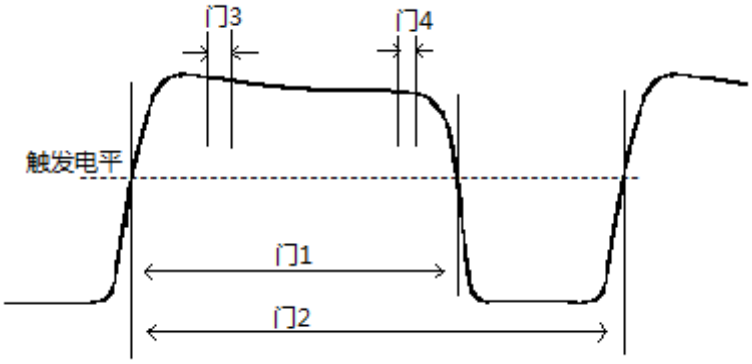

Figure 4.2 Gate measurement diagram

The measured signal as shown in the figure is a pulse signal with a period of 100 us and a pulse width of 70 us.

- SYST:PRES //Reset the device to its default value
- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR INT //Trigger source set to internal
- CALC1:FEED "POW:AVER ON SWEEP1" //Configure Measurement 1 to measure the average power of gate 1
- CALC2:FEED "POW:AVER ON SWEEP2" //Configure Measurement 2 to measure the average power of gate 2
- CALC3:FEED "POW:PEAK ON SWEEP1" //Configure Measurement 3 to measure the peak power of gate 1
- CALC4:FEED1 "POW:AVER ON SWEEP3" //Configuration measurement 4 input 1 is the average power of gate 3
- CALC4:FEED2 "POW:AVER ON SWEEP4" //Configuration measurement 4 input 2 is the average power of gate 4

  //Execute the following two commands according to the actual test requirements (external zeroing operation is required when measuring small signals)
- CAL:ZERO:TYPE EXT //Set to external zeroing mode
- CAL:ZERO:AUTO ONCE //Cut off the signal input and perform an external zeroing

  //Automatically change the frequency and the measurement length of the gate according to the test signal
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- SWE1:TIME 70e-6 //Measurement length of gate 1 is 70 us
- SWE2:TIME 100e-6 //Measurement length of gate 2 is 100 us
- SWE3:OFFS:TIME 7e-6 //Measurement start time of gate 3 is 7 us
- SWE3:TIME 1e-6 //Measurement length of gate 3 is 1 us
- SWE4:OFFS:TIME 62e-6 //Measurement start time of gate 4 is 62 us

- SWE4:TIME 1e-6 //Measurement length of gate 4 is 1 us

- MEAS1? //Perform a measurement and read the average power (pulse power) of gate 1
- FETCH2? //Read the average power (average power) of gate 2
- FETCH3? //Read the peak power (peak power) of gate 3
- FETCH4:RAT? //Read the measured value of the average power of gate 3 - average power of gate 4 (pulse top fluctuation)

4.3.3 Fast build-up of top-of-pulse average power measurements with "gates"

- SYST:PRES //Reset the device to its default value
- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR INT //Trigger source set to internal
- TRAC:STAT ON //Enable trace measurement
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- CALC:FEED "POW:AVER ON SWEEP1" //Configure Measurement 1 to measure the average power of gate 1
- SENS:TRAC:AUTO //Automatic setting
- SENS:SWE:AUTO:REF1 10.0 //Set the start position of automatic gate to 10% of gate 1
- SENS:SWE:AUTO:REF2 10.0 //Set the end position of automatic gate to 90% of gate 1
- SENS:SWE:AUTO ON //Set Gate 1 as automatic gate
- MEAS? //Perform one measurement and obtain the average power of gate 1

4.3.4 GSM timeslot measurements in list mode

- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR EXT //Trigger source set to external
- SENS:LIST:STAT ON //Enable list mode.
- SENS:LIST:FREQ:STAR 1 GHz //Set start frequency to 1 GHz
- SENS:LIST:FREQ:STOP 10 GHz //Set start frequency to 10 GHz
- SENS:LIST:POIN 10 //Set the number of measurement points to 10
- SENS:LIST:MTYP AVER //Set the measurement type to average power
- SENS:LIST:TSC 2 //Set the number of time slots to 2
- SENS:LIST:TSL:EXCL:OFFS:TIME 0 //Offset time of the exclusion area is 0

- SENS:LIST:TSL:EXCL:TIME 0 //Time length of the exclusion area is 0
- SENS:LIST:TSL:TIME 577e-6 //Time length of the time timeslot measurement is 577 us
- SENS:LIST:TSL:TREF1 10 //Start time offset of the time timeslot measurement is 10%
- CAL:ZERO:AUTO OFF // Turn auto- zero off

//Repeat the following commands to obtain multiple measurement results

- INIT:CONT ON //Initiate measurement
- *OPC //Set the operation end bit in the standard event state register
- *ESR? //Query the value of the standard event state register
- FETC? //Fetch measurement results

4.3.5 External trigger buffer measurement

- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR EXT //Trigger source set to external
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- SENS:FREQ:STEP 0 //Sweep points 0
- SENS:BUFF:MTYP "AVER" //Buffer measurement type is Average Power
- SENS:BUFF:COUN 10 //Number of buffer measurements 10
- TRIG:DELAY 100 us // Capture external trigger signal with 100 us delay
- SENS:SWE:APER 750 us //Set aperture to 750 us
- CAL:ZERO:AUTO OFF // Turn auto- zero off

//Repeat the following commands to obtain multiple measurement results

- INIT:CONT ON //Initiate measurement
- *OPC //Set the operation end bit in the standard event state register
- *ESR? //Query the value of the standard event state register
- FETC? //Fetch measurement results

4.3.6 External trigger buffer sweep measurement

- DET:FUNC NORM //Set the measurement mode to "NORM"
- TRIG:SOUR EXT //Trigger source set to external
- SENS:BUFF:MTYP "AVER" //Buffer measurement type is Average Power
- SENS:FREQ:STAR 1 GHz //Set the start frequency to 1 GHz
- SENS:FREQ:STOP 10 GHz //Set start frequency to 10 GHz
- SENS:FREQ:STEP 10 //Sweep points 10

- TRIG:DELAY 100 us // Capture external trigger signal with 100 us delay
- SENS:SWE:APER 750 us //Set aperture to 750 us
- CAL:ZERO:AUTO OFF // Turn auto- zero off

//Repeat the following commands to obtain multiple measurement results

- INIT:CONT ON //Initiate measurement
- *OPC //Set the operation end bit in the standard event state register
- *ESR? //Query the value of the standard event state register
- FETC? //Fetch measurement results

4.3.7 Fast Measurement Mode (Free Run)

"AVER" mode (4000 readings/sec)

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- UNIT:POW W //Calculation 1 power measurement unit W
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:AVER OFF //Measurement average OFF
- SENS:DET:FUNC AVER //Measurement mode "AVER"
- SENS:MRAT FAST //Measurement speed in fast mode
- TRIG:COUN 100 //Measurement buffer size 100
- SENS:SWE:APER 250e-6 //Set the aperture length to 250 us
- FETC? //Fetch measurement results

"NORM" mode (50000 readings/sec)

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- UNIT:POW W //Calculation 1 power measurement unit W
- CAL:ZERO:AUTO OFF //Auto-zeroing OFF
- CAL:AUTO OFF //Auto-calibration OFF
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:AVER OFF //Measurement average OFF
- SENS:DET:FUNC NORM //Measurement mode "NORM"
- SENS:MRAT FAST //Measurement speed in fast mode
- TRIG:COUN 200 //Measurement buffer size 200
- SENS:SWE:APER 20e-6 //Set the aperture length to 20 us
- FETC? //Fetch measurement results

4.3.8 Fast Measurement Mode (External Trigger)

When the aperture length is not larger than the time interval of the external trigger signal, the external trigger signal can be captured continuously without interruption.

4.3 Application Examples

The measurement speed is determined by the greater of the time interval of the external trigger signal and the length of the aperture.

"AVER" mode, up to 4000 readings/sec;
"NORM" mode, up to 50,000 readings/sec.

The following routines help users establish GSM timeslot measurement based on external trigger (16 GSM Architecture), which can continuously measure 128 timeslots.

"AVER" mode

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- TRIG:SOUR EXT //Set to external trigger
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:AVER OFF //Measurement average OFF
- SENS:DET:FUNC AVER //Measurement mode "AVER"
- SENS:MRAT FAST //Measurement speed in fast mode
- TRIG:COUN 128 //Measurement buffer size 128
- SENS:SWE:APER 500e-6 //Set the aperture length to 500 us
- FETC? //Fetch measurement results

"NORM" mode

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- TRIG:SOUR EXT //Set to external trigger
- CAL:ZERO:AUTO OFF //Auto-zeroing OFF
- CAL:AUTO OFF //Auto-calibration OFF
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:AVER OFF //Measurement average OFF
- SENS:DET:FUNC NORM //Measurement mode "NORM"
- SENS:MRAT FAST //Measurement speed in fast mode
- TRIG:COUN 128 //Measurement buffer size 128
- TRIG:DEL 50e-6 //Set the trigger delay to 50 us
- SENS:SWE:APER 500e-6 //Set the aperture length to 500 us
- FETC? //Fetch measurement results

4.3.9 Continuous and Uninterrupted Measurements

The average power of known periodic signals, especially large periodic signals, can be accurately measured.

Mode 1: Accurate measurement of the signal with a period of 5s = 50ms*100 (FETCH mode)

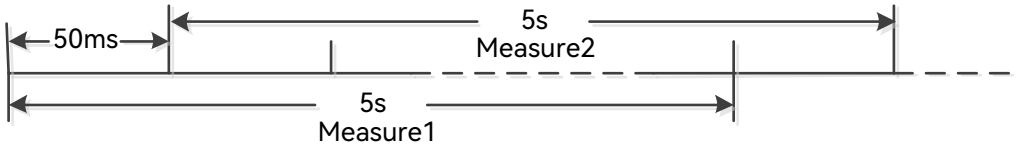

Figure 4.3 Measurement process diagram

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- CAL:ZERO:AUTO OFF //Auto-zeroing OFF
- CAL:AUTO OFF //Auto-calibration OFF
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:DET:FUNC NORM //Measurement mode "NORM"
- SENS:SWE:APER 50e-3 //Set the aperture measurement length to 50ms
- SENS:AVER:COUN 100 //Set the average number of measurements to 100
- FETC? //Fetch measurement results

Mode 2: Accurate measurement of the signal with a period of 5s = 50ms*100 (MEAS mode)

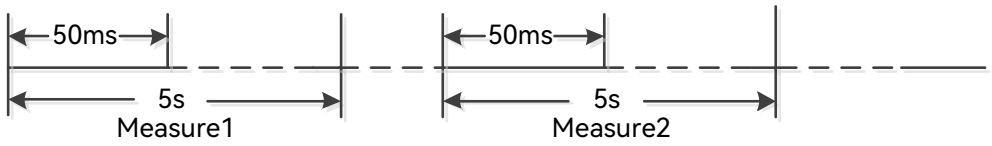

Figure 4.4 Measurement process diagram

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- CAL:ZERO:AUTO OFF //Auto-zeroing OFF
- CAL:AUTO OFF //Auto-calibration OFF
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:DET:FUNC NORM //Measurement mode "NORM"
- SENS:SWE:APER 50e-3 //Set the aperture measurement length to 50ms
- SENS:AVER:COUN 100 //Set the average number of measurements to 100
- MEAS? //Perform a measurement and obtain the results

Mode 3: Accurate measurement of the signal with a period of 1s = 50ms*20 (The measurement period of this method cannot exceed 1 second)

4.3 Application Examples

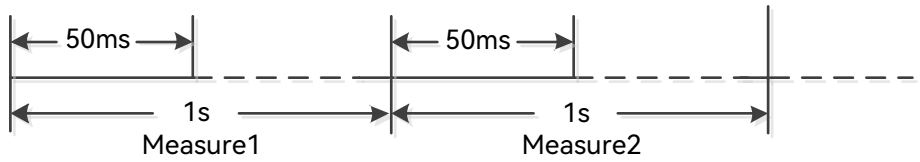

Figure 4.5 Measurement process diagram

- SYST:PRES //Reset the device to its default value
- SENS:FREQ 1 GHz //Set the frequency to 1 GHz
- CAL:ZERO:AUTO OFF //Auto-zeroing OFF
- CAL:AUTO OFF //Auto-calibration OFF
- SENS:AVER OFF //Measurement average OFF
- SENS:AVER:SDET OFF //Step detection OFF
- SENS:DET:FUNC NORM //Measurement mode "NORM"
- SENS:MRAT FAST //Measurement speed in fast mode
- TRIG:COUN 20 //Measurement buffer size 20
- SENS:SWE:APER 50e-3 //Set the aperture measurement length to 50ms
- FETC? //Obtain the measurement results (the average power in this period can be obtained by summing and averaging all the measurement results)

5. Error description

This chapter will show you how to find problems and accept after-sales service. and explain error message of the 87236.

- Error message.....207
- Method to obtain after-sales services.....212

5.1 Error message

The 87236 records errors during measurement in two ways: error message queues displayed on the front panel and SCPI (in the remote control mode) error message queues. which are stored and managed separately.

1) Error message format and description

In remote control mode, errors are recorded in the error/event queue of the state reporting system, and can be queried with the command "SYSTem:ERRor?". The format is as follows:

"<Error code>, "<Error in error queue>; ["Detailed error description]"

Example:

"-110", Data out of range;"

The programming control error message includes two types:

- A negative error code defined by the SCPI standard. This type of error is not specified here.

Table 5.1 List of descriptions on instrument feature error messages

Failure code	Error description
-101	. Invalid character: There are invalid characters in the command string (command or parameter). For example: AVER:COUN !6
-102	. Syntax error: The command string syntax is invalid. For example: DISPlay:ACT, CH1
-108	. Parameters are not allowed: the command has too many parameters, or the command

Failure code	Error description
	without parameters follows the parameters. For example: TRAC:AUT ON
-109	. Missing parameters: The command has too few parameters. For example: AVER
-112	. Command string is too long: A single segment of the command has more than 12 characters. For example: OUTPutROSCillatorSTATe ON
-113	Undefined header Undefined header: 87236 receives an unrecognized command. Possible causes: Wrong spelling, or wrong abbreviation of the command, etc. For example: CALI:AUTO
-121	. Invalid characters in the numeric value: there are invalid characters in the numeric parameter. For example:SENS:CORR:GAIN2 #12
-123	. The index is too large: the index of numerical parameters exceeds 32000. For example: SENS:CORR:GAIN2 1E32001
-124	. Too many bits: the number of bits of numeric parameters exceeds 255, without the leading 0.
-128	. Numeric parameters are not allowed: commands that cannot receive numeric parameters receive a numeric value.
-131	. Invalid suffix: the suffix of numeric parameter is incorrect. For example: FREQ 10GZ
-134	. Suffix too long: the suffix exceeds 12 characters. For example: FREQ 10GHHHHHHHHHHHHHHHHHHZ
-138	. Suffix not allowed: numeric parameters cannot be followed by suffixes. For example: SENS:CORR:GAIN2 12HZ
-148	. Character data is not allowed: Check whether quotation marks need to be added. For example: MEM:CLE State_1 Correct: MEM:CLE "State_1"

Failure code	Error description
-151	. Invalid string data: Check whether the single quotation marks or double quotation marks of the string match. For example: MEM:CLE "State1
-158	. Character data is not allowed: Check whether the parameter type is valid. For example: OUTP:ROSC "ON"
-161	. Invalid block data: Check according to Section 7.7.6 of IEEE 488.2.
-168	. Block data not allowed: a valid data block was detected, but the command does not support data blocks. For example: OUTP:ROSC #15FETC?
-178	. Expression data not allowed: a valid expression was detected, but expression is not allowed in the 87236. For example: SENS:CORR:GAIN2 (1+3)
-211	Trigger ignored Trigger ignored: when 87236 is not in "wait for trigger" state, trig:imm, *trg and other commands are received.
-213	Init ignored Initialization is ignored: when 87236 has been initialized, the measurement initialization command is received. For example: INIT:CONT ON INIT
-214	Trigger deadlock Trigger deadlock
-220	Parameter error; Frequency list must be in ascending order. Parameter error; the frequency list must be arranged in ascending order
-221	. Setting conflict: there are many reasons for conflict, such as setting trigger delay during statistical measurement.
-222	. Data out of range: Numerical data is not within the valid range. for example: AVER:COUN 100000
-224	. Illegal parameter value: a discrete parameter was received, but it is invalid for this command.
-226	Lists not same length

Failure code	Error description
	List length is different
-230	Data corrupt or stale; Please calibrate Invalid or damaged data; Please calibrate.
-231	Data questionable; CAL ERROR Data question; Calibration error: the 87236 calibration failed. The most likely reason is that 87236 is not connected to the output of the calibration source during calibration. Data questionable; CAL ERROR Ch1 Data question; channel A calibration error: the 87236 calibration failed. The most likely reason is that 87236 is not connected to the output of the calibration source during calibration. Data questionable; CAL ERROR Ch2 Data question; channel B calibration error: the 87236 calibration failed. The most likely reason is that 87236 is not connected to the output of the calibration source during calibration. Data questionable; Input Overload Data question; Input overload: the power input exceeds the upper power limit of the 87236. Data questionable; Input Overload Ch1 Data question; Input overload: the power input exceeds the upper power limit of the 87236. Data questionable; Lower window log error Data question; Logarithm error in lower measurement: when the difference measurement is carried out, the measurement result is 0 and the unit of display is logarithm. Data questionable; Upper window log error Data question; Logarithm error in upper measurement: when the difference measurement is carried out, the measurement result is 0 and the unit of display is logarithm. Data questionable; ZERO ERROR Data question; Zeroing error: the 87236 zeroing failed. The most likely reason is that there is power signal input during zeroing. Data questionable; ZERO ERROR Ch1 Data question; channel A zeroing error: the 87236 zeroing failed. The most likely reason is that there is power signal input during zeroing.
-241	. Missing hardware: 87236 cannot execute the command, type mismatch.
-310	System error; Sensor EEPROM Read Failed - critical data not found or unreadable System error; EEPROM read failed - key data not found or unreadable System error; Sensor EEPROM Read Failed - unknown EEPROM table format System error; EEPROM read failed - unknown EEPROM format.
-321	. Exceeding memory

Failure code	Error description
-330	Self-test Failed; Self-test failed
-350	Queue overflow Queue overflow: the error queue is full, and subsequent errors will no longer be recorded.
-410	Query INTERRUPTED The query is interrupted: A command needs to send data to the output buffer, but the send buffer already contains the data sent by the previous command (without overwriting the previous data). The output buffer is cleared on shutdown or on receipt of the *RST command. Refer to Section 6.3.2.3 of IEEE 488.2 for details.
-420	Query UNTERMINATED Query not ended: The 87236 is set to Speak (i.e., send data to the interface bus), but the command to send data to the output buffer is not received. Refer to Section 6.3.2.2 of IEEE 488.2 for details. For example, after executing the CONFigure command (which produces no data), an attempt is made to read data from the remote interface.
-430	Query DEADLOCKED Query deadlock: The output buffer cannot hold too much data generated by the command, and the output buffer is full. Command execution continues but data is lost. Refer to Section 6.3.1.7 of IEEE 488.2 for details.
-440	Query UNTERMINATED after indefinite response Query not ended after an indefinite response: Some combination queries may generate illegal response messages. If a query command that produces an indefinite response (any block response of indefinite length or any ASCII response data) is not the last query command, the instrument will report a query error and no further responses will be sent after that query command. Refer to Section 6.5.7.5 of IEEE 488.2 for details.

2) Error message type

The error event corresponds only to one type of error message, and the error message types are introduced in details below:

- Query error (−499 to −400): indicates the output queue control of the instrument detects the message exchange protocol error specified in Chapter 6 of IEEE 488.2. At this time, the event state register of the error query bit (bit2) is set (for details, refer to 6.5 of IEEE 488.2). The data cannot be successfully read from the output queue at this time.
- Instrument characteristic error (-399 to -300, 201 to 703, and 800 to 810): indicating that the instrument operation is not successful, and the reason may be abnormal hardware or firmware state. Such error codes are often used self-detection of the instrument. At this point, the instrument characteristic error bit (bit3) of the event state register is set.

- Execution error (-299 to -200): indicating that an error is detected during the measurement of the instrument. At this point, the execution error bit (bit4) of the event state register is set.
- Command error (-199 to -100): indicating a syntax error detected during command parsing of the instrument, usually due to an incorrect command format. At this point, the command error bit (bit5) of the event state register is set.

5.2 Method to obtain after-sales services

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5.2.1 Contacting us

In case of any failure to the 87236, check and store the error message, analyze possible causes, and refer to the methods provided in "7.2 Fault diagnosis and troubleshooting" in the user's manual for preliminary troubleshooting. If the problem cannot be solved, contact the service and consultation center of the Company as per the contact information provided below and provide us with the error message collected. We will coordinate with you to solve the problem as soon as possible.

Contact information:

Service consultation: 400-1684191

Website: www.ceyear.com

Email: techbb@ceyear.com

Postal code: 266555

Address: No. 98, Xiangjiang Road, Huangdao District, Qingdao, Shandong Province, China

5.2.2 Package and mailing

In case of any failure to the 87236 that is difficult to be eliminated, contact us by phone or fax. If it is confirmed that the 87236 has to be returned for repair, pack it with the original packing materials and packing box by following the steps below:

1) Prepare a detailed description of the failure of the 87236 and put it into the packing box along with it.

2) Pack the 87236 with the original packing materials, so as to minimize possible damage;
3) Place cushions at the four corners of the outer packing box, and place the network analyzer in the outer packing box.
4) Seal the opening of the packing box with adhesive tape and reinforce the packing box with nylon tape.
5) Specify text like "Fragile"! Do not touch! Handel with care!" and so on.
6) Please consign it as precision instruments.
7) Keep a copy of all shipping documents.

NOTICE

Precautions on packing the 87236

Using other materials for packing the 87236 may damage the instrument. Never use polystyrene beads as packing materials because on the one hand, they cannot provide sufficient protection on the instrument, and on the other hand, they can be sucked in to the instrument fan by the static electricity generated, resulting in instrument damage.

TIPS

Instrument package and transportation

Please follow carefully the precautions described in "3.1.1.1 Unpacking" of the User's Manual when transporting or handling the instrument (for example, damage occurred during delivery).

Annex

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Annex A Zoom table of SCPI classified by subsystem

Table 1 Zoom table of SCPI classified by subsystem

Index	Command	Brief description of functions
46	*CLS	Clear the instrument state data structure
46	*DDT	Query or set the operation in response to *TRG general command. Note: The 87236 does not support this command at the moment.
47	*ESE	Query or set the standard event state enable register
48	*ESR?	Query the value of the standard event state register
48	*IDN?	Query the identification string of 87236
48	*OPC	When all waiting operations are completed, set the operation end bit in the standard event state register
48	*OPT?	Query the instrument option configuration.
49	*RCL	Recall the state in the specified storage/recall register
49	*RST	Reset the 87236
49	*SAV	Store the instrument state into the specified register
49	*SRE	Query or set the service request register
50	*STB?	Query the state word.
50	*TRG	Trigger all channels waiting

Index	Command	Brief description of functions
		for trigger
51	*TST?	Perform self-test
51	*WAI	Place the 87236 in the wait state
176	:ABORt[1]	Stop the measurement of the corresponding channel of the 87236
53	:CALCulate[1]|2|3|4:FEED[1]|2	Query or set the measurement mode of measurement display
54	:CALCulate[1]|2|3|4:GAIN[:MAGNitude]	Query or set the calculation offset value in the specified measurement
54	:CALCulate[1]|2|3|4:GAIN:STATe	Query or set the switch state of the calculation offset
55	:CALCulate[1]|2|3|4:LIMit:CLEar:AUTO	Control when the limit FCO (failure count) is cleared
55	:CALCulate[1]|2|3|4:LIMit:CLEar[:IMMediate]	Clear the FCO (failure count) of the specified measurement
55	:CALCulate[1]|2|3|4:LIMit:FAIL?	Query whether the specified measurement exceeds the limit.
56	:CALCulate[1]|2|3|4:LIMit:FCOunt?	Query the limit detection failure count (FCO) of the specified measurement
56	:CALCulate[1]|2|3|4:LIMit:LOWer[:DATA]	Query or set the lower limit of the specified measurement limit
57	:CALCulate[1]|2|3|4:LIMit:STATe	Query or set the ON/OFF state of the specified measurement limit detection
57	:CALCulate[1]|2|3|4:LIMit:UPPer[:DATA]	Query or set the upper limit of the specified measurement limit
58	:CALCulate[1]|2|3|4:MATH[:EXPRession]	Query or set the specified measurement expression
59	:CALCulate[1]|2|3|4:MATH[:EXPRession]:CATalogue?	Enumerate all measurement expressions
59	:CALCulate[1]|2|3|4:RELative[:MAGNitude]:AUTO	Set the reference value for relative measurement

Index	Command	Brief description of functions
59	:CALCulate[1]|2|3|4:RELative[:MAGNitude]:VALue?	Query the reference value for relative measurement
60	:CALCulate[1]|2|3|4:RELative:STATe	Query or set the relative measurement ON/OFF state
60	:CALibration[1][:ALL]	Zeroing and calibration of the 87236
61	:CALibration[1]:AUTO	Calibration of the 87236
61	:CALibration[1]:ZERO:AUTO	Zeroing of the 87236
61	:CALibration[1]:ZERO:TYPE	Query or set the zeroing type.
63	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]	Query or set the power measurement mode of the specified measurement
63	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence	Set the power measurement mode of the specified measurement as difference measurement and turn on relative measurement
64	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative	Set the power measurement mode of the specified measurement as difference measurement, and turn on relative measurement
64	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio	Set the power measurement mode of the specified measurement as ratio measurement and turn off relative measurement
64	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative	Set the power measurement mode of the specified measurement as ratio measurement and turn on relative measurement
65	:CONFigure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative	Set the absolute power measurement mode of the specified measurement, and turn on the relative measurement
76	:DISPlay[:WINDow[1]|2][:NUMeric[1]|2]:RESolution	Query or set the display resolution of the specified measurement

Index	Command	Brief description of functions
65	:FETCh[1]:ARRay:AMEasure:POWer?	Query the automatically measured power value for a given channel
66	:FETCh[1]:ARRay:AMEasure:STATistical?	Query the statistical measurement value of a given channel
66	:FETCh[1]:ARRay:AMEasure:TIME?	Query the time value of the automatic measurement for a given channel
66	:FETCh[1]:DROop?	Query the pulse droop measurement value of a given channel
67	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]?	Set the specified measurement as absolute power measurement, turn off relative measurement, and return the measurement value
67	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?	Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value
68	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?	Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value
68	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?	Set the power measurement mode of the specified measurement as ratio measurement, turn off relative measurement, and return the measurement value
69	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?	Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value
70	:FETCh[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?	Set the specified measurement as absolute

Index	Command	Brief description of functions
		power measurement, turn on relative measurement, and return the measurement value
77	:FORMat[:READings]:BORDer	Query or set the transmission order of binary data
77	_:\DISPlay:CLEar	Query or set the data transmission format
177	:INITiate[1]:CONTinuous	Query or set the trigger state
177	:INITiate:CONTinuous:ALL	Query or set the trigger state of all channels
177	:INITiate:CONTinuous:SEQuence[1]	Query or set the trigger state
178	:INITiate[1][:IMMediate]	Set to trigger waiting state
178	:INITiate[:IMMediate]:ALL	Set all channels to trigger waiting state
178	:INITiate[:IMMediate]:SEQuence[1]	Set to trigger waiting state
178	:INPut:TRIGger:IMPedance	Query or set the trigger input impedance. Note: The 87236 does not support this command at the moment. This command is used for expansion.
70	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]?	Set the specified measurement as absolute power measurement, turn off relative measurement, and return the measurement value
71	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?	Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value
71	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?	Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value
72	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?	Set the power measurement mode of the specified measurement as ratio measurement, turn off relative

Index	Command	Brief description of functions
		measurement, and return the measurement value
72	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?	Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value
73	:MEASure[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?	Set the specified measurement as absolute power measurement, turn on relative measurement, and return the measurement value
78	:MEMory:CATalog[:ALL]?	Enumerate the user configurations in the 87236, including storage/recall configuration, frequency response offset table (FDO), etc
78	:MEMory:CATalog:STATe?	Enumerate the storage/recall configuration in the 87236
78	:MEMory:CATalog:TABLe?	Enumerate the frequency response offset table in the 87236
79	:MEMory:CLEar[:NAME]	It is used to clear the frequency response offset table or storage/recall table specified in the power
80	:MEMory:CLEar:TABLe[1]|2|3|4|5|6|7|8|9|10	Clear the specified frequency response offset table
80	:MEMory:FREE[:ALL]?	Query the total number of bytes unused in the user configuration space and the number of bytes
80	:MEMory:FREE:STATe?	Query the total number of bytes unused in the storage/recall space and the number of bytes
80	:MEMory:FREE:TABLe?	Query the total number of unused bytes and the number of bytes used in the

Index	Command	Brief description of functions
		frequency response offset table
80	:MEMory:NSTates?	Query the number of storage/recall states, and always return 10
80	:MEMory:STATe:CATalog?	Enumerate the names of all storage/recall states
81	:MEMory:STATe:DEFine	Query or set the name of the storage/recall state register.
81	:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:DEFine	Query or set the name in the specified frequency response offset table
81	:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency	Query or set the frequency list in the specified frequency response offset table
82	:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:FREQuency:POINts?	Query the frequency points in the specified frequency response offset table
82	:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]	Query or set the amplitude gain list in the specified frequency response offset table
82	:MEMory:TABLe[1]|2|3|4|5|6|7|8|9|10:GAIN[:MAGNitude]:POINts?	Query the amplitude gain points in the specified frequency response offset table
82	:MEMory:TABLe:MOVE	Rename the specified frequency response offset table
83	:MEMory:TABLe:SELect	Query or set the current frequency response offset table
179	:OUTPut:TRIGger[:STATe]	Query or set the trigger output ON/OFF state.
84	:PSTatistic[1]:CCDF:COUNt	Query or set the total number of statistics end
84	:PSTatistic[1]:CCDF:DATA?	Query the statistical probability list of the 87236
85	:PSTatistic[1]:CCDF:DATA:MAX	Query or set the maximum value of the X-axis of the

Index	Command	Brief description of functions
		statistical trace
85	:PSTatistic[1]:CCDF:DECades	Query or set the "decimal number" of the statistical vertical axis
86	:PSTatistic[1]:CCDF:END:ACTion	Query or set the statistics end behavior
86	:PSTatistic[1]:CCDF:GAUSsian:MARKer[1]|2[:SET]	Set the marker to the Gaussian probability curve. The 87236 does not support this command at the moment.
86	:PSTatistic[1]:CCDF:GAUSsian[:STATe]	Query or set the display state of Gaussian probability curve. The 87236 does not support this command at the moment.
87	:PSTatistic[1]:CCDF:MARKer[1]|2:DATA?	Query the power and probability at the marker in the statistical trace
87	:PSTatistic[1]:CCDF:MARKer:DELTa?	Query two power differences and probability differences (M2-M1)
87	:PSTatistic[1]:CCDF:MARKer[1]|2:X	Query or set the horizontal position of the marker
88	:PSTatistic[1]:CCDF:MARKer[1]|2:Y	Query or set the vertical position of the marker
88	:PSTatistic[1]:CCDF:POWer?	Query the power at a given probability point
88	:PSTatistic[1]:CCDF:PROBability?	Query the probability at a given power point
89	:PSTatistic[1]:CCDF:REFerence:DATA?	Query the reference statistical probability list of the 87236
89	:PSTatistic[1]:CCDF:REFerence:MARKer[1]|2[:SET]	Set marker to reference statistics curve
89	:PSTatistic[1]:CCDF:REFerence:POWer:AVERage?	Query the average power of the reference statistics curve
90	:PSTatistic[1]:CCDF:REFerence:POWer:PEAK?	Query the peak power of the channel statistics curve
90	:PSTatistic[1]:CCDF:REFerence:POWer:PTAVerage?	Query the peak to average ratio of the reference statistics curve
90	:PSTatistic[1]:CCDF:REFerence[:STATe]	Query or set the display state

Index	Command	Brief description of functions
		of the reference statistics curve
91	:PSTatistic[1]:CCDF:STORe:REFerence	When setting: store statistics curve to the reference statistics curve; When querying: query whether the reference curve exists
91	:PSTatistic[1]:CCDF:TABLe?	Query the statistical list: average power, average power probability, power under 6 probabilities, peak to average ratio, and sampling count
91	:PSTatistic[1]:CCDF:TIME	Query or set the statistics end timing
92	:PSTatistic[1]:CCDF:TRACe:MARKer[1]|2[:SET]	Set marker to channel statistics curve
92	:PSTatistic[1]:CCDF:TRACe:POWer:AVERage?	Query the average power of the channel statistics curve
92	:PSTatistic[1]:CCDF:TRACe:POWer:PEAK?	Query the peak power of the channel statistics curve
92	:PSTatistic[1]:CCDF:TRACe:POWer:PTAVerage?	Query the peak to average ratio of the channel statistics curve
93	:PSTatistic[1]:CCDF:TRACe[:STATe]	Query or set the display state of channel statistics curve
93	:PSTatistic[1]:CCDF:Y:MAX	Query or set the "maximum probability value" for statistical display
73	:READ[1]|2|3|4[:SCALar][:POWer][:AC]?	Set the specified measurement as absolute power measurement, turn off relative measurement, and return the measurement value
74	:READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence?	Set the specified measurement as differential power measurement, turn off relative measurement, and return the measurement value

Index	Command	Brief description of functions
74	:READ[1]|2|3|4[:SCALar][:POWer][:AC]:DIFFerence:RELative?	Set the specified measurement as differential power measurement, turn on relative measurement, and return the measurement value
75	:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio?	Set the power measurement mode of the specified measurement as ratio measurement, turn off relative measurement, and return the measurement value
75	:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RATio:RELative?	Set the power measurement mode of the specified measurement as ratio measurement, turn on relative measurement, and return the measurement value
75	:READ[1]|2|3|4[:SCALar][:POWer][:AC]:RELative?	Set the specified measurement as absolute power measurement, turn on relative measurement, and return the measurement value
94	[:SENSe[1]:]AVERage[1]|2:COUNt	Query or set the measurement average count and the video average count.
95	[:SENSe[1]:]AVERage:COUNt:AUTO	Query or set the channel measurement auto-average state
95	[:SENSe[1]:]AVERage:RESet	Clear the averaging buffer and restart averaging.
96	[:SENSe[1]:]AVERage:SDETect	Query or set the channel step detection state
96	[:SENSe[1]:]AVERage[1]|2[:STATe]	Query or set the ON/OFF state of the channel measurement average and video average
96	[:SENSe[1]:]BANDwidth|BWIDth:VIDeo	Query or set the measured video bandwidth.
97	[:SENSe[1]:]BUFFer:COUNt	Query or set the buffer size of external trigger measurement, which is only used for external

Index	Command	Brief description of functions
		trigger measurement.
97	[:SENSe[1]:]BUFFer:MTYPe	Query or set the external trigger buffer measurement type, which is only used for external trigger measurement.
98	[:SENSe[1]:]CORRection:CSET2:STATe	Query or set the activation state of the frequency response offset table
98	[:SENSe[1]:]CORRection:DCYCle[:INPut][:MAGNitude]	Query or set the channel duty cycle value for pulse power measurement.
99	[:SENSe[1]:]CORRection:DCYCle[:INPut]:STATe	Query or set the ON/OFF state of channel duty cycle for pulse power measurement.
99	[:SENSe[1]:]CORRection:FDOFfset[:INPut][:MAGNitude]?	Query the frequency response offset factor.
100	[:SENSe[1]:]CORRection:GAIN[1]|2|3|4[:INPut][:MAGNitude]	Query or set the channel offset
100	[:SENSe[1]:]CORRection:GAIN[1]|2|3|4[:INPut]:STATe	Query or set the activation state of channel offset
101	[:SENSe[1]:]DETector:FUNCtion	Query or set the detection measurement mode
101	[:SENSe[1]:]FREQuency[:CW|FIXed]	Query or set the frequency.
101	[:SENSe[1]:]FREQuency[:CW|FIXed]:STARt	Query or set the frequency for the start frequency of the external trigger buffer sweep measurement.
102	[:SENSe[1]:]FREQuency[:CW|FIXed]:STEP	Query or set the frequency step number for the external trigger buffer sweep measurement.
103	[:SENSe[1]:]FREQuency[:CW|FIXed]:STOP	Query or set the frequency for the stop frequency of the external trigger buffer sweep measurement.
103	[:SENSe[1]:]LIST:FREQuency:STARt	Query or set the start frequency of the timeslot list sweep measurement.
104	[:SENSe[1]:]LIST:FREQuency:STOP	Query or set the stop frequency of the timeslot list

Index	Command	Brief description of functions
		sweep measurement.
104	[:SENSe[1]:]LIST:MTYPe	Query or set the timeslot list sweep measurement type, which is only used for external trigger measurement.
105	[:SENSe[1]:]LIST:POINts	Query or set the number of points for timeslot list sweep measurement, which is only used for external trigger measurement.
106	[:SENSe[1]:]LIST:STATe	Query or set the timeslot list sweep measurement state.
106	[:SENSe[1]:]LIST:TSCount	Query or set the number of slots for the timeslot list sweep measurement.
107	[:SENSe[1]:]LIST:SLot:EXCLude:OFFSet:TIME	Query or set the start time (offset time) of the "measurement exclusion area" relative to the start position of the slot.
107	[:SENSe[1]:]LIST:TSLot:EXCLude:TIME	Query or set the duration of the "measurement exclusion area" relative to the start position of the slot.
108	[:SENSe[1]:]LIST:TSLot:TIME	Query or set the length of time slot measurement.
109	[:SENSe[1]:]LIST:TSLot:TREF[1]|2	Query or set the left and right reference values (percentage relative to the slot duration) of the timeslot measurement gate
109	[:SENSe[1]:]MRATe	Query or set the measurement speed.
110	[:SENSe[1]:]PULSe[1]|2-20:DISTal	Query and set the distal line in the pulse measurement
111	[:SENSe[1]:]PULSe[1]|2-20:MESial	Query and set the mesial line in the pulse measurement
111	[:SENSe[1]:]PULSe[1]|2-20:PROXimal	Query and set the proximal line in pulse measurement
112	[:SENSe[1]:]PULSe[1]|2-20:UNIT	Query and set the unit of pulse definition

Annex A Zoom table of SCPI classified by subsystem

Index	Command	Brief description of functions
113	[:SENSe[1]:]SWEep[1]|2|3|4:AUTO	Query or set the Auto Gate state of the specified gate
112	[:SENSe[1]:]SWEep:APERture	Query or set the measurement aperture or measurement time interval.
113	[:SENSe[1]:]SWEep:APERture:AUTO	Query or set the auto-measurement aperture or measurement interval state.
114	[:SENSe[1]:]SWEep[1]|2|3|4:AUTO:REFernce[1]|2	Query or set the reference ratio of the specified gate
114	[:SENSe[1]:]SWEep[1]|2|3|4:OFFSet:TIME	Query or set the start time of the specified gate
115	[:SENSe[1]:]SWEep[1]|2|3|4:TIME	Query or set the time length of the specified gate
115	[:SENSe[1]:]TRACe:AUTOscale	Auto setting
116	[:SENSe[1]:]TRACe:OFFSet:TIME	Query or set the horizontal start time of the channel trace
116	[:SENSe[1]:]TRACe:TIME	Query or set the duration of the channel trace
117	[:SENSe[1]:]TRACe:UNIT	Query or set the unit of channel trace
117	[:SENSe[1]:]TRACe:X:SCALe:PDIV	Query or set the horizontal scale
185	:SERVice:BIST:TBASe:STATe	Query or set the state of the internal 10 MHz time base signal output at the "trigger output" port
185	:SERVice:BIST:VIDeo:STATe	Query or set the state of video output signal output at the "trigger output" port
186	:SERVice:SENSor[1]:CDATe?	Query the calibration date of the 87236
186	:SERVice:SENSor[1]:CPLace?	Query the calibration location of the 87236
186	:SERVice:SENSor[1]:FREQuency:MAXimum?	Query the maximum frequency of the 87236
187	:SERVice:SENSor[1]:FREQuency:MINimum?	Query the minimum frequency of the 87236
187	:SERVice:SENSor[1]:SNUMber?	Query the serial number of

Index	Command	Brief description of functions
		the 87236
187	:SERVice:SENSor[1]:TYPE?	Query the type of the 87236
187	:SERVice:SNUMber	Query or set the serial number of the 87236
135	:STATus:DEVice:CONDition?	Query the value in the device state condition register
135	:STATus:DEVice:ENABle	Query or set the device state event enable register
135	:STATus:DEVice[:EVENt]?	Query the device event register
135	:STATus:DEVice:NTRansition	Query or set the negative transition filter of the device
136	:STATus:DEVice:PTRansition	Query or set the positive transition filter of the device
136	:STATus:OPERation:CALibrating[:SUMMary]:CONDition?	Query the value in the calibration operating state condition register
136	:STATus:OPERation:CALibrating[:SUMMary]:ENABle	Query or set the calibration operation event enable register
136	:STATus:OPERation:CALibrating[:SUMMary][:EVENt]?	Query the calibration operation event register
137	:STATus:OPERation:CALibrating[:SUMMary]:NTRansition	Query or set the negative transition filter for calibration operation
137	:STATus:OPERation:CALibrating[:SUMMary]:PTRansition	Query or set the positive transition filter for calibration operation
137	:STATus:OPERation:CONDition?	Query the value in the operating state condition register
138	:STATus:OPERation:ENABle	Query the value in the operating state condition register
138	:STATus:OPERation[:EVENt]?	Query the operating state event register
139	:STATus:OPERation:LLFail[:SUMMary]:CONDition?	Query the value in the lower limit detection operating state condition register
139	:STATus:OPERation:LLFail[:SUMMary]:ENABle	Query or set the event enable

Index	Command	Brief description of functions
		register for lower limit detection operation
139	:STATus:OPERation:LLFail[:SUMMary][:EVENt]?	Query the event register for lower limit detection operation
140	:STATus:OPERation:LLFail[:SUMMary]:NTRansition	Query or set the negative transition filter for lower limit detection operation
140	:STATus:OPERation:LLFail[:SUMMary]:PTRansition	Query or set the positive transition filter for lower limit detection operation
138	:STATus:OPERation:NTRansition	Query or set the negative transition filter for operating state
138	:STATus:OPERation:PTRansition	Query or set the positive transition filter for operating state
140	:STATus:OPERation:SENSe[:SUMMary]:CONDition?	Query the value in the sensor operating state condition register
140	:STATus:OPERation:SENSe[:SUMMary]:ENABle	Query or set the sensor operation event enable register
141	:STATus:OPERation:SENSe[:SUMMary][:EVENt]?	Query the event register for sensing operation
141	:STATus:OPERation:SENSe[:SUMMary]:NTRansition	Query or set the negative transition filter for sensing operation
141	:STATus:OPERation:SENSe[:SUMMary]:PTRansition	Query or set the positive transition filter for sensing operation
142	:STATus:OPERation:TRIGger[:SUMMary]:CONDition?	Query the value in the trigger operating state condition register
142	:STATus:OPERation:TRIGger[:SUMMary]:ENABle	Query or set the trigger operation event enable register
142	:STATus:OPERation:TRIGger[:SUMMary][:EVENt]?	Query the event register for trigger operation
142	:STATus:OPERation:TRIGger[:SUMMary]:NTRansition	Query or set the negative

Index	Command	Brief description of functions
		transition filter for trigger operation
143	:STATus:OPERation:TRIGger[:SUMMary]:PTRansition	Query or set the positive transition filter for trigger operation
143	:STATus:OPERation:ULFail[:SUMMary]:CONDition?	Query the value in the upper limit detection operating state condition register
143	:STATus:OPERation:ULFail[:SUMMary]:ENABle	Query or set the event enable register for upper limit detection operation
144	:STATus:OPERation:ULFail[:SUMMary][:EVENt]?	Query the event register for upper limit detection operation
144	:STATus:OPERation:ULFail[:SUMMary]:NTRansition	Query or set the negative transition filter for upper limit detection operation
144	:STATus:OPERation:ULFail[:SUMMary]:PTRansition	Query or set the positive transition filter for upper limit detection operation
144	:STATus:PRESet	Preset some state registers
145	:STATus:QUEStionable:CALibration[:SUMMary]:CONDition?	Query the value in the calibration questionable state condition register
145	:STATus:QUEStionable:CALibration[:SUMMary]:ENABle	Query or set the calibration questionable event enable register
146	:STATus:QUEStionable:CALibration[:SUMMary][:EVENt]?	Query the calibration operation event register
146	:STATus:QUEStionable:CALibration[:SUMMary]:NTRansition	Query or set the questionable negative transition filter for calibration operation
146	:STATus:QUEStionable:CALibration[:SUMMary]:PTRansition	Query or set the questionable positive transition filter for calibration operation
146	:STATus:QUEStionable:CONDition?	Query the value in the questionable state condition register
147	:STATus:QUEStionable:ENABle	Query or set the questionable state event enable register

Index	Command	Brief description of functions
147	:STATus:QUEStionable[:EVENt]?	Query the questionable state event register
147	:STATus:QUEStionable:NTRansition	Query or set the questionable negative transition filter for operating state
148	:STATus:QUEStionable:POWer[:SUMMary]:CONDition?	Query the value in the power questionable state condition register
148	:STATus:QUEStionable:POWer[:SUMMary]:ENABle	Query or set the power questionable event enable register
149	:STATus:QUEStionable:POWer[:SUMMary][:EVENt]?	Query the questionable event register for power operation
149	:STATus:QUEStionable:POWer[:SUMMary]:NTRansition	Query or set the questionable negative transition filter for power operation
149	:STATus:QUEStionable:POWer[:SUMMary]:PTRansition	Query or set the questionable positive transition filter for power operation
148	:STATus:QUEStionable:PTRansition	Query or set the questionable positive transition filter for operating state
152	:SYSTem:ERRor:CODE?	Return error code from error queue
152	:SYSTem:ERRor[:NEXT]?	Return error code and error information from the error queue
152	:SYSTem:HELP:HEADers?	Query the list of commands supported by 87236
153	:SYSTem:IDN	Query or set "*IDN?" of the 87236 Query the returned user-defined string.
153	:SYSTem:IDN:AUTO	Query or set the "*IDN?" of the 87236 Whether to return the switch of the user-defined string.
154	:SYSTem:PRESet	Reset 87236 to the state specified by the parameter
169	:SYSTem:VERSion?	Query the SCPI version

Index	Command	Brief description of functions
		number used by 87236
169	:TRACe[1][:DATA]?	Query the pulse measurement trace data
170	:TRACe[1]:DEFine:DURation:REFerence	Query or set the reference value used to calculate the pulse duration (i.e. pulse width
171	:TRACe[1]:DEFine:TRANsition:REFerence	Query or set the reference value used to calculate the pulse transition duration (rise time or fall time
171	:TRACe[1]:MEASurement:INSTant:REFerence?	Query the moment when the trace intersects with the given reference value
172	:TRACe[1]:MEASurement:PULSe[1]|2-20:AM|AMPLitude?	Query the power of the first transition of the pulse.
172	:TRACe[1]:MEASurement:PULSe[1]|2-20:AT|ATRailing?	Query the power of the last transition of the pulse.
172	:TRACe[1]:MEASurement:PULSe[1]|2-20:DCYCle?	Query the duty cycle of the pulse
173	:TRACe[1]:MEASurement:PULSe[1]|2-20:DURation?	Query the pulse duration (i.e. pulse width)
173	:TRACe[1]:MEASurement:PULSe[1]|2-20:PERiod?	Query the pulse period
173	:TRACe[1]:MEASurement:PULSe[1]|2-20:SEParation?	Query the pulse interval time
173	:TRACe[1]:MEASurement:PULSe[1]|2-20:TILTed|DROop?	Query the droop of the pulse.
174	:TRACe[1]:MEASurement:REFerence?	Query the power of a given reference value
174	:TRACe[1]:MEASurement:TILTed|DROop:UNIT?	Query or set the unit of pulse droop.
174	:TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:DURation?	Query the pulse negative transition duration (i.e. fall time)
175	:TRACe[1]:MEASurement:TRANsition[1]|2-20:NEGative:OCCurence?	Query the pulse negative transition (i.e. fall) moment
175	:TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:DURation?	Query the pulse positive transition duration (i.e. rise time)
175	:TRACe[1]:MEASurement:TRANsition[1]|2-20:POSitive:OCCurence?	Query the pulse positive transition (i.e. rise) moment

Index	Command	Brief description of functions
175	:TRACe[1]:STATe	Query or set the trace measurement state of the channel.
176	:TRACe[1]:UNIT	Query or set the trace unit of a given channel
179	:TRIGger[1][:IMMediate]	Set to trigger waiting state
179	:TRIGger:MODE	Query or set the trigger mode of the 87236
180	:TRIGger[:SEQuence[1]]:COUNt	Query or set the trigger event detection/measurement cycles count.
180	:TRIGger[:SEQuence[1]]:DELay	Query or set the trigger delay
181	:TRIGger[:SEQuence[1]]:HOLDoff	Query or set the trigger holdoff
181	:TRIGger[:SEQuence[1]]:HYSTeresis	Query or set the trigger hysteresis of the 87236
181	:TRIGger[:SEQuence[1]]:IMMediate	Set to trigger waiting state
182	:TRIGger[:SEQuence[1]]:LEVel	Query or set the trigger level
182	:TRIGger[:SEQuence[1]]:LEVel:AUTO	Query or set the auto trigger level state
182	:TRIGger[:SEQuence[1]]:POSition	Query or set the position of the trigger event on the screen
183	:TRIGger[:SEQuence[1]]:SLOPe	Query or set the trigger type
183	:TRIGger[:SEQuence[1]]:SOURce	Query or set the trigger source.
184	:UNIT[1]|2|3|4:POWer	Query or set the unit of measured power
184	:UNIT[1]|2|3|4:POWer:RATio	Query or set the unit of measured ratio measurement power