MULTIFUNCTION GENERATOR

WF1967/WF1968

Instruction Manual (Remote Control)

NF Corporation
MULTIFUNCTION GENERATOR

WF1967/WF1968

Instruction Manual
(Remote Control)
INTRODUCTION

This instruction manual describes the GPIB, USB and LAN (Option) interfaces of WF1967/WF1968. For operations from the panel, see the separate manual "WF1967/WF1968 Instruction Manual (Operations)."

The GPIB, USB and LAN interfaces of WF1967/WF1968 features abundant functions and can control almost all operations on the front panel. In addition, they can read the setting values from external equipment such as personal computer.

WF1967/WF1968 Instruction Manual (Remote Control) consists of the following chapters.

1. Preparation before operation
   This chapter describes the interface settings and the GPIB address and LAN settings.

2. Command explanation
   This chapter describes the overview of the commands and setting examples.

3. Status System
   This chapter describes the status reporting, including status byte and standard event status register.

4. Error Messages
   This chapter describes the error numbers and their meaning.

5. Specification
   This chapter describes the specifications of the remote control interfaces.

6. Command Tree
   This chapter lists commands as a tree structure.
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# 1. Preparation before Use

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1.1 Overview of WF1967/WF1968 GPIB/USB Interface

Almost all the functions of WF1967/WF1968 can be remotely set via the GPIB, USB and LAN (Option) interface. Moreover, the saved data and the settings can be transferred to an external device. This allows you to easily configure an automatic measurement system.

1.2 USB Preparations

The WF1967/WF1968 can be controlled by NI-VISA from National Instruments Corporation. Almost all panel operations can be controlled, and internal statuses, such as setting values and errors, can be read out.

Install a NI-VISA on the controlling computer, and connect it using a commercially available USB cable. The installation file for this driver can be downloaded from the website of National Instruments Corporation. The driver installation is described below.

1. Either search the NI-VISA page on the website of National Instruments Corporation.

2. Download the version of NI-VISA that supports your OS from the NI-VISA page.

3. Execute the downloaded file and install it.

4. Once the file has installed successfully, the NI-VISA is installed.

For details of NI-VISA, contact National Instruments Corporation or visit the National Instruments Website.

1.3 GPIB Preparations

Mount a GPIB controller board (card) to the controlling computer, and then connect between them using a commercial GPIB cable. For details, see the instruction manual of your GPIB controller board (card).
1.4 LAN Preparations

TCP/IP protocol communication only supports.
It does not correspond to the IP address automatic assignment by DHCP. When you connect to the network, contact the administrator, IP address, subnet mask, please set the default gateway.
When you directly connect a personal computer use a crossover cable. However, when the hub or personal computer can automatically recognize the straight and cross, you can use both.

1.5 Selecting Interface

You can select whether the GPIB or the USB interface is to be used. If the LAN option is mounted, you can also select the LAN. WF1967/WF1968 cannot be controlled from the interface that is not selected. The selected interface is backed up even when the power is turned off.
"USB" is selected at shipping.

(1) On the Menu screen, select [4:Utility] and then press the ENTER key.
(2) Select [Remote] and then press the ENTER key.

(3) Select [Interface] and then press the ENTER key to display the screen for selecting USB, GPIB or LAN.

⚠️ CAUTION  When the computer recognizes WF1967/WF1968, if you switch the interface from USB to GPIB or disconnect the USB cable, the computer may exhibit unexpected behavior.
1.6 GPIB Address Setting

When you select the GPIB interface, you can set the GPIB address. Set the GPIB address to a different value than the addresses of other devices connected with the GPIB cable. The set value is retained in the memory even when the power is turned off. "2" is set at shipping.

1. Set [Interface] to "GPIB" by performing step (1) to (3) described in "1.4 Selecting Interface."

2. Select [GPIB Address] and then press the ENTER key to display the screen for setting the GPIB address.

   Enter the address by using the numeric keypad on the panel.
1.7 USB ID

If multiple units of WF1967/WF1968 are connected within a system via USB, the following numbers are used to enable the application identify each unit.

- Vendor No. : 3402(0x0D4A)
- Product No. : 57(0x0039)/WF1967, 58(0x003A)/WF1968
- Serial No. : Product’s manufacturing number (serial number)

1.8 LAN settings

If the LAN interface have been installed and the LAN option is selected, a physical address, port number, IP address, subnet mask, default gateway will be displayed. The physical address one by one specific value, the port number is 5025 (decimal) in a fixed, cannot be changed Both. Set the IP address, subnet mask, default gateway. Set value will be retained even if the power is turned off in memory.

(1) Set [Interface] to "GPIB" by performing step (1) to (3) described in “1.4 Selecting Interface.”

(2) Select “IP” and then press the ENTER key to display the screen for IP address. Enter the address by using the numeric keypad on the panel. Please set four. It does not correspond to the IP address automatic assignment by DHCP. When you connect to the network, contact the administrator, IP address, subnet mask, please set the default gateway. Incorrect setting, there is a risk of interfering with the communication on the connected network.
(3) Select “Mask” and then press the ENTER key to display the screen for subnetmask. Please set four.  
This is the mask that separates the network address and the host address of the IP address.

(4) Select “Gate” and then press the ENTER key to display the screen for default gateway.  
Please set four.  
This is the mask that separates the network address and the host address of the IP address.  
When you access an external network, set the IP address of the gateway used implicitly.

1.9 Releasing Remote State

In the remote state, the "USB" or "GPIB" icon is lit on the LCD, and "LOCAL" is displayed on the [F5] soft-key. When the [F5] key is pressed in this state, the remote state is released and the panel operations become enabled. If "LOCAL" is not displayed (local lockout status), the [F5] key operation is disabled. To enable the panel operations, specify the local control from the remote control controller.
1.10 Considerations

- The USB, GPIB and LAN connectors are located on the rear panel.
- The USB and GPIB interfaces are expected to be used under a relatively stable environment. Avoid using in a place that has power fluctuation or environment with much electrical noise.
- Connect or disconnect the GPIB connector only after all devices connected on the bus are powered off.
- When using the GPIB interface, power on all devices connected on the bus.
- The total length of GPIB cable must be 2m x (number of devices) or 20m, whichever is shorter.
- The length of a single cable must be 4m or shorter.
- Check the GPIB address carefully before setting it.
  If a duplicate address is set to multiple units within the same system, the equipment may be damaged.
- When using the GPIB interface, set EOI with the controller of the GPIB connected with the equipment.
- When LAN is used, you cannot use the GPIB-specific features, such as SRQ and device clear.
- During LAN use, by the misuse of abnormalities and command of the communication path, when the equipment is no longer responding to commands, please turn on the power. Or, once you switch to the other interface, please select the LAN again.
- Since there is no concept of END message to LAN, it does not add EOI.
- In USB interface use, USB memory can not be used.
2. Command explanation

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2.1 Overview of Commands

The commands of WF1967/WF1968 comply with IEEE488.2 and SCPI (version 1999.0). SCPI defines the communication method used between controllers and measurement equipment. For general information about SCPI, refer to other appropriate documents.

2.1.1 Conventions

For convenience in describing the commands, the following conventions are used in this document.

< >  
< > indicates something other than itself. In the case of parameter or response data, the abbreviation of the type is enclosed in < >.

[ ]  
The items enclosed in [ ] are optional, and can be omitted.

{abc|xyz}  
Indicates that either “abc” or “xyz” can be used.

[abc|xyz]  
Indicates that either “abc” or “xyz” can be used but that both are optional and can be omitted.

Uppercase, lowercase  
Keywords in a mixture of uppercase and lowercase letters are the long form, while keywords in uppercase letters only are the short form.
2.1.2 Command

The program messages of WF1967/WF1968 consist of common commands and subsystem commands. This section describes the format of each command, the subsystem command tree, and so on.

2.1.2.1 Common Commands

The common commands are to control the comprehensive functions of the equipment. Figure 2.1 shows the syntax of common commands.

![Figure 2.1 Common Command Syntax](image)

The keyword in Figure 2.1 consists of three alphabetic characters. Here, SP is a space character (ASCII code 32).

2.1.2.2 Subsystem Commands

The subsystem commands are used to execute specific functions of the equipment. Each subsystem command consists of a root keyword, one or more lower-level keywords, a parameter, and a suffix. The followings show examples of command and query.

:OUTPut:STATe ON
:OUTPut:STATe?

OUTPut is the root-level keyword linking a second-level keyword, and ON is a parameter.
2.1.2.3 Subsystem command tree

(A) Structure of command tree

In SCPI, a hierarchical structure similar to the one used in a file system is used for the subsystem commands. This command structure is called “command tree.”

Figure 2.2 shows an example of a command tree of subsystem commands.

In the command tree in Figure 2.2, the keywords nearest the top ([:SOURce], :OUTPut, and :SYSTem) are root level keywords, and to reach the keywords on the lower levels, a specific path must be followed. For example, to access "[:OFFSet]", the path must be [:SOURce] - :VOLTage - [:LEVeI] - [:IMMediate] - [:OFFSet].
(B) Current path movement

The current path is a level within the command tree, and becomes the first level from which the parser starts the search when the user sends the next command. The parser determines the current path according to the following rules.

1. At power-on and reset
   The current path is set to the root.

2. Message terminator
   Upon reception of a message terminator, the current path is set to the root.

3. Colon (command separator)
   When a colon is placed between two keywords, the colon moves the current path one level down in the command tree.

4. Colon (root specifier)
   When a colon is placed at the beginning of a command, the current path is set to the root.

5. Semicolon
   Semicolons do not affect to the current path.

6. Space
   Spaces do not affect to the current path.

7. Comma
   Commas do not affect to the current path.

8. EEE488.2 common commands
   Common commands do not affect to the current path.

By using semicolons properly, multiple commands can be sent efficiently. For example,

:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0; OFFSet 1.0

is the same as sending the following two commands:
When an optional keyword is omitted, you should pay careful attention to the current path movement.
For example,

```
:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0
:SOURce:VOLTage:LEVel:IMMediate:OFFSet 1.0
```

sets the current path to "SOURce." Therefore, if the following two program messages are send as one program message,

```
:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0
:SOURce:FREQuency:FIXed 1000.0
```

results in an error. However,

```
:SOURce:VOLTage 1.0; FREQuency:FIXed 1000.0
```

does not result in an error.
### Subsystem command syntax

The syntax of subsystem commands is shown in Figure 2.3.

![Subsystem Command Syntax](image)

**Figure 2.3** Subsystem Command Syntax

(A) Keyword

The keyword in Figure 2.3 is a string of up to 12 characters consisting of uppercase and lowercase alphabetic characters, underscore (_), and numeric characters, beginning with an alphabetic character.

Most of the keywords listed in "2.2 Command List" consist of a mixture of uppercase and lowercase letters. Here, uppercase letters indicate the short form of keywords, while uppercase and lowercase letters indicate the long form of keywords. Keywords are written in uppercase and lowercase letter for convenience, but actual commands are not case sensitive. Examples for the keyword "OUTPut" are listed in Table 2.1.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>Can be used as long form.</td>
</tr>
<tr>
<td>OUTP</td>
<td>Can be used as short form.</td>
</tr>
<tr>
<td>OuTpUt</td>
<td>Not case sensitive. Can be used as long form.</td>
</tr>
<tr>
<td>oUtP</td>
<td>Not case sensitive. Can be used as short form.</td>
</tr>
<tr>
<td>OUTPU</td>
<td>Cannot be used because it corresponds to neither long form nor short form.</td>
</tr>
<tr>
<td>OUT</td>
<td>Cannot be used because it corresponds to neither long form nor short form.</td>
</tr>
</tbody>
</table>
(B) Keyword separator

The colons (:) in Figure 2.3 are interpreted as keyword separators. These keyword separators serve to separate an upper-level keyword from a lower-level keyword in a command tree as shown in Figure 2.2.

The colon (:) at the beginning of the subsystem command is interpreted as a root specifier. This root specifier sets the current path to the root.

(C) Keyword omission

The keywords enclosed in square brackets ([ ]) in the commands listed in "2.2 Command List" can be omitted. If omitted, the equipment interprets the command as if that optional keyword is received.

For example,

:OUTPut[:STATe]

means that you can use either of the following commands:

:OUTPut:STATe
:OUTPut

(D) Channel specification

In the case of a 2-channel equipment, many commands allow you to specify the channel by using an optional numeric keyword suffix.

For example,

:OUTPut[1][2]:STATe

means that commands for channel 1 and 2 are as follows:

:OUTPut[1]:STATe
:OUTPut2:STATe
If no channel number is specified, [1] is considered to be omitted, and the command is interpreted as the command for channel 1. For example, to control the channel 1 output to be turned ON, you can use either of the following commands.

:OUTPut1:STATe ON
:OUTPut:STATe ON

(E) Parameters

Parameter types are described below.

(1) Numeric parameter (<REAL>, <INT>)

The syntax of numeric parameters is shown in Figure 2.4.

![Figure 2.4  Numeric Parameter (<REAL>, <INT>) Syntax](image)

The syntaxes of the mantissa and index in Figure 2.4 are shown in Figure 2.5 and 2.6.

![Figure 2.5  Mantissa Syntax](image)
(2) Discrete Parameter (<DISC>)

The syntax of the discrete parameter is shown in Figure 2.7.

(3) Boolean Value Parameter (<BOL>)

The syntax of the Boolean value parameter is shown in Figure 2.8.

The Boolean value parameter is interpreted as true for values other than 0, and as false for 0 (zero). If the specified value includes a fractional part, that value is interpreted as the whole number obtained by rounding the fractional part. Therefore, for example, "0.4" is false, and "0.5" is true.
(4) String parameter (<STR>)

The syntax of string parameters is shown in Figure 2.9.

![String Parameter (STR) Syntax](image)

(5) Block parameter (<BLK>)

The syntax of block parameters is shown in Figure 2.10.

![Block Parameter (BLK) Syntax](image)

In the figure, NL is a new line character (ASCII code 10), and ^END is an EOI asserted by the last byte.

(F) Parameter separator

Parameter separators are used to separate parameters in a command which have two or more parameters.

(G) Query parameter

A query parameter is specified after "?" of query, and can be used for most of queries supported by the commands that have numeric parameters. For example, when "MINimum" or "MAXimum" is
specified as query parameter, the settable minimum value or settable maximum value can be queried, respectively.

(H) Suffix

The syntax of suffix is shown in Figure 2.11.

![Suffix Syntax Diagram]

Figure 2.11 Suffix Syntax

In WF1967/WF1968, the prefix and unit attached to a parameter are valid only for that command, and do not affect other commands.

`:SOURce1:VOLTage:AMPLitude:UNIT VRMS` Sets the amplitude unit to Vrms

`:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude 2.0` Sets the amplitude to 2.0Vrms

`:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude 2.0VPP` Sets the amplitude to 2.0Vp-p
2.1.2.5 **Program message syntax**

Two or more common commands and subsystem commands can be combined and sent from the controller to the equipment as one program message. The syntax of the program message is shown in Figure 2.12.

![Program Message Syntax Diagram](image)

Figure 2.12 Program Message Syntax

Commands are separated by a semicolon (;).

2.1.2.6 **Response message syntax**

A response message is the data that is transmitted from the equipment in response to a query.

(A) Response message syntax

The syntax of the response message is shown in Figure 2.13.

![Response Message Syntax Diagram](image)

Figure 2.13 Response Message Syntax

In response messages, commas (,) and semicolons (;) are used as separators. When multiple values are returned by one command, the data are separated by commas (,). On the other hand, when there are multiple queries in one program message, the data for each query are separated by semicolons (;).

(B) Response message data

The data types of response messages are as follows.
(1) Real number response data (<REAL>)

The syntax of the real number response data is shown in Figure 2.14.

![Real Number Response Data (<REAL>) Syntax](image1)

The syntax of the NR2 number response data is shown in Figure 2.15.

![NR2 Number Response Data (<NR2>) Syntax](image2)

The syntax of the NR3 number response data is shown in Figure 2.16.

![NR3 Number Response Data (<NR3>) Syntax](image3)
(2) Integer response data (<INT>)
The syntax of the integer response data is shown in Figure 2.17.

![Figure 2.17 Integer Response Data (<INT>) Syntax](image)

(3) Discrete response data (<DISC>)
The syntax of the discrete response data is shown in Figure 2.18.

![Figure 2.18 Discrete Response Data (<DISC>) Syntax](image)

(4) Numeric Boolean value response data (<NBOL>)
The syntax of the numeric Boolean value response data is shown in Figure 2.19.

![Figure 2.19 Numeric Boolean Value Response Data (<NBOL>) Syntax](image)
(5) String response data (<STR>)
The syntax of the string response data is shown in Figure 2.20.

![Figure 2.20 String Response Data (<STR>) Syntax](image)

(6) Definite length arbitrary block response data (<DBLK>)
The syntax of the definite length arbitrary block response data is shown in Figure 2.21.

![Figure 2.21 Definite Length Arbitrary Block Response Data (<DBLK>) Syntax](image)

(7) Indefinite length arbitrary block response data (<IBLK>)
The syntax of the indefinite length arbitrary block response data is shown in Figure 2.22.

![Figure 2.22 Indefinite Length Arbitrary Block Response Data (<IBLK>) Syntax](image)
This section shows the list of the remote control commands of WF1967/WF1968. The meanings of the symbols used in the command list table are as follows. The lowercase part of each keyword indicates that the part can be omitted.

- Square brackets ([ ]) indicate the optional keywords. (implicit keywords)
- Vertical bars ( | ) indicate that one of multiple keywords can be selected.

Table 2.2 Command List

(Oscillation Mode)

<table>
<thead>
<tr>
<th>Function</th>
<th>Command</th>
<th>Description Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous oscillation mode</td>
<td>[:SOURce[1</td>
<td>2]]:CONTinuous:[IMMediate]</td>
</tr>
<tr>
<td>Continuous oscillation mode selection</td>
<td>[:SOURce[1</td>
<td>2]]:CONTinuous:STATe?</td>
</tr>
<tr>
<td>Continuous oscillation mode query</td>
<td>[:SOURce[1</td>
<td>2]]:CONTinuous:STATe?</td>
</tr>
<tr>
<td>Synchronization signal output selection/query</td>
<td>:OUTPut[1</td>
<td>2]:SYNC:TYPE</td>
</tr>
<tr>
<td>Subchannel phase setting/query</td>
<td>[:SOURce[1</td>
<td>2]]:SChannel:PHAs:e[:ADJust]</td>
</tr>
<tr>
<td>Subchannel waveform selection/query</td>
<td>[:SOURce[1</td>
<td>2]]:SChannel:FUNCtion[:SHAPe]</td>
</tr>
<tr>
<td>Subchannel Arbitrary waveform selection/query</td>
<td>[:SOURce[1</td>
<td>2]]:SChannel:FUNCtion:USER</td>
</tr>
<tr>
<td>Subchannel Noise band setting/query</td>
<td>[:SOURce[1</td>
<td>2]]:SChannel:FUNCtion:NOIs:e:BW</td>
</tr>
<tr>
<td>Modulated oscillation mode common setting of modulation</td>
<td>[:SOURce[1</td>
<td>2]]:{FSKey</td>
</tr>
<tr>
<td>Modulated oscillation mode common setting of FSK/PSK</td>
<td>[:SOURce[1</td>
<td>2]]:{FSKey</td>
</tr>
<tr>
<td>Function</td>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Signal polarity with external modulation source selection/query</td>
<td>[:SOURce[1</td>
<td>2]];{FSKey</td>
</tr>
<tr>
<td>Internal modulation frequency setting/query</td>
<td>[:SOURce[1</td>
<td>2]];{FSKey</td>
</tr>
<tr>
<td>Synchronization signal output selection/query</td>
<td>:OUTPut[1</td>
<td>2]:SYNC:{FSKey</td>
</tr>
<tr>
<td><strong>Modulated oscillation mode common setting of other than FSK/PSK</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulation source selection/query</td>
<td>[:SOURce[1</td>
<td>2]];{FM</td>
</tr>
<tr>
<td>Internal modulation frequency setting/query</td>
<td>[:SOURce[1</td>
<td>2]];{FM</td>
</tr>
<tr>
<td>Internal modulation waveform selection/query</td>
<td>[:SOURce[1</td>
<td>2]];{FM</td>
</tr>
<tr>
<td>Arbitrary waveform for internal modulation selection/query</td>
<td>[:SOURce[1</td>
<td>2]];{FM</td>
</tr>
<tr>
<td>Noise band for internal modulation setting/query</td>
<td>[:SOURce[1</td>
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### Manual trigger (TRIG key operation)

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2.3 Descriptions of Individual Commands

This section describes the details of each command.

2.3.1 Oscillation Mode

2.3.1.1 Continuous oscillation mode

2.3.1.1.1 Continuous oscillation mode selection

[:SOURce[1|2]]:CONTinuous[:IMMediate]

| Description |
| Sets the oscillation mode to the continuous oscillation |

Setting parameter
None

Setting example
:SOURce1:CONTinuous:IMMediate
Sets the oscillation mode of CH1 to the continuous oscillation

2.3.1.1.2 Continuous oscillation mode query

[:SOURce[1|2]]:CONTinuous:STATe?

| Description |
| Queries whether or not the oscillation mode is the continuous oscillation |

Query parameter
None

Response format
<NBOL>

<NBOL> → 0 : Oscillation mode is not the continuous oscillation mode
1 : Oscillation mode is the continuous oscillation mode

Remarks
If you want to switch to the continuous oscillation without being affected by the oscillation mode set at that time, use this command to switch to the continuous oscillation mode.
2.3.1.3 Synchronization signal output selection/query

:OUTPut[1|2]:SYNC:TYPE

- :OUTPut[1|2]:SYNC:TYPE
- :OUTPut[1|2]:SYNC:TYPE?

Description
Selects/queries the synchronization output in the continuous oscillation mode

Setting parameter
SYNC|SFCTn|OFF
- SYNC → Waveform synchronization
- SFCTn → Subchannel signal
- OFF → Output stop

Query parameter
None

Response format
SYNC|SFCT|OFF

† For the meaning of each response data, see the setting parameter

Setting example
:OUTPut1:SYNC:TYPE SYNC
Sets the synchronization output of CH1 in the continuous oscillation mode to the waveform synchronization

2.3.1.4 Subchannel phase setting/query

[:SOURce[1|2]][:SCHannel]:PHASE[:ADJust]

- [:SOURce{1|2}][:SCHannel]:PHASE[:ADJust]
- [:SOURce{1|2}][:SCHannel]:PHASE[:ADJust]?

Description
Sets/queries the phase of subchannel

Setting parameter
<phase>|MINimum|MAXimum
- <phase> ::= <REAL>[<units>]
- <REAL> → Phase : -180.000° to 180.000°
- Resolution : 0.001°
- <units> ::= DEG
- MINimum → -180.000°
- MAXimum → 180.000°

Query parameter
[MINimum|MAXimum]
MINimum $\rightarrow$ Queries the minimum value
MAXimum $\rightarrow$ Queries the maximum value

Response format

\[<NR3>\]

Setting example

:SOURce1:SCHannel:PHASe:ADJust 90DEG
Sets the subchannel phase of CH1 to 90°

Remarks

The phase setting of modulation source at the time of internal modulation is the same as the entity

### 2.3.1.1.5 Subchannel waveform selection/query

\[[:SOURce[1|2]][:SCHannel]:FUNCTION[:SHAPe]\]

<table>
<thead>
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</tr>
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<td>SINusoid $\rightarrow$ Sine wave</td>
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<td>PRAMp $\rightarrow$ Rising ramp wave</td>
</tr>
<tr>
<td>NRAMp $\rightarrow$ Falling ramp wave</td>
</tr>
<tr>
<td>NOISe $\rightarrow$ Noise</td>
</tr>
<tr>
<td>USER $\rightarrow$ Arbitrary waveform</td>
</tr>
</tbody>
</table>

Query parameter

None

Response format

SIN|SQU|TRI|PRAM|NRAM|NOIS|USER

† For the meaning of each response data, see the setting parameter

Setting example

:SOURce1:SCHannel:FUNCTION:SHAPe SINusoid
Sets the subchannel waveform of CH1 to sine wave

Remarks

The waveform setting of modulation source at the time of internal modulation is the same as the entity
2.3.1.1.6 Subchannel arbitrary waveform selection/query

[:SOURce[1|2]]:SChannel:FUNCTION:USER

- [:SOURce[1|2]]:SChannel:FUNCTION:USER
- [:SOURce[1|2]]:SChannel:FUNCTION:USER?

Description
Selects/queries the arbitrary waveform of subchannel

Setting parameter
- `<memory>` ::= `<INT>`
- `<INT>` Memory number: 0 to 128

Query parameter
None

Response format
- `<NR1>`

Setting example
:SOURce1:SChannel:FUNCTION:USER 3
Sets the data of memory number 3 to the arbitrary waveform of the subchannel of CH1

Remarks
† Memory number 0 is the edit memory.
The arbitrary waveform setting of internal modulation source at the time of modulated oscillation is the same as the entity

2.3.1.1.7 Subchannel noise band setting/query

[:SOURce[1|2]]:SChannel:FUNCTION:NOISe:BW

- [:SOURce[1|2]]:SChannel:FUNCTION:NOISe:BW
- [:SOURce[1|2]]:SChannel:FUNCTION:NOISe:BW?

Description
Sets/queries the bandwidth of noise of subchannel

Setting parameter
- `<bw>`|MINimum|MAXimum
  - `<bw>` ::= `<INT>`
  - `<INT>` → Bandwidth number: 1 to 7
  - MINimum → 1 (Narrowband 100kHz)
  - MAXimum → 7 (Wideband 100MHz)

Query parameter
- [MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR1>

Setting example

:SOURce1:FUNCtion:NOISe:BW 1
Sets the noise from the modulation source of CH1 to the narrowest bandwidth (100kHz)

Remarks

The noise bandwidth setting of internal modulation source at the time of modulated oscillation is the same as the entity
Noise bandwidth corresponding to each parameter is as follows: 1 (100kHz), 2 (300kHz), 3 (1MHz), 4 (3MHz), 5 (10MHz), 6 (30MHz), and 7 (100MHz).

2.3.1.2 Modulated oscillation mode

Some of the modulation functions are available in the burst oscillation mode or the sweep oscillation mode. Therefore, when the "oscillation mode" is "burst oscillation mode" or "sweep oscillation mode," it is necessary to perform "Continuous oscillation mode selection" to switch to the "modulated oscillation mode."

2.3.1.2.1 Common setting of modulation

Starting/stopping of modulation can be performed by "TRIGger[1|2]:SELection:EXECute" described in "Trigger operation/execution control."

2.3.1.2.1.1 Phase of internal modulation source setting/query

[:SOURce[1|2]]:{FSKey|PSKey|FM|PM|AM|AMSC|OFSM|PWM}:INTernal:PHASe[:ADJust]

■[:SOURce[1|2]]:{FSKey|PSKey|FM|PM|AM|AMSC|OFSM|PWM}:INTernal:PHASe[:ADJust]

☐[:SOURce[1|2]]:{FSKey|PSKey|FM|PM|AM|AMSC|OFSM|PWM}:INTernal:PHASe[:ADJust]?

Description

Sets/queries the phase of internal modulation source

Whichever modulation type is specified, the result is the same

Setting parameter

<phase>|MINimum|MAXimum

<phase> ::= <REAL>[<units>]

<REAL> → Phase : -180.000° to 180.000°

Resolution : 0.001°

<units> ::= DEG

MINimum → -180.000°
Query parameter

\[
\text{[MINimum][MAXimum]}
\]

- MINimum → Queries the minimum value
- MAXimum → Queries the maximum value

Response format

\[
\text{<NR3>}
\]

Setting example

:\SOURce1:\FM:INTernal:PHASE:ADJust 90DEG
Sets the phase of the internal modulation source of CH1 to 90°

Remarks

The subchannel phase setting in the continuous oscillation mode is the same as the entity

---

### 2.3.1.2.2 Common setting of FSK/PSK

#### 2.3.1.2.2.1 Modulation source selection/query

\[[:\SOURce[1|2]][:FSKey|PSKey]:\SOURce\]

- \[[:\SOURce[1|2]][:FSKey|PSKey]:\SOURce\]
- \[[:\SOURce[1|2]][:FSKey|PSKey]:\SOURce?\]

**Description**

Selects/queries the modulation source of FSK/PSK

Also when FSKey is specified at the time of PSK, the result is the same

**Setting parameter**

\[
\begin{array}{ll}
\text{INTernal} & \rightarrow \text{Internal} \\
\text{EXTernal} & \rightarrow \text{External} \\
\text{CH1} & \rightarrow \text{Setting of CH1 (Only CH2 of the 2-channel equipment (WF1968) can be selected)} \\
\end{array}
\]

**Query parameter**

None

**Response format**

\[
\text{INT|EXT|CH1}
\]

† For the meaning of each response data, see the setting parameter

**Setting example**

:\SOURce1:FSKey:\SOURce INTernal
Sets the modulation source of FSK/PSK of CH1 to the internal
2.3.1.2.2.2 Signal polarity with external modulation source selection/query

[:SOURce[1|2]]::FSKey|PSKey::SLOPe

- Description
  Selects/queries the polarity while the external modulation source is selected at the time of FSK/PSK

- Setting parameter
  POSitive|NEGative
  POSitive → Positive polarity
  NEGative → Negative polarity

- Query parameter
  None

- Response format
  POS|NEG
  † For the meaning of each response data, see the setting parameter

- Setting example
  :SOURce1::FSKey::SLOPe NEGative
  Sets the polarity of the external modulation source of FSK/PSK of CH1 to the negative polarity

2.3.1.2.2.3 Internal modulation frequency setting/query

[:SOURce[1|2]]::FSKey|PSKey::INTernal::FREQuency

- Description
  Sets/queries the internal modulation frequency of FSK/PSK
  Also when FSKey is specified at the time of PSK, the result is the same

- Setting parameter
  <frequency>|MINimum|MAXimum
  <frequency> ::= <REAL>[<eunits>][<units>]
  <REAL> → Internal modulation frequency : 0.1mHz to 5MHz
  Resolution : 11 digits or 1µHz
  <eunits> ::= M (mega) K|U|N
  † Note that when the unit is frequency, M is used to mean "10^6"
  <units> ::= HZ
MINimum → 0.1mHz  
MAXimum → 5MHz

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FSKey:INTernal:FREQuency 1KH
Sets the internal modulation frequency of FSK/PSK of CH1 to 1kHz

2.3.1.2.2.4 Synchronization signal output selection/query

:OUTPut[1|2]:SYNC:{FSKey|PSKey}:TYPE

■:OUTPut[1|2]:SYNC:{FSKey|PSKey}:TYPE

□:OUTPut[1|2]:SYNC:{FSKey|PSKey}:TYPE?

Description

Selects/queries the synchronization output at the time of FSK/PSK modulation
Whichever modulation type is specified, the result is the same

Setting parameter

SYNC|MSYNc|SFCTn|OFF
SYNC → Waveform synchronization
MSYNc → Internal modulation synchronization
SFCTn → Sub waveform
OFF → Output stop

Query parameter

None

Response format

SYNC|MSYN|SFCT|OFF
† For the meaning of each response data, see the setting parameter

Setting example

:OUTPut1:SYNC:FSKey:TYPE SYNC
Sets the synchronization output of CH1 to the waveform synchronization

Remarks

At the time of burst modulation, ":OUTPut[1|2]:SYNC:BURSt:TYPE" should be used and at the time of sweep modulation, "OUTPut[1|2]:SYNC:SWEep:TYPE" should be used.
2.3.1.2.3 Common setting for other than FSK/PSK

2.3.1.2.3.1 Modulation source selection/query

[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:SOURce

▌[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:SOURce

☐ [:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:SOURce?

Description
Selects/queries the modulation source of FM/PM/AM/AM (DSB-SC)/DC offset modulation/PWM
Whichever modulation type is specified, the result is the same

Setting parameter
INTernal|EXTernal|CH1
INTernal → Internal
EXTernal → External
CH1 → Setting of CH1
(Only CH2 of the 2-channel equipment (WF1968) can be selected)

Query parameter
None

Response format
INT|EXT|CH1
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1::FM:SOURce INTernal
Sets the modulation source of FM of CH1 to the internal

2.3.1.2.3.2 Internal modulation frequency setting/query

[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:INTernal:FREQuency

▌[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:INTernal:FREQuency

☐ [:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:INTernal:FREQuency?

Description
Sets/queries the internal modulation frequency of FM/PM/AM/AM (DSB-SC)/DC offset modulation/PWM
Whichever modulation type is specified, the result is the same

Setting parameter
<frequency>|MINimum|MAXimum
<frequency> ::= <REAL>[<eunits>] [<units>]

Internal modulation frequency: 0.1mHz to 20MHz
Resolution: 12 digits or 1µHz

Note that when the unit is frequency, M is used to mean “10^6”

Query parameter
[MInimum|MAXimum]
MInimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

Setting example
:SOURce1:FMTERnal:FREQuency 1KHZ
Sets the internal modulation frequency of CH1 to 1kHz

2.3.1.2.3.3 Internal modulation waveform selection/query
[:SOURce[1|2]]:{FM|PM|AM|AMSC|OFSM|PWM}:INternal:FUNCtion[:SHApe]

■ [:SOURce[1|2]]:{FM|PM|AM|AMSC|OFSM|PWM}:INternal:FUNCtion[:SHApe]
□ [:SOURce[1|2]]:{FM|PM|AM|AMSC|OFSM|PWM}:INternal:FUNCtion[:SHApe]?

Description
Selects/queries the internal modulation waveform of FM/PM/AM/AM (DSB-SC)/DC offset modulation/PWM
Whichever modulation type is specified, the result is the same

Setting parameter
SINusoid|SQUare|TRIangle|PRAMp|NRAMp|NOISe|USER
SINusoid → Sine wave
SQUare → Square wave
TRIangle → Triangle wave
PRAMp → Rising ramp wave
NRAMp → Falling ramp wave
NOISe → Noise
USER → Arbitrary waveform

Query parameter
None

Response format
SIN|SQU|TRI|PRAM|NRAM|NOIS|USER
† For the meaning of each response data, see the setting parameter
Setting example

Sets the internal modulation waveform of CH1 to sine wave

Remarks
The subchannel waveform setting in the continuous oscillation mode is the same as the entity

2.3.1.2.3.4 Arbitrary waveform for internal modulation selection/query

[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:INTernal:FUNCtion:USER

Description
Selects/queries the arbitrary waveform of the internal modulation waveform of FM/PM/AM/AM (DSB-SC)/DC offset modulation/PWM Whichever modulation type is specified, the result is the same

Setting parameter

<memory> ::= <INT>
<INT> Memory number: 0 to 128

Query parameter
None

Response format

<NR1>

Setting example

Sets the data of memory number 3 to the arbitrary waveform of the internal modulation waveform of CH1

Remarks
† Memory number 0 is the edit memory.
The subchannel arbitrary waveform setting in the continuous oscillation mode is the same as the entity

2.3.1.2.3.5 Noise bandwidth for internal modulation setting/query

[:SOURce[1|2]]::{FM|PM|AM|AMSC|OFSM|PWM}:INTernal:FUNCtion:NOIsSe:BW

Description
Sets/queries the bandwidth of noise
Whichever modulation type is specified, the result is the same

Setting parameter

\[
\begin{align*}
<\text{bw}> & | \text{MINimum} | \text{MAXimum} \\
<\text{bw}> & \text{\(\rightarrow\)} \text{ <INT>} \\
\text{MINimum} & \rightarrow 1 \text{ (Narrowband 100kHz)} \\
\text{MAXimum} & \rightarrow 7 \text{ (Wideband 100MHz)}
\end{align*}
\]

Query parameter

\[
\begin{align*}
\text{MINimum} & \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} & \rightarrow \text{Queries the maximum value}
\end{align*}
\]

Response format

\[
\text{<NR1>}
\]

Setting example

\[
\text{:SOURce1:FM:INTernal:FUNCtion:NOISe:BW 1}
\]
Sets the noise from the modulation source of CH1 to the narrowest bandwidth (100kHz)

Remarks

The subchannel waveform noise bandwidth setting in the continuous oscillation mode is the same as the entity
Noise bandwidth corresponding to each parameter is as follows: 1 (100kHz), 2 (300kHz), 3 (1MHz), 4 (3MHz), 5 (10MHz), 6 (30MHz), and 7 (100MHz).

2.3.1.2.3.6 Synchronization signal output selection/query

\[
\text{:OUTPut[1|2]:SYNC:{FM | PM | AM | AMSC | OFSM | PWM}:TYPE}
\]

Selects/queries the synchronization output at the time of modulation other than FSK/PSK
Whichever modulation type is specified, the result is the same
The operation target is the same as with the selection/query of the synchronization output in the continuous oscillation mode

Setting parameter

\[
\begin{align*}
\text{SYNC}|\text{MSYNc}|\text{MFCTn}|\text{SFCTn}|\text{OFF} \\
\text{SYNC} & \rightarrow \text{Waveform synchronization} \\
\text{MSYNc} & \rightarrow \text{Internal modulation synchronization} \\
\text{MFCTn} & \rightarrow \text{Internal modulation signal} \\
\text{SFCTn} & \rightarrow \text{Sub waveform} \\
\text{OFF} & \rightarrow \text{Output stop}
\end{align*}
\]

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Query parameter
None

Response format
SYNC|MSYN|MFCT|SFCT|OFF
† For the meaning of each response data, see the setting parameter

Setting example
:OUTPut1:SYNC:FSKey:TYPE SYNC
Sets the synchronization output of CH1 to the waveform synchronization

Remarks
When the modulation is stopped in the MSYNc/MFCTn setting, the output shall be converted to SSYNc/SFCTn.
At the time of burst modulation, ":OUTPut[1|2]:SYNC:BURSt:TYPE" should be used and at the time of sweep modulation, "OUTPut[1|2]:SYNC:SWEep:TYPE" should be used.

2.3.1.2.4 FSK (frequency shift keying)

2.3.1.2.4.1 FSK selection/query
[:SOURce[1|2]]:FSKey:STATe

■[:SOURce[1|2]]:FSKey:STATe
□ [:SOURce[1|2]]:FSKey:STATe?

Description
Switches the modulation type to FSK (frequency shift keying)
Queries whether or not the modulation type is FSK

Setting parameter
<state> ::= <BOL>
<BOL> → 0/OFF: Switches off FSK when the modulation type is FSK (frequency shift keying)
1/ON : Switches the modulation type to FSK (frequency shift keying)

Query parameter
None

Response format
<NBOL>
<NBOL> → 0 : Modulation type is not FSK (frequency shift keying)
1 : Modulation type is FSK (frequency shift keying)

Setting example
:SOURce1:FSKey:STATe ON
Switches the modulation type of CH1 to FSK (frequency shift keying)
Remarks
Depending on the state, FSK may be used also when the current oscillation mode is the burst oscillation mode.

2.3.1.2.4.2 Hop frequency setting/query

[:SOURce[1|2]]:FSKey[:FREQuency]

■ [:SOURce[1|2]]:FSKey[:FREQuency]
□ [:SOURce[1|2]]:FSKey[:FREQuency]?

Description
Sets/queries the hop frequency of FSK

Setting parameter

<frequency>|MINimum|MAXimum

<frequency> ::= <REAL>[<eunits>][<units>]
<REAL> → Hop frequency
† The range of setting is within the allowed range of frequency setting for each carrier waveform.
[eunits] ::= M (mega) K|U|N
† Note that when the unit is frequency, M is used to mean “10^6”
<units> ::= HZ

MINimum → Sets the maximum value
MAXimum → Sets the minimum value

Query parameter

[MINimum][MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FSKey:FREQuency 1KHZ
Sets the hop frequency of FSK of CH1 to 1kHz

2.3.1.2.5 PSK (phase shift keying)

2.3.1.2.5.1 PSK selection/query

[:SOURce[1|2]]:PSKey:STATe

■ [:SOURce[1|2]]:PSKey:STATe
□ [:SOURce[1|2]]:PSKey:STATe?

Description
Switches the modulation type to PSK (phase shift keying)
Queries whether or not the modulation type is PSK

**Setting parameter**

\[<\text{state}> ::= \langle\text{BOL}\rangle\]

\[\langle\text{BOL}\rangle \rightarrow \text{0/OFF} : \text{When the modulation type is PSK (phase shift keying), cancels PSK}\]

\[1/\text{ON} : \text{Switches the modulation type to PSK (phase shift keying)}\]

**Query parameter**

None

**Response format**

\[\langle\text{NBOL}\rangle\]

\[\langle\text{NBOL}\rangle \rightarrow \text{0} : \text{Modulation type is not PSK (phase shift keying)}\]

\[1 : \text{Modulation type is PSK (phase shift keying)}\]

**Setting example**

\[:\text{SOUR}ce1:\text{FSKey}:\text{STATe ON}\]

Switches the modulation type of CH1 to PSK (phase shift keying)

**Remarks**

Depending on the state, PSK may be used even when the current oscillation mode is the burst oscillation mode

### 2.3.1.2.5.2 Deviation setting/query

[:\text{SOUR}ce[1|2]]:\text{PSKey}[:\text{DEViation}]

- • [:\text{SOUR}ce[1|2]]:\text{PSKey}[:\text{DEViation}]
- o [:\text{SOUR}ce[1|2]]:\text{PSKey}[:\text{DEViation}]?

**Description**

Sets/queries the deviation of PSK

**Setting parameter**

\[<\text{deviation}>|\text{MINimum}|\text{MAXimum}\]

\[<\text{deviation}> ::= <\text{REAL}>[<\text{units}>]\]

\[<\text{REAL}> \rightarrow \text{Deviation} : -1800.000° \text{to} 1800.000°,\]

\[\text{Resolution} : 0.001°\]

\[<\text{units}> ::= \text{DEG}\]

\[\text{MINimum} \rightarrow -1800.000°\]

\[\text{MAXimum} \rightarrow 1800.000°\]

**Query parameter**

\[[\text{MINimum}|\text{MAXimum}]\]

\[\text{MINimum} \rightarrow \text{Queries the minimum value}\]

\[\text{MAXimum} \rightarrow \text{Queries the maximum value}\]

**Response format**

\[<\text{NR3}>\]
Setting example
:SOURce1:PSKey:DEViation 30DEG
Sets the deviation of PSK of CH1 to 30°

2.3.1.2.6 FM (frequency modulation)

2.3.1.2.6.1 FM selection/query
[:SOURce[1|2]]:FM:STATe

■[:SOURce[1|2]]:FM:STATe
□[:SOURce[1|2]]:FM:STATe?

Description
Switches the modulation type to FM (frequency modulation)
Queries whether or not the modulation type is FM

Setting parameter
<state> ::= <BOL>
  <BOL> → 0/OFF : Cancels FM (frequency modulation) when the modulation type is FM
  1/ON : Switches the modulation type to FM (frequency modulation)

Query parameter
None

Response format
<NBOL>
  <NBOL> → 0 : Modulation type is not FM (frequency modulation)
  1 : Modulation type is FM (frequency modulation)

Setting example
:SOURce1:FM:STATe ON
Switches the modulation type of CH1 to FM (frequency modulation)

Remarks
Depending on the state, FM may be used also when the current oscillation mode is the burst oscillation mode or sweep oscillation mode

2.3.1.2.6.2 Peak deviation setting/query
[:SOURce[1|2]]:FM[:DEViation]

■[:SOURce[1|2]]:FM[:DEViation]
□[:SOURce[1|2]]:FM[:DEViation]?

Description
Sets/queries the peak deviation of FM
Setting parameter

<deviation>[MINimum][MAXimum]

<deviation> ::= <REAL>[<eunits>][<units>]

<REAL> → Peak deviation: 0.00µHz or more but less than 100MHz

Resolution: 8 digits or 0.01µHz

† The setting range is where carrier + peak deviation is within the allowed range of frequency setting for carrier waveform.

<eunits> ::= M (mega) K|U|N

† Note that when the unit is frequency, M is used to mean "10^6"

<units> ::= HZ

MINimum → Sets the minimum value
MAXimum → Sets the maximum value

Query parameter

[MINimum][MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FM:DEViation 1KHZ
Sets the peak deviation of FM of CH1 to 1kHz

2.3.1.2.7 PM (phase modulation)

2.3.1.2.7.1 PM selection/query

[:SOURce[1|2]]:PM:STATe

■[:SOURce[1|2]]:PM:STATe

□[:SOURce[1|2]]:PM:STATe?

Description

Switches the modulation type to PM (phase modulation)
Queries whether or not the modulation type is PM

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF : Cancels PM (phase modulation) when the modulation type is PM

1/ON : Switches the modulation type to PM (phase modulation)

Query parameter

None

Response format
<NBOL>

\[ <\text{NBOL}> \rightarrow 0 : \text{Modulation type is not PM (phase modulation)} \]
\[ \quad 1 : \text{Modulation type is PM (phase modulation)} \]

**Setting example**

:SOURCE1:PM:STATe ON
Switches the modulation type of CH1 to PM (phase modulation)

**Remarks**

Depending on the state, PM may be used also when the current oscillation mode is the burst oscillation mode or sweep oscillation mode.

### 2.3.1.2.7.2 Peak deviation setting/query

\[ [:\text{SOURCE}[1|2]]:PM[:\text{DEViation}] \]

- [:SOURCE[1|2]]:PM[:DEViation]
- [:SOURCE[1|2]]:PM[:DEViation]?

**Description**

Sets/queries the peak deviation of PM

**Setting parameter**

\[ <\text{deviation}>[\text{MINimum}][\text{MAXimum}] \]
\[ <\text{deviation}> ::= <\text{REAL}>[<\text{units}>] \]
\[ <\text{REAL}> \rightarrow \text{Peak deviation} : 0.000° to 180.000°, \]
\[ \text{Resolution} : 0.001° \]
\[ <\text{units}> ::= \text{DEG} \]
\[ \text{MINimum} \rightarrow 0.000° \]
\[ \text{MAXimum} \rightarrow 180.000° \]

**Query parameter**

\[ [\text{MINimum}][\text{MAXimum}] \]
\[ \text{MINimum} \rightarrow \text{Queries the minimum value} \]
\[ \text{MAXimum} \rightarrow \text{Queries the maximum value} \]

**Response format**

\[ <\text{NR3}> \]

**Setting example**

:SOURCE1:PM:DEViation 30DEG
Sets the peak deviation of PM of CH1 to 30°
2.3.1.2.8 AM (amplitude modulation)

2.3.1.2.8.1 AM selection/query

[:SOURce[1|2]]:AM:STATe

- :[:SOURce[1|2]]:AM:STATe
- [:SOURce[1|2]]:AM:STATe?

Description
Switches the modulation type to AM (amplitude modulation)
Queries whether or not the modulation type is AM

Setting parameter

```
<state> ::= <BOL>

<BOL> → 0/OFF : Cancels AM (amplitude modulation) when the modulation type is AM
1/ON : Switches the modulation type to AM (amplitude modulation)
```

Query parameter
None

Response format

```
<NBOL>

<NBOL> → 0 : Modulation type is not AM (amplitude modulation)
1 : Modulation type is AM (amplitude modulation)
```

Setting example

:SOURce1:AM:STATe ON
Switches the modulation type of CH1 to AM

Remarks
Depending on the state, AM may be used also when the current oscillation mode is the burst oscillation mode or sweep oscillation mode.

2.3.1.2.8.2 Modulation depth setting/query

[:SOURce[1|2]]:AM[:DEPTh]

- [:SOURce[1|2]]:AM[:DEPTh]
- [:SOURce[1|2]]:AM[:DEPTh]?

Description
Sets/queries the modulation depth of AM

Setting parameter

```
<depth>|MINimum|MAXimum

< depth > ::= <REAL>[<units>]```

<REAL> → Modulation depth: 0.0% to 100.0%,
Resolution : 0.1%

<units> ::= PCT
MINimum → 0.0%
MAXimum → 100.0%

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example
:SOURce1:AM:DEPTh 30PCT
Sets the modulation depth of AM of CH1 to 30%

Remarks
When the modulation depth is set to 0%, the output amplitude is one-half of the set amplitude.

2.3.1.2.9 AM (DSB-SC)(carrier suppression amplitude modulation)

2.3.1.2.9.1 AM (DSB-SC) selection/query
[:SOURce[1|2]]:AMSC:STATe

■ [:SOURce[1|2]]:AMSC:STATe
☐ [:SOURce[1|2]]:AMSC:STATe?

Description
Switches the modulation type to AM (DSB-SC)(carrier suppression amplitude modulation)
Queries whether or not the modulation type is AM (DSB-SC)

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF : Cancels AM (DSB-SC) when the modulation type is AM (DSB-SC)
1/ON : Switches the modulation type to modulation AM (DSB-SC)

Query parameter
None

Response format

<NBOL>

<NBOL> → 0 : Modulation type is not AM (DSB-SC)
1 : Modulation type is AM (DSB-SC)
Setting example
:SOURce1:AMSC:STATe ON
Switches the modulation type of CH1 to AM (DSB-SC)

Remarks
Depending on the state, AM (SC) may be used also when the current oscillation
mode is
the burst oscillation mode or sweep oscillation mode.

2.3.1.2.9.2 Modulation depth setting/query
[:SOURce[1|2]]:AMSC[:DEPTh]

■[:SOURce[1|2]]:AMSC[:DEPTh]
□[:SOURce[1|2]]:AMSC[:DEPTh]?

Description
Sets/queries the modulation depth of AM (DSB-SC)

Setting parameter
<depth>[MINimum][MAXimum]
  <depth> ::=  <REAL>[<units>]
  <REAL> →  Modulation depth: 0.0% to 100.0%,
          Resolution   : 0.1%
  <units> ::=  PCT
MINimum → 0.0%
MAXimum → 100.0%

Query parameter
[MINimum][MAXimum]
  MINimum → Queries the minimum value
  MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:AMSC:DEPTh 30PCT
Sets the modulation depth of AM (DSB-SC) of CH1 to 30%

Remarks
When the modulation depth is set to 100%, the maximum amplitude of output
becomes equal to the amplitude setting.
2.3.1.2.10  DC offset modulation

2.3.1.2.10.1  DC offset modulation selection/query

[:SOURce[1|2]]:OFSM:STATe

- [:SOURce[1|2]]:OFSM:STATe
- [:SOURce[1|2]]:OFSM:STATe?

Description
Switches the modulation type to DC offset modulation
Queries whether or not the modulation type is DC offset modulation

Setting parameter
<state> ::= <BOL>
<BOL> → 0/OFF : Cancels the DC offset modulation when the modulation type is DC offset modulation
1/ON : Switches the modulation type to DC offset modulation

Query parameter
None

Response format
<NBOL>
<NBOL> → 0 : Modulation type is not DC offset modulation
1 : Modulation type is DC offset modulation

Setting example
:SOURce1:OFSM:STATe ON
Switches the modulation type of CH1 to DC offset modulation

Remarks
Depending on the state, DC offset modulation may be used also when the current oscillation mode is the burst oscillation mode or sweep oscillation mode.

2.3.1.2.10.2  Peak deviation setting/query

[:SOURce[1|2]]:OFSM[:DEViation]

- [:SOURce[1|2]]:OFSM[:DEViation]
- [:SOURce[1|2]]:OFSM[:DEViation]?

Description
Sets/queries the peak deviation of DC offset modulation

Setting parameter
<deviation>|MINimum|MAXimum
<deviation> ::= <REAL>[<eunits>][<units>]
<REAL> → Peak deviation: 0V to 10V/open,
Resolution: 4 digits or 0.1mV (499.9mV or less),
5 digits or 1mV (0.5V or more),
<eunits> ::= M (milli)
<units> ::= V
MINimum → 0V/open
MAXimum → 10V/open

Query parameter
[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:OFSM:DEViation 3V
Sets the peak deviation of DC offset modulation of CH1 to 3V

2.3.1.2.11 PWM (pulse width modulation)

2.3.1.2.11.1 PWM selection/query
[:SOURce[1|2]]:PWM:STATe

■[:SOURce[1|2]]:PWM:STATe
☐[:SOURce[1|2]]:PWM:STATe?

Description
Switches the modulation type to PWM (pulse width modulation)
Queries whether or not the modulation type is PWM

Setting parameter
<state> ::= <BOL>
<BOL> → 0/OFF: Cancels PWM when the modulation type is PWM
1/ON: Switches the modulation type to PWM (pulse width modulation)

Query parameter
None

Response format
<NBOL>
<NBOL> → 0: Modulation type is not PWM (pulse width modulation)
1: Modulation type is PWM (pulse width modulation)
Setting example
:SOURce1:PWM:STATe ON
Switches the modulation type of CH1 to PWM (pulse width modulation)

Remarks
Depending on the state, PWM may be used also when the current oscillation mode is
the burst oscillation mode or sweep oscillation mode.

2.3.1.2.11.2 Peak deviation setting/query
[:SOURce[1|2]]:PWM[:DEViation]:DCYCle

■[:SOURce[1|2]]:PWM[:DEViation]:DCYCle
□[:SOURce[1|2]]:PWM[:DEViation]:DCYCle?

Description
Sets/queries the peak deviation of PWM
† The upper limit of peak deviation setting may vary depending on the duty value of
the carrier, or on the oscillation frequency in case of square wave with the normal
duty range setting or in case of pulse wave

Setting parameter
<deviation>|MINimum|MAXimum
<deviation> ::= <REAL>[<units>]
<REAL> → Peak deviation
: 0.0000 % to 49.9900 %
(Square wave/normal duty range)
: 0.0000 % to 50.0000 %
(Square wave/extended duty range)
: 0.0000 % to 49.9000 % (pulse wave)

Resolution : 0.0001 %
<units> ::= PCT
MINimum → 0.0000 %
MAXimum → 49.9900 % (Square wave/normal duty range),
50.0000 % (Square wave/extended duty range),
49.9000 % (Pulse wave)

Query parameter
[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:PWM:DEViation:DCYCle 30PCT
Sets the peak deviation of PWM of CH1 to 30%
2.3.1.3 Sweep oscillation mode

2.3.1.3.1 Common setting of sweep

Starting/stopping/hold/resume of sweep can be performed by "TRIGger[1|2]:SELected:EXECute" described in "2.3.5.9 Trigger operation/execution control."

2.3.1.3.1.1 Sweep mode selection/query

[:SOURce[1|2]]:SWEep:MODE

- [:SOURce[1|2]]:SWEep:MODE
- [:SOURce[1|2]]:SWEep:MODE?

Description
Selects/queries the sweep mode

Setting parameter
SINGle|CONTinuous|GATed
  SINGle → Single
  CONTinuous → Continuous
  GATed → Gated single

Query parameter
None

Response format
SING|CONT|G
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:SWEep:MODE SINGle
Sets the sweep mode of CH1 to the single

2.3.1.3.1.2 Sweep slope selection/query

[:SOURce[1|2]]:SWEep:SPACing

- [:SOURce[1|2]]:SWEep:SPACing
- [:SOURce[1|2]]:SWEep:SPACing?

Description
Selects/queries the sweep slope

Setting parameter
LINear|LOGarithmic
  LINear → Linear
  LOGarithmic → Logarithmic

Query parameter
None

Response format
LIN|LOG
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:SWEep:SPACing LINear
Sets the sweep slope of CH1 to linear

2.3.1.3.1.3 Sweep direction selection/query
[:SOURce[1|2]]:SWEep:INTernal:FUNCtion

■[:SOURce[1|2]]:SWEep:INTernal:FUNCtion
□[:SOURce[1|2]]:SWEep:INTernal:FUNCtion?

Description
Selects/queries the sweep direction

Setting parameter
RAMP|TRIangle
  RAMP → One way
  TRIangle → Shuttle

Query parameter
None

Response format
RAMP|TRI
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:SWEep:INTernal:FUNCtion RAMP
Sets the sweep direction of CH1 to one-way

2.3.1.3.1.4 Sweep time setting/query
[:SOURce[1|2]]:SWEep:TIME

■[:SOURce[1|2]]:SWEep:TIME
□[:SOURce[1|2]]:SWEep:TIME?

Description
Sets/queries the sweep time

Setting parameter
<t ime>|MINimum|MAXimum
  <time> := <REAL>[<eunits>][<units>]
  <REAL> → Sweep time  : 0.1ms to 10ks
  Resolution : 4 digits or 0.1ms
<eunits> ::= MA (mega) | K|M (milli) U|N
<uunits> ::= S
MINimum → 0.1 ms
MAXimum → 10,000 s

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:SWEep:TIME 1MS
Sets the sweep time of CH1 to 1ms

2.3.1.3.1.5 Stop level setting/query

[:SOURce[1|2]]:SWEep:SLEVel

■[:SOURce[1|2]]:SWEep:SLEVel
□[:SOURce[1|2]]:SWEep:SLEVel?

Description

Sets/queries the stop level value when the oscillation is stopped, in case of gated single-shot sweep

Setting parameter

<level>|MAXimum|MINimum
<level> ::= <REAL>[<uunits>]
REAL → Stop level value : -100.00 % to 100.00 %, Resolution : 0.01 %
(uunits) ::= PCT
MINimum → -100.00 %
MAXimum → 100.00 %

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:SWEep:SLEVel 20PCT
Sets the stop level value to 20% when gated single-shot sweep of CH1 is stopped
2.3.1.3.1.6 Stop level selection/query
[:SOURce[1|2]]:SWEep:SLEVel:STATe

- [:SOURce[1|2]]:SWEep:SLEVel:STATe
- [:SOURce[1|2]]:SWEep:SLEVel:STATe?

Description
Selects/queries the stop level value when the oscillation is stopped, in case of single-shot sweep or gated single-shot sweep

Setting parameter
- <state> ::= <BOL>
  - <BOL> → 0/OFF : Disabled
  - 1/ON : Enabled

Query parameter
None

Response format
<NBOL>

Setting example
:SOURce1:SWEep:SLEVel:STATe ON
Enables the stop level value when the oscillation is stopped, in case of single-shot sweep or gated single-shot sweep of CH1

2.3.1.3.1.7 Oscillation stop unit setting/query
[:SOURce[1|2]]:SWEep:OSTop

- [:SOURce[1|2]]:SWEep:OSTop
- [:SOURce[1|2]]:SWEep:OSTop?

Description
Selects/queries the oscillation stop unit at the time of sweep oscillation

Setting parameter
- HALF|CYCLE
  - HALF → Half-cycle
  - CYCLE → 1 cycle

Query parameter
None

Response format
HALF|CYCL
† For the meaning of each response data, see the setting parameter

Setting example
Instructio

2.3.1.3.1.8 Multi-connector control on/off selection/query

[:SOURce[1|2]]:SWEep:MCONnector:STATe

- [:SOURce[1|2]]:SWEep:MCONnector:STATe
- [:SOURce[1|2]]:SWEep:MCONnector:STATe?

**Description**

Selects/queries whether or not the multi-connector control is enabled/disabled

**Setting parameter**

- <state> ::= <BOL>
  - <BOL> → 0/OFF : Disabled
  - 1/ON  : Enabled

**Query parameter**

None

**Response format**

<NBOL>

**Setting example**

:SOURce1:SWEep:MCONnector:STATe ON

Enables the multi-connector control of CH1

2.3.1.3.1.9 Synchronization output selection/query

:OUTPut[1|2]:SYNC:SWEep:TYPE

- :OUTPut[1|2]:SYNC:SWEep:TYPE
- :OUTPut[1|2]:SYNC:SWEep:TYPE?

**Description**

Selects/queries the synchronization output in the sweep oscillation mode

**Setting parameter**

SYNC|SSYNc|XDRive|MARKer|OFF
- SYNC → Reference phase synchronization
- SSYNc → Sweep synchronization
- XDRive → Sweep X drive
- MARKer → Marker
- OFF → Output stop

**Query parameter**

None

**Response format**

SYNC|SSYN|XDR|MARK|OFF
† For the meaning of each response data, see the setting parameter

Setting example
[:SOURce1]:SYNC:SWEep:TYPE SYNC
Sets the sweep synchronization output of CH1 to the reference phase synchronization

2.3.1.3.2 Frequency Sweep Setting

2.3.1.3.2.1 Frequency sweep selection/query
[:SOURce[1|2]]:FREQuency:MODE

■[:SOURce[1|2]]:FREQuency:MODE

☐[:SOURce[1|2]]:FREQuency:MODE?

Description
Switches the oscillation mode to the sweep oscillation frequency sweep type
Queries whether or not the oscillation mode is the sweep oscillation frequency sweep type

Setting parameter
CW|FIXed|SWEep
  CW|FIXed → Switch to the continuous oscillation when the oscillation mode is the sweep oscillation frequency sweep type
  SWEep → Switches the oscillation mode to the sweep oscillation frequency sweep type

Query parameter
None

Response format
CW|FIX|SWE
  CW|FIX : The oscillation mode is not the sweep oscillation frequency sweep type
  SWE : The oscillation mode is the sweep oscillation frequency sweep type

Setting example
:SOURce1:FREQuency:MODE SWEep
Sets the oscillation mode of CH1 to the sweep oscillation frequency sweep type
2.3.1.3.2.2 Starting value setting/query
[:SOURce[1|2]]:FREQuency:STARt

- [:SOURce[1|2]]:FREQuency:STARt
- [:SOURce[1|2]]:FREQuency:STARt?

Description
Sets/queries the starting value of the frequency sweep

Setting parameter

- `<frequency>|MINimum|MAXimum`
  - `<frequency>` ::= `<REAL>[<eunits>][<units>]`
  - `<REAL>` → Stop value: 0.01 µHz to 200 MHz
    - Resolution: 0.01 µHz (<50 MHz), 0.1 µHz (≥ 50MHz)
  - † The setting range varies depending on the waveform and oscillation mode.
  - `<eunits>` ::= M (mega) K|U|N
  - † Note that when the unit is frequency, M is used to mean \(^{10}\)\(^{6}\)
  - `<units>` ::= HZ
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value

Query parameter

- [MINimum[MAXimum]]
  - MINimum → Queries the minimum value
  - MAXimum → Queries the maximum value

Response format

- <NR3>

Setting example

- :SOURce1:FREQuency:STARt 1KHZ
  - Sets the starting value of the frequency sweep of CH1 to 1kHz

2.3.1.3.2.3 Stop value setting/query
[:SOURce[1|2]]:FREQuency:STOP

- [:SOURce[1|2]]:FREQuency:STOP
- [:SOURce[1|2]]:FREQuency:STOP?

Description
Sets/queries the stop value of frequency sweep

Setting parameter

- `<frequency>|MINimum|MAXimum`
  - `<frequency>` ::= `<REAL>[<eunits>][<units>]`

Query parameter

- [MINimum[MAXimum]]
  - MINimum → Queries the minimum value
  - MAXimum → Queries the maximum value
Stop value: 0.01 µHz to 200 MHz
Resolution: 0.01 µHz (<50 MHz), 0.1 µHz (≧ 50 MHz)
† The setting range varies depending on the waveform and oscillation mode.
<units> ::= M (mega) K|U|N
† Note that when the unit is frequency, M is used to mean "10^6"
<units> ::= HZ
MINimum → Sets the minimum value
MAXimum → Sets the maximum value

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FREQuency:STOP 1KHZ
Sets the stop value of the frequency sweep of CH1 to 1kHz

2.3.1.3.2.4 Center value setting/query

[:SOURce[1|2]]:FREQuency:CENTer

■[:SOURce[1|2]]:FREQuency:CENTer

☐[:SOURce[1|2]]:FREQuency:CENTer?

Description

Sets/queries the center value of frequency sweep

Setting parameter

<frequency>[MINimum][MAXimum]

<frequency> ::= <REAL>[<eunits>][<units>]

<REAL> → Center value: 0.01 µHz to 200 MHz
Resolution: 0.01 µHz (<50 MHz), 0.1 µHz (≧ 50 MHz)
† The setting range varies depending on the waveform and oscillation mode.
<eunits> ::= M (mega) K|U|N
† Note that when the unit is frequency, M is used to mean "10^6"
<units> ::= HZ
MINimum → Sets the minimum value
MAXimum → Sets the maximum value

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value
Response format

<NR3>

Setting example

:SOURce1:FREQuency:CENTer 1KHZ
Sets the center value for the frequency sweep of CH1 to 1kHz

2.3.1.3.2.5 Span value setting/query
[:SOURce[1|2]]:FREQuency:SPAN

■ [:SOURce[1|2]]:FREQuency:SPAN

□ [:SOURce[1|2]]:FREQuency:SPAN?

Description
Sets/queries the span value of frequency sweep

Setting parameter

\(<\text{frequency}>|\text{MINimum}|\text{MAXimum} \)

\(<\text{frequency}> := <\text{REAL}>[[\text{eunits}]][\text{units}]\)

\(<\text{REAL}> \rightarrow \) Span value : 0Hz to 199.999 999 999 999 9 MHz,

Resolution : 0.01 µHz (<50 MHz), 0.1 µHz (≧ 50 MHz)

† The setting range varies depending on the waveform and oscillation mode.

\(<\text{eunits}> := \text{M (mega) K|U|N} \)

† Note that when the unit is frequency, M is used to mean “10^6”

\(<\text{units}> := \text{HZ} \)

\(\text{MINimum} \rightarrow \) Sets the minimum value
\(\text{MAXimum} \rightarrow \) Sets the maximum value

Query parameter

[\text{MINimum}|\text{MAXimum}]

\(\text{MINimum} \rightarrow \) Queries the minimum value
\(\text{MAXimum} \rightarrow \) Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FREQuency:SPAN 1KHZ
Sets the span value for the frequency sweep of CH1 to 1kHz
### 2.3.1.3.2.6 Marker value setting/query

[:SOURce[1|2]]:MARKer:FREQuency

- **Description**
  Sets/queries the marker value of frequency sweep

- **Setting parameter**
  
  ```
  <frequency>|CENTer|MINimum|MAXimum
  <frequency> ::= <REAL>[<eunits>][<units>]
  <REAL> → Marker value: 0.01 µHz to 200 MHz
  Resolution: 0.01 µHz (<50 MHz), 0.1 µHz (≧50 MHz)
  † The setting range varies depending on the waveform and
  oscillation mode.
  <eunits> ::= M (mega) K|U|N
  † Note that when the unit is frequency, M is used to mean "10^6"
  <units> ::= HZ
  CENTer → Center value of frequency sweep
  MINimum → Sets the minimum value
  MAXimum → Sets the maximum value
  ```

- **Query parameter**
  
  ```
  [CENTer|MINimum|MAXimum]
  CENTer → Queries the center value of frequency sweep
  MINimum → Queries the minimum value
  MAXimum → Queries the maximum value
  ```

- **Response format**
  
  ```
  <NR3>
  ```

- **Setting example**
  
  ```
  :SOURce1:MARKer:FREQuency 1KHZ
  Sets the marker value of the frequency sweep of CH1 to 1kHz
  ```

### 2.3.1.3.2.7 Start/stop value swapping setting

[:SOURce[1|2]]:FREQuency:SWAP

- **Description**
  Swaps the starting value and the stop value of the frequency sweep

- **Setting parameter**
  None

- **Setting example**
  None
2.3.1.3.2.8 Start/stop value output setting

[:SOURce[1|2]]:FREQuency:STATe

**Description**

Switches the state of frequency sweep

**Setting parameter**

STARt|STOP

STARt → Switches the output to the starting value
STOP → Switches the output to the stop value

**Setting example**

:SOURce1:FREQuency:STATe START
Switches the state of frequency sweep of CH1 to the starting value

2.3.1.3.3 Phase sweep setting

2.3.1.3.3.1 Phase sweep selection/query

[:SOURce[1|2]]:PHASe:MODE

**Description**

Switches the oscillation mode to the sweep oscillation phase sweep type
Queries whether or not the oscillation mode is the sweep oscillation phase sweep type

**Setting parameter**

FIXed|SWEep

FIXed → Switch to the continuous oscillation when the oscillation mode is the sweep oscillation phase sweep type
SWEep → Switches the oscillation mode to the sweep oscillation phase sweep type

**Query parameter**

None

**Response format**

FIX|SWE

FIX : Oscillation mode is not the sweep oscillation phase sweep type
SWE : Oscillation mode is the sweep oscillation phase sweep type
Setting example
:SOURce1:PHASe:MODE SWEEP
Sets the oscillation mode of CH1 to the sweep oscillation phase sweep type

2.3.1.3.3.2 Starting value setting/query
[:SOURce[1|2]]:PHASe:STARt

■ [:SOURce[1|2]]:PHASe:STARt
☐ [:SOURce[1|2]]:PHASe:STARt?

Description
Sets/queries the starting value of the phase sweep

Setting parameter

<phase>|MINimum|MAXimum
<phase> ::= <REAL>[<units>]  
<REAL> → Starting value : -1800.000° to 1800.000°  
Resolution : 0.001°
<units> ::= DEG
MINimum → - 1800.000°
MINimum → 1800.000°

Query parameter

[MNimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:PHASe:START 90DEG
Sets the starting value of the phase sweep of CH1 to 90°

2.3.1.3.3.3 Stop value setting/query
[:SOURce[1|2]]:PHASe:STOP

■ [:SOURce[1|2]]:PHASe:STOP
☐ [:SOURce[1|2]]:PHASe:STOP?

Description
Sets/queries the stop value of the phase sweep

Setting parameter

<phase>|MINimum|MAXimum
<phase> ::= <REAL>[<units>]  
<REAL> → Stop value : -1800.000° to 1800.000°,  
Resolution : 0.001°
2.3.1.3.3.4 Center value setting/query

[:SOURce[1|2]]:PHASe:CENTer

■ [:SOURce[1|2]]:PHASe:CENTer

☐ [:SOURce[1|2]]:PHASe:CENTer?

Description
Sets/queries the center value of the phase sweep

Setting parameter

<phase>|MINimum|MAXimum

<phase> ::= <REAL>[<units>]

<REAL> → Center value: -1800.000° to 1800.000°, Resolution: 0.001°

<units> ::= DEG

MINimum → -1800.000°
MAXimum → 1800.000°

Query parameter

[MINimum|MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:PHASe:STOP 90DEG
Sets the stop value of the phase sweep of CH1 to 90°

:SOURce1:PHASe:CENTer 90DEG
Sets the center value of the phase sweep of CH1 to 90°
2.3.1.3.3.5 Span value setting/query
[:SOURce[1|2]]::PHAsE::SPAN

- [:SOURce[1|2]]::PHAsE::SPAN
- [:SOURce[1|2]]::PHAsE::SPAN?

Description
Sets/queries the span value of the phase sweep

Setting parameter
- <phase>|MINimum|MAXimum
  - <phase> ::= <REAL>[<units>]
    - <REAL> → Span value: 0.000° to 3600.000°,
      Resolution: 0.001°
  - <units> ::= DEG
    - MINimum → 0.000°
    - MAXimum → 3600.000°

Query parameter
- [MINimum|MAXimum]
  - MINimum → Queries the minimum value
  - MAXimum → Queries the maximum value

Response format
- <NR3>

Setting example
:SOURce1::PHAsE::SPAN 90DEG
Sets the span value of the phase sweep of CH1 to 90°

2.3.1.3.3.6 Marker value setting/query
[:SOURce[1|2]]::MARKer::PHAsE

- [:SOURce[1|2]]::MARKer::PHAsE
- [:SOURce[1|2]]::MARKer::PHAsE?

Description
Sets/queries the marker value of the phase sweep

Setting parameter
- <phase>|CENTer|MINimum|MAXimum
  - <phase> ::= <REAL>[<units>]
    - <REAL> → Marker value: -1800.000° to 1800.000°,
      Resolution: 0.001°
  - <units> ::= DEG
    - CENTer → Center value of the phase sweep
    - MINimum → -1800.000°
    - MAXimum → 1800.000°
Query parameter

[CNETer][MINimum][MAXimum]

CENTER → Queries the center value of the phase sweep
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:MARKer:PHASe 90DEG
Sets the marker value of the phase sweep of CH1 to 90°

2.3.1.3.3.7 Start/stop value swapping setting

[:SOURce[1|2]]:PHASe:SWAP

Description

Swaps the starting value and the stop value of the phase sweep

Setting parameter

None

Setting example

:SOURce1:PHASe:SWAP
Swaps the starting value and the stop value of the phase sweep of CH1

2.3.1.3.3.8 Start/stop value output setting

[:SOURce[1|2]]:PHASe:STATe

Description

Switches the state of phase sweep

Setting parameter

START|STOP
START → Switches the output to the starting value
STOP → Switches the output to the stop value

Setting example

:SOURce1:PHASe:STATe START
Switches the state of phase sweep of CH1 to the starting value
2.3.1.3.4 Amplitude sweep setting

2.3.1.3.4.1 Amplitude sweep selection/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:MODE

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:MODE
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:MODE?

Description
Switches the oscillation mode to the sweep oscillation amplitude sweep type
Queries whether or not the oscillation mode is the sweep oscillation amplitude sweep type

Setting parameter
FIXed|SWEep
- FIXed → Switch to the continuous oscillation when the oscillation mode is the sweep oscillation amplitude sweep type
- SWEep → Switches the oscillation mode to the sweep oscillation amplitude sweep type

Query parameter
None

Response format
FIX|SWE
- FIX : The oscillation mode is not the sweep oscillation amplitude sweep type
- SWE : The oscillation mode is the sweep oscillation amplitude sweep type

Setting example
:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:MODE SWEep
Sets the oscillation mode of CH1 to the sweep oscillation amplitude sweep type

2.3.1.3.4.2 Starting value setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:START

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:START
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:START?

Description
Sets/queries the starting value of the amplitude sweep

Setting parameter
<amplitude>|MINimum|MAXimum
- <amplitude> ::= <REAL>[<eunits>][<units>]
- <REAL> → Starting value : 0Vp-p to 20Vp-p/open,
Instructio

Resolution

: 0 Vp-p to 10 Vp-p/50Ω,
: -Inf, -89.03 to +16.98dBV/open,
: -Inf, -82.04 to +23.97 dBm/50Ω

† Inf: Infinity
† The setting range varies depending on the waveform,
frequency, and DC offset.

<eunits> ::= M (milli)
<units> ::= VPP|VPK|VRMS|DBV|DBM

MINimum  →  0 Vp-p
MAXimum  →  20Vp-p/open, 10Vp-p/50Ω

(This is the settable upper limit with the current setting)

Query parameter

[MINimum[MAXimum]
MINimum  →  Queries the minimum value
MAXimum  →  Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:STARt 5VPP
Sets the starting value of the amplitude sweep of CH1 to 5Vp-p

2.3.1.3.4.3 Stop value  setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:STOP

■[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:STOP
□[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:STOP?

Description

Sets/queries the stop value of the amplitude sweep

Setting parameter

<amplitude>|MINimum[MAXimum

<amplitude> ::= <REAL>[<eunits>]<[units>]
<REAL>  →  Stop value : 0Vp-p to 20Vp-p/open,
: 0Vp-p to 10Vp-p/50Ω,
: -Inf, -89.03 to +16.98dBV/open,
: -Inf, -82.04 to +23.97 dBm/50Ω

Resolution  : 4 digits or 0.1mVp-p (999.9mVp-p or less),
: 5 digits or 1mVp-p (1Vp-p or more)
: 0.01 (Unit is DBV/DBM)
The setting range varies depending on the waveform, frequency, and DC offset.

<eunits> ::= M (milli)
<units> ::= VPP|VPK|VRMS|DBV|DBM

MINimum → 0 Vp-p
MAXimum → 20Vp-p/open, 10Vp-p/50Ω
(This is the settable upper limit with the current setting)

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:STOP 5VPP
Sets the stop value of the amplitude sweep of CH1 to 5Vp-p

2.3.1.3.4 Center value setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:CENTer

Description
Sets/queries the center value of the amplitude sweep

Setting parameter

<amplitude>|MINimum|MAXimum
<amplitude> ::= <REAL>[<eunits>][<units>]

<REAL> → Center value: 0Vp-p to 20Vp-p/open,
: 0 Vp-p to 10 Vp-p/50Ω,
:-Inf, -89.03 to +16.98dBV/open,
:-Inf, -82.04 to +23.97 dBm/50Ω

Resolution: 4 digits or 0.1mVp-p
(999.9mVp-p or less),
: 5 digits or 1mVp-p
(1Vp-p or more)
: 0.01 (Unit is DBV/DBM)

† Inf: Infinity
† The setting range varies depending on the waveform, frequency, and DC offset.

<eunits> ::= M (milli)
<units> ::= VPP|VPK|VRMS|DBV|DBM

MINimum → 0 Vp-p
MAXimum → 20Vp-p/open, 10Vp-p/50Ω
(This is the settable upper limit with the current setting)

**Query parameter**

\[
\text{[MINimum][MAXimum]}
\]

- **MINimum** → Queries the minimum value
- **MAXimum** → Queries the maximum value

**Response format**

\[
<NR3>
\]

**Setting example**

:\SOUR\text{ce}1:\VOLT\text{age}:\IMMediate:AMPLitude:CENTer 5VPP

Sets the center value of the amplitude sweep of CH1 to 5Vp-p

### 2.3.1.3.4.5 Span value setting/query

\[
[:\SOUR\text{ce}[1|2]]:\VOLT\text{age}[[:\LEVel][:\IMMediate][:\AMPLitude]]:SPAN
\]

- **[MINimum]** \[MINimum → Queries the minimum value\]
- **[MAXimum]** \[MAXimum → Queries the maximum value\]

**Response format**

\[
<NR3>
\]

**Setting parameter**

\[
<\text{amplitude}>|\text{MINimum}|\text{MAXimum}
\]

- **<amplitude>** ::= \( <\text{REAL}>[<\text{eunits}>][<\text{units}>] \)
- **<REAL>** → Span value: 0Vp-p to 20Vp-p/open,
  - 0 Vp-p to 10 Vp-p/50Ω,
  - -Inf, -89.03 to +16.98 dBV/open,
  - -Inf, -82.04 to +23.97 dBm/50Ω

Resolution: 4 digits or 0.1mVp-p (999.9mVp-p or less),
- 5 digits or 1mVp-p (1Vp-p or more)
- 0.01 (Unit is DBV/DBM)

† Inf: Infinity
---
† The setting range varies depending on the waveform, frequency, and DC offset.

- **<eunits>** ::= M (milli)
- **<units>** ::= VPP|VPK|VRMS|DBV|DBM

- **MINimum** → 0 Vp-p
- **MAXimum** → 20Vp-p/open, 10Vp-p/50Ω

(This is the settable upper limit with the current setting)

**Query parameter**

\[
\text{[MINimum][MAXimum]}
\]

- **MINimum** → Queries the minimum value
- **MAXimum** → Queries the maximum value

**Response format**

\[
<NR3>
\]
2.3.1.3.4.6 **Marker value setting/query**

[:SOURce[1|2]]:MARKer:VOLTage[:LEVel][:IMMediate][:AMPLitude]

- [:SOURce[1|2]]:MARKer:VOLTage[:LEVel][:IMMediate][:AMPLitude]
- [:SOURce[1|2]]:MARKer:VOLTage[:LEVel][:IMMediate][:AMPLitude]?

**Description**
Sets/queries the marker value of the amplitude sweep.

**Setting parameter**

<amplitude>|CENTer|MINimum|MAXimum

<amplitude> ::= <REAL>[<eunits>][<units>]

<REAL> → Marker value
: 0Vp-p to 0Vp-p/open,
: 0 Vp-p to 10 Vp-p/50Ω,
: -Inf, -89.03 to +16.98dBV/open,
: -Inf, -82.04 to +23.97 dBm/50Ω

Resolution :
: 4 digits or 0.1mVp-p (999.9mVp-p or less),
: 5 digits or 1mVp-p (1Vp-p or more)
: 0.01 (Unit is DBV/DBM)

† Inf: Infinity
† The setting range varies depending on the waveform, frequency, and DC offset.

<eunits> ::= M (milli)
<units> ::= VPP|VPK|VRMS|DBV|DBM

CENTer → Center value of the amplitude sweep
MINimum → 0 Vp-p
MAXimum → 20Vp-p/open, 10Vp-p/50Ω
(This is the settable upper limit with the current setting)

**Query parameter**

[CENTer|MINimum|MAXimum]

CENTer → Queries the center value of the amplitude sweep
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

**Response format**

<NR3>

**Setting example**

:SOURce1::MARKer:VOLTage:LEVel:IMMediate:AMPLitude:SPAN 5VPP
Sets the span value of the amplitude sweep of CH1 to 5Vp-p
2.3.1.3.4.7 Start/stop value swapping setting

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:SWAP

Description
Swaps the starting value and the stop value of the amplitude sweep

Setting parameter
None

Setting example
:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:SWAP
Swaps the starting value and the stop value of the amplitude sweep of CH1

2.3.1.3.4.8 Start/stop value output setting

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:STATe

Description
Switches the state of amplitude sweep

Setting parameter
START|STOP

START → Switches the output to the starting value
STOP → Switches the output to the stop value

Setting example
:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:STATe START
Switches the state of amplitude sweep of CH1 to the starting value

2.3.1.3.5 DC offset sweep setting

2.3.1.3.5.1 DC offset sweep selection/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:MODE

Description
Switches the oscillation mode to the sweep oscillation DC offset sweep type
Queries whether or not the oscillation mode is the sweep oscillation DC offset sweep type

Setting parameter
FIXed|SWEep
FIXed → Switch to the continuous oscillation when the oscillation mode is the sweep oscillation DC offset sweep type
SWEep → Switches the oscillation mode to the sweep oscillation DC offset sweep type

Query parameter
None

Response format
FIX|SWE
FIX : The oscillation mode is not the sweep oscillation DC offset sweep type
SWE : The oscillation mode is the sweep oscillation DC offset sweep type

Setting example
:SOURce1:VOLTage:LEVel:IMMediate:OFFSet:MODE SWEep
Sets the oscillation mode of CH1 to the sweep oscillation DC offset sweep type

2.3.1.3.5.2 Starting value setting/query
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STARt

■[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STARt
☐[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STARt?

Description
Sets/queries the starting value of the DC offset sweep

Setting parameter
<offset>|MINimum|MAXimum
<offset> ::= <REAL>[<eunits>[<units>]]
<REAL> → DC offset : ±10V/open, ±5V/50Ω,
Resolution : 4 digits or 0.1mV (±499.9mV or less),
: 5 digits or 1mV (±0.5V or more),
<eunits> ::= M (milli)
<units> ::= V
MINimum → -10V/open, -5V/50Ω
(MINimum is the settable lower limit with the current setting)
MAXimum → 10V/open, 5V/50Ω (MAXimum is the settable upper limit with the current setting)

Query parameter
[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>
Setting example
:SOURce1:VOLTage:LEVel:IMMediate:OFFSet:STARt 2.5V
Sets the starting value of the DC offset sweep of CH1 to 2.5V

2.3.1.3.5.3 Stop value setting/query
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STOP

◼[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STOP
☐[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STOP?

Description
Sets/queries the stop value of DC offset sweep

Setting parameter
<offset>|MINimum|MAXimum
<offset> ::= <REAL>[<eunits>[<units>]]
<REAL> → DC offset : ±10V/open, ±5V/50Ω,
Resolution : 4 digits or 0.1mV
(±499.9mV or less),
: 5 digits or 1mV (±0.5V or more),
† The setting range varies depending on the amplitude setting.
<eunits> ::= M (milli)
<units> ::= V
MINimum → -10V/open, -5V/50Ω
(This is the settable lower limit with the current setting)
MAXimum → 10V/open, 5V/50Ω
(This is the settable upper limit with the current setting)

Query parameter
[M|INimum|M|AXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:VOLTage:LEVel:IMMediate:OFFSet:STOP 2.5V
Sets the stop value of the DC offset sweep of CH1 to 2.5V

2.3.1.3.5.4 Center value setting/query
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:CENTer

◼[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:CENTer
☐[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:CENTer?
Description
Sets/queries the center value of DC offset sweep

Setting parameter

```
<offset>|MINimum|MAXimum
<offset> ::=  <REAL>[<eunits>][<units>]
<REAL> → DC offset : ±10V/open, ±5V/50Ω,
       Resolution : 4 digits or 0.1mV
                       (±499.9mV or less),
                       : 5 digits or 1mV (±0.5V or more)
† The setting range varies depending on the amplitude setting.
<eunits> ::= M (milli)
<units> ::= V
MINimum → -10V/open, -5V/50Ω
           (This is the settable lower limit with the current setting)
MAXimum → 10V/open, 5V/50Ω
           (This is the settable upper limit with the current setting)
```

Query parameter

```
[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value
```

Response format

```
<NR3>
```

Setting example

```
:SOURce1:VOLTage:LEVel:IMMediate:OFFSet:CENTer 2.5V
Sets the center value of the DC offset sweep of CH1 to 2.5V
```

2.3.1.3.5.5 Span value setting/query

```
[:SOURce[1][2]]:VOLTage[:LEVel][[:IMMediate]:OFFSet:SPAN
```

Description
Sets/queries the span value of the DC offset sweep

Setting parameter

```
<offset>|MINimum|MAXimum
<offset> ::=  <REAL>[<eunits>][<units>]
<REAL> → DC offset : 0 to 20V/open, 0 to 5V/50Ω,
       Resolution : 4 digits or 0.1mV
                       (±499.9mV or less),
                       : 5 digits or 1mV (±0.5V or more)
† Resolution depends on the starting and stop values.
```

WF1967 WF1968 Instruction Manual (Remote Control)  89
† The setting range varies depending on the amplitude setting.

\[ \text{<eunits>} ::= \text{M (milli)} \]
\[ \text{<units>} ::= \text{V} \]

<table>
<thead>
<tr>
<th>MINimum</th>
<th>MAXimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ 0V</td>
<td>→ 20V/open, 10V/50Ω</td>
</tr>
</tbody>
</table>

(This is the settable upper limit with the current setting)

Query parameter

\[ [\text{MINimum}|\text{MAXimum}] \]

MINimum → Queries the minimum value

MAXimum → Queries the maximum value

Response format

\[ <\text{NR3}> \]

Setting example

\[ :\text{SOURce1}:\text{VOLTage:LEVel:IMMediate:OFFSet:SPAN} \ 2.5V \]

Sets the span value of the DC offset sweep of CH1 to 2.5V

2.3.1.3.5.6 Marker value setting/query

\[ [:\text{SOURce[1|2]}]:\text{MARKer:VOLTage[:LEVel][:IMMediate]:OFFSet} \]

Setting parameter

\[ \langle\text{offset}\rangle|\text{CENTER}|\text{MINimum}|\text{MAXimum} \]

\[ \langle\text{offset}\rangle ::= \langle\text{REAL}\rangle[\langle\text{eunits}\rangle]|\langle\text{units}\rangle] \]

\[ \langle\text{REAL}\rangle \rightarrow \text{DC offset} : \pm10V/open, \pm5V/50Ω, \]

Resolution: 4 digits or 0.1mV

\[ (\pm499.9mV \text{ or less}), \]

5 digits or 1mV (±0.5V or more)

† The setting range varies depending on the amplitude setting.

\[ \langle\text{eunits}\rangle ::= \text{M (milli)} \]

\[ \langle\text{units}\rangle ::= \text{V} \]

<table>
<thead>
<tr>
<th>CENTER</th>
<th>MINimum</th>
<th>MAXimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ The center value of DC offset sweep</td>
<td>→ -10V/open, -5V/50Ω</td>
<td>→ 10V/open, 5V/50Ω</td>
</tr>
</tbody>
</table>

(This is the settable lower limit with the current setting)

Query parameter

\[ [\text{CENTER}|\text{MINimum}|\text{MAXimum}] \]

CENTER → Queries the center value of DC offset sweep
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:MARKer:VOLTage:LEVel:IMMediate:OFFSet 2.5V
Sets the marker value of the DC offset sweep of CH1 to 2.5V

2.3.1.3.5.7 Start/stop value swapping setting
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:SWAP

| [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:SWAP
| Description
| Swaps the starting value and the stop value of the DC offset sweep
| Setting parameter
| None
| Setting example
| :SOURce1:VOLTage:LEVel:IMMediate:OFFSet:SWAP
| Swaps the starting value and the stop value of the DC offset sweep of CH1

2.3.1.3.5.8 Start/stop value output setting
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STATe

| [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:STATe
| Description
| Switches the state of DC offset sweep
| Setting parameter
| START|STOP
| START → Switches the output to the starting value
| STOP → Switches the output to the stop value
| Setting example
| :SOURce1:VOLTage:LEVel:IMMediate:OFFSet:STATe START
| Switches the state of DC offset sweep of CH1 to the starting value
2.3.1.3.6 Duty sweep setting

2.3.1.3.6.1 Duty sweep selection/query

[:SOURce[1|2]]:PULSe:DCYCle:MODE

- [:SOURce[1|2]]:PULSe:DCYCle:MODE
- [:SOURce[1|2]]:PULSe:DCYCle:MODE?

Description
Switches the oscillation mode to the sweep oscillation duty sweep type.
Queries whether or not the oscillation mode is the sweep oscillation duty sweep type.

Setting parameter
- FIXed|SWEep
  - FIXed → Switch to the continuous oscillation when the oscillation mode is the sweep oscillation duty sweep type.
  - SWEep → Switches the oscillation mode to the sweep oscillation duty sweep type.

Query parameter
None

Response format
- FIX|SWE
  - FIX : The oscillation mode is not the sweep oscillation duty sweep type.
  - SWE : The oscillation mode is the sweep oscillation duty sweep type.

Setting example
:SOURce1:PULSe:DCYCle:MODE SWEep
Sets the oscillation mode of CH1 to the sweep oscillation duty sweep type.

2.3.1.3.6.2 Starting value setting/query

[:SOURce[1|2]]:PULSe:DCYCle:STARt

- [:SOURce[1|2]]:PULSe:DCYCle:STARt
- [:SOURce[1|2]]:PULSe:DCYCle:STARt?

Description
Sets/queries the starting value of the duty sweep.
† The Allowed range of setting varies depending on the oscillation frequency in case of square wave with the normal duty range setting or in case of pulse wave.

Setting parameter
- <duty>|MINimum|MAXimum
- <duty> ::= <REAL>[<units>]
- <REAL> → Starting value : 0.0100 % to 99.9900 %
(Square wave/normal duty range) : 0.0000 % to 100.0000 %
(Square wave/extended duty range) : 0.0001 % to 99.9999 %
(Pulse wave) : 0.0001 % to 99.9999 %

Resolution : 0.0001 %

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example
:SOURce1:PULSe:DCYCle:STARt 20PCT
Sets the starting value of the duty sweep of CH1 to 20%

2.3.1.3.6.3 Stop value setting/query
[:SOURce[1|2]]:PULSe:DCYCle:STOP

■[:SOURce[1|2]]:PULSe:DCYCle:STOP
☐[:SOURce[1|2]]:PULSe:DCYCle:STOP?

Description
Sets/queries the stop value of duty sweep
† The Allowed range of setting varies depending on the oscillation frequency in case of square wave with the normal duty range setting or in case of pulse wave.

Setting parameter

<duty>|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
<REAL> → Stop value : 0.0100% to 99.9900 %
(Square wave/normal duty range)
: 0.0000 % to 100.0000 %
(Square wave/extended duty range)
: 0.0001 % to 99.9999 % (Pulse wave)
Resolution : 0.0001 %

<units> ::= PCT
MINimum → 0.0100 % (Square wave/normal duty range),
0.0000 % (Square wave/extended duty range),
0.0001 % (Pulse wave)

**MAXimum** → 99.9900 % (Square wave/normal duty range),
100.0000 % (Square wave/extended duty range),
99.9999 % (Pulse wave)

**Query parameter**


<table>
<thead>
<tr>
<th>MINimum</th>
<th>MAXimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINimum</td>
<td>Queries the minimum value</td>
</tr>
<tr>
<td>MAXimum</td>
<td>Queries the maximum value</td>
</tr>
</tbody>
</table>

**Response format**

<NR3>

**Setting example**

:SOURce1:PULSE:DCYCle:STOP 20PCT
Sets the stop value of the duty sweep of CH1 to 20%

### 2.3.1.3.6.4 Center value setting/query

**[:SOURce[1|2]]:PULSe:DCYCle:CENTer**

- **[:SOURce[1|2]]:PULSe:DCYCle:CENTer**
- **[:SOURce[1|2]]:PULSe:DCYCle:CENTer?**

**Description**

Sets/queries the center value of duty sweep

† The Allowed range of setting varies depending on the oscillation frequency in case of square wave with the normal duty range setting or in case of pulse wave.

**Setting parameter**

<table>
<thead>
<tr>
<th>duty &gt;</th>
<th>MINimum</th>
<th>MAXimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>duty &gt;</td>
<td>MINimum</td>
<td>MAXimum</td>
</tr>
<tr>
<td>&lt;REAL&gt;</td>
<td>CENTER value : 0.0100 % to 99.9900 % (Square wave/normal duty range)</td>
<td></td>
</tr>
<tr>
<td>&lt;REAL&gt;</td>
<td>CENTER value : 0.0000 % to 100.0000 % (Square wave/extended duty range)</td>
<td></td>
</tr>
<tr>
<td>&lt;REAL&gt;</td>
<td>CENTER value : 0.0001 % to 99.9999 % (Pulse wave)</td>
<td></td>
</tr>
<tr>
<td>units &gt;</td>
<td>CENTER value : 0.0001 %</td>
<td></td>
</tr>
</tbody>
</table>

**Resolution**

- MINimum → 0.0100 % (Square wave/normal duty range),
- 0.0000 % (Square wave/extended duty range),
- 0.0001 % (Pulse wave)

- MAXimum → 99.9900 % (Square wave/normal duty range),
- 100.0000 % (Square wave/extended duty range),
- 99.9999 % (Pulse wave)

**Query parameter**


<table>
<thead>
<tr>
<th>MINimum</th>
<th>MAXimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINimum</td>
<td>Queries the minimum value</td>
</tr>
<tr>
<td>MAXimum</td>
<td>Queries the maximum value</td>
</tr>
</tbody>
</table>
Response format

<NR3>

Setting example
:SOURce1:PULSe:DCYCle:CENTer 20PCT
Sets the center value of the duty sweep of CH1 to 20%

2.3.1.3.6.5 Span value setting/query
[:SOURce[1|2]]:PULSe:DCYCle:SPAN

■ [:SOURce[1|2]]:PULSe:DCYCle:SPAN

☑ [:SOURce[1|2]]:PULSe:DCYCle:SPAN?

Description
Sets/queries the span value of duty sweep
† The Allowed range of setting varies depending on the oscillation frequency in case of square wave with the normal duty range setting or in case of pulse wave.

Setting parameter
<duty>|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
REAL → Span value : 0.0000 % to 99.9800 %
(Square wave/normal duty range)
: 0.0000 % to 100.0000 %
(Square wave/extended duty range)
: 0.0000 % to 99.9998 % (Pulse wave)

Resolution : 0.0000%

<units> ::= PCT
MINimum → 0.0000 %
MAXimum → 99.9800 % (Square wave/normal duty range),
100.0000 % (Square wave/extended duty range),
99.9998 % (Pulse wave)

Query parameter
[MINimum[MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:PULSe:DCYCle:SPAN 20PCT
Sets the span value of the duty sweep of CH1 to 20%
2.3.1.3.6.6 Marker value setting/query
[:SOURce[1|2]]:MARKer:PULSe:DCYCle

- [:SOURce[1|2]]:MARKer:PULSe:DCYCle
- [:SOURce[1|2]]:MARKer:PULSe:DCYCle?

Description
Sets/queries the marker value of duty sweep
† The Allowed range of setting varies depending on the oscillation frequency in case of square wave with the normal duty range setting or in case of pulse wave.

Setting parameter
<duty>|CENTER|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
<REAL> → Marker value: 0.0100 % to 99.9900 %
(Square wave/normal duty range)
: 0.0000 % to 100.0000 %
(Square wave/extended duty range)
: 0.0001 % to 99.9999 %
(Pulse wave)

Resolution : 0.0001 %

<units> ::= PCT
MINimum → 0.0100 % (Square wave/normal duty range),
0.0000 % (Square wave/extended duty range),
0.0001 % (Pulse wave)
MAXimum → 99.9900 % (Square wave/normal duty range),
100.0000 % (Square wave/extended duty range),
99.9999 % (Pulse wave)

Query parameter
[CENTER|MINimum|MAXimum]
CENTER → Queries the center value of duty sweep
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:MARKer:PULSe:DCYCle 20PCT
Sets the marker value of the duty sweep of CH1 to 20%

2.3.1.3.6.7 Start/stop value swapping setting
[:SOURce[1|2]]:PULSe:DCYCle:SWAP

- [:SOURce[1|2]]:PULSe:DCYCle:SWAP

Description
Swaps the starting value and the stop value of the duty sweep

Setting parameter
None

Setting example
:SOURce1:PULSe:DCYCle:SWAP
Swaps the starting value and the stop value of the duty sweep of CH1

2.3.1.3.6.8 Start/stop value output setting
[:SOURce[1|2]]:PULSe:DCYCle:STATe

- Description
  Switches the state of duty sweep

- Setting parameter
  START|STOP
  START → Switches the output to the starting value
  STOP → Switches the output to the stop value

- Setting example
  :SOURce1:PULSe:DCYCle:STATe START
  Switches the state of duty sweep of CH1 to the starting value

2.3.1.4 Burst oscillation mode

2.3.1.4.1 Common setting of burst

For the trigger related settings, see the section for "Trigger Operation"

2.3.1.4.1.1 Burst oscillation mode selection/query
[:SOURce[1|2]]:BURSt:STATe

- Description
  Switches the continuous/burst of the oscillation mode
  Queries whether or not the oscillation mode is burst

- Setting parameter
  <state> ::= <BOL>
  <BOL> → 0/OFF : Continuous
  1/ON : Burst

- Query parameter
  None

- Response format
Setting example
:SOURce1:BURSt:STATe ON
Sets the oscillation mode of CH1 to burst

### 2.3.1.4.1.2 Burst mode selection/query

[::SOURce[1|2]]:BURSt:MODE

- **[:SOURce[1|2]]:BURSt:MODE**
- **[:SOURce[1|2]]:BURSt:MODE?**

**Description**
Selects/queries the burst mode

**Setting parameter**
AUTO|TRIGger|GATE|TGATe

- AUTO → Auto burst
- TRIGger → Trigger burst
- GATE → Gate
- TGATe → Triggered gate

**Query parameter**
None

**Response format**
AUTO|TRIG|GATE|TGAT

† For the meaning of each response data, see the setting parameter

**Setting example**
:SOURce1:BURSt:MODE AUTO
Sets the burst mode of CH1 to auto burst

### 2.3.1.4.1.3 Stop level setting/query

[::SOURce[1|2]]:BURSt:SLEVel

- **[::SOURce[1|2]]:BURSt:SLEVel**
- **[::SOURce[1|2]]:BURSt:SLEVel?**

**Description**
Sets/queries the stop level value at the time of burst

**Setting parameter**
[level]|MAXimum|MINimum

- **<level>** ::=  
  - **<REAL>[<units>]**
  - **<REAL>** → Stop level value: -100.00 % to 100.00 %,
  - Resolution: 0.01 %
Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

Setting example
:SOURce1:BURSt:SLEVel 20PCT
Sets the stop level value of CH1 at the time of burst to 20%

2.3.1.4.1.4 Stop level selection/query

[:SOURce[1|2]]:BURSt:SLEVel:STATe

■[:SOURce[1|2]]:BURSt:SLEVel:STATe
□[:SOURce[1|2]]:BURSt:SLEVel:STATe?

Description
Selects/queries the stop level at the time of burst oscillation

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF : Disabled
1/ON : Enabled

Query parameter

None

Response format

<NBOL>

Setting example
:SOURce1:BURSt:SLEVel:STATe ON
Enables the stop level of CH1 at the time of burst oscillation

2.3.1.4.1.5 Synchronization signal output selection/query

:OUTPut[1|2]:SYNC:BURSt:TYPE

■:OUTPut[1|2]:SYNC:BURSt:TYPE
□:OUTPut[1|2]:SYNC:BURSt:TYPE?

Description
Selects/queries the synchronization output in the burst mode
Setting parameter

SYNC|BSYNc| MSYNc|MFCTn|SFCTn|OFF

SYNC → Reference phase synchronization
BSYNc → Burst synchronization
MSYNc → Internal modulation synchronization
MFCTn → Internal modulation signal
SFCTn → Sub waveform
OFF → Output stop

Query parameter

None

Response format

SYNC|BSYN| MSYN|MFCT|SFCT|OFF

† For the meaning of each response data, see the setting parameter

Setting example

:OUTP1:SYNC:BURSt:TYPE SYNC
Sets the burst synchronization output of CH1 to the reference phase synchronization

Remarks

When the modulation function is stopped, MSYNc/MFCTn setting is converted to OFF

2.3.1.4.2 Auto burst

2.3.1.4.2.1 Mark wave number setting/query

[:SOURce[1|2]]:BURSt:AUTO:NCYCles

Setting parameter

<mark>|MINimum|MAXimum
<mark> ::= <REAL>
<REAL> → Mark wave number : 0.5 to 999,999.5 waves
Resolution : 0.5 waves
MINimum → 0.5 waves
MAXimum → 999,999.5 waves

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value
Response format
   <NR3>

Setting example
   :SOURce1:BURSt:AU:NCYCles 10
   Sets the mark wave number of CH1 at the time of auto burst to 10

2.3.1.4.2.2 Space wave number setting/query
   [:SOURce[1|2]]:BURSt:AU:SPACE
   \[
   \begin{align*}
   \text{Definition} & : \text{Sets/queries the space wave number at the time of auto burst} \\
   \text{Setting parameter} & : \langle \text{space} \rangle | \text{MINimum} | \text{MAXimum} \\
   \langle \text{space} \rangle & : = \langle \text{REAL} \rangle \\
   \langle \text{REAL} \rangle & \rightarrow \text{Space wave number: 0.5 to 999,999.5 waves,} \\
                     & \quad \text{Resolution: 0.5 waves} \\
   \text{MINimum} & \rightarrow 0.5 \text{ waves} \\
   \text{MAXimum} & \rightarrow 999,999.5 \text{ waves} \\
   \end{align*}
   \]
   \[
   \begin{align*}
   \text{Query parameter} & : [\text{MINimum} | \text{MAXimum}] \\
   \text{MINimum} & \rightarrow \text{Queries the minimum value} \\
   \text{MAXimum} & \rightarrow \text{Queries the maximum value} \\
   \end{align*}
   \]

Response format
   <NR3>

Setting example
   :SOURce1:BURSt:AU:SPACE 10
   Sets the space wave number of CH1 at the time of auto burst to 10

2.3.1.4.3 Trigger burst

2.3.1.4.3.1 Mark wave number setting/query
   [:SOURce[1|2]]:BURSt[:TRIGger]:NCYCles
   \[
   \begin{align*}
   \text{Definition} & : \text{Sets/queries the mark wave number at the time of trigger burst} \\
   \text{Setting parameter} & \\
   \end{align*}
   \]
<mark>|MINimum|MAXimum
<mark> ::= <REAL>

<REAL> → Mark wave number : 0.5 to 999,999.5 waves
Resolution : 0.5 waves
MINimum → 0.5 waves
MAXimum → 999,999.5 waves

Query parameter

[M]INimum[M]AXimum
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<N R3>

Setting example
:SOURce1:BURSt:TRIGger:NCYCles 10
Sets the mark wave number of CH1 at the time of trigger burst to 10

2.3.1.4.3.2 Trigger delay time setting/query
[:SOURce[1|2]]:BURSt[:TRIGger]:TDELay

■ [:SOURce[1|2]]:BURSt[:TRIGger]:TDELay
□ [:SOURce[1|2]]:BURSt[:TRIGger]:TDELay?

Description

Sets/queries the trigger delay time of trigger burst

Setting parameter

<delay>|MINimum|MAXimum
<delay> ::= <REAL>[<eunits>][<units>]

<REAL> → Trigger delay time : 0.0 ns to 1 ks,
Resolution : 8 digits or 0.1ns
=eunits> ::= MA (mega)|K|M (milli)|U|N
<units> ::= S
MINimum → 0.0ns
MAXimum → 1000s

Query parameter

[M]INimum[M]AXimum
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<N R3>

Setting example
:SOURce1:BURSt:TRIGger:TDELay 10MS
Sets the trigger delay time of CH1 at the time of trigger burst to 10ms
2.3.1.4.4 Gate

2.3.1.4.4.1 Oscillation stop unit setting/query

[:SOURce[1|2]]:BURSt:GATE:OSTop

- [:SOURce[1|2]]:BURSt:GATE:OSTop
- [:SOURce[1|2]]:BURSt:GATE:OSTop?

Description
Selects/queries the oscillation stop unit at the time of gate

Setting parameter
HALF|CYCLe
  HALF → Half-cycle
  CYCLe → 1 cycle

Query parameter
None

Response format
HALF|CYCLe
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:BURSt:GATE:OSTop HALF
Sets the oscillation stop unit of CH1 at the time of gate to half-cycle

2.3.1.4.5 Triggered gate

2.3.1.4.5.1 Oscillation stop unit setting/query

[:SOURce[1|2]]:BURSt:TGAtE:OSTop

- [:SOURce[1|2]]:BURSt:TGAtE:OSTop
- [:SOURce[1|2]]:BURSt:TGAtE:OSTop?

Description
Selects/queries the oscillation stop unit at the time of triggered gate

Setting parameter
HALF|CYCLe
  HALF → Half-cycle
  CYCLe → 1 cycle

Query parameter
None
Response format

HALF|CYCL

† For the meaning of each response data, see the setting parameter

Setting example

:SOURce1:BURSt:TGATe:OSTop HALF
Sets the oscillation stop unit of CH1 at the time of triggered gate to half-cycle

2.3.2 Waveform Selection/Setting

2.3.2.1 Waveform selection/query

[:SOURce[1|2]]:FUNCtion[:SHAPe]

Description

Sets/queries the waveform

Setting parameter

DC|NOISe|SINusoid|SQUare|PULSe|RAMP
|USINe|CSINe|CFCSine|ACSine|SSINe|MCSSine
|ONPSine|OPFSine|CONSine|COFSine
|GAUSSian|LORentz|HAVersine|HSPulse|TPULse|SINC
|ERIsen|EFALl|SOLStep|DOSCillation
|OSURge|PSURge
|TOFFset|HSEPulse|BRRamp
|USER

DC → DC
NOISe → Noise
SINusoid → Sine wave
SQUare → Square wave
PULSe → Pulse wave
RAMP → Ramp wave
USINe → Unbalanced sine wave
CSINe → Clipped sine wave
CFCSine → CF controlled sine wave
ACSine → Conduction angle controlled sine wave
SSINe → Staircase sine wave
MCSSine → Multi-cycle sine wave
ONPSine → On-phase controlled sine wave
OPFSine → Off-phase controlled sine wave
CONSine → Chattering-on sine wave
COFSine → Chattering-off sine wave
GAUSSian → Gaussian pulse
LORentz → Lorentz pulse
HAVersine → Haversine
HSPulse → Half-sine pulse
TPULse → Trapezoid pulse
SINC → Sin(x)/x
ERISe → Exponential rise
EFALl → Exponential fall
SOLStep → 2nd-order LPF step response
DOSCillation → Damped oscillation
OSURge → Oscillation surge
PSURge → Pulse surge
TOFFset → Trapezoid wave with offset
HSEPulse → Half-sine edge pulse
BRRPulse → Bottom-referenced ramp wave
USER → Arbitrary waveform

Query parameter
None

Response format
DC|NOIS|SIN|SQU|PULS|RAMP
|USIN|CSIN|CFCS|ACS|SSIN|MCS
|ONPS|OFPS|CONS|COFS
|GAUS|LOR|HAV|HSP|TPUL|SINC
|ERIS|EFAL|SOL|DOSC
|OSUR|PSUR
|TOFF|HSEP|BRR
|USER
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:FUNCtion:SHApe RAMP
Sets the waveform of CH1 to ramp wave

2.3.2.2 Waveform polarity selection/query
:OUTPut[1|2]:POLarity

■:OUTPut[1|2]:POLarity
☐:OUTPut[1|2]:POLarity?

Description
Selects/queries the polarity of waveform

Setting parameter
<shape>,<polarity>

<shape>::= SINusoid|SQUare|PULSe|RAMP|NOISe
|USINe|CSINe|CFCSine|ACSine|SSINe|MCSine
|ONPSine|OFPSine|CONSine|COFSine
|GAUSsian|LORentz|HAVersine|HSPulse|TPULSe|SINC
|ERISe|EFALl|SOLStep|DOSCillation
|OSURge|PSURge
|TOFFset|HSEPulse|BRRamp
|USER
SINusoid → Sine wave
SQUare → Square wave
PULSe → Pulse wave
RAMP → Ramp wave
NOISE → Noise
USINE → Unbalanced sine wave
CSINE → Clipped sine wave
CFCSine → CF controlled sine wave
ACSine → Conduction angle controlled sine wave
SSINE → Staircase sine wave
MCSine → Multi-cycle sine wave
ONPSine → On-phase controlled sine wave
OFPSine → Off-phase controlled sine wave
CONSine → Chattering-on sine wave
COFSine → Chattering-off sine wave
GAUSsian → Gaussian pulse
LORentz → Lorentz pulse
HAVersine → Haversine
HSPulse → Half-sine pulse
TPULSe → Trapezoid pulse
SINC → Sin(x)/x
ERISe → Exponential rise
EFALl → Exponential fall
SOLStep → 2nd-order LPF step response
DOSCillation → Damped oscillation
OSURge → Oscillation surge
PSURge → Pulse surge
TOFFset → Trapezoid wave with offset
HSEPulse → Half-sine edge pulse
BRRamp → Bottom-referenced ramp wave
USER → Arbitrary waveform

<polarity> ::= NORMal|INVerted
NORMal → Normal
INVerted → Inverted

Query parameter

<shape> ::= SINusoid|SQUare|PULSe|RAMP
|USINE|CSINE|CFCSine|ACSine|SSINE|MCSine
|ONPSine|OFPSine|CONSine|COFSine
|GAUSsian|LORentz|HAVersine|HSPulse|TPULSe|SINC
|ERISe|EFALl|SOLStep|DOSCillation
|OSURge|PSURge
|TOFFset|HSEPulse|BRRamp
|USER

† For the meaning of each parameter, see the setting parameter

Response format

NORM|INV
† For the meaning of each response data, see the setting parameter
Setting example
:OUTPut1:POLarity SINusoid,NORMal
Set the polarity of sine wave of CH1 to normal

2.3.2.3 Amplitude range selection/query
:OUTPut[1|2]:SCALe

- :OUTPut[1|2]:SCALe
- :OUTPut[1|2]:SCALe?

Description
Selects/queries the amplitude range of waveform

Setting parameter

<shape>, <scale>

<shape> ::= SINusoid|SQUare|PULSe|RAMP |NOISe |USINe|CSINe|CFCSIne|ACSIne|SSIne|MCSIne
|ONPSIne|OFPSIne|CONSIne|COFSIne
|GAUSSian|LORentz|HAVersine|HSPulse|TPULSe|SINC
|ERISe|EFAL|SOLStep|DOSCillation
|OSURge|PSURge
|TOFFset|HSEPulse|BRaPP

| USER

| SINusoid  → Sine wave |
| SQUare    → Square wave |
| PULSe     → Pulse wave |
| RAMP      → Ramp wave |
| NOISe     → Noise |
| USINe     → Unbalanced sine wave |
| CSINe     → Clipped sine wave |
| CFCSIne   → CF controlled sine wave |
| ACSIne    → Conduction angle controlled sine wave |
| SSIne     → Staircase sine wave |
| MCSIne    → Multi-cycle sine wave |
| ONPSIne   → On-phase controlled sine wave |
| OFPSIne   → Off-phase controlled sine wave |
| CONSIne   → Chattering-on sine wave |
| COFSIn    → Chattering-off sine wave |
| GAUSSian  → Gaussian pulse |
| LORentz   → Lorentz pulse |
| HAVersine → Haversine |
| HSPulse   → Half-sine pulse |
| TPULSe    → Trapezoid pulse |
| SINC      → Sin(x)/x |
| ERISe     → Exponential rise |
| EFAL      → Exponential fall |
| SOLStep   → 2nd-order LPF step response |
| DOSCillation → Damped oscillation |
OSURge \rightarrow \text{Oscillation surge}
PSURge \rightarrow \text{Pulse surge}
TOFFset \rightarrow \text{Trapezoid wave with offset}
HSEPulse \rightarrow \text{Half-sine edge pulse}
BRRamp \rightarrow \text{Bottom-referenced ramp wave}
USER \rightarrow \text{Arbitrary waveform}

\texttt{<scale> ::= MFS|FS|PFS}
\quad MFS \rightarrow -FS/0
\quad FS \rightarrow \pm FS
\quad PFS \rightarrow 0/+FS

\textbf{Query parameter}

\texttt{<shape> ::= SINusoid|SQUare|PULSe|RAMP}
\quad |USINE|CSINe|CFCSine|ACSine|SSINe|MCSine
\quad |ONPSine|OFPSine|CONSine|COFSine
\quad |GAUSSian|LORentz|HAVersine|HSEPulse|TPULSe|SINC
\quad |ERISe|EFALl|SOLStep|DOSCillation
\quad |OSURge|PSURge
\quad |TOFFset|HSEPulse|BRRamp
\quad |USER

\begin{itemize}
  \item For the meaning of each parameter, see the setting parameter
\end{itemize}

\textbf{Response format}

MFS|FS|PFS

\begin{itemize}
  \item For the meaning of each response data, see the setting parameter
\end{itemize}

\textbf{Setting example}

\texttt{OUTPut1:SCAlE SINusoid,FS}

Sets the amplitude range of sine wave of CH1 to $\pm$FS

2.3.2.4 \textbf{Individual waveform setting}

2.3.2.4.1 \textbf{Square/pulse wave shared commands}

\subsection*{2.3.2.4.1.1 \textbf{duty unit selection/query}}

\texttt{[:SOURce[1|2]]:PULSe:DCYCle:UNIT}

\begin{itemize}
  \item \texttt{[:SOURce[1|2]]:PULSe:DCYCle:UNIT}
  \item \texttt{[:SOURce[1|2]]:PULSe:DCYCle:UNIT?}
\end{itemize}

\textbf{Description}

Selects/queries the phase unit

\textbf{Setting parameter}

\begin{itemize}
  \item PCT|USER
    \begin{itemize}
      \item PCT \rightarrow \%
      \item USER \rightarrow \text{User-defined unit}
    \end{itemize}
\end{itemize}

\textbf{Query parameter}
None

**Response format**

PCT|USER

† For the meaning of each response data, see the setting parameter

**Setting example**

[:SOURce1]:PULSe:DCYCle:UNIT PCT

Sets the duty unit of CH1 to %

**Remarks**

† This command is system unit setting command, it is not reflected on this device screen.

† For system unit, see the Chapter 2.6.

### 2.3.2.4.1.2 Duty user-defined unit setting/query

[:SOURce[1|2]]:PULSe:DCYCle:USER

#### Description

Sets/queries the user-defined unit of duty

#### Setting parameter

\[
<\text{name}>, <\text{form}>, <\text{m}>, <\text{n}>
\]

- **<name>**
  - ::= <STR>
  - \(<\text{STR}>\) → Name of user-defined unit (maximum 4 letters)
  - † Optional (If omitted, the setting is not changed)

- **<form>**
  - ::= LINear|LOGarithmic
  - LINear → Linear
  - LOGarithmic → Log
  - † Optional (If omitted, the setting is not changed)

- **<m>**
  - ::= <REAL>|MINimum|MAXimum
  - <REAL> → m (scale)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

- **<n>**
  - ::= <REAL>|MINimum|MAXimum
  - <REAL> → n (offset)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

#### Query parameter

None

**Response format**

\[
<\text{name}>, <\text{form}>, <\text{m}>, <\text{n}>
\]

- **<name>**
  - ::= <STR>
2.3.2.4.2 Square wave

2.3.2.4.2.1 extension on/off selection/query

[:SOURce[1|2]]::FUNCTION:SQUare:EXTend

- [:SOURce[1|2]]::FUNCTION:SQUare:EXTend
- [:SOURce[1|2]]::FUNCTION:SQUare:EXTend?

Description
Selects/queries the square wave extended duty range on/off

Setting parameter

<state> ::= <BOL>

- <BOL> → 0/OFF : Square wave extension off = normal duty range
- 1/ON : Square wave extension on = extended duty range

Query parameter
None

Response format

<NBOL>

- <NBOL> → 0 : Square wave extension off = normal duty range
- 1 : Square wave extension on = extended duty range

Setting example

:SOURce1::FUNCTION:SQUare:EXTend ON
Sets the square wave of CH1 to the extended duty range

2.3.2.4.2.2 Duty value setting/query

[:SOURce[1|2]]::FUNCTION:SQUare:DCYCle

- [:SOURce[1|2]]::FUNCTION:SQUare:DCYCle
- [:SOURce[1|2]]::FUNCTION:SQUare:DCYCle?

Description
Sets/queries the duty (square wave)
† The setting range of duty varies depending on the oscillation frequency in case of normal duty range setting.
Setting parameter

<duty>|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
<REAL> → Duty : 0.0100 % to 99.9900 %
(Normal range),
: 0.0000 % to 100.0000 %
(Extended range).
Resolution : 0.0001%
<units> ::= PCT|USER
MINimum → 0.0100 % (Normal range),
0.0000 % (Extended range)
MAXimum → 99.9900 % (Normal range),
100.0000 % (Extended range)

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCTION:SQUare:DCYCle 20PCT
Sets the duty (square wave) of CH1 to 20%

Remarks

† To enable the extended duty range of square wave, set
"[:SOURce[1|2]]:FUNCTION:SQUare:EXTend"
to On in "Square wave extension on/off selection."
† This command cannot set/query the frequency of sequence.

2.3.2.4.3 Pulse wave

2.3.2.4.3.1 Duty value setting/query

[:SOURce[1|2]]:PULSe:DCYCle

■[:SOURce[1|2]]:PULSe:DCYCle
□[:SOURce[1|2]]:PULSe:DCYCle?

Description

Sets/queries the duty (pulse wave)
† The setting range of duty varies depending on the oscillation frequency.

Setting parameter

<duty>|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
<REAL> → Duty : 0.01 % to 99.99 %,
Resolution: 0.0001%  

\[ \begin{align*}  
\text{<units>} & := \text{PCT|USER} \\
\text{MINimum} & \rightarrow 0.01\% \text{ or the current settable minimum value} \\
\text{MAXimum} & \rightarrow 99.99\% \text{ or the current settable maximum value} 
\end{align*} \]

Query parameter

\[ \begin{align*}  
\text{[MINimum|MAXimum]} \\
\text{MINimum} & \rightarrow \text{Queries the current settable minimum value} \\
\text{MAXimum} & \rightarrow \text{Queries the current settable maximum value} 
\end{align*} \]

Response format

\[ \text{<NR3>} \]

Setting example

\[ \text{:SOURce1:PULSe:DCYCle 20PCT} \]
Sets the duty (pulse wave) of CH1 to 20%

2.3.2.4.3.2 pulse width setting/query

\[ \text{[:SOURce[1|2]]:PULSe:WIDTh} \]

\[ \begin{align*}  
\text{ motivo } [:\text{SOURce[1|2]}]:\text{PULSe:WIDTh} \\
\text{ motivo } [:\text{SOURce[1|2]}]:\text{PULSe:WIDTh?} 
\end{align*} \]

Description

Sets/queries the pulse width

Setting parameter

\[ \begin{align*}  
\text{<width>|MINimum|MAXimum} \\
\text{<width>} & := \text{<REAL>[<eunits>][<units>]} \\
\text{<REAL>} & \rightarrow \text{Pulse width: 7.31 ns to 99.999 9 Ms,} \\
& \quad \text{Resolution: 0.0001\% or less of the cycle or 0.01ns} \\
\text{<eunits>} & := \text{MA (mega) |K|M (milli) U|N} \\
\text{<units>} & := \text{S} \\
\text{MINimum} & \rightarrow \text{The current settable minimum value} \\
\text{MAXimum} & \rightarrow \text{The current settable maximum value} 
\end{align*} \]

Query parameter

\[ \begin{align*}  
\text{[MINimum|MAXimum]} \\
\text{MINimum} & \rightarrow \text{Queries the current settable minimum value} \\
\text{MAXimum} & \rightarrow \text{Queries the current settable maximum value} 
\end{align*} \]

Response format

\[ \text{<NR3>} \]

Setting example

\[ \text{:SOURce1:PULSe:WIDTh 1ms} \]
Sets the pulse width of CH1 to 1ms
2.3.2.4.3.3 Rising time setting/query
[:SOURce[1|2]]:PULSe:TRANsition[:LEADing]

- [:SOURce[1|2]]:PULSe:TRANsition[:LEADing]
- [:SOURce[1|2]]:PULSe:TRANsition[:LEADing]?

Description
Sets/queries the rising time of pulse wave

Setting parameter

- <seconds>|MINimum][MAXimum
- <seconds> ::= <REAL>[<eunits>]<units>
- <REAL> → Rising time: 4.3 ns to 58.8 Ms,
  Resolution: 3 digits or 0.1 ns
- <eunits> ::= MA (mega) |K|M (milli) U|N
- <units> ::= S
- MINimum → 4.3 ns
- MAXimum → 58.8 Ms

Query parameter

- [MINimum][MAXimum]
- MINimum → Queries the minimum value
- MAXimum → Queries the maximum value

Response format

- <NR3>

Setting example

- :SOURce1:PULSe:TRANsition:LEADing 1ms
  Sets the rising time of the pulse wave of CH1 to 1ms

2.3.2.4.3.4 Falling time setting/query
[:SOURce[1|2]]:PULSe:TRANsition:TRAiling

- [:SOURce[1|2]]:PULSe:TRANsition:TRAiling
- [:SOURce[1|2]]:PULSe:TRANsition:TRAiling?

Description
Sets/queries the falling time of pulse wave

Setting parameter

- <seconds>|MINimum][MAXimum
- <seconds> ::= <REAL>[<eunits>]<units>
- <REAL> → Falling time: 4.3 ns to 58.8 Ms,
  Resolution: 3 digits or 0.1 ns
- <eunits> ::= MA (mega) |K|M (milli) U|N
- <units> ::= S
- MINimum → 4.3 ns
MAXimum → 58.8Ms

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURcel:PUlSe:TRANsition:TRAilng 1ms
Sets the falling time of the pulse wave of CH1 to 1ms

2.3.2.4.3.5 Cycle setting/query

[:SOURce[1|2]]:PULSe:PERiod

■ [:SOURce[1|2]]:PULSe:PERiod

☐ [:SOURce[1|2]]:PULSe:PERiod?

Description

Sets/queries the cycle

Setting parameter

<period>|MINimum|MAXimum

<period> ::= <REAL>|<eunits>|<units>

<REAL> → Cycle : 5.00 ns to 100 Ms
Resolution : 0.01ns or 16 digits
† The setting range varies depending on the waveform and oscillation mode.

<eunits> ::= MA (mega) |K|M (milli) U|N

<units> ::= S|USER

MINimum → Sets the minimum value
MAXimum → Sets the maximum value

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURcel:PUlSe:PERiod 1US
Sets the cycle of CH1 to 1µs
2.3.2.4.3.6 Cycle unit selection/query
[:SOURce[1|2]]:PULSe:PERiod:UNIT

■[:SOURce[1|2]]:PULSe:PERiod:UNIT
□[:SOURce[1|2]]:PULSe:PERiod:UNIT?

Description
Selects/queries the cycle unit

Setting parameter
S|USER
- \( S \rightarrow s \) (second)
- USER → User-defined unit

Query parameter
None

Response format
S|USER
- \( S \) For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:PULSe:PERiod:UNIT S
Sets the cycle unit of CH1 to "s"

Remarks
- † This command is system unit setting command, it is not reflected on this device screen.
- † For system unit, see the Chapter 2.6.

2.3.2.4.3.7 Cycle user-defined unit setting/query
[:SOURce[1|2]]:PULSe:PERiod:USER

■[:SOURce[1|2]]:PULSe:PERiod:USER
□[:SOURce[1|2]]:PULSe:PERiod:USER?

Description
Sets/queries the user-defined unit of cycle

Setting parameter
[<name>],[<form>],[<m>],[<n>]
- \(<\text{name}>\) ::= <STR>
- \(<\text{STR}>\) → Name of user-defined unit
- (maximum 4 letters)
- † Optional (If omitted, the setting is not changed)
- \(<\text{form}>\) ::= LINear|LOGarithmic
- LINear → Linear
- LOGarithmic → Log
Optional (If omitted, the setting is not changed)

\[m\] ::= \langle\text{REAL}\rangle | \text{MINimum} | \text{MAXimum}
\langle\text{REAL}\rangle \rightarrow m \text{ (scale)}
\text{MINimum} \rightarrow \text{Sets the minimum value}
\text{MAXimum} \rightarrow \text{Sets the maximum value}
Optional (If omitted, the setting is not changed)

\[n\] ::= \langle\text{REAL}\rangle | \text{MINimum} | \text{MAXimum}
\langle\text{REAL}\rangle \rightarrow n \text{ (offset)}
\text{MINimum} \rightarrow \text{Sets the minimum value}
\text{MAXimum} \rightarrow \text{Sets the maximum value}
Optional (If omitted, the setting is not changed)

**Query parameter**
None

**Response format**
\langle\text{name}\rangle, \langle\text{form}\rangle, \langle\text{m}\rangle, \langle\text{n}\rangle
\langle\text{name}\rangle ::= \langle\text{STR}\rangle
\langle\text{form}\rangle ::= \text{LIN} | \text{LOG}
\langle\text{m}\rangle ::= \langle\text{NR3}\rangle
\langle\text{n}\rangle ::= \langle\text{NR3}\rangle
Optional (If omitted, the setting is not changed)

For the meaning of each response data, see the setting parameter

**Setting example**
[:SOURce[1|2]]:FUNCtion:RAMP:SYMMetry

Sets the user-defined unit of the cycle of CH1 to "ms"

### 2.3.2.4.4 Ramp wave

#### 2.3.2.4.4.1 symmetry setting/query

[:SOURce[1|2]]:FUNCtion:RAMP:SYMMetry

- [:SOURce[1|2]]:FUNCtion:RAMP:SYMMetry
- [:SOURce[1|2]]:FUNCtion:RAMP:SYMMetry?

**Description**
Sets/queries the symmetry of ramp wave

**Setting parameter**
\langle\text{symmetry}\rangle | \text{MINimum} | \text{MAXimum}
\langle\text{symmetry}\rangle ::= \langle\text{REAL}\rangle [\langle\text{units}\rangle]
\langle\text{REAL}\rangle \rightarrow \text{Symmetry} : 0.00\% to 100.00\%,
\text{Resolution} : 0.01\%
\langle\text{units}\rangle ::= \text{PCT}
\text{MINimum} \rightarrow 0.00\%
\text{MAXimum} \rightarrow 100.00\%

**Query parameter**
\[\text{MINimum} | \text{MAXimum}]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:FUNCtion:RAMP:SYMMetry 20PCT
Sets the symmetry of the ramp wave of CH1 to 20%

2.3.2.4.5 Noise

2.3.2.4.5.1 Noise bandwidth setting/query
[:SOURce[1|2]]:FUNCtion:NOISe:BW

■ [:SOURce[1|2]]:FUNCtion:NOISe:BW
☐ [:SOURce[1|2]]:FUNCtion:NOISe:BW?

Description
Sets or queries the bandwidth of noise

Setting parameter

\<bw>|MINimum|MAXimum
\\<bw> ::= <INT>
\<INT> → Bandwidth number: 1 to 7
MINimum → 1 (Narrowband 100kHz)
MAXimum → 7 (Wideband 100MHz)

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:FUNCtion:NOISe:BW 1
Sets the bandwidth of the noise from CH1 to the narrowest (100kHz)
Noise bandwidth corresponding to each parameter is as follows: 1 (100kHz), 2 (300kHz), 3 (1MHz), 4 (3MHz), 5 (10MHz), 6 (30MHz), and 7 (100MHz).
2.3.2.5 PWF waveform

2.3.2.5.1 Steady sine wave group

2.3.2.5.1.1 Unbalanced sine wave  first half amplitude  setting/query

[:SOURce[1|2]]::FUNCTION:USINe:AMPLitude[1]

Description
Sets/queries the first half amplitude of unbalanced sine wave

Setting parameter

<amplitude>|MINimum|MAXimum
<amplitude> ::= <REAL>[<units>]
<REAL> → First half amplitude : -100.00 % to 100.00 %,
Resolution : 0.01%
<units> ::= PCT
MINimum → -100.00%
MAXimum → 100.00%

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCTION:USINe:AMPLitude1 20PCT
Sets the first half amplitude of the unbalanced sine wave of CH1 to 20%

2.3.2.5.1.2 Unbalanced sine wave  second half amplitude  setting/query

[:SOURce[1|2]]::FUNCTION:USINe:AMPLitude2

Description
Sets/queries the second half amplitude of unbalanced sine wave

Setting parameter

<amplitude>|MINimum|MAXimum
<amplitude> ::= <REAL>[<units>]
<REAL> → Second half amplitude : -100.00 % to 100.00 %,
Resolution : 0.01%

<units> ::= PCT
MINimum → -100.00%
MAXimum → 100.00%

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:USINe:AMPLitude2 20PCT
Sets the second half amplitude of the unbalanced sine wave of CH1 to 20%

2.3.2.5.1.3 Clipped sine wave clip rate setting/query

[:SOURce[1|2]]:FUNCtion:CSINE:CLIP

■[:SOURce[1|2]]:FUNCtion:CSINE:CLIP
☐[:SOURce[1|2]]:FUNCtion:CSINE:CLIP?

Description

Sets/queries the clip rate of clipped sine wave

Setting parameter

<clip>[MINimum][MAXimum]
<clip> ::= <REAL>[<units>]
<REAL> → Clip rate : 0.00 % to 99.99 %,
Resolution : 0.01 %
<units> ::= PCT
MINimum → 0.00%
MAXimum → 99.99%

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:CSINE:CLIP 20PCT
Sets the clip rate of the clipped sine wave of CH1 to 20%
2.3.2.5.1.4 CF controlled sine wave crest factor setting/query

[:SOURce[1|2]]::FUNCTION:CFCSine:CFACtor

Description
Sets/queries the crest factor of CF controlled sine wave

Setting parameter

::= <REAL>

<REAL> → Crest factor : 1.41 to 10.00, Resolution : 0.01
MINimum → 1.41
MAXimum → 10.00

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCTION:CFCSine:CFACtor 5.00
Sets the crest factor of the CF controlled sine wave of CH1 to 5.00

2.3.2.5.1.5 Conduction angle controlled sine wave conduction angle setting/query

[:SOURce[1|2]]::FUNCTION:ACSine:ANGLE

Description
Sets/queries the conduction angle of conduction angle controlled sine wave

Setting parameter

<angle>|MINimum|MAXimum

<angle> ::= <REAL>[<units>]

<REAL> → Conduction angle : -180.00° to 180.00°, Resolution : 0.01°

<units> ::= DEG
MINimum → -180.00°
MAXimum → 180.00°
Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:ACSine:ANGLE 30DEG
Sets the conduction angle of the conduction angle controlled sine wave of CH1 to 30°

2.3.2.5.1.6 Staircase sine wave  number of steps setting/query

[:SOURce[1|2]]:FUNCtion:SSINe:STEPS

■[:SOURce[1|2]]:FUNCtion:SSINe:STEPS

☐[:SOURce[1|2]]:FUNCtion:SSINe:STEPS?

Description

Sets/queries the number of steps of staircase sine wave

Setting parameter

<steps>|MINimum|MAXimum
<steps> ::= <INT>

<INT> → Number of steps : 2 to 256,
MINimum → 2
MAXimum → 256

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR1>

Setting example

:SOURce1:FUNCtion:SSINe:STEPS 10
Sets the number of steps of the staircase sine wave of CH1 to 10

2.3.2.5.1.7 Multi-cycle sine wave  number of cycle setting/query

[:SOURce[1|2]]:FUNCtion:MCSine:CYCLes

■[:SOURce[1|2]]:FUNCtion:MCSine:CYCLes

☐[:SOURce[1|2]]:FUNCtion:MCSine:CYCLes?

Description

Sets/queries the number of cycle of multi-cycle sine wave
Setting parameter

\[
\langle \text{cycles}\rangle | \text{MINimum} | \text{MAXimum}
\]
\[
\langle \text{cycles}\rangle ::= \langle \text{REAL}\rangle
\]
\[
\langle \text{REAL}\rangle \rightarrow \text{Number of cycle : 0.01 to 50.00,}
\]
\[
\text{Resolution : 0.01}
\]
\[
\text{MINimum} \rightarrow 0.01
\]
\[
\text{MAXimum} \rightarrow 50.00
\]

Query parameter

\[
[\text{MINimum}|\text{MAXimum}]
\]
\[
\text{MINimum} \rightarrow \text{Queries the minimum value}
\]
\[
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
<\text{NR3}>
\]

Setting example

\[
:\text{SOURce1:FUNCtion:MCSine:CYCLes 0.2}
\]
Sets the number of cycle of the multi-cycle sine wave of CH1 to 0.2

2.3.2.5.1.8 Multi-cycle sine wave start phase setting/query

\[
[:\text{SOURce[1|2]}]:\text{FUNCtion:MCSine:PHASe}
\]

■ [:\text{SOURce[1|2]}]:\text{FUNCtion:MCSine:PHASe}

□ [:\text{SOURce[1|2]}]:\text{FUNCtion:MCSine:PHASe}?

Description

Sets/queries the start phase of multi-cycle sine wave

Setting parameter

\[
\langle \text{clip}\rangle | \text{MINimum} | \text{MAXimum}
\]
\[
\langle \text{clip}\rangle ::= \langle \text{REAL}\rangle[\langle \text{units}\rangle]
\]
\[
\langle \text{REAL}\rangle \rightarrow \text{Start phase : -360.00° to 360.00°,}
\]
\[
\text{Resolution : 0.01°}
\]
\[
\langle \text{units}\rangle ::= \text{DEG}
\]
\[
\text{MINimum} \rightarrow -360.00°
\]
\[
\text{MAXimum} \rightarrow 360.00°
\]

Query parameter

\[
[\text{MINimum}|\text{MAXimum}]
\]
\[
\text{MINimum} \rightarrow \text{Queries the minimum value}
\]
\[
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
<\text{NR3}>
\]

Setting example

\[
:\text{SOURce1:FUNCtion:MCSine:PHASe 30DEG}
\]
Sets the start phase of the multi-cycle sine wave of CH1 to 30°
### 2.3.2.5.2 Transient sine wave group

#### 2.3.2.5.2.1 On-phase controlled sine wave complete-on phase setting/query

[:SOURce[1|2]]:FUNCtion:ONPSine:ONPHase

- [ :SOURce[1|2]]:FUNCtion:ONPSine:ONPHase
- [:SOURce[1|2]]:FUNCtion:ONPSine:ONPHase?

**Description**
Sets/queries the complete-on phase of on-phase controlled sine wave

**Setting parameter**

- `<phase>|MINimum|MAXimum`
  - `<phase>` ::= `<REAL>[<units>]`
  - `<REAL>` → Complete-on phase : 0.00° to 360.00°,
    - Resolution : 0.01°
  - `<units>` ::= DEG
  - MINimum → 0.00°
  - MAXimum → 360.00°

**Query parameter**

- [MINimum][MAXimum]
- MINimum → Queries the minimum value
- MAXimum → Queries the maximum value

**Response format**

- <NR3>

**Setting example**

:SOURce1:FUNCtion:ONPSine:ONPHase 30DEG
Sets the complete-on phase of the on-phase controlled sine wave of CH1 to 30°

#### 2.3.2.5.2.2 On-phase controlled sine wave on-slope time setting/query

[:SOURce[1|2]]:FUNCtion:ONPSine:STIMe

- [ :SOURce[1|2]]:FUNCtion:ONPSine:STIMe
- [:SOURce[1|2]]:FUNCtion:ONPSine:STIMe?

**Description**
Sets/queries the on-slope time of on-phase controlled sine wave

**Setting parameter**

- `<time>|MINimum|MAXimum`
  - `<time>` ::= `<REAL>[<units>]`
  - `<REAL>` → On-slope time : 0.00% to 50.00%,
    - Resolution : 0.01%
  - `<units>` ::= PCT
MINimum → 0.00%
MAXimum → 50.00%

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:ONPSine:STIMe 20PCT
Sets the on-slope time of the on-phase controlled sine wave of CH1 to 20%

2.3.2.5.2.3 Off-phase controlled sine wave off-phase setting/query

[:SOURce[1|2]]:FUNCtion:OFPSine:OFPHase

■[:SOURce[1|2]]:FUNCtion:OFPSine:OFPHase
□[:SOURce[1|2]]:FUNCtion:OFPSine:OFPHase?

Description

Sets/queries the off-phase of the off-phase controlled sine wave

Setting parameter

<phase>|MINimum|MAXimum
<phase> ::= <REAL>[<units>]
<REAL> → Off-phase : 0.00° to 360.00°,
Resolution : 0.01°
<units> ::= DEG
MINimum → 0.00°
MAXimum → 360.00°

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:OFPSine:OFPHase 30DEG
Sets the off-phase of the off-phase controlled sine wave of CH1 to 30°
2.3.2.5.2.4 Off-phase controlled sine wave   off-slope time   setting/query
[:SOURce[1|2]]:FUNCtion:OFPSine:STIMe

- [:SOURce[1|2]]:FUNCtion:OFPSine:STIMe
- [:SOURce[1|2]]:FUNCtion:OFPSine:STIMe?

**Description**
Sets/queries the off-slope time of the off-phase controlled sine wave

**Setting parameter**

- `<time>`:MINimum[MAXimum]
  - `<time>` ::= <REAL>[<units>]
  - `<REAL>` → Off-slope time: 0.00 % to 50.00 %,
    Resolution: 0.01 %
  - `<units>` ::= PCT
  - MINimum → 0.00%
  - MAXimum → 50.00%

**Query parameter**

- [MINimum[MAXimum]]
  - MINimum → Queries the minimum value
  - MAXimum → Queries the maximum value

**Response format**

- <NR3>

**Setting example**

[:SOURce1]:FUNCtion:OFPSine:STIMe 20PCT
Sets the off-slope time of the off-phase controlled sine wave of CH1 to 20%

2.3.2.5.2.5 Chattering-on sine wave   on-phase   setting/query
[:SOURce[1|2]]:FUNCtion:CONSine:ONPHase

- [:SOURce[1|2]]:FUNCtion:CONSine:ONPHase
- [:SOURce[1|2]]:FUNCtion:CONSine:ONPHase?

**Description**
Sets/queries the on-phase of chattering-on sine wave

**Setting parameter**

- `<phase>`:MINimum[MAXimum]
  - `<phase>` ::= <REAL>[<units>]
  - `<REAL>` → On-phase: 0.00° to 360.00°,
    Resolution: 0.01°
  - `<units>` ::= DEG
  - MINimum → 0.00°
  - MAXimum → 360.00°
Query parameter

| [MINimum|MAXimum] |
|----------------|
| MINimum       | Queries the minimum value |
| MAXimum       | Queries the maximum value |

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:CONSine:ONPHase 30DEG
Sets the on-phase of the chattering-on sine wave of CH1 to 30°

2.3.2.5.2.6 Chattering-on sine wave number of chattering setting/query

[:SOURce[1|2]]:FUNCtion:CONSine:NCHattering

Description

Sets/queries the number of chattering of chattering-on sine wave

Setting parameter

\(<\text{chattering}>\) | MINimum|MAXimum
\(<\text{chattering}>\) ::= <INT>
\(<\text{INT}>\) → Number of chattering : 0 to 20,
MINimum   →  0
MAXimum   →  20

Query parameter

| [MINimum|MAXimum] |
|----------------|
| MINimum       | Queries the minimum value |
| MAXimum       | Queries the maximum value |

Response format

<NR1>

Setting example

:SOURce1:FUNCtion:CONSine:NCHattering 2
Sets the number of chattering of the chattering-on sine wave of CH1 to 2

2.3.2.5.2.7 Chattering-on sine wave on-state time setting/query

[:SOURce[1|2]]:FUNCtion:CONSine:TON

Description

Sets/queries the on-state time of chattering-on sine wave
Setting parameter

\(<\text{time}>\)[\text{MINimum}|\text{MAXimum}\)

\(<\text{time}>\) ::= \(<\text{REAL}>[<\text{units}>]\)

\(<\text{REAL}>\) → On-state time: 0.00 % to 20.00 %,
Resolution : 0.01%

\(<\text{units}>\) ::= PCT
MINimum → 0.00%
MAXimum → 20.00%

Query parameter

[\text{MINimum}|\text{MAXimum}]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

\(<\text{NR3}>\)

Setting example

[:SOURce1]:FUNCtion:CONSine:TON 20PCT
Sets the on-state time of the chattering-on sine wave of CH1 to 20%

2.3.2.5.2.8 Chattering-on sine wave off-state time setting/query

[:SOURce[1|2]]:FUNCTION:CONSine:TOFF

■[:SOURce[1|2]]:FUNCTION:CONSine:TOFF
□[:SOURce[1|2]]:FUNCTION:CONSine:TOFF?

Description
Sets/queries the off-state time of chattering-on sine wave

Setting parameter

\(<\text{time}>\)[\text{MINimum}|\text{MAXimum}\)

\(<\text{time}>\) ::= \(<\text{REAL}>[<\text{units}>]\)

\(<\text{REAL}>\) → Off-state time :0.00 % to 20.00 %,
Resolution :0.01 %

\(<\text{units}>\) ::= PCT
MINimum → 0.00 %
MAXimum → 20.00%

Query parameter

[\text{MINimum}|\text{MAXimum}]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

\(<\text{NR3}>\)

Setting example

[:SOURce1]:FUNCtion:CONSine:CLIP 20PCT
Sets the off-state time of the chattering-on sine wave of CH1 to 20%
2.3.2.5.2.9 Chattering-off sine wave off-phase setting/query
[:SOURce[1|2]]:FUNCtion:COFSine:OFPHase

Description
Sets/queries the off-phase of chattering-off sine wave

Setting parameter

\[
\text{<phase>|MINimum|MAXimum} \\
\text{<phase> ::= <REAL>[<units>]} \\
\text{<REAL> \rightarrow Off-phase : 0.00° to 360.00°,} \\
\text{Resolution : 0.01°} \\
\text{<units> ::= DEG} \\
\text{MINimum \rightarrow 0.00°} \\
\text{MAXimum \rightarrow 360.00°}
\]

Query parameter

\[
\text{[MINimum[MAXimum]} \\
\text{MINimum \rightarrow Queries the minimum value} \\
\text{MAXimum \rightarrow Queries the maximum value}
\]

Response format

\[
<NR3>
\]

Setting example

:SOURce1:FUNCtion:COFSine:OFPHase 30DEG
Sets the off-phase of the chattering-off sine wave of CH1 to 30°

2.3.2.5.2.10 Chattering-off sine wave number of chattering setting/query
[:SOURce[1|2]]:FUNCtion:COFSine:NCHattering

Description
Sets/queries the number of chattering of chattering-off sine wave

Setting parameter

\[
\text{<chattering>|MINimum|MAXimum} \\
\text{<chattering> ::= <INT>} \\
\text{<INT> \rightarrow Number of chattering : 0 to 20,} \\
\text{MINimum \rightarrow 0} \\
\text{MAXimum \rightarrow 20}
\]

Query parameter

\[
\text{[MINimum[MAXimum]}
\]
Response format

<NR1>

Setting example

:SOURce1:FUNCtion:COFSine:NCHattering 2
Sets the number of chattering of the chattering-off sine wave of CH1 to 2

**2.3.2.5.2.11 Chattering-off sine wave on-state time setting/query**

[:SOURce[1|2]]:FUNCTION:COFSine:TON

- **ças::** :SOURce[1|2]]:FUNCTION:COFSine:TON
- **ças::** :SOURce[1|2]]:FUNCTION:COFSine:TON?

Description
Sets/queries the on-state time of chattering-off sine wave

**Setting parameter**

<time>|MINimum|MAXimum
<time> ::= <REAL>[<units>]
<REAL> → On-state time: 0.00 % to 20.00 %, Resolution : 0.01%
<units> ::= PCT
MINimum → 0.00%
MAXimum → 20.00%

**Query parameter**

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

**Response format**

<NR3>

**Setting example**

:SOURce1:FUNCtion:COFSine:TON 20PCT
Sets the on-state time of the chattering-off sine wave of CH1 to 20%

**2.3.2.5.2.12 Chattering-off sine wave off-state time setting/query**

[:SOURce[1|2]]:FUNCTION:COFSine:TOFF

- **ças::** :SOURce[1|2]]:FUNCTION:COFSine:TOFF
- **ças::** :SOURce[1|2]]:FUNCTION:COFSine:TOFF?

Description
Sets/queries the off-state time of chattering-off sine wave
Setting parameter

\[
\text{<time>|MINimum|MAXimum}
\]
\[
\text{<time> ::= <REAL>[<units>]}
\]
\[
\text{<REAL> → Off-state time : 0.00 % to 20.00 %,}
\]
\[
\text{Resolution : 0.01 %}
\]
\[
\text{<units> ::= PCT}
\]
\[
\text{MINimum → 0.00 %}
\]
\[
\text{MAXimum → 20.00 %}
\]

Query parameter

\[
\text{[MINimum|MAXimum]}
\]
\[
\text{MINimum → Queries the minimum value}
\]
\[
\text{MAXimum → Queries the maximum value}
\]

Response format

\[
\text{<NR3>}
\]

Setting example

`:SOURce1:FUNCtion:COFSine:TOFF 20PCT`
Sets the off-state time of the chattering-off sine wave of CH1 to 20%

2.3.2.5.3 Pulse waveform group

2.3.2.5.3.1 Gaussian pulse standard deviation setting/query

\[
[:SOURce[1|2]]:FUNCtion:GAUSSian:SIGMa
\]

■[:SOURce[1|2]]:FUNCtion:GAUSSian:SIGMa

□[:SOURce[1|2]]:FUNCtion:GAUSSian:SIGMa?

Description
Sets/queries the standard deviation of Gaussian pulse

Setting parameter

\[
\text{<sigma>|MINimum|MAXimum}
\]
\[
\text{<sigma> ::= <REAL>[<units>]}
\]
\[
\text{<REAL> → Standard deviation : 0.01 % to 100.00 %,}
\]
\[
\text{Resolution : 0.01 %}
\]
\[
\text{<units> ::= PCT}
\]
\[
\text{MINimum → 0.01 %}
\]
\[
\text{MAXimum → 100.00 %}
\]

Query parameter

\[
\text{[MINimum|MAXimum]}
\]
\[
\text{MINimum → Queries the minimum value}
\]
\[
\text{MAXimum → Queries the maximum value}
\]

Response format

\[
\text{<NR3>}
\]
Setting example
:SOURce1:FUNCtion:GAUSsian:SIGMa 20PCT
Sets the standard deviation of the Gaussian pulse of CH1 to 20%

2.3.2.5.3.2 Lorentz pulse  half value of width  setting/query
[:SOURce[1|2]]:FUNCtion:LORentz:HWIDth

■[:SOURce[1|2]]:FUNCtion:LORentz:HWIDth
☐[:SOURce[1|2]]:FUNCtion:LORentz:HWIDth?

Description
Sets/queries the half value of width of Lorentz pulse

Setting parameter

\[
\begin{align*}
&widt h | \text{MINimum} | \text{MAXimum} \\
\text{width} & : = \text{<REAL>}[\text{<units>}] \\
\text{<REAL>} & \rightarrow \text{Half value of width : 0.01 \% to 100.00 \%,} \\
& \quad \text{Resolution : 0.01 \%} \\
\text{<units>} & : = \text{PCT} \\
\text{MINimum} & \rightarrow 0.01 \% \\
\text{MAXimum} & \rightarrow 100.00 \% \\
\end{align*}
\]

Query parameter

\[
\begin{align*}
&\text{[MINimum|MAXimum]} \\
\text{MINimum} & \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} & \rightarrow \text{Queries the maximum value} \\
\end{align*}
\]

Response format

<NR3>

Setting example
:SOURce1:FUNCtion:LORentz:HWIDth 20PCT
Sets the half value of width of the Lorentz pulse of CH1 to 20%

2.3.2.5.3.3 Haversine width setting/query
[:SOURce[1|2]]:FUNCtion:HAVersine:WIDTh

■[:SOURce[1|2]]:FUNCtion:HAVersine:WIDTh
☐[:SOURce[1|2]]:FUNCtion:HAVersine:WIDTh?

Description
Sets/queries the width of Haversine

Setting parameter

\[
\begin{align*}
&widt h | \text{MINimum} | \text{MAXimum} \\
\text{width} & : = \text{<REAL>}[\text{<units>}] \\
\text{<REAL>} & \rightarrow \text{Width : 0.01 \% to 100.00 \%,} \\
& \quad \text{Resolution : 0.01\%} \\
\end{align*}
\]
2.3.2.5.3.4 Half-sine pulse width setting/query

[:SOURce[1|2]]:FUNCtion:HSPulse:WIDTh

■[:SOURce[1|2]]:FUNCtion:HSPulse:WIDTh

□[:SOURce[1|2]]:FUNCtion:HSPulse:WIDTh?

Description
Sets/queries the width of half-sine pulse

Setting parameter

<width>|MINimum|MAXimum

<width> ::= <REAL>[<units>]

<REAL> → Width : 0.01 % to 100.00 %,
Resolution : 0.01 %

<units> ::= PCT
MINimum → 0.01 %
MAXimum → 100.00 %

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:HAVersine:WIDTh 20PCT
Sets the width of the Haversine of CH1 to 20%
### 2.3.2.5.3.5 Trapezoid pulse slope width setting/query

`:SOURce[1|2]]:FUNCtion:TPULse:RFALI`

- `[SOURce[1|2]]:FUNCtion:TPULse:RFALI`
- `[SOURce[1|2]]:FUNCtion:TPULse:RFALI?`

**Description**
Sets/queries the slope width of trapezoid pulse

**Setting parameter**

\[
<\text{width}> | \text{MINimum} | \text{MAXimum} \\
<\text{width}> \ ::= \ <\text{REAL}>[<\text{units}>] \\
<\text{REAL}> \ → \ \text{Slope width} : 0.00 \% \text{ to } 50.00 \%, \text{Resolution} : 0.01\% \\
<\text{units}> \ ::= \ \text{PCT} \\
\text{MINimum} \ → \ 0.00 \% \\
\text{MAXimum} \ → \ 50.00 \%
\]

**Query parameter**

- `[MINimum][MAXimum]`
  - MINimum \ → \ Queries the minimum value
  - MAXimum \ → \ Queries the maximum value

**Response format**

- `<NR3>`

**Setting example**

`SOURce1:FUNCtion:TPULse:RFALI 20PCT`

Sets the slope width of the trapezoid pulse of CH1 to 20%

### 2.3.2.5.3.6 Trapezoid pulse upper base width setting/query

`:SOURce[1|2]]:FUNCtion:TPULse:UBASe`

- `[SOURce[1|2]]:FUNCtion:TPULse:UBASe`
- `[SOURce[1|2]]:FUNCtion:TPULse:UBASe?`

**Description**
Sets/queries the upper base width of trapezoid pulse

**Setting parameter**

\[
<\text{width}> | \text{MINimum} | \text{MAXimum} \\
<\text{width}> \ ::= \ <\text{REAL}>[<\text{units}>] \\
<\text{REAL}> \ → \ \text{Upper base width} : 0.00 \% \text{ to } 100.00 \%, \text{Resolution} : 0.01\% \\
<\text{units}> \ ::= \ \text{PCT} \\
\text{MINimum} \ → \ 0.00 \% \\
\text{MAXimum} \ → \ 100.00\%
\]
2.3.2.5.3.7  \textbf{Sin(x)/x number of zero crossings setting/query}  

\texttt{[:SOURce[1|2]]:FUNCtion:SINC:ZCRossing}

\begin{itemize}
  \item \texttt{[:SOURce[1|2]]:FUNCtion:SINC:ZCRossing}
  \item \texttt{[:SOURce[1|2]]:FUNCtion:SINC:ZCRossing?}
\end{itemize}

\textbf{Description}

Sets/queries the number of zero crossings of Sin(x)/x

\textbf{Setting parameter}

\begin{itemize}
  \item \texttt{<number>|MINimum|MAXimum}
  \item \texttt{<number> ::= <INT>}
  \item \texttt{<INT> → Number of zero crossings : 1 to 50,}
  \item \texttt{MINimum → 1}
  \item \texttt{MAXimum → 50}
\end{itemize}

\textbf{Query parameter}

\begin{itemize}
  \item \texttt{[MINimum|MAXimum]}
  \item \texttt{MINimum → Queries the minimum value}
  \item \texttt{MAXimum → Queries the maximum value}
\end{itemize}

\textbf{Response format}

\begin{itemize}
  \item \texttt{<NR1>}
\end{itemize}

\textbf{Setting example}

\begin{itemize}
  \item \texttt{:SOURce1:FUNCtion:SINC:ZCRossing 10}
  \item Sets the number of zero crossings of the Sin(x)/x of CH1 to 10
\end{itemize}

2.3.2.5.4  \textbf{Transient response waveform group}

2.3.2.5.4.1  \textbf{Exponential rise time constant setting/query}  

\texttt{[:SOURce[1|2]]:FUNCtion:ERISe:TCONstant}

\begin{itemize}
  \item \texttt{[:SOURce[1|2]]:FUNCtion:ERISe:TCONstant}
  \item \texttt{[:SOURce[1|2]]:FUNCtion:ERISe:TCONstant?}
\end{itemize}
Description
Sets/queries the time constant of exponential rise

Setting parameter

\[ \langle \text{tc}\rangle | \text{MINimum}| \text{MAXimum} \]
\[ \langle \text{tc}\rangle \ ::= \langle \text{REAL}\rangle [\langle \text{units}\rangle] \]
\[ \langle \text{REAL}\rangle \rightarrow \text{Time constant} : 0.01\% \text{ to } 100.00\% , \]
\[ \text{Resolution} : 0.01\% \]
\[ \langle \text{units}\rangle ::= \text{PCT} \]
MINimum \rightarrow 0.01\%
MAXimum \rightarrow 100.00\%

Query parameter

[MINimum][MAXimum]
MINimum \rightarrow Queries the minimum value
MAXimum \rightarrow Queries the maximum value

Response format

\langle \text{NR3}\rangle

Setting example

:SOURce1:FUNCTion:ERISe:TCONstant 20PCT
Sets the time constant of the exponential rise of CH1 to 20%

2.3.2.5.4.2 Exponential fall time constant setting/query

[:SOURce[1|2]]:FUNCTION:EFALL:TCONstant

Description
Sets/queries the time constant of exponential fall

Setting parameter

\[ \langle \text{tc}\rangle | \text{MINimum}| \text{MAXimum} \]
\[ \langle \text{tc}\rangle \ ::= \langle \text{REAL}\rangle [\langle \text{units}\rangle] \]
\[ \langle \text{REAL}\rangle \rightarrow \text{Time constant} : 0.01\% \text{ to } 100.00\% , \]
\[ \text{Resolution} : 0.01\% \]
\[ \langle \text{units}\rangle ::= \text{PCT} \]
MINimum \rightarrow 0.01\%
MAXimum \rightarrow 100.00\%

Query parameter

[MINimum][MAXimum]
MINimum \rightarrow Queries the minimum value
MAXimum \rightarrow Queries the maximum value

Response format

\langle \text{NR3}\rangle
Setting example
:SOURce1:FUNCtion:EFALl:TCONstant 20PCT
Sets the time constant of the exponential fall of CH1 to 20%

2.3.2.5.4.3 2nd-order LPF step response  natural frequency  setting/query
[:SOURce[1|2]]:FUNCTION:SOLStep:NFRequency

Description
Sets/queries the natural frequency of 2nd-order LPF step response

Setting parameter

\[
\begin{align*}
\langle \text{frequency} \rangle | \text{MINimum} | \text{MAXimum} \\
\langle \text{frequency} \rangle &\equiv \langle \text{REAL} \rangle \\
\langle \text{REAL} \rangle &\rightarrow \text{Natural frequency: 1.00 to 50.00,} \\
&\quad \text{Resolution } : 0.01 \\
\text{MINimum} &\rightarrow 1.00 \\
\text{MAXimum} &\rightarrow 50.00
\end{align*}
\]

Query parameter

\[
\begin{align*}
[\text{MINimum} | \text{MAXimum}] \\
\text{MINimum} &\rightarrow \text{Queries the minimum value} \\
\text{MAXimum} &\rightarrow \text{Queries the maximum value}
\end{align*}
\]

Response format

\[
\langle NR3 \rangle
\]

Setting example
:SOURce1:FUNCTION:SOLStep:NFRequency 10
Sets the natural frequency of the 2nd-order LPF step response of CH1 to 10

2.3.2.5.4.4 2nd-order LPF step response  Q  setting/query
[:SOURce[1|2]]:FUNCTION:SOLStep:Q

Description
Sets/queries the Q of 2nd-order LPF step response

Setting parameter

\[
\begin{align*}
\langle q \rangle | \text{MINimum} | \text{MAXimum} \\
\langle q \rangle &\equiv \langle \text{REAL} \rangle \\
\langle \text{REAL} \rangle &\rightarrow \text{LPF Q: 0.50 to 50.00,} \\
&\quad \text{Resolution } : 0.01 \\
\text{MINimum} &\rightarrow 0.50
\end{align*}
\]
Query parameter

[MINimum|MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:SOLStep:Q 10
Sets the Q of the 2nd-order LPF step response of CH1 to 10

2.3.2.5.4.5 Damped oscillation oscillation frequency setting/query

[:SOURce[1|2]]:FUNCtion:DOSCillation:OFRequency

Description

Sets/queries the oscillation frequency of damped oscillation

Setting parameter

<frequency>|MINimum|MAXimum

<frequency> ::= <REAL>

<REAL> → Attenuating frequency: 0.01 to 50.00,
Resolution: 0.01

MINimum → 0.01
MAXimum → 50.00

Query parameter

[MINimum|MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:DOSCillation:OFRequency 10
Sets the oscillation frequency of the damped oscillation of CH1 to 10
### 2.3.2.5.4.6 Damped oscillation damping time constant setting/query

[:SOURce[1|2]]:FUNCtion:DOSCillation:DTConstant

**Description**
Sets/queries the damping time constant of damped oscillation

**Setting parameter**

```
<tc>|MINimum|MAXimum
<tc> ::= <REAL>[<units>]
<REAL> → Damping time constant : -100.00 % to 100.00 %, Resolution : 0.01 %
<units> ::= PCT
MINimum → -100.00%
MAXimum → 100.00%
```

**Query parameter**

```
[M|MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value
```

**Response format**

```
<N3>
```

**Setting example**

```
:SOURce1:FUNCtion: DOSCillation: DTConstant 20PCT
Sets the damping time constant of the damped oscillation of CH1 to 20%
```

### 2.3.2.5.5 Surge waveform group

#### 2.3.2.5.5.1 Oscillation surge oscillation frequency setting/query

[:SOURce[1|2]]:FUNCtion:OSURge:OFRequency

**Description**
Sets/queries the oscillation frequency of oscillation surge

**Setting parameter**

```
<frequency>|MINimum|MAXimum
<frequency> ::= <REAL>
<REAL> → Oscillation frequency : 0.01 to 50.00, Resolution : 0.01
MINimum → 0.01
```
MAXimum → 50.00

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:OSURge:OFRequency 10
Sets the oscillation frequency of the oscillation surge of CH1 to 10

2.3.2.5.5.2 Oscillation surge damping time constant setting/query

[:SOURce[1|2]]:FUNCtion:OSURge:DTConstant

■ [:SOURce[1|2]]:FUNCtion:OSURge:DTConstant
☐ [:SOURce[1|2]]:FUNCtion:OSURge:DTConstant?

Description
Sets/queries the damping time constant of oscillation surge

Setting parameter

<tc>MINimum[MAXimum]
<tc> ::= <REAL>[<units>]
<REAL> → Damping time constant : 0.01 % to 100.00 %,
Resolution : 0.01 %
<units> ::= PCT
MINimum → 0.01%
MAXimum → 100.00%

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:OSURge:DTConstant 20PCT
Sets the damping time constant of the oscillation surge of CH1 to 20%

2.3.2.5.5.3 Oscillation surge trailing time constant setting/query

[:SOURce[1|2]]:FUNCtion:OSURge:TTConstant

■ [:SOURce[1|2]]:FUNCtion:OSURge:TTConstant
☐ [:SOURce[1|2]]:FUNCtion:OSURge:TTConstant?
Description
Sets/queries the trailing time constant of oscillation surge

Setting parameter

\[
<\text{tc}>|\text{MINimum}|\text{MAXimum}
\]

\[
<\text{tc}> ::= <\text{REAL}>[<\text{units}>]
\]

\[
<\text{REAL}> \rightarrow \text{Trailing time constant: 0.01 \% to 100.00 \%},
\]

\[
\text{Resolution: } 0.01 \%
\]

\[
<\text{units}> ::= \text{PCT}
\]

\[
\text{MINimum} \rightarrow 0.01\%
\]

\[
\text{MAXimum} \rightarrow 100.00\%
\]

Query parameter

\[
[\text{MINimum}|\text{MAXimum}]
\]

\[
\text{MINimum} \rightarrow \text{Queries the minimum value}
\]

\[
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
<\text{NR3}>
\]

Setting example

\[
:\text{SOURce1:FUNCtion:OSURge:TTConstant} 20\text{PCT}
\]

Sets the trailing time constant of the oscillation surge of CH1 to 20%

---

2.3.2.5.5.4 Pulse surge rising time setting/query

\[
[:\text{SOURce[1|2]}]:\text{FUNCtion:PSURge:TR}
\]

■[:\text{SOURce[1|2]}]:\text{FUNCtion:PSURge:TR}

☐[:\text{SOURce[1|2]}]:\text{FUNCtion:PSURge:TR}?

Description
Sets/queries the rising time of pulse surge

Setting parameter

\[
<\text{time}>|\text{MINimum}|\text{MAXimum}
\]

\[
<\text{time}> ::= <\text{REAL}>[<\text{units}>]
\]

\[
<\text{REAL}> \rightarrow \text{Rising time: 0.01 \% to 100.00 \%},
\]

\[
\text{Resolution: } 0.01 \%
\]

\[
<\text{units}> ::= \text{PCT}
\]

\[
\text{MINimum} \rightarrow 0.01\%
\]

\[
\text{MAXimum} \rightarrow 100.00\%
\]

Query parameter

\[
[\text{MINimum}|\text{MAXimum}]
\]

\[
\text{MINimum} \rightarrow \text{Queries the minimum value}
\]

\[
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
<\text{NR3}>
\]
Setting example
:SOURce1:FUNCtion:PSURge:TR 20PCT
Sets the rising time of the pulse surge of CH1 to 20%

2.3.2.5.5 Pulse surge duration time setting/query
[:SOURce[1|2]]:FUNCtion:PSURge:TD

■[:SOURce[1|2]]:FUNCtion:PSURge:TD
☐[:SOURce[1|2]]:FUNCtion:PSURge:TD?

Description
Sets/queries the duration time of pulse surge

Setting parameter
	<time>|MINimum|MAXimum
	<time> ::= <REAL>[<units>]
	<REAL> → Duration time  : 0.01 % to 100.00 %,
Resol ution  : 0.01 %
<units> ::= PCT
MINimum → 0.01%
MAXimum → 100.00%

Query parameter
[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:FUNCtion:PSURge:TD 20PCT
Sets the duration time of the pulse surge of CH1 to 20%

2.3.2.5.6 Other waveform group

2.3.2.5.6.1 Trapezoid wave with offset leading delay setting/query
[:SOURce[1|2]]:FUNCtion:TOFFset:DElay

■[:SOURce[1|2]]:FUNCtion:TOFFset:DElay
☐[:SOURce[1|2]]:FUNCtion:TOFFset:DElay?

Description
Sets/queries the leading delay of trapezoid wave with offset

Setting parameter
<delay>|MINimum|MAXimum
<delay> ::= <REAL>[<units>]
<REAL> → Leading delay  : 0.00 % to 100.00 %,
Resolution : 0.01 %

\[
\text{<units>} \quad ::= \quad \text{PCT} \\
\text{MINimum} \quad \rightarrow \quad 0.00\% \\
\text{MAXimum} \quad \rightarrow \quad 100.00\%
\]

Query parameter

\[[\text{MINimum}|\text{MAXimum}]\]
- MINimum \quad → \quad Queries the minimum value
- MAXimum \quad → \quad Queries the maximum value

Response format

\(<\text{NR3}>\)

Setting example

[:SOURce1]:FUNCTION:TOFFset:DELazy 20PCT
Sets the leading delay of the trapezoid wave with offset of CH1 to 20%

### 2.3.2.5.6.2 Trapezoid wave with offset rising-slope width setting/query

\[:\text{SOURce}[1|2]]:FUNCTION:TOFFset:RISe

- □[:SOURce\{1|2\}]:FUNCTION:TOFFset:RISe?

**Description**

Sets/queries the rising-slope width of trapezoid wave with offset

**Setting parameter**

\[<\text{width}>|\text{MINimum}]{\text{MAXimum}}\]

\[
\text{<width>} \quad ::= \quad <\text{REAL}>|<\text{units}> \\
\text{<REAL>} \quad \rightarrow \quad \text{Rising-slope width} \quad : \quad 0.00 \% \text{ to } 100.00 \%, \\
\text{Resolution} \quad : \quad 0.01 \% \\
\text{<units>} \quad ::= \quad \text{PCT} \\
\text{MINimum} \quad \rightarrow \quad 0.00\% \\
\text{MAXimum} \quad \rightarrow \quad 100.00\%
\]

Query parameter

\[[\text{MINimum}|\text{MAXimum}]\]
- MINimum \quad → \quad Queries the minimum value
- MAXimum \quad → \quad Queries the maximum value

Response format

\(<\text{NR3}>\)

Setting example

[:SOURce1]:FUNCTION:TOFFset:RISe 20PCT
Sets the rising-slope width of the trapezoid wave with offset of CH1 to 20%
2.3.2.5.6.3 Trapezoid wave with offset upper base width setting/query

[:SOURce[1|2]]:FUNCtion:TOFFset:UBASe

- [:SOURce[1|2]]:FUNCtion:TOFFset:UBASe
- [:SOURce[1|2]]:FUNCtion:TOFFset:UBASe?

Description
Sets/queries the upper base width of trapezoid wave with offset

Setting parameter

\[ \text{<width>}[\text{MINimum}][\text{MAXimum}] \]
\[ \text{<width>} ::= \text{<REAL>}[\text{<units>}] \]
\[ \text{<REAL>} \rightarrow \text{Upper base width : 0.00 \% to 100.00 \%}, \]
\[ \text{Resolution} : 0.01 \% \]
\[ \text{<units>} ::= \text{PCT} \]
\[ \text{MINimum} \rightarrow 0.00\% \]
\[ \text{MAXimum} \rightarrow 100.00\% \]

Query parameter

\[ \text{[MINimum][MAXimum]} \]
\[ \text{MINimum} \rightarrow \text{Queries the minimum value} \]
\[ \text{MAXimum} \rightarrow \text{Queries the maximum value} \]

Response format

\[ \text{<NR3>} \]

Setting example

:SOURce1:FUNCtion:TOFFset:UBASe 20PCT
Sets the upper base width of the trapezoid wave with offset of CH1 to 20%

2.3.2.5.6.4 Trapezoid wave with offset falling-slope width setting/query

[:SOURce[1|2]]:FUNCtion:TOFFset:FALL

- [:SOURce[1|2]]:FUNCtion:TOFFset:FALL
- [:SOURce[1|2]]:FUNCtion:TOFFset:FALL?

Description
Sets/queries the falling-slope width of trapezoid wave with offset

Setting parameter

\[ \text{<width>}[\text{MINimum}][\text{MAXimum}] \]
\[ \text{<width>} ::= \text{<REAL>}[\text{<units>}] \]
\[ \text{<REAL>} \rightarrow \text{Falling-slope width : 0.00 \% to 100.00 \%}, \]
\[ \text{Resolution} : 0.01 \% \]
\[ \text{<units>} ::= \text{PCT} \]
\[ \text{MINimum} \rightarrow 0.00\% \]
\[ \text{MAXimum} \rightarrow 100.00\% \]
Query parameter

[MInimum][M AXimum]
M INimum → Queries the minimum value
M AXimum → Queries the maximum value

Response format

<N R3>

Setting example

:SOURce1:FUN Ction:TOFFset:FALL 20PCT
Sets the falling-slope width of the trapezoid wave with offset of CH1 to 20%

2.3.2.5.6.5 Trapezoid wave with offset offset setting/query

[:SOURce[1|2]]:FUN Ction:TOFFset:OFFSet

■[:SOURce[1|2]]:FUN Ction:TOFFset:OFFSet

☐[:SOURce[1|2]]:FUN Ction:TOFFset:OFFSet?

Description

Sets/queries the offset of trapezoid wave with offset

Setting parameter

<offset>|M INimum|M AXimum
<offset> ::= <REAL>[<units>]
<REAL> → Offset : 0.00 % to 100.00 %,
Resolution : 0.01%
(units) ::= PCT
M INimum → 0.00%
M AXimum → 100.00%

Query parameter

[M INimum][M AXimum]
M INimum → Queries the minimum value
M AXimum → Queries the maximum value

Response format

<N R3>

Setting example

:SOURce1:FUN Ction:TOFFset:OFFSet 20PCT
Sets the offset of the trapezoid wave with offset of CH1 to 20%

2.3.2.5.6.6 Half-sine edge pulse leading edge time setting/query

[:SOURce[1|2]]:FUN Ction:HSEPulse:LE

■[:SOURce[1|2]]:FUN Ction:HSEPulse:LE

☐[:SOURce[1|2]]:FUN Ction:HSEPulse:LE?

Description
Sets/queries the leading edge time of half-sine edge pulse

Setting parameter

\[
\langle \text{time} \rangle | \text{MINimum} | \text{MAXimum}
\]
\[
\langle \text{time} \rangle \rightarrow \langle \text{REAL} \rangle | \langle \text{units} \rangle \\
\langle \text{REAL} \rangle \rightarrow \text{Leading edge time} : 0.00 \% \text{ to } 100.00 \%, \text{ Resolution} : 0.01 \%
\]
\[
\langle \text{units} \rangle \rightarrow \text{PCT}
\]
\[
\text{MINimum} \rightarrow 0.00 \% \\
\text{MAXimum} \rightarrow 100.00 \%
\]

Query parameter

\[
[\text{MINimum} | \text{MAXimum}] \\
\text{MINimum} \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
\langle \text{NR3} \rangle
\]

Setting example

\[
:\text{SOURce1} : \text{FUNCtion: HSE Pulse: LE} \ 20 \text{PCT}
\]

Sets the leading edge time of the half-sine edge pulse of CH1 to 20%

2.3.2.5.6.7 Half-sine edge pulse trailing edge time setting/query

\[
[: \text{SOURce[1|2]}] : \text{FUNCtion: HSE Pulse: TE}
\]

■[:SOURce[1|2]] : FUNCtion: HSE Pulse: TE

☐[:SOURce[1|2]] : FUNCtion: HSE Pulse: TE?

Description

Sets/queries the trailing edge time of half-sine edge pulse

Setting parameter

\[
\langle \text{time} \rangle | \text{MINimum} | \text{MAXimum}
\]
\[
\langle \text{time} \rangle \rightarrow \langle \text{REAL} \rangle | \langle \text{units} \rangle \\
\langle \text{REAL} \rangle \rightarrow \text{Trailing edge time} : 0.00 \% \text{ to } 100.00 \%, \text{ Resolution} : 0.01 \%
\]
\[
\langle \text{units} \rangle \rightarrow \text{PCT}
\]
\[
\text{MINimum} \rightarrow 0.00 \% \\
\text{MAXimum} \rightarrow 100.00 \%
\]

Query parameter

\[
[\text{MINimum} | \text{MAXimum}] \\
\text{MINimum} \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\]

Response format

\[
\langle \text{NR3} \rangle
\]

Setting example
2.3.2.5.6.8 Half-sine edge pulse duty setting/query

[:SOURce[1|2]]::FUNCtion:HSEPulse:DCYCLE

Description
Sets/queries the duty of half-sine edge pulse

Setting parameter

<duty>|MINimum|MAXimum
<duty> ::= <REAL>[<units>]
<REAL> → Duty :0.00 % to 100.00 %,
Resolution :0.01 %
<units> ::= PCT
MINimum → 0.00%
MAXimum → 100.00%

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1::FUNCtion:HSEPulse:DCYCLE 20PCT
Sets the duty of the half-sine edge pulse of CH1 to 20%

2.3.2.5.6.9 Bottom-referenced ramp wave symmetry setting/query

[:SOURce[1|2]]::FUNCtion:BRRAMP:SYMmetry

Description
Sets/queries the symmetry of bottom-referenced ramp wave

Setting parameter

<symmetry>|MINimum|MAXimum
<symmetry> ::= <REAL>[<units>]
<REAL> → Symmetry :0.00 % to 100.00 %,
Resolution :0.01 %
<units> ::= PCT
MINimum → 0.00%

:SOURce1::FUNCtion:HSEPulse:TE 20PCT
Sets the trailing edge time of the half-sine edge pulse of CH1 to 20%
MAXimum → 100.00%

Query parameter

[MINimum][MAXimum]

MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FUNCtion:BRAMp:SYMmetry 20PCT
Sets the symmetry of the bottom-referenced ramp wave of CH1 to 20%

2.3.2.6 Arbitrary waveform

2.3.2.6.1 Arbitrary waveform selection/query

[:SOURce[1|2]]:FUNCtion:USER

Description

Selects/queries arbitrary waveform

Setting parameter

<memory> ::= <INT>

<INT> → Memory number : 0 to 128

Query parameter

None

Response format

<NR1>

Setting example

:SOURce1:FUNCtion:USER 3
Sets the data of memory number 3 to the arbitrary waveform of CH1

Remarks

† Memory number 0 is the edit memory.

2.3.2.6.2 Arbitrary waveform data read/write

{:TRACe|:DATA}[[:DATA]

■{:TRACe|:DATA}[[:DATA]

■{:TRACe|:DATA}[[:DATA]

☐{:TRACe|:DATA}[[:DATA]?
Description

Reads/writes the arbitrary wave data
† When writing the data, write the arbitrary wave data <data> with the arbitrary wave name <name> to the memory number <memory> as described below.
† When reading the data, select the name and data of the arbitrary wave stored in the memory number <memory> as described below.

Setting parameter

<memory>,[<name>],[<data>]

<memory> ::= <INT>
<INT> → Memory number : 0 to 128

<name> ::= <STR>
<STR> → Arbitrary wave name (20 characters or less)
† Optional (If omitted, the setting is not changed)
† If the arbitrary wave name is less than 20 characters, the remaining characters are filled with spaces (with the ASCII code 32).

<data> ::= <BLK>
<BLK> → Data format of arbitrary wave data is as follows:
○ Array format
#<digit><byte><format><number><data[0]>…<data[n-1]>
# → Start of binary data
<digit> → Number other than "0", which indicates the number of digits of the subsequent <byte>
<byte> → Numeric string which indicates the number of byte of the subsequent data
<format> → The data format (4 bytes) array is specified by 0
<number> → The second power of the number of data (4 byte) 4096 to 1048576 is specified
<data[i]> → The i-th value (2 byte)

○ Control point format
#<digit><byte><format><number><x[0]><y[0]>…<x[n-1]><y[n-1]>
# → Start of binary data
<digit> → Number other than "0", which indicates the number of digits of the subsequent <byte>
<byte> → Numeric string which indicates the number of byte of the subsequent data
<format> → The data format (4 byte) control point is specified by 1
<number> → The number of data points (4 bytes)
<x[i]> → x value of i-th control point (4 bytes)
<y[i]> → y value of i-th control point (2 bytes)

Query parameter

<memory>

<memory> ::= <INT>
<INT> → Memory number : 0 to 128
Response format

\[
\text{<name>}, \text{<data>}
\]
\[
\text{<name> ::= "STR"}
\]
\[
\text{<STR> → Arbitrary wave name (20 characters)}
\]
\[
\text{<data> ::= "BLK"}
\]
† For <BLK>, see the setting parameter

Remarks

(1) <format>, <number>, <data[i]>, <x[i]>, and <y[i]> are binary data (big endian).

(2) <data[i]> is the two's complement form and from -32767 (H'8001) to 32767 (H'7FFF).
   If a value is -32768 (H'8000), set it as -32767 (H'8001).

(3) The control point <x[i]> is treated as a numeric value of X axis from 0 up to 31st power of two. The numeric range is expressed as a range from H'00000000 to H'7FFFF in hexadecimal.
   If data exceeding the setting range is included, it is handled as an error and no command is executed.

(4) The control point <x[i]> must be sorted in ascending order from the beginning of data.
   If it is not sorted, an error occurs.

(5) The control point <y[i]> is treated as a numeric value of Y axis from -32767 to 32767. The numeric range is expressed as a range from H'8001 to H'7FFF in hexadecimal.

   The value representing 0 is H'0000.
   -32768 (H'8000) is set as -32767 (H8001).
   If the amplitude width of actual signal output is ±1.0Vp-p, 1 LSB 1/32767 V is used.
   † All of the logical signal output values are not guaranteed.

(6) Arbitrary wave memory number 0 is the edit memory.
(7) The arbitrary wave name of memory number 0 is "<Edit Memory>" (20 characters).
(8) Array format data cannot be set for the arbitrary wave memory number 0.
(9) Arbitrary wave name cannot be set for the arbitrary wave memory number 0. If it is specified, it is ignored.
2.3.2.6.3 Memory operations

No command is available to operate USB memory.

2.3.2.6.3.1 Store

\{:TRACe\}:STORe

Description
Saves the contents of edit memory (memory number 0) as an arbitrary wave file to the memory.

Setting parameter

\(<memory>,<name>\)

\(<memory> ::= \langle INT\>
\(<INT> \rightarrow \) Memory number of location to save: 1 to 128
\(<name> ::= \langle STR\>
\(<STR> \rightarrow \) Arbitrary wave name (20 characters or less)
† Optional (If omitted, the setting is not changed)
† If the arbitrary wave name is less than 20 characters, the remaining characters are filled with spaces (ASCII code 32).

Setting example

\(:TRACe:STORe 2,"name"\)
Saves the contents of edit memory as the arbitrary wave name "name" to the memory number 2

2.3.2.6.3.2 Recall

\{:TRACe\}:RECall

Description
Reads the arbitrary wave file of the specified memory number into the edit memory (memory number 0).

Setting parameter

\(<memory>\)

\(<memory> ::= \langle INT\>
\(<INT> \rightarrow \) Memory number of calling source : 1 to 128

Setting example

\(:TRACe:RECall 2\)
Reads the contents of memory number 2 into the edit memory.
2.3.2.6.3.3 Copy

{:TRACe|:DATA}:COPY

- {:TRACe|:DATA}:COPY

**Description**

Copies the arbitrary wave data.

† This command writes the waveform, which is set to the specified channel, into the specified memory number.

**Setting parameter**

<memory>,[<name>],<chan>,<wave>

- <memory> ::= <INT>
  - <INT> → Memory number : 0 to 128
- <name> ::= <STR>
  - <STR> → Arbitrary wave name (20 characters)
    † Optional (If omitted, the destination name is assumed.)
    † If the arbitrary wave name is less than 20 characters, the remaining characters are filled with spaces (ASCII code 32).
- <chan> ::= <INT>
  - <INT> → Channel number : 1 to 2
- <wave> ::= SINusoid|SQUare|PULSe|RAMP
  - [USINe|CSIne|CFCSIne|ACSIne|SSIne|MCSIne]
    - [ONPSIne|OFPSIne|CONSIne|COFSIne]
    - [GAUSSian|LORentz|HAVersine|HSPulse|TPULSe|SINC]
    - [ERIS|EFAL|SOLStep|DOSCillation]
    - [OSURge|PSURge]
    - [TOFFset|HSEPulse|BRRamp]
    - [USER]

- SINusoid → Sine wave
- SQUare → Square wave
- PULSe → Pulse wave
- RAMP → Ramp wave
- USINe → Unbalanced sine wave
- CSIne → Clipped sine wave
- CFCSIne → CF controlled sine wave
- ACSIne → Conduction angle controlled sine wave
- SSIne → Staircase sine wave
- MCSIne → Multi-cycle sine wave
- ONPSIne → On-phase controlled sine wave
- OFPSIne → Off-phase controlled sine wave
- CONSIne → Chattering-on sine wave
- COFSIne → Chattering-off sine wave
- GAUSSian → Gaussian pulse
- LORentz → Lorentz pulse
- HAVersine → Haversine
- HSPulse → Half-sine pulse
- TPULSe → Trapezoid pulse
SINC $\rightarrow$ $\frac{\sin(x)}{x}$
ERISe $\rightarrow$ Exponential rise
EFAL $\rightarrow$ Exponential fall
SOLStep $\rightarrow$ 2nd-order LPF step response
DOSCillation $\rightarrow$ Damped oscillation
OSURge $\rightarrow$ Oscillation surge
PSURge $\rightarrow$ Pulse surge
TOFFset $\rightarrow$ Trapezoid wave with offset
HSEPulse $\rightarrow$ Half-sine edge pulse
BRRamp $\rightarrow$ Bottom-referenced ramp wave
USER $\rightarrow$ Arbitrary waveform

† Copy the waveform <wave> of the channel number <chan> as the arbitrary wave name <name> to the memory number <memory>.

**Setting example**

```
:TRACe:COPY 1,"name",1,SINusoid
```
Copies the waveform memory of sine wave of CH1 as the arbitrary wave name "name" to the arbitrary wave memory 1

**Remarks**

(1) Memory number 0 is the edit memory.
(2) The arbitrary wave name of memory number 0 is "<Edit Memory>" (20 characters).
(3) When copying the arbitrary wave, the arbitrary wave data of the memory selected in "[:SOURce[1|2]]:FUNCtion:USER" is copied.

### 2.3.2.6.3.4 delete

{[:TRACe|:DATA]:DELeTe}

**Description**

Deletes the arbitrary wave memory

**Setting parameter**

<memory>

<memory> ::= <INT>

<INT> $\rightarrow$ Memory number : 0 to 128

**Setting example**

```
:TRACe:DELeTe 1
```
Deletes the memory number 1

**Remarks**

(1) Memory number 0 is the edit memory.
(2) Specifying the memory number 0 gives the same effect as the case of operating the [New] soft-key in the Edit arbitrary waveform screen on the main unit.
2.3.2.6.3.5 Information acquisition

{::TRACe[:DATA]:INFormation?}

□{::TRACe[:DATA]:INFormation?}

Description
Acquires the information of arbitrary wave memory

Query parameter

<memory> ::= <INT>
<INT>  →  Memory number : 0 to 128

Response format

<name>,<format>,<number>

<name> ::= <STR>
<STR>  →  Arbitrary wave name (20 characters)

<format> ::= <INT>
<INT>  →  Data format
0 →  Array format
1 →  Control point format

<number> ::= <INT>
<int>  →  The number of data points

2.3.3 Output Signal Setting

2.3.3.1 Frequency

2.3.3.1.1 setting/query

[:SOURce[1|2]]::FREQuency[:CW]:FIXed]

□[:SOURce[1|2]]::FREQuency[:CW]:FIXed]

□[:SOURce[1|2]]::FREQuency[:CW]:FIXed]?

Description
Sets/queries the frequency of the main oscillator

Setting parameter

<frequency>|MINimum|MAXimum
<frequency> ::= <REAL>[<eunits>][<units>]
<REAL>  →  Frequency : 0.01 µHz to 200 MHz
Resolution : 0.01 µHz (< 50 MHz),
0.1 µHz( ⩾ 50 MHz)
† The setting range varies depending on the waveform and oscillation mode.
<eunits> ::= M (mega) K|U|N
† Note that when the unit is frequency, M is used to mean "10^6"
<units> ::= HZ|USER
MINimum → Sets the maximum value
MAXimum → Sets the minimum value

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:FREQuency:CW 1MHZ
Sets the frequency of CH1 to 1MHz

Remarks

† This command cannot set/query the frequency of sequence.

2.3.3.1.2 Unit selection/query

[:SOURce[1|2]]:FREQuency:UNIT

■[:SOURce[1|2]]:FREQuency:UNIT

□[:SOURce[1|2]]:FREQuency:UNIT?

Description

Selects/queries the unit of frequency

Setting parameter

HZ|USER

HZ → Hz
USER → User-defined unit

Query parameter:

None

Response format

HZ|USER
† For the meaning of each response data, see the setting parameter

Setting example

:SOURce1:FREQuency:UNIT HZ
Sets the unit of the frequency of CH1 to "Hz"

Remarks

† This command is system unit setting command, it is not reflected on this device screen.
† For system unit, see the Chapter 2.6.
2.3.3.1.3  user-defined unit setting/query

[:SOURce[1|2]]:FREQuency:USER

■ [:SOURce[1|2]]:FREQuency:USER

□ [:SOURce[1|2]]:FREQuency:USER?

Description
Sets/queries the user-defined unit of frequency

Setting parameter

- \[<\text{name}>].[<\text{form}>].[<\text{m}>].[<\text{n}>]\n- \<\text{name}\> := <\text{STR}>
  - <\text{STR}> → Name of user-defined unit
    (maximum 4 letters)
    † Optional (If omitted, the setting is not changed)
- \<\text{form}\> := LINear|LOGarithmic
  - LINear → Linear
  - LOGarithmic → Log
    † Optional (If omitted, the setting is not changed)
- \<\text{m}\> := <\text{REAL}|MINimum|MAXimum
  - <\text{REAL}> → m (scale)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
    † Optional (If omitted, the setting is not changed)
- \<\text{n}\> := <\text{REAL}|MINimum|MAXimum
  - <\text{REAL}> → n (offset)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
    † Optional (If omitted, the setting is not changed)

Query parameter
None

Response format
- \<\text{name}\>,\<\text{form}\>,\<\text{m}\>,\<\text{n}\>
  - \<\text{name}\> := <\text{STR}>
  - \<\text{form}\> := LIN|LOG
  - \<\text{m}\> := <\text{NR3}>
  - \<\text{n}\> := <\text{NR3}>
    † For the meaning of each response data, see the setting parameter

Setting example
- [:SOURce1]:FREQuency:USER "kHz",LINear,1000,0
  Sets the user-defined unit of the frequency of CH1 to "kHz"
2.3.3.1.4 External synchronization oscillation mode (Synclator)

2.3.3.1.4.1 selection/query

[:SOURce[1|2]]:FREQuency:SYNC

- [:SOURce[1|2]]:FREQuency:SYNC
- [:SOURce[1|2]]:FREQuency:SYNC?

Description
Selects/queries the external synchronization oscillation mode (Synclator function)

Setting parameter

- <state> ::= <BOL>
  - <BOL> → 0/OFF: Cancels the external synchronization oscillation mode
  - 1/ON: Sets to the external synchronization oscillation mode

Query parameter
None

Response format

- <NBOL>
  - <NBOL> → 0: Canceling the external synchronization oscillation mode
  - 1: In the external synchronization oscillation mode

Setting example

:SOURce1:FREQuency:SYNC OFF
Cancels the external synchronization oscillation mode of CH1

2.3.3.1.4.2 Synchronization source selection/query

[:SOURce[1|2]]:FREQuency:SYNC:SOURce

- [:SOURce[1|2]]:FREQuency:SYNC:SOURce
- [:SOURce[1|2]]:FREQuency:SYNC:SOURce?

Description
Selects/queries the synchronization source of the external synchronization oscillation mode (Synclator function)

Setting parameter

- EXTernal|CH1
  - EXTernal → Specifies the external trigger input terminal of the external: designated channel
  - CH1 → Specifies the external trigger input terminal of CH1
    (Only CH2 of the 2-channel equipment (WF1968) can be selected)

Query parameter
None
Response format
EXT|CH1
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:FREQuency:SYNC:SOURce EXTernal
Sets the synchronization source of the external synchronization oscillation mode
(Synclator function) of CH1 to external

2.3.3.1.4.3 Signal polarity of synchronization source selection/query
[:SOURce[1|2]]:FREQuency:SYNC:SLOPe

■[:SOURce[1|2]]:FREQuency:SYNC:SLOPe
☐[:SOURce[1|2]]:FREQuency:SYNC:SLOPe?

Description
Selects/queries the polarity of synchronization source of the external
synchronization oscillation mode (Synclator function)

Setting parameter
POSitive|NEGative
POSitive → Positive polarity
NEGative → Negative polarity

Query parameter
None

Response format
POS|NEG
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:FREQuency:SYNC:SLOPe NEGative
Sets the polarity of synchronization source of the external synchronization
oscillation mode (Synclator function) of CH1 to negative polarity

2.3.3.2 Phase

2.3.3.2.1 setting/query
[:SOURce[1|2]]:PHASE[:ADJust]

■[:SOURce[1|2]]:PHASE[:ADJust]
☐[:SOURce[1|2]]:PHASE[:ADJust]?

Description
Sets/queries the phase of the oscillator

Setting parameter
<phase>|MINimum|MAXimum
<phase> ::= <REAL>[<units>]
<REAL> → Phase : -1800.000° to 1800.000°
Resolution : 0.001°
<units> ::= DEG|USER
MINimum → -1800.000°
MAXimum → 1800.000°

Query parameter
[M]INimum|[MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR3>

Setting example
:SOURce1:PHASe:ADJust 90DEG
Sets the phase of CH1 to 90°

2.3.3.2.2 Unit selection/query
[:SOURce[1|2]]:PHASe:UNIT

■[:SOURce[1|2]]:PHASe:UNIT
□[:SOURce[1|2]]:PHASe:UNIT?

Description
Selects/queries the phase unit

Setting parameter
DEG|USER
DEG → °
USER → User-defined unit

Query parameter
None

Response format
DEG|USER
† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:PHASe:UNIT DEG
Sets the unit of the phase of CH1 to "°"

Remarks
† This command is system unit setting command, it is not reflected on this device screen.
† For system unit, see the Chapter 2.6.
2.3.3.2.3 user-defined unit setting/query
[:SOURce[1|2]]:PHASE:USER

■ [:SOURce[1|2]]:PHASE:USER

☐ [:SOURce[1|2]]:PHASE:USER?

Description
Sets/queries the user-defined unit of phase

Setting parameter

[[<name>],[<form>],[<m>],[<n>]]

- **<name>** ::= <STR>
  - <STR> → Name of user-defined unit (maximum 4 letters)
  - † Optional (If omitted, the setting is not changed)

- **<form>** ::= LINear|LOGarithmic
  - LINear → Linear
  - LOGarithmic → Logarithmic
  - † Optional (If omitted, the setting is not changed)

- **<m>** ::= <REAL>|MINimum|MAXimum
  - <REAL> → m (scale)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

- **<n>** ::= <REAL>|MINimum|MAXimum
  - <REAL> → n (offset)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

Query parameter
None

Response format

[[<name>],[<form>],[<m>],[<n>]]

- **<name>** ::= <STR>
- **<form>** ::= LIN|LOG
- **<m>** ::= <NR3>
- **<n>** ::= <NR3>

† For the meaning of each response data, see the setting parameter

Setting example
:SOURce1:PHASE:USER "rad",LINear,57.32,0
Sets the user-defined unit of the phase of CH1 to "rad"
2.3.3.3 Amplitude

2.3.3.3.1 setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Sets/queries the amplitude of oscillator

Setting parameter

<amplitude>|MINimum|MAXimum

- <amplitude> ::= <REAL>|<eunits>|<units>
- <REAL> → Amplitude: 0Vp-p to 20Vp-p/open,
  : 0 Vp-p to 10 Vp-p/50Ω,
  : -Inf, -89.03 to +16.98dBV/open,
  : -Inf, -82.04 to +23.97 dBm/50Ω

Resolution: 4 digits or 0.1mVp-p
  (999.9mVp-p or less),
  : 5 digits or 1mVp-p (1Vp-p or more)
  : 0.01 (Unit is DBV/DBM)

† Inf: Infinity
† The setting range varies depending on the waveform, frequency, and DC offset.

- <eunits> ::= M (milli)
- <units> ::= VPP|VPK|VRMS|DBV|DBM|USER

† The available unit varies depending on the waveform.

MINimum → 0 Vp-p
MAXimum → 20Vp-p/open, 10Vp-p/50Ω
(This is the settable upper limit with the current setting)

Query parameter

[MINimum|MAXimum]

- MINimum → Queries the minimum value
- MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURcel:VOLTage:LEVel:IMMediate:AMPLitude 10VPP
Sets the amplitude of CH1 to 10Vp-p

Remarks

† This command cannot set/query the amplitude of sequence.
2.3.3.3.2 Unit selection/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:UNIT

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:UNIT
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:UNIT?

Description

Selects/queries the amplitude unit

Setting parameter

VPP|VPK|VRMS|DBV|DBM|USER

VPP → Vp-p
VPK → Vpk
VRM → Vrms
DBV → dBV
DBM → dBm
USER → User-defined unit
† Available unit varies depending on the waveform.

Query parameter

None

Response format

VPP|VPK|VRMS|DBV|DBM|USER
† For the meaning of each response data, see the setting parameter

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:AMPLitude:UNIT VPP
Sets the amplitude unit of CH1 to "Vp-p"

Remarks

† This command is system unit setting command, it is not reflected on this device screen.
† For system unit, see the Chapter 2.6.

2.3.3.3 user-defined unit setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:USER

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:USER
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]:USER?

Description

Sets/queries the user-defined unit of amplitude

Setting parameter

- [<name>], [<<form>], [<m>], [<n>]
- <name> ::= <STR>
  <STR> → Name of user-defined unit
  (maximum 4 letters)
† Optional (If omitted, the setting is not changed)

<form> ::= LINear|LOGarithmic
   LINear → Linear
   LOGarithmic → Log
† Optional (If omitted, the setting is not changed)

<m> ::= <REAL>|MINimum|MAXimum
   <REAL> → m (scale)
   MINimum → Sets the minimum value
   MAXimum → Sets the maximum value
† Optional (If omitted, the setting is not changed)

<n> ::= <REAL>|MINimum|MAXimum
   <REAL> → n (offset)
   MINimum → Sets the minimum value
   MAXimum → Sets the maximum value
† Optional (If omitted, the setting is not changed)

Query parameter
None

Response format

<name>,<form>,<m>,<n>
<name> ::= <STR>
<form> ::= LIN|LOG
<m> ::= <NR3>
<n> ::= <NR3>
† For the meaning of each response data, see the setting parameter

Setting example
:SOURcel:VOLTage:LEVel:IMMediate:AMPLitude:USER
"mVpk",LINear,0.001,0
Sets the user-defined unit of the amplitude of CH1 to "mVpk"

2.3.3.4 DC offset

2.3.3.4.1 setting/query
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet

■[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet
□[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet?

Description
Sets/queries the DC offset of oscillator

Setting parameter
<offset>|MINimum|MAXimum
<offset> ::= <REAL>[<eunits>][<units>]
   <REAL> → DC offset : ±10V/open, ±5V/50Ω,
   Resolution : 4 digits or 0.1mV (±499.9mV or less),
: 5 digits or 1mV (±0.5V or more).
† The setting range varies depending on the amplitude setting.

<units> ::= M (milli)
<units> ::= V|USER

MINimum → -10V/open, -5V/50Ω
(This is the settable lower limit with the current setting)
MAXimum → 10V/open, 5V/50Ω
(This is the settable upper limit with the current setting)

Query parameter

[MINimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:OFFSet 2.5V
Sets the DC offset of CH1 to 2.5V

2.3.3.4.2 Unit setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:UNIT

■[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:UNIT
☐[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet:UNIT

Description
Selects/queries the DC offset unit

Setting parameter

V|USER
V → V
USER → User-defined unit

Query parameter

None

Response format

V|USER
† For the meaning of each response data, see the setting parameter

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:OFFSet:UNIT V
Sets the unit of the DC offset of CH1 to "V"

Remarks

† This command is system unit setting command, it is not reflected on this device screen.
† For system unit, see the Chapter 2.6.
2.3.3.4.3 **user-defined unit setting/query**

[:SOURce[1|2]]::VOLTage[::LEVel][::IMMediate]:OFFSet:USER

- [:SOURce[1|2]]::VOLTage[::LEVel][::IMMediate]:OFFSet:USER
- [:SOURce[1|2]]::VOLTage[::LEVel][::IMMediate]:OFFSet:USER?

**Description**

Sets/queries the user-defined unit of DC offset

**Setting parameter**

[<name>], [<form>], [<m>], [<n>]

- `<name>` ::= `<STR>`
  - <STR> → Name of user-defined unit
    - (maximum 4 letters)
    - † Optional (If omitted, the setting is not changed)

- `<form>` ::= LINear|LOGarithmic
  - LINear → Linear
  - LOGarithmic → Log
  - † Optional (If omitted, the setting is not changed)

- `<m>` ::= <REAL>|MINimum|MAXimum
  - <REAL> → m (scale)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

- `<n>` ::= <REAL>|MINimum|MAXimum
  - <REAL> → n (offset)
  - MINimum → Sets the minimum value
  - MAXimum → Sets the maximum value
  - † Optional (If omitted, the setting is not changed)

**Query parameter**

None

**Response format**

<name>, <form>, <m>, <n>

- `<name>` ::= `<STR>`
- `<form>` ::= LIN|LOG
- `<m>` ::= <NR3>
- `<n>` ::= <NR3>
  - † For the meaning of each response data, see the setting parameter

**Setting example**

:SOURce1::VOLTage::LEVel::IMMediate::OFFSet::USER "mV", LINear, 0.001, 0

Sets the user-defined unit of the DC offset of CH1 to "mV"
2.3.3.5 Upper and lower limit voltage

2.3.3.5.1 High level setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH?

Description
Sets/queries the high level

Setting parameter

<high>|MINimum|MAXimum
<high> ::= <REAL>[<eunits>][<units>]
REAL → High level
† The setting range varies depending on the state.
<eunits> ::= M (milli)
<units> ::= V|USER
MINimum → Sets the minimum value
MAXimum → Sets the maximum value

Query parameter

[M|Nimum|MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:SOURce1:VOLTage:LEVel:IMMediate:HIGH 5V
Setting the high level of CH1 to 5V

2.3.3.5.2 High level unit selection/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH:UNIT

- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH:UNIT
- [:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH:UNIT?

Description
Selects/queries the unit of high level

Setting parameter

V|USER
  V → V
  USER → User-defined unit
Query parameter

None

Response format

V|USER

† For the meaning of each response data, see the setting parameter

Setting example

:SOURcel:VOLTage:LEVel:IMMediate:HIGH:UNIT V
Sets the unit of the high level of CH1 to "V"

Remarks

† The user-defined unit is the same as the one for DC offset.
† This command is system unit setting command, it is not reflected on this device screen.
† For system unit, see the Chapter 2.6.

2.3.3.5.3 Low level setting/query

[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW

•[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW

□[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW?

Description

Sets/queries the low level

Setting parameter

<low>|MINimum|MAXimum

<low> ::= <REAL>[<eunits>][<units>]  
<REAL>   → Low level

† The setting range varies depending on the status.

<eunits> ::= M (milli)
<units>   ::= V|USER

MINimum  → Sets the minimum value
MAXimum  → Sets the maximum value

Query parameter

[MINimum|MAXimum]

MINimum  → Sets the minimum value
MAXimum  → Sets the maximum value

Response format

<NR3>

Setting example

:SOURcel:VOLTage:LEVel:IMMediate:LOW 0V
Sets the low level of CH1 to 0V
### 2.3.3.5.4 Low level unit selection/query

```plaintext
[:SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW:UNIT
```

- **Description**
  Selects/queries the unit of low level

- **Setting parameter**
  
<table>
<thead>
<tr>
<th>V</th>
<th>USER</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>USER</td>
<td>User-defined unit</td>
</tr>
</tbody>
</table>

- **Query parameter**
  None

- **Response format**
  
  V|USER
  † For the meaning of each response data, see the setting parameter

- **Setting example**
  
  :SOURce1:VOLTage:LEVel:IMMediate:LOW:UNIT V
  
  Sets the unit of the low level of CH1 to "V"

- **Remarks**
  † The user-defined unit is the same as the one for DC offset.
  † This command is system unit setting command, it is not reflected on this device screen.
  † For system unit, see the Chapter 2.6.

### 2.3.3.6 Subchannel operation

#### 2.3.3.6.1 Amplitude setting/query

```plaintext
[:SOURce[1|2]]:SCHannel:VOLTage[:LEVel][:IMMediate][:AMPLitude]
```

- **Description**
  Sets/queries the amplitude of subchannel output

- **Setting parameter**
  
  `<amplitude>|MINimum|MAXimum`
  
  `<amplitude>` ::= `<REAL>[<eunits>][<units>]`
  
  `<REAL>` → Amplitude : 0V-p to 6V-p/open,
Resolution: 1mVp-p

\[
\begin{align*}
\text{<eunits> ::= M (milli)} \\
\text{<units> ::= VPP} \\
\text{MINimum} \rightarrow 0 \text{ Vp-p} \\
\text{MAXimum} \rightarrow 6 \text{ Vp-p/open}
\end{align*}
\]

Query parameter

\[
\begin{align*}
\text{[MINimum][MAXimum]} \\
\text{MINimum} \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\end{align*}
\]

Response format

\[
\text{<NR3>}
\]

Setting example


Sets the amplitude of the subchannel output of CH1 to 3Vp-p

2.3.3.6.2 Offset setting/query

\[
\text{[:SOURCE[1|2]]:SChannel:VOLTage[:LEVEL][:IMMediate]:OFFSet}
\]

- [:SOURCE[1|2]]:SChannel:VOLTage[:LEVEL][:IMMediate]:OFFSet

- [:SOURCE[1|2]]:SChannel:VOLTage[:LEVEL][:IMMediate]:OFFSet?

Description

Sets/queries the DC offset of subchannel output

Setting parameter

\[
\begin{align*}
\text{<offset>|MINimum|MAXimum} \\
\text{<offset> ::= <REAL>[<eunits>][<units>]} \\
\text{<REAL>} \rightarrow \text{DC offset : ±3V/open} \\
\text{Resolution : 1mV} \\
\text{<eunits> ::= M (milli)} \\
\text{<units> ::= V} \\
\text{MINimum} \rightarrow -3V/open \\
\text{MAXimum} \rightarrow 3V/open
\end{align*}
\]

Query parameter

\[
\begin{align*}
\text{[MINimum][MAXimum]} \\
\text{MINimum} \rightarrow \text{Queries the minimum value} \\
\text{MAXimum} \rightarrow \text{Queries the maximum value}
\end{align*}
\]

Response format

\[
\text{<NR3>}
\]

Setting example

:SOURCE1:SChannel:VOLTage:LEVEL:IMMediate:OFFSet 2.5V

Sets the DC offset of the subchannel output of CH1 to 2.5V
2.3.4 Signal Output Operation

2.3.4.1 Output on/off setting/query

:OUTPut[1|2][:STAtE]

- :OUTPut[1|2][:STAtE]
- :OUTPut[1|2][:STAtE]?

Description
Selects/queries the on/off of the output

Setting parameter

<table>
<thead>
<tr>
<th>&lt;state&gt;</th>
<th>:= (BOL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOL</td>
<td>→ 0/OF</td>
</tr>
<tr>
<td></td>
<td>1/ON</td>
</tr>
</tbody>
</table>

Response format

<table>
<thead>
<tr>
<th>&lt;NBOL&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBOL</td>
</tr>
</tbody>
</table>

Setting example

:OUTPut1:STAtE ON
Sets the output of CH1 to On

Remarks
To set the SYNC/SUB OUT output to Off, use one of the following commands according to the oscillation mode

| Continuous or modulated oscillation mode | :OUTPut[1|2]:SYNC:TYPE OFF |
|----------------------------------------|---------------------------|
| Burst oscillation mode                 | :OUTPut[1|2]:SYNC:BURSt:TYPE OFF |
| Sweep oscillation mode                 | :OUTPut[1|2]:SYNC:SWEep:TYPE OFF |

2.3.4.2 Output on at power on setting/query

:OUTPut[1|2]:PON

- :OUTPut[1|2]:PON
- :OUTPut[1|2]:PON?

Description
Selects/queries the output on/off at power-on operation

Setting parameter
ON[OFF][LAST
ON   → Output On
OFF  → Output Off
LAST→ Setting from the previous power off operation
(Turning Off→On without using the power switch sets the output Off)

Query parameter
None

Response format
ON[OFF][LAST
† For the meaning of each response data, see the setting parameter

Setting example
:OUTPut1:PON ON
Sets the output of CH1 at power-on to On

2.3.4.3 Auto-range operation (output range) selection/query
[:SOURce[1|2]]:VOLTage:RANGe:AUTO

■[:SOURce[1|2]]:VOLTage:RANGe:AUTO
☐[:SOURce[1|2]]:VOLTage:RANGe:AUTO?

Description
Selects/queries the auto range on/off

Setting parameter
<state> ::= <BOL>
          <BOL> → 0/OFF : Auto range off
                   1/ON  : Auto range on

Query parameter
None

Response format
<NBOL>
          <NBOL> → 0 : Auto range off
                   1 : Auto range on

Setting example
:SOURce1:VOLTage:RANGe:AUTO ON
Sets the auto range of CH1 to On

2.3.4.4 Reference phase initialization
[:SOURce[1|2]]:PHASe:INITiate

■[:SOURce[1|2]]:PHASe:INITiate

Description
Executes the reference phase initialization. WF1968 is performed both channel regardless of the this specification of [1|2] (It is not possible to be initialized separately).

Setting parameter
None

2.3.4.5 External addition input setting/query
[:SOURce[1|2]]:COMBine:FEED

■[:SOURce[1|2]]:COMBine:FEED
□[:SOURce[1|2]]:COMBine:FEED?

Description
Selects/queries the external addition

Setting parameter
OFF| X0.4|X2|X10
  OFF  →  Disables the external addition
  X0.4  →  Adds 0.4 times of the external addition
  X2  →  Adds 2 times of the external addition
  X10  →  Adds 10 times of the external addition

Query parameter
None

Response format
OFF|X0.4|X2|X10

Setting example
:SOURce1:COMBine:FEED X2
Adds 2 times of the external addition to the output of CH1

2.3.4.6 Load impedance setting/query
:OUTPut[1|2]:LOAD

■:OUTPut[1|2]:LOAD
□:OUTPut[1|2]:LOAD?

Description
Sets/queries the load impedance

Setting parameter
<load>|MINimum|MAXimum|INFinity
  <load>  ::=  <INT>[<eunits>][<units>]
  <INT>  →  Load impedance : 1Ω to 10kΩ, Resolution: 1Ω
  <eunits>  ::=  K
  <units>  ::=  OHM
MINimum → 1 Ω
MAXimum → 10kΩ
INFiinity → High-Z

Query parameter
[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format
<NR1>INF

Setting example
:OUTPut1:LOAD 50OHM
Sets the load impedance of CH1 to 50Ω

2.3.5 Trigger Operation

2.3.5.1 Sweep mode trigger source selection/query
:TRIGger[1|2]:SWEep:SOURce

■:TRIGger[1|2]:SWEep:SOURce
□:TRIGger[1|2]:SWEep:SOURce?

Description
Selects/queries the trigger source at the time of sweep

Setting parameter
TIMer|EXTernal|CH1
TIMer → Trigger according to the internal trigger cycle
EXTernal → External trigger
CH1 → Trigger of CH1 (Only CH2 can be selected)

Query parameter
None

Response format
TIM|EXT|CH1
† For the meaning of each response data, see the setting parameter

Setting example
:TRIGger2:SWEep:SOURce EXT
Sets the trigger source of CH2 at the time of sweep to external
2.3.5.2  Sweep mode internal trigger cycle setting/query

:TRIGger[1|2]:SWEep:TIMer

**Description**
Sets/queries the internal trigger cycle at the time of sweep

**Setting parameter**

```
<period>|MINimum|MAXimum
 périod> ::= <REAL>[<eunits>][<units>]
<REAL>  → Cycle : 100.0 µs to 10,000 s,
         Resolution : 5 digits or 0.1µs
<eunits> ::= MA (mega) |K|M (milli) U|N
<units>  ::= S

MINimum  → 100.0 µs
MAXimum  → 10,000 s
```

**Query parameter**

```
[MINimum|MAXimum]
MINimum  → Queries the minimum value
MAXimum  → Queries the maximum value
```

**Response format**

<NR3>

**Setting example**

:TRIGger1:SWEep:TIMer 1MS
Sets the internal trigger cycle of CH1 at the time of sweep to 1ms

2.3.5.3  Sweep mode external trigger signal polarity selection/query

:TRIGger[1|2]:SWEep:SLOPe

**Description**
Selects/queries the external trigger polarity at the time of sweep

**Setting parameter**

POSitive|NEGative|OFF
POSitive → Rising
NEGative → Falling
OFF      → Disabled

**Query parameter**
None

Response format
POS|NEG|OFF
† For the meaning of each response data, see the setting parameter

Setting example
:TRIGger:SWEep:SLOPe NEGative
Sets the external trigger polarity at the time of sweep to falling

2.3.5.4 Burst mode trigger source selection/query
:TRIGger[1|2]:BURSt:SOURce

◼:TRIGger[1|2]:BURSt:SOURce
☐:TRIGger[1|2]:BURSt:SOURce?

Description
Selects/queries the trigger source at the time of burst

Setting parameter

TIMer|EXTernal|CH1
TIMer        → Trigger according to the internal trigger cycle
EXTernal   → External trigger
CH1        → External trigger of CH1 (Only CH2 can be selected)

Query parameter
None

Response format
TIM|EXT|CH1
† For the meaning of each response data, see the setting parameter

Setting example
:TRIGger2:BURSt:SOURce EXT
Sets the trigger source of CH2 at the time of burst to external

2.3.5.5 Burst mode internal trigger cycle setting/query
:TRIGger[1|2]:BURSt:TIMer

◼:TRIGger[1|2]:BURSt:TIMer
☐:TRIGger[1|2]:BURSt:TIMer?

Description
Sets/queries the internal trigger cycle at the time of burst

Setting parameter

<period>|MINimum|MAXimum
<period> ::= <REAL>[<eunits>][<units>]
<REAL> → Cycle : 1.0 µs to 1,000 s,
Resolution : 5 digits or 0.1µs
<eunits> ::= MA (mega) |K|M (milli) U|N
<units> ::= S
MINimum → 1.0µs
MAXimum → 1,000s

Query parameter

[MINimum][MAXimum]
MINimum → Queries the minimum value
MAXimum → Queries the maximum value

Response format

<NR3>

Setting example

:TRIGger1:BURSt:TIMer 1MS
Sets the internal trigger cycle of CH1 at the time of burst to 1ms

2.3.5.6 Burst mode external trigger signal polarity selection/query

:TRIGger[1|2]:BURSt:SLOPe

■:TRIGger[1|2]:BURSt:SLOPe

☐:TRIGger[1|2]:BURSt:SLOPe?

Description
Selects/queries the external trigger polarity at the time of burst

Setting parameter

POSitive|NEGative|OFF
POSitive → Rising (at the time of trigger burst/triggered gate)
Positive polarity (at the time of gate)
NEGative → Falling (at the time of trigger burst/triggered gate)
Negative polarity (at the time of gate)
OFF → Disabled

Query parameter

None

Response format

POS|NEG|OFF
† For the meaning of each response data, see the setting parameter

Setting example

:TRIGger:BURSt:SLOPe NEGative
Sets the external trigger polarity at the time of burst to falling
2.3.5.7  Manual trigger (TRIG key operation)

*TRG

■*TRG

Description
Performs the same action as the trigger execution with the [TRIG] button being pressed

Setting parameter
None

Remarks
† Channel cannot be specified. Trigger is targeted to CH1.
† This command may not be used depending on the oscillation mode (See Table 2.3).

2.3.5.8  Manual trigger (TRIG key operation)

:TRIGger[1|2][:SEQuence][:IMMediate]

■:TRIGger[1|2][:SEQuence][:IMMediate]

Description
Performs the same action as with the trigger execution when the [TRIG] button is pressed

Setting parameter
None

Remarks
† This command may not be used depending on the oscillation mode (See Table 2.3).

2.3.5.9  Execution control setting

:TRIGger[1|2]:SELected:EXECute

■:TRIGger[1|2]:SELected:EXECute

Description
Controls the oscillation modes

Setting parameter
○ Modulated oscillation mode
  START|STOP
  START  →  Start
  STOP  →  Stop
○ Sweep Oscillation Mode
  START|STOP|HOLD|RESume
STARt → Start
STOP → Stop
HOLD → Hold
RESume → Resume

Sequence
STARt|STOP|ISTop|HOLD|RESume|EBRanch

START → Start
STOP → Stop
ISTop → Forced termination
HOLD → Hold
RESume → Resume
EBRanch → Event branch

Remarks
† In the sequence mode, whether or not "[1|2]" is specified does not affect the operation.
† This command cannot be used in the burst oscillation mode.

2.3.6 Setting Memory Operations

For the arbitrary waveform memory operation and sequence memory operation, see "2.3.2.6.3 Waveform/arbitrary waveform/memory operation" and "2.3.9.6 Sequence/memory operation." No command is available to operate USB memory.

2.3.6.1 clear
:MEMory:STATe:DELete

■:MEMory:STATe:DELete

Description
Clears the setting memory

Setting parameter
<memory>|MINimum|MAXimum
<memory> ::= <INT>
<int> → Memory number : 1 to 10
MINimum → 1
MAXimum → 10

2.3.6.2 Store
*SAV

■*SAV

Description
Stores to the set memory

Setting parameter
<memory> ::= <INT>
2.3.6.3 Recall
*RCL

**RCL

Description
Recalls from the set memory

Setting parameter

\[
<\text{memory}> ::= \langle\text{INT}\rangle
\]
\[
\langle\text{INT}\rangle \rightarrow \text{Memory number : 1 to 10}
\]

2.3.7 Status operations

2.3.7.1 Status register and related queue clear
*CLS

**CLS

Description
Clears event register and error queue

Setting parameter
None

Remarks
(1) The following registers are cleared:
- Status byte register
- Standard event status register
- Operation status event register
- CH1 operation status event register
- CH2 operation status event register
- Questionable data status event register
- CH1 Questionable data status event register
- CH2 Questionable data status event register
- Warning event register
- CH1 warning event register
- CH2 warning event register
- Error queue

(2) This command can clear the overload message (No.23133).

2.3.7.2 Status reporting related preset setting
:STATus:PRESet

**:STATus:PRESet
**Description**

Presets the registers

**Setting parameter**

None

**Remarks**

† The following registers are cleared by this command:
  - Operation status transition filter (negative)
  - Operation status transition filter (positive)
  - Operation status enable register
  - CH1 operation status transition filter (negative)
  - CH1 operation status transition filter (positive)
  - CH1 operation status enable register
  - CH2 operation status transition filter (negative)
  - CH2 operation status transition filter (positive)
  - CH2 operation status enable register
  - Questionable data status transition filter (negative)
  - Questionable data status transition filter (positive)
  - Questionable data status enable register
  - CH1 questionable data status transition filter (negative)
  - CH1 questionable data status transition filter (positive)
  - CH1 questionable data status enable register
  - CH2 questionable data status transition filter (negative)
  - CH2 questionable data status transition filter (positive)
  - CH2 questionable data status enable register
  - Warning event enable register
  - CH1 warning event enable register
  - CH2 warning event enable register

---

### 2.3.7.3 Status register at power-on clear flag setting/query

*PSC*

- **PSC**

- **PSC?**

**Description**

Sets/queries the power-on status clear flag

**Setting parameter**

\[
\texttt{<state>} ::= \texttt{<INT>}
\]

\[
\texttt{<INT>} \rightarrow 0: \text{OFF} \\
\texttt{1: ON}
\]

**Query parameter**

None

**Response format**

\[
\texttt{<NR1>}
\]
Setting example
*PSC 1
Enables the automatic clear at the power-on of the enable register, etc.

2.3.7.4 Status byte register query
*STB?

☐*STB?

Description
Queries the status byte register

Query parameter
None

Response format
<NR1>

2.3.7.5 Service request enable register setting/query
*SRE

☒*SRE

☒*SRE?

Description
Sets/queries the service request enable register

Setting parameter
<value> ::= <INT>
  <INT> → For setting values, see "3. Status System."

Query parameter
None

Response format
<NR1>

Setting example
*SRE 8
Sets 8 to the service request enable register

2.3.7.6 Standard event status register query
*ESR?

☐*ESR?

Description
Queries the standard event status register
### 2.3.7.7 Standard event status enable register setting/query

**ESE**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*ESE</td>
<td>Sets the standard event status enable register</td>
</tr>
<tr>
<td>*ESE?</td>
<td>Queries the standard event status enable register</td>
</tr>
</tbody>
</table>

**Setting parameter**

- `<value>` := `<INT>`
- `<INT>` → For setting values, see "3. Status System."

**Query parameter**

None

**Response format**

<NR1>

**Setting example**

*ESE 8
Sets 8 to the standard event status enable register.

---

### 2.3.7.8 Operation Status Register Group

The operation status register group of this equipment has three register sets (common/CH1/CH2).
However, CH2 is available only in the 2-channel equipment (WF1968). Each register can be accessed by using the following command sets.

---

#### 2.3.7.8.1 Condition register query

`:STATUs:OPERation[:CH1]:CH2]:CONDition?`

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>:STATus:OPERation[:CH1]:CH2]:CONDition?</td>
<td>Queries the operation status condition register of common/CH1/CH2</td>
</tr>
</tbody>
</table>

**Query parameter**

None

**Response format**

<NR1>
2.3.7.8.2 Transition filter register (negative) setting/query
:STATus:OPERation[:CH1]:CH2]:NTRansition

Description
Sets/queries the operation status transition filter (negative) of common/CH1/CH2

Setting parameter

\[
<\text{value}> ::= \langle\text{INT}\rangle
\]

\[
\langle\text{INT}\rangle \rightarrow \text{For setting values, see "3. Status System."}
\]

Query parameter
None

Response format
\[
<\text{NR1}>
\]

Setting example

:STATus:OPERation:NTRansition 512
Sets 1 in the bit 9 of the common operation status transition filter (negative)

2.3.7.8.3 Transition filter register (positive) setting/query
:STATus:OPERation[:CH1]:CH2]:PTRansition

Description
Sets/queries the operation status transition filter (positive) of common/CH1/CH2

Setting parameter

\[
<\text{value}> ::= \langle\text{INT}\rangle
\]

\[
\langle\text{INT}\rangle \rightarrow \text{For setting values, see "3. Status System."}
\]

Query parameter
None

Response format
\[
<\text{NR1}>
\]

Setting example

:STATus:OPERation:CH1:PTRansition 512
Sets 1 in the bit 9 of the CH1 operation status transition filter (positive)
2.3.7.8.4 Event register query
:STATus:OPERation[:CH1|:CH2][;EVENt]?

☐:STATus:OPERation[:CH1|:CH2][;EVENt]?

Description
Queries the operation status event register of common/CH1/CH2

Query parameter
None

Response format
<NR1>

Setting example
:STATus:OPERation:EVENt?
Queries the common operation status event register

2.3.7.8.5 Event enable register setting/query
:STATus:OPERation[:CH1|:CH2]:ENABle

様々:STATus:OPERation[:CH1|:CH2]:ENABle

☐:STATus:OPERation[:CH1|:CH2]:ENABle?

Description
Sets/queries the operation status event enable register of common/CH1/CH2

Setting parameter
<value> ::= <INT>

<int> → For setting values, see "3. Status System."

Query parameter
None

Response format
<NR1>

Setting example
:STATus:OPERation:CH1:ENABle 512
Sets 1 in the bit 9 of the CH1 operation status event enable register
2.3.7.9 Questionable data status register group

The questionable data status register group of this equipment has three register sets (common/CH1/CH2). However, CH2 is available only in the 2-channel equipment (WF1968). Each register can be accessed by using the following command sets.

2.3.7.9.1 Condition register query
:STATus:QUEStionable[:CH1|:CH2]:CONDition?

☐:STATus:QUEStionable[:CH1|:CH2]:CONDition?

Description
Queries the questionable data status condition register of common/CH1/CH2

Query parameter
None

Response format
<NR1>

2.3.7.9.2 Transition filter register (negative) setting/query
:STATus:QUEStionable[:CH1|:CH2]:NTRansition

☐:STATus:QUEStionable[:CH1|:CH2]:NTRansition?

Description
Sets/queries the questionable data status transition filter (negative) of common/CH1/CH2

Setting parameter
<value> ::= <INT>

<INT> → For setting values, see "3. Status System."

Query parameter
None

Response format
<NR1>

Setting example
:STATus:QUEStionable:NTRansition 16
Sets 1 in the bit 4 of the common questionable data status transition filter (negative)
2.3.7.9.3 Transition filter register (positive) setting/query
:STATus:QUEStionable[:CH1|:CH2]:PTRansition

- :STATus:QUEStionable[:CH1|:CH2]:PTRansition
- :STATus:QUEStionable[:CH1|:CH2]:PTRansition?

Description
Sets/queries the questionable data status transition filter (positive) of common/CH1/CH2

Setting parameter

- `<value>` ::= `<INT>`
- `<INT>` → For setting values, see "3. Status System."

Query parameter
None

Response format

- `<NR1>`

Setting example

:STATus:QUEStionable:CH1:PTRansition 16
Sets 1 in the bit 4 of the CH1 questionable data status transition filter (positive)

2.3.7.9.4 Event register query
:STATus:QUEStionable[:CH1|:CH2][:EVENT]?

- :STATus:QUEStionable[:CH1|:CH2][:EVENT]?

Description
Queries the questionable data status event register of common/CH1/CH2

Query parameter
None

Response format

- `<NR1>`

2.3.7.9.5 Event enable register setting/query
:STATus:QUEStionable[:CH1|:CH2]:ENABle

- :STATus:QUEStionable[:CH1|:CH2]:ENABle
- :STATus:QUEStionable[:CH1|:CH2]:ENABle?

Description
Sets/queries the questionable data status event enable register of common/CH1/CH2

**Setting parameter**

\[
=value \quad ::= \quad \text{<INT>}
\]

\[
\text{<INT>} \quad \rightarrow \quad \text{For setting values, see "3. Status System."}
\]

**Query parameter**

None

**Response format**

<NR1>

**Setting example**

:STATus:QUEStionable:ENABle 16

Sets 1 in the bit 4 of the common questionable data status event enable register

### 2.3.7.10 Warning event register group

The warning event register group of this equipment has three register sets (common/CH1/CH2). However, CH2 is available only in the 2-channel equipment (WF1968). Each register can be accessed by using the following command sets.

#### 2.3.7.10.1 Event register query

:STATus:WARNing[:CH1|:CH2][:EVENt]?

Description

Queries the warning event register of common/CH1/CH2

**Query parameter**

None

**Response format**

<NR1>

#### 2.3.7.10.2 Event enable register setting/query

:STATus:WARNing[:CH1|:CH2]:ENABle

**Description**

Sets/queries the warning event enable register of common/CH1/CH2

**Setting parameter**

\[
=value \quad ::= \quad \text{<INT>}
\]

\[
\text{<INT>} \quad \rightarrow \quad \text{For setting values, see "3. Status System."}
\]
Query parameter
None

Response format
<NR1>

Setting example
:STATus:WARNing:CH1:ENABle 16
Sets 1 in the bit 4 of the CH1 warning event enable register

2.3.8 2-channel operation

These commands are only enabled for the 2-channel equipment (WF1968)

2.3.8.1 2-channel mode setting/query
:CHANnel:MODE

■:CHANnel:MODE
□:CHANnel:MODE?

Description
Selects/queries the channel mode

Setting parameter

<table>
<thead>
<tr>
<th>INDependent</th>
<th>PHASE</th>
<th>TONE</th>
<th>RATio</th>
<th>DIFFerential</th>
<th>DIF2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>2 phase</td>
<td>Constant frequency difference</td>
<td>Constant frequency ratio</td>
<td>Differential output 1</td>
<td>Differential output 2</td>
</tr>
</tbody>
</table>

Query parameter
None

Response format

IND|PHAS|TONE|RAT|DIFF|DIF2
† For the meaning of each response data, see the setting parameter

Setting example
:CHANnel:MODE INDependent
Sets the channel mode to independent

Remarks
† This command is available only for the 2-channel equipment (WF1968)
2.3.8.2 Constant frequency difference mode: frequency difference setting/query
:CHANnel:DELTa

- :CHANnel:DELTa
- :CHANnel:DELTa?

Description
Sets/queries the frequency difference in the constant frequency difference mode

Setting parameter

- `<frequency>|MINimum|MAXimum`
  - `<frequency>` ::= `<REAL>[<eunits>][<units>]`
  - `<REAL>` → Frequency difference : (CH2 frequency – CH1 frequency)
  - Resolution : 0.01µHz
  - `<eunits>` ::= M (mega) K|U|N
  - † Note that when the unit is frequency, M is used to mean "10^6"
  - `<units>` ::= HZ
- MINimum → Sets the minimum value
- MAXimum → Sets the maximum value

Query parameter

- [MINimum|MAXimum]
  - MINimum → Queries the minimum value
  - MAXimum → Queries the maximum value

Response format

- `<NR3>`

Setting example

- :CHANnel:DELTa 1KHZ
  - Set the frequency difference to 1kHz

Remarks

- † This command is available only for the 2-channel equipment

2.3.8.3 Constant frequency ratio mode: frequency ratio setting/query
:CHANnel:RATio

- :CHANnel:RATio
- :CHANnel:RATio?

Description
Sets/queries the frequency ratio in the constant frequency ratio mode

Setting parameter
<value1>|MINimum|MAXimum,<value2>|MINimum|MAXimum

<value1> ::= <INT>
<value2> ::= <INT>

cka

Frequency ratio of CH1 : 1 to 9,999,999
Frequency ratio of CH2 : 1 to 9,999,999

MINimum → 1
MAXimum → 9,999,999

Query parameter
None

Response format
<NR1>,<NR1>

Setting example
:CHANnel:RATio 2,3
Sets the frequency ratio to 2:3

Remarks
† This command is available only for the 2-channel equipment

2.3.8.4 2-channel equivalence operation setting/query
:INSTrument:COUPle

Description
Selects/queries the 2-channel equivalence setting state

Setting parameter
ALL|NONE

ALL → Equivalence setting On
NONE → Equivalence setting Off

Query parameter
None

Response format
ALL|NONE
† For the meaning of each response data, see the setting parameter

Setting example
:INSTrument:COUPle ALL
Sets to use the 2-channel equivalence setting function

Remarks
† This command is available only for the 2-channel equipment
2.3.9 Sequence Mode

Starting/stopping/forced termination/hold/resume/event branch of sequence can be performed by ":TRIGger[1|2]:SELect:EXECute" described in "2.3.5.9 Trigger operation/execution control."

2.3.9.1 Sequence selection

[:SOURce[1|2]]:SEQuence:STATe

- [:SOURce[1|2]]:SEQuence:STATe

- [:SOURce[1|2]]:SEQuence:STATe?

**Description**

Switches the oscillation mode to sequence
Queries whether or not the oscillation mode is sequence

**Remarks**

† Whether or not ":[1|2]" is specified does not affect the operation.

**Setting parameter**

\[<\text{state}> ::= \langle\text{BOL}\rangle\]
\[\langle\text{BOL}\rangle \rightarrow 0/\text{OFF}: \text{Disabled}\]
\[1/\text{ON}: \text{Enabled}\]

**Query parameter**

None

**Response format**

\[<\text{NBOL}>\]

**Setting example**

:SOURce1:SEQuence:STATe ON
Sets the oscillation mode to sequence

2.3.9.2 Sequence data I/O

{:TRACe}:DATA]:SEQuence

- {:TRACe}:DATA]:SEQuence

- {:TRACe}:DATA]:SEQuence?

**Description**

Performs the input and output of the sequence data

**Setting parameter**

\[<\text{memory}>,[<\text{name}>],<\text{data}>\]
<memory> ::= <INT>

<INT> → Memory number : 0 to 10

$name$ ::= <STR>

<STR> → Sequence name (20 characters or less)
† Optional (If omitted, the setting is not changed)
† If the sequence name is less than 20 characters, the remaining characters are filled with spaces (ASCII code 32)

<data> ::= <BLK>

<BLK> → Sequence data
(See "2.4 Specification of I/O Data of Sequence")

Query parameter

<memory>

<memory> ::= <INT>

<INT> → Memory number : 0 to 10

Response format

<name>, <sequence>

<name> ::= <STR>

<STR> → Sequence name (20 characters)

<sequence> ::= <BLK>

<BLK> → #<digit><byte><data>

# → Start of binary data

<digit> → Number other than "0", which indicates the number of digits of the subsequent <byte>

<byte> → Numeric string which indicates the number of byte of the subsequent <data>

<data> → Sequence data
(See "2.4 Specification of I/O Data of Sequence")

Remarks

(1) Sequence data is in text format.
(2) Memory number 0 is the current memory.
(3) The sequence name of memory number 0 is "<Current Memory>" (20 characters).
† 1 channel equipment (WF1967) can import the sequence data obtained by the 2 channel equipment (WF1968). In this case, however, the data of CH2 is ignored.
† 2 channel equipment (WF1968) can import the sequence data obtained by the 1 channel equipment (WF1967). In this case, however, the sequence of CH2 is considered as the initial data.
† The sequence data read out from the WF1973/WF1974 can be imported to WF1967/WF1968 for use. The sequence data read out from the WF1967/WF1968, however, cannot be imported to WF1973/WF1974 (cannot be used).
### 2.3.9.3 Compilation of sequence data

**[:TRIGger[1|2]:COMpile[:IMMediate]]**

- **Description**
  Compiles the sequence data

- **Setting parameter**
  None

- **Remarks**
  † Whether or not "[1|2]" is specified does not affect the operation.

### 2.3.9.4 Acquisition of current step number

**[:SOURce[1|2]:SEQuence:CSTep?]**

- **Description**
  Queries the current step of the sequence

- **Query parameter**
  None

- **Response format**
  `<NR1>`

- **Remarks**
  † Whether or not "[1|2]" is specified does not affect the operation.

### 2.3.9.5 Initialization of sequence data

**{:TRACe|:DATA}:SEQuence:CLEar**

- **Description**
  Initializes the sequence data

- **Setting parameter**
  `<memory>`

  ```
  <memory> ::= <INT>
  <INT> → Memory number : 0 to 10
  ```

- **Remarks**
  † Memory number 0 is the current memory.
2.3.9.6 Memory operations

No command is available to operate USB memory.

2.3.9.6.1 Sequence store

{:+TRAcE:+DATA:+SEQuence:+STORe}

||{:+TRAcE:+DATA:+SEQuence:+STORe}||

**Description**
Stores the sequence data

**Setting parameter**

<memory>, <name>

- **<memory>** ::= <INT>
  - <INT> → Memory number of location to save: 1 to 10

- **<name>** ::= <STR>
  - <STR> → Sequence name (20 characters or less)
  - † Optional (If omitted, the setting is not changed)
  - † If the arbitrary wave name is less than 20 characters, the remaining characters are filled with spaces (ASCII code 32).

**Setting example**

:+TRAcE:+SEQuence:+STORe 2,"name"

Saves the sequence data with the sequence name "name" in the memory number 2

2.3.9.6.2 Sequence recall

{:+TRAcE:+DATA:+SEQuence:+RECall}

||{:+TRAcE:+DATA:+SEQuence:+RECall}||

**Description**
Reads out the sequence data

**Setting parameter**

<memory>|MINimum|MAXimum

- **<memory>** ::= <INT>
  - <INT> → Memory number: 1 to 10
  - MINimum → 1
  - MAXimum → 10

**Setting example**

:+TRAcE:+SEQuence:+RECall 2
Imports the sequence data of memory number 2
2.3.9.7 **Sequence automatic execution at power on setting/query**

[:SOURce[1|2]]:SEQuence:PON

- [:SOURce[1|2]]:SEQuence:PON
- [:SOURce[1|2]]:SEQuence:PON?

**Description**

Selects/queries the sequence automatic execution on/off at power-on operation

**Remarks**

† Whether or not "[1|2]" is specified does not affect the operation.

**Setting parameter**

ON|OFF|LAST
- ON → Sequence automatic execution On
- OFF → Sequence automatic execution Off
- LAST→ Setting from the previous power-off operation
  (Turning Off -> On without using the power switch sets the sequence automatic execution Off)

**Query parameter**

None

**Response format**

ON|OFF|LAST  
† For the meaning of each response data, see the setting parameter

**Setting example**

:SEQuence:PON ON
Sets the sequence automatic execution at power-on operation to On

---

2.3.10 **Other Operations**

2.3.10.1 **Equipment-specific information query**

*IDN?*

- *IDN?

**Description**

Reads out the device ID

**Query parameter**

None

**Response format**

<corporation>,<model>,<serial>,<firmware>

  <corporation> → Manufacturer  :NF Corporation
2.3.10.2 Error message query
:SYSTem:ERRor?

Description
Queries the error

Query parameter
None

Response format
<code>,<message>
<code> ::= <INT>
<INT> → Error code
<message> ::= <STR>
<STR> → Error message

2.3.10.3 Initialization of setting
*RST

Description
Initializes the setting
† This does not clear the status registers, etc.

Setting parameter
None

2.3.10.4 Operation completion event bit setting
*OPC

Description
Sets 1 to the OPC bit at the previous termination of all commands

Setting parameter
None
2.3.10.5 Setting output queue to 1 at operation completion
*OPC?

*OPC?

Description
Sets 1 to the output buffer at the previous termination of all commands

Query parameter
None

2.3.10.6 Waiting for command, query execution
*WAI

*WAI

Description
Waits for the termination of all previous commands

Setting parameter
None

2.3.10.7 Self diagnosis result query
*TST?

*TST?

Description
Queries the self diagnosis result

Query parameter
None

Response format
<NR1> → 0

Remarks
(1) This equipment always returns 0.
(2) Remote control cannot check the internal status. Execute this query by the panel operation.

2.3.10.8 External reference frequency input setting/query
[:SOURce[1|2]]:ROSCillator:SOURce

[:SOURce[1|2]]:ROSCillator:SOURce

[:SOURce[1|2]]:ROSCillator:SOURce?
Description
Sets/queries the reference frequency source

Setting parameter
INTernal|EXTernal
INTernal → Internal clock
EXTernal → External reference frequency input

Query parameter
None

Response format
INT|EXT

Setting example
:SOURce:ROSCillator:SOURce INTernal
Sets the reference frequency source to the internal clock

Remarks
† Whether or not "[1|2]" is specified does not affect the operation.

2.3.10.9 External reference frequency output setting/query
[:SOURce[1|2]]:ROSCillator:OUTPut[:STATe]

■[:SOURce[1|2]]:ROSCillator:OUTPut[:STATe]
□[:SOURce[1|2]]:ROSCillator:OUTPut[:STATe]?

Description
Sets/queries the reference frequency output

Setting parameter
<state> ::= <BOL>
  <BOL> → 0/OFF: Output Off
           1/ON : Output On

Query parameter
None

Response format
<NBOL>
  <NBOL> → 0 : Output Off
           1 : Output On

Setting example
:ROSCillator:OUTPut[:STATe] ON
Sets the reference frequency output to On

Remarks
† Whether or not "[1|2]" is specified does not affect the operation.
2.4 Specification of I/O Data of Sequence

The data handled by the I/O command of sequence "{:TRACe:DATA}:SEQuence" is in INI file format. This section describes the sections and keys of the INI file.

2.4.1 Section [FILE]

This sets the parameter related to the file format. This section is mandatory.

(1) File version.

\[\text{VERSION} = \text{<version>}\]
\[\text{<version>} ::= \text{<STR>}\]
\[\text{<STR>} \rightarrow \text{Version of the file}\]
† Specify "1.00" as the file version.

2.4.2 Section [SYSTEM]

This section specifies the system information on the equipment side. This section is mandatory.

(1) Model name

\[\text{MODEL} = \text{<mod>}\]
\[\text{<mod>} ::= \text{<STR>}\]
\[\text{<STR>} \rightarrow \text{Model name}\]

(2) Number of channel

\[\text{NCHAN} = \text{<chan>}\]
\[\text{<chan>} ::= \text{<INT>}\]
\[\text{<INT>} \rightarrow \text{Number of channel}\]

(3) Firmware version

\[\text{VERSION} = \text{<version>}\]
\[\text{<version>} ::= \text{<STR>}\]
\[\text{<STR>} \rightarrow \text{Version of the firmware}\]
† Specify "1.00" as the firmware version.

2.4.3 Section [DATA]

(1) Sequence
This section sets the data related to the entire sequence.

SEQ = <ststtp>,<syncout>,<dctrl>,<dctrl_mode>,<trgslp>

<ststtp> ::= <INT>
<INT> → Start step (1 to 255)

<syncout> ::= <DISC>
<DISC> → Synchronization output (SYNC: waveform synchronization, SSYN: sequence synchronization)

<dctrl> ::= <BOL>
<BOL> → Digital control input ON/OFF (0/OFF: OFF, 1/ON: ON)

<dctrl_mode> ::= <DISC>
<DISC> → How to use the digital control (STAR: Start, SBR: State branch)

<trgslp> ::= <DISC>
<DISC> → Trigger polarity (POS: Positive, NEG: Negative, OFF: Disabled)

(2) Noise bandwidth
This sets the bandwidth of noise.

NOISEBW#<chan> = <BW>

<chan> ::= <INT>
<INT> → Channel number (1 to 2)

<BW> ::= <INT>
<INT> → Noise bandwidth number (1 to 7)

(3) Step
This sets the data related to each step.

STEP#<step> = <time>,<sterm>,<auto_hold>,<scode>,<stbra_sw>,<stbra>,<evbra_sw>,
<evbra>,<jpstp_sw>,<jpstp>,<jpcnt_sw>,<jpcnt>,<sphase_sw>,<sphase>

<step> ::= <INT>
<INT> → Step number (0 to 255)

<time> ::= <REAL>
<REAL> → Step time

<sterm> ::= <DISC>
<DISC> → Step termination (CONT: Continues, STOP: Stops)

<auto_hold> ::= <BOL>
<BOL> → Auto hold ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<scode> ::= <INT>
<INT> → Step code

<stbra_sw> ::= <BOL>
<BOL> → State branch step ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<stbra> ::= <INT>
<INT> → State branch step (0 to 255)

<evbra_sw> ::= <BOL>
<BOL> → Event branch step ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<evbra> ::= <INT>
<INT> → Event branch step (0 to 255)

<jpstp_sw> ::= <BOL>
<BOL> → Jump step ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<jpstp> ::= <INT>
<INT> → Jump step (0 to 255)

<jpcnt_sw> ::= <DISC>
<DISC> → Number designation of jumps (INF: Infinite number, ON: Number of jumps as designated)

<jpcnt> ::= <INT>
<INT> → Number of jumps (1 to 9999)

<sphase_sw> ::= <BOL>
<BOL> → Termination phase ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<sphase> ::= <REAL>
<REAL> → Termination phase

(4) Channel data
This sets the data related to each channel.
CHAN#<step>#{chan> = <wf_type>,<wf_arb_no>,<wf_polarity>,<wf_scale>,<wf_squex>,
       <freq_val>,<freq_actn>,<amptd_val>,<amptd_actn>,<ofs_val>,
       <ofs_actn>,<ph_val>,<ph_actn>,<dy_val>,<dy_actn>

<step> ::= <INT>
   <INT> → Step number (0 to 255)

<chan> ::= <INT>
   <INT> → Channel number (1 to 2)

<wf_type> ::= <DISC>
   <DISC> → Waveform (DC: DC, NOIS: Noise, SIN: Sine wave,
              SQU: Square wave, USER: Arbitrary wave)

<wf_arb_no> ::= <INT>
   <INT> → Arbitrary wave number (0 to 128)

<wf_polarity> ::= <DISC>
   <DISC> → Waveform polarity (NORM: Normal, INV: Inverted)

<wf_scale> ::= <DISC>
   <DISC> → Waveform amplitude range (PFS: 0 / +FS, FS: ±FS, MFS: -FS / 0)

<wf_squex> ::= <BOL>
   <BOL> → Square wave extension ON/OFF (0 / OFF : OFF, 1 / ON : ON)

<freq_val> ::= <REAL>
   <REAL> → Frequency

<freq_actn> ::= <DISC>
   <DISC> → Operation type (CONS: Constant, KEEP: Keep, SWE: Sweep)

<amptd_val> ::= <REAL>
   <REAL> → Amplitude

<amptd_actn> ::= <DISC>
   <DISC> → Operation type (CONS: Constant, KEEP: Keep, SWE: Sweep)

<ofs_val> ::= <REAL>
   <REAL> → DC offset

<ofs_actn> ::= <DISC>
<DISC> → Operation type (CONS: Constant, KEEP: Keep, SWE: Sweep)

<ph_val> ::= <REAL>
<REAL> → Phase

<ph_actn> ::= <DISC>
<DISC> → Operation type (CONS: Constant, KEEP: Keep, SWE: Sweep)

(dy_val) ::= <REAL>
<REAL> → Duty

(dy_actn) ::= <DISC>
<DISC> → Operation type (CONS: Constant, KEEP: Keep, SWE: Sweep)
2.5 **Trigger/Oscillation Status Control**

WF1967/WF1968 provide the commands to trigger from the remote control (GET (Group Execute Trigger), ":TRG", and ":TRIGger[1|2][:SEQUence][:IMMediate]”) and the command to control the oscillation status (:TRIGger[1|2]:SELection:EXEcute”).

As shown in Table 2.3, some of these commands are not available depending on the oscillation mode. Invalid command will be ignored.

| Oscillation Mode    | GET/"TRG/ :TRIGger[1|2][:SEQUence][:IMMediate] | :TRIGger[1|2]:SELection:EXEcute |
|---------------------|-------------------------------------------------|---------------------------------|
| Continuous          | Disabled                                        | Disabled                        |
| Modulation          | Disabled                                        | Enabled                         |
| Sweep               |                                                  |                                 |
| Continuous          | Disabled                                        | Enabled                         |
| Single              | Enabled                                         | Enabled                         |
| Gated single        | Enabled                                         | Enabled                         |
| Burst               |                                                  |                                 |
| Auto burst          | Disabled                                        | Disabled                        |
| Trigger burst       | Enabled                                         | Disabled                        |
| Gate                | Disabled                                        | Disabled                        |
| Triggered gate      | Enabled                                         | Disabled                        |
| Sequence            | Disabled                                        | Enabled                         |

In above commands, since GET and ":TRG are designated for CH1, channel cannot be specified. However, when the 2-channel equivalence setting is on, CH1 and CH2 can be specified (WF1968 only).
2.6 System Unit

The system unit is assumed to be a default unit in the setting/query of parameters such as the frequency and amplitude with the remote control. Changing the system unit is not reflected on this device screen. If you omit the unit in the parameter setting, the system unit is assumed to be the unit when executing a command. When you query parameters, the response message is returned based on the system unit.

For example, when the system unit of amplitude is Vrms, this equipment sets the amplitude as shown below.

When the unit is specified as Vp-p:
::SOURce1:VOLTage:LEVeL:IMMediate:AMPLitude 1.0Vpp
→ Sets the amplitude to 1.0Vp-p because this equipment interprets the command in the specified unit.

When the unit is omitted:
::SOURce1:VOLTage:LEVeL:IMMediate:AMPLitude 1.0
→ Sets the amplitude to 1.0Vrms because this equipment interprets the command by using the system unit as the unit.

The following commands are used to set the system unit:

Setting of system unit for frequency:
::SOURce[1|2]:FREQuency:UNIT

Setting of system unit for amplitude:
::SOURce[1|2]:VOLTage[:LEVel][:IMMediate]:AMPLitude:UNIT

Setting of system unit of DC offset, high level, and low level:
::SOURce[1|2]:VOLTage[:LEVel][:IMMediate]:OFFSet:UNIT
::SOURce[1|2]:VOLTage[:LEVel][:IMMediate]:HIGH:UNIT
::SOURce[1|2]:VOLTage[:LEVel][:IMMediate]:LOW:UNIT

† One system unit is shared with DC offset, high level, and low level. The above three commands have the same function.

Setting of system unit for phase:
::SOURce[1|2]:PHASe:UNIT
Setting of system unit for the duty of square wave/pulse:

[:SOURce[1|2]]:PULSe:DCYCle:UNIT

Setting of system unit for cycle:

[:SOURce[1|2]]:PULSe:PERiod:UNIT
3. Status System

3.1 Status Byte Register and
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    Questionable data status register group ................................... 212
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WF1967/WF1968 provide the status reporting function defined in IEEE488.2.

3.1 Status Byte Register and Service Request Enable Register

The configuration of the status byte register and the service request enable register is shown in Figure 3.1.

![Status Byte Register and Service Request Enable Register](image)

Figure 3.1 Status Byte Register and Service Request Enable Register
3.1.1 Status Byte Register

Each bit of the status byte register is described in Table 3.1.

Table 3.1 Status Byte Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>(Unused)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>WAR</td>
<td>Warning event register summary</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>ERR</td>
<td>Error queue summary</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>QUE</td>
<td>Questionable data status register summary</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>MAV</td>
<td>Message queue summary</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>ESB</td>
<td>Event summary bit</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>RQS/MSS</td>
<td>Request service/master summary status</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>OPR</td>
<td>Operation status register summary summary</td>
</tr>
</tbody>
</table>

The status byte register is cleared when a *CLS command is received.

3.1.2 Service Request Enable Register

The service request enable register is used to select the summary bit within the status byte register that generates service requests shown in Figure 3.1.

The service request enable register is cleared when the power is turned on while the power on status clear flag (*set in PSC) is set to TRUE.
3.2 Standard Event Status Register Group

The standard event status register group is shown in Figure 3.2.

![Figure 3.2 Standard Event Status Register Group](image)

3.2.1 Standard Event Status Register

Content of each bit of the standard event status register is shown in Table 3.2.

Table 3.2 Standard Event Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>OPC</td>
<td>Operation completion</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>RQC</td>
<td>Request control</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>QYE</td>
<td>Query error</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>DDE</td>
<td>Equipment-specific error</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>EXE</td>
<td>Execution error</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>CME</td>
<td>Command error</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>URQ</td>
<td>User request</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>PON</td>
<td>Power ON</td>
</tr>
</tbody>
</table>

The standard event status register is cleared when the *ESR? query or *CLS command is received.

3.2.2 Standard Event Status Enable Register

The standard event status enable register is used to select the bit of the standard event status register as shown in Figure 3.2, and reflect the status of the selected bit to the ESB of the status byte register.
The standard event status enable register is cleared when the power is turned on while the power on status clear flag (set in *PSC) is set to TRUE.
3.3 Operation status register group / Questionable data status register group

The configuration of the operation status register group and the questionable data status register group is shown in Figure 3.3.

3.3.1 Overview of Registers

3.3.1.1 Condition register

The condition register shows the current status of WF1967/WF1968. This register is not cleared even when a query addressed to the condition register is received.

3.3.1.2 Transition filter register

The transition filter register is used to determine the event bit transition. The relationship between the transition filter setting and the event register transition is shown in Table 3.3.
Table 3.3 Transition Filter and Event Register Transition

<table>
<thead>
<tr>
<th>Each bit setting of positive transition filter</th>
<th>Each bit setting of negative transition filter</th>
<th>Transition of condition register to make each bit of event register 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0 → 1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1 → 0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0 → 1 or 1 → 0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Each bit of event register bit is not made 1.</td>
</tr>
</tbody>
</table>

The transition filter register is cleared when :STATus:PRESet command is received or when the power is turned on while the power on status clear flag (set in *PSC) is set to TRUE.

### 3.3.1.3 Event register

The event register is a register that reflects the changes of the condition register according to the setting of the transition filter register. The event register is cleared upon reception of a query addressed to the event register or the *CLS command.

### 3.3.1.4 Event enable register

The event enable register is used to select bits in the event register to be summarized. The event enable register is used to select the bit of the event register as shown in Figure 3.3, and reflect the status of the selected bit to the summary bit of the status byte register. The event enable register is cleared when :STATus:PRESet command is received or when the power on is turned on while the power on status clear flag (set in *PSC) is set to TRUE.
3.3.2 Operation Status Register Group

The operation status register group is shown in Figure 3.3. This register group has one register set for each channel and one register set to summarize their sets. Content of each operation status register is described in Table 3.4 and Table 3.5.

Table 3.4 Operation Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>512</td>
<td>CH1 operation status register summary</td>
</tr>
<tr>
<td>10</td>
<td>1024</td>
<td>CH2 operation status register summary</td>
</tr>
<tr>
<td>11</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(Non-use)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Reserved)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>(Reserved)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Always 0</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.5 CH1 (CH2) Operation Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
</table>
| 0   | 1      | Sequence: EDIT  
      |         | Shows the Edit status.  
| 1   | 2      | Sequence: READY  
      |         | Shows the Ready status.  
| 2   | 4      | Sequence: RUN  
      |         | Shows the Run status or Hold status.  
| 3   | 8      | Sequence: HOLD  
      |         | Shows the Hold status.  
| 4   |        | (Unused)  
| 5   |        | (Unused)  
| 6   | 64     | Modulation: RUN  
      |         | Shows that modulation function is working. This bit shows the status of modulation function also in the sweep/burst oscillation mode.  
| 7   | 128    | Modulation/sweep/burst: STOP  
      |         | Shows the status such as the Stop and Conflict statuses in which the primary oscillation mode is not made.  
      |         | Even if the status is Run, this bit is set to 1 during the trigger delay period in the trigger burst.  
      |         | The triggered gate is closed.  
| 8   | 256    | Continuous oscillation/modulation/sweep/burst: RUN  
      |         | Shows the Run status and Hold status.  
      |         | (This does not show the status of modulation in the sweep/burst oscillation mode)  
| 9   | 512    | Sweep: HOLD  
      |         | Shows the Hold status in the sweep oscillation mode.  
| 10  | 1024   | Sweep/burst: TRIGGER WAIT  
      |         | Shows the TrigWait status in the sweep/burst oscillation mode.  
| 11  | 2048   | Modulation/sweep/burst: CONFLICT  
      |         | Shows the Conflict status.  
| 12  | 4096   | Synchlator: UnLock  
      |         | Shows the UnLock status.  
| 13  |        | (Unused)  
| 14  |        | (Unused)  
| 15  |        | Always 0 |
The relationship between each bit in Table 3.5 and the output waveform is shown below.

3.3.2.1 Continuous oscillation

Figure 3.4 Relationship between Output and Operation Status Register (Bit 7-11) at Continuous Oscillation
3.3.2.2 Modulation

Figure 3.5 Relationship between Output and Operation Status Register (Bit 7-11) at Modulation
3.3.2.3  Sweep

Figure 3.6 Relationship between Output and Operation Status Register (Bit 7 to 11) in Case of Single-Shot Sweep or Gated Single-Shot Sweep

Figure 3.7 Relationship between Output and Operation Status Register (Bit 7-11) at Continuous Sweep
3.3.2.4 Burst

Figure 3.8 Relationship between Output and Operation Status Register (Bit 7-11) at Auto Burst

Figure 3.9 Relationship between Output and Operation Status Register (Bit 7-11) at Trigger Burst
Figure 3.10 Relationship between Output and Operation Status Register (Bit 7 to 11) at Gate

Figure 3.11 Relationship between Output and Operation Status Register (Bit 7 to 11) at Triggered Gate
3.3.2.5 Sequence

Figure 3.12 Relationship between Output and Operation Status Register (Bit 0 to 3) at Sequence
3.3.3 Questionable Data Status Register Group

The contents of the questionable data status register is shown in Table 3.6.

Table 3.6 Questionable Data Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>CH1 overload register summary</td>
</tr>
<tr>
<td>1</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>Overheat detection</td>
</tr>
<tr>
<td>5</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>No external reference clock</td>
</tr>
<tr>
<td>7</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>256</td>
<td>Shows that the calibration is not completed.</td>
</tr>
<tr>
<td>9</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1024</td>
<td>CH2 overload register summary</td>
</tr>
<tr>
<td>11</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Always 0</td>
<td></td>
</tr>
</tbody>
</table>
Content of CH1 and CH2 overload register is described in Table 3.7.

Table 3.7 CH1 and CH2 Overload Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Main output overload</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Sub output overload</td>
</tr>
<tr>
<td>2</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>32768</td>
<td>Always 0</td>
</tr>
</tbody>
</table>
3.4 Warning Event Register Group

The warning event register group is shown in Table 3.8. This register group configures three register sets: one register set for each channel and one register set to summarize their sets.

![Diagram of Warning Event Register Group]

Figure 3.13 Warning Event Status Register Group Model

3.4.1 Event Register

Content of each bit of the warning event register and the CH1 (CH2) warning event register is shown in Table 3.8 and Table 3.9.

The meaning of terms in Table 3.9 is as follows:

Channel mode parameters:
- Means the frequency difference and frequency ratio.

Waveform parameters:
- Means the duty variable range, waveform polarity, amplitude range, ramp wave symmetry, and parameter variable waveform-specific parameter.

Basic parameters:
- Means the frequency, period (cycle), phase, amplitude, DC offset, high level, low level, duty, pulse width, and rising/falling time.
Other parameters:

   Means the channel mode, channel mode parameter, waveform, waveform parameter, basic parameter, and parameters other than system unit.

The warning event register shows the status change of the equipment due to the remote control and does not show the status change of the equipment due to the panel operation.
Table 3.8 Warning Event Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>512</td>
<td>CH1 warning event register summary</td>
</tr>
<tr>
<td>10</td>
<td>1024</td>
<td>CH2 warning event register summary</td>
</tr>
<tr>
<td>11</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>32768</td>
<td>Always 0</td>
</tr>
</tbody>
</table>
### Table 3.9 CH1 (CH2) Warning Event Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>The waveform or waveform parameter is changed due to the change of channel mode or channel mode parameter.</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>The basic parameter is changed due to the change of channel mode or channel mode parameter.</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>The oscillation mode is changed due to the change of channel mode or channel mode parameter.</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Other parameters are changed due to the change of channel mode or channel mode parameter.</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>The channel mode or channel mode parameter is changed due to the change of waveform.</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>The basic parameter is changed due to the change of waveform or waveform parameter.</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>The oscillation mode is changed due to the change of waveform or waveform parameter.</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>Other parameters are changed due to the change of waveform or waveform parameter.</td>
</tr>
<tr>
<td>8</td>
<td>256</td>
<td>Other basic parameters are changed due to the change of basic parameters (frequency, period (cycle), phase, amplitude, DC offset, high level, and low level).</td>
</tr>
<tr>
<td>9</td>
<td>512</td>
<td>Other basic parameters are changed due to the change of basic parameters (duty and pulse width).</td>
</tr>
<tr>
<td>10</td>
<td>1024</td>
<td>Other basic parameters are changed due to the change of basic parameters (rising time and falling time).</td>
</tr>
<tr>
<td>11</td>
<td>2048</td>
<td>Other parameters are changed due to the change of basic parameters.</td>
</tr>
<tr>
<td>12</td>
<td>4096</td>
<td>System unit is changed.</td>
</tr>
<tr>
<td>13</td>
<td>(Unused)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>16384</td>
<td>Other parameters are changed.</td>
</tr>
<tr>
<td>15</td>
<td>32768</td>
<td>Always 0</td>
</tr>
</tbody>
</table>

The event register is cleared upon reception of a query addressed to the event register or the *CLS command.

### 3.4.2 Event Enable Register

The event enable register is used to select bits in the event register to be summarized. The event enable register is cleared when :STATus:PRESet command is received or when the power on is turned on while the power on status clear flag (set in *PSC) is set to TRUE.

### 3.5 Others

WF1967/WF1968 provide the error queue and error message queue.
4. Error messages
If an error occurs when the remote control is performed, the error number is stored in the error queue. The error numbers and their corresponding messages and error contents are shown in Table 4.1. You can query the error number and message using “:SYSTem:ERROR?”.

**Table 4.1 Error Numbers, Messages, and their Contents**

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Message</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>-102</td>
<td>Syntax error</td>
<td>The received string contains an incorrect syntax.</td>
</tr>
<tr>
<td>-108</td>
<td>Parameter not allowed</td>
<td>There are too many parameters.</td>
</tr>
<tr>
<td>-109</td>
<td>Missing parameter</td>
<td>One or more parameters are missing.</td>
</tr>
<tr>
<td>-110</td>
<td>Command header error</td>
<td>There is an error in the header.</td>
</tr>
<tr>
<td>-111</td>
<td>Header separator error</td>
<td>There is an error in the keyword separator of the header.</td>
</tr>
<tr>
<td>-113</td>
<td>Undefined header</td>
<td>The received string contains an invalid header.</td>
</tr>
<tr>
<td>-120</td>
<td>Numeric data error</td>
<td>There is an error in the numerical parameter.</td>
</tr>
<tr>
<td>-130</td>
<td>Suffix error</td>
<td>There is an error in the suffix of the numerical parameter.</td>
</tr>
<tr>
<td>-140</td>
<td>Character data error</td>
<td>There is an error in the discrete parameter.</td>
</tr>
<tr>
<td>-150</td>
<td>String data error</td>
<td>There is an error in the string parameter.</td>
</tr>
<tr>
<td>-160</td>
<td>Block data error</td>
<td>There is an error in the block parameter.</td>
</tr>
<tr>
<td>-200</td>
<td>Execution error</td>
<td>The command cannot be executed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The relevant error occurs in the following cases:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When &quot;*CLS&quot; cannot be executed due to the status of equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When &quot;*RST&quot; cannot be executed due to the status of equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When sequence cannot be changed to other oscillation mode due to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the status of equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When other commands cannot be executed.</td>
</tr>
<tr>
<td>-211</td>
<td>Trigger ignored</td>
<td>GET (Group Execute Trigger), &quot;*TRG&quot;, and other commands relating to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the trigger are ignored.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The relevant error occurs in the following cases:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the compilation command is ignored because the equipment is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>not in the sequence Edit status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the trigger from remote is ignored because the equipment is not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in the sequence Ready status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the control command is ignored due to the status of equipment</td>
</tr>
<tr>
<td>-220</td>
<td>Parameter error</td>
<td>There is an error in the parameter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The relevant error occurs in the following cases:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When there is an error in the prefix/unit of the numerical parameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the specified unit cannot be used due to the status of equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the name of arbitrary waveform exceeds 20 characters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the name of arbitrary waveform contains a double quotation mark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(&quot;&quot;&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the number of data points for the arbitrary waveform is incorrect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the compilation of sequence fails due to one of the following</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reasons:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the number of used waveforms exceeds 128 or the total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>amount exceeds 512 KW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· When the sequence setting is too complicated and cannot be checked</td>
</tr>
<tr>
<td>Error No.</td>
<td>Message</td>
<td>Contents</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| -221     | Settings conflict | The correct syntax parameter is received but the command cannot be executed due to the status of equipment. The relevant error occurs in the following cases:  
  - When the sweep function cannot be set in the log because the equipment is not a frequency sweep  
  - When arbitrary waveform data in the array format is set in the arbitrary waveform edit memory  
  - When the specification of array/control point format of the arbitrary waveform data is incorrect  
  - When the specified channel setting cannot be set in 2-channel equivalence setting due to another channel's restriction (22039)  
  - When the compilation of sequence is not successful due to one of the following reasons:  
    - When The frequency is beyond the upper frequency of the current waveform in the relationship between two steps (23121)  
    - When the amplitude and offset do not meet the mutual restriction in the relationship between two steps (23122)  
    - When the frequency and duty of square wave do not meet the mutual restriction in the relationship between two steps (23123)  
    - When the external modulation/addition input connector cannot be used for the external modulation because it is used for the external addition (23129)  
    - When the external modulation/addition input connector cannot be used for the external addition because it is used for the external modulation (23130) |
| -222     | Data out of range | The correct syntax parameter is received but the command cannot be executed due to the value out of range. The relevant error occurs in the following cases:  
  - When a value out of range is set for each register of the status system  
  - When 0 is set for the frequency ratio N/M  
  - When a value out of range is set for the user-defined unit, m/n  
  - When the standard waveform of CH2 in the 1-channel machine is copied to the memory  
  - When a value out of the setting range is set (23045) |
| -225     | Out of memory | Memory required for execution is insufficient. The relevant error occurs in the following cases:  
  - When arbitrary waveform data cannot be saved due to insufficient memory |
| -290     | Memory use error | Command cannot be executed because an error occurs relating to memory. The relevant error occurs in the following cases:  
  - When empty memory is specified for the arbitrary waveform number  
  - When the compilation of sequence is not successful because empty memory is specified for the arbitrary waveform number (23125)  
  - When the currently output or used arbitrary wave is deleted (32004) |
| -291     | Out of memory | Specified memory does not exist. The relevant error occurs in the following cases:  
  - When a value other than 0 to 128 is specified for the arbitrary wave number  
  - When a value other than 0 to 10 is specified for the sequence number |
<table>
<thead>
<tr>
<th>Error No.</th>
<th>Message</th>
<th>Contents</th>
</tr>
</thead>
</table>
| -310     | System error | This is a failure of this instrument. The relevant error occurs in the following cases:  
  - When arbitrary waveform cannot be read out in the compilation of sequence (23124)  
  - When the internal error occurs (24135, 24136, 35005) |
| -350     | Queue overflow | An error occurs but the error is discarded because the error cannot be entered in the error queue. |
| -410     | Query INTERRUPTED | A new response message entered the message queue, and thus the previous response message was deleted. |
| -420     | Query UTERMINATED | The talker was specified, but the message queue has no response message. |
| -440     | Query UTERMINATED after indefinite response | Query exists after "*IDN?" in the received string ("*IDN?" must be the last query in the received string). |
5. Specifications

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## 5.1 Interface Functions

### Table 5.1 Interface Functions of USB

<table>
<thead>
<tr>
<th>Function</th>
<th>Subset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source handshake</td>
<td>SH1</td>
<td>All send handshake functions provided</td>
</tr>
<tr>
<td>Acceptor handshake</td>
<td>AH1</td>
<td>All receive handshake functions provided</td>
</tr>
<tr>
<td>Talker</td>
<td>T6</td>
<td>Basic talker functions and talker release by the MLA</td>
</tr>
<tr>
<td>Listener</td>
<td>L2</td>
<td>Basic listener functions provided</td>
</tr>
<tr>
<td>Service request</td>
<td>SR1</td>
<td>All service request functions provided</td>
</tr>
<tr>
<td>Remote/Local</td>
<td>RL1</td>
<td>All remote/local functions provided</td>
</tr>
<tr>
<td>Parallel poll</td>
<td>PP0</td>
<td>Parallel poll function not provided</td>
</tr>
<tr>
<td>Clear the device</td>
<td>DC1</td>
<td>All device clear functions provided</td>
</tr>
<tr>
<td>Device trigger</td>
<td>DT1</td>
<td>Device trigger function provided</td>
</tr>
<tr>
<td>Controller</td>
<td>C0</td>
<td>Controller function not provided</td>
</tr>
</tbody>
</table>

### Table 5.2 Interface Functions of GPIB

<table>
<thead>
<tr>
<th>Function</th>
<th>Subset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source handshake</td>
<td>SH1</td>
<td>All send handshake functions provided</td>
</tr>
<tr>
<td>Acceptor handshake</td>
<td>AH1</td>
<td>All receive handshake functions provided</td>
</tr>
<tr>
<td>Talker</td>
<td>T6</td>
<td>Basic talker functions and talker release by the MLA</td>
</tr>
<tr>
<td>Listener</td>
<td>L4</td>
<td>Basic listener functions and listener release by the MTA</td>
</tr>
<tr>
<td>Service request</td>
<td>SR1</td>
<td>All service request functions provided</td>
</tr>
<tr>
<td>Remote/Local</td>
<td>RL1</td>
<td>All remote/local functions provided</td>
</tr>
<tr>
<td>Parallel poll</td>
<td>PP0</td>
<td>Parallel poll function not provided</td>
</tr>
<tr>
<td>Clear the device</td>
<td>DC1</td>
<td>All device clear functions provided</td>
</tr>
<tr>
<td>Device trigger</td>
<td>DT1</td>
<td>All device trigger functions provided</td>
</tr>
<tr>
<td>Controller</td>
<td>C0</td>
<td>Controller function not provided</td>
</tr>
</tbody>
</table>

## 5.2 Response to Interface Message

### Table 5.3 Response to Interface Message

<table>
<thead>
<tr>
<th>IFC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>· Initialize the interface.</td>
</tr>
<tr>
<td></td>
<td>· Release the specified listener or talker.</td>
</tr>
<tr>
<td>DCL and SDC</td>
<td>· Clear the I/O buffer.</td>
</tr>
<tr>
<td></td>
<td>· Clear the error.</td>
</tr>
<tr>
<td></td>
<td>· Release the SRQ send and reset the error factor bits.</td>
</tr>
<tr>
<td></td>
<td>· Disable the SRQ send.</td>
</tr>
<tr>
<td>LLO</td>
<td>· Disable the LOCAL key (software key) operation of the panel.</td>
</tr>
<tr>
<td>GTL</td>
<td>· Selects the local state.</td>
</tr>
</tbody>
</table>
In LAN, you can not use these features.

**5.3 Multi-Line Interface Message**

<table>
<thead>
<tr>
<th>b4</th>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>Column</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>NUL</td>
<td>DLE</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>MSG</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>MSG</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>MSG</td>
<td>0</td>
</tr>
</tbody>
</table>

- **MSG** means an interface message
- **SDC** : Select Device Clear
- **DCL** : Device Clear
- **PPU** : Parallel Poll Unconfigure
- **SPE** : Serial Poll Enable
- **SPD** : Serial Poll Disable
- **UNL** : Unlisten
- **UNT** : Untalk

**Note:**
- *1 MSG means an interface message
- *2 b1=DIO1 · · · b7=DIO7. DIO8 is not used
- *3 Accompanied by the secondary command

**Command Group:**

- **PCG** : Primary command group
- **UCG** : Universal command group
- **LAG** : Listener address group
- **TAG** : Talker address group

**Address command group (ACG)**

- **Primary command group (PCG)**
- **Secondary command group (SCG)**

**Meaning is defined by the primary command group**
6. Command tree

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6.1 Command Tree

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    ................. TYPE   43
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    ........ BURSt   49
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    ................. NCYCles  100
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    ................. INTERNAL 48
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    ................. SLOPe 48
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    ................. ANGLE 120
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    ................. SYMMetry 146
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    ................. COFSine 128
    ................. NCHattering 128
    ................. OFPHase 128
    ................. TOFF 129
    ................. TON 129
    ................. CONSine 126
    ................. NCHattering 126
<table>
<thead>
<tr>
<th>Function</th>
<th>Offset</th>
<th>Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[DEViation]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCYcle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAte</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROSCiillator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTPUTp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[STAte]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCHannel</td>
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<td></td>
</tr>
<tr>
<td>FUNCTION</td>
<td></td>
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</tr>
<tr>
<td>NOIs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[SHApe]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ADJust]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLTage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[LEVel]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[IMMediate]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[AMPLitude]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFFSet</td>
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<td></td>
</tr>
<tr>
<td>SEquence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSTep?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PON</td>
<td></td>
<td></td>
</tr>
<tr>
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Notes

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Multifunction Generator
WF1967/WF1968
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