BERTWave Series
Remote Control
Operation Manual

13th Edition

- For safety and warning information, please read this manual before attempting to use the equipment.
- Additional safety and warning information is provided within the MP2100A/MP2101A/MP2102A BERTWave Operation Manual, MP2100B BERTWave Operation Manual or MP2110A BERTWave Operation Manual. Please also refer to them before using the equipment.
- Keep this manual with the equipment.

ANRITSU CORPORATION
Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

- **DANGER**: This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
- **WARNING**: This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
- **CAUTION**: This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

- ![Prohibited operation](image)
  - This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.
- ![Obligatory safety precaution](image)
  - This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.
- ![Warning or caution](image)
  - This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.
- ![Note](image)
  - This indicates a note. The contents are described in the box.
- ![Recycle](image)
  - These indicate that the marked part should be recycled.

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BERTWave Series
Remote Control Operation Manual

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When you dispose of export-controlled items, the products/manuals need to be broken/shredded so as not to be unlawfully used for military purpose.
About This Manual

The manual set for the BERTWave Series consists of the following five operation manuals:

MP2110A BERTWave Operation Manual (M-W3831AE)
This manual is intended for those who use the MP2110A BERTWave, and explains the installation procedure, handling precautions, connector connection procedures, panel operations, maintenance procedures, specifications and various functions.

MP2100B BERTWave Operation Manual (M-W3772AE)
This manual is intended for those who use the MP2100B BERTWave, and explains the installation procedure, handling precautions, connector connection procedures, panel operations, maintenance procedures, specifications and various functions.

MX210001A Jitter Analysis Software Operation Manual (M-W3569AE)
This manual explains the operation method and remote control commands for the MX210001A Jitter Analysis Software.

MX210002A Transmission Analysis Software Operation Manual (M-W3571AE)
This manual explains the operation method and remote control commands for the MX210002A Transmission Analysis Software.

BERTWave series Remote Control Operation Manual (M-W3773AE) (This Manual)
This manual explains the commands to control the BERTWave, status register structure, and sample programs.
Also, there is the manual “MP2100A BERTWave MP2101A BERTWave PE MP2102A BERTWave SS Operation Manual (Operation) (M-W3349AE)”. MP2100A, MP2101A, and MP2102A are the discontinued products.

This manual explains the remote control commands.

This manual assumes the reader has the following information:

- The reader has read through the MP2100B BERTWave Operation Manual or MP2110A BERTWave Operation Manual.
- The reader can create the C or Basic program.

For the connection of the power source and peripheral devices, panel operation, and maintenance, refer to the following manual:
MP2100B BERTWave Operation Manual
MP2110A BERTWave Operation Manual

In this manual, the models of BERTWave are described as follows.

MP210xA:
- MP2100A, MP2101A, and MP2102A

this instrument:
- MP2100A, MP2101A, MP2102A, and MP2100B, and MP2110A

BERTWave:
- MP2100A, MP2101A, MP2102A, MP2100B, and MP2110A
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</tr>
<tr>
<td>SYN</td>
<td>A-31</td>
</tr>
<tr>
<td>SYE</td>
<td>A-32</td>
</tr>
<tr>
<td>SYM</td>
<td>A-33</td>
</tr>
<tr>
<td>Command</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>FPS</td>
<td>A-33</td>
</tr>
<tr>
<td>HRE</td>
<td>A-34</td>
</tr>
<tr>
<td>MTR?</td>
<td>A-34</td>
</tr>
<tr>
<td>ERS?</td>
<td>A-35</td>
</tr>
<tr>
<td>:SENSep:PARam:AEXecute?</td>
<td>A-36</td>
</tr>
<tr>
<td>END?</td>
<td>A-38</td>
</tr>
<tr>
<td>ER?</td>
<td>A-39</td>
</tr>
<tr>
<td>EC?</td>
<td>A-39</td>
</tr>
<tr>
<td>CC?</td>
<td>A-40</td>
</tr>
<tr>
<td>FRQ?</td>
<td>A-40</td>
</tr>
<tr>
<td>MOD</td>
<td>A-41</td>
</tr>
<tr>
<td>PRD</td>
<td>A-42</td>
</tr>
<tr>
<td>CUR</td>
<td>A-42</td>
</tr>
<tr>
<td>STA</td>
<td>A-43</td>
</tr>
<tr>
<td>STO</td>
<td>A-43</td>
</tr>
<tr>
<td>MSR?</td>
<td>A-43</td>
</tr>
<tr>
<td>MSA?</td>
<td>A-43</td>
</tr>
<tr>
<td>MSO?</td>
<td>A-44</td>
</tr>
<tr>
<td>MLP?</td>
<td>A-44</td>
</tr>
<tr>
<td>ETI?</td>
<td>A-44</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:MEASurement?</td>
<td>A-45</td>
</tr>
<tr>
<td>:MEASure:AMPLitude::{CHA</td>
<td>CHB}?</td>
</tr>
<tr>
<td>:MEASure:TIME?</td>
<td>A-48</td>
</tr>
<tr>
<td>:MEASure:MASK?</td>
<td>A-49</td>
</tr>
<tr>
<td>:MEASure:HISTogram:TIME?</td>
<td>A-51</td>
</tr>
</tbody>
</table>
Chapter 1  Overview

This chapter explains the outline of the remote control.

1.1 What is Remote Control? ............................................1-2
1.2 Main Uses for Remote Control .................................1-3
1.3 Abbreviations..............................................................1-5
1.4 Restrictions on Software Versions..............................1-6
1.1 What is Remote Control?

The remote control function sends commands via the communications interface from the control PC to set the measuring instrument and read the measurement results and measuring instrument conditions.

The BERTWave supports the Ethernet or GPIB as a control interface. For MP210xA and MP2100B, the Option 030 is required to use GPIB interface.

When using either interface, set the number to distinguish the BERTWave from other equipment. This number must be an IP address and TCP port number when using the Ethernet interface, or the GPIB address when using GPIB connection.

The character strings for controlling the BERTWave are called “command”. The command is composed of the ASCII character strings. For example, the following command is used to output the signal of the pulse pattern generator (hereafter, PPG) to the connector.

:OUTput:DATA:OUTput ON

A command for reading data from the BERTWave is called “query”. A query command has the question symbol (?) appended to the end of string. For example, sending the following command queries the PPG bit rate set at the instrument.

:OUTput:BITRate?

The control PC receives the following response to the query from the instrument.

1250000

The bit rate is 1250000 kbit/s.

When the BERTWave is measured via remote control, the Remote lamp on the screen is lit. Only the power switch and the key Local/Panel Unlock on the system menu are valid in this situation. This situation is called panel lock. To unlock the panel, touch Local/Panel Unlock on the system menu.
1.2 Main Uses for Remote Control

The main uses for remote control are:

**Automation of measurement**
To control measuring instruments by executing a program, instead of touch-panel operations. Measurement can be automated by describing the control procedures for controlling the measuring instruments, in the program.

**Remote control of instruments**
To collect measurement data by controlling measuring instruments installed at remote locations, over communications lines.

**Control of multiple measuring instruments**
To measure the characteristics of DUTs via the remote control of multiple measuring instruments.

![Figure 1.2-1 Example of Controlling Multiple Instruments](image)
Figure 1.2-1 shows an example of controlling multiple instruments. In this example, the bit error rates are measured with changes in the optical input level of the optical receiver. On the control PC, set the attenuation of the optical attenuator to read the optical power level measured by the optical power meter, and the bit error rate measured by the BERTWave. Table 1.2-1 shows the measurement results that are obtained by changing the optical attenuation.

<table>
<thead>
<tr>
<th>Optical Power (dBm)</th>
<th>Bit Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>–25.034</td>
<td>0.011442</td>
</tr>
<tr>
<td>–24.523</td>
<td>0.0048758</td>
</tr>
<tr>
<td>–24.031</td>
<td>0.001631</td>
</tr>
<tr>
<td>–23.536</td>
<td>0.0004421</td>
</tr>
<tr>
<td>–23.030</td>
<td>0.000078419</td>
</tr>
<tr>
<td>–22.523</td>
<td>0.0000088616</td>
</tr>
<tr>
<td>–22.031</td>
<td>0.000000616</td>
</tr>
<tr>
<td>–21.524</td>
<td>0.000000016</td>
</tr>
<tr>
<td>–21.037</td>
<td>0.0000000028235</td>
</tr>
</tbody>
</table>
1.3 Abbreviations

Table 1.3-1 shows the abbreviations used in this operation manual.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Formal name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>CR</td>
<td>Carriage Return</td>
</tr>
<tr>
<td>ED</td>
<td>Error Detector</td>
</tr>
<tr>
<td>EOI</td>
<td>End or Identify</td>
</tr>
<tr>
<td>ESER</td>
<td>Event Status Enable Register</td>
</tr>
<tr>
<td>ESR</td>
<td>Event Status Register</td>
</tr>
<tr>
<td>GPIB</td>
<td>General Purpose Interface Bus</td>
</tr>
<tr>
<td>HiSLIP</td>
<td>High Speed LAN Instrument Protocol</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LF</td>
<td>Line Feed</td>
</tr>
<tr>
<td>MAV</td>
<td>Message Available</td>
</tr>
<tr>
<td>MSS</td>
<td>Master Summary Status</td>
</tr>
<tr>
<td>OSER</td>
<td>Operation Status Enable Register</td>
</tr>
<tr>
<td>OSR</td>
<td>Operation Status Register</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PPG</td>
<td>Pulse Pattern Generator</td>
</tr>
<tr>
<td>SCPI</td>
<td>Standard Commands for Programmable Interfaces</td>
</tr>
<tr>
<td>SRER</td>
<td>Service Request Enable Register</td>
</tr>
<tr>
<td>SRQ</td>
<td>Service Request</td>
</tr>
<tr>
<td>STB</td>
<td>Status Byte Register</td>
</tr>
<tr>
<td>TR</td>
<td>Transition Filter</td>
</tr>
<tr>
<td>VISA</td>
<td>Virtual Instrument Software Architecture</td>
</tr>
<tr>
<td>VXI-11</td>
<td>VMEbus Extensions for Instrumentation-11</td>
</tr>
</tbody>
</table>
1.4 Restrictions on Software Versions

Some of the commands described in this manual are only available in a specific version of the MX210000A BERTWave Control Software.

In MP2100B (version 4) and MP2110A (version 5 or later), the MX210000A version is displayed at the upper right of the application window.

Figure 1.4-1 Display of Software Version Number (MP2100B, MP2110A)
1.4 Restrictions on Software Versions

For MP210xA (version 3 or earlier), confirm the version of MX210000A in Information dialog box of Setup Utility.

![Figure 1.4-2 Display of Software Version Number (MP210xA, MP2100B)](image_url)
Chapter 2 Before Use

This chapter explains the preparations for using remote control.

2.1 Connection Types of Remote Controlling ..............2-2
2.2 Multiple Sessions (Version 5 or later) ..................2-3
2.3 Required Equipment ......................................2-4
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  2.9.2 When using GPIB ...............................2-30
2.1 Connection Types of Remote Controlling

The following connections can be performed when controlling BERTWave remotely.

- Raw Socket connection
- VXI-11 connection (version 5 or later)
- HiSLIP connection (version 5 or later)
- GPIB connection

Table 2.1-1 lists the resource names when performing the connection using VISA.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>VISA Resource Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Socket</td>
<td>TCPIP[0]::&lt;IP address</td>
<td>host name&gt;::&lt;Port number&gt;::SOCKET</td>
</tr>
<tr>
<td>VXI-11</td>
<td>TCPIP[0]::&lt;IP address</td>
<td>host name&gt;::inst0::INSTR</td>
</tr>
<tr>
<td>HiSlip</td>
<td>TCPIP[0]::&lt;IP address</td>
<td>host name&gt;::hislip[0]::&lt;Port number&gt;::INSTR</td>
</tr>
<tr>
<td>GPIB</td>
<td>GPIB[0]::&lt;primary address&gt;::&lt;secondary address&gt;::INSTR</td>
<td>GPIB::1::INSTR</td>
</tr>
</tbody>
</table>
2.2 Multiple Sessions (Version 5 or later)

When Raw Socket, VXI-11, or HiSLIP is used as the protocol, multiple PCs can connect with MP2110A simultaneously. If the different types of protocols are used, these PCs are not connected with MP2110A simultaneously. When controlling the multiple sessions using VXI-11 or HiSLIP, the session can be locked to perform the exclusion control of the sessions. Table 2.2-1 lists the maximum number of sessions for each protocol.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Maximum Number of Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Socket</td>
<td>30 sessions</td>
</tr>
<tr>
<td>VXI-11</td>
<td>30 sessions</td>
</tr>
<tr>
<td>HiSLIP</td>
<td>8 sessions</td>
</tr>
<tr>
<td>GPIB</td>
<td>1 session</td>
</tr>
</tbody>
</table>
2.3 Required Equipment

The equipment required for remote control is as follows:

- Control PC
- Ethernet interface
- GPIB interface*
- Program development tool

**Control PC**
Prepare the PC that meets the operating environment for the GPIB interface and program development tools.

**Ethernet Interface**
Prepare Ethernet-compliant interface and cable.

**GPIB Interface***
Prepare IEEE 488.2-compliant GPIB interface and cable.

**Program Development Tool**
Prepare a tool for developing and running programs for performing remote control. For the requirements specification of the program development tool, refer to the manuals that come with the tool you prepared.

VISA is required for using the sample program explained in Appendix C.

* The option 030 is required for using GPIB in MP210xA and MP2100B.
2.4 Connecting Equipment

2.4.1 Connecting Ethernet

Connect the Ethernet connector on the side-panel of the BERTWave and Control PC using LAN cables. The Ethernet connector is located on the left side panel for MP210xA and MP2100B, and on the rear panel for MP2110A.

Use a LAN cable to connect the BERTWave and Control PC directly. Use a LAN cable via a network hub when connecting to multiple external devices.

Figure 2.4.1-1 Direct Connection between BERTWave and Control PC

Figure 2.4.1-2 Sample Connection with Multiple External Devices

Notes:
- MP210xA and MP2100B cannot connect to the network including the address range from 192.168.1.0 to 192.168.1.255.
- The control PC may have difficulty in communicating with the BERTWave, depending on the status of communications between them. The direct connection is recommended to ensure communication stability.
2.4.2 Connecting GPIB

Connect the GPIB connector on the rear panel of the BERTWave and an external device using a GPIB cable.

⚠️ **CAUTION**

Always connect the GPIB cable BEFORE turning on the power to the BERTWave. Connecting it while the power is on may damage internal circuits.

Up to 15 devices, including the control PC can be connected to one BERTWave unit. Always follow the conditions shown below when connecting devices.

![GPIB Cable Connection](image)

**Figure 2.4.2-1  GPIB Cable Connection 1**

- Total cable length: Up to 20 m
- Cable length between devices: Up to 4 m
- Number of devices that can be connected: Up to 15
Connect cables without forming loops.

(a) Daisy Chain

(b) Star

(c) Loop

Figure 2.4.2-2  GPIB Cable Connection 2
2.5 Setting Interface

For details on how to set the interface, refer to 2.14 “Setting Interface for Remote Control” in the *MP2100B BERTWave Operation Manual* and 4.3.10 “Remote Control” in the *MP2110A BERTWave Operation Manual*.

2.5.1 MP210xA and MP2100B

1. Switch on the power to the MP210xA or MP2100B.
2. Touch **Setup Utility** at the Selector screen.
3. Touch **Remote Control**.
4. In order to use Ethernet, touch the Active Interface button to set the button display to **Ethernet**. To use GPIB, set the button display to **GPIB**.
   
   When the Option 030 is not installed, the Active Interface button is disabled.

5. When using Ethernet, set the IP address, subnet mask, gateway and port number.
   
   The gateway address can be omitted.
   
   The port number can be set from 1024 to 5001.
   
   When using GPIB, set the GPIB address.

6. Touch **Apply**, and then the settings are completed.

   Touch **Exit**, and then the set value is deleted.

**Note:**

Do not set the following IP address.

192.168.1.xxx
2.5.2 MP2110A

1. Switch on the power to the MP2110A.
2. Click **System Menu**.
3. Click **Remote Control**.
4. Set the GPIB address, IP address, subnet mask, gateway and port number.
   The gateway address can be omitted.
   The port number can be set from 1024 to 5001.
5. Click **OK**, and then the settings are completed.
   Click **Cancel**, and then the set value is deleted.

*Note:*

Do not set the following IP address.
169.254.1.xxx
2.6 Checking Connection

This section describes how to check if the Control PC can recognize the BERTWave.

For MP210xA and MP2100B, start Main Application before checking the connection.
1. If the Setup Utility dialog box is displayed, touch Exit.
2. On the Selector screen, touch Main Application.

2.6.1 When using Ethernet (Windows 7)

This section explains how to use the free software, Tera Term Version 4.69.

1. When starting Tera Term, the New connection window is opened. Enter the IP address and TCP port number in the Host. Set the service to Other and protocol to IPv4. Click OK.

If the BERTWave IP address is set to 192.168.100.2, and the port number is set to 5001, set as follows.

2. When Tera Term recognizes the BERTWave, the communication window is displayed.
3. Click Settings (S) · Terminal (T)., on the menu.
2.6 Checking Connection

4. Under **New-line**, set **Receive** to **LF** and **Transmit** to **CR+LF**. Select the **Local echo** check box and click **OK**.

![Terminal setup](image)

5. Send *IDN?*. Confirm that the response is displayed from the BERTWave.

### 2.6.2 When using GPIB

1. Install the software drivers for the GPIB interface.
2. Run the software.
   For the operation method, refer to the GPIB interface operation manual.
3. Check the displayed instrument address.
2.7 Message Format

2.7.1 Message Types

Messages are composed of the character strings indicating message and message end. The character string indicating the message end is LF (Line Feed) or CR (Carriage Return) +LF.

*Note:* If LF or CR+LF is not attached to the message end, a timeout error occurs because the communication does not end.

Messages are composed of the following types depending on the transmission direction:

**Program Messages**
Messages sent from control PC to instrument

There are two types of the program messages:
- **Command**
  This can be used for measurement condition settings and measurement start.
- **Query**
  This queries the status and settings of the measuring instrument. When transmitting the query, the instrument creates a response message to the query.

**Response Messages**
Messages sent from instrument to control PC
2.7 Message Format

2.7.2 Message Configuration

The messages are composed of header and data parts separated by more than a half width space. Program messages always have a header but sometimes have no data. Response messages always have data but sometimes have no header.

Header
The command header has the following types:

- Simple header
  The header is composed of alphanumeric characters and underbars, and the initial character is an alphabetic character.
  Example: STA

- Common command header
  The header is composed of alphanumeric characters and underbars, and the initial character is an asterisk (*).
  Example: *CLS

- Multiple headers
  Single headers are linked by colons. Colons can be used at the header.
  Multiple headers can be used to configure layered processing.
  Example: :SENSE:MEASURE:START

Queries have a question mark (?) appended to the header.

Example: *ESE?
:CONFIGURE?

Data
The data format is character string data, numeric data, and binary data.

String data is ASCII code enclosed in quotation marks.
An example of the program message when inputting Model ANR-005 at the title is shown below.

Example:
:SYSYEM:MEMORY:STORE 'Model ANR-005',0,ALL
:SYESEM:MEMORY:STORE "Model ANR-005",0,ALL

When quotation marks are included in the character string, paired marks are used.

Example:
He said "Good product". → "He said ""Good Product""."
He said 'Good product'. → 'He said '''Good Product'''"
In addition, paired quotation marks can be used inside other paired quotation marks.

Example:

He said "Good product". → 'He said "Good Product".'
He said 'Good product'. → "He said 'Good Product'.'

The numeric values can be described by using numeric data, input numeric values either as decimal, binary, octal, or hexadecimal numbers. When using the binary, octal, or hexadecimal numbers, put #B, #O, or #H before the data.

Example:

10 #B1010  #O12  #HA
1550 #B11000001110  #O3016  #H60E

When using decimal numbers, use integer number, fixed point, or floating point. The following examples indicate the same values.

Example:

-10  -10.00  -1E1
1250  1250.000  1.25E3
0.0023  2.3E-4

For the binary data, the head string starts with a sign (#) and continues with data after a numeric value indicating the data length.

Example:  #42002an%e4445+\...

4 digits  2002 bytes binary data
When there are multiple data in a message, separate each of them with commas (,).

Example:

:INPUT:DATA:ATFFACTOR 1,6  
:SENSE:MEASURE:EALARM:PERIOD 0,0,1,0

When concatenating multiple program messages, separate the messages with semicolons (;).

Example:

:MOD:ID 5;:DISP:MODE EYE;:SAMP:STAT RUN

**Note:**

When sending multiple messages separated by semicolons, the maximum length of the concatenated string is 1024 bytes.

When sending a concatenated string of query messages, response messages are separated by semicolons.

Example:

:MOD:ID 1;:OUTP:BITR:STAN?;:OUTP:BITR?  
>"10G_LAN",10312500
2.7.3 Common Commands

The GPIB specifications (IEEE 488.2) define equipment commands. In this manual, these defined commands are called common commands.

The common commands are divided into mandatory and option commands. The BERTWave supports the common commands listed in Table 2.7.3-1.

<table>
<thead>
<tr>
<th>Command</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CLS</td>
<td>Clears stand event register and output queue</td>
</tr>
<tr>
<td>*ESE</td>
<td>Sets and queries standard event enable register</td>
</tr>
<tr>
<td>*ESR</td>
<td>Queries standard event register</td>
</tr>
<tr>
<td>*IDN</td>
<td>Queries product information</td>
</tr>
<tr>
<td>*OPC</td>
<td>Sets/queries bit setting and bit 0 for status byte indicating message processing completion</td>
</tr>
<tr>
<td>*OPT</td>
<td>Queries option information</td>
</tr>
<tr>
<td>*RST</td>
<td>Initializes BERTWave setting conditions</td>
</tr>
<tr>
<td>*SRE</td>
<td>Sets and queries SRER</td>
</tr>
<tr>
<td>*STB</td>
<td>Queries status byte register</td>
</tr>
<tr>
<td>*TRG</td>
<td>Starts measurement</td>
</tr>
<tr>
<td>*WAI</td>
<td>Waits previous sent message completion</td>
</tr>
</tbody>
</table>

2.7.4 Device Dependent Commands

In this manual, commands that differ according to the functions of the measuring instrument are called Device Dependent Commands.

This instrument has two types of Device Dependent Commands.

- SCPI
  Commands meeting SCPI standard
- Native
  Commands consisting of at least three ASCII characters
2.8 Checking Instrument Status

The BERTWave has registers indicating status, such as errors and command execution status. This section explains these registers.

2.8.1 Register Structure

Figure 2.8.1-1 shows the structure of the registers indicating the instrument status.
Each register uses 8-bit or 16-bit data. The register output values are the decimal totals for each bit shown in Table 2.8.1-1.

**Table 2.8.1-1  Register Bit Decimal Conversion Values**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Decimal value</th>
<th>Bit</th>
<th>Decimal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>8</td>
<td>256</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>9</td>
<td>512</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>10</td>
<td>1024</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>11</td>
<td>2048</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>12</td>
<td>4096</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>13</td>
<td>8192</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>14</td>
<td>16382</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>15</td>
<td>32764</td>
</tr>
</tbody>
</table>

The register has a corresponding bit enable register.
2.8.2 Status Byte Register

The status byte register (STB) displays the status of equipment defined by the GPIB standards. When the equipment status changes, the value in the STB changes too. It can be used to generate interrupts to the Control PC. These interrupts are called service requests.

There is a service request enable register (SRER) for the STB. The SRER can select the status byte bit generating the service request.

![Diagram of Status Byte Register and Service Request Enable Register]

**Figure 2.8.2-1 Configuration of Status Byte Register and Service Request Enable Register**

*Note:*

When using the GPIB interface, the service request is enabled.

The following methods are used to read the status byte register.

- Using common *STB? command
- Using GPIB serial poll (when the Option 030 is installed for MP210xA or MP2100B)
  
  Read the GPIB interface manual for the serial poll method.

  When using serial polling, even if bit 6 is 1, it becomes 0 after reading once.

The *SRE* and *SRE?* common commands can be used for setting and reading the SRER for setting reading of the status byte register. To output the STB data, set the bit corresponding to the SRER to 1.
The definition of each bit of the STB is shown in the following table.

**Table 2.8.2-1  Bit Definition of Status Byte Register**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>This is the logical sum of each bit of the logical product of the OSR and its event enable register.</td>
</tr>
</tbody>
</table>
| 6   | MSS (Master Summary Register)  
It is the logical sum of the bit 5 to 0, bit 7 logical product of the STB and the SRER. |
| 5   | This is the logical sum of each bit of the logical product of the standard event status register and standard event enable register. |
| 4   | MAV (Message Available summary)  
This is always 1 when there is a response message in the output queue of this instrument |
| 3   | Not used; always 0  |
| 2   | Becomes 1 at System Error  |
| 1   | Not used; always 0  |
| 0   | Not used; always 0  |

Bit 7 of the STB indicates information about the OSR.  
For details about the information, refer to section 2.8.4 “Operation Status Register”.

Bit 6 of the STB is called the master summary status (MSS) bit. When it is 1, there is a notification from BERTWave to the control PC. When it changes to 1 from 0, a service request is generated.

Bit 5 of the STB indicates information about the standard event register.  
For details about the information, refer to section 2.8.3 “Standard Event Status Register”.

The device dependent register data is not indicated in the STB.  
Bits 7 and 5 of the STB can be set to 0 using the *CLS common command. When *CLS is sent after a command or when a query is sent after *CLS, the send queue is cleared and bit 4 is set to 0.

The SRER cannot be set to 0 by *CLS, so use *SRE.
2.8.3 Standard Event Status Register

There is a standard event status enable register (ESE) for the standard event status register (ESR). The logical product of these two registers and the logical sum of each bit of this result is output to bit 5 of the STB.

![Configuration of Standard Event Status Register and Standard Event Status Enable Register](image)

Figure 2.8.3-1 Configuration of Standard Event Status Register and Standard Event Status Enable Register
The definition of each bit of the ESR is listed in the table below.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1 if the BERTWave is powered on.</td>
</tr>
<tr>
<td>6</td>
<td>Not used: always 0</td>
</tr>
<tr>
<td>5</td>
<td>1 if a command error occurs. Refer to Appendix B, “Error Codes” for details.</td>
</tr>
<tr>
<td>4</td>
<td>1 if an execution error occurs. Refer to Appendix B, “Error Codes” for details.</td>
</tr>
<tr>
<td>3</td>
<td>1 if a device-dependent error occurs. Refer to Appendix B, “Error Codes” for details.</td>
</tr>
<tr>
<td>2</td>
<td>Not used: always 0</td>
</tr>
<tr>
<td>1</td>
<td>Not used: always 0</td>
</tr>
<tr>
<td>0</td>
<td>Operation Complete Changed to 0 if a program message is received. Becomes 1 when the entire command operation has completed after *OPC command operation or when sending response data to a query has ended.</td>
</tr>
</tbody>
</table>

Bit 7 to bit 0 of the ESR can be read by the *ESR? command. The standard event register returns to 0 when read.

The ESE can be set and read using the *ESE and *ESE? commands. To output standard event register data, set the bit corresponding to the enable register to 1.

The bit 0 can be read using the *OPC command.

The standard register can be set to 0 using the *CLS command.
2.8.4 Operation Status Register

The operation status register (OSR) is composed of the following registers:

- Operation status condition register
- Transition filter
- Operation status event register
- Operation status enable register (OSER)

The operation status condition register indicates changes in the status. When the status changes, the value of this register also changes.

The OSER records changes in the value of the execution status condition register. There is a transition filter that defines the write condition before the OSER. The transition filter sets the OSER to 1 under any of the following conditions:

- When bit changes from 0 to 1
- When bit changes from 1 to 0
- When bit changes from 0 to 1 and bit changes from 1 to 0

The OSER sets the OSER output at each bit. The logical product of these two registers is obtained and the logical sum of each bit of the result is output at bit 7 of the STB.
Each bit definition of the execution status is as follows.

**Table 2.8.4-1  Bit Definition of Operation Status Register**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 12</td>
<td>Not used: always 0</td>
</tr>
<tr>
<td>11</td>
<td>1 during execution of PPG/ED pattern setting.</td>
</tr>
<tr>
<td>10 to 5</td>
<td>Not used: always 0</td>
</tr>
<tr>
<td>4</td>
<td>1 during execution of ED measurement.</td>
</tr>
<tr>
<td>3 to 0</td>
<td>Not used: always 0</td>
</tr>
</tbody>
</table>

The commands for confirming the execution start or end time at the OSR are shown in the following table.
2.8 Checking Instrument Status

Table 2.8.4-2 Commands for Confirming Execution of operation at Operation Status Register

<table>
<thead>
<tr>
<th>Operation Status Register Bit</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>:SENSe:MMEMory:PATTern:RECall</td>
</tr>
<tr>
<td></td>
<td>:SENSe:PATTern:TYPE</td>
</tr>
<tr>
<td></td>
<td>:SOURce:MMEMory:PATTern:RECall</td>
</tr>
<tr>
<td></td>
<td>:SOURce:PATTern:TYPE</td>
</tr>
<tr>
<td>4</td>
<td>[:BERT:ALL]:SENSe:MEASure:STARt</td>
</tr>
<tr>
<td></td>
<td>[:BERT:ALL]:SENSe:MEASure:STOP</td>
</tr>
</tbody>
</table>

To detect the execution start, set the corresponding bit of the transition filter to 1 using STATus:OPERation:PTRansition.

To detect the execution end, set the corresponding bit of the transition filter to 1 using STATus:OPERation:NTRansition.

The OSER can be read using ‘STATus:OPERation[:EVENt]?’. When the register is read, the OSR returns to 0.

The operation status condition register can be read using :STATus:OPERation:CONDition?.

To set the OSER, use ‘STATus:OPERation:ENBle’. To read the OSER, use STATus:OPERation:ENBle?. To output the OSR data, set the bit for the status setting enable register to 1.

When sending ‘STATus:OPERation:RESet’, the operation status event register is set to 0.

However, sending ‘STATus:OPERation:RESet’ does not reset the OSER.
2.8.5 Device Dependent Registers

The following registers are called the device dependent registers.

- PPG/ED Ch1 to 4 Status Register
- XFP/SFP+ Status Register
- Scope Status Register

The device dependent register has condition register, transition filter, and event register as the operation status register does. However, there is no enable register for switching the output at each bit on/off.

![Diagram of Device Dependent Register]

**Figure 2.8.5-1 Configuration of Device Dependent Register**

When the value of the device dependent register changes, there is no effect on the STB. As a result, a service request is not generated to the control PC.
Each bit definition of the device dependent register is as follows.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 6</td>
<td>Not used; always 0</td>
</tr>
<tr>
<td>5</td>
<td>Indicates Omission Error occurs.</td>
</tr>
<tr>
<td>4</td>
<td>Indicates Insertion Error occurs.</td>
</tr>
<tr>
<td>3</td>
<td>Indicates CR Unlock occurs.</td>
</tr>
<tr>
<td>2</td>
<td>Indicates SYNC Loss occurs.</td>
</tr>
<tr>
<td>1</td>
<td>Indicates Bit Error occurs.</td>
</tr>
<tr>
<td>0</td>
<td>Indicates PLL Unlock occurs.</td>
</tr>
</tbody>
</table>

Table 2.8.5-2  Bit Definition of XFP/SFP+ Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 2</td>
<td>Not used; always 0</td>
</tr>
<tr>
<td>1</td>
<td>Indicates LOS occurs.</td>
</tr>
<tr>
<td>0</td>
<td>Indicates Ready status.</td>
</tr>
</tbody>
</table>

Table 2.8.5-3  Bit Definition of Scope Status Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 9</td>
<td>Not used; always 0</td>
</tr>
<tr>
<td>8</td>
<td>Not used; always 0</td>
</tr>
<tr>
<td>7</td>
<td>Indicates CRU Unlock occurs in MP2110A-054 or MP2110A-055. *1</td>
</tr>
<tr>
<td>6</td>
<td>Indicates that Precision Trigger is out of synchronized status. *2</td>
</tr>
<tr>
<td>5</td>
<td>Indicates that the frequency of trigger input signal is abnormal. *2</td>
</tr>
<tr>
<td>4</td>
<td>Indicates PLL Unlock (No trigger input) occurs.</td>
</tr>
<tr>
<td>3</td>
<td>Not used; always 0</td>
</tr>
<tr>
<td>2</td>
<td>Indicates CAL alarm (Orange) occurs.</td>
</tr>
<tr>
<td>1</td>
<td>Indicates CAL alarm (Red) occurs.</td>
</tr>
<tr>
<td>0</td>
<td>Indicates CAL alarm (Yellow) occurs.</td>
</tr>
</tbody>
</table>

*1: Software version 6 or later
*2: Software version 5 or later

To detect the occurrence of these phenomena, set the transition filter bit to 1 using the following commands:

:INSTrument:FE{1|2|3|4}:PTRansition
:INSTrument:XSF:PTRansition
:INSTrument:WAV:PTRansition

To detect the end of these phenomena, set the transition filter bit to 1 using the following commands:
The device dependent event register can be read using the following queries:

:INSTrument:PE{1|2|3|4}:EVENT?
:INSTrument:XSFP:EVENT?
:INSTrument:WAV:EVENT?

The device dependent condition register can be read using the following queries:

:INSTrument:PE{1|2|3|4}:CONDition?
:INSTrument:XSFP:CONDition?
:INSTrument:WAV:CONDition?

The device dependent event register can be initialized using the following queries:

:INSTrument:PE{1|2|3|4}:RESet
:INSTrument:XSFP:RESet
:INSTrument:WAV:RESet
2.9 Checking If Message Execution Is Completed

Some of the BERTWave program messages may take several seconds to several ten seconds to execute. Depending on the interface (Ethernet or GPIB) you are using, the procedure to check if time-consuming message execution is completed is different.

2.9.1 When using Ethernet

Even during execution of a program message sent to the BERTWave, the subsequent message(s) can be sent. However, until execution of the previously sent message(s) is completed, the subsequent message(s) is not processed, and is stored in the buffer of the BERTWave.

Therefore, note that execution of the previously sent program message(s) may not have always been completed, even if the subsequent message(s) can be sent. To check if execution of a program message is completed, send a query to receive a response.

Example:

```
:CALibrate:AMPLitude       Starts Level calibration for Scope
:SYSTem:ERRor?             Query for error code and error message
> 0,"No Error"             No error
```

It may take around 50 seconds to complete execution of the :CALibrate:AMPLitude command in this example (in software version 5 or later). AMPLitude is sent, and subsequently :SYSTem:ERRor?, and then execution completion of AMPLitude is checked by receiving a response message.

**Note:**

If it may take a long time to process the command that precedes the query, set the sufficient response timeout, with respect to the command processing time. (Timeout needs to be longer by at least 10 seconds than the command processing time.)
2.9.2 When using GPIB

Sending the subsequent message is forced to wait, on the control PC, until execution of the sent message is completed. Therefore, prevent a communication timeout from occurring during message execution by the BERTWave, when sending a time-consuming command. Set the sufficient timeout for GPIB interface of the control PC, with respect to the command processing time. (Timeout needs to be longer by at least 10 seconds than the command processing time.)

Example: Sending a command that takes about 20 seconds to execute
1. Set the timeout for GPIB interface to 30 seconds.
2. Send a command which takes time to complete.
3. Reset the timeout to the previous setting.
Chapter 3 Message List

This chapter describes the message details of remote control commands for BERTWave.

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<th>Description</th>
<th>Page</th>
</tr>
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<td>3-110</td>
</tr>
<tr>
<td>3.6.8</td>
<td>ED</td>
<td>3-115</td>
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<td>XFP/SFP+ specific Messages (MP210xA, MP2100B)</td>
<td>3-134</td>
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<td>3-142</td>
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<td>3-171</td>
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<td>3-187</td>
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<td>Measure</td>
<td>3-205</td>
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<td>3.9.7</td>
<td>Acquiring results</td>
<td>3-237</td>
</tr>
<tr>
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<td>Marker</td>
<td>3-253</td>
</tr>
<tr>
<td>3.9.9</td>
<td>Jitter</td>
<td>3-256</td>
</tr>
</tbody>
</table>
3.1 Rules for Describing Messages

The following table shows the rules for describing messages.

Table 3.1-1 Rules for Describing Messages

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;&gt;</td>
<td>Parameters in angled bracket are input by the programmer.</td>
</tr>
<tr>
<td>[]</td>
<td>Messages or parameters in square brackets can be omitted.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>if A</td>
</tr>
<tr>
<td>{}</td>
<td>Group the choices. For example, A</td>
</tr>
<tr>
<td>&lt;binary_data&gt;</td>
<td>This string is in binary data format.</td>
</tr>
<tr>
<td>&lt;character&gt;</td>
<td>Alphabet or numeric characters</td>
</tr>
<tr>
<td>&lt;file_name&gt;</td>
<td>The string indicates file name and path. The double quotation marks</td>
</tr>
<tr>
<td></td>
<td>or single quotation marks are needed at the beginning and end of</td>
</tr>
<tr>
<td></td>
<td>the data. /,;*?,&quot;,&lt;,&gt; are not used in the file name. Example:</td>
</tr>
<tr>
<td></td>
<td>&quot;PATTERN005&quot;</td>
</tr>
<tr>
<td>&lt;integer&gt;</td>
<td>Decimal integer</td>
</tr>
<tr>
<td></td>
<td>Example: –100, 12500000</td>
</tr>
<tr>
<td>&lt;numeric&gt;</td>
<td>Decimal number</td>
</tr>
<tr>
<td></td>
<td>Example: 0, 1.2E–6, 2.35</td>
</tr>
<tr>
<td>&lt;string&gt;</td>
<td>String data</td>
</tr>
<tr>
<td></td>
<td>The double quotation marks or single quotation marks are needed at</td>
</tr>
<tr>
<td></td>
<td>the beginning and end of the data.</td>
</tr>
<tr>
<td>&lt;enable&gt;</td>
<td>On/Off setting</td>
</tr>
<tr>
<td></td>
<td>To turn off, specify 0 or OFF. (Response: 0)</td>
</tr>
<tr>
<td></td>
<td>To turn on, specify 1 or ON. (Response: 1)</td>
</tr>
<tr>
<td></td>
<td>Example: 0, 1, OFF, ON</td>
</tr>
<tr>
<td>...</td>
<td>Indicates that multiple parameters or responses are omitted.</td>
</tr>
<tr>
<td>&gt;</td>
<td>Precedes a response, in Example of Use.</td>
</tr>
</tbody>
</table>

Some parts of the header strings can be omitted. The lower-case characters can be omitted, but the upper-case characters cannot be omitted.

Example: :STAT:OPER:EVENT?

The following header strings are also acceptable:

:STAT:OPER:EVEN?
:STAT:OPERATION:EVEN?
:STAT:OPERAT:EVEN?
:STAT:OPERATION:EVEN?
:STAT:OPERATION:EVENT?

BERTWave interprets them in the same way.
Chapter 3  Message List

3.2 Correspondence Between Panel and Messages

This section explains correspondence between panel and messages.

3.2.1 Messages corresponding to common operations

Figure 3.2.1-1  Messages Corresponding to Common Operations

Figure 3.2.1-2  Messages Corresponding to System Menu (MP210xA, MP2100B)

Figure 3.2.1-3  Messages Corresponding to System Menu (MP2110A)
3.2 Correspondence Between Panel and Messages

Figure 3.2.1-4  Messages Corresponding to System Alarm Dialog Box (MP210xA, MP2100B)
3.2.2 Messages corresponding to PPG/ED

When controlling PPG/ED, add :BERT[ch] to the beginning of the message header or specify a channel using the :MODule:ID command. Refer to Section 3.5, “Specifying Module and Channel” for details.

![Diagram of PPG/ED settings]

Figure 3.2.2-1 Messages Corresponding to PPG Panel (MP210xA, MP2100B)
3.2 Correspondence Between Panel and Messages

Figure 3.2.2-2 Messages Corresponding to ED Panel–1 (MP210xA, MP2100B)
Figure 3.2.2-3  Messages Corresponding to ED Panel–2 (MP210xA, MP2100B)
3.2 Correspondence Between Panel and Messages

Figure 3.2.2-4 Messages Corresponding to PPG/ED Panel–1 (MP2110A)
Chapter 3  Message List

Figure 3.2.2-5  Messages Corresponding to PPG/ED Panel–2 (MP2110A)
3.2 Correspondence Between Panel and Messages

Figure 3.2.2-6 Messages Corresponding to All BER Measurement-1
### Figure 3.2.2-7  Messages Corresponding to All BER Measurement-2

<table>
<thead>
<tr>
<th>ED</th>
<th>Start/Stop</th>
<th>Start Time</th>
<th>Progress</th>
<th>Bit Rate</th>
<th>Test Pattern</th>
<th>Test Pattern</th>
<th>Error</th>
<th>Total</th>
<th>ER</th>
<th>INS</th>
<th>OMI</th>
<th>OMI</th>
<th>CC</th>
<th>FREQ(kHz)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>08/19/2016 16:00:56</td>
<td></td>
<td>10Gbe LANPHY(10.3125G)</td>
<td>ProgrammablePattern</td>
<td></td>
<td>0.0000E-11</td>
<td>0</td>
<td>0.0000E-11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.7234E+11</td>
<td>10312499</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>08/19/2016 16:00:56</td>
<td></td>
<td>10Gbe LANPHY(10.3125G)</td>
<td>ProgrammablePattern</td>
<td></td>
<td>1.7876E-07</td>
<td>0</td>
<td>1.7876E-07</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.2284E+11</td>
<td>10312500</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>08/19/2016 16:00:56</td>
<td></td>
<td>10Gbe LANPHY(10.3125G)</td>
<td>ProgrammablePattern</td>
<td></td>
<td>0.0000E-11</td>
<td>0</td>
<td>0.0000E-11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.7234E+11</td>
<td>10312499</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>08/19/2016 16:00:56</td>
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<td>10Gbe LANPHY(10.3125G)</td>
<td>ProgrammablePattern</td>
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<td>0.0000E-11</td>
<td>0</td>
<td>0.0000E-11</td>
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<td>0</td>
<td>0</td>
<td>5.7234E+11</td>
<td>10312499</td>
<td></td>
</tr>
</tbody>
</table>

**[:BERT:ALL]:SENSe:MEASure:EALarm:STATE?**

**[:BERT:ALL]:DISPlay:RESult:EALarm:HResE**
### 3.2.3 Messages corresponding to XFP/SFP+ (MP210xA, MP2100B)

When controlling XFP/SFP+, add :PMODule to the beginning of the message header or send :MODule:ID 3 first. Refer to Section 3.5, “Specifying Module and Channel” for details.

![Diagram](image)

**Figure 3.2.3-1  Messages Corresponding to XFP/SFP+ Panel**
3.2.4 Messages corresponding to O/E (MP210xA, MP2100B)

When controlling O/E, add ':OE to the beginning of the message header or send ':MODule:ID 4 first. Refer to Section 3.5, “Specifying Module and Channel” for details.

![Figure 3.2.4-1 Messages Corresponding to O/E Panel](image)
3.2.5  Messages corresponding to Scope

When controlling Scope, add ‘:SCOPe’ to the beginning of the message header or send ‘:MODule:ID 5’ first. Refer to Section 3.5, “Specifying Module and Channel” for details.

3.2.5.1  Result Window

Figure 3.2.5.1-1  Messages Corresponding to Scope Panel (MP2110A)
Chapter 3 Message List

Figure 3.2.5.1-2 Messages Corresponding to Scope Panel (MP210xA, MP2100B)
### 3.2 Correspondence Between Panel and Messages

#### Table 3.2.5.1-3: Messages Corresponding to Amplitude/Time Measurement Result (NRZ)

<table>
<thead>
<tr>
<th>NRZ?</th>
<th>Cha</th>
<th>Corrected</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>211.16</td>
<td>213.57</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>6.45</td>
<td>6.45</td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td>123.50</td>
<td>122.90</td>
</tr>
<tr>
<td>One Level</td>
<td>B</td>
<td>1507.75</td>
<td>1507.72</td>
</tr>
<tr>
<td>Zero Level</td>
<td>B</td>
<td>-1510.13</td>
<td>-1510.12</td>
</tr>
</tbody>
</table>

---

*FETCh:AMPLitude:AVEPower[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:CROSSing[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:EXTRatio[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:EYEAmplitude[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:EYEHeight[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:EYEHeight:RATio[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:LEVEL:ONE[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:LEVEL:ZERO[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:SNR[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:OMA:DBM[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:OMA:MW[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:JITTER:PPeak[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:JITTER:RMS[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:TRISE[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:FTIME[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:EYEWidth[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:TIME:DCD[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:OMAXp[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:VECP[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:TDEC[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*

*FETCh:AMPLitude:RINoise[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]*
Figure 3.2.5.1-4  Messages Corresponding to Amplitude/Time Measurement Result (PAM4)
### 3.2 Correspondence Between Panel and Messages

#### Message List

- :SYSTem:PRINt:COPY

#### Figure 3.2.5.1-5 Messages Corresponding to Jitter Measurement Result

<table>
<thead>
<tr>
<th>Message</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TJ</td>
<td>975.44</td>
<td>mIl</td>
</tr>
<tr>
<td>DJ</td>
<td>720.00</td>
<td>mIl</td>
</tr>
<tr>
<td>RJ</td>
<td>11.34</td>
<td>mIl</td>
</tr>
<tr>
<td>J2</td>
<td>773.75</td>
<td>mIl</td>
</tr>
<tr>
<td>J9</td>
<td>855.43</td>
<td>mIl</td>
</tr>
<tr>
<td>EYE Opening</td>
<td>124.56</td>
<td></td>
</tr>
<tr>
<td>DDPW</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Rj</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>P3-pp</td>
<td>741.00</td>
<td>mIl</td>
</tr>
<tr>
<td>PJ Frequency</td>
<td>0.00</td>
<td>kHz</td>
</tr>
</tbody>
</table>

---

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Chapter 3 Message List

Figure 3.2.5.1-6 Messages Corresponding to Mask Test Measurement Result

Figure 3.2.5.1-7 Messages Corresponding to Mask Test All Measurement Result (MP2110A)
3.2 Correspondence Between Panel and Messages

Figure 3.2.5.1-8 Messages Corresponding to Histogram Measurement Result

Figure 3.2.5.1-9 Messages Corresponding to Marker Display
Chapter 3 Message List

Figure 3.2.5.1-10 Messages Corresponding to Amplitude/Time&Mask Measurement Result

Figure 3.2.5.1-11 Messages Corresponding to Amplitude/Time&Mask All Measurement Result (MP2110A)

Figure 3.2.5.1-12 Messages Corresponding to Amplitude/Time&Histogram Measurement Result
3.2  Correspondence Between Panel and Messages

Figure 3.2.5.1-13  Messages Corresponding to Jitter Display-1 (MP2110A – Eye, Advanced Jitter)
Figure 3.2.5.1-14 Messages Corresponding to Jitter Display-2 (MP2110A – Advanced Jitter)
3.2.5.2 Setup

Figure 3.2.5.2-1 Messages Corresponding to Setup Dialog Box (MP210xA, MP2100B)
Figure 3.2.5.2-2 Messages Corresponding to Setup Dialog Box (MP2110A) (General, Utilities)
3.2 Correspondence Between Panel and Messages

3.2.5.2-3 Messages Corresponding to Setup Dialog Box (MP2110A) (Save)

Figure 3.2.5.2-3 Messages Corresponding to Setup Dialog Box (MP2110A) (Save)

3.2.5.3 Measure

Figure 3.2.5.3-1 Messages Corresponding to Measure Dialog Box (MP210xA, MP2100B) (Amplitude/Time, Amplitude/Time & Mask, Amplitude/Time & Histogram)
Figure 3.2.5.3-2  Messages Corresponding to Measure Dialog Box (MP210xA, MP2100B)
(Mask Test, Amplitude/Time&Mask)
3.2  Correspondence Between Panel and Messages

Figure 3.2.5.3-3  Messages Corresponding to Measure Dialog Box
(MP210xA, MP2100B) (Histogram, Amplitude/Time & Histogram)
Chapter 3  Message List

Figure 3.2.5.3-4  Messages Corresponding to Measure Dialog Box (MP2110A)  
(Amplitude/Time)
3.2 Correspondence Between Panel and Messages

Figure 3.2.5.3-5 Messages Corresponding to Setup (NRZ Amplitude/Time) Dialog Box (MP2110A)

Figure 3.2.5.3-6 Messages Corresponding to Setup (PAM4 Amplitude/Time) Dialog Box (MP2110A)
Figure 3.2.5.3-7  Messages Corresponding to Measure Dialog Box (MP2110A) (Jitter)
3.2  Correspondence Between Panel and Messages

Figure 3.2.5.3-8  Messages Corresponding to Measure Dialog Box (MP2110A) (Equalizer)
Figure 3.2.5.3-9  Messages Corresponding to Measure Dialog Box (MP2110A) (Mask Test)
### 3.2.5.4 Time

![Diagram of EYE/Pulse Scope Time settings]

- **Data Clock Rate**
  - Tracking: Off
  - Master: PPG1

- **Recalculate Option**: Clock Rate

- **Clock Rate**: 1.062 500 MHz

- **Divide Ratio**: 8

- **Bit Rate**: 8 500 000 Mbps

- **Divide Ratio Detect**: On

- **Acquire Clock Rate**: Off

- **DISPlay:WINDow:X:BITs**

- **DISPlay:WINDow:X:UNIT**

- **DISPlay:WINDow:X:OFFSets**

- **CONFigure:TRACking:DRATe**

- **CONFigure:TRACking:DRATe:MASTer**

- **TIME:CLKRate**

- **TIME:DIVRatio**

- **TIME:DATRate**

- **TIME:ACQClock?**

- **TIME:AUTodetect**

- **CONFigure:TRACking:PATLength**

- **CONFigure:TRACking:PATLength:MASTer**

- **TIME:PATLength**

- **CONFigure:SKEW:{CHA|CHB}**

---

**Figure 3.2.5.4-1 Messages Corresponding to Time Dialog Box (MP210xA, MP2100B)**
Figure 3.2.5.4-2 Messages Corresponding to Time Dialog Box (MP2110A) (Rate, Scale/Offset)
3.2 Correspondence Between Panel and Messages

Message List

Figure 3.2.5.4-3 Messages Corresponding to Time Dialog Box (MP2110A) (CRU)
3.2.5.5 Amplitude, O/E

Figure 3.2.5.5-1 Messages Corresponding to Amplitude Dialog Box (MP210xA, MP2100B)

Figure 3.2.5.5-2 Messages Corresponding to Amplitude Dialog Box (MP2110A) (Scale Offset)
3.2 Correspondence Between Panel and Messages

Figure 3.2.5.5-3 Messages Corresponding to Amplitude Dialog Box (MP2110A) (O/E)

3.2.5.6 Marker

:CALCulate:MARKer:{X1|X2|Y1|Y2}

Figure 3.2.5.6-1 Messages Corresponding to Marker Dialog Box
3.2.5.7 Histogram

Figure 3.2.5.7-1 Messages Corresponding to Histogram Dialog Box (MP2110A)
3.2.6 Messages corresponding to Information

Figure 3.2.6-1 Messages Corresponding to Information Dialog Box from Setup Utility (MP210xA, MP2100B)

Figure 3.2.6-2 Messages Corresponding to System Information Dialog Box from System Menu (MP2110A)
3.2.7 Messages with no corresponding panel operation

Command messages with no corresponding panel operation are listed below.
For messages corresponding to the status registers, refer to 2.8.4 “Operation Status Register” and 2.8.5 “Device Dependent Registers”.

<table>
<thead>
<tr>
<th>Command</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>[:SYStem:DISPlay:DATA?</td>
<td>Queries the data of the screenshot image file.</td>
</tr>
<tr>
<td>[:SYStem:DISPlay:RESult</td>
<td>Sets and queries the On/Off state of the plotting processing of measurement results.</td>
</tr>
<tr>
<td>TRM</td>
<td>Sets and queries the terminator of response data.</td>
</tr>
<tr>
<td>GTL</td>
<td>Added in Version 5: Changes the status to Local.</td>
</tr>
<tr>
<td>[:SYStem:VERSion?</td>
<td>Queries the version of SCPI.</td>
</tr>
<tr>
<td>[:TIME:TRACking:STATus?</td>
<td>Queries the tracking status of Scope.</td>
</tr>
<tr>
<td>[:TRACe:</td>
<td>CHANnelA</td>
</tr>
</tbody>
</table>
3.3 Messages Corresponding to Common Operations

3.3.1 Setting system configuration

TRM

Function
This command sets and queries the type of terminator of the response data.

Syntax
{TRM|:SYSTem:TERMination} 0|1
{TRM|:SYSTem:TERMination}?

Parameter
0  LF+EOI (default)
1  CR+LF+EOI

LF (Line Feed) is 0x0A in ASCII.
CR (Carriage Return) is 0x0D in ASCII.
EOI (End or Identify) is a GPIB interface signal indicating the end of data.

Response Data
0|1

Example of Use
To set the terminator type to LF+EOI:
TRM 0
TRM?
>TRM 0

GTL (Go to local)

Function
*Added in Version 5:* This command releases the remote connection status and changes the status to Local.

Example of Use
GTL
Chapter 3  Message List

:SYSTem:BEEPer:SET
Function

*Only in MP210xA and MP2100B:* This command sets and queries the buzzer ON/OFF.

Syntax

:SYSTem:BEEPer:SET <enable>
:SYSTem:BEEPer:SET?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

To set buzzer ON:

:SYST:BEEP:SET ON
:SYST:BEEP:SET?
>`1

*Note:*

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
3.3 Messages Corresponding to Common Operations

3.3.2 Obtaining system information

:SYSTem:VERSion?

Function
This command queries the SCPI version the software of the BERTWave is referring to.

Response Data
1999.0

Example of Use
:SYST:VERS?
>1999.0

*IDN? (Identification)

Function
This command queries the manufacturer, model name, serial number, and installer version.

Syntax
*IDN?

Response Data
ANRITSU,MP21{00{A|B}|10A},<serial_number>,<version>

Example of Use
*IDN?
>ANRITSU,MP2100A,6200123456,03.01.00
*IDN?
>ANRITSU,MP2100B,6200123456,04.00.00
*IDN?
>ANRITSU,MP2110A,6200123456,06.00.00

*OPT? (Option Identification Query)

Function
This command queries what options are installed.

Syntax
*OPT?

Response Data
<option_id>[,<option_id>]...
The installed options are returned in the OPT<number> format.
### Table 3.3.2-1  option_id List

<table>
<thead>
<tr>
<th>option_id</th>
<th>Option Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT001</td>
<td>Dual Electrical Receiver</td>
</tr>
<tr>
<td>OPT003</td>
<td>Optical/Single-ended Electrical Receiver</td>
</tr>
<tr>
<td>OPT005</td>
<td>Extended PPG/ED Channel</td>
</tr>
<tr>
<td>OPT007</td>
<td>1ch Electrical BERT and Optical/Single-ended Electrical Scope</td>
</tr>
<tr>
<td>OPT011</td>
<td>1CH BERT</td>
</tr>
<tr>
<td>OPT012</td>
<td>2CH BERT</td>
</tr>
<tr>
<td>OPT014</td>
<td>4CH BERT</td>
</tr>
<tr>
<td>OPT021</td>
<td>Dual Electrical Scope</td>
</tr>
<tr>
<td>OPT022</td>
<td>Dual Optical Scope</td>
</tr>
<tr>
<td>OPT023</td>
<td>Optical and Single-ended Electrical Scope</td>
</tr>
<tr>
<td>OPT024</td>
<td>Precision Trigger</td>
</tr>
<tr>
<td>OPT025</td>
<td>Optical Scope for Singlemode</td>
</tr>
<tr>
<td>OPT026</td>
<td>Optical Scope for Multimode</td>
</tr>
<tr>
<td>OPT030</td>
<td>For MP210xA, MP2100B: GPIB Quad Optical Scope for Singlemode Baseband Flat</td>
</tr>
<tr>
<td>OPT032</td>
<td>Dual Optical Scope Baseband Flat</td>
</tr>
<tr>
<td>OPT033</td>
<td>Optical and Single-ended Electrical Scope Baseband Flat</td>
</tr>
<tr>
<td>OPT035</td>
<td>Optical Scope for Singlemode Baseband Flat</td>
</tr>
<tr>
<td>OPT036</td>
<td>Optical Scope for Multimode Baseband Flat</td>
</tr>
<tr>
<td>OPT039</td>
<td>Quad Optical Scope for Multimode Baseband Flat</td>
</tr>
<tr>
<td>OPT040</td>
<td>Quad Optical Scope for Singlemode</td>
</tr>
<tr>
<td>OPT042</td>
<td>Dual Optical Scope</td>
</tr>
<tr>
<td>OPT043</td>
<td>Optical and Single-ended Electrical Scope</td>
</tr>
<tr>
<td>OPT045</td>
<td>Optical Scope for Singlemode</td>
</tr>
<tr>
<td>OPT046</td>
<td>Optical Scope for Multimode</td>
</tr>
<tr>
<td>OPT049</td>
<td>Quad Optical Scope for Multimode</td>
</tr>
<tr>
<td>OPT050</td>
<td>XFP Slot</td>
</tr>
<tr>
<td>OPT051</td>
<td>SFP+ Slot</td>
</tr>
<tr>
<td>OPT052</td>
<td>Full Rate Clock Output</td>
</tr>
<tr>
<td>OPT053</td>
<td>Clock Recovery (External Data)</td>
</tr>
<tr>
<td>OPT054</td>
<td>Clock Recovery (MP2110A: Electrical/Optical, MP2100B: Optical Data)</td>
</tr>
<tr>
<td>OPT055</td>
<td>For MP2100B: Clock Recovery For MP2110A: 26G/53Gbaud Clock Recovery (SM Optical)</td>
</tr>
<tr>
<td>OPT056</td>
<td>Low Pass Filter Bank (8.5G/10G/10.7G)</td>
</tr>
<tr>
<td>OPT057</td>
<td>Low Pass Filter Bank (2G/4G/8.5G/10G)</td>
</tr>
<tr>
<td>OPT058</td>
<td>Low Pass Filter Bank (1.2G/10G/10.7G)</td>
</tr>
<tr>
<td>OPT059</td>
<td>Low Pass Filter Bank (1.2G/2.5G/3.1G/6.2G)</td>
</tr>
<tr>
<td>OPT060</td>
<td>Low Pass Filter Bank (2G/3.1G/6.2G/10G)</td>
</tr>
</tbody>
</table>
3.3 Messages Corresponding to Common Operations

<table>
<thead>
<tr>
<th>Option Id</th>
<th>Option Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT061</td>
<td>1 High Bit Rate Filter</td>
</tr>
<tr>
<td>OPT062</td>
<td>2 High Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT063</td>
<td>4 High Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT064</td>
<td>1 to 2 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT065</td>
<td>4 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT066</td>
<td>1 High Bit Rate and 1 to 2 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT067</td>
<td>1 to 2 High Bit Rate and 3 to 4 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT068</td>
<td>2 to 3 High Bit Rate and 1 to 2 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT069</td>
<td>3 High Bit Rate and 3 Low Bit Rate Filter Bank</td>
</tr>
<tr>
<td>OPT070</td>
<td>LPF for 156M (L)</td>
</tr>
<tr>
<td>OPT071</td>
<td>LPF for 622M (L)</td>
</tr>
<tr>
<td>OPT072</td>
<td>LPF for 1.0G (L)</td>
</tr>
<tr>
<td>OPT073</td>
<td>LPF for 1.2G (L)</td>
</tr>
<tr>
<td>OPT075</td>
<td>LPF for 2.5G (L)</td>
</tr>
<tr>
<td>OPT076</td>
<td>LPF for 2.1G (H)</td>
</tr>
<tr>
<td>OPT077</td>
<td>LPF for 2.5G (H)</td>
</tr>
<tr>
<td>OPT078</td>
<td>LPF for 2.6G (H)</td>
</tr>
<tr>
<td>OPT079</td>
<td>LPF for 3.1G (H)</td>
</tr>
<tr>
<td>OPT080</td>
<td>LPF for 4.2G (H)</td>
</tr>
<tr>
<td>OPT081</td>
<td>LPF for 5.0G (H)</td>
</tr>
<tr>
<td>OPT082</td>
<td>LPF for 6.2G (H)</td>
</tr>
<tr>
<td>OPT083</td>
<td>LPF for 8.5G (H)</td>
</tr>
<tr>
<td>OPT084</td>
<td>LPF for 9.9G to 10.3G (H)</td>
</tr>
<tr>
<td>OPT085</td>
<td>LPF for 10.5G to 11.3G (H)</td>
</tr>
<tr>
<td>OPT086</td>
<td>For MP210xA: LPF for Multi 10G (9.9G to 10.7G) (H) For MP2100B: LPF for Multi 10G (8.5G to 11.3G) (H)</td>
</tr>
<tr>
<td>OPT087</td>
<td>Filter Bank Set (622M/1.2G/2.5G/4.2G/6.2G/Multi 10G)</td>
</tr>
<tr>
<td>OPT088</td>
<td>Filter Bank Set (4.2G/5.0G/6.2G/Multi 10G)</td>
</tr>
<tr>
<td>OPT089</td>
<td>Filter Bank Set (156M/622M/1.2G/2.5G)</td>
</tr>
<tr>
<td>OPT090</td>
<td>Bit rate Extension for PPG/ED</td>
</tr>
<tr>
<td>OPT091</td>
<td>ED High Sensitivity</td>
</tr>
<tr>
<td>OPT092</td>
<td>PPG/ED Bit Rate Extension for 125M to 12.5G</td>
</tr>
<tr>
<td>OPT093</td>
<td>PPG/ED Bit Rate Extension</td>
</tr>
<tr>
<td>OPT095</td>
<td>PAM4 Analysis Software</td>
</tr>
<tr>
<td>OPT096</td>
<td>Jitter Analysis Software</td>
</tr>
</tbody>
</table>

Example of Use

*OPT?
>OPT001, OPT030, OPT050
Chapter 3  Message List

:SYSTem:INFormation?

Function
This command queries the manufacturer, model name, serial number, and installed option(s) of the BERTWave.

Syntax
:SYSTem:INFormation?

Response Data
ANRITSU,MP21{00|A|B|10A},<serial_number>[,<option_id>]...

For <option_id>, refer to “*OPT?”.

Example of Use
:SYST:INF?
>ANRITSU,MP2100A,6200123456,OPT001,OPT050

:SYSTem:{DATE|TIME}?

Function
This command queries the date or time of the BERTWave.

Syntax
:SYSTem:DATE?
:SYSTem:TIME?

Response Data
When querying the date:  <year>,<month>,<day>
When querying the time:  <hour>,<minute>,<second>

Example of Use
:SYST:DATE?
>2009,10,24
:SYST:TIME?
>9,50,39

:SYSTem:ERRor?

Function
This command queries the error code and error message.

Syntax
:SYSTem:ERRor?
3.3  Messages Corresponding to Common Operations

Response Data

<integer>,<string>

<integer>
Range    –32768 to 32767
0 is returned if no errors have occurred. For error codes returned by the BERTWave, refer to Appendix B “Error Codes”.

<string>
Error message corresponding to the value of <integer> (Up to 255 characters)

Example of Use
:SYST:ERR?
>0,"No error"
3.3.3 System alarm (MP210xA, MP2100B)

:SYSTem:ERRor:HCLear

Function
This command clears the system alarm history.

Syntax
:SYSTem:ERRor:HCLear

Example of Use
:SYST:ERR:HCL

:SYSTem:ERRor:HISTory?

Function
This command queries if there exists a system alarm history.

Syntax
:SYSTem:ERRor:HISTory?

Response Data
Not Occurred No system alarms have occurred.
Occurred A system alarm(s) has occurred.

Example of Use
:SYST:ERR:HIST?
>Not occurred
3.3 Messages Corresponding to Common Operations

**:SYSTem:DISPlay:ALARm**

**Function**
This command sets and queries the On/Off state of the Auto Popup for system alarm occurrence.

**Syntax**
**:SYSTem:DISPlay:ALARm <enable>**
**:SYSTem:DISPlay:ALARm?**

**Parameter**
0|OFF 
1|ON

**Response Data**
0|1

**Example of Use**
**:SYST:DISP:ALAR ON**
**:SYST:DISP:ALAR?**

**:SYSTem:INFormation:ERRor?**

**Function**
This command queries the system alarm information.

**Syntax**
**:SYSTem:INFormation:ERRor?**

**Response Data**
<error_code>[,<error_code>]...
0 is returned if no alarms have occurred. 
If multiple alarms have occurred, all error codes are returned in ascending order.

1 PPG/ED Fatal Temperature
2 EYE/Pulse Scope Temperature
3 PPG/ED PLL Unlock (MP210xA) PPG/ED Hardware Error (MP2100B)
4 Power
5 EYE/Pulse Scope Fatal Temperature
6 PPG/ED Illegal Mode (MP210xA)

**Example of Use**
**:SYST:INF:ERR?**

>1,2,3
3.3.4 Resetting/recalling settings

*RST (Reset)

**Function**
This command resets the settings to the factory defaults.

**Syntax**
*RST

**Example of Use**
*RST

**Notes:**
- Output from PPG/XFP/SFP+ is turned off.
- ED/Scope measurement is stopped: the data obtained so far in the stopped measurement is cleared.
- The time at which the system alarm occurred is cleared.
3.3 Messages Corresponding to Common Operations

:SYSTem:MMEMory:RECall
Function
This command recalls the configuration file.

Syntax
:SYSTem:MMEMory:RECall <setup_file>

Parameter
<setup_file>
Specify the name and type of the configuration file you want to recall.

Table 3.3.4-1 Setting File Format

<table>
<thead>
<tr>
<th>Contents of File</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settings for the entire BERTWave</td>
<td>&quot;&lt;file_name&gt;.CND&quot;,0,ALL</td>
</tr>
<tr>
<td>Settings for PPG/ED Ch1</td>
<td>&quot;&lt;file_name&gt;.PE1&quot;,1,PE1</td>
</tr>
<tr>
<td>Settings for PPG/ED Ch2</td>
<td>&quot;&lt;file_name&gt;.PE2&quot;,2,PE2</td>
</tr>
<tr>
<td>Settings for PPG/ED Ch3</td>
<td>&quot;&lt;file_name&gt;.PE3&quot;,8,PE3</td>
</tr>
<tr>
<td>Settings for PPG/ED Ch4</td>
<td>&quot;&lt;file_name&gt;.PE4&quot;,9,PE4</td>
</tr>
<tr>
<td>Settings for XFP</td>
<td>&quot;&lt;file_name&gt;.XFP&quot;,3,XFP</td>
</tr>
<tr>
<td>Settings for SFP+</td>
<td>&quot;&lt;file_name&gt;.SFP&quot;,3,SFP</td>
</tr>
<tr>
<td>Settings for O/E</td>
<td>&quot;&lt;file_name&gt;.OES&quot;,4,OES</td>
</tr>
<tr>
<td>Settings for Scope</td>
<td>&quot;&lt;file_name&gt;.WFS&quot;,5,WFS</td>
</tr>
<tr>
<td>Settings for Jitter</td>
<td>&quot;&lt;file_name&gt;.JIT&quot;,6,JIT</td>
</tr>
<tr>
<td>Settings for Transmission</td>
<td>&quot;&lt;file_name&gt;.TAS&quot;,7,TAS</td>
</tr>
</tbody>
</table>

Example of Use
:SYST:MEM:REC "settings_all",0,ALL
:SYST:MEM:REC "settings_ppged1.PE1",1,PE1
3.3.5 Storing settings and results

:SYSTem:MMEMory:STORe

Function
This command stores the settings or measurement results to a file.

Syntax
:SYSTem:MMEMory:STORe <setup_file>|<results_file>

Parameter
Specify the name and type of a file to which you want to store setting/results, as follows:
<setup_file>
Refer to :SYSTem:MMEMory:RECall
<results_file>

<table>
<thead>
<tr>
<th>Result</th>
<th>Format*1,a2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDCh1 measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>EDCh2 measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>EDCh3 measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>EDCh4 measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>O/E measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>Scope measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>Jitter measurement</td>
<td>&quot;&lt;file_name&gt;.{CSV</td>
</tr>
<tr>
<td>Transmission measurement (TransmissionAnalysis)</td>
<td>&quot;&lt;file_name&gt;.{S2P</td>
</tr>
<tr>
<td>Transmission measurement (WaveformEstimation)</td>
<td>&quot;&lt;file_name&gt;.WFE&quot;*,7,WER,WFE</td>
</tr>
</tbody>
</table>

*1: CSV, TXT, S2P and WFE indicate file formats.

*2: File extensions, and third and fourth parameters are not case-sensitive.
3.3 Messages Corresponding to Common Operations

Example of Use

To store settings:
:SYST:MMEM:STOR "settings_all",0,ALL
:SYST:MMEM:STOR "settings_ppged1.PE1",1,PE1
:SYST:MMEM:STOR "settings_jitter.JIT",6,JIT

To store measurement results:
:SYST:MMEM:STOR "results_ed1.TXT",1,ER1,TXT
:SYST:MMEM:STOR "results_scope.CSV",5,WFR,CSV
:SYST:MMEM:STOR "results_transmission_analysis.S2P",7,TAR,S2P
:SYST:MMEM:STOR "results_waveform_estimation.WFE",7,WFR,WFE

Note:

If the file extension of the saved configuration file is changed, it cannot be recalled.
3.3.6 Turning on/off plotting processing
:SYSTem:DISPlay:RESult

Function
This command sets and queries the On/Off state of the plotting processing of measurement results.

Syntax
:SYSTem:DISPlay:RESult {{0|OFF}[,ED]|{1|ON}}
:SYSTem:DISPlay:RESult?

Parameter
0|OFF Plotting processing Off
ED Added in Version 4:
   Plotting processing Off (Only ED measurement results)
1|ON Plotting processing On

Response Data
0|1

Example of Use
To stop the plotting processing of ED/Scope measurement results:
:SYST:DISP:RES OFF
:SYST:DISP:RES?
>0
To stop the plotting processing of only ED measurement results:
:SYST:DISP:RES OFF,ED
:SYST:DISP:RES?
>0
To resume the plotting processing:
:SYST:DISP:RES ON
:SYST:DISP:RES?
>1

Note:
If the plotting processing is set to Off, the following screen message is displayed instead of measurement results. This reduces the response time for remote control.

The measurement results display cannot be updated during remote control.
Press the [Local/Panel Unlock] button to return to local control and re-open the updated measurement results display.
3.3 Messages Corresponding to Common Operations

3.3.7 Screen Copy

:SYSTem:PRINt:COPY

Function
This command saves the full screenshot to a file.

Syntax
:SYSTem:PRINt:COPY [<file_name>,<directory>][,PNG|JPEG]

Parameter
<file_name>,<directory>
Specify the file name and folder to save the screenshot. If the specified folder is not found, it is created automatically. If the file name and folder are omitted, the screenshot is saved as mmdyyyy_hhmssmmm.png|jpeg in the following directory:

Storage location for MP210xA and MP2100B:
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Screen Copy

Storage location for MP2110A:
C:\Users\Public\Documents\Anritsu\MX210000A\UserData\Screen Copy

PNG|JPEG
Specify the image file format. If omitted, it defaults to PNG.

Example of Use
:SYST:PRIN:COPY "screen_copy_full","C:\screen_copy"

Notes:
- If the MX210000A screen is minimized, the screen copy function cannot be performed.
- If the file name is not specified, an image file is created newly each time this command is sent. Make sure there is sufficient disk space.
- To save the screenshot of the Scope screen, execute :EYEP:PRIN:COPY.
- To obtain image file data, execute :SYST:DISP:DATA?.

Message List
:SYSTem:DISPlay:DATA?

Function
This command queries the last screenshot image file saved by :SYST|EYEP:PRIN:COPY.

Syntax
:SYSTem:DISPlay:DATA?

Response Data
#<digit><data_size><binary_data><terminator>

<digit> is a one-digit number that indicates the number of digits of <data_size>.
<data_size> indicates the data size of <binary_data>.
<binary_data> is image file data of the screenshot.
<terminator> indicates the terminator (LF or CR/LF) specified by the :SYST:TERM command.

Example of Use
To save the screenshot to an image file:
:SYST:PRIN:COPY "screen_copy_full","C:\screen_copy"

To query the screenshot image file:
:SYST:DISP:DATA?
>#541056Avdl-*;E4"as..."

Note:
The end of response data cannot be detected by the terminator, because <binary_data> contains CR/LF. The procedure for obtaining the response data for this command is described below.

1. Disable the terminator detection function of the control interface.
2. Send :SYSTem:DISPlay:DATA?.
3. Read the first byte that follows "#" in the response data. It indicates the number of digits of the data size.
4. Read the bytes by the number of digits indicated. The bytes indicate the data size (byte).
5. Read the binary data of the indicated data size.
6. Read the terminator.
7. Enable the terminator detection function of the control interface.
8. Output the received binary data as-is to a file to create a screenshot image file.
3.3  Messages Corresponding to Common Operations

Example: For binary data of 2002 bytes

\#42002an%*qe4445+\... 

1. Read the first byte “4” that follows “#”. It indicates the data size is a four-digit number.
2. Read the four-digit string “2002” that follows “4”. It indicates the data size is 2002 bytes.
3. Disable the terminator detection function of the control interface.
4. Read the binary data of 2002 bytes.
5. Output the read binary data of 2002 bytes to a file, which is called a screenshot image file.
3.3.8 Specifying screen display

:DISPlay:ACTive

Function
This command activates the screen of the specified function.

Syntax
:DISPlay:ACTive <module_id>

Parameter

<module_id>
Refer to “:MODule:ID”.

Example of Use
To activate the PPG/ED Ch1 screen:
:DISP:ACT 1

Note:
The purpose of this command is only to activate the specified screen.
To specify the module you want to remotely control,
execute :MODule:ID.

:DISPlay:ACTive:ACResult

Function
Added in Version 4: This command displays all BER measurement results on the screen.

Syntax
:DISPlay:ACTive:ACResult

Example of Use
:DISP:ACT:ACR
3.4 Status Register

3.4.1 Clearing register

*CLS (Clear Status)

Function

This command clears the standard event status register and output queue.

Syntax

*CLS

Example of Use

*CLS

Notes:

*CLS common command clears the following registers.

- Standard event status register
- Output queue
  Therefore, bits 5 of status byte register becomes 0.

The setting value of each enable register does not vary depending on *CLS.

- Standard event status enable register
- Service request enable register
- Operation status register
- Device dependent status register

The *CLS common command clears the status byte register when sending *CLS command before the query after the program message terminator. All unread messages in the output queue are cleared at this time. An example is shown below.

SENS-BIT 8500000
*CLS; SENS-BIT?

When receiving SENS-BIT? after *CLS, the status byte register is cleared.
:STATus:PRESet

Function
This command initializes the event registers and transition filters of the operation status register and device dependent registers (PPG/ED/XFP/SFP+/Scope).

Syntax
:STATus:PRESet

Example of Use
:STAT:PRES

Note:
All bits in the event registers and negative transition filters are set to 0, and all bits in the positive transition filters are set to 1.
3.4.2 Status byte register

*STB? (Status Byte)

**Function**

This command queries the value of the status byte register.

**Syntax**

*STB?

**Response Data**

<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5 + bit6 + bit7

bit7 : 2^7 = 128 Operation status register
bit6 : 2^6 = 64 RQS service request
bit5 : 2^5 = 32 Standard event status register summary
bit4 : 2^4 = 16 MAV output queue
bit3 : 2^3 = 8 Not used
bit2 : 2^2 = 4 Error event queue
bit1 : 2^1 = 2 Not used
bit0 : 2^0 = 1 Not used

**Example of Use**

*STB?

>0
Chapter 3  Message List

*SRE (Service Request Enable)

Function
This command sets and queries the value of the service request enable register.

Syntax
*SRE <integer>
*SRE?

Parameter
<integer> = 0 to 255
The mask bits of the status byte register are set to 0.
The meanings of the bits are the same as those of *STB?.

Response Data
<integer>

Example of Use
The following example shows how to mask bits 7,6,3,1 and 0 and permit bits 5, 4, and 2.
*SRE 52
*SRE?
>52

Note:
When the target register is “Not used”, enabling the register is not required in this command.
3.4.3 Standard event status register
*ESR? (Standard Event Status Register)

Function
This command queries the value of the standard event status register.

Syntax
*ESR?

Response Data
<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5 + bit6 + bit7

- bit7: 2⁷ = 128 Power-on
- bit6: 2⁶ = 64 Not used
- bit5: 2⁵ = 32 Command error
- bit4: 2⁴ = 16 Operation error
- bit3: 2³ = 8 Device Dependent error
- bit2: 2² = 4 Not used
- bit1: 2¹ = 2 Not used
- bit0: 2⁰ = 1 Completion of operation

For more information about errors, refer to Appendix B “Error Codes”.
This value (sum of standard event status register, 0 to 255) is obtained by ANDing with 8 bits set by *ESE.

Example of Use
To query the value of the standard event status register at the time the operation error and command error have occurred:
*ESR?
>48

Note:
The standard event status register is cleared by executing *ESR?.
*ESE (Event Status Enable)

Function
This command sets and queries the value of the standard event status enable register.

Syntax
*ESE <integer>
*ESE?

Parameter
<integer> = 0 to 255
Set 0 to the standard event status register bit(s) when masking it (them). The meanings of the bits are the same as those of *ESR?.

Response Data
<integer>

Example of Use
To mask bits 4, 5, 6 and 7 and enable bits 0, 1, 2 and 3:
*ESE 15
*ESE?
>15

Note:
When the target register is “Not used”, enabling the register is not required in this command.
3.4.4 Operation status register

:STATus:OPERation:CONDition?

Function
This command queries the details of the operation status condition register.

Syntax
:STATus:OPERation:CONDition?

Response Data
<integer> = bit4 + bit11
bit4: $2^4 = 16$ Measurement (ED)
bit11: $2^{11} = 2048$ Pattern Setting (PPG/ED)

Example of Use
:STAT:OPER:COND?
>16

Note:
1 is not returned as the response data of bit11 because USER cannot be set at Test Pattern in MP2110A.

:STATus:OPERation[:EVENT]?

Function
This command queries the operation status event register.

Syntax
:STATus:OPERation[:EVENT]?

Response Data
<integer> = bit4 + bit11
The meanings of the bits are the same as those of :STATus:OPERation:CONDition?.

Example of Use
:STAT:OPER?
>16
:STAT:OPER:ENAB

Function
This command sets and queries the operation status enable register.

Syntax
:STAT:OPER:ENAB <integer>
:STAT:OPER:ENAB?

Parameter
<integer> = 0 to 65535
Specify the value for the bit(s) you want to enable.
The meanings of the bits are the same as those
of :STAT:OPER:COND?:.

Response Data
<integer>

Example of Use
To set only bit 4 of the operation status event register to be queried:
At this time, $2^4 = 16$ is set in the operation status enable register.
:STAT:OPER:ENAB 16
To query the value of the operation status enable register:
:STAT:OPER:ENAB?
>16

Note:
When the target register is “Not used”, enabling the register is not
required in this command.
:STATus:OPERation:NTRansition

Function
This command sets and queries the transition filter (negative transition) of the operation status register.

Syntax
:STATus:OPERation:NTRansition <integer>
:STATus:OPERation:NTRansition?

Parameter
<integer> = 0 to 65535
To set the event register to 1 when the condition register has changed from 1 to 0, set the bit to 1.
The meanings of the bits are the same as those of :STATus:OPERation:CONDition?.

Response Data
<integer>

Example of Use
To set bit 4 of operation status event register to bit 1 when bit 4 of operation status condition register changed from 1 to 0:
At this time, \(2^4 = 16\) is set to the transition filter (negative transition).
:STAT:OPER:NTR 16
To query transition filter (negative transition) of operation status register:
:STAT:OPER:NTR?
>16

Note:
When the target register is “Not used”, enabling the register is not required in this command.
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:STATus:OPERation:PTRansition

Function
This command sets and queries the transition filter (positive transition) of the operation status register.

Syntax
:STATus:OPERation:PTRansition <integer>
:STATus:OPERation:PTRansition?

Parameter
<integer> = 0 to 65535
If the event register is set to 1 when the condition register is changed from 0 to 1, the bit is set to 1.
The meanings of the bits are the same as those of :STATus:OPERation:CONDition?.

Response Data
<integer>

Example of Use
To set bit 11 of operation status event register to bit 1 when bit 11 of operation status condition register changes from 0 to 1:
At this time, $2^{11} = 2048$ is set in the transition filter (positive transition).
:STAT:OPER:PTR 2048
To query transition filter (positive transition) of operation status register:
:STAT:OPER:PTR?
>2048

Note:
When the target register is "Not used", enabling the register is not required in this command.
3.4.5 PPG/ED status register

:INSTrument:PE<ch>:RESet

Function
This command initializes the PPG/ED status event register.

Syntax
:INSTrument:PE<ch>:RESet

Parameter
<ch>
Channel number of PPG/ED
Range 1 to 4

Example of Use
:INST:PE1:RES

:INSTrument:PE<ch>:CONDition?

Function
This command queries the details of the PPG/ED condition register.

Syntax
:INSTrument:PE<ch>:CONDition?

Parameter
<ch>
Channel number of PPG/ED
Range 1 to 4

Response Data
<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5
bit5: 2^5 = 32 Omission Error
bit4: 2^4 = 16 Insertion Error
bit3: 2^3 = 8 CR Unlock
bit2: 2^2 = 4 Pattern Sync Loss
bit1: 2^1 = 2 Total Error
bit0: 2^0 = 1 PLL Unlock

Example of Use
:INST:PE1:COND?
>1
Note:
In MP2110A, 1 is not returned as the response data of bit3, bit4, and bit5.
In MP2100B, 1 is not returned as the response data of bit3.

:INSTrument:PE<ch>:EVENt?

Function
This command queries the details of the PPG/ED event register.

Syntax
:INSTrument:PE<ch>:EVENt?

Parameter
<ch>
Channel number of PPG/ED
Range 1 to 4

Response Data
<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5
The meanings of the bits are the same as those of :INSTrument:PE<ch>:CONDition?.

Example of Use
:INST:PE1?
>1
:**INSTrument:**PE<ch>:NTRansition

**Function**
This command sets and queries the transition filter (negative transition) of the PPG/ED status.

**Syntax**
:INSTrument:**PE<ch>:NTRansition <integer>
:INSTrument:**PE<ch>:NTRansition?

**Parameter**
<ch>
Channel number of PPG/ED
Range 1 to 4
<integer> = 0 to 65535
To set the event register to 1 when the condition register has changed from 1 to 0, set the bit to 1.
The meanings of the bits are the same as those of :INSTrument:**PE<ch>:CONDition?.

**Response Data**
<integer>

**Example of Use**
:INST:PE1:NTR 15
:INST:PE1:NTR?
>15

**Note:**
When the target register is “Not used”, enabling the register is not required in this command.
:INSTrument:PE<ch>:PTRansition

Function
This command sets and queries the transition filter (positive transition) of the PPG/ED status.

Syntax
:INSTrument:PE<ch>:PTRansition <integer>
:INSTrument:PE<ch>:PTRansition?

Parameter
<ch>
Channel number of PPG/ED
Range 1 to 4
<integer> = 0 to 65535
To set the event register to 1 when the condition register has changed from 0 to 1, set the bit to 1.
The meanings of the bits are the same as those of :INSTrument:PE<ch>:CONDition?.

Response Data
<integer>

Example of Use
:INST:PE1:PTR?
>3

Note:
When the target register is “Not used”, enabling the register is not required in this command.
3.4.6 Scope status register

:INSTrument:WAV:RESet

Function
This command initializes the Scope status event register.

Syntax
:INSTrument:WAV:RESet

Example of Use
:INST:WAV:RES

:INSTrument:WAV:CONDition?

Function
This command queries the details of the Scope status condition register.

Syntax
:INSTrument:WAV:CONDition?

Response Data
<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5 + bit6 + bit7 + bit8
bit8: 2^8 = 256 Not used
bit7: 2^7 = 128 CRU Unlock (Only in MP2110A)*1
bit6: 2^6 = 64 PT phase unlock (Only in MP2110A)*2
bit5: 2^5 = 32 Trigger setting wrong (Only in MP2110A)*3
bit4: 2^4 = 16 Free Running (Only in MP2110A)*4
bit3: 2^3 = 8 Not used
bit2: 2^2 = 4 CAL Alarm (Orange)*5
bit1: 2^1 = 2 CAL Alarm (Red)*6
bit0: 2^0 = 1 CAL Alarm (Yellow)*7

*1: Check the input signal to CRU In and the CRU setting on the Time dialog box. If something is wrong, correct the setting so that the Lock Status lamp is lit green.
*3: Set the frequency of input trigger clock to 0.1 to 15.0 GHz (2.4 GHz or above when Precision Trigger is On.).
*4: Check that the signal is input to the trigger clock input connector
Sampling Rate is changed by 3% or more. This may occur when Sampling Mode (Eye/Pulse/Coherent Eye) is changed, or Bit Rate or Pattern Length is changed in Pulse/Coherent Eye Mode.

*6: Execute CALibrate:AMPLitude. The temperature has a difference of ±5.0ºC or more from the previous calibration.

*7: Execute CALibrate:AMPLitude. The temperature has a difference of ±2.5ºC or more from the previous calibration.

Example of Use
::INST:WAV:COND?
>1

:INSTrument:WAV[:EVENt]?
Function
This command queries the details of the Scope status event register.

Syntax
::INSTrument:WAV:[EVENt]?

Response Data
<integer> = bit0 + bit1 + bit2 + bit3 + bit4 + bit5 + bit6 + bit7 + bit8
The meanings of the bits are the same as those of :INSTrument:WA V:CONDition?.

Example of Use
::INST:WAV?
>1

:INSTrument:WAV:NTRansition
Function
This command sets and queries the transition filter (negative transition) of the Scope status register.

Syntax
::INSTrument:WAV:NTRansition <integer>
::INSTrument:WAV:NTRansition?

Parameter
<integer> = 0 to 65535
To set the event register to 1 when the condition register has changed from 1 to 0, set the bit to 1.
The meanings of the bits are the same as those of :INSTrument:WA V:CONDition?.

3.4 Status Register

Response Data
<integer>

Example of Use
:INST:WAV:NTR?
>1

Note:
When the target register is “Not used”, enabling the register is not required in this command.

:INSTrument:WAV:PTRansition

Function
This command sets and queries the transition filter (positive transition) of the Scope status register.

Syntax
:INSTrument:WAV:PTRansition <integer>
:INSTrument:WAV:PTRansition?

Parameter
<integer> = 0 to 65535
If the event register is set to 1 when the condition register is changed from 0 to 1, the bit is set to 1.
The meanings of the bits are the same as those of :INSTrument:WAV:CONDition?.

Response Data
<integer>

Example of Use
:INST:WAV:PTR?
>3

Note:
When the target register is “Not used”, enabling the register is not required in this command.
3.4.7 XFP/SFP+ status register

:INSTrument:XSFP:RESet

**Function**
This command initializes the XFP/SFP+ status event register.

**Syntax**
:INSTrument:XSFP:RESet

:INSTrument:XSFP:CONDition?

**Function**
This command queries the condition register details on the XFP/SFP+ status register.

**Syntax**
:INSTrument:XSFP:CONDition?

**Response Data**
<integer> = bit0 + bit1
bit1: 2^1 = 2    LOS
bit0: 2^0 = 1    Ready

**Example of Use**
:INST:XSFP:COND?
>0

:INSTrument:XSFP[:EVENt]?

**Function**
This command queries the details on the XFP/SFP+ status event register.

**Syntax**
:INSTrument:XSFP[:EVENt]?

**Response Data**
<integer> = bit0 + bit1
The meanings of the bits are the same as those of :INSTrument:XSFP:CONDition?.

**Example of Use**
:INST:XSFP?
>0
:INSTRument:XSFP:NTRansition

Function
This command sets and queries the transition filter (negative transition) of the XFP/SFP+ status.

Syntax
:INSTRument:XSFP:NTRansition <integer>
:INSTRument:XSFP:NTRansition?

Parameter
<integer> = 0 to 65535
To set the event register to 1 when the condition register has changed from 1 to 0, set the bit to 1.
The meanings of the bits are the same as those of :INSTRument:XSFP:CONDition?.

Response Data
<integer>

Example of Use
:INST:XSFP:NTR?
>3

Note:
When the target register is “Not used”, enabling the register is not required in this command.
:INSTRument:XSFP:PTRansition

Function
This command sets and queries the transition filter (positive transition) of the XFP/SFP+ status.

Syntax
:INSTRument:XSFP:PTRansition <integer>
:INSTRument:XSFP:PTRansition?

Parameter
<integer> = 0 to 65535
If the event register is set to 1 when the condition register is changed from 0 to 1, the bit is set to 1.
The meanings of the bits are the same as those of :INSTRument:XSFP:CONDition?.

Response Data
<integer>

Example of Use
:INST:XSFP:PTR?
>3

Note:
When the target register is “Not used”, enabling the register is not required in this command.
3.4.8 Register operation without dependence on module

*OPC (Operation Complete)

**Function**

*OPC* sets bit 0 of the standard event status register to be changed from 0 to 1 when execution of the message being processed has been completed. *OPC? queries OPC bit value. OPC bit is “0” while the message is being processed and “1” when the processing is completed.

When one of the following happens, the operation completion waiting by *OPC* and *OPC?* become invalid.

- Power is turned on.
- DCL or SCL has been received on IEEE488.1 interface.
- *CLS* command is received.
- *RST* command is received.
- All running processes have been completed.

**Syntax**

*OPC

*OPC?

---

**Response Data**

1

---

**Example of Use**

*OPC?

>1

**Note:**

For the BERTWave, the response data for *OPC?* is always 1.

Each of all the messages, including *OPC?*, for the BERTWave cannot be executed, unless the previously sent message has been completed. Therefore, the response data for *OPC?* is always 1 (Operation Complete).

---

*WAI (Wait to Continue)

**Function**

This command holds execution of the next message until processing of the message sent before *WAI* is completed.

**Syntax**

*WAI
Example of Use
*WAI

Note:
It is not required to use *WAI, because the BERTWave sends a
message after completing the processing of the previous message.

:SOURce:OUTPut:ASET
Function
This command sets and queries the On/Off state of signal outputting from
all PPG channels and optical outputting from XFP/SFP+.

Syntax
:SOURce:OUTPut:ASET <enable>
:SOURce:OUTPut:ASET?

Parameter
0|OFF
1|ON

Response Data
0|1
0  All outputting (PPG/Optical) Off
1  At least one outputting (PPG/Optical) On

Example of Use
:SOUR:OUTP:ASET ON
:SOUR:OUTP:ASET?
>1

*TRG (Trigger)
Function
This command triggers the measurement for all modules (all ED channels
and Scope).

Syntax
*TRG

Example of Use
*TRG
:SENSe:MEASure:ASTP

Function
This command stops the measurement for all modules (all ED channels and Scope).

Syntax
:SENSe:MEASure:ASTP

Example of Use
:SENSe:MEASure:ASTP

:SENSe:MEASure:ASTate?

Function
This command queries the measurement status for all modules (all ED channels and Scope).

Syntax
:SENSe:MEASure:ASTate?

Response Data
0 | 1
0  | Measurement stops for all modules.
1  | At least one module, measurement in progress

Example of Use
:SENSe:MEASure:AST?
>0
3.5 Specifying Module and Channel

There are two methods of specifying one of the function menu items of BERTWave, by using remote commands.

3.5.1 Specifying with command

This section describes the method of specifying a function menu item, by using the :MODule:ID command.

The commands sent after the :MODule:ID command will control items on the specified function menu.

:MODule:ID

Function
This command sets and queries the module that is subject to remote control.

Syntax
:MODule:ID <module_id>
:MODule:ID?

Parameter

<module_id> = {1|2|3|4|5|6|7|8|9}

Function menu items
1  PPG/ED Ch1
2  PPG/ED Ch2
3  XFP/SFP+
4  O/E
5  EYE/Pulse Scope
6  Jitter Analysis
7  Transmission Analysis
8  PPG/ED Ch3
9  PPG/ED Ch4

Response Data

<module_id>

Example of Use

To start/stop ED Ch1 measurement:
:MOD:ID 1
:SENSe:MEASure:STARt
:SENSe:MEASure:STOP

To start ED Ch3 measurement:
:MOD:ID 8
:SENSe:MEASure:STARt
3.5 Specifying Module and Channel

To start Scope measurement:
:MOD:ID 5
:SAMPling:STATus RUN
To query the module ID:
:MOD:ID?
>5

**Notes:**
- The IDs for Ch3 and Ch4 of PPG/ED are respectively 8 and 9, not 3 and 4.
- In MP2110A, when O/E(4) is specified, Scope(5) is specified.
- If the ID is not specified correctly, an Undefined Header error occurs.

### 3.5.2 Specifying in header (Added in Version 3.02)

This section describes the method of specifying a function menu item, by adding a keyword for module/channel at the beginning of the header. It is not required to send the :MODule:ID command described in 3.5.1 “Specifying with command”.

<table>
<thead>
<tr>
<th>Key Word</th>
<th>Function Menu Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>:BERT[ch]</td>
<td>PPG/ED Ch1 to Ch 4</td>
</tr>
<tr>
<td></td>
<td>When nothing is specified at &lt;ch&gt;, Ch1 is specified.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>To start the ED channel 1 measurement:</td>
</tr>
<tr>
<td></td>
<td>:BERT:SENSe:MEASure:STA rtED</td>
</tr>
<tr>
<td></td>
<td>To start the channel 3 measurement:</td>
</tr>
<tr>
<td></td>
<td>:BERT3:SENSe:MEASure:STARt</td>
</tr>
<tr>
<td>:PMODule</td>
<td>XFP/SFP+ (Pluggable Module)</td>
</tr>
<tr>
<td>:OE</td>
<td>O/E</td>
</tr>
<tr>
<td></td>
<td>In MP2110A, when :OE is specified, a command is sent to Scope.</td>
</tr>
<tr>
<td>:SCOPe</td>
<td>Scope</td>
</tr>
<tr>
<td></td>
<td>Example: To start the Scope measurement:</td>
</tr>
<tr>
<td></td>
<td>‘SCOPe:SAMPling:STATus RUN</td>
</tr>
<tr>
<td>:JITTER</td>
<td>Jitter Analysis (MX210001A)</td>
</tr>
<tr>
<td></td>
<td>Do not describe “SENSe” that is the beginning of the command.</td>
</tr>
<tr>
<td></td>
<td>Example: :JITTER:GRAPh:ESTimate:RJPJ</td>
</tr>
<tr>
<td>:VNA</td>
<td>Transmission Analysis (MX210002A)</td>
</tr>
<tr>
<td></td>
<td>Do not describe “SENSe” that is the beginning of the command.</td>
</tr>
<tr>
<td></td>
<td>Example: :VNA:WE:SIGNal:SOURce</td>
</tr>
</tbody>
</table>

**Notes:**
- The above keywords cannot be used in native commands.
- This method is not available if the compatibility with the version 3.02 or earlier is required.
3.6 BERT(PPG/ED) Messages

3.6.1 Window Operation

:DISPlay:RESult

Function

*Only in MP2110A:* This command sets and queries switching the Setup and Result panels of the BERT.

Syntax

:DISPlay:RESult <enable>

:DISPlay:RESult?

Parameter

<table>
<thead>
<tr>
<th>0</th>
<th>OFF</th>
<th>Setup panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON</td>
<td>Result panel</td>
</tr>
</tbody>
</table>

Response Data

0|1

Example of Use

To switch the panel of the BERT to the Result panel.

:DISP:RES 1

:DISP:RES?

>1
3.6.2 Clock Input

:OUTPut:RCLock

Function

Added in Version 4: This command sets and queries the Reference CLK for PPG/ED.

Syntax

:OUTPut:RCLock INT|EXT10M|EXT1_16|EXT1_40|CH1
:OUTPut:RCLock?

Parameter

In MP210xA and MP2100B:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>Internal 10MHz</td>
</tr>
<tr>
<td>EXT10M</td>
<td>10MHz In</td>
</tr>
<tr>
<td>EXT1_16</td>
<td>Ext 1/16 In</td>
</tr>
<tr>
<td>CH1</td>
<td>Dependent on the Reference CLK for PPG1 (Available if the remote control target is Ch2.)</td>
</tr>
</tbody>
</table>

In MP2110A:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>Internal 10MHz</td>
</tr>
<tr>
<td>EXT1_16</td>
<td>Ext 1/16 In (When the Option 093 is installed)</td>
</tr>
<tr>
<td>EXT1_40</td>
<td>Ext 1/40 In</td>
</tr>
</tbody>
</table>

Response Data

INT|EXT10M|EXT1_16|EXT1_40|CH1

Example of Use

:OUTP:RCL INT
:OUTP:RCL?
>INT

Note:

In MP210xA and MP2100B:
When Ch3 or Ch4 is selected at :MODule:ID, a setting error (–220 Parameter error) occurs because the clocks for Ch3 and Ch4 are dependent on the clocks for Ch1 and Ch2.
In MP2110A:
The setting can be changed regardless of the channel selection status.
When External is set, the settings using “:OUTPut:BITRate:STANdard” and “:OUTPut:BITRate:OFFSet” are ignored and an error (–220 Parameter error) occurs.
Chapter 3 Message List

:OUTPut:RCLock:SELect

Function

Only in MP210xA and MP2100B: This command is compatible with version 4 or later, and sets and queries which clock (internal or external) is used as Reference CLK.

Syntax

:OUTPut:RCLock:SELect
INTernal|EXTernal|CH1External|CH2External|SYNChronize

:OUTPut:RCLock:SELect?

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTernal</td>
<td>Ch1/2: Internal clock</td>
</tr>
<tr>
<td>EXTernal</td>
<td>Ch1/2: External clock</td>
</tr>
<tr>
<td>CH1External</td>
<td>Ch1: External clock, Ch2: Internal clock</td>
</tr>
<tr>
<td>CH2External</td>
<td>Ch1: Internal clock, Ch2: External clock</td>
</tr>
<tr>
<td>SYNChronize</td>
<td>Ch1: Internal clock, Ch2: Dependent on Reference CLK for PPG1</td>
</tr>
</tbody>
</table>

Response Data

INT|EXT|CH1E|CH2E|SYNC

Example of Use

:OUTP:RCL:SEL INT
:OUTP:RCL:SEL?
>INT

Notes:

- In MP210xA, SYNChronize is available only when the Option 052 is installed. (In MP2100B, it is available even when the Option 052 is not installed.)

- When Ch3 or Ch4 is selected at :MODule:ID, a setting error (~220 Parameter error) occurs because the clocks for Ch3 and Ch4 are dependent on the clocks for Ch1 and Ch2.

- When this command is used in MP2110A, an error (~113 Undefined Header) occurs because MP2110A does not support this command.
3.6  BERT(PPG/ED) Messages

:OUTPut:CMU:EXTClock
Function
*Only in MP210xA and MP2100B:* This command is compatible with version 4 or later, and sets and queries the connector to input Reference CLK when the external clock is used as Reference CLK.

Syntax
:OUTPut:CMU:EXTClock 10M|1_16
:OUTPut:CMU:EXTClock?

Parameter
10M  Ext 10MHz In
1_16  Ext 1/16 In

Response Data
10M|1_16

Example of Use
To set the Ext Clk In connector for inputting an external clock:
:OUTP:CMU:EXTC 1_16
:OUTP:CMU:EXTC?
>1_16

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.

:OUTPut:RCLock:STATus?
Function
*Only in MP2100B and MP2110A:* This command queries the state of the Reference CLK status indicator.

Syntax
:OUTPut:RCLock:STATUs?

Response Data
NONE  Reference clock was not detected.
NOT_READY  Reference clock was detected but is not synchronized with pattern data.
READY  Reference clock is synchronized with pattern data.

Example of Use
:OUTP:RCL:STAT?
>READY
:OUTPut:RCLock:APPLy

Function

*Only in MP2100B and MP2110A:* This command starts synchronization of the input clock when the external clock is used as Reference CLK. This command is available when the response to :OUTPut:RCLock:STATus? is NOT READY.

Syntax

:OUTPut:RCLock:APPLy

Example of Use

:OUTP:RCL:STAT?
>NOT READY
:OUTP:RCL:APPL

Notes:

- In MP2100B:
  When Ch3 or Ch4 is selected at :MODule:ID, a setting error (–220 Parameter error) occurs because the clocks for Ch3 and Ch4 are dependent on the clocks for Ch1 and Ch2.
  In MP2110A:
  The setting can be changed regardless of the channel selection status.

- When Internal is selected at “OUTPut:RCLock”, the setting using the command is ignored and an error (–310,"System error") occurs.
3.6.3 Clock Output

:OUTPut:CLOCK:SOURce:CHANnel

Function

Only in MP2110A: This command sets and queries the clock source of the clock that is output to the Clock Output connector.

Syntax

:OUTPut:CLOCK:SOURce:CHANnel 1|3
:OUTPut:CLOCK:SOURce:CHANnel?

Parameter

To set the clock source to Ch1/2: 1
To set the clock source to Ch3/4: 3

Response Data

1|3

Example of Use

To set the clock source to Ch1/2:
:OUTP:CLOC:SOUR:CHAN 1
:OUTP:CLOC:SOUR:CHAN?
>1

Note:

This command can be set only when the Option 014 is installed. When this command is executed while the Option 014 is not installed, an error (~113 Undefined Header) occurs.

:OUTPut:CLOCK:DIVRate?

Function

Only in MP2110A: This command queries the division rate (for operating bit rate) of the clock that is output to the Clock Output connector.

Syntax

:OUTPut:CLOCK:DIVRate?

Response Data

1_2|1_4|OFF
1_2 1/2
1_4 1/4

Example of Use

To query the division rate of the clock that is output to the Clock Output connector:
Chapter 3  Message List

:OUTP:CLOC:DIVR?
>1_2

:OUTPut:SYNC:SOURce
Function
This command sets and queries the signal source to be output to the Sync Out connector.

Syntax
:OUTPut:SYNC:SOURce <character>
:OUTPut:SYNC:SOURce?

Parameter
<br> <character>
In MP210xA and MP2100B:
For PPG Pattern Sync: PPG{1|2|3|4}PATT
When using PPG as the signal source: PPG{1|2}CLOC{1|2|4|8|16|64}
When using ED as the signal source: ED{1|2|3|4}CLOC{4|8|16}

In MP2110A:
For PPG Pattern Sync: PPG{1|2|3|4}PATT
When using PPG as the signal source: PPGCLOC{8|16|40}

Response Data
<br> <character>

Example of Use
To set the 1/16 divided clock that synchronizes with the data output from PPG1, as the signal to be output to the Sync Out connector:
:OUTP:SYNC:SOUR PPG1CLOC16
:OUTP:SYNC:SOUR?
>PPG1CLOC16
3.6.4 Tracking Setting

:BERT:ALL:PARam:TRACking

Function

*Added in Version 4:* This command sets and queries the On/Off state of Ch Tracking.

Syntax

:BERT:ALL:PARam:TRACking <enable>

:BERT:ALL:PARam:TRACking?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:BERT:ALL:PAR:TRAC ON
:BERT:ALL:PAR:TRAC?

>1

Notes:

- In MP210xA and MP2100B:
  When Ch Tracking is set to On and a channel other than Ch1 is set at Reference CLK of PPG2, an error (–220 Parameter error) occurs.
  In MP2110A:
  The setting can be changed regardless of the Ch Tracking status.

- If Ch Tracking is set to On, ED Tracking is set to On as well.
**:SENSe:PARam:TRACking**

**Function**
This command sets and queries the On/Off state of ED Tracking.

**Syntax**
:SENSe:PARam:TRACking <enable>
:SENSe:PARam:TRACking?

**Parameter**
0|OFF
1|ON

**Response Data**
0|1

**Example of Use**
:SENS:PAR:TRAC ON
:SENS:PAR:TRAC?
>1
3.6.5 Bit Rate Setting

:OUTPut:BITRate:STANdard

Function
This command sets and queries the bit rate standard for the PPG.

Syntax
:OUTPut:BITRate:STANdard <bitrate_standard>
:OUTPut:BITRate:STANdard?

Parameter
<bitrate_standard> = <string>
The following strings can be used for <bitrate_standard>.

<table>
<thead>
<tr>
<th>&lt;string&gt;</th>
<th>Standard</th>
<th>Bit Rate (bit/s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE&quot;</td>
<td>Variable-1/1</td>
<td>6.25G to 12.5G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_FC_FEC&quot;</td>
<td>10GFC FEC</td>
<td>11.3168G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_OTU2E&quot;</td>
<td>OTU2e (10GbE FEC)</td>
<td>11.095728G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_OTU1E&quot;</td>
<td>OTU1e (10GbE FEC)</td>
<td>11.049107G</td>
<td></td>
</tr>
<tr>
<td>&quot;OTU-2&quot;</td>
<td>OTU2</td>
<td>10.709225G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-192FEC&quot;</td>
<td>G.975 FEC</td>
<td>10.664228G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_FC&quot;</td>
<td>10GFC</td>
<td>10.51875G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_LAN&quot;</td>
<td>10GbE LAN/PHY</td>
<td>10.3125G</td>
<td></td>
</tr>
<tr>
<td>&quot;INF10G&quot;</td>
<td>InfiniBand x4</td>
<td>10G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-192&quot;</td>
<td>OC-192/STM-64</td>
<td>9.95328G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_WAN&quot;</td>
<td>10GbE WAN/PHY</td>
<td>9.95328G</td>
<td></td>
</tr>
<tr>
<td>&quot;8G_FC&quot;</td>
<td>8GFC</td>
<td>8.5G</td>
<td></td>
</tr>
<tr>
<td>&quot;VARIABLE-1/2&quot;</td>
<td>Variable-1/2</td>
<td>6.25G to 3.125G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-10&quot;</td>
<td>CPRI x10</td>
<td>6.144G</td>
<td>*2</td>
</tr>
<tr>
<td>&quot;OBSAIRP3-8&quot;</td>
<td>OBSAI RP3 x8</td>
<td>6.144G</td>
<td>*2</td>
</tr>
<tr>
<td>&quot;INF5G&quot;</td>
<td>InfiniBand x2</td>
<td>5G</td>
<td></td>
</tr>
<tr>
<td>&quot;4G_FC&quot;</td>
<td>4GFC</td>
<td>4.25G</td>
<td></td>
</tr>
<tr>
<td>&quot;VARIABLE-1/4&quot;</td>
<td>Variable-1/4</td>
<td>3.125G to 1.5625G</td>
<td>*1</td>
</tr>
<tr>
<td>&quot;CPRI-5&quot;</td>
<td>CPRI x5</td>
<td>3.072G</td>
<td>*1,*2</td>
</tr>
<tr>
<td>&quot;OBSAIRP3-4&quot;</td>
<td>OBSAI RP3 x4</td>
<td>3.072G</td>
<td>*1,*2</td>
</tr>
<tr>
<td>&quot;OTU-1&quot;</td>
<td>OTU1</td>
<td>2.666057G</td>
<td>*1</td>
</tr>
<tr>
<td>&quot;2GBE&quot;</td>
<td>2GbE</td>
<td>2.5G</td>
<td>*1</td>
</tr>
<tr>
<td>&quot;INF&quot;</td>
<td>InfiniBand</td>
<td>2.5G</td>
<td>*1</td>
</tr>
<tr>
<td>&quot;OC-48&quot;</td>
<td>OC-48/STM16</td>
<td>2.488G</td>
<td>*1</td>
</tr>
</tbody>
</table>

*1: When the Option 090 is installed, the bit rate that is equal to or less than Variable-1/4 can be selected for the ED.

*2: When the Option 090/092 is installed, the bit rate can be selected.
### Table 3.6.5-1  Bit Rate Standards (MP210xA, MP2100B) (Cont’d)

<table>
<thead>
<tr>
<th>Standard</th>
<th>Bit Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;CPRI-4&quot;</td>
<td>CPRI x4</td>
<td>2.4576G</td>
</tr>
<tr>
<td>&quot;2G_FC&quot;</td>
<td>2GFC</td>
<td>2.125G</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/8&quot;</td>
<td>Variable-1/8</td>
<td>1.5625G</td>
</tr>
<tr>
<td>&quot;OBSAIRP3-2&quot;</td>
<td>OBSAI RP3 x2</td>
<td>1.536G</td>
</tr>
<tr>
<td>&quot;1GBE&quot;</td>
<td>1GbE</td>
<td>1.25G</td>
</tr>
<tr>
<td>&quot;OC-24&quot;</td>
<td>OC-24</td>
<td>1.244G</td>
</tr>
<tr>
<td>&quot;CPRI-2&quot;</td>
<td>CPRI x2</td>
<td>1.2288G</td>
</tr>
<tr>
<td>&quot;1G_FC&quot;</td>
<td>1GFC</td>
<td>1.0625G</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/16&quot;</td>
<td>Variable-1/16</td>
<td>781.25M to 390.625M</td>
</tr>
<tr>
<td>&quot;OBSAIRP3&quot;</td>
<td>OBSAI RP3</td>
<td>768M</td>
</tr>
<tr>
<td>&quot;OC-12&quot;</td>
<td>OC-12/STM-4</td>
<td>622.08M</td>
</tr>
<tr>
<td>&quot;CPRI&quot;</td>
<td>CPRI</td>
<td>614.4M</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/32&quot;</td>
<td>Variable-1/32</td>
<td>390.625M to 195.312M</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/64&quot;</td>
<td>Variable-1/64</td>
<td>195.312M to 125M</td>
</tr>
<tr>
<td>&quot;OC-3&quot;</td>
<td>OC-3/STM-1</td>
<td>155.22M</td>
</tr>
</tbody>
</table>

### Table 3.6.5-2  Bit Rate Standards (MP2110A)

<table>
<thead>
<tr>
<th>Standard</th>
<th>Bit Rate (bit/s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE&quot;</td>
<td>Variable(24.3-28.2G)</td>
<td>24.3 to 28.2G</td>
</tr>
<tr>
<td>&quot;32G_FC&quot;</td>
<td>32GFC</td>
<td>28.05G</td>
</tr>
<tr>
<td>&quot;OTU-4&quot;</td>
<td>OTU4</td>
<td>27.952493G</td>
</tr>
<tr>
<td>&quot;100GE_4_FEC&quot;</td>
<td>100GbE/4 FEC</td>
<td>27.7393G</td>
</tr>
<tr>
<td>&quot;100GE_4&quot;</td>
<td>100GbE/4</td>
<td>25.78125G</td>
</tr>
<tr>
<td>&quot;INF_EDR&quot;</td>
<td>InfiniBand EDR</td>
<td>25.78125G</td>
</tr>
<tr>
<td>&quot;INF_FDR&quot;</td>
<td>InfiniBand FDR</td>
<td>25.78125G</td>
</tr>
<tr>
<td>&quot;VARIABLE10G&quot;</td>
<td>Variable (9.5-14.2G)</td>
<td>9.5 to 14.2G</td>
</tr>
<tr>
<td>&quot;16G_FC&quot;</td>
<td>16GFC</td>
<td>14.025G</td>
</tr>
<tr>
<td>&quot;10G_FC_FEC&quot;</td>
<td>10GFC FEC</td>
<td>11.3168G</td>
</tr>
<tr>
<td>&quot;10G_OTU2E&quot;</td>
<td>OTU2e (10GbE FEC)</td>
<td>11.095728G</td>
</tr>
<tr>
<td>&quot;10G_OTU1E&quot;</td>
<td>OTU1e (10GbE FEC)</td>
<td>11.049107G</td>
</tr>
<tr>
<td>&quot;OTU-2&quot;</td>
<td>OTU2</td>
<td>10.709225G</td>
</tr>
<tr>
<td>&quot;OC-192FEC&quot;</td>
<td>G.975 FEC</td>
<td>10.664228G</td>
</tr>
<tr>
<td>&quot;10G_FC&quot;</td>
<td>10GFC</td>
<td>10.51875G</td>
</tr>
<tr>
<td>&quot;10G_LAN&quot;</td>
<td>10GbE LAN/PHY</td>
<td>10.3125G</td>
</tr>
<tr>
<td>&quot;INF10G&quot;</td>
<td>InfiniBand x4</td>
<td>10G</td>
</tr>
<tr>
<td>&quot;OC-192&quot;</td>
<td>OC-192/STM-64</td>
<td>9.95328G</td>
</tr>
<tr>
<td>&quot;10G_WAN&quot;</td>
<td>10GbE WAN/PHY</td>
<td>9.95328G</td>
</tr>
</tbody>
</table>

*: This can be selected when the Option 093 is installed.
Response Data

<bitrate_standard> = <string>

Example of Use

:OUTP:BITR:STAN "10G_LAN"
:OUTP:BITR:STAN? >"10G_LAN"

Notes:

- *Added in Version 4:*
  
  In MP210xA and MP2100B:
  When bit rates are set to Ch3 and Ch4 using this command, a setting error (-220 Parameter error) occurs because the bit rates for Ch3 and Ch4 are dependent on the bit rates for Ch1 and Ch2.
  In MP2110A:
  The bit rate setting can be changed regardless of the selected channel.

- When External is set at Reference CLK, an error (-220 Parameter error) occurs.
:INPut:BITRate:STANdard

**Function**
This command is compatible with version 4 or later, and sets and queries the bit rate standard for the ED.

**Syntax**
:INPut:BITRate:STANdard <bitrate_standard>
:INPut:BITRate:STANdard?

**Parameter**
<bitrate_standard>
Refer to Parameter of “:OUTPut:BITRate:STANdard”.

**Response Data**
<bitrate_standard>

**Example of Use**
:INP:BITR:STAN "10G_LAN"
:INP:BITR:STAN?
>"10G_LAN"

**Notes:**
- *Modified in Version 4:*
  In MP2100B:
  When this command is executed, a setting error (–220 Parameter error) occurs because the bit rate of ED is dependent on the bit rate of PPG.
  In MP2110A:
  The bit rates of PPG and ED are common, so the bit rates can be set without error.
- When External is set at Reference CLK, an error (–220 Parameter error) occurs.
3.6 BERT(PPG/ED) Messages

:OUTPut:BITRate

**Function**
This command sets and queries the bit rate of the PPG if the bit rate standard is Variable.

**Syntax**
:OUTPut:BITRate <bitrate>
:OUTPut:BITRate?

**Parameter**

<bitrate> = <numeric>

The setting ranges are limited as follows depending on the options (unit: 1 kbit/s steps).

<table>
<thead>
<tr>
<th>&lt;bitrate&gt;</th>
<th>When the Option 092 is installed (kbit/s)</th>
<th>When the Option 090 is installed (kbit/s)</th>
<th>When the Option 090 and 092 are not installed (kbit/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE&quot;</td>
<td>6250001 to 12500000</td>
<td>8000000 to 12500000</td>
<td>8500000 to 11320000</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/2&quot;</td>
<td>3125001 to 6250000</td>
<td>4000000 to 6250000</td>
<td>4250000 to 5660000</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/4&quot;</td>
<td>1562501 to 3125000</td>
<td>2000000 to 3125000</td>
<td>2125000 to 2830000</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/8&quot;</td>
<td>781251 to 1562500</td>
<td>1000000 to 1562500</td>
<td>1062500 to 1415000</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/16&quot;</td>
<td>390626 to 781250</td>
<td>500000 to 781250</td>
<td>531250 to 70750</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/32&quot;</td>
<td>195313 to 390625</td>
<td>250000 to 390625</td>
<td>265625 to 353750</td>
</tr>
<tr>
<td>&quot;VARIABLE-1/64&quot;</td>
<td>125000 to 195312</td>
<td>125000 to 195312</td>
<td>132813 to 176875</td>
</tr>
</tbody>
</table>

In MP2110A:

<table>
<thead>
<tr>
<th>&lt;bitrate&gt;</th>
<th>Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE&quot;</td>
<td>24300000 to 28200000</td>
</tr>
<tr>
<td>&quot;VARIABLE10G&quot;</td>
<td>9500000 to 14200000 (When the Option 093 is installed)</td>
</tr>
</tbody>
</table>

**Response Data**

<bitrate> = <numeric>

**Example of Use**

:OUTP:BITR:STAN "VARIABLE"
:OUTP:BITR 8500000
:OUTP:BITR?
>8500000

**Notes:**

- In MP2100B of Version 4.
When bit rates are set to Ch3 and Ch4 using this command, a setting error (–220 Parameter error) occurs because the bit rates for Ch3 and Ch4 are dependent on the bit rates for Ch1 and Ch2. In MP2110A:
The bit rate setting can be changed regardless of the selected channel.

- In MP2100B and MP2110A:
  <bitrate_standard> is automatically changed depending on the specified bit rate only when <bitrate_standard> is Variable.

- When External is set at Reference CLK, a setting error (–220 Parameter error) occurs.

**:INPut:BITRate**

**Function**
This command is compatible with version 4 or later, and sets and queries the bit rate of the ED if the bit rate standard is Variable.

**Syntax**
**:INPut:BITRate <bitrate>**
**:INPut:BITRate?**

**Parameter**

<bitrate> = <numeric>

**Response Data**

<bitrate> = <integer>

**Example of Use**
**:INP:BITR:STAN "VARIABLE"**
**:INP:BITR 8500000**
**:INP:BITR?**
>8500000

**Notes:**
- **Modified in Version 4:**
  In MP2100B:
  When this command is executed, an error (–220 Parameter error) occurs because the bit rate of ED is dependent on the bit rate of PPG.

- In MP2110A:
  The bit rates of PPG and ED are common, so the bit rates can be set without error.
:OUTPut:BITRate:OFFSet

Function
This command sets and queries the bit rate offset for the PPG.

Syntax
:OUTPut:BITRate:OFFSet <numeric>
:OUTPut:BITRate:OFFSet?

Parameter
<numeric>
Range –100 to 100, 1 ppm step

Response Data
<integer>

Example of Use
:OUTP:BITR:OFFS 100
:OUTP:BITR:OFFS?
>100

Notes:

- In MP210xA and MP2100B:
  When Ch3 or Ch4 is selected at :MODule:ID and this command is used, a setting error (–220 Parameter error) occurs because the bit rates for Ch3 and Ch4 are dependent on the bit rates for Ch1 and Ch2.
  In MP2110A:
  The setting can be changed regardless of the selected channel.

- When External is set at Reference CLK, a setting error (–220 Parameter error) occurs.
Function

*Only in MP210xA and MP2100B:* This command sets and queries the clock divide ratio (1/n) of the PPG.

Syntax

:OUTPut:BITRate:DIVRate <character>

:OUTPut:BITRate:DIVRate?

Parameter

<character>

1_{1|2|4|8|16|32|64}

Response Data

1_{1|2|4|8|16|32|64}

Example of Use

To set the clock divide ratio of the PPG to 1/2:

:OUTP:BITR:DIVR 1_2

:OUTP:BITR:DIVR?

>1_2

Notes:

- This command is executed when the Reference CLK is Ext 1/16 In.

- When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
:INPut:BITRate:DIVRate?

Function

*Only in MP210xA and MP2100B:* This command queries the clock divide ratio (1/n) of the error detector.

Syntax

:INPut:BITRate:DIVRate?

Response Data

1_{1|2|4|8|16|32|64}

Example of Use

:INP:BITR:DIVR?
>1_2

*Note:* When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
3.6.6 Test Pattern Setting

:SOURce:PATTern:TYPE

Function
This command sets and queries the test pattern of the PPG.

Syntax
:SOURce:PATTern:TYPE <character>
:SOURce:PATTern:TYPE?

Parameter
In MP210xA and MP2100B:
<character> = PRBS{7|9|15|23|31}|USER

In MP2110A:
<character> = PRBS{7|9|15|23|31}|CLOC{2|16}

Response Data
PRBS{7|9|15|23|31}|CLOC{2|16}|USER

Example of Use
To set the test pattern of the PPG to PRBS2^23–1:
:SOUR:PATT:TYPE PRBS23
:SOUR:PATT:TYPE?
>PRBS23

To set the test pattern of the PPG to 1/2 Clock Pattern:
:SOUR:PATT:TYPE CLOC2
:SOUR:PATT:TYPE?
>CLOC2

To set the test pattern of the PPG to Programmable Pattern:
:SOUR:PATT:TYPE USER
:SOUR:PATT:TYPE?
>USER
:SENSe:PATTern:TYPE

Function
This command sets and queries the test pattern of the ED.

Syntax
:SENSe:PATTern:TYPE <character>
:SENSe:PATTern:TYPE?

Parameter
In MP210xA and MP2100B:
<character> = PRBS{7|9|15|23|31}|USER

In MP2110A:
<character> = PRBS{7|9|15|23|31}

Response Data
PRBS{7|9|15|23|31}|USER

Example of Use
To set the test pattern of the ED to PRBS2^23–1:
:SENSe:PATT:TYPE PRBS23
:SENSe:PATT:TYPE?
>PRBS23
To set the test pattern of the ED to Programmable Pattern:
:SENSe:PATT:TYPE USER
:SENSe:PATT:TYPE?
>USER

Note:
Parameters that can be set in MP2110A differ from parameters
that can be set in MP210xA and MP2100B.
When Ch Tracking is set to On:
In MP210xA and MP2100B:
When Ch3 or Ch4 is selected at :MODule:ID, a setting error (–220
Parameter error) occurs because the clocks for Ch3 and Ch4 are
dependent on the clocks for Ch1 and Ch2.
In MP2110A:
The setting can be changed regardless of the channel selection
status.
When ED Tracking is set to On, a setting error occurs.
**:SOURce:PATTern:LOGic**

**Function**
This command sets and queries the test pattern logic (positive/negative logic) of the PPG.

**Syntax**
:SOURce:PATTern:LOGic POSitive|NEGative
:SOURce:PATTern:LOGic?

**Parameter**
POSitive|NEGative

**Response Data**
POS|NEG

**Example of Use**
:SOUR:PATT:LOG POS
:SOUR:PATT:LOG?
>POS

**Note:**
When the test pattern for PPG is not PRBS, the setting using this command is ignored and an error (-220,"Parameter error") occurs.

**:SENSe:PATTern:LOGic**

**Function**
This command sets and queries the test pattern logic (negative/positive logic) of the ED.

**Syntax**
:SENSe:PATTern:LOGic POSitive|NEGative
:SENSe:PATTern:LOGic?

**Parameter**
POSitive|NEGative

**Response Data**
POS|NEG

**Example of Use**
:SENS:PATT:LOG POS
:SENS:PATT:LOG?
>POS
3.6 BERT(PPG/ED) Messages

Note:
When the test pattern for ED is not PRBS, the setting using this command is ignored and an error (–220,"Parameter error") occurs.

:SOURce:MMEMory:PATTern:RECall
Function
*Only in MP210xA and MP2100B:* This command sets the programmable pattern file for the PPG.

Syntax
:SOURce:MMEMory:PATTern:RECall <file_name>,{BIN|TXT}

Parameter

<file_name>
Name of pattern file in the following folder (including file extension)
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Pattern

BIN|TXT
BIN Binary file
TXT Text file

Example of Use
:SOUR:PATT:TYPE USER
:SOUR:MMEM:PATT:REC "10101010.dat",BIN

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
Chapter 3  Message List

:SENSe:MMEMory:PATTern:RECall
Function
Only in MP210xA and MP2100B: This command sets the programmable pattern file for the ED.

Syntax
:SENSe:MMEMory:PATTern:RECall <file_name>,BIN|TXT

Parameter
Same as :SOURce:MMEMory:PATTern:RECall.

Example of Use
:SENS:PATT:TYPE USER
:SENS:MMEM:PATT:REC "10101010.dat",BIN

Notes:
● When ED Tracking is set to On, an error occurs.
● When this command is used in MP2110A, an error (~113 Undefined Header) occurs because MP2110A does not support this command.

:SOURce:PATTern:DATA:LENGth?
Function
This command queries the pattern length when the test pattern of the PPG is Programmable Pattern.

Syntax
:SOURce:PATTern:DATA:LENGth?

Response Data
<integer>
2 to 1305600

Example of Use
:SOUR:PATT:DATA:LENG?
>16384
:SENSe:PATTern:DATA:LENGth?

Function
This command queries the pattern length when the test pattern of the ED is Programmable Pattern.

Syntax
:SENSe:PATTern:DATA:LENGth?

Response Data
Same as :SOURce:PATTern:DATA:LENGth?.

Example of Use
:SENSe:PATT:DATA:LENG?
>16384
3.6.7 PPG

:OUTPut:DATA:OUTPut

Function
This command sets and queries the On/Off state of PPG signal output.

Syntax
:OUTPut:DATA:OUTPut <enable>
:OUTPut:DATA:OUTPut?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:OUTP:DATA:OUTP ON
:OUTP:DATA:OUTP?
>1

Note:
To turn on and off the signal output from all channels, use :SOURce:OUTPut:ASET.
3.6 BERT(PPG/ED) Messages

:OUTPut:DATA:AMPLitude

Function
This command sets and queries the amplitude voltage of the signal to be output from the Data Out and Data Out connectors of PPG.

Syntax
:OUTPut:DATA:AMPLitude DATA,<numeric>
:OUTPut:DATA:AMPLitude? DATA

Parameter
<numic>
Range 0.10 to 0.80, 0.01 Vp-p step

Response Data
<numic>

Example of Use
To set the output amplitude of the PPG to 0.5 Vp-p:
:OUTP:DATA:AMPL DATA,0.5
:OUTP:DATA:AMPL? DATA
>0.5

:OUTPut:DATA:ATTFactor

Function
This command sets and queries the External Attenuator Factor value of PPG.

Syntax
:OUTPut:DATA:ATTFactor DATA,<numeric>
:OUTPut:DATA:ATTFactor? DATA

Parameter
<numic>
Range 0 to 30, 1 dB step

Response Data
<integer>

Example of Use
:OUTP:DATA:ATTF DATA,20
:OUTP:DATA:ATTF? DATA
>20
:OUTPut:DATA:RELative?

Function
This command queries the Relative value displayed on PPG panel.

Syntax
:OUTPut:DATA:RELative? DATA

Response Data
<numeric>
Range 0.00 to 0.80, 0.01 Vp-p step

Example of Use
:OUTP:DATA:REL? DATA
>0.4

:SOURce:PATTern:EADDition:SET

Function
*Only in MP210xA and MP2100B:* This command sets and queries whether to add a bit error(s) to the test pattern to be generated by PPG.

Syntax
:SOURce:PATTern:EADDition:SET <enable>
:SOURce:PATTern:EADDition:SET?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:SOUR:PATT:EADD:SET ON
:SOUR:PATT:EADD:SET?
>1

Note:
When this command is used in MP2110A, an error (~13 Undefined Header) occurs because MP2110A does not support this command.
:SOURce:PATTern:EADDition:VARiation

Function

*Only in MP210xA and MP2100B:* This command sets and queries the error addition mode (Repeat/Single) for PPG.

Syntax

:SOURce:PATTern:EADDition:VARiation REPeat|SINGle
:SOURce:PATTern:EADDition:VARiation?

Parameter

REPeat|SINGle

Response Data

REP|SING

Example of Use

:SOUR:PATT:EADD:VAR REP
:SOUR:PATT:EADD:VAR?
>REP

*Note:*

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.

:SOURce:PATTern:EADDition:SINGle

Function

This command generates a single error in the test pattern when the error addition mode for PPG is Single.

Syntax

:SOURce:PATTern:EADDition:SINGle

Example of Use

:SOUR:PATT:EADD:SING
:SOURCE:PATTERN:EADDition:RATE

Function
Only in MP210xA and MP2100B: This command sets and queries the rate of adding bit errors when the error addition mode for PPG is Repeat.

Syntax
:SOURce:PATTern:EADDition:RATE <character>[,1]
:SOURce:PATTern:EADDition:RATE?

Parameter

<character>
E_{2|3|4|5|6|7|8|9|10|11|12}
Exponent of error addition rate (2 to 12)

[,1]
Indicates a mantissa of the error addition rate is 1.

Response Data

<character>,1

Example of Use
To set the error addition rate to 1E–9:
:SOUR:PATT:EADD:RATE E_9,1
:SOUR:PATT:EADD:RATE?
>E_9,1

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
3.6.8 ED

3.6.8.1 Setting

:INPut:DATA:INTerface

Function
This command sets and queries the connector inputting signal into the ED.

Syntax
:INPut:DATA:INTerface DATA|DIFF|OPT|XDATa
:INPut:DATA:INTerface?

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA</td>
<td>Electrical Single-Ended Data (Inputting to the Data In connector)</td>
</tr>
<tr>
<td>DIFF</td>
<td>Differential 50 Ohm (Inputting to the Data In and Data In connectors)</td>
</tr>
<tr>
<td>OPT</td>
<td>Optical (Inputting to the O/E Data In connector)</td>
</tr>
<tr>
<td>XDATa</td>
<td>Electrical Single-Ended Data (Inputting to the Data In connector)</td>
</tr>
</tbody>
</table>

Response Data
DATA|DIFF|OPT|XDATa

Example of Use
:INP:DATA:INT DATA
:INP:DATA:INT?
>DATA

Notes:
- OPT is available if the Option 003 or 007 is installed.
- XDATa and DIFF cannot be selected for Ch1 of the Option 003/007.
:INPut:DATA:ATTFactor

Function
This command sets and queries the external attenuation factor for the ED in dB unit.

Syntax
:INPut:DATA:ATTFactor DATA,<numeric>
:INPut:DATA:ATTFactor? DATA

Parameter
<numeric>
Range 0 to 30, 1 dB step

Response Data
<integer>

Example of Use
:INP:DATA:ATTF DATA,10
:INP:DATA:ATTF? DATA
>10
:INPut:DATA:THReshold

Function
This command sets and queries the input threshold for ED, in mV units.

Syntax
:INPut:DATA:THReshold <numeric>
:INPut:DATA:THReshold?

Parameter
<numeric>
The range of the input threshold, assuming External ATT is A (dB), is as follows:
Range \(-85 \times 10^{\frac{A}{20}}\) to \(85 \times 10^{\frac{A}{20}}\), \(10^{\frac{A}{20}}\) mV step

Response Data
<integer>

Notes:
- The setting needs to be made according to the specified step.
- The fractional portions of minimum and maximum values are truncated, and the step is rounded off to the nearest integer.

Example of Use
:INP:DATA:ATTF DATA,10
:INP:DATA:THR -270
:INP:DATA:THR?
>-270
:SENSe:PATTern:SYNC:ASYNc

Function

*Only in MP210xA and MP2100B:* This command sets and queries the On/Off state of Auto SYNC (auto pattern resynchronization processing) of ED.

Syntax

:SENSe:PATTern:SYNC:ASYNc <enable>
:SENSe:PATTern:SYNC:ASYNc?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:SENS:PATT:SYNC:ASYN ON
:SENS:PATT:SYNC:ASYN?
>1

*Note:*

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
:SENSe:PATTern:SYNC:THReshold

Function

*Only in MP210xA and MP2100B:* This command sets and queries the threshold for Auto SYNC of ED.

Syntax

:SENSe:PATTern:SYNC:THReshold <character>
:SENSe:PATTern:SYNC:THReshold?

Parameter

<character>
INT or E_{2|3|4|5|6|7|8} (1E−2 to 1E−8)

Response Data

<character>
INT|E_{2|3|4|5|6|7|8}

Example of Use

:SENS:PATT:SYNC:THR E_2
:SENS:PATT:SYNC:THR?
>E_2

*Note:*

When this command is used in MP2110A, an error (−113 Undefined Header) occurs because MP2110A does not support this command.
:SENSe:PATTern:SYNC:PSMode

Function

*Only in MP210xA and MP2100B:* This command sets and queries the On/Off state of SYNC Control when the test pattern for ED is Programmable Pattern.

Syntax

:SENSe:PATTern:SYNC:PSMode FRAMe|NORMa1
:SENSe:PATTern:SYNC:PSMode?

Parameter

FRAMe SYNc Control On
NORMa1 SYNc Control Off

Response Data

FRAM|NORM

Example of Use

To set SYNc Control to On:

:SENS:PATT:SYNC:PSM FRAM
:SENS:PATT:SYNC:PSM?
>FRAM

Note:

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
:SENSe:PATTern:SYNC:FPOSition

Function

*Only in MP210xA and MP2100B:* This command sets and queries the frame position when the test pattern for ED is Programmable Pattern and Sync Control is On.

Syntax

:SENSe:PATTern:SYNC:FPOSition <numeric>
:SENSe:PATTern:SYNC:FPOSition?

Parameter

<numeric>

Range: 1 to <Data Length> –64, 1 bit step

Response Data

<integer>

Example of Use

[:SENSe:PATT:SYNC:FPOS 1
 :SENSe:PATT:SYNC:FPOS? >1

*Note:*

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
3.6.8.2 Status-related commands

[:BERT:ALL]:DISPlay:RESult:EALarm:HRESet

Function
This command resets the error alarm history of ED.

Syntax
[:BERT:ALL]:DISPlay:RESult:EALarm:HRESet

Example of Use
To reset the error alarm history of the channel specified by :MODule:ID:
:DISP:RES:EAL:HRES

Added in Version 4: To clear the error alarm histories of all ED channels when specifying :BERT:ALL:

[:BERT:ALL]:CALCulate:DATA:MONitor?

Function
This command queries if the specified error/alarm has occurred at ED.

Syntax
[:BERT:ALL]:CALCulate:DATA:MONitor?
"BIT:TOTal"|"CRUNlock"|"PSLoss"

Parameter
"BIT:TOTal" Bit Error
"CRUNlock" CR Unlock
"PSLoss" SYNC Loss

Response Data
"Occur" Error/alarm has occurred.
"Not Occur" Error/alarm has not occurred.

Example of Use
To query if Bit Error has occurred at the channel specified by :MODule:ID:
:CALC:DATA:MON? "BIT:TOT"
>"Occur"

Added in Version 4: If :BERT:ALL is specified in the header, the data of all channels are returned in the order of Ch1, Ch2, Ch3, and Ch4.
>"Occur","Occur","Occur","Occur"
3.6  BERT(PPG/ED) Messages

[:BERT:ALL]:CALCulate:DATA:MONitor:HISTory?

Function

*Added in Version 5:* This command queries whether there is the specified error/alarm history or not.

Syntax

[:BERT:ALL]:CALCulate:DATA:MONitor:HISTory?
"BIT:TOTal" | "PSLoss"

Parameter

"BIT:TOTal"  Bit Error
"PSLoss"  SYNC Loss

Response Data

"Occur"  Error/alarm has occurred.
"Not Occur"  Error/alarm has not occurred.

Example of Use

To query the Bit Error history of the channel specified by :MODule:ID:

>"Occur"

If :BERT:ALL is specified in the header, the data of all channels are returned in the order of Ch1, Ch2, Ch3, and Ch4.


>"Occur", "Occur", "Occur", "Occur"
3.6.8.3 Fast measurement command

[:BERT:ALL]:SENSe:MEASure:IMMediate?

**Function**

*Added in Version 4:* This command immediately executes BER measurement and returns results.

**Syntax**

[:BERT:ALL]:SENSe:MEASure:IMMediate? <time>[,<item>]

**Parameter**

*time*

Measurement time

Range 10 to 3000 step, 10 ms

*item*

Measurement items

"ER:TOTal" Total Bit Error Rate

"EC:TOTal" Total Bit Error Count

"PSLoss" SYNC Loss

**Response Data**

If *item* is specified, only the specified measurement item(s) is returned.

If *item* is omitted, results of all the measurement items are returned in the order of Total ER, Total EC, and SYNC Loss, as a comma-separated string.

If :BERT:ALL is specified in the header, the data of all channels are returned in the order of Ch1, Ch2, Ch3, and Ch4.

Response data for each measurement item is returned in the following format:

- "ER:TOTal": "0.0001E-18" to "1.0000E-00" (Form2)
- "EC:TOTal": "0" to "9999999" or "1.0000E+07" to "9.9999E+17" (Form1)
- "PSLoss": "Not Occur" or "Occur"
- "------" is returned if there is no data to return.

**Example of Use**

To perform 10 ms measurement on the specified channel, and query the result of Bit Error Rate:


>"1.0000E-02"

To perform 1 s measurement on the specified channel, and query the results of all measurement items:

:SNS:MEAS:IMM? 1000

>"1.0000E-02","850001","Not Occur"
To perform 10 ms measurement on all channels, and query the results of Bit Error Rate (The response example below is for the BERTWave that consists of two channels):

```
>"1.0000E-02","1.0000E-02"
```

To perform 1 s measurement on all channels, and query the results of all measurement items (The response example below is for the BERTWave that consists of two channels):

```
:ALL:SENS:MEAS:IMM? 1000
>"1.0000E-02","850001","Not Occur","1.0000E-02","850001","Not Occur"
```

**Notes:**

- This command is effective in reducing the time required to perform a measurement sequence. (The shorter measurement period than GUI can be specified. The measurement sequence can automatically be started and stopped. Measurement results of multiple channels can be queried at a time.)

- This command is available in MP2100B and MP2110A, but not available in MP210xA.

- Execution of this command stops measurement on all ED channels.

- Measurement results of this command are not displayed in the PPG/ED screen, because fast processing is performed. The screen display of the scope is updated.
3.6.8.4 Measurement commands

[:BERT:ALL]:CALCulate:DATA:EALarm?

Function
This command queries the measurement results of the error detector (ED).

Syntax
[:BERT:ALL]:CALCulate:DATA:EALarm? "<period>:<item>"

Parameter

- **<period>** = CURRent | LAST
  - CURRent: To query the current measurement results.
  - LAST: To query the results of the last measurement performed as specified by Gating Time.

- **<item>**
  Select a measurement item(s) from the following:
  - AINTerval:CRUNlock: CR Unlock Seconds
  - AINTerval:PSLoss: SYNC Loss Seconds
  - EC:TOTal: Bit Error Count Total
  - EC:INSertion: Bit Error Count Insertion
  - EC:OMIssion: Bit Error Count Omission
  - ER:TOTal: Bit Error Rate Total
  - ER:INSertion: Bit Error Rate Insertion
  - ER:OMIssion: Bit Error Rate Omission
  - CC:TOTal: Clock Count Total
  - FREQuency: FREQ(kHz)

Response Data
The response format varies, depending on the item specified for <item>, as follows.

- AINTerval:{CRUNlock | PSLoss}
- EC:{TOTal | INSertion | OMIssion}
- CC:TOTal
- Range: "0" to "99999999" or "1.0000E+07" to "9.9999E+17" (Form1)
- ER:{TOTal | INSertion | OMIssion}
- Range: "0.0001E-18" to "1.0000E-00" (Form2)
- FREQuency
  "<integer>" (Form3)
  "-------" is returned if there is no data to return.
Example of Use

To query the Bit Error Rate with the channel specified by :MODule:ID: :CALC:DATA:EAL? "CURR:ER:TOT"

>"0.0000E-12"

*Added in Version 4:* (When :BERT:ALL is specified)

To return the data of all channels in the order of Ch1, Ch2, Ch3, and Ch4:


>"0.0000E-12","0.0000E-12","0.0000E-12","0.0000E-12"

**Notes:**

- When CR Unlock or SYNC Loss is detected once or more in the 1 s interval, it is counted as the 1 second where an error has occurred.

- SYNC Loss is not counted while CR Unlock is detected.

- Bit Error is not counted while CR Unlock or SYNC Loss is detected in the 100 ms interval.

- In MP2110A, “------” is returned for the query where INSertion, OMission, and CRUNlock are specified at <item>.

- In MP2100B, “------” is returned for the query where CRUNlock is specified at <item>. 
:SENSe:MEASure:EALarm:MODE

Function
This command sets and queries the gating cycle of ED.

Syntax
:SENSe:MEASure:EALarm:MODE REPeat|SINGle|UNTimed
:SENSe:MEASure:EALarm:MODE?

Parameter
REPeat     Repeatedly performs measurement for the period of time set for Gating Time.
SINGle    Performs single measurement for the period of time set for Gating Time.
UNTimed  Finishes measurement using panel operation or continues measurement until the :SENSe:MEASure:STOP is sent.

Response Data
REP|SING|UNT

Example of Use
:SENSe:MEASure:EALarm:MODE REP
:SENSe:MEASure:EALarm:MODE?
>REP

Note:
When Ch Tracking is set to ON:
In MP210xA and MP2100B:
When Ch3 or Ch4 is selected at :MODule:ID, a setting error (–220 Parameter error) occurs because the clocks for Ch3 and Ch4 are dependent on the clocks for Ch1 and Ch2.
In MP2110A:
The setting can be changed regardless of the channel selection status.
:SENSe:MEASure:EALarm:PERiod

Function
This command sets and queries the gating time of ED.

Syntax
:SENSe:MEASure:EALarm:PERiod
<days>,<hours>,<minutes>,<seconds>
:SENSe:MEASure:EALarm:PERiod?

Parameter
<days>,<hours>,<minutes>,<seconds>

Response Data
<days>,<hours>,<minutes>,<seconds>

Example of Use
To set the gating time to 1 minute:
:SENS:MEAS:EAL:PER 0,0,1,0
:SENS:MEAS:EAL:PER?
>0,0,1,0

Note:
When Ch Tracking is set to ON:
In MP210xA and MP2100B:
When Ch3 or Ch4 is selected at :MODule:ID, a setting error (–220 Parameter error) occurs because the clocks for Ch3 and Ch4 are dependent on the clocks for Ch1 and Ch2.
In MP2110A:
The setting can be changed regardless of the channel selection status.
Chapter 3  Message List

:DISPlay:RESult:EALarm:MODE
Function
This command sets and queries the On/Off state of real-time update of ED measurement results.

Syntax
:DISPlay:RESult:EALarm:MODE <enable>
:DISPlay:RESult:EALarm:MODE?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:DISP:RES:EAL:MODE ON
:DISP:RES:EAL:MODE?
>1

Note:
If set to Off, measurement results are updated when the measurement progress reaches 100%.

[:BERT:ALL]:SENSe:MEASure:STARt
Function
This command starts the ED measurement.

Syntax
[:BERT:ALL]:SENSe:MEASure:STARt

Example of Use
To start measurement on the channel specified by :MODule:ID : :SENS:MEAS:STAR

Added in Version 4: To start measurement on all ED channels:
:BERT:ALL:SENSe:MEAS:STAR

Notes:
- If measurement is running, execution of this command clears the current data, and restarts measurement.
- To start measurement of all modules including Scope, use :SENS:MEAS:ASTR.
[BERT:ALL]:SENSe:MEASure:STOP

**Function**
This command stops the ED measurement.

**Syntax**
[:BERT:ALL]:SENSe:MEASure:STOP

**Example of Use**
To stop measurement on the channel specified by :MODule:ID:
:SENSe:MEASure:STOP

*Added in Version 4:* To stop measurement on all ED channels when :BERT:ALL is specified in the header:

[:BERT:ALL]:SENSe:MEASure:STOP

**Note:**
To stop measurement of all modules including Scope, use :SENSe:MEASure:ASTP.

[BERT:ALL]:SENSe:MEASure:EALarm:STATe?

**Function**
This command queries measurement status of the ED.

**Syntax**
[:BERT:ALL]:SENSe:MEASure:EALarm:STATe?

**Response Data**
0 | 1
0  | None of the channels is being measured.
1  | At least one of the channels is being measured.

**Example of Use**
To query the measurement status of the channel specified by :MODule:ID:
:SENSe:MEASure:EALarm:STAT?
>0

*Added in Version 4:* When :BERT:ALL is specified, the measurement statuses for all ED channels are queried.

[:BERT:ALL]:SENSe:MEASure:EALarm:STAT?
>0

**Note:**
To query the measurement status of all modules including Scope,
use :SENSe:MEASure:ASTate?.

:SENSe:MEASure:EALarm:STARt?

Function
This command queries the measurement start time of the ED.

Syntax
:SENSe:MEASure:EALarm:STARt?

Response Data
"<year>,<month>,<day>,<hour>,<minute>,<second>"
If time data is not available, "0,0,0,0,0,0" is returned.

Example of Use
To query the measurement start time of the ED:
:SENS:MEAS:EAL:STAR?
>"2009,10,05,16,25,40"

:SENSe:MEASure:EALarm:STOP?

Function
This command queries the measurement end time of the ED.

Syntax
:SENSe:MEASure:EALarm:STOP?

Response Data
"<year>,<month>,<day>,<hour>,<minute>,<second>"
If time data is not available, "0,0,0,0,0,0" is returned.

Example of Use
When Gating Cycle is Single or Repeat
:SENS:MEAS:EAL:STOP?
>"2009,10,05,16,25,40"
When Gating Cycle is Untimed and the measurement is performing:
:SENS:MEAS:EAL:STOP?
>"0,0,0,0,0,0"
:SENSe:MEASure:EALarm:ELAPsed?

Function
This command queries the period of time elapsed from the start time of
the ED measurement.

Syntax
:SENSe:MEASure:EALarm:ELAPsed?

Response Data
"<days>,<hours>,<minutes>,<seconds>"

Example of Use
:SENS:MEAS:EAL:ELAP?
>"0,0,2,10"

:SENSe:MEASure:EALarm:TIMed?

Function
This command queries the measurement remaining time until the ED
completes the measurement.

Syntax
:SENSe:MEASure:EALarm:TIMed?

Response Data
"<days>,<hours>,<minutes>,<seconds>"

Example of Use
:SENS:MEAS:EAL:TIM?
>"0,0,2,10"
3.7 XFP/SFP+ specific Messages (MP210xA, MP2100B)

:CALCulate:OPTical:STATus?

Function
This command queries the status of the XFP/SFP+ slot optical transceiver.

Syntax
:CALCulate:OPTical:STATus? "READY"|"LOS"

Parameter
"READY" Detection of XFP/SFP+
"LOS" Occurrence of LOS

Response Data
If "READY" is specified:
"None" XFP/SFP+ not detected
"Occur" XFP/SFP+ detected
If "LOS" is specified:
"None" No LOS occurs or XFP/SFP+ not detected
"Occur" LOS occurs

Example of Use
:CALC:OPT:STAT? "LOS"
>"Occur"

:SOURce:OPTical:SIGNal:WLENgth?

Function
This command queries the wavelength of the optical transceiver (XFP/SFP+).

Syntax
:SOURce:OPTical:SIGNal:WLENgth?

Response Data
<string>
"xxxx" Four-digit wavelength (Unit: nm)
(Right-justified if it is less than four digits.)
"------" XFP/SFP+ not detected

Example of Use
:SOUR:OPT:SIGN:WLEN?
>" 850"
:SOURCE:OPTICAL:SIGNAL:OUTPUT

Function
This command sets and queries the optical output of the optical transceiver (XFP/SFP+).

Syntax
:SOURCE:OPTICAL:SIGNAL:OUTPUT <enable>
:SOURCE:OPTICAL:SIGNAL:OUTPUT?

Parameter
0|OFF
1|ON

Response Data
0|1
0 Optical output Off or XFP/SFP+ not detected
1 Optical output On

Example of Use
To set the optical output to On:
:SOUR:OPT:SIGN:OUTP ON
:SOUR:OPT:SIGN:OUTP?
>1
Chapter 3  Message List

:SOURce:OPTical:XFP:REFClock

Function
This command sets and queries the reference clock of the optical transceiver (XFP).

Syntax
:SOURce:OPTical:XFP:REFClock <character>
:SOURce:OPTical:XFP:REFClock?

Parameter
<character>
ED1Sync  Sync with ED1
ED2Sync  Sync with ED2
PPG1Sync Sync with PPG1
PPG2Sync Sync with PPG2

Response Data
ED1Sync | ED2Sync | PPG1Sync | PPG2Sync

Example of Use
:SOUR:OPT:XFP:REF PPG1Sync
:SOUR:OPT:XFP:REF?
>PPG1Sync
3.8 O/E messages

Refer to Section 3.9.5.3, “O/E”.
3.9 Scope-specific messages

*Modified in Version 6:* Read “bitrate” in the explanation as “baud rate”.

*Modified in Version 7:* CHC, CHD, and ALL as the commands and the parameters can be set in version 7 or later.

CHC: Channel C
CHD: Channel D
ALL: All channels

3.9.1 Setting active channel and On/Off display

[:INPut:{CHA|CHB|CHC|CHD|ALL}]

**Function**
This command sets and queries the On/Off state of waveform display by specifying the channel of Scope.

**Syntax**

```
[:SENSe]:INPut:{CHA|CHB|CHC|CHD|ALL} 0|OFF|1|ON
[:SENSe]:INPut:{CHA|CHB|CHC|CHD|ALL}?
```

**Parameter**

0|OFF
1|ON

**Response Data**

OFF|ON

**Example of Use**

:INP:CHA ON
:INP:CHA?
>ON

[:CONFigure:MEASure:CHANnel]

**Function**
This command sets and queries the active channel for waveform measurement of Scope.

A channel on which the following operations are executed is called “active channel”.
1. Channel on which Auto Scale of X axis is executed.
   When multiple channels are On, Auto Scale is executed on X axis of the channel specified by this command.
   When one channel is On, Auto Scale is executed on that channel.
   Y axis of both channels are adjusted regardless of the setting of active channel.
2. Target channel when measurement results are acquired by the :FETCh*** and :MEASure*** commands.

3. Channel on which Mask Test and Histogram Measurement are executed. (Version 6 or earlier)

**Syntax**

`:CONF:MEAS:CHANel A|B|C|D`

`:CONF:MEAS:CHANel?`

**Parameter**

A: Channel A
B: Channel B
C: Channel C
D: Channel D

**Response Data**

A|B|C|D

**Example of Use**

`:CONF:MEAS:CHAN A`

`:CONF:MEAS:CHAN?`

>`A`

**Note:**

The active channel is changed not only by this command, but also by the :INPut:{CHA|CHB|CHC|CHD|ALL} command. The channel that is turned On last by the :INPut:{CHA|CHB|CHC|CHD|ALL} command is the active channel.
Chapter 3  Message List

:CONFigure:MEASure:TYPe

Function
This command sets and queries Measure Item of Scope.

Syntax
:CONFigure:MEASure:TYPe
AMPHistogram|AMPMask|AMPTIME|HISTogram|MASK|OFF
:CONFigure:MEASure:TYPe?

Parameter
AMPHistogram  Amplitude/Time & Histogram*1, *2
AMPMask      Amplitude/Time & Mask Test*1, *2, *3
AMPTIME      Amplitude/Time*1
HISTogram    Histogram*2
MASK         Mask Test*2, *3
OFF          Off

*1:  When Sampling Mode is Pulse, Amplitude/Time cannot be selected.  
     (version 7.00.11 or earlier)
*2:  When Sampling Mode is Advanced Jitter, Histogram and Mask Test 
     cannot be selected.
*3:  When Signal Type is PAM4, Mask Test cannot be selected.

The functions are turned On/Off as the following table by the specified 
parameters.
The results of both Mask Test and Histogram cannot be displayed.

Table 3.9.1-1  Measure Item Settings and Measurement Result Display

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Amp/Time</th>
<th>MaskTest</th>
<th>Histogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMPHistogram</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>AMPMask</td>
<td>On</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>AMPTIME</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>HISTogram</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>MASK</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>OFF</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
</tbody>
</table>

Response Data
AMPHistogram | AMPMask | AMPTIME | HISTogram | MASK | OFF

Example of Use
:CONF:MEAS:TYP  AMPM
:CONF:MEAS:TYP?
>AMPMask
3.9 Scope-specific messages

:CONFigure:MEASure:AMPTime:DISPlay

Function
Added in Version 6: This command sets and queries the On/Off state of the display of the Amplitude/Time results.
For screen display of measurement results, refer to the description of :CONFigure:MEASure:TYPe.

Syntax
:CONFigure:MEASure:AMPTime:DISPlay <enable>
:CONFigure:MEASure:AMPTime:DISPlay?

Parameter
0|OFF Measurement results are not displayed.
1|ON Measurement results are displayed.

Example of Use
:CONF:MEAS:AMPT:DISP ON
:CONF:MEAS:AMPT:DISP?
>1
3.9.2 Basic operation

:DISPlay:WINDow:GRAPhics:CLEar

Function

This command erases the trace on the Scope screen.

*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified.

Syntax

:DISPlay:WINDow:GRAPhics:CLEar[:{CHA|CHB|CHC|CHD|ALL}]

Example of Use

:DISP:WIND:GRAP:CLE

:SAMPling:STATus

Function

This command runs and holds the sampling processing of Scope, and queries the state of the sampling processing.

*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax

[:SENSe]:SAMPling:STATus[:{CHA|CHB|CHC|CHD|ALL}]

RUN[,AUTOscale]|HOLD

[:SENSe]:SAMPling:STATus[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter

RUN Runs the sampling processing.
HOLD Holds the sampling processing.

*Modified in Version 3.03/4.01:* When the :SAMPling:STATus RUN command is sent while Sampling is running, the Sampling restarts.

*Modified in Version 7:* AUTOscale can be specified. Auto Scale is executed before the sampling processing is started.

Response Data

RUN|HOLD

Example of Use

To run the sampling processing:

:SAMP:STAT RUN

To query if the Sampling processing has been held (HOLD status):
3.9 Scope-specific messages

:SAMP:STAT?
>HOLD
To execute Auto Scale on Channel B, and then start the sampling processing.
:SAMP:STAT:CHB RUN,AUTO

:DISPlay:WINDow:AUTOscale

Function
This command automatically adjusts the vertical and horizontal axes so that the waveform is displayed in the center of the Scope screen.

Note:
:DISPlay:WINDow:AUTOscale executes Auto Scale on all channels.

To execute Auto Scale on a specified channel(s), use :SAMPling:STATus. Specify RUN,AUTOscale as parameters.

Syntax
:DISPlay:WINDow[:SCALE]:AUTOscale
[BOTH|HORizontal|VERTical]

Parameter
In the Eye mode, the following parameters can be specified.
In the Coherent Eye mode, only BOTH can be specified.
BOTH Scale on the vertical axis and offset on the horizontal axis auto-adjusted
HORizontal Offset on the horizontal axis auto-adjusted
VERTical Scale on the vertical axis auto-adjusted

Example of Use
:DISP:WIND:AUTO

Note:
If the parameter is specified when in Eye mode, execution of this command only adjusts the offset on the horizontal axis and the scale on the vertical axis, without measuring the waveform frequency. Additionally, when this parameter is specified, Acquire Clock (measuring frequency of the clock signal input to the Trigger Clk In connector) is not executed during Auto Scale, which provides an advantage of shorter duration of automatic adjustment by Auto Scale. If the clock frequency is already known, specify this parameter as needed.
:DISPlay:WINDow:MODE

Function

*Added in Version 7:* This command sets and queries the graph display mode.

Syntax

:DISPlay:WINDow:MODE OVERlap|SINGle|TILE

:DISPlay:WINDow:MODE?

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERlap</td>
<td>Overlap</td>
</tr>
<tr>
<td>SINGle</td>
<td>Single</td>
</tr>
<tr>
<td>TILE</td>
<td>Tile</td>
</tr>
</tbody>
</table>

Response Data

OVERlap|SINGle|TILE

Example of Use

:DISPlay:WINDow:MODE TILE
:DISPlay:WINDow:MODE?
> TILE

:DISPlay:WINDow:ZOOM

Function

*Added in Version 6:* This command sets and queries the expanded/reduced state of waveform display area. It is used for setting 9 or more measurement items and for returning the reduced waveform display area to normal size (expanded).

Syntax

:DISPlay:WINDow:ZOOM <enable>

:DISPlay:WINDow:ZOOM?

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF Waveform display area is in reduced size.</td>
</tr>
<tr>
<td>1</td>
<td>ON Waveform display area is in normal size (expanded).</td>
</tr>
</tbody>
</table>

Example of Use

:DISPlay:WINDow:ZOOM ON
:DISPlay:WINDow:ZOOM?
>1
3.9 Scope-specific messages

3.9.3 Setup

3.9.3.1 Signal Type

:DISPlay:SIGNal

Function

Added in Version 6: This command sets and queries the type of input signal (NRZ or PAM4). PAM4 can be set when MP2110A-095 is installed.

Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax

:DISPlay:SIGNal[:{CHA|CHB|CHC|CHD|ALL}] NRZ|PAM4
:DISPlay:SIGNal[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter

<table>
<thead>
<tr>
<th>NRZ</th>
<th>PAM4</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>145</td>
</tr>
</tbody>
</table>

Example of Use

:DISP:SIGN:CHB NRZ
:DISP:SIGN:CHB?
>NRZ

3.9.3.2 Sampling

:DISPlay:MODE

Function

This command sets and queries the Sampling Mode of Scope.

Syntax

[:SENSe]:DISPlay:MODE AJITter|COHErenteye|EYE|PULSe
[:SENSe]:DISPlay:MODE?

Parameter

<table>
<thead>
<tr>
<th>AJITter</th>
<th>COHErenteye</th>
<th>EYE</th>
<th>PULSe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Jitter mode (Added in Version 6: Can be set when Option 096 is installed.)</td>
<td>Coherent eye mode</td>
<td>Eye mode</td>
<td>Pulse mode</td>
</tr>
</tbody>
</table>

Response Data

AJITter | COHErenteye | EYE | PULSe
Example of Use
:DISP:MODE PULSe
:DISP:MODE?
>PULSe

:DISPlay:MODE:EYE:FAST

Function
*Only in MP2100B:* This command sets and queries the On/Off state of the Fast Sampling Mode of Scope.

Syntax
[:SENSe]:DISPlay:MODE:EYE:FAST <enable>
[:SENSe]:DISPlay:MODE:EYE:FAST?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:DISP:MODE EYE
:DISP:MODE:EYE:FAST ON
:DISP:MODE:EYE:FAST?
>1

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.

:OPTion:MAX:SAMPles:NUMber

Function
This command sets and queries the Number Of Samples.

Syntax
[:SENSe]:OPTion:MAX:SAMPles:NUMber <integer>
[:SENSe]:OPTion:MAX:SAMPles:NUMber?

Parameter
<integer>
When Sampling mode is set to **EYE**:
In MP210xx: 509|1021|1350|2039|4093|8191|16381
3.9  **Scope-specific messages**

In MP2110A: 1350|2048|4050

When Sampling mode is set to **Coherent Eye** or **Pulse**:
512|1024|2048|4096|8192|16384

**Response Data**

<integer>

**Example of Use**

:SENS:OPT:MAX:SAMP:NUM?

>8191
Chapter 3  Message List

:ACCUmulation:TYPe

Function
This command sets and queries the data collection process of Scope.

Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to
the command to specify a channel or all channels. If any channel is not
specified, ALL is specified for command, and the active channel is
specified for query.

Syntax
[:SENSe]:ACCUmulation:TYPe[:{CHA|CHB|CHC|CHD|ALL}]
<character>
[:SENSe]:ACCUmulation:TYPe[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter
<character>
NONE The data collection is not overwritten. When the fresh
data is collected, the displayed data is deleted.
INFinite The data collection is overwritten.
The acquired data does not go out of the screen.
LIMited The data collection is limited by the number of samples
and time.
When it reaches the limited conditions, the data
collection is ended.
The acquired data does not go out of the screen.
PERSistency The data collection is overwritten.
After the fixed time, the acquired data goes out of the
screen.
AVERaging The average of the collected data is displayed. Only
when Sampling Mode is set to Pulse, this can be used.

Response Data
NONE | INFinite | LIMited | PERSistency | AVERaging

Example of Use
:ACCU:TYP LIMited
:ACCU:TYP?
> LIMited

:ACCUmulation:LIMit

Function
This command sets and queries the limit (time/number) for the data
collection, when Accumulation Type of Scope is Limited.

Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to
the command to specify a channel or all channels. If any channel is not
specified, ALL is specified for command, and the active channel is
specified for query.
3.9 Scope-specific messages

Syntax

[:SENSe]:ACCUmulation:LIMit[:({CHA|CHB|CHC|CHD|ALL})]
TIME|SAMPle|WAveform|PATTern,<numeric>
[:SENSe]:ACCUmulation:LIMit[:({CHA|CHB|CHC|CHD|ALL})]?

Parameter

TIME|SAMPle|WAveform|PATTern

TIME The data collection is limited at time.
SAMPle The data collection is limited by the number of samples.
WAveform The data collection is limited by the number of waveforms.
PATTern Added in Version 6: The data collection is limited by the number of patterns. Valid in Advanced Jitter mode.

In version 7 or later, this parameter can be set even if Accumulation Type of Scope is Pulse or Coherent Eye.

<numeric>

When specifying TIME, set the limit by the time in seconds.
When specifying SAMPle, set the limit by the number of samples in million units, in the range of 1 to 99999.
When specifying WAveform, set the limit by the number of waveforms, in the range of 1 to 999999.
When specifying PATTern, set the limit by the number of patterns, in the range of 1 to 999999.

Response Data

TIME|SAMPle|WAveform|PATTern,<integer>

Example of Use

:ACCU:LIM SAMPle,10
:ACCU:LIM?
>SAMPle,10

Note:

The unit (second or million) does not need to be specified by the command. The unit is determined automatically depending on the specified limit type, as follows:

- second (when the limit type is Time)
- million (when the limit type is Sample)

When this message is transmitted while collecting the data (when Sampling of the screen is RUN), the displayed waveform is deleted and the data collection is done over again.
:ACCUmulation:PERSistency
Function
This command sets and queries the data display time when the data collection process of Scope is Persistency.
*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax

```
[:SENSe]:ACCUmulation:PERSistency[:{CHA|CHB|CHC|CHD|ALL}] <numeric>
[:SENSe]:ACCUmulation:PERSistency[:{CHA|CHB|CHC|CHD|ALL}]?
```

Parameter

<numeric>
Time to display collected data (seconds)

Response Data

<integer>

Example of Use

:ACCU:PERS?
>10.0

:ACCUmulation:AVERaging
Function
This command sets and queries the averaging process count of Scope.
*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax

```
[:SENSe]:ACCUmulation:AVERaging[:{CHA|CHB|CHC|CHD|ALL}] <integer>
[:SENSe]:ACCUmulation:AVERaging[:{CHA|CHB|CHC|CHD|ALL}]?
```

Parameter

<integer>
Range 1 to 9999
3.9 Scope-specific messages

3.9.3.3 Clock Recovery (MP2110A)

:TIME:CRU[{26G|53G}]

Function

*Added in Version 6:* This command sets and queries the CRU mode.

*Modified in Version 7.01:* This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

Syntax

:TIME:CRU[{26G|53G}] OFF|RECovery|THRough

:TIME:CRU[{26G|53G}]?

Parameter

OFF
RECovery
THRough

Response Data

OFF|RECovery|THRough

Example of Use

:TIME:CRU RECovery
:TIME:CRU?
>RECovery
Chapter 3  Message List

:TIME:CRU{[26G|53G]}:RATE:STANdard

Function

Added in Version 6: This command sets and queries the operation rate for the CRU by standard name.

Modified in Version 7.01: This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

Syntax

:TIME:CRU{[26G|53G]}:RATE:STANdard "<bitrate_standard>"
:TIME:CRU{[26G|53G]}:RATE:STANdard?

Parameter

<bitrate_standard> = <string>

The following strings can be used for <bitrate_standard>.

Table 3.9.3.3-1  Symbol Rate Standards (MP2110A-054)

<table>
<thead>
<tr>
<th>&lt;string&gt;</th>
<th>Standard</th>
<th>Symbol Rate (baud)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE&quot;</td>
<td>Variable</td>
<td>25.5 to 28.2G</td>
</tr>
<tr>
<td>&quot;32G_FC&quot;</td>
<td>32GFC</td>
<td>28.05G</td>
</tr>
<tr>
<td>&quot;OTU-4&quot;</td>
<td>OTU4</td>
<td>27.952493G</td>
</tr>
<tr>
<td>&quot;100GE_4_FEC&quot;</td>
<td>100GbE/4 FEC</td>
<td>27.7393G</td>
</tr>
<tr>
<td>&quot;100GE_4&quot;</td>
<td>100GbE/4</td>
<td>25.78125G</td>
</tr>
<tr>
<td>&quot;400GE_8&quot;</td>
<td>400GbE/8</td>
<td>26.5625G</td>
</tr>
</tbody>
</table>

Table 3.9.3.3-2  Symbol Rate Standards (MP2110A-055)

<table>
<thead>
<tr>
<th>&lt;string&gt;</th>
<th>Standard</th>
<th>Symbol Rate (baud)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VARIABLE26G&quot;</td>
<td>Variable (25.5-28.9G)</td>
<td>25.5-28.9G</td>
</tr>
<tr>
<td>&quot;VARIABLE53G&quot;</td>
<td>Variable (51-58G)</td>
<td>51.0-58.0G</td>
</tr>
<tr>
<td>&quot;32G_FC&quot;</td>
<td>32GFC</td>
<td>28.05G</td>
</tr>
<tr>
<td>&quot;OTU-4&quot;</td>
<td>OTU4</td>
<td>27.952493G</td>
</tr>
<tr>
<td>&quot;100GE_4_FEC&quot;</td>
<td>100GbE/4 FEC</td>
<td>27.7393G</td>
</tr>
<tr>
<td>&quot;100GE_4&quot;</td>
<td>100GbE/4</td>
<td>25.78125G</td>
</tr>
<tr>
<td>&quot;400GE_8&quot;</td>
<td>400GbE/8</td>
<td>26.5625G</td>
</tr>
<tr>
<td>&quot;64G_FC&quot;</td>
<td>64GFC</td>
<td>28.9G</td>
</tr>
</tbody>
</table>

Response Data

<bitrate_standard> = <string>

Example of Use

:TIME:CRU:RATE:STAN "100GE_4"
:TIME:CRU:RATE:STAN?
3.9  Scope-specific messages

>:TIME:CRU[{26G|53G}]:RATE

Function

*Added in Version 6:* This command sets and queries the CRU operation rate by symbol rate (kbaud).

If this command is sent when <bitrate_standard> is not VARIABLE, it is changed to VARIABLE automatically.

*Modified in Version 7.01:* This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

If <bitrate_standard> for MP2110A-055 is not VARIABLE26G or VARIABLE53G in Table 3.9.3.3-2, it is automatically changed according to <symbolrate> when this command is sent.

Syntax

`:TIME:CRU[{26G|53G}]:RATE <symbolrate>
`:TIME:CRU[{26G|53G}]:RATE?

Parameter

<symbolrate> = <numeric>

For MP2110A-054  25500000 to 28200000
For MP2110A-055  25500000 to 28900000, 51000000 to 58000000

Response Data

<symbolrate> = <numeric>

Example of Use

`:TIME:CRU:RATE 25781250
`:TIME:CRU:RATE?
>25781250

>:TIME:CRU[{26G|53G}]:LBWidth

Function

*Added in Version 6:* This command sets and queries CRU Loop Band Width.

*Modified in Version 7.01:* This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

Syntax

`:TIME:CRU[{26G|53G}]:LBWidth 4M|10M|BITRATE_1667

>:TIME:CRU[{26G|53G}]:LBWidth

>:TIME:CRU[{26G|53G}]:LBWidth

>"100GE_4"
Chapter 3  Message List

:TIME:CRU[\{26G|53G\}]:LBWidth?

Parameter

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4M</td>
<td>4 MHz</td>
</tr>
<tr>
<td>10M</td>
<td>10 MHz</td>
</tr>
<tr>
<td>BITRATE_1667</td>
<td>(&lt;\text{TIME:CRU:RATE value}&gt; / 1667)</td>
</tr>
</tbody>
</table>

Response Data

4M | 10M | BITRATE_1667

Example of Use

:TIME:CRU:LBW 10M
:TIME:CRU:LBW?
>10M

:TIME:CRU[\{26G|53G\}]:STATus?

Function

*Added in Version 6:* This command queries the CRU lock status.
*Modified in Version 7.01:* This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

Syntax

:TIME:CRU[\{26G|53G\}]:STATus?

Response Data

LOCK | UNLOCK

LOCK  CRU is locked. (The Status lamp is lit green)
UNLOCK CRU is not locked. (The Status lamp is lit red, orange, or black)

Example of Use

:TIME:CRU:STATus?
>LOCK

:TIME:CRU[53G]:RELock

Function

*Added in Version 7.01:* This command resynchronizes the CRU.

Syntax

:TIME:CRU[53G]:RELock
3.9 Scope-specific messages

Example of Use
:TIME:CRU:REL

:TIME:CRU[53G]:ARELock
Function
*Added in Version 7.01:* This command sets and queries the On/Off state of CRU’s Auto Relock.

Syntax
:TIME:CRU[53G]:ARELock
:TIME:CRU[53G]:ARELock?

Parameter
0 | OFF Does not lock on the input signal automatically when it is input to the CRU. Manually lock it using :TIME:CRU[53G]:RELock.
1 | ON Locks on the input signal automatically when it is input to the CRU.

Response Data
0 | 1

Example of Use
:TIME:CRU:AREL 0
:TIME:CRU:AREL?
>1

:TIME:CRU[{26G|53G}]:FREQuency?
Function
*Added in Version 6:* This command queries the frequency (kHz) of CRU output clock signal.
*Modified in Version 7.01:* This command provides choices of CRUs to be controlled. If 26G is specified, MP2110A-054 is controlled, and if 53G, MP2110A-055. If omitted, the setting for Tracking Target is applied.

Syntax
:TIME:CRU[({26G|53G}]):FREQuency?

Response Data
<integer>
Example of Use

:TIME:CRU:FREQ?
>25781250

:TIME:CRU:SELeect

Function

*Added in Version 7.01:* This command sets and queries the CRU to be controlled.

Syntax

:TIME:CRU:SELeect 26G|53G
:TIME:CRU:SELeect?

Parameter

26G  Controls MP2110A-054.
53G  Controls MP2110A-055.

Response Data

26G|53G

Example of Use

:TIME:CRU:SELeect 53G
:TIME:CRU:SELeect?
>53G

*Note:*

This command affects the following:

- Tracking target if CRU is specified by :TIME:TRACking.
3.93.4 Clock Recovery (MP210xx)

:INPut:CLKRecovery

Function
This command sets and queries the clock recovery output mode of Scope.

Syntax
[:SENSe]:INPut:CLKRecovery OFF|LESS27|85
[:SENSe]:INPut:CLKRecovery?

Parameter
OFF Sets the clock recovery output to Off
LESS27 Sets the clock recovery output to On and frequency to 0.1 to 2.7 GHz
85 Sets the clock recovery output to On and frequency to 8.5 to 12.5 GHz

Response Data
OFF|LESS27|85

Example of Use
:INP:CLKR 85

:CONFigure:CLKRecovery

Function
This command sets and queries the bandwidth of the clock recovery unit for Scope.

Syntax
:CONFigure:CLKRecovery 1|2|4|8 [MHz]
:CONFigure:CLKRecovery?

Parameter
1|2|4|8 [MHz]

Response Data
1|2|4|8 MHz

Example of Use
To set the bandwidth of clock recovery unit to 4 MHz
:CONF:CLKR 4 MHz
:CONF:CLKR?
>4 MHz
### 3.9.3.5 Waveform Color

`:DISPlay:WAVEform:COLor` Function

*Added in Version 5.01:* This command sets the color of the waveform.

**Syntax**

`:DISPlay:WAVEform:COLor CGRade|GSCale
`:DISPlay:WAVEform:COLor?`

**Parameter**

CGRade  Color Grade
GSCale   Gray Scale

**Response Data**

CGRade|GSCale

**Example of Use**

To set the waveform to color.

`:DISP:WAV:COL CGRade

`:DISPlay:WAVEform:COLor:GSCale[:TEQualizer][:{CHA|CHB|CHC|CHD|ALL}]` Function

*Added in Version 6.01:* This command sets and queries the color for showing the waveform using a monochromatic color scale.

*Modified in Version 7:* If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

**Syntax**

`:DISPlay:WAVEform:COLor:GSCale[:TEQualizer][:{CHA|CHB|CHC|CHD|ALL}] <color>
`:DISPlay:WAVEform:COLor:GSCale[:TEQualizer][:{CHA|CHB|CHC|CHD|ALL}]?`

**Parameter**

<color>
BLUE|GREEN|LBLUE|LGREEN|ORANGE|PINK|RED|YELLOW

**Response Data**

BLUE|GREEN|LBLUE|LGREEN|ORANGE|PINK|RED|YELLOW

**Example of Use**

To set the monochromatic color scale for CHA waveform to Blue.
To set and query the waveform color when the TDECQ Equalizer is used, include :TEQualizer in the command.

:DISPLAY:MASK:COLor

Function

 Added in Version 5.02: This command sets and queries the color of the mask.

Syntax

:DISPLAY:MASK:COLor PURPLE|GRAY
:DISPLAY:MASK:COLor?

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PURPLE</td>
<td>Purple</td>
</tr>
<tr>
<td>GRAY</td>
<td>Gray</td>
</tr>
</tbody>
</table>

Response Data

PURPLE|GRAY

Example of Use

To set the color of mask to purple.

:DISPLAY:MASK:COL PURPLE
Chapter 3  Message List

3.9.3.6 Label

:DISPlay:INFormation

Function
Added in Version 5.02: This command sets and queries the On/Off state of the Preset Information display for Scope.

Syntax
:DISPlay:INFormation <enable>
:DISPlay:INFormation?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:DISP:INF OFF
:DISP:INF?
>0

:DISPlay:LABel

Function
This command sets a label to display in the Scope screen.
Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax
:DISPlay:LABel[:{CHA|CHB|CHC|CHD|ALL}]
"<label>"[,<pixel_x>,<pixel_y>]
:DISPlay:LABel[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter
"<label>"
Specifies the character string of label (up to 1023 alphanumeric characters).
Added in Version 5.02: Starts a new line by inputting a line feed code (\n).
[,<pixel_x>,<pixel_y>]

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3.9 Scope-specific messages

*Added in Version 5.02:* Specifies the start position of label display (X, Y) (in the waveform display area, the upper left is (0, 0) and the lower right is (665, 497)).

*: This is enabled when Preset Information is set to Off.

**Response Data**

"<label>[,<pixel_x>,<pixel_y>]"

*: "<pixel_x>,<pixel_y>" is omitted when the default value is (0,0).

**Example of Use**

:DISP:LAB "BERTWave",50,10
:DISP:LAB?
> "BERTWave",50,10
:DISP:LAB "BERTWave",0,0
:DISP:LAB?
> "BERTWave"

**Notes:**

- Up to 1023 characters can be entered. However, all characters may not be displayed because the characters that can be displayed are limited.
- It takes a long time to actually display the label after completing this command processing during Sampling Run. Therefore, the wait time about 200 ms may be required before executing the COPY command that copies the screen (the required wait time varies depending on the length of the character string).

**:DISPlay:LABel:DALL**

**Function**

This command deletes the label displayed in the Scope screen.

*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

**Syntax**

:DISPlay:LABel:DALL[:{CHA|CHB|CHC|CHD|ALL}]

**Example of Use**

:DISP:LAB:DALL
3.9.3.7 Warning

:DISPlay:WARNing:OVERload

Function
Added in Version 7.01: This command sets and queries the On/Off state of Scope warning display (Overload/Clipped).

Syntax
:DISPlay:WARNing:OVERload <enable>
:DISPlay:WARNing:OVERload?

Parameter
0 | OFF
1 | ON

Response Data
0 | 1

Example of Use
:DISP:WARN:OVER ON
:DISP:WARN:OVER?
>1
3.9 Scope-specific messages

:DISPlay:WARNing:QUEStionableeye

Function

Added in Version 7.01: This command sets and queries whether to display N/A as a measurement result when “NRZ?” or “PAM4?” is displayed in the Scope Result window.

Syntax

:DISPlay:WARNing:QUEStionableeye <enable>
:DISPlay:WARNing:QUEStionableeye?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:DISP:WARN:QUES ON
:DISP:WARN:QUES?
>1

3.9.3.8 Trace Memory

:TMEMory:REFerence:SET

Function

Modified in Version 7: This command saves the trace specified by :TMEMory:CHANnel, as a reference trace.

Syntax

[:SENSe]:TMEMory:REFerence:SET

Example of Use

:TMEM:REF:SET

:TMEMory:REFerence:CLEar

Function

Modified in Version 7: This command clears the reference trace of the channel specified by :TMEMory:CHANnel.

Syntax

[:SENSe]:TMEMory:REFerence:CLEar
Chapter 3  Message List

Example of Use
:TMEM:REF:CLE

:TMEM:CHAN
Function
This command sets and queries the channel saved as a reference trace of Scope.
When saving the reference trace, use :TMEM:REF:SET.

Syntax
[:SENSe]:TMEM:CHAN BOTH|CHA|CHB|CHC|CHD
[:SENSe]:TMEM:CHAN?

Parameter
BOTH   For dual channel: Channel A and B
       For quad channel: Channel A, B, C, and D
CHA    Channel A
CHB    Channel B
CHC    Channel C
CHD    Channel D

Response Data
Both |CHA|CHB|CHC|CHD

Example of Use
:TMEM:CHAN Both
:TMEM:CHAN?
>Both

3.9.3.9 Calibration
:CAL:TEMP?
Function
This command queries the current temperature and temperature during the calibration on the Scope module.

Syntax
:CAL:TEMP?

Response Data
<num>,<num>
Current temperature (°C), Temperature during calibration (°C)

Example of Use
:CAL:TEMP?
3.9 Scope-specific messages

>:CALibrate:AMPLitude?

Function
This command initiates an amplitude calibration for Scope Channel.

Syntax
>:CALibrate:APPLitude[?]

For Version 3.2 or earlier, send this command, omitting “?” . In this case, a response is returned even if “?” is omitted.

Response Data
One of the following results is returned when the calibration ends.
"Calibration complete." Calibration has successfully completed.
"Calibration Failed.(CHA)" Calibration of channel A has failed. (Version 6 or earlier)
"Calibration Failed.(CHB)" Calibration of channel B has failed. (Version 6 or earlier)
"Calibration Failed.(CHA&CHB)" Calibration of channels A and B has failed. (Version 6 or earlier)
"Calibration Failed." Calibration has failed. (Version 7 or later)

Example of Use
>:CAL:AMPL?
(Time-waiting process of approx. 60 s)
>"Calibration complete."

Note:
In EYE mode, calibration takes about 50 s. Therefore, the timeout for the interface must be set to 60 s. If Timeout is set to less than 60 s, a calibration result may not be read due to a timeout error occurring before outputting the result to an output queue.
3.9.3.10 Selftest

:CALibrate:APPLication

Function
This command starts the self-test of the Scope.
Also, this command queries the self-test result of the Scope.

Syntax
:CALibrate:APPLication
:CALibrate:APPLication?

Response Data
When the self-diagnostic is completed successfully, “Self Test Passed!” is returned.
When the self-test error occurs, the response message is not returned.

Example of Use
:CAL:APPL?
>"Self Test Passed!"
3.9.3.11 Screen Copy

:EYE Pulse:PRINT:COPY

Function
This command takes a screenshot of the Scope screen.

*Modified in Version 7:* A channel can be specified using CHA, CHB, CHC, or CHD.
If any channel is specified, an image of the screen in Single display mode is saved.
If any channel is not specified, an image of the screen currently displayed is saved.

*Added in Version 7:* For queries, the command takes a screenshot and reads an image of the screen as a binary data.

Syntax

```
[:SENSe]:EYE Pulse:PRINT:COPY[:{CHA|CHB|CHC|CHD}]
[file_name],[directory],[PNG|JPEG]
[:SENSe]:EYE Pulse:PRINT:COPY[:{CHA|CHB|CHC|CHD}]?
[PNG|JPEG]
```

Parameter
Refer to :SYSTem:PRINT:COPY.

Example of Use

```
:EYE Pulse:PRINT:COPY:CHA "screen_copy_eye","C:/screen_copy"
```

Notes:

- Specify a file name when capturing screenshots repeatedly.
  If the file name is not specified, an image file is created newly each time this command is sent. Make sure there is sufficient disk space.

- To take a screenshot of the entire screen, use :SYSTem:PRINT:COPY.

- To query the screenshot image file data, use :SYSTem:DISP:DATA?.

- In the software earlier than version 3.03/4.01.01, specify a module using :MOD:ID 5 before executing the COPY command.
:PRIN:GRATicule

Function
This command sets and queries the On/Off state for taking a screenshot of only the waveform area of Scope.

Syntax
[:SENSe]:PRIN:GRATicule <enable>
[:SENSe]:PRIN:GRATicule?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:PRIN:GRAT ON
:PRIN:GRAT?
>1

:PRIN:INVerse

Function
This command sets and queries the On/Off state of background color inversion for a screenshot of Scope.

Syntax
[:SENSe]:PRIN:INVerse <enable>
[:SENSe]:PRIN:INVerse?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:PRIN:INV OFF
:PRIN:INV?
>0
3.9 Scope-specific messages

3.9.3.12 Save

:TRACe[:DATA]:{CHANnelA|CHANnelB|CHANnelC|CHANnelD}:BINary?

Function
This command performs Pattern Capture of Scope, and queries the
amplitude data captured for one cycle of the test pattern out of the
waveform being displayed.

Syntax
:TRACe[:DATA]:{CHANnelA|CHANnelB|CHANnelC|CHANnelD}:BINa
ry?

Response Data
#<digit><data_size><binary_data><terminator>

<digit> is a one-digit number that indicates the number of digits of
<data_size>.
<data_size> indicates the data size of <binary_data>.
<binary_data> is the time-series data of the waveform for one pattern. It
indicates a double-precision floating-point number separated by 8 bytes.
<terminator> indicates the terminator (LF or CR/LF) specified by
the :SYST:TERM command.

Example of Use
:TRAC:CHANA:BIN?
>#78388352??WY??Z...?

Note:
For how to save the binary data, refer to the descriptions
of :SYSTem:DISPlay:DATA?.

:TRACe[:DATA]:SPUI

Function
This command sets the number of times to measure amplitude per UI
with the Pattern Capture function (number of samples).

Syntax
:TRACe[:DATA]:SPUI 1|2|4|8|16|32
:TRACe[:DATA]:SPUI?

Parameter
1|2|4|8|16|32
Response Data
1|2|4|8|16|32

Example of Use
:TRAC:SPUI 32
:TRAC:SPUI?
>32
3.9 Scope-specific messages

3.9.4 Time

3.9.4.1 Trigger Clock Rate (MP2100B, MP2110A)

:TIME:TRACking

Function

Added in Version 5: This command sets and queries the tracking for Bit Rate and Divide Ratio of Scope.

Syntax

[:SENSe]:TIME:TRACking <master>
[:SENSe]:TIME:TRACking?

Parameter

<master>

For MP2100B

OFF Tracking Off
PPG1_SYNCOUT PPG1 Bit Rate and Sync Output Divide Ratio
PPG1_USER PPG1 Bit Rate and User Defined Divide Ratio
PPG2_SYNCOUT PPG2 Bit Rate and Sync Output Divide Ratio
PPG2_USER PPG2 Bit Rate and User Defined Divide Ratio

For MP2110A

OFF Tracking Off
PPG_CLOCKOUT PPG Bit Rate and Clock Output Divide Ratio
PPG_SYNCOUT PPG Bit Rate and Sync Output Divide Ratio
PPG_USER PPG Bit Rate and User Defined Divide Ratio
CRU Added in Version 6: Recovered Clock Rate and 1/2 Divide Ratio
Modified in 7.01:

MP2110A-054: 1/2 Divide Ratio
MP2110A-055: 1/4 Divide Ratio (26G band)
1/8 Divide Ratio (53G band)

Response Data

<master>

Example of Use

:TIME:TRAC PPG_CLOCKOUT
:TIME:TRAC?
>PPG_CLOCKOUT
Chapter 3 Message List

:TIME:TRACking:STATus?

Function

*Added in Version 5:* This command queries the tracking statuses for Bit Rate and Divide Ratio of Scope.

Syntax

[:SENSe]:TIME:TRACking:STATus?

Response Data

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO_ERROR</td>
<td>No error or Tracking Off</td>
</tr>
<tr>
<td>ERR_REFCLC</td>
<td>Tracking error. The Reference CLK setting of PPG is External. Change it to Internal.</td>
</tr>
<tr>
<td>ERR_CLKOUT</td>
<td>Tracking error. The Clock Out output of PPG is OFF.</td>
</tr>
<tr>
<td>ERR_CRU</td>
<td><em>Added in Version 6:</em> Tracking error. :TIME:CRU is not in RECovery mode.</td>
</tr>
</tbody>
</table>

Example of Use

:TIME:TRAC:STAT?

>NO_ERROR

3.9.4.2 Trigger Clock Rate (MP210xx)

:CONFigure:TRACking:DRATe

Function

*Only in MP210xA and MP2100B:* This command sets and queries the On/Off state of tracking of bit rate and clock rate of Scope.

Syntax

:CONFigure:TRACking:DRATe <enable>

:CONFigure:TRACking:DRATe?

Parameter

<table>
<thead>
<tr>
<th>0</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON</td>
</tr>
</tbody>
</table>

Response Data

| 0 | 1 |

Example of Use

:CONF:TRAC:DRAT ON

:CONF:TRAC:DRAT?

>1
3.9 Scope-specific messages

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command. Use “:TIME:TRACking”.

:CONFigure:TRACking:DRATe:MASTer

Function
Only in MP210xA and MP2100B: This command sets and queries the synchronization source for tracking of bit rate and clock rate of Scope.

Syntax
:CONFigure:TRACking:DRATe:MASTer 0|1|2|3
:CONFigure:TRACking:DRATe:MASTer?

Parameter
0 PPG1 Bit Rate and Sync Output Divide Ratio
1 ED1 Bit Rate and Sync Output Divide Ratio
2 PPG2 Bit Rate and Sync Output Divide Ratio
3 ED2 Bit Rate and Sync Output Divide Ratio

Response Data
0|1|2|3

Example of Use
:CONF:TRAC:DRAT:MAST 2
:CONF:TRAC:DRAT:MAST?
>2

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command. Use “:TIME:TRACking”.
Chapter 3  Message List

3.9.4.3 Setting

:TIME:ACQ Clock?

Function
This command sets Trigger Clock Rate automatically.

Syntax
[:SENSe]:TIME:ACQ Clock?

Response Data
<integer> MHz
Detected Clock Rate value

Example of Use
:TIME:ACQ?
>100.000 MHz

Note:
This command detects the frequency of the signal input to the Trigger Clk In connector and change the Clock Rate setting. To read the Clock Rate setting value only, use “:TIME:CLKRate” instead of this command.
3.9 Scope-specific messages

:TIME:CLKRate

Function
This command sets and queries the clock rate of Scope.
When changing the clock rate, the bit rate is changed to the value
multiplexed clock rate by divide ratio.

Syntax
[:SENSe]:TIME:CLKRate <numeric> [GHz|MHz|kHz]
[:SENSe]:TIME:CLKRate?

Parameter
<numeric>
Clock rate
GHz, MHz, or kHz can be used as the unit.
When omitting the unit, the unit is fixed to MHz.

Response Data
<numeric> MHz

Example of Use
To set the clock rate of the Scope to 10312.5 MHz:
:TIME:CLKR 10312.5
:TIME:CLKR?
>10312.50 MHz

Note:
In MP2110A, when Precision Trigger is set to On, the lower limit of
Clk Rate is 2.4 GHz.
:TIME:DATRate

Function
This command sets and queries the bit rate of Scope (symbol rate for MP2110A).
When changing the bit rate, the clock rate is changed to the value multiplexed bit rate by divide Ratio.

Syntax
[:SENSe]:TIME:DATRate <numeric>[Gbps|Mbps|kbps]
[:SENSe]:TIME:DATRate?

Parameter
<numeric>
Bit rate
Gbps, Mbps, or kbps can be used as the unit. When omitting the unit, the unit is fixed to Mbps.

Response Data
<numeric> Mbps

Example of Use
To set the bit rate of the Scope to 155220 kbit/s
:TIME:DATR 155220kbps
:TIME:DATR?
>155.220  Mbps
3.9 Scope-specific messages

:TIME:DIVRatio

Function
This command sets and queries the clock divide ratio of Scope.
When changing the clock divide ratio, either of the bit rate (symbol rate for MP2110A) or clock frequency is changed.

Syntax
[:SENSe]:TIME:DIVRatio <integer>,{CLKR|DATA}
[:SENSe]:TIME:DIVRatio?

Parameter
<integer>
Divide ratio 1 to 99
When Sampling mode is Pulse or CoherentEye, it operates only when 1, 2, 4, 8, 16, 32, 40, 48, or 64 is set.
(48 is added in Version 6)
DATR The bit rate is re-calculated from the divide ratio and clock frequency.
CLKR The clock frequency is re-calculated from the divide ratio and bit rate.

Response Data
<integer>
Divide ratio 1 to 99

Example of Use
To set the 1/16 value of the clock frequency to the bit rate:
:TIME:DIVR 16,CLKR
**:TIME:AUTodetect**

**Function**
This command sets and queries the On/Off state of auto detection of the clock divide ratio (1/n) input to the Trigger Clk In connector of Scope.

**Syntax**
```
[:SENSe]:TIME:AUTodetect ON|OFF
[:SENSe]:TIME:AUTodetect?
```

**Parameter**
0|OFF
1|ON

**Response Data**
ON|OFF

**Example of Use**
```
:TIME:AUT ON
:TIME:AUT?
>ON
```

**:TIME:PTRigger**

**Function**
*Only in MP2110A:* This command sets and queries the On/Off state of Precision Trigger for Scope.

**Syntax**
```
[:SENSe]:TIME:PTRigger <enable>
[:SENSe]:TIME:PTRigger?
```

**Parameter**
0|OFF
1|ON

**Response Data**
0|1

**Example of Use**
```
:TIME:PTR 1
:TIME:PTR?
>1
```

**Note:**
This setting is enabled when the Option 024 is installed.
3.9 Scope-specific messages

:TIME:PTRigger:RESet

Function

*Only in MP2110A:* This command resets Precision Trigger of Scope.

Syntax

[:SENSe]:TIME:PTRigger:RESet

Example of Use

:TIME:PTR:RES

*Note:*

Use this command when the PT phase unlock (bit6) is detected by :IN斯特ure:WAV:CONDition?.
### 3.9.4.4 Scale/Offset

:DISPlay:WINDow:X:UNIT

**Function**
This command sets and queries the unit of the horizontal scale of Scope.

**Syntax**
:DISPlay:WINDow:X[:SCALe]:UNIT PS|UI
:DISPlay:WINDow:X[:SCALe]:UNIT?

**Parameter**
- **PS**: Sets the unit to picosecond ($10^{-12}$ seconds).
- **UI**: Sets the unit to Unit Interval.

**Response Data**
PS | UI

**Example of Use**
:DISP:WIND:X:UNIT UI
:DISP:WIND:X:UNIT?
>UI

:DISPlay:WINDow:X:BITs

**Function**
This command sets and queries the horizontal scale of Scope, by the number of bits.

**Syntax**
:DISPlay:WINDow:X[:SCALe]:BITs <integer>
:DISPlay:WINDow:X[:SCALe]:BITs?

**Parameter**
- **<integer>**
  - Eye mode, Coherent Eye mode:
    - MP210xx 1 to 1000, 1 bit step
      - (If Fast Sampling Mode is On, the range is 1 to 100.)
    - MP2110A 1 to 100, 1 bit step
  - Pulse mode: 1 to 65535, 1 bit step

**Response Data**
<integer>

**Example of Use**
:DISP:WIND:X:BIT 2
3.9 Scope-specific messages

:DISP:WIND:X:BIT?
>2

:DISPlay:WINDow:X:OFFSets

Function
This command sets and queries the offset value of the horizontal scale of the Scope (Version 6 or earlier).

Modified in Version 7:
When Sampling Mode is Pulse:
This command sets and queries the offset value of the horizontal scale.

When Sampling Mode is other than Pulse:
This command converts the offset value to Skew and sets Skew for all channels to the converted value.
The query response is 0.

Syntax

Parameter
<numeric>
Offset value
Unit UI or picosecond (ps)
The unit can be set using the :DISPlay:WINDow:X:UNIT.
When unit is UI: 0 to 32768
When unit is ps:
\[
\text{Offset (UI)} = \frac{\text{Symbol Rate (Gbaud or Gbit/s)} \times 1000}{\text{Symbol Rate (Gbaud or Gbit/s)} \times 1000}
\]

Response Data
<numeric>

Example of Use
:DISP:WIND:X:OFFS 150
3.9.4.5 Test Pattern / Pattern Length

:TIME:PATTern:TYPE

Function

*Added in Version 6:* This command sets and queries input signal pattern type to be measured in Pulse or CoherentEye mode.

Syntax

:TIME:PATTern:TYPE VARiable|PRBS{7|9|13|15}|SSPRQ
:TIME:PATTern:TYPE?

Parameter

VARiable
PRBS7
PRBS9
PRBS13
PRBS15
SSPRQ

If the desired pattern is not included in the options, select VARiable (Variable Length) and specify a pattern length by the :TIME:PATTLength command.

However, the TDECQ measurement cannot be performed when VARiable is selected.

Also, if a type other than VARiable is selected, the sampling speed is faster.

Response Data

VARiable| PRBS{7|9|13|15} | SSPRQ

Example of Use

:TIME:PATT:TYPE PRBS15
:TIME:PATT:TYPE?
>PRBS15
3.9 Scope-specific messages

:TIME:PATLength

Function
This command sets and queries the data pattern length used in the pulse or CoherentEye mode of the Scope.

*Modified in Version 6:* This setting is valid when TIME:PATTern:TYPE is VARiable.

Syntax
[:SENSe]:TIME:PATLength <numeric>
[:SENSe]:TIME:PATLength?

Parameter
<numeric>

Range

*Version 5 or older:* 1 to 16777216
*Version 6 or later:* 2 to 32768

Response Data
<integer>

*Version 5 or older:* 1 to 16777216
*Version 6 or later:* 2 to 32768

Example of Use
:TIME:PATL 511
:TIME:PATL?
>511

:CONFigure:TRACking:PATLength

Function
This command sets and queries the On/Off state of pattern length tracking of Scope.

Syntax
:CONFigure:TRACking:PATLength <enable>
:CONFigure:TRACking:PATLength?

Parameter
0|OFF
1|ON

Response Data
0|1
Example of Use
:CONFg:TRAC:PATL OFF
:CONFg:TRAC:PATL?
>0

:CONFigure:TRACking:PATLength:MASTer
Function
This command sets and queries the synchronization source for pattern
length tracking of Scope.

Syntax
:CONFigure:TRACking:PATLength:MASTer 0|1|2|3|4|5|6|7
:CONFigure:TRACking:PATLength:MASTer?

Parameter
0  PPG1
1  ED1
2  PPG2
3  ED2
4  PPG3
5  ED3
6  PPG4
7  ED4

Response Data
0|1|2|3|4|5|6|7

Example of Use
:CONFg:TRAC:PATL:MAST 1
:CONFg:TRAC:PATL:MAST?
>1
3.9.4.6 Skew

:CONFigure:SKEW:{CHA|CHB|CHC|CHD}

Function
For MP21x0A and MP2100B, this command sets and queries the skew of Scope.
For MP2110A, this command sets and queries Software Delay of Scope.

Syntax
:CONFigure:SKEW:{CHA|CHB|CHC|CHD} <numeric>
:CONFigure:SKEW:{CHA|CHB|CHC|CHD}?

Parameter
<numeric>
The range is “±BIT/DATR/2 (ps)” calculated using the scale of the X axis (:DISP:WIND:X:BIT) and BitRate (:TIME:DATR).

Response Data
<numeric>

Example of Use
:CONF:SKEW:CHA 6.4
:CONF:SKEW:CHA?
>6.4
Chapter 3  Message List

:CONFigure:SKEW:ALIGn

Function
Added in Version 5.02: This command sets and queries the On/Off state for automatically adjusting the Skew setting value to display the waveforms of both Channel A and Channel B in the center when executing Auto Scale.
Modified in Version 7: Nothing is processed even if this command is sent. The query response is always 0.

Syntax
:CONFigure:SKEW:ALIGn <enable>
:CONFigure:SKEW:ALIGn?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:CONF:SKEW:ALIG ON
:CONF:SKEW:ALIG?
>1
3.9 Scope-specific messages

3.9.5 Amplitude, O/E

3.9.5.1 Scale/Offset

:DISP:WINDow:CHANnel:BOTH

Function
This command sets and queries the On/Off state of Tracking of Scope.

Syntax
:DISP:WINDow:CHANnel:BOTH <enable>
:DISP:WINDow:CHANnel:BOTH?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:DISP:WIND:CHAN:BOTH ON
:DISP:WIND:CHAN:BOTH?
>1

:DISP:WINDow:Y:DIVision:{CHA|CHB|CHC|CHD}

Function
This command sets and queries the unit of the vertical scale of Scope.

Syntax
:DISP:WINDow:Y[:SCALe]:DIVision:{CHA|CHB|CHC|CHD} <numeric>
:DISP:WINDow:Y[:SCALe]:DIVision:{CHA|CHB|CHC|CHD}?

Parameter
<numeric>

Electrical channel: 1.0 to 200.0 × [10 (attenuation/20)] (mV)
Optical channel: A value (µW) where the range of the electrical channel is divided by Conversion Gain (V/W)

Response Data
<numeric>

Example of Use
:DISP:WIND:Y:DIV:CHA?
>100.0
Chapter 3  Message List

Notes:

- The settable maximum value varies depending on the attenuation set by `:INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}]`.

- For optical interface, the settable maximum value varies depending on the O/E conversion gain set by `:CALibrate:CGain`.

`:DISPlay:WINDow:Y:OFFSets:{CHA|CHB|CHC|CHD}`

**Function**

This command sets and queries the offset value for the vertical scale of Scope.

**Syntax**

`:DISPlay:WINDow:Y[:SCALe]:OFFSets:{CHA|CHB|CHC|CHD}<numeric>`

`:DISPlay:WINDow:Y[:SCALe]:OFFSets:{CHA|CHB|CHC|CHD}?`

**Parameter**

<numeric>

Electrical channel: –500 to 500 (mV)

Optical channel: A value (mW) where the range of the electrical channel is divided by Conversion Gain (V/W)

**Response Data**

<numeric>

**Example of Use**

`:DISP:WIND:Y:OFFS:CHB?`

>`-50`

**Notes:**

- The settable maximum value varies depending on the attenuation set by `:INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}]`.

- For optical interface, the settable maximum value varies depending on the O/E conversion gain set by `:CALibrate:CGain`.
3.9 Scope-specific messages

:INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}]

Function
This command sets and queries the amount of attenuation for adjusting the Scope amplitude scale.
Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax
[:SENSe]:INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}]
<numeric>
[:SENSe]:INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter
<numeric>
0.00 to 30.00 (dB)

Response Data
<numeric>

Example of Use
:INP:ATT:CHA 20.00
3.9.5.2 Channel Math

:CALCulate:CHANnel:MATH

Function
This command sets and queries the calculation between channels of Scope.

Syntax
:CALCulate:CHANnel:MATH <enable>
:CALCulate:CHANnel:MATH?

Parameter
0|OFF
1|ON

Response Data
1|0

Example of Use
:CALC:CHAN:MATH OFF
:CALC:CHAN:MATH?
>0
:CALCulate:CHANnel:MATH:DEFine

Function
This command sets and queries the calculation formula between channels of Scope.

Syntax
:CALCulate:CHANnel:MATH:DEFine 0|1|2
:CALCulate:CHANnel:MATH:DEFine?

Parameter
0: Channel A + Channel B
1: Channel A – Channel B
2: Channel B – Channel A

Response Data
0|1|2

Example of Use
:CALC:CHAN:MATH:DEF?
>1

:DISPlay:WINDow:Y:DIVision:CHMath

Function
This command sets and queries the value (mV) of the vertical scale of Scope when Channel Math is On.

Syntax
:DISPlay:WINDow:Y[:SCALe]:DIVision:CHMath <numeric>
:DISPlay:WINDow:Y[:SCALe]:DIVision:CHMath?

Parameter
<numeric>
Range 1 to 200 mV, 0.1 mV step

Response Data
<numeric>

Example of Use
:DISP:WIND:Y:DIV:CHM?
>100

Note:
The settable maximum value varies depending on the attenuation set by :INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}].
Chapter 3 Message List

:DISPlay:WINDow:Y:OFFSets:CHMath

Function
This command sets and queries the offset value (mV) of the vertical scale of Scope when Channel Math is On.

Syntax
:DISPlay:WINDow:Y[:SCALe]:OFFSets:CHMath <numeric>
:DISPlay:WINDow:Y[:SCALe]:OFFSets:CHMath?

Parameter
<numeric>
Range –1000.0 to +1000.0 mV, 0.1 mV step

Response Data
<numeric>

Example of Use
:DISP:WIND:Y:OFFS:CHM?
>-50

Note:
The settable maximum value varies depending on the attenuation set by :INPut:ATTenuation[:{CHA|CHB|CHC|CHD|ALL}].
3.9.5.3 O/E

:CALibrate:OEPower[:JUDGe]

Function
This command judges if the O/E converter can be calibrated, and queries the result of judgment.

Syntax
:CALibrate:OEPower
:CALibrate:OEPower:JUDGe
:CALibrate:OEPower:JUDGe?
:CALibrate:OEPower?

Response Data
Pass | Fail
Pass  The O/E converter can be calibrated.
Fail   The O/E converter cannot be calibrated. (Optical input level > –30 dBm)

Example of Use
:CAL:OEP:JUDG
:CAL:OEP:JUDG?
>Pass
3.9.5.4 Conversion Gain/Responsivity

:INPut:WAVLength

Function
This command sets and queries the optical wavelength input to the O/E converter.

Syntax
[:SENSe]:INPut:WAVLength[:{CHA|CHB|CHC|CHD|ALL}] <character>

[:SENSe]:INPut:WAVLength[:{CHA|CHB|CHC|CHD|ALL}]?

[:{CHA|CHB|CHC|CHD|ALL}] can be specified only in MP2110A. When nothing is specified, CHB is specified (Version 6 or earlier). Modified in Version 7: When nothing is specified, ALL is specified for command, and the active channel is specified for query.

Parameter
<character>
850 850 nm
USER_MMF Defined by users (MMF) (Only in MP2110A)
1310 1310 nm
1550 1550 nm
USER Defined by users (SMF) (Added in Version 3.01.13)

Response Data
850|USER_MMF|1310|1550|USER

Example of Use
To set the ChB O/E converter wavelength to 1550 nm
:INP:WAVL 1550
:INP:WAVL?
>1550

:CALibrate:CGain

Function
This command sets and queries the O/E Conversion Gain.

Syntax
:CALibrate:CGain[:{CHA|CHB|CHC|CHD}] <numeric>
:CALibrate:CGain[:{CHA|CHB|CHC|CHD}]?

[:{CHA|CHB|CHC|CHD}] can be specified only in MP2110A.
When nothing is specified, CHB is specified (Version 6 or earlier). Modified in Version 7: When nothing is specified, the active channel is specified.

Parameter

<numeric>
1 to 9999 (V/W)

Response Data

<integer>

Example of Use

:CAL:CG 320
:CAL:CG?
>320

Note:

Only in MP2110A: When Wavelength is not User and the O/E Conversion Gain is set using this command, the user is automatically changed to a user who is corresponding to the wavelength currently selected.

:CALibrate:SYSTem:CGain

Function

Only in MP210xA and MP2100B: This command sets and queries the System Conversion Gain for the O/E converter.

Syntax

:CALibrate:SYSTem:CGain <numeric>
:CALibrate:SYSTem:CGain?

Parameter

<numeric>
1 to 9999 (V/W)

Response Data

<integer>

Example of Use

:CAL:SYST:CG?
>160
:CALibrate:RESPonsivity

Function
This command sets and queries Responsivity of the O/E converter.

Syntax
:CALibrate:RESPonsivity[:{CHA|CHB|CHC|CHD}] <numeric>
:CALibrate:RESPonsivity[:{CHA|CHB|CHC|CHD}]?

[:{CHA|CHB|CHC|CHD}] can be specified only in MP2110A.
When nothing is specified, CHB is specified (Version 6 or earlier).
Modified in Version 7: When nothing is specified, the active channel is specified.

Parameter
<numeric>
0.001 to 65.535 (A/W)

Response Data
<numeric>

Example of Use
:CAL:RESP?
>0.853

Note:
Only in MP2110A: When Wavelength is not User and Responsivity is set using this command, the user is automatically changed to a user who is corresponding to the wavelength currently selected.

:CALibrate:AUTocorrect

Function
Added in Version 3.01.13: This command automatically adjusts the values of Conversion Gain, Responsivity, and System Conversion Gain so that they become equal to the values measured by the optical power meter.

Syntax
:CALibrate:AUTocorrect[:{CHA|CHB|CHC|CHD}]

[:{CHA|CHB|CHC|CHD}] can be specified only in MP2110A. When nothing is specified, CHB is specified (Version 6 or earlier).
Modified in Version 7: When nothing is specified, the active channel is specified.
3.9 Scope-specific messages

Example of Use
To set User at Wavelength:
:INP:WAVL USER

To measure the unmodulated optical signal power by the optical power meter and set the measured value:
:CAL:CALP -7.00
:CAL:CALP?
>-7.00

To input the optical signal to the optical input connector and automatically adjust the values:
:CAL:AUT

Note:
Perform the following settings before adjusting the values automatically using this command.
- Set User at Wavelength.
- Set the result of measuring the unmodulated optical signal power by the optical power meter to :CALibrate:CALPower.

:CALibrate:CALPower

Function
Added in Version 3.01.13: This command sets and queries the optical power measurement value used for adjusting the values automatically by :CALibrate:AUTocorrect.

Syntax
:CALibrate:CALPower[:{CHA|CHB|CHC|CHD}] <numeric>
:CALibrate:CALPower[:{CHA|CHB|CHC|CHD}]?

[:{CHA|CHB|CHC|CHD}] can be specified only in MP2110A. When nothing is specified, CHB is specified (Version 6 or earlier).

Modified in Version 7: When nothing is specified, the active channel is specified.

Parameter
<numeric>
-10 to –2 dBm

Example of Use
Refer to “Example of Use” of :CALibrate:AUTocorrect.
3.9.5.5 Filter

:FILTER

Function

*Added in Version 5:* This command sets and queries the internal low-pass filter.

Syntax

[:SENSe]:FILTER[:{CHA|CHB|CHC|CHD|ALL}]

{"NO_FILTER"|"<standard>"}

[:SENSe]:FILTER[:{CHA|CHB|CHC|CHD|ALL}]?

[:{CHA|CHB|CHC|CHD|ALL}] can be specified only in MP2110A.

When nothing is specified, CHB is specified (Version 6 or earlier).

*Modified in Version 7:* When nothing is specified, ALL is specified for command, and the active channel is specified for query.

Parameter

| Table 3.9.5.5-1 NRZ Filter Settings List (MP2110A) |
|---------------------------------|----------|---------|--------|
| "<standard>" | Standard | Bit Rate | Remarks |
| "100GE_4" | 100GbE/4 | 25.78125Gbit/s |  |
| "100GE_4_FEC" | 100GbE/4 FEC | 27.7393Gbit/s |  |
| "OTU-4" | OTU4 | 27.952493Gbit/s |  |
| "32G_FC" | 32GFC | 28.05Gbit/s |  |

| Table 3.9.5.5-2 PAM4 Filter Settings List (MP2110A) |
|---------------------------------|----------|---------|--------|
| "<standard>" | Standard | Frequency | Remarks |
| "400GE_8" | 26.5625 Gbaud | 19.34 GHz | * |
| "400GE_8_SMF" | 26.5625 Gbaud SM TDECQ | 13.3 GHz | * |
| "400GE_8_MMF" | 26.5625 Gbaud MM TDECQ (IEEE802.3cd Draft2.0) | 12.6 GHz | * |
| "400GE_8_MMF_D3" | 26.5625 Gbaud MM TDECQ (IEEE802.3cd Draft3.0) | 11.2 GHz | * |
| "400GE_4_SMF" | 53.1250 Gbaud SM TDECQ | 26.5625 GHz | * |
| "400GE_4" | 53.1250 Gbaud (38.7 GHz) | 38.7 GHz | * |
| "64G_FC_SMF" | 28.9000 Gbaud SM TDECQ | 14.45 GHz | * |
| "64G_FC_MMF" | 28.9000 Gbaud MM TDECQ | 12.4 GHz | * |
3.9 Scope-specific messages

*: Added in Version 6: Digital filter for PAM4 measurement. It is selectable under the following conditions.
- Sampling Mode: Coherent Eye
- Pattern Length Type: Other than Variable

Table 3.9.5.5-3 Filter Settings List (MP2100B)

<table>
<thead>
<tr>
<th>&lt;standard&gt;</th>
<th>Standard</th>
<th>Bit Rate (bit/s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;10G_FC_FEC&quot;</td>
<td>10GFC FEC</td>
<td>11.3168G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_OTU2E&quot;</td>
<td>OTU2e (10GbE FEC)</td>
<td>11.095728G</td>
<td></td>
</tr>
<tr>
<td>&quot;OTU-2&quot;</td>
<td>OTU2</td>
<td>10.709225G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-192FEC&quot;</td>
<td>G.975 FEC</td>
<td>10.664228G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_FC&quot;</td>
<td>10GFC</td>
<td>10.51875G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_LAN&quot;</td>
<td>10GbE LAN/PHY</td>
<td>10.3125G</td>
<td></td>
</tr>
<tr>
<td>&quot;INF10G&quot;</td>
<td>InfiniBand x4</td>
<td>10G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-192&quot;</td>
<td>OC-192/STM-64</td>
<td>9.95328G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_WAN&quot;</td>
<td>10GbE WAN/PHY</td>
<td>9.95328G</td>
<td></td>
</tr>
<tr>
<td>&quot;8G_FC&quot;</td>
<td>8GFC</td>
<td>8.5G</td>
<td></td>
</tr>
<tr>
<td>&quot;6_3G&quot;</td>
<td>fc = 6.3GHz</td>
<td>6.3G</td>
<td></td>
</tr>
<tr>
<td>&quot;XAUI-2&quot;</td>
<td>XAUI Optical x2</td>
<td>6.25G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-10&quot;</td>
<td>CPRI x10</td>
<td>6.144G</td>
<td></td>
</tr>
<tr>
<td>&quot;INF5G&quot;</td>
<td>InfiniBand x2</td>
<td>5G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-8&quot;</td>
<td>CPRI x8</td>
<td>4.9515G</td>
<td></td>
</tr>
<tr>
<td>&quot;4G_FC&quot;</td>
<td>4GFC</td>
<td>4.25G</td>
<td></td>
</tr>
<tr>
<td>&quot;10G_FC_LX4&quot;</td>
<td>10GFC-LX4</td>
<td>3.1875G</td>
<td></td>
</tr>
<tr>
<td>&quot;10GBASE_LX4&quot;</td>
<td>10GBASE-LX4</td>
<td>3.125G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-5&quot;</td>
<td>CPRI x5</td>
<td>3.072G</td>
<td></td>
</tr>
<tr>
<td>&quot;OTU-1&quot;</td>
<td>OTU1</td>
<td>2.666057G</td>
<td></td>
</tr>
<tr>
<td>&quot;2GBE&quot;</td>
<td>2GbE</td>
<td>2.5G</td>
<td></td>
</tr>
<tr>
<td>&quot;INF&quot;</td>
<td>InfiniBand</td>
<td>2.5G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-48&quot;</td>
<td>OC-48/STM16</td>
<td>2.488G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-4&quot;</td>
<td>CPRI x4</td>
<td>2.4576G</td>
<td></td>
</tr>
<tr>
<td>&quot;2G_FC&quot;</td>
<td>2GFC</td>
<td>2.125G</td>
<td></td>
</tr>
<tr>
<td>&quot;1GBE&quot;</td>
<td>1GbE</td>
<td>1.25G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-24&quot;</td>
<td>OC-24</td>
<td>1.244G</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI-2&quot;</td>
<td>CPRI x2</td>
<td>1.2288G</td>
<td></td>
</tr>
<tr>
<td>&quot;1G_FC&quot;</td>
<td>1GFC</td>
<td>1.0625G</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-12&quot;</td>
<td>OC-12/STM-4</td>
<td>622.08M</td>
<td></td>
</tr>
<tr>
<td>&quot;CPRI&quot;</td>
<td>CPRI</td>
<td>614.4M</td>
<td></td>
</tr>
<tr>
<td>&quot;OC-3&quot;</td>
<td>OC-3/STM-1</td>
<td>155.22M</td>
<td></td>
</tr>
</tbody>
</table>
Response Data
{"NO_FILTER"|"<standard>"}

Example of Use
To set 100GbE/4 to the filter:
:FILT "100GE_4"
:FILT?
>"100GE_4"

:INPut:FILTer:ENABle
Function
*Only in MP210xA and MP2100B: Added in Version 3.01.13:* This command sets and queries the On/Off state of the Option 086 filter.

Syntax
[[:SENSe]:INPut:FILTer:ENABle 0|1
[[:SENSe]:INPut:FILTer:ENABle?]

Parameter
0    Sets the Filter to Off.
1    Sets the Filter to On.

Response Data
0|1

Example of Use
To set the filter to Off.
:INPut:FILTer:ENABle 0
:INPut:FILTer:ENABle?
>0

Note:
This command can be used only when the Option 086 of MP210xA or MP2100B is installed. In MP2110A, this command cannot be used, so use the command :FILTer.
Perform Amplitude Calibration before using this command.
:INPut:FILTer

Function

*Only in MP210xA and MP2100B:* This command sets and queries the internal low-pass filter.

Syntax

[:SENSe]:INPut:FILTer <integer>
[:SENSe]:INPut:FILTer?

Parameter

**Table 3.9.5.5-4  Filter Settings List (MP210xA, MP2100B)**

<table>
<thead>
<tr>
<th>&lt;integer&gt;</th>
<th>Standards</th>
<th>Bit Rate (bit/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>2GFC</td>
<td>2.125G</td>
</tr>
<tr>
<td>2</td>
<td>4GFC</td>
<td>4.25G</td>
</tr>
<tr>
<td>3</td>
<td>fc = 6.3GHz</td>
<td>6.3G</td>
</tr>
<tr>
<td>4</td>
<td>10GFC</td>
<td>10.51875G</td>
</tr>
<tr>
<td>5</td>
<td>10GbE WAN</td>
<td>9.95328G</td>
</tr>
<tr>
<td>6</td>
<td>10GbE LAN/PHY</td>
<td>10.3125G</td>
</tr>
<tr>
<td>7</td>
<td>OC192/STM-64</td>
<td>9.95328G</td>
</tr>
<tr>
<td>8</td>
<td>G.975 FEC</td>
<td>10.664228G</td>
</tr>
<tr>
<td>9</td>
<td>OTU2</td>
<td>10.709225G</td>
</tr>
<tr>
<td>10</td>
<td>1GFC</td>
<td>1.0625G</td>
</tr>
<tr>
<td>11</td>
<td>10GFC FEC</td>
<td>11.3168G</td>
</tr>
<tr>
<td>12</td>
<td>1GbE</td>
<td>1.25G</td>
</tr>
<tr>
<td>13</td>
<td>2GbE</td>
<td>2.5G</td>
</tr>
<tr>
<td>14</td>
<td>OTU2e (10GbE FEC)</td>
<td>11.095728G</td>
</tr>
<tr>
<td>15</td>
<td>InfiniBand</td>
<td>2.5G</td>
</tr>
<tr>
<td>16</td>
<td>InfiniBand x2</td>
<td>5G</td>
</tr>
<tr>
<td>17</td>
<td>InfiniBand x4</td>
<td>10G</td>
</tr>
<tr>
<td>18</td>
<td>OC3/STM-1</td>
<td>155.52M</td>
</tr>
<tr>
<td>19</td>
<td>OC12/STM-4</td>
<td>622.08M</td>
</tr>
<tr>
<td>20</td>
<td>OC24</td>
<td>1.244G</td>
</tr>
<tr>
<td>21</td>
<td>OC48/STM-16</td>
<td>2.488G</td>
</tr>
<tr>
<td>22</td>
<td>OTU1</td>
<td>2.66648G</td>
</tr>
<tr>
<td>23</td>
<td>CPRI</td>
<td>614.4M</td>
</tr>
<tr>
<td>24</td>
<td>CPRI x2</td>
<td>1.2288G</td>
</tr>
<tr>
<td>25</td>
<td>CPRI x4</td>
<td>2.4576G</td>
</tr>
<tr>
<td>26</td>
<td>CPRI x5</td>
<td>3.072G</td>
</tr>
<tr>
<td>27</td>
<td>CPRI x8</td>
<td>4.9515G</td>
</tr>
<tr>
<td>28</td>
<td>CPRI x10</td>
<td>6.144G</td>
</tr>
<tr>
<td>29</td>
<td>10GBASE-LX4</td>
<td>3.125G</td>
</tr>
</tbody>
</table>
Table 3.9.5.5-4  Filter Settings List (MP210xA, MP2100B) (Cont’d)

<table>
<thead>
<tr>
<th>&lt;integer&gt;</th>
<th>Standards</th>
<th>Bit Rate (bit/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>10GFC-LX4</td>
<td>3.1875G</td>
</tr>
<tr>
<td>31</td>
<td>XAUI Optical x2</td>
<td>6.25G</td>
</tr>
<tr>
<td>32</td>
<td>8GFC</td>
<td>8.5G</td>
</tr>
</tbody>
</table>

**Response Data**

<integer>

**Example of Use**

To set the filter to OC192/STM-64:

:INP:FILT 7

:INP:FILT?

>7

**Note:**

In MP2110A, this command cannot be used, so use the command :FILTer.
3.9.5.6  Extinction Ratio Correction

:CONFigure:EXRCorrection

Function
This command sets and queries the On/Off state of the extinction ratio correction of the O/E converter.

Syntax
:CONFigure:EXRCorrection[:{CHA|CHB|CHC|CHD|ALL}] 0|1
:CONFigure:EXRCorrection[:{CHA|CHB|CHC|CHD|ALL}]?

[:{CHA|CHB|CHC|CHD|ALL}] can be specified only in MP2110A. When nothing is specified, CHB is specified (Version 6 or earlier). Modified in Version 7: When nothing is specified, ALL is specified for command, and the active channel is specified for query.

Parameter
0  Off
1  On

Response Data
0|1

Example of Use
:CONF:EXRC 1
:CONF:EXRC?
>1
Chapter 3  Message List

:CONFigure:EXRCorrection:FACTor

Function
This command sets and queries the extinction ratio correction factor for the O/E converter.

Syntax
:CONFigure:EXRCorrection:FACTor[:{CHA|CHB|CHC|CHD|ALL}]
<numeric>
:CONFigure:EXRCorrection:FACTor[:{CHA|CHB|CHC|CHD|ALL}]?

[:{CHA|CHB|CHC|CHD|ALL}] can be specified only in MP2110A. When nothing is specified, CHB is specified (Version 6 or earlier). Modified in Version 7: When nothing is specified, ALL is specified for command, and the active channel is specified for query.

Parameter
<numeric>
–9.99 to 9.99%, 0.01 step

Response Data
<numeric>

Example of Use
To set Ch B extinction ratio correction factor to 1.2%
:CONF:EXRC:FACT:CHB 1.20
:CONF:EXRC:FACT:CHB?
>1.20
3.9 Scope-specific messages

3.9.6 Measure

3.9.6.1 Setting Measurement Items

:CONFigure:MEASure:DISPlay:ADD

Function

Added in Version 6: This command adds the measurement items for the Amplitude/Time measurement.

Syntax

:CONFigure:MEASure:DISPlay:ADD
CHA|CHB|CHC|CHD|ALL,<meas_item>

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHA:</td>
<td>Channel A</td>
</tr>
<tr>
<td>CHB:</td>
<td>Channel B</td>
</tr>
<tr>
<td>CHC:</td>
<td>Channel C</td>
</tr>
<tr>
<td>CHD:</td>
<td>Channel D</td>
</tr>
<tr>
<td>ALL:</td>
<td>All channels</td>
</tr>
</tbody>
</table>

<meas_item>

For NRZ:
<meas_item>={AVEPower{:DBM|MW}|CROSSing|EXTRatio|EYEAmplitude|EYEHeight:EYERatio|LEVEL:ONE|LEVEL:ZERO|OMA:DBM|OMA:MW|OMAXp|RINoise|SNR|TDEC|VECP|DCD|EYEWidth|FTI|Me|JITTER:PPeak|JITTER:RMS|TRISe}

When PAM4 (OPT095) is added:
<meas_item>={AVEPower|CEQ|EYE:HEIGHT|EYE:LEVEL|LEVEL|LEVEL:PPeak|LEVEL:RMS|LINEarity|OER|OMA|PTDq|TDECq|EYE:SKew|EYE:WIDTH|LEVEL:SKew}

When Jitter (OPT096) is added:
<meas_item>={DCD|DDJ|DDPWS|DJ|EOPening|ISI|J2|J4|J9|PJ[:FREQuency]|RJ[:RMS]|TJ}

Example of Use

:CONF:MEAS:DISP:ADD CHA,LEVEL:ZERO

:CONFigure:MEASure:DISPlay:ADELete[:{CHA|CHB|CHC|CHD|ALL}]

Function

Added in Version 6: This command deletes all the Amplitude Time measurement items for the specified channel or for all channels.

Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not
specified, ALL is specified for command, and the active channel is specified for query.

**Syntax**

```
:CONFigure:MEASure:DISPlay:ADELete{:CHA|CHB|CHC|CHD|ALL }
```

**Example of Use**

```
:CONF:MEAS:DISP:ADEL:ALL
```

`:CONFigure:MEASure:AMPTIME{1|2|3|4}

**Function**

*Only in MP210xA and MP2100B:* This command sets and queries the amplitude/time measurement items to be displayed in the Scope screen.

**Syntax**

```
:CONFigure:MEASure:AMPTIME{1|2|3|4} {CHA|CHB},<integer>
:CONFigure:MEASure:AMPTIME{1|2|3|4}? 
```

**Parameter**

1|2|3|4

- **CHA:** Channel A
- **CHB:** Channel B

- `<integer>` Measurement item
  0 One Level
  1 Zero Level
  2 Eye Amplitude
  3 Eye Height
  4 Crossing
  5 SNR
  6 Average Power (dBm)
  7 Average Power (mW)
  8 Extinction Ratio
  9 Jitter p-p
  10 Jitter RMS
  11 Rise Time
  12 Fall Time
  13 Eye Width
  14 DCD
  15 OMA (mW)
  16 OMA (dBm)

**Response Data**

{CHA | CHB | N/A},<integer>| N/A}
3.9 Scope-specific messages

Example of Use
To display the following measurement results on the screen:
- Channel A jitter (p-p)
- Channel A jitter (RMS)
- Channel A Crossing
- Channel A eye amplitude

:CONF:MEAS:AMPTIME1 CHA, 9
:CONF:MEAS:AMPTIME2 CHA, 10
:CONF:MEAS:AMPTIME3 CHA, 4
:CONF:MEAS:AMPTIME4 CHA, 2

To query the measurement result displayed on the screen:
:CONF:MEAS:AMPTIME1?
>CHA, 9
:CONF:MEAS:AMPTIME2?
>CHA, 10
:CONF:MEAS:AMPTIME3?
>CHA, 4
:CONF:MEAS:AMPTIME4?
>CHA, 2

:CONFigure:MEASure:AREa:DISPlay

Function
This command sets and queries the Amplitude/Time measurement area display of Scope.

Syntax
:CONFigure:MEASure:AREa:DISPlay <enable>
:CONFigure:MEASure:AREa:DISPlay?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:CONF:MEAS:ARE:DISP ON
:CONF:MEAS:ARE:DISP?
>1
:CONFigure:MEASure:AREa:ITEM

Function
This command sets and queries the measurement item number displayed in the Amplitude/Time measurement area of Scope.

Syntax
:CONFigure:MEASure:AREa:ITEM <integer>
:CONFigure:MEASure:AREa:ITEM?

Parameter
<integer>
MP210xA, MP2100B: 1 to 4
MP2110A: 1 to 32

Response Data
<integer>

Example of Use
:CONFigure:MEASure:AREa:ITEM 4
:CONFigure:MEASure:AREa:ITEM?
>4
3.9.6.2 Amplitude/Time (PAM4)  

:CONFigure:MEASure:PAM:TIMing  

**Function**  
*Added in Version 6:* This command sets and queries the phase reference for each Eye of PAM4 signal.

**Syntax**  
:CONfigure:MEASure:PAM:TIMing TRACk|INDependent  
:CONfigure:MEASure:PAM:TIMing?

**Parameter**  
TRACk Track to Middle Eye Timing  
INDependent Independent Timing

**Response Data**  
TRACk|INDependent

**Example of Use**  
:CONF:MEAS:PAM:TIM TRACk  
:CONF:MEAS:PAM:TIM?  
>TRACk

:CONFigure:MEASure:PAM:CENTer  

**Function**  
*Added in Version 6:* This command sets and queries the reference for Eye Center Type of PAM4 signal.

**Syntax**  
:CONfigure:MEASure:PAM:CENTer HEIGht|WIDTh  
:CONfigure:MEASure:PAM:CENTer?

**Parameter**  
HEIGht Maximum Eye Height  
WIDTh Maximum Eye Width

**Response Data**  
HEIGht|WIDTh

**Example of Use**  
:CONF:MEAS:PAM:CENT HEIGht  
:CONF:MEAS:PAM:CENT?  
>HEIGht
Chapter 3  Message List

:CONFigure:MEASure:PAM:EOPening

Function
Added in Version 6: This command sets and queries Eye Opening Definition in Eye Heights/Widths of PAM4 signal.

Syntax
:CONFigure:MEASure:PAM:EOPening ZERO|E_{1|2|3|4|5|6}
:CONFigure:MEASure:PAM:EOPening?

Parameter
ZERO  Zero Hits
E_1    1E–01
E_2    1E–02
E_3    1E–03
E_4    1E–04
E_5    1E–05
E_6    1E–06

Response Data
ZERO|E_{1|2|3|4|5|6}

Example of Use
:CON:MEAS:PAM:EOP ZERO
:CON:MEAS:PAM:EOP?
>ZERO

:CONFigure:MEASure:PAM:LINearity:DEFinition

Function
Added in Version 7.00.13: This command sets and queries the definition of the Linearity measurement method for PAM4.

Syntax
:CONFigure:MEASure:PAM:LINearity:DEFinition
RLMC94|RLMA120
:CONFigure:MEASure:PAM:LINearity:DEFinition?

Parameter
RLMC94    IEEE Clause 94
RLMA120    IEEE Annex 120D

Response Data
RLMC94|RLMA120
Example of Use
:CONF:MEAS:PAM:LIN:DEF?
>RLMC94

:CONFigure:MEASure:PAM:TDECQ:SER
Function
Added in Version 6.01.00: This command sets and queries the standard for SER that determines the factor $Q_t$ used for TDECQ of PAM4.

Syntax
:CONFigure:MEASure:PAM:TDECQ:SER VARiable|IEEE|FC
:CONFigure:MEASure:PAM:TDECQ:SER?

Parameter
VARiable
IEEE
FC

Response Data
VARiable|IEEE|FC

Example of Use
:CONF:MEAS:PAM:TDECQ:SER?
>IEEE

:CONFigure:MEASure:PAM:TDECQ:SER:VARiable
Function
Added in Version 6.01.00: This command sets and queries the SER value that determines the factor $Q_t$ used for TDECQ of PAM4.

Syntax
:CONFigure:MEASure:PAM:TDECQ:SER:VARiable
E_<exponent>[,<mantissa>]
:CONFigure:MEASure:PAM:TDECQ:SER:VARiable?

Parameter
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;exponent&gt;</td>
<td>Exponent of SER</td>
<td>1 to 6</td>
</tr>
<tr>
<td>&lt;mantissa&gt;</td>
<td>Mantissa of SER (1 if omitted)</td>
<td>1.00 to 9.99</td>
</tr>
</tbody>
</table>

The parameters for setting SER to $4.8 \times 10^{-4}$ are $E_4,4.8$. 
Response Data
E_<exponent>,<mantissa>

Example of Use
:CONF:MEAS:PAM:TDECQ:SER:VARiable E_4,4.8
>E_4,4.8

:CONFigure:MEASure:PAM:TDECQ:OTHReshold
Function
Added in Version 6.01.00: This command sets and queries whether to finely adjust the measurement threshold so that TDECQ of PAM4 can be optimized.

Syntax
:CONFigure:MEASure:PAM:TDECQ:OTHReshold <enable>
:CONFigure:MEASure:PAM:TDECQ:OTHReshold?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:CONF:MEAS:PAM:TDECQ:OTH ON
:CONF:MEAS:PAM:TDECQ:OTH?
>1

:CONFigure:MEASure:PAM:TEQualizer:{CHA|CHB}
Function
Added in Version 6: This command sets and queries the On/Off state of TDECQ Equalizer of PAM4 signal.
Modified in Version 7: Nothing is processed even if this command is sent. The query response is always 1.

Syntax
:CONFigure:MEASure:PAM:TEQualizer:{CHA|CHB} <enable>
:CONFigure:MEASure:PAM:TEQualizer:{CHA|CHB}?

Parameter
0|OFF
3.9  Scope-specific messages

1|ON

Response Data
0|1

Example of Use
:CONF:MEAS:PAM:TEQ:CHA ON
:CONF:MEAS:PAM:TEQ:CHA?
>1

:CONFigure:MEASure:PAM:TEQualizer:DISPlay[:{CHA|CHB|CHC|CHD|ALL}]

Function
Added in Version 6: This command sets and queries Display Equalized Waveform after TDECQ Equalizer is applied.
Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax
:CONFigure:MEASure:PAM:TEQualizer:DISPlay[:{CHA|CHB|CHC|CHD|ALL}] <enable>
:CONFigure:MEASure:PAM:TEQualizer:DISPlay[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter
0|OFF
1|ON

Response Data
0|1
0  Displays the waveform before TDECQ Equalizer is applied.
1  Displays the waveform after TDECQ Equalizer is applied.

Example of Use
:CONF:MEAS:PAM:TEQ:DISP:CHB?
>0

:CONFigure:MEASure:PAM:TEQualizer:ETYPe[:{CHA|CHB|CHC|CHD|ALL}]

Function
Added in Version 7.00.13: This command sets and queries the equalizer type to automatically calculate the Tap for Reference Equalizer.
Chapter 3  Message List

Syntax
:CONFigure:MEASure:PAM:TEQualizer:ETYPe:{CHA|CHB|CHC|CHD|ALL} TDECQ|LINEAR
:CONFigure:MEASure:PAM:TEQualizer:ETYPe:{CHA|CHB|CHC|CHD|ALL}?

Parameter
TDECQ  Sets the equalizer type to TDECQ Equalizer. TDECQ Equalizer calculates the Tap coefficient that optimizes TDECQ.
LINEAR  Sets the equalizer type to Linear Equalizer. Linear Equalizer calculates the Tap coefficient that increases the eye opening.

Response Data
TDECQ|LINEAR

Example of Use
>TDECQ

:CONFFigure:MEASure:PAM:TEQualizer:CALCulate[:{CHA|CHB|CHC|CHD|ALL}]

Function
Added in Version 6: This command sets and queries the optimal Tap value for TDECQ Equalizer of PAM4 signal.
Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.
Modified in Version 7.00.18: When calculating the Tap coefficients in Sampling HOLD mode, the waveform for one pattern and the measurement result are displayed after the calculation. When the calculation result is Fail, the Tap coefficients are initialized (main cursor is reset to 1, others are reset to 0).

Syntax
:CONFigure:MEASure:PAM:TEQualizer:CALCulate[:{CHA|CHB|CHC|CHD|ALL}]

Example of Use
3.9 Scope-specific messages

:CONFigure:MEASure:PAM:TEQualizer:CALCulate:RESult[:{CHA|CHB|CHC|CHD|ALL}]

Function

*Added in Version 6:* This command queries the result of automatic calculation of PAM4 TDECQ Equalizer.

*Modified in Version 7:* Specifying the channel can be omitted. If any channel is not specified, the active channel is specified.

Syntax

:CONFigure:MEASure:PAM:TEQualizer:CALCulate:RESult[:{CHA|CHB|CHC|CHD|ALL}]?

Response Data

Pass | Fail
Pass | The calculation successfully completed.
Fail | The calculation failed.
None | Any calculations have never been made (version 7 or later).

Example of Use

>Pass

:CONFigure:MEASure:PAM:TEQualizer:NPRecursors[:{CHA|CHB|CHC|CHD|ALL}]

Function

*Added in Version 7:* This command sets and queries the number of precursors of PAM4 TDECQ Equalizer. If any channel is not specified, the active channel is specified.

Syntax

:CONFigure:MEASure:PAM:TEQualizer:NPRecursors[:{CHA|CHB|CHC|CHD|ALL}] <integer>
:CONFigure:MEASure:PAM:TEQualizer:NPRecursors [:{CHA|CHB|CHC|CHD|ALL}]?

Parameter

<integer> | Cursor number
0 to 8 | Specify the number less than the number of Taps set by :CONFigure:MEASure:PAM:TEQualizer:TAPS:COUNt.

Response Data

<integer>
Chapter 3  Message List

Example of Use
>3


Function
Added in Version 6.00.45: Sets and queries how to calculate the optimal Tap coefficient for PAM4 TDECQ Equalizer.
Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Syntax

Parameter
AUTO | FAST

Response Data
AUTO | FAST

Example of Use


Function
Added in Version 6: This command sets and queries the Tap number of TDECQ Equalizer of PAM4 signal.
Modified in Version 7: Specifying the channel can be omitted. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.
Modified in Version 7.00.13: The Tap number that can be set has been changed to the range of 3 to 13 (previously 5, 7, and 9).
3.9  Scope-specific messages

Syntax
:CONFigure:MEASure:PAM:TEQualizer:TAPS:COUNt[:{CHA|CHB|CHC|CHD|ALL}] <integer>
:CONFigure:MEASure:PAM:TEQualizer:TAPS:COUNt[:{CHA|CHB|CHC|CHD|ALL}]?

Parameter
<integer>  Tap number
3 to 13

Response Data
<integer>

Example of Use
>5

:CONFigure:MEASure:PAM:TEQualizer:TAPS:{CHA|CHB|CHC|CHD}

Function
Added in Version 6: This command sets and queries the Tap value of TDECQ Equalizer of PAM4 signal.

Syntax
:CONFigure:MEASure:PAM:TEQualizer:TAPS:{CHA|CHB|CHC|CHD} <string>
:CONFigure:MEASure:PAM:TEQualizer:TAPS:{CHA|CHB|CHC|CHD}?

Parameter
<string>

Response Data
<string>
Tap values up to six decimal places are returned separated by commas.

Example of Use
:CONF:MEAS:PAM:TEQ:TAPS:CHB "0.0,0.2,0.4,0.6,0.8"
>"0.000000,0.200000,0.400000,0.600000,0.800000"
3.9.6.3 Amplitude/Time (Setting Rise/Fall Time Measurement)

:CONFigure:MEASure:DEFine

Function
This command sets and queries the level measuring the Rise/Fall time on Scope.

Syntax
:CONFigure:MEASure:DEFine 0|1
:CONFigure:MEASure:DEFine?

Parameter
0 20/80%
1 10/90%

Response Data
0|1

Example of Use
:CONF:MEAS:DEF 1
:CONF:MEAS:DEF?
>1

:CONFigure:MEASure:TRANsition:CORRection

Function
This command sets and queries the On/Off state of use of the correction factor for rise/fall time of Scope.

Syntax
:CONFigure:MEASure:TRANsition:CORRection <enable>
:CONFigure:MEASure:TRANsition:CORRection?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
To use the correction factor:
:CONF:MEAS:TRAN:CORR ON
:CONF:MEAS:TRAN:CORR?
>1
3.9 Scope-specific messages

:CONFigure:MEASure:TRANsition:CORRect:FACTor

Function
This command sets and queries the correction factor for rise/fall time of Scope.

Syntax
:CONFigure:MEASure:TRANsition:CORRect:FACTor <numeric>
:CONFigure:MEASure:TRANsition:CORRect:FACTor?

Parameter
<numeric>
Correction factor
Range 0.0 to 9999.9

Response Data
<numeric>

Example of Use
:CONF:MEAS:TRAN:CORR:FACT 0.0
:CONF:MEAS:TRAN:CORR:FACT?
>0.0

3.9.6.4 Amplitude/Time (Setting Zero/One Level Measurement)

:CONFigure:MEASure:EYEBoundary:OFFSet

Function
This command sets and queries the horizontal position for 1 and 0 level measurement performed by Scope.

Syntax
:CONFigure:MEASure:EYEBoundary:OFFSet <numeric>
:CONFigure:MEASure:EYEBoundary:OFFSet?

Parameter
<numeric>
Position measuring level (UI)
Range 0.00 to 1.00

Response Data
<numeric>

Example of Use
:CONF:MEAS:EYEB:OFFS 0.3
:CONF:MEAS:EYEB:OFFS?
>0.3

:CONFigure:MEASure:EYEBoundary:WIDTh

Function
This command sets and queries the horizontal width measuring 1 level and 0 level on Scope.

Syntax
:CONFigure:MEASure:EYEBoundary:WIDTH <numeric>
:CONFigure:MEASure:EYEBoundary:WIDTH?

Parameter
<numeric>
Width measuring level (UI)
Range 0.00 to 1.00

Response Data
<numeric>

Example of Use
:CONF:MEAS:EYEB:WIDT 0.20
:CONF:MEAS:EYEB:WIDT?
>0.20
3.9.6.5 Amplitude/Time (Setting SNR Measurement)  
:CONFigure:MEASure:NOISe

**Function**
This command sets and queries the position to measure noises of SNR for Scope.

**Syntax**
:CONFigure:MEASure:NOISe ZERO_ONE|ZERO|ONE
:CONFigure:MEASure:NOISe?

**Parameter**
ZERO_ONE Zero Level + One Level
ZERO Zero Level
ONE One Level

**Response Data**
ZERO_ONE|ZERO|ONE

**Example of Use**
:CONF:MEAS:NOIS ZERO_ONE
:CONF:MEAS:NOIS?
 ZERO_ONE
3.9.6.6 Mask Test

:CONFigure:MASK

Function

*Added in Version 7:* This command sets and queries the channel used for the mask test.

Syntax

:CONFigure:MASK[:,:,{CHA|CHB|CHC|CHD|ALL}] 0|1|OFF|ON
:CONFigure:MASK[:,:,{CHA|CHB|CHC|CHD|ALL}]?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:CONFigure:MASK:CHB 1
:CONFigure:MASK:CHB?
>1

:CONFigure:MASK:RECall

Function

*Added in Version 5:* This command sets and queries the mask used for Scope.

Syntax

:CONFigure:MASK:RECall "<file_name>"
:CONFigure:MASK:RECall?

Parameter

"<file_name>"

Mask file names: The following files are pre-installed in MP2110A.
"100GbE-CLR4-FEC.txt"
"100GbE-CLR4.txt"
"100GbE-CWDM4.txt"
"100GbE-ER4_Tx.txt"
"100GbE-LR4_Tx.txt"
"100GbE-SR4_Rx.txt"
"100GbE-SR4_Tx.txt"
"32GFC_MM.txt"
"32GFC_SM.txt"
3.9 Scope-specific messages

"8GFC_Elect_Rx.txt"
"8GFC_Elect_Tx.txt"
"HDMI_TP1.txt"
"HDMI_TP2.txt"
"InfiniBand_EDR_Cable_In_Limiting.txt"
"InfiniBand_EDR_Cable_Out_Limiting.txt"
"InfiniBand_EDR_Host_Out_Limiting.txt"
"InfiniBand_EDR_Stressed_In_Limiting.txt"
"OTU-4.txt"

Response Data
"<file_name>"

Example of Use
:CONF:MASK:REC "100GbE-LR4_Tx.txt"
:CONF:MASK:REC?
>"100GbE-LR4_Tx.txt"

:CONFigure:MASK:TYPe

Function
Only in MP210xA and MP2100B: This command sets and queries the type of the mask used for Scope.

Syntax
:CONFigure:MASK:TYPe <integer>[,<file_name>]
:CONFigure:MASK:TYPe?
**Parameter**

<table>
<thead>
<tr>
<th>&lt;integer&gt;</th>
<th>Mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>User Defined</td>
</tr>
<tr>
<td>0</td>
<td>1GFC</td>
</tr>
<tr>
<td>1</td>
<td>2GFC</td>
</tr>
<tr>
<td>2</td>
<td>4GFC</td>
</tr>
<tr>
<td>3</td>
<td>8GFC</td>
</tr>
<tr>
<td>4</td>
<td>8GFC_Elect_Tx</td>
</tr>
<tr>
<td>5</td>
<td>8GFC_Elect_Rx</td>
</tr>
<tr>
<td>6</td>
<td>10GFC</td>
</tr>
<tr>
<td>7</td>
<td>10GbE FEC</td>
</tr>
<tr>
<td>8</td>
<td>1GbE</td>
</tr>
<tr>
<td>9</td>
<td>2GbE</td>
</tr>
<tr>
<td>10</td>
<td>10GbE WAN</td>
</tr>
<tr>
<td>11</td>
<td>10GbE LAN/PHY</td>
</tr>
<tr>
<td>12</td>
<td>10GFC FEC</td>
</tr>
<tr>
<td>13</td>
<td>OC48/STM16</td>
</tr>
<tr>
<td>14</td>
<td>OTU-1</td>
</tr>
<tr>
<td>15</td>
<td>OC192/STM64</td>
</tr>
<tr>
<td>16</td>
<td>OC192/STM64 FEC(G.975)</td>
</tr>
<tr>
<td>17</td>
<td>OTU-2 1310nm</td>
</tr>
<tr>
<td>18</td>
<td>OTU-2 1550nm</td>
</tr>
<tr>
<td>19</td>
<td>OTU-2 1550nm Expand</td>
</tr>
<tr>
<td>20</td>
<td>OTU-2 Amplified</td>
</tr>
</tbody>
</table>

If -1 is set to <integer>, specify the file name in <file_name>.

**Response Data**

<integer>,"<file_name>"

**Example of Use**

To select Mask other than User Mask:

```plaintext
:CONF:MASK:TYP?
>8,""
```

To select "test.txt" as a user mask file:

```plaintext
:CONF:MASK:TYP -1,"test.txt"
:CONF:MASK:TYP?
>1,"test.txt"
```

**Note:**

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command. Use “:CONFigure:MASK:RECall”.  

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3.9.6.7 Mask Test (Mask Alignment)

:CONFigure:MASK:ALGorithm

Function
This command sets and queries the mask alignment method of Scope.

Syntax
:CONFigure:MASK:ALGorithm 0|2
:CONFigure:MASK:ALGorithm?

Parameter
0  Zero/One/Crossing: Mask alignment by detecting the intersection of
     Zero Level and One level
2  User Defined

Response Data
0|2

Example of Use
:CONF:MASK:ALG 2
:CONF:MASK:ALG?
>2

:CONFigure:MASK:UPDate

Function
This command updates the mask alignment of the mask test for Scope
when Align Method is Zero/One/Crossing.

Syntax
:CONFigure:MASK:UPDate

Example of Use
:CONF:MASK:UPD

:CONFigure:MASK:USER:MARKer

Function
This command sets and queries the On/Off state of the Alignment Marker
display when Align Method is User Defined.

Syntax
:CONFigure:MASK:USER:MARKer <enable>
:CONFigure:MASK:USER:MARKer?
Chapter 3  Message List

Parameter
<enable>
0  Display Off
1  Display On

Response Data
0|1

Example of Use
:CONF:MASK:USER:MARK 1
:CONF:MASK:USER:MARK?
>1

:CONFigure:MASK:USER:LOCation:{X1|XDELta}

Function
This command sets and queries the position for the horizontal direction of the mask when Align Method is User Defined.

Syntax
:CONFigure:MASK:USER:LOCation:{X1|XDELta} <numeric>
:CONFigure:MASK:USER:LOCation:{X1|XDELta}?

Parameter
<numeric>
When X1 is specified:  Position of X1 (UI)
When XDELta is specified:  Difference between X1 and X2, Positive number (UI)

Response Data
<numeric>

Example of Use
To set the user alignment marker X1 to the position 0.25 UI and the difference between the user alignment markers X1 and X2 to the position 1 UI:
:CONF:MASK:USER:LOC:X1 0.25
:CONF:MASK:USER:LOC:X1?
>0.25
:CONF:MASK:USER:LOC:XDEL 1
>1.00
3.9 Scope-specific messages

:CONFigure:MASK:USER:LOCation:{Y1|YDELta}

**Function**
This command sets and queries the position for the vertical direction of the mask when Align Method is User Defined.

**Syntax**
:CONFigure:MASK:USER:LOCation:{Y1|YDELta} <numeric>
:CONFigure:MASK:USER:LOCation:{Y1|YDELta}?

**Parameter**
<numeric>
When **Y1** is specified: Position of Y1 (mV)
When **YDELta** is specified: Difference between Y1 and Y2, Positive number (mV)

**Response Data**
<numeric>

**Example of Use**
To set the user adjustment marker Y1 to 10 mV and the user adjustment marker Y2 to –10 mV, respectively
:CONF:MASK:USER:LOC:Y1 10
:CONF:MASK:USER:LOC:Y1?
>10.00
>20.00
3.9.6.8 Mask Test (Mask Margin)

**:CONFigure:MASK:MARGin:CONTupdate**

**Function**
This command sets and queries the mask margin updating method for the mask test of Scope.

**Syntax**
:CONFigure:MASK:MARGin:CONTupdate 0|1
:CONFigure:MASK:MARGin:CONTupdate?

**Parameter**
0 Updates the mask margin only once.
1 Updates the mask margin whenever measuring

**Response Data**
0|1

**Example of Use**
:CONF:MASK:MARG:CONT 0
:CONF:MASK:MARG:CONT?
>0

**:CONFigure:MASK:MARGin**

**Function**
This command sets and queries the mask margin for the test mask of the Scope.

*Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, ALL is specified for command, and the active channel is specified for query.*

**Syntax**
:CONFigure:MASK:MARGin[:{CHA|CHB|CHC|CHD|ALL}]<mask_margin>[%]
:CONFigure:MASK:MARGin[:{CHA|CHB|CHC|CHD|ALL}]?

**Parameter**
<mask_margin>[%]
Mask Margin
Range –100 to 100%
In version 5.00 or earlier, the value is an integer (<integer>). In version 5.01 or later, the value is a number up to first decimal place (<numeric>).
3.9 Scope-specific messages

Response Data
<mask_margin>%

Example of Use
:CONF:MASK:MARG 10%
:CONF:MASK:MARG?
>10%

:MEASure:MASK:MARGIn?

Function
This command queries the results after performing the mask margin measurement using One Shot.

Modified in Version 7: CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, the active channel is specified.

Syntax
:MEASure:MASK:MARGIn[:{CHA|CHB|CHC|CHD|ALL}]?

Response Data
<mask_margin>
Range –100 to 100%
In version 5.00 or earlier, the value is an integer (<integer>). In version 5.01 or later, the value is a number up to first decimal place (<numeric>).

Example of Use
:MEAS:MASK:MARG?
>12

:SAMPles:JUDGe:TYPE

Function
Added in Version 3.03/4.01: This command sets and queries the Margin Type for Mask Margin measurement.

Syntax
[:SENSe]:SAMPles:JUDGe:TYPE COUNT|RATE
[:SENSe]:SAMPles:JUDGe:TYPE?

Parameter
COUNT Hit Count
RATE Hit Ratio

Response Data
COUNT|RATE
Example of Use
To set the threshold for Mask Margin measurement to Hit Count 10:
:SAMP:JUDG:TYPE COUNT
:SAMP:JUDG 10
:SAMP:JUDG?
>10

To set the threshold for Mask Margin measurement to Hit Ratio 1E–5:
:SAMP:JUDG:TYPE RATE
:SAMP:JUDG:RATE E_5,1
:SAMP:JUDG:RATE?
>E_5,1

:SAMPles:JUDGe
Function
This command sets and queries the Hit Count for Mask Margin measurement.

Syntax
[[:SENSe]:SAMPles:JUDGe <numeric>]
[[:SENSe]:SAMPles:JUDGe?]

Parameter
<numeric>
Sample point counts in the mask area

Response Data
<integer>

Example of Use
See “Example of Use” of :SAMPles:JUDGe:TYPE
Function

*Added in Version 3.03/4.01* This command sets and queries the Hit Ratio for Mask Margin measurement.

Syntax

[[:SENSe]:SAMPles:JUDGe:RATE E_<exponent>[,<mantissa>]]
[[:SENSe]:SAMPles:JUDGe:RATE?]

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;exponent&gt;</td>
<td>Exponent of Hit Ratio</td>
<td>1 to 12</td>
</tr>
<tr>
<td>&lt;mantissa&gt;</td>
<td>Mantissa of Hit Ratio (1 if omitted)</td>
<td>1 to 9<em>1, 1.0 to 9.9</em>2</td>
</tr>
</tbody>
</table>

*1: In version 5.00 or earlier, the value is an integer. (<integer>)

*2: In version 5.01 or later, the value is a number up to first decimal place. (<numeric>)

To set the Hit Ratio to $2 \times 10^{-6}$, specify the parameter as “E_6,2”.

Response Data

E_<exponent>,<mantissa>

Example of Use

See “Example of Use” of :SAMPles:JUDGe:TYPE.
3.9.6.9 Mask Test (Mask Margin Area Restriction)

:CONFigure:MASK:AREa:RESTriction

Function
This command sets and queries the On/Off state of the mask area restriction of Scope.

Syntax
:CONFigure:MASK:AREa:RESTriction <enable>
:CONFigure:MASK:AREa:RESTriction?

Parameter
0 | OFF
1 | ON

Response Data
0 | 1

Example of Use
:CONF:MASK:ARE:REST ON
:CONF:MASK:ARE:REST?
>1

:CONFigure:MASK:AREa:RESTriction:ANGLe

Function
This command sets and queries the angle restricting the mask area of Scope.

Syntax
:CONFigure:MASK:AREa:RESTriction:ANGLe <integer>
:CONFigure:MASK:AREa:RESTriction:ANGLe?

Parameter
<integer>
Angle restriction mask area
Range −90 to 90 degrees

Response Data
<integer>

Example of Use
:CONF:MASK:ARE:REST:ANGL?
>−30
3.9 Scope-specific messages

:CONFigure:MASK:AREa:RESt:WIDTh

Function
This command sets and queries the width restricting the mask area of Scope.

Syntax
:CONFigure:MASK:AREa:RESt:WIDTh <numeric>
:CONFigure:MASK:AREa:RESt:WIDTh?

Parameter
<numeric>
Width restricting mask area
Range 0.01 to 1.00 UI

Response Data
<numeric>

Example of Use
:CON:MASK:ARE:RESt:WIDT 0.15
:CON:MASK:ARE:RESt:WIDT?
>0.15
3.9.6.10 Histogram

:CONFigure:HISTogram

Function

*Added in Version 7:* This command sets and queries whether to display the histogram measurement results of Scope.

Syntax

:CONFigure:HISTogram <enable>

:CONFigure:HISTogram?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:CONF:HIST OFF
:CONF:HIST?
>0

:CONFigure:HISTogram:AXIS

Function

This command sets and queries the axis for histogram measurement of Scope.

Syntax

:CONFigure:HISTogram:AXIS TIME|AMPLitude
:CONFigure:HISTogram:AXIS?

Parameter

TIME Time direction histogram
AMPLitude Amplitude direction histogram

Response Data

TIME|AMPLitude

Example of Use

:CONF:HIST:AXIS AMPLitude
:CONF:HIST:AXIS?
3.9 Scope-specific messages

>&AMPLitude

:HISTogram:CENTer

Function
This command moves the marker position of the histogram measurement of Scope to the center of the screen.

Syntax
[:SENSe]:HISTogram:CENTer

Example of Use
:HIST:CENT

:HISTogram:{X1|X2}

Function
This command sets and queries the position of the marker X1 or X2 for setting the histogram measurement area of Scope.

Syntax
[:SENSe]:HISTogram:{X1|X2} <numeric>
[:SENSe]:HISTogram:{X1|X2}?

Parameter
X1|X2  Marker

<numeric>
Marker position (Time)
Unit  UI or ps
Range

<table>
<thead>
<tr>
<th>Unit</th>
<th>Version 6 or earlier</th>
<th>Version 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>ps</td>
<td>0 to 1271001</td>
<td>0 to 2541964*</td>
</tr>
<tr>
<td>UI</td>
<td>0 to 32768</td>
<td>0 to 65535*</td>
</tr>
</tbody>
</table>

*: The maximum value varies depending on the symbol rate.

Response Data
<numeric>

Example of Use
:HIST:X1 10050
:HIST:X1?
>10050
Chapter 3  Message List

:HISTogram:{Y1|Y2}

Function
This command sets and queries the position of the marker Y1 or Y2 for setting the histogram measurement area of Scope.

Syntax
[:SENSe]:HISTogram:{Y1|Y2} <numeric>
[:SENSe]:HISTogram:{Y1|Y2}?

Parameter
Y1|Y2  Marker

<numumeric>
Marker position (Amplitude)
Unit  mV (Electrical input)
       µW (Optical input)
Range  mV:  Between minimum and maximum values for display area
       µW:  Between minimum and maximum values for display area
Minimum value: Offset – Scale × 5
Maximum value: Offset + Scale × 5

Response Data
<numumeric>

Example of Use
:HIST:Y2 -60
:HIST:Y2?
>-60
3.9 Scope-specific messages

3.9.7 Acquiring results

:FETCH:AMPT:QUESTionableeye?

Function
This command queries if "EYE?", "NRZ?", "PAM4?", or a warning is displayed on the Scope amplitude measurement screen. 
*Modified in Version 7:* CHA, CHB, CHC, CHD, or ALL can be appended to the command to specify a channel or all channels. If any channel is not specified, the active channel is specified.

Syntax
:FETCh:AMPLitude:QUESTionableeye[:{CHA|CHB|CHC|CHD|ALL}]?

Response Data
0|1|N/A
0: Not display
1: Display
N/A: Not amplitude measurement screen

Example of Use
:FETC:AMPT:QUES?
>1

Note:
If the response data of this command is 1, the measurement results and response data are all N/A except for Average Power (Version 6.01.00 or later).

:FETCH:AMPT:QUESTionableeye:STATus:{CHA|CHB|CHC|CHD|ALL}?

Function
*Added in Version 6.01.00:* This command queries whether a warning is displayed in the Scope screen.

Syntax
:FETCh:AMPT:QUESTionableeye:STATus:{CHA|CHB|CHC|CHD|ALL}?

Response Data
<integer> = bit0 + bit1 + bit2
bit0 : \(2^0 = 1\) Questionable Eye (NRZ?/PAM4?)
bit1 : \(2^1 = 2\) Overload
bit2 : \(2^2 = 4\) Clipped
Example of Use
:FETC:AMPT:QUES:STAT:CHB?
>1

:FETCh:AMPLitude:<meas_item>?

**Function**
This command queries the results of all measurement items for the amplitude measurement function of Scope.

**Syntax**
:FETCh:AMPLitude<meas_item>[:CURRent][:{CHA|CHB|CHC|CHD|ALL}]?

For NRZ
<meas_item>={:AVEPower|CROSsing|EXTRatio|EYEAmplitude|EYEHeight|EYEHeight:RATio|LEVEL:ONE|LEVEL:ZERO|OMA:DBM|OMA:MW|OMAXp|RINoise|SNR|TDEC|VECP}

*Added in Version 6:* For PAM4
<meas_item>={:TEQualizer}:AVEPower|CEQ|EYE[0|1|2]:HEIGHT|EYE[0|1|2]:LEVEL|LEVEL[0|1|2|3]|LEVEL[0|1|2|3]:FPeak|LEVEL[0|1|2|3]:RMS|LINearity|OER|OMA|PTDeq:EYE[0|1|2]:{LEFT|RIGHT}|RINoise|TDECQ}

For Version 6 or later, this command can be used as a query by appending CHA|CHB.
For Version 7 or later, this command can be used as a query by appending CURRent, and CHC|CHD|ALL.
If any channel is not specified, the active channel is specified.

**Response Data**
<current>,<average>,<std_dev>,<min>,<max>
The measurement results of the items specified at <meas_item> are returned at <numeric> in the following sequence. When there is no measurement result, N/A is returned.
- Current value, average value, standard deviation value,
- Minimum value, Maximum value

The items in Table 3.9.7-1 are measured when :DISPlay:SIGNal is NRZ and :DISPlay:MODE is EYE or COHErenteye.
### Table 3.9.7-1  Response Data of Amplitude Measurement (NRZ)

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:AMPLitude:LEVel:ONE[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:LEVel:ZERO[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:EYEAmplitude[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:EYEHeight[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:EYEHeight:RATio[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:CROSSing[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:SNR[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:AVEPower[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:EXTRatio[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:OMA:MW[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:OMA:DBM[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:OMAXp[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:VECP[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:TDEC[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:AMPLitude:RINoise[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
</tbody>
</table>

*1: The unit for electrical channel is mV and the unit for optical channel is μW.
*2: The value is output in version 7 or later of MP2110A.
*3: When the optical channel is used, the value is returned. When the electrical channel is used, N/A is returned.
*4:* The values are output in the sequence listed below.

**Table 3.9.7-2  Average Power Data Order**

<table>
<thead>
<tr>
<th>Item</th>
<th>&lt;current&gt;</th>
<th>&lt;average&gt;</th>
<th>&lt;std_dev&gt;</th>
<th>&lt;min&gt;</th>
<th>&lt;max&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Power (mW)</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Average Power (dBm)</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

*5:* The value is output in version 6 or later of MP2110A.

*6:* The value is output in version 7.00.13 or later of MP2110A.

*Added in Version 6:* The items in Table 3.9.7-3 are measured when :DISPlay:SIGNal is PAM4 and :DISPlay:MODE is EYE or COHErenteye.

To query the results when TDECQ Equalizer is applied, specify :TEQualizer.

*Added in Version 6:* The items in Table 3.9.7-3 are measured when :DISPlay:SIGNal is PAM4 and :DISPlay:MODE is EYE or COHErenteye.

To query the results when TDECQ Equalizer is applied, specify :TEQualizer.

**Table 3.9.7-3  Response Data of Amplitude Measurement (PAM4)**

<table>
<thead>
<tr>
<th>Contents of Response</th>
<th>Header*4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>:FETCh:AMPLitude[:TEQualizer]:LINearity[:CURRent][:{CHA</td>
</tr>
<tr>
<td>Levels*2</td>
<td>:FETCh:AMPLitude[:TEQualizer]:LEVEL[0</td>
</tr>
<tr>
<td>Levels RMS*2</td>
<td>:FETCh:AMPLitude[:TEQualizer]:LEVEL[0</td>
</tr>
<tr>
<td>Levels Peak-Peak*2</td>
<td>:FETCh:AMPLitude[:TEQualizer]:LEVEL[0</td>
</tr>
<tr>
<td>Eye Levels*2</td>
<td>:FETCh:AMPLitude[:TEQualizer]:EYE[0</td>
</tr>
<tr>
<td>Eye Heights*2</td>
<td>:FETCh:AMPLitude[:TEQualizer]:EYE[0</td>
</tr>
<tr>
<td>Combination of the mW value and the dBm value of Average Power *3, *4</td>
<td>:FETCh:AMPLitude[:TEQualizer]:AVEPower[:CURRent][:{CHA</td>
</tr>
<tr>
<td>TDECQ*3</td>
<td>:FETCh:AMPLitude[:TEQualizer]:TDECQ[:CURRent][:{CHA</td>
</tr>
<tr>
<td>Outer OMA*3</td>
<td>:FETCh:AMPLitude[:TEQualizer]:OOMA[:CURRent][:{CHA</td>
</tr>
<tr>
<td>Outer Extinction Ratio (Outer ExR) *3</td>
<td>:FETCh:AMPLitude[:TEQualizer]:OER[:CURRent][:{CHA</td>
</tr>
<tr>
<td>Ceq*3, *5</td>
<td>:FETCh:AMPLitude[:TEQualizer]:CEQ[:CURRent][:{CHA</td>
</tr>
<tr>
<td>Partial TDECQ*3, *5</td>
<td>:FETCh:AMPLitude[:TEQualizer]:PTDeq:EYE[0</td>
</tr>
<tr>
<td>RIN OMA*3, *5</td>
<td>:FETCh:AMPLitude[:TEQualizer]:RINoise[:CURRent][:{CHA</td>
</tr>
</tbody>
</table>
3.9  Scope-specific messages

*1: The positions of LEVEL0 to LEVEL3, and EYE0 to EYE2 are shown in the figure below.

![Figure 3.9.7-1  Positions of EYEs and LEVELs](image)

*2: The unit for electrical channel is mV and the unit for optical channel is μW.

*3: When the optical channel is used, the value is returned. When the electrical channel is used, N/A is returned.

*4: For the data output order, refer to Table 3.9.7-2 “Average Power Data Order”.

*5: The value is output in version 7.00.13 or later of MP2110A.

Example of Use

:FETC:AMPL:LEV:ONE?
>35.16,35.11,0.11,34.78,35.44
:FETC:AMPL:LEV:ZERO?
>-15.12,-15.20,0.05,-15.35,-15.05
:FETC:AMPL:EYEA?
>55.22,54.89,0.12,54.53,55.25
:FETC:AMPL:EYEH?
>45.81,45.77,0.08,45.53,46.01
:FETC:AMPL:CROS?
>46.01,45.80,0.19,45.27,46.41
:FETC:AMPL:SNR?
>10.08,10.11,0.19,9.55,10.70
:FETC:AMPL:AVEP?
>25.00,-16.02,25.50,-15.93,0.02,0.05,24.86,-16.05,26.12,-15.83
:FETC:AMPL:EXTR?
>6.82,6.77,0.13,6.38,7.16
:FETC:AMPL:OMA:MW?
>0.15,0.16,0.03,0.06,0.25
:FETC:AMPL:OMA:DBM?
>-8.22,-8.24,0.21,-8.85,-7.59
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Note:
When Measure Item is not Amplitude/Time, N/As are returned as all response data.

:FETCh:TIME:<meas_item>?

Function
This command queries the results obtained by the time measurement function of Scope.

Syntax
:FETCh:TIME<meas_item>:{CURRent]|{CHA|CHB|CHC|CHD|ALL}

For NRZ
<meas_item>=:{DCD|EYEWidth|FTIMe|JITTer:PPeak|JITTer:RMS|TRISe}
For PAM4
<meas_item>=[:TEQualizer]:{EYE[0|1|2]:SKEW|EYE[0|1|2]:WIDETh|LEVEL[0|1|2|3]:SKEW}
For Jitter (OPT096)
<meas_item>=[:AJITter]:{DJ|EOPening|J2|J4|J9|RJ|TJ}|:AJITter:{DCD|DDJ|DDPWS|ISI|PJ[:FREQuency]|RJ[:RMS]}

For Version 6 or later, this command can be used as a query by appending CHA|CHB. However, CHA|CHB cannot be appended when :DISPlay:MODE is AJITter.
Also, CHA|CHB cannot be appended in version older than 6. Active Channel result can be acquired.
For Version 7 or later, this command can be used as a query by appending CURRent and CHC|CHD|ALL.
If any channel is not specified, the active channel is specified.

Response Data
<current>,<average>,<std_dev>,<min>,<max>
The measurement results of the items specified at <meas_item> are returned at <numeric> in the following sequence. When there is no measurement result, N/As are returned.
  Current value, average value, standard deviation value,
  Minimum value, Maximum value
3.9 Scope-specific messages

The items in Table 3.9.7-4 are measured when ‘DISPlay:SIGNal’ is NRZ and ‘DISPlay:MODE’ is EYE or COHERenteye.

### Table 3.9.7-4  Response Data of Time Measurement (NRZ)

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:TIME:JITTER:PPeak[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME:JITTER:RMS[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME:TRIS[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME:FTIME[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME:EYED[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME:DCD[:CURRent][:{CHA</td>
<td>CHB</td>
</tr>
</tbody>
</table>

* Added in Version 6: The items in Table 3.9.7-5 are measured when ‘DISPlay:SIGNal’ is PAM4 and ‘DISPlay:MODE’ is EYE or COHERenteye.
* To query the results when TDECQ Equalizer is applied, specify ‘:TEQualizer’.

### Table 3.9.7-5  Response Data of Time Measurement (PAM4)

<table>
<thead>
<tr>
<th>Header*</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:TIME[:TEQualizer]:LEVEL[0</td>
<td>1</td>
</tr>
<tr>
<td>:FETCh:TIME[:TEQualizer]:EYE[0</td>
<td>1</td>
</tr>
<tr>
<td>:FETCh:TIME[:TEQualizer]:EYE[0</td>
<td>1</td>
</tr>
</tbody>
</table>

*: For the positions of LEVEL0 to LEVEL3, and EYE0 to EYE2, refer to Figure 3.9.7-1.
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Added in Version 6: The items in Table 3.9.7-6 are measured when MP2110A-096 is installed.

Table 3.9.7-6  Response Data of Time Measurement (Jitter)

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:TIME[:AJITter]:TJ[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:J2[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:J4[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:J9[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:EOPening[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:RJ[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:DJ[:CURREnt][{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:RJ:RMS[:CURREnt]</td>
<td>RJ (rms) *3</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:PJ:CURRent</td>
<td>PJ (p-p) *3</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:PJ:FREQuency[:CURREnt]</td>
<td>PJ Frequency*3 of PJ vs Freq</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:DDPWs[:CURREnt]</td>
<td>DDPWS*3</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:DDJ[:CURREnt]</td>
<td>DDJ (p-p) *3</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:DCD[:CURREnt]</td>
<td>DCD*3</td>
</tr>
<tr>
<td>:FETCh:TIME[:AJITter]:ISI[:CURREnt]</td>
<td>ISI (p-p) *3</td>
</tr>
</tbody>
</table>

*1: Specify :AJITter when :DISPlay:MODE is set to AJITter. In this case, the active channel will be specified even if the command specifies the channel.

Do not specify :AJITter when :DISPlay:MODE is set to EYE.

*2: The value is output in version 7 or later of MP2110A.

*3: Measured when :DISPlay:MODE is AJITter.

Example of Use

:FETC:TIME:JITT:PP?
>66.25,65.89,0.98,63.95,68.83

:FETC:TIME:JITT:RMS?
>15.31,15.52,0.26,14.74,16.30

:FETC:TIME:TRIS?
>128.22,130.11,1.52,125.55,134.67

:FETC:TIME:FTIM?
>133.66,129.96,2.59,122.19,137.75
3.9 Scope-specific messages

:FETC:TIME:EYEW?
>208.60,206.15,3.32,216.11,196.19
:FETC:TIME:DCD?
>47.2,45.22,1.22,41.56,48.88

Note:
The response data is N/A when the Measure Item is not set to Amplitude/Time.

:FETCh:MASK:<meas_item>?

Function
This command queries the results for the mask measurement of the Scope.

Syntax
:FETCh:MASK:<meas_item>[[:{CHA|CHB|CHC|CHD}]]?
<meas_item>=MEASurement|SAMPles:{FAILed[:{BOTTom|CENTer|TOP}]}|TOTal

For Version 7 or later, this command can be used as a query by appending CHA|CHB|CHC|CHD.
If any channel is not specified, the active channel is specified.
Response Data
The measurement results of the items specified at <meas_item> are returned. When there is no measurement result, N/A(s) is (are) returned.

Table 3.9.7-7  Response Data of Mask Measurement

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:MASK:MEASurement[:{CHA</td>
<td>CHB}]?</td>
</tr>
<tr>
<td>:FETCh:MASK:SAMPles:TOTal[:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:MASK:SAMPles:FAILed[:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:MASK:SAMPles:FAILed:BOTTom[:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:MASK:SAMPles:FAILed:CENTer[:{CHA</td>
<td>CHB</td>
</tr>
<tr>
<td>:FETCh:MASK:SAMPles:FAILed:TOP[:{CHA</td>
<td>CHB</td>
</tr>
</tbody>
</table>

Example of Use
:FETC:MASK:MEAS?
>16831,30
:FETC:MASK:SAMP:TOT?
>16831
:FETC:MASK:SAMP:FAIL?
>30
:FETC:MASK:SAMP:FAIL:BOTT?
>0
:FETC:MASK:SAMP:FAIL:CENT?
>20
:FETC:MASK:SAMP:FAIL:TOP?
>10

Note:
When Measure Item is not Mask Test, N/As are returned as all response data.
3.9 Scope-specific messages

:FETCh:HISTogram:AMPlitude:<meas_item>?

Function
This command queries the histogram measurement result of the amplitude axis for Scope.

Syntax
:FETCh:HISTogram:AMPlitude:<meas_item>?
<meas_item>=HITS|MEAN|MEASurement|PPeak|STDDeviation

Response Data
The measurement results of the items specified at <meas_item> are returned. When there is no measurement result, N/A(s) is (are) returned.

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:HISTogram:AMPlitude:MEAN?</td>
<td>&lt;numeric&gt; Mean*</td>
</tr>
<tr>
<td>:FETCh:HISTogram:AMPlitude:STDDeviat</td>
<td>&lt;numeric&gt; Std Dev*</td>
</tr>
<tr>
<td>:FETCh:HISTogram:AMPlitude:PPeak?</td>
<td>&lt;numeric&gt; P-P (Peak to Peak)*</td>
</tr>
<tr>
<td>:FETCh:HISTogram:AMPlitude:HITS?</td>
<td>&lt;integer&gt; Hits (Number of data within area)</td>
</tr>
<tr>
<td>:FETCh:HISTogram:AMPlitude:MEASurement?</td>
<td>Returns the above four results separated by commas.</td>
</tr>
</tbody>
</table>

*: The unit for electrical channel is mV and the unit for optical channel is µW.

Example of Use
:FETC:HIST:AMPL:MEAN?
>32.1
:FETC:HIST:AMPL:STDD?
>4.53
:FETC:HIST:AMPL:PP?
>28.1
:FETC:HIST:AMPL:HITS?
>89632
:FETC:HIST:AMPL:MEAS?
>32.1,4.53,28.1,89632

Notes:
- This message queries data that the measurement ends.
- When Measure Item is not Histogram or is the time axis histogram, N/A(s) is (are) returned as the response data.
Chapter 3  Message List

:FETCh:HISTogram:TIME:<meas_item>?

Function
This command queries the time axis histogram measurement result of Scope.

Syntax
:FETCh:HISTogram:TIME:<meas_item>?
<meas_item>=HITS|MEAN|MEASurement|PPeak|STDDeviation

Response Data
The measurement results of the items specified at <meas_item> are returned. When there is no measurement result, N/A(s) is (are) returned.

<table>
<thead>
<tr>
<th>Header</th>
<th>Contents of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FETCh:HISTogram:TIME:MEAN?</td>
<td>&lt;numeric&gt; Mean (ps)</td>
</tr>
<tr>
<td>:FETCh:HISTogram:TIME:STDD?</td>
<td>&lt;numeric&gt; Std Dev (ps)</td>
</tr>
<tr>
<td>:FETCh:HISTogram:TIME:PPeak?</td>
<td>&lt;numeric&gt; P-P (ps)</td>
</tr>
<tr>
<td>:FETCh:HISTogram:TIME:HITS?</td>
<td>&lt;integer&gt; Hits (Number of data within area)</td>
</tr>
<tr>
<td>:FETCh:HISTogram:TIME:MEASurement?</td>
<td>Returns the above four results separated by commas.</td>
</tr>
</tbody>
</table>

Example of Use
:FETC:HIST:TIME:MEAN?
>1.53
:FETC:HIST:TIME:STDD?
>0.022
:FETC:HIST:TIME:PP?
>0.081
:FETC:HIST:TIME:HITS?
>6831
:FETC:HIST:TIME:MEAS?
>1.53,0.022,0.081,6831

Notes:
● This message queries data that the measurement ends.
● When Measure Item is not Histogram or is the amplitude axis histogram, N/A(s) is (are) returned as the response data.
3.9 Scope-specific messages

:TRACe:{CHANnelA|CHANnelB|CHANnelC|CHANnelD|CHANnels}?

**Function**
This command queries the trace data of Scope that is in eye pattern mode.

**Syntax**
:TRACe[:DATA]:{CHANnelA|CHANnelB|CHANnelC|CHANnelD|CHANnels}?

**Parameter**
:TRACe:CHANnelA
   This command requests sending of trace data for Channel A.
   Before sending this command, be sure to set the display of Channel A to On and the displays of other channels to Off.
:TRACe:CHANnelB
   This command requests sending of trace data for Channel B.
   Before sending this command, be sure to set the display of Channel B to On and the displays of other channels to Off.
:TRACe:CHANnelC
   This command requests sending of trace data for Channel C.
   Before sending this command, be sure to set the display of Channel C to On and the displays of other channels to Off.
:TRACe:CHANnelD
   This command requests sending of trace data for Channel D.
   Before sending this command, be sure to set the display of Channel D to On and the displays of other channels to Off.
:TRACe:CHANnels
   This command can be used in version 6 or earlier. It requests sending of trace data for All channels. Be sure to set the displays of all channels to On.
   When the display of the channel querying the trace data is set to Off, the data cannot be returned.

**Response Data**
- When channel to read not displayed: "Channel Off"
- When reading one channel:
  {CHA|CHB|CHC|CHD}-<integer>(<numeric>,<numeric>)[,(<numeric>,<numeric>)]...
- When reading all channels:
  CHA:<integer>(<numeric>,<numeric>)[,(<numeric>,<numeric>)]...,CHD:<integer>(<numeric>,<numeric>)[,(<numeric>,<numeric>)]...

CHA|CHB|CHC|CHD
CHA: Channel A
Chapter 3  Message List

CHB:  Channel B
CHC:  Channel C
CHD:  Channel D

<integer>
Trace data score

(<numeric>,<numeric>)
Each time and amplitude

Example of Use
To query the trace data for the Channel A:
:TRAC:CHANA?
>CHA-2039(86.0,39.97),(86.0,167.13)...

To query the trace data for Channel A and Channel B for MP2100B:
:TRAC:CHAN?
>CHA-2039(86.0,39.97),(86.0,167.13)...,(285.9,-3.92),CHB-2039(86.0,152.10)...

Note:
This message is invalid when Scope is in Pulse or Coherent Eye mode.

Before sending this message, send :TRACe:PREPare to stop updating the Scope screen and make the Scope get ready for receiving trace data query.

If this message is sent after :TRACe:PREPare is sent, the Scope starts data acquisition and creates trace data. Once trace data is created, this message can be used.

To release this status, send :TRACe:END after completing reading of the trace data.

The following changes are made for the MX210000A of Version 3.00 or later.
- This message can be used when Scope is in pulse mode. However, this message cannot be used when in coherent eye.
- Sending of the command :TRACe:PREPare is not required before sending the data.
- Sending of the command :TRACe:END is not required after sending the data.
3.9 Scope-specific messages

:TRACe:PREPare

Function
This command sets the instrument to the status (readout mode) in which the Scope trace data can be read via the remote interface.

Syntax
:TRACe[:DATA]:PREPare CHA|CHB|BOTH

Parameter
CHA:
Sets status for reading only Channel A data
Before using this command, Channel A is set to On and Channel B is set to Off.
Send :TRACe:CHANnelA? after this parameter is set.

CHB:
Sets status for reading only Channel B data
Before using this command, Channel B is set to On and Channel A is set to Off.
Send :TRACe:CHANnelB? after this parameter is set.

BOTH:
Sets status for reading Channel A and B data
Before using this command, Both Channel A and B is set to On.
Send :TRACe:CHANnels? after this parameter is set.

Example of Use
To set the Channel A waveform display to On.
:INPut:CHA ON
:INPut:CHB OFF
To activate the data reading status of Channel A.
:TRACe:PREPare CHA
To read out the data of Channel A.
:TRACe:CHANnelA?
To release the data reading status of Channel A.
:TRACe:END

Notes:
- When this command is sent, updating of the Scope waveform screen is stopped.
- Send :TRACe:PREPare before sending :TRACe:CHANnelA|CHANnelB|CHANnels? to query the trace data.
- The status set by this command is released by :TRACe:END.
:TRACe:END

Function
This command terminates the status (readout mode) set by the :TRACe:PREPare command.

Syntax
:TRACe [ :DATA ] :END

Example of Use
:TRAC :END

Notes:
- When executing this command, the normal screen-update mode is returned.
- Send this command after reading all the trace data after sending the trace data query.
- This command is used in combination with the :TRACe:PREPare command.
3.98 Marker

:CALCulate:MARKer:AOFF

Function
This command deletes the marker displayed in the Scope screen.

Syntax
:CALCulate:MARKer:AOFF

Example of Use
:CALC:MARK:AOFF

:CALCulate:MARKer:CENTer

Function
This command displays all markers of Scope at the center of the screen.

Syntax
:CALCulate:MARKer:CENTer

Example of Use
:CALC:MARK:CENT

:CALCulate:MARKer:{X1|X2|Y1|Y2}

Function
This command sets and queries the On/Off state of the amplitude marker X1/X2/Y1/Y2 display of Scope.

Syntax
:CALCulate:MARKer:{X1|X2|Y1|Y2} <enable>
:CALCulate:MARKer:{X1|X2|Y1|Y2}?

Parameter
0|OFF
1|ON

Response Data
0|1

Example of Use
:CALC:MARK:X1 ON
:CALC:MARK:X1?
>1
Chapter 3  Message List

:CALCulate:MARKer:LOCation:{X1|X2}

Function
This command sets and queries the position of the time marker X1/X2 of Scope.

Syntax
:CALCulate:MARKer:LOCation:{X1|X2} <numeric>
:CALCulate:MARKer:LOCation:{X1|X2}?  

Parameter
<numeric>  
Unit: UI or ps  

Response Data
<numeric>  
When the marker is not displayed, N/A is returned.

Example of Use
To display the marker X2 to the 1.5 UI position
:CALC:MARK:LOC:X2 1.5
:CALC:MARK:LOC:X2?
>1.500

:CALCulate:MARKer:LOCation:XDELta?

Function
This command queries the difference between X1 marker and X2 marker.

Syntax
:CALCulate:MARKer:LOCation:XDELta?

Response Data
<numeric>  
Unit: UI or ps  
The response data when both or either of markers are not displayed is "N/A".
Set the unit (UI or ps) by :DISPlay:WINDow:X:UNIT.

Example of Use
:CALC:MARK:LOC:XDEL?
>152.330
3.9 Scope-specific messages

:CALCulate:MARKer:LOCation:{CHA|CHB|CHC|CHD}:{Y1|Y2}

Function
This command sets and queries the position of the Y1/Y2 marker of Scope.

Syntax
:CALCulate:MARKer:LOCation:{CHA|CHB|CHC|CHD}:{Y1|Y2} <numeric>
:CALCulate:MARKer:LOCation:{CHA|CHB|CHC|CHD}:{Y1|Y2}?

Parameter
<numeric>
The range and step vary depending on the scale of the Y axis (:DISPlay:WINDow:Y:DIVision:{CHA|CHB|CHC|CHD}).

Response Data
<numeric>
The response data when the marker is not displayed is "N/A".

Example of Use
To query the value of the marker Y2 for the Channel A waveform:
:CALC:MARK:LOC:CHA:Y2 55.35
:CALC:MARK:LOC:CHA:Y2?
>55.35

:CALCulate:MARKer:LOCation:{CHA|CHB|CHC|CHD}:YDELta?

Function
This command queries the difference between Y1 marker and Y2 marker.

Syntax
:CALCulate:MARKer:LOCation:{CHA|CHB|CHC|CHD}:YDELta?

Response Data
<numeric>
The unit for electrical channel is mV and the unit for optical channel is μW.
The response data when both or either of markers are not displayed is "N/A".

Example of Use
:CALC:MARK:LOC:CHB:YDEL?
>15.3
3.9.9 Jitter

:JITTer:RESult:ERRor?

Function

Added in Version 6: This command queries an error(s) that occurred during the AdvancedJitter measurement.

Syntax

:JITTer:RESult:ERRor?

Response Data

<integer>: Total of the values that are given to each error type

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EYE?</td>
<td>1</td>
</tr>
<tr>
<td>TIE Error</td>
<td>2</td>
</tr>
<tr>
<td>Pattern Lost</td>
<td>4</td>
</tr>
<tr>
<td>Illegal Error</td>
<td>32768</td>
</tr>
</tbody>
</table>

When more than one error occurs at the same time, the values of all errors are totalized.
For example, when Pattern Lost and Illegal Error happen at the same time, the response data is 4+32768=32772.

Example of Use

When Pattern Lost occurs

:JITT:RES:ERR?
> 4

:JITTer:MEASure:PDJ

Function

Added in Version 6: This command sets and queries the On/Off state of the PDJ measurement.

Syntax

:JITTer:MEASure:PDJ <enable>
:JITTer:MEASure:PDJ?

Parameter

0|OFF
1|ON
3.9  *Scope-specific messages*

**Response Data**

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDJ Off</td>
<td>PDJ On</td>
</tr>
</tbody>
</table>

**Example of Use**

`:JITT:MEAS:PDJ:STAN 5`  
`:JITT:MEAS:PDJ:STAN?`  
>`>5`

**:JITTer:MEASure:PDJ:STANdard**

**Function**

*Added in Version 6:* This command sets and queries the standard for the PDJ measurement.

**Syntax**

`:JITTer:MEASure:PDJ:STANdard 0|1|2|3|4|5`  
`:JITTer:MEASure:PDJ:STANdard?`

**Parameter**

| 0: STM-0  
| 1: STM-1  
| 2: STM-4  
| 3: STM-16  
| 4: STM-64  
| 5: STM-256 |

**Response Data**

| 0|1|2|3|4|5 |

**Example of Use**

`:JITT:MEAS:PDJ:STAN 5`  
`:JITT:MEAS:PDJ:STAN?`  
>`>5`

**:JITTer:MEASure:PDJ:FILTer**

**Function**

*Added in Version 6:* This command sets and queries the filter for the PDJ measurement.

**Syntax**

`:JITTer:MEASure:PDJ:FILTer 0|1|2|3|4|5|6|7|8`  
`:JITTer:MEASure:PDJ:FILTer?`
Parameter
0: LP
1: HP0+LP
2: HP1+LP
3: HP1'+LP
4: HP2+LP
5: HP+LP
6: HP'+LP
7: LP'
8: HP0+LP'

Response Data
0|1|2|3|4|5|6|7|8

Example of Use
:JITT:MEAS:PDJ:FILT 0
:JITT:MEAS:PDJ:FILT?
>0

:JITT:MEAS:EDGE:TYPE

Function
*Added in Version 6:* This command sets and queries the edge detection method of pattern data for the Jitter measurement.

Syntax
:JITT:MEAS:EDGE:TYPE ALL|FALL|RISE
:JITT:MEAS:EDGE:TYPE?

Parameter
ALL: All
FALL: Fall
RISE: Rise

Response Data
ALL|FALL|RISE

Example of Use
:JITT:MEAS:EDGE:TYPE ALL
:JITT:MEAS:EDGE:TYPE?
>ALL
3.9  Scope-specific messages

:*JITTer:MEASure:TJ:BER[:CHB]*

Function

*Added in Version 6:* This command sets and queries the bit error rate for the TJ and Eye Opening measurement.

*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

Syntax

:*JITTer:MEASure:TJ:BER[:CHB] <character>*

:*JITTer:MEASure:TJ:BER[:CHB]?*

Parameter

*<character>:* Set the bit error rate referring to the table below.

<table>
<thead>
<tr>
<th>&lt;character&gt;</th>
<th>Bit Error Rate</th>
<th>&lt;character&gt;</th>
<th>Bit Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_1</td>
<td>10^-1</td>
<td>E_10</td>
<td>10^-10</td>
</tr>
<tr>
<td>E_2</td>
<td>10^-2</td>
<td>E_11</td>
<td>10^-11</td>
</tr>
<tr>
<td>E_3</td>
<td>10^-3</td>
<td>E_12</td>
<td>10^-12</td>
</tr>
<tr>
<td>E_4</td>
<td>10^-4</td>
<td>E_13</td>
<td>10^-13</td>
</tr>
<tr>
<td>E_5</td>
<td>10^-5</td>
<td>E_14</td>
<td>10^-14</td>
</tr>
<tr>
<td>E_6</td>
<td>10^-6</td>
<td>E_15</td>
<td>10^-15</td>
</tr>
<tr>
<td>E_7</td>
<td>10^-7</td>
<td>E_16</td>
<td>10^-16</td>
</tr>
<tr>
<td>E_8</td>
<td>10^-8</td>
<td>E_17</td>
<td>10^-17</td>
</tr>
<tr>
<td>E_9</td>
<td>10^-9</td>
<td>E_18</td>
<td>10^-18</td>
</tr>
</tbody>
</table>

Response Data

E_1|E_2|E_3|E_4|E_5|E_6|E_7|E_8|E_9|E_10|E_11|E_12|E_13|E_14|E_15|E_16|E_17|E_18

Example of Use

:*JITT:MEAS:TJ:BER E_9*

:*JITT:MEAS:TJ:BER?*

>E_9
Chapter 3 Message List

:JITTer:MEASure:RJ:FIXed[:{CHA|CHB}]

**Function**

*Added in Version 6:* This command sets and queries Fixed RJ of the Jitter measurement.

*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

**Syntax**

:JITTer:MEASure:RJ:FIXed[:{CHA|CHB}] <enable>

:JITTer:MEASure:RJ:FIXed[:{CHA|CHB}]?

**Parameter**

0|OFF Fixed RJ Off
1|ON Fixed RJ On

**Response Data**

0|1

**Example of Use**

:JITT:MEAS:RJ:FIX ON
:JITT:MEAS:RJ:FIX?

>1

:JITTer:MEASure:RJ:FIXed:VALue[:{CHA|CHB}]

**Function**

*Added in Version 6:* This command sets and queries RJ Value of Fixed RJ. 

*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

**Syntax**

:JITTer:MEASure:RJ:FIXed:VALue[:{CHA|CHB}] <numeric>

:JITTer:MEASure:RJ:FIXed:VALue[:{CHA|CHB}]?

**Parameter**

<numeric> 0.01 to 999.99

**Response Data**

<numeric> 0.01 to 999.99

**Example of Use**

:JITT:MEAS:RJ:FIX:VAL 2.50
:JITT:MEAS:RJ:FIX:VAL?

>2.50
3.9 Scope-specific messages

:JITTer:MEASure:CORRection[:{CHA|CHB}]

**Function**

*Added in Version 6:* This command sets and queries Correction Factor of the Jitter measurement.

*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

**Syntax**

:JITTer:MEASure:CORRection[:{CHA|CHB}] <enable>

:JITTer:MEASure:CORRection[:{CHA|CHB}]?

**Parameter**

0|OFF  Correction Factor Off
1|ON   Correction Factor On

**Response Data**

0|1

**Example of Use**

:JITT:MEAS:CORR ON

:JITT:MEAS:CORR?

>1
Chapter 3  Message List

:JITTer:MEASure:CORRection:DJ:SCALe[:{CHA|CHB|CHC|CHD|ALL}]

Function

*Added in Version 6:* This command sets and queries DJ (scale) of Correction Factor.

Syntax

:JITTer:MEASure:CORRection:DJ:SCALe[:{CHA|CHB|CHC|CHD|ALL}] <numeric>

:JITTer:MEASure:CORRection:DJ:SCALe[:{CHA|CHB|CHC|CHD|ALL}]?

A channel can be specified when Sampling Mode is Eye. When Sampling Mode is Advanced Jitter, a channel cannot be specified. 

*Modified in Version 7:* If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

Parameter

<numeric>: 0.01 to 999.99

Response Data

<numeric>: 0.01 to 999.99

Example of Use

:JITT:MEAS:CORR:DJ:SCAL 5.00
:JITT:MEAS:CORR:DJ:SCAL?
>5.00

:JITTer:MEASure:CORRection:RJ:SCALe[:{CHA|CHB}]

Function

*Added in Version 6:* This command sets and queries RJ (scale) of Correction Factor.

*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

Syntax

:JITTer:MEASure:CORRection:RJ:SCALe[:{CHA|CHB}] <numeric>

:JITTer:MEASure:CORRection:RJ:SCALe[:{CHA|CHB}]?

Parameter

<numeric>: 0.01 to 999.99

Response Data

<numeric>: 0.01 to 999.99
### Example of Use

```plaintext
:JITT:MEAS:CORR:RJ:SCAL 20.00
:JITT:MEAS:CORR:RJ:SCAL?
>20.00
```

### Function

*Added in Version 6:* This command sets and queries RJ (rms) of Correction Factor.
*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

### Syntax

```plaintext
:JITTer:MEASure:CORRection:RJ:RMS[:{CHA|CHB}] <numeric>
:JITTer:MEASure:CORRection:RJ:RMS[:{CHA|CHB}]?
```

#### Parameter

*<numeric>*: 0.01 to 999.99

#### Response Data

*<numeric>*: 0.01 to 999.99

### Example of Use

```plaintext
:JITT:MEAS:CORR:RJ:RMS 2.50
:JITT:MEAS:CORR:RJ:RMS?
>2.50
```
:JITTer:MEASure:CROSsing[:{CHA|CHB}]

Function
*Added in Version 6:* This command sets and queries the edge detection method of pattern data for the Jitter measurement.  
*Modified in Version 7:* A channel cannot be specified. The channel to be set and queried is the active channel.

**Syntax**

```
:JITTer:MEASure:CROSsing[:{CHA|CHB}] AUTO|MANual
:JITTer:MEASure:CROSsing[:{CHA|CHB}]?
```

**Parameter**

- AUTO: Auto
- MANual: Manual

**Response Data**

AUTO | MANual

**Example of Use**

```
:JITT:MEAS:CROS AUTO
:JITT:MEAS:CROS?
> AUTO
```

[JITTer:MEAS:MANual]

**Function**

*Added in Version 6:* This command sets and queries Manual Crossing of Threshold Level for the Jitter measurement.  
*Modified in Version 7:* If any channel is not specified, ALL is specified for command, and the active channel is specified for query.

**Syntax**

```
:JITTer:MEASure:CROSsing:MANual[:{CHA|CHB|CHC|CHD|ALL}] <integer>
:JITTer:MEASure:CROSsing:MANual[:{CHA|CHB|CHC|CHD|ALL}]?
```

**Parameter**

- **<integer>:** 30 to 70%

**Response Data**

- **<integer>:** 30 to 70

**Example of Use**

```
:JITT:MEAS:CROS:MAN 55
:JITT:MEAS:CROS:MAN?
```
### :JITTer:GRAPh:ESTimate:RJDJ[:{CHA|CHB|CHC|CHD}]

**Function**

*Added in Version 6:* This command sets and queries Estimated RJ/DJ Histogram on the TJ Histogram screen.

*Modified in Version 7:* If any channel is not specified, the active channel is specified.

**Syntax**

```
:JITTer:GRAPh:ESTimate:RJDJ[:{CHA|CHB|CHC|CHD}] <enable>
:JITTer:GRAPh:ESTimate:RJDJ[:{CHA|CHB|CHC|CHD}]?
```

**Parameter**

- 0 | OFF
- 1 | ON

**Response Data**

0 | 1

**Example of Use**

```
:JITT:GRAP:EST:RJDJ OFF
:JITT:GRAP:EST:RJDJ?
>0
```

### :JITTer:GRAPh:ESTimate:RJPJ

**Function**

*Added in Version 6:* This command sets and queries Estimated RJ/PJ Histogram on the RJ/PJ Histogram screen.

**Syntax**

```
:JITTer:GRAPh:ESTimate:RJPJ <enable>
:JITTer:GRAPh:ESTimate:RJPJ?
```

**Parameter**

- 0 | OFF
- 1 | ON

**Response Data**

0 | 1

**Example of Use**

```
:JITT:GRAP:EST:RJPJ 1
:JITT:GRAP:EST:RJPJ?
>1
```
:JITTer:GRAPh:DDJ:{ALL|FALL|RISE}

Function

Added in Version 6: This command sets and queries the On/Off state of DDJ Histogram graph display (All Edge, Fall Edge, Rise Edge).

Syntax

:JITTer:GRAPh:DDJ:{ALL|FALL|RISE} <enable>
:JITTer:GRAPh:DDJ:{ALL|FALL|RISE}?

Parameter

0|OFF
1|ON

Response Data

0|1

Example of Use

:JITT:GRAP:DDJ:FALL 0
:JITT:GRAP:DDJ:FALL?
>0
:JITT:GRAP:DDJ:RISE ON
:JITT:GRAP:DDJ:RISE?
>1

:JITTer:MEASure:PJ:FREQuency:CALCulate

Function

Added in Version 6: This command executes PJ Calculation for PJ vs Frequency graph.

Syntax

:JITTer:MEASure:PJ:FREQuency:CALCulate
Appendix A Command Compatibility With Existing Products

Appendix A explains the command compatibility between BERTWaves with different models, and the compatible commands that can be used as the command messages for both conventional products and BERTWave.

A.1 Command Compatibility Between MP2100A and MP2100B ................................................. A-2
A.2 Command Compatibility Between MP2100B and MP2110A .................................................. A-3
A.3 Command Compatibility Tables with Products Other Than BERTWave .................................. A-6
A.4 Introduction of Native Commands ......................... A-8
A.5 Compatible Commands and Descriptions ............ A-9
A.1 Command Compatibility Between MP2100A and MP2100B

If one of the following bit rate setting commands is used for PPG Ch3 or PPG Ch4 of MP2100B, an error occurs:

:OUTPut:BITRate:STANdard
:OUTPut:CLOCk:OPERation
:OUTPut:BITRate
:OUTPut:CLOCk:FREQuency
:OUTPut:CMU:FREQuency
:OUTPut:BITRate:OFFSet
:OUTPut:CLOCk:OFFset:PPM

If one of the following ED bit rate setting commands is used for MP2100B, an error occurs:

:INPut:BITRate:STANdard
:INPut:BITRate

The following changes are made to the Reference CLK setting commands for MP2100B:

Addition:
:OUTPut:RCLock

Changed into compatible commands:
:OUTPut:CMU:REFClock
:OUTPut:RCLock:SELect

For MP2100B, Ch Tracking and Ch2 Reference CLK are set to On and Ch1, by default. Therefore, if your BERTWave is MP2100A, execution of a sequence results in an error, in case where the following items for Ch1 and Ch2 are set to different values, respectively.

- Bitrate
- Test Pattern
- Gating Cycle/Period
A.2 Command Compatibility Between MP2100B and MP2110A

In MP2110A, the following commands that were dependent on Ch2 to 4 (Master was Ch1) are changed to the common setting. So the settings of these commands can be changed even when any channel is specified.

:OUTPut:RCLock
:OUTPut:RCLock:APPLy
:OUTPut:BITRate:STANdard
:INPut:BITRate:STANdard
:OUTPut:BITRate
:INPut:BITRate
:OUTPut:BITRate:OFFSet

In MP2110A, the following commands that were dependent on Ch2 to 4 (Master was Ch1) when Ch Tracking was ON are changed to the common setting. So the settings of these commands can be changed even when any channel is specified.

:SOURce:PATTern:TYPE
:SENSe:MEASure:EAALarm:MODE
:SENSe:MEASure:EAALarm:PERiod

In MP2110A, the following commands cannot be used. When the command is used, an error occurs.

:SYSTem:BEEPer:SET
:SYSTem:ERRor:HCLear
:SYSTem:ERRor:HISTORY?
:SYSTem:DISPlay:ALARm
:SYSTem:INFormation:ERRor?
:OUTPut:RCLock:SElecT
:OUTPut:CMU:EXTClock
:INPut:BITRate:DIVRate?
:OUTPut:BITRate:DIVRate
:SOURce:MMEMory:PATTern:RECall
:SENSe:MMEMory:PATTern:RECall
:SOURce:PATTern:EADDition:SET
:SOURce:PATTern:EADDition:VARiation
:SOURce:PATTern:EADDition:RATE
:SENSe:PATTern:SYNC:ASYNc
:SENSe:PATTern:SYNC:THReshold
:SENSe:PATTern:SYNC:FSMode
Appendix A  Command Compatibility With Existing Products

:SENSe:PATTern:SYNC:FPOSition
:DISPLAY:MODE:EYE:FAST
:CALibrate:SYSTem:CGain

In MP2110A, the following commands are changed.

:CONFigure:TRACking:DRATe
:CONFigure:TRACking:DRATe:MASTer
→ This command is changed to “:TIME:TRACking”.
And “:TIME:TRACking:STATus?” was added.

:INPut:FILTer:ENABle
:INPut:FILTer
→ This command is changed to “:FILTer[:CHA|CHB]”.

:CONFigure:MASK:TYPe
→ This command is changed to “:CONFigure:MASK:RECall”.

In MP2110A, the following commands were added.

:OUTPut:CLOCk:DIVRate?
:OUTPut:CLOCk:SOURce:CHANnel
:DISPLAY:RESult
[:BERT:ALL]:CALCulate:DATA:MONitor:HISTory?
:TIME:PTRigger
:TIME:PTRigger:RESet

In MP2110A, specifying ChA or ChB was added to the following commands. When nothing is specified, ChB is specified. When ChA or ChB is specified in MP210xA and MP2100B, an error (–113 Undefined Header) occurs.

:INPut:WAVLength[:CHA|CHB]
:CALibrate:CGain[:CHA|CHB]
:CALibrate:RESPonsivity[:CHA|CHB]
:CALibrate:AUTocorrect[:CHA|CHB]
:CALibrate:CALPower[:CHA|CHB]
:CONFigure:EXRCorrection[:CHA|CHB]
:CONFigure:EXRCorrection:FACTor[:CHA|CHB]

In version 7 or later, when the channel of the following commands is not specified, the active channel is specified.

:CALibrate:CGain[:{CHA|CHB|CHC|CHD}]
:CALibrate:RESPonsivity[:{CHA|CHB|CHC|CHD}]
:CALibrate:AUTocorrect[:{CHA|CHB|CHC|CHD}]

A·4
A.2 Command Compatibility Between MP2100B and MP2110A

:CALibrate:CALPower[:{CHA|CHB|CHC|CHD}]

In version 7 or later, when the channel of the following commands is not specified, ALL is specified in the command and the active channel is specified in the queries.

:INPut:WAVLength[:{CHA|CHB|CHC|CHD|ALL}]
:CONFigure:EXRCorrection[:{CHA|CHB|CHC|CHD|ALL}]
:CONFigure:EXRCorrection:FACTor[:{CHA|CHB|CHC|CHD|ALL}]

In MP2110A, the default value of Number of Samples (:OPTion:MAX:SAMPLEs:NUMber) of Scope is different. The default value in MP210xx is 8191 and the default value in MP2110A is 2048.
### A.3 Command Compatibility Tables with Products Other Than BERTWave

- **✓**: Compatible.
- *****: Partly compatible; occasional errors when sending commands for previous hardware to this instrument.
- *(Blank)*: Incompatible; sending commands for previous hardware to this instrument always causes errors.

<table>
<thead>
<tr>
<th>SCPI Command</th>
<th>Native Command</th>
<th>MP1800A</th>
<th>MP1632C</th>
<th>MP1776A</th>
</tr>
</thead>
<tbody>
<tr>
<td>:CALCulate:DATA:EALarm</td>
<td>END?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>ER?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>EC?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>CC?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>FRQ?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:CALCulate:DATA:MONitor</td>
<td>MTR?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>ERS?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:CALCulate:OPTical:STATus</td>
<td>HRE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:DISPlay:RESult:EALarm:HRESet</td>
<td>CUR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:DISPlay:RESult:EALarm:MODE</td>
<td>DSD</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:INPut:DATA:INTERface</td>
<td>COP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:MODule:ID</td>
<td>CEC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:CLOCk:FREQuency</td>
<td>CRF</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:CMU:EXTClock</td>
<td>CRE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:CMU:FREQuency</td>
<td>CRS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:CMU:REFClock</td>
<td>DAP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:CMU:RESolution</td>
<td>DAT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:DATA:AMPLitude</td>
<td>DON</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:DATA:ATTFactor</td>
<td>RFC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:OUTPut:DATA:OUTPut</td>
<td>SAT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:ASTRt</td>
<td>SOT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:ASTP</td>
<td>STT?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:ASTate?</td>
<td>MOD</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:MODE</td>
<td>PRD</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:ELAPsed</td>
<td>STA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:START</td>
<td>STO</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:STOP</td>
<td>LGC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
## Command Compatibility Tables with Products Other Than BERTWave

### Appendix A

#### Table A.3-1  Command Compatibility (Cont’d)

<table>
<thead>
<tr>
<th>SCPI Command</th>
<th>Native Command</th>
<th>MP1800A</th>
<th>MP1632C</th>
<th>MP1776A</th>
</tr>
</thead>
<tbody>
<tr>
<td>:SENSe:PLAY:TYPE</td>
<td>PTS</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SENSe:PLAY:SYNC:ASync</td>
<td>SYN</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:PLAY:SYNC:THReshold</td>
<td>SYE</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:PLAY:SYNC:FSMode</td>
<td>SYM</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>:SENSe:PLAY:SYNC:FPOSition</td>
<td>FPS</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:STATe?</td>
<td>MSR?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:START?</td>
<td>MSA?</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:STOP?</td>
<td>MSO?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:ELApsed?</td>
<td>MLP?</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SENSe:MEASure:EALarm:TIMed?</td>
<td>ETI?</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SOURce:OPTical:SIGNal:WLENgth?</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SOURce:OPTical:SIGNal:OUTPut</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SOURce:OUTPut:ASET</td>
<td>OON</td>
<td>✓</td>
<td>✓</td>
<td>(OON)</td>
</tr>
<tr>
<td>:SOURce:PLAY:ADDition:RATE</td>
<td>ERT</td>
<td>✓</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>:SOURce:PLAY:ADDition:SET</td>
<td>EAD</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SOURce:PLAY:ADDition:SINGLE</td>
<td>ESL</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SOURce:PLAY:ADDition:VARiation</td>
<td>EAV</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SOURce:PLAY:LOGic</td>
<td>LGC</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SOURce:PLAY:TYPE</td>
<td>PTS</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:OPERation:CONDition?</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:OPERation:ENABLE</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:OPERation[:EVENt]?</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:OPERation:NTRansition</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:OPERation:PTRansition</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:STATus:FRESet</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SYSTem:ERRor?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:[DATE</td>
<td>TIME]?</td>
<td>RTM?</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:DISPlay:RESult</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SYSTem:INFormation:ERRor?</td>
<td>INF?</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:SYSTem:MEMory:INITialize</td>
<td>INI</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SYSTem:FINt:COPY</td>
<td>HCP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>:SYSTem:TERMination</td>
<td>TRM</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:VERsion?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
A.4 Introduction of Native Commands

Native Command Usage Purpose
The purpose of the Native command is to allow use of remote interface software for previous Anritsu pulse pattern generator and error detector models with the BERTWave.

Native Command Format
The Native command is configured by the string of ASCII code. For the Native command format, refer to 2.7 “Message Format”. The word string that indicates the Native command end is LF (line feed) or CR (carriage return) +LF.

Note:
Native commands must end with LF or CR+LF; otherwise, a timeout error results because the communication is not able to end.

Channel Setting Method
When using the pulse pattern generator/ error detector with two or more channels, the channel to be controlled is set using :MODule:ID command before executing the Native command.

Example of Use
When controlling the PPG/ED_1ch:
:MOD:ID 1
When controlling the PPG/ED_2ch:
:MOD:ID 2
When querying the currently controlled channel:
:MOD:ID?
A.5 Compatible Commands and Descriptions

RTM?

Function
Compatible command: This command has the same function as :SYSTem:{DATE|TIME}?.

Response Data
RTM <year>,<month>,<day>,<hour>,<minute>,<second>
Each of the parameters in the response data is a two-digit number. The lower two digits of the year is output as <year>.

Example of Use
RTM?
>RTM 09,10,24,09,51,13

INF?

Function
Compatible command: This command has the same function as :SYSTem:INFormation:ERRor?.

Response Data
INF <error_code>
The meanings of <error_code> are the same as those of :SYSTem:INFormation:ERRor?.

Example of Use
INF?
>INF 1

:SYSTem:MEMory:INITialize

Function
This command has the same function as *RST.

Example of Use
:SYST:MEM:INIT
IN1

Function
Compatible command: This command has the same function as :SYSTem:MEMory:INITialize.

Example of Use
INI

HCP

Function
Compatible command: This command has the same function as :SYSTem:PRINt:COPY.

Example of Use
HCP

OON

Function
This command sets and queries the On/Off state of signal outputting from all PPG channels and optical outputting from XFP/SFP+.

Syntax
OON 0|1
OON?

Parameter
0  PPG output and optical output OFF
1  PPG output and optical output ON

Response Data
OON 0|1

Example of Use
OON 1
OON?
>OON 1
A.5  Compatible Commands and Descriptions

:SENSe:MEASure:ASTRt

Function
This command has the same function as *TRG.

Example of Use
:SENS:MEAS:ASTR

SAT

Function
Compatible command: This command has the same function as :SENSe:MEASure:ASTRt.

Example of Use
SAT

SOT

Function
Compatible command: This command has the same function as :SENSe:MEASure:ASTP.

Example of Use
SOT

STT?

Function
Compatible command: This command has the same function as :SENSe:MEASure:ASTate?.

Response Data
STT 0|1

Example of Use
STT?
>STT 1
Appendix A  Command Compatibility With Existing Products

:OUTPut:CMU:REFClock

Function

Compatible command: This command has the same function as :OUTPut:RCLock:SELect.

Syntax

:OUTPut:CMU:REFClock
INTernal|EXTernal|CH1External|CH2External|SYNChronize
:OUTPut:CMU:REFClock?

Example of Use

:OUTP:CMU:REFC INT
:OUTP:CMU:REFC?
>INT

RFC

Function

Compatible command: This command has the same function as :OUTPut:RCLock:SELect.

Syntax

RFC 0|1|2|3|4
RFC?

Parameter

0  INTernal
1  EXTernal
2  Added in Version 4: CH1External
3  Added in Version 4: CH2External
4  Added in Version 4: SYNChronize

Response Data

RFC 0|1|2|3|4

Example of Use

RFC 0
RFC?
>RFC 0
CRE

Function
Compatible command: This command has the same function as RFC.

Syntax
CRE 0|1|2|3|4
CRE?

Example of Use
CRE 0
CRE?
>CRE 0

CEC

Function
Compatible command: This command has the same function as :OUTPut:CMU:EXTClock.

Syntax
CEC 0|1
CEC?

Parameter
0 Ext 10MHz In
1 Ext 1/16 In

Response Data
CEC 0|1

Example of Use
CEC 1
CEC?
>CEC 1
Appendix A  Command Compatibility With Existing Products

**SOP**

**Function**

*Compatible command only for MP210xA, MP2100B:* This command has the same function as :OUTPut:SYNC:SOURce.

**Syntax**

SOP <integer>
SOP?

**Parameter**

<integer>

0  PPG1_1/1Clk
1  PPG1_1/2Clk
2  PPG1_1/4Clk
3  PPG1_1/8Clk
4  PPG1_1/16Clk
5  PPG1_1/64Clk
6  PPG2_1/1Clk
7  PPG2_1/2Clk
8  PPG2_1/4Clk
9  PPG2_1/8Clk
10 PPG2_1/16Clk
11 PPG2_1/64Clk
13 ED1_1/16Clk
15 ED2_1/16Clk
16 PPG1_Pattern Sync
17 PPG2_Pattern Sync
19 ED1_1/4Clk
20 ED1_1/8Clk
22 ED2_1/4Clk
23 ED2_1/8Clk
24 ED3_1/4Clk
25 ED3_1/8Clk
26 ED4_1/4Clk
27 ED4_1/8Clk
28 ED4_1/16Clk
29 PPG3_Pattern Sync
30 PPG4_Pattern Sync

**Response Data**

SOP <integer>
Example of Use
To set the 1/16 divide clock synchronized with the data output of the PPG Channel 1 to the output signal to the Sync Output connector.

SOP 4
SOP?
>SOP 4

Note:
When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.

:SENSe:PARam:AEXecute

Function
Compatible command only for MP210xA, MP2100B (Version 4 or later):
This command is compatible with version 4 or later, and performs batch setting of PPG/ED of Ch1 and Ch2.

Syntax
:SENSe:PARam:AEXecute
<ppg1>,<ppg2>,<ed1>,<ed2>,<bitrate_standard>,<bitrate>,<ppm>,<pattern>,<amplitude>

Parameter
<ppg1>,<ppg2>,<ed1>,<ed2>
   Specify the object device(s) to be set by the command.
   Specify 1 for the object device(s) to be set by the command; specify 0 otherwise.

<bitrate_standard> = <string>
   Select a standard for the bit rate of PPG/ED. The parameter values are the same as for :OUTPut|INPut:BITRate:STANdard.

<bitrate> = <integer>
   Specify/query the bit rate (kbit/s) if “Variable” is selected as the bit rate standard for PPG/ED. The parameter values are the same as for :OUTPut|INPut:BITRate.

<ppm> = <integer>
   Specify/query the bit rate offset (ppm) for PPG. The parameter values are the same as for :OUTPut:BITRate:OFFSet.

<pattern> = PRBS{7|9|15|23|31}|USER
   Specify the test pattern for PPG/ED. The parameter values are the same as for :SOURce|SENSe:PATTern:TYPE.

<amplitude> = <numeric>
   Specify the signal amplitude (Vpp) of PPG. The parameter values are the same as for :OUTPut:DATA:AMPLitude.
Example of Use
To set PPG/ED of Ch1/2 to the bit rate of 10.3125 Gbit/s, offset of 100 ppm, test pattern of PRBS \(2^{31}-1\), and amplitude of 0.8 Vpp:

\[
{:SENS:PAR:AEX 1,1,1,1,"VARIABLE",10312500,100,PRBS31,0.80}
\]

Note:
When this command is used in MP2110A, an error (-113 Undefined Header) occurs because MP2110A does not support this command.

:OUTPut:CLOCk:OPERation

Function
Compatible command only for MP210xA, MP2100B: This command has the same function as :OUTPut:BITRate:STANdard.

Syntax
:OUTPut:CLOCk:OPERation <bitrate_standard>
:OUTPut:CLOCk:OPERation?

Parameter
<bitrate_standard> = <string>
Select a standard for the bit rate of PPG/ED.
The parameter values are the same as for :{OUTPut|INPut}:BITRate:STANdard.

Example of Use
:OUTP:CLOC:OPER "10G_LAN"
:OUTP:CLOC:OPER?
>"10G_LAN"

Note:
When this command is used in MP2110A, an error (-113 Undefined Header) occurs because MP2110A does not support this command.
OPE

Function

Compatible command only for MP210xA, MP2100B: This command has the same function as :OUTPut:BITRate:STANdard.

Syntax

OPE <bitrate_standard>

OPE?

Parameter

<bitrate_standard> = <integer>

Table A.5-1 Bit Rate Standards

<table>
<thead>
<tr>
<th>&lt;integer&gt;</th>
<th>Standard</th>
<th>Bit Rate (bit/s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Variable-1/1</td>
<td>6.25G to 12.5G</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1GFC</td>
<td>1.0625G</td>
<td>*1</td>
</tr>
<tr>
<td>2</td>
<td>2GFC</td>
<td>2.125G</td>
<td>*1</td>
</tr>
<tr>
<td>3</td>
<td>4GFC</td>
<td>4.25G</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8GFC</td>
<td>8.5G</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10GFC</td>
<td>10.51875G</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10GFC FEC</td>
<td>11.3168G</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1GbE</td>
<td>1.25G</td>
<td>*1</td>
</tr>
<tr>
<td>8</td>
<td>2GbE</td>
<td>2.5G</td>
<td>*1</td>
</tr>
<tr>
<td>9</td>
<td>Infiniband</td>
<td>2.5G</td>
<td>*1</td>
</tr>
<tr>
<td>10</td>
<td>10GbE WAN/PHY</td>
<td>9.95328G</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>10GbE LAN/PHY</td>
<td>10.3125G</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>OTU1e (10GbE FEC)</td>
<td>11.049107G</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>OTU2e (10GbE FEC)</td>
<td>11.095728G</td>
<td></td>
</tr>
</tbody>
</table>

*1: When the Option 090 is installed, the bit rate that is equal to or less than Variable-1/4 can be selected for the ED.
### Table A.5-1  Bit Rate Standards (Cont’d)

<table>
<thead>
<tr>
<th>&lt;integer&gt;</th>
<th>Standard</th>
<th>Bit Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>OC-3/STM-1</td>
<td>155.22M</td>
<td>*1</td>
</tr>
<tr>
<td>15</td>
<td>OC-12/STM-4</td>
<td>622.08M</td>
<td>*1</td>
</tr>
<tr>
<td>16</td>
<td>OC-48/STM16</td>
<td>2.488G</td>
<td>*1</td>
</tr>
<tr>
<td>17</td>
<td>OTU-1</td>
<td>2.666057G</td>
<td>*1</td>
</tr>
<tr>
<td>18</td>
<td>OC-192/STM-64</td>
<td>10.664228G</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>G.975 FEC</td>
<td>10.709225G</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>OTU2</td>
<td>10.709225G</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Variable-1/2</td>
<td>6.25G to 3.125G</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Variable-1/4</td>
<td>3.125G to 1.5625G</td>
<td>*1</td>
</tr>
<tr>
<td>23</td>
<td>Variable-1/8</td>
<td>1.5625G to 781.25M</td>
<td>*1</td>
</tr>
<tr>
<td>24</td>
<td>Variable-1/16</td>
<td>781.25M to 390.625M</td>
<td>*1</td>
</tr>
<tr>
<td>25</td>
<td>Variable-1/32</td>
<td>390.625M to 195.312M</td>
<td>*1</td>
</tr>
<tr>
<td>26</td>
<td>Variable-1/64</td>
<td>195.312M to 125M</td>
<td>*1</td>
</tr>
<tr>
<td>27</td>
<td>Infiniband x2</td>
<td>5G</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Infiniband x4</td>
<td>10G</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>OC-24</td>
<td>1.244G</td>
<td>*1</td>
</tr>
<tr>
<td>30</td>
<td>CPRI</td>
<td>614.4M</td>
<td>*1</td>
</tr>
<tr>
<td>31</td>
<td>CPRI x2</td>
<td>1.2288G</td>
<td>*1</td>
</tr>
<tr>
<td>32</td>
<td>CPRI x4</td>
<td>2.4576G</td>
<td>*1</td>
</tr>
<tr>
<td>33</td>
<td>CPRI x5</td>
<td>3.072G</td>
<td>*1, *2</td>
</tr>
<tr>
<td>34</td>
<td>CPRI x10</td>
<td>6.144G</td>
<td>*2</td>
</tr>
<tr>
<td>35</td>
<td>OBSAI RP3</td>
<td>768M</td>
<td>*1, *2</td>
</tr>
<tr>
<td>36</td>
<td>OBSAI RP3 x2</td>
<td>1.536G</td>
<td>*1, *2</td>
</tr>
<tr>
<td>37</td>
<td>OBSAI RP3 x4</td>
<td>3.072G</td>
<td>*1, *2</td>
</tr>
<tr>
<td>38</td>
<td>OBSAI RP3 x8</td>
<td>6.144G</td>
<td>*2</td>
</tr>
<tr>
<td>39</td>
<td>Variable (9.5-14.2G)</td>
<td>9.5G to 14.2G</td>
<td></td>
</tr>
</tbody>
</table>

*2: When the Option 090/092 is installed, the bit rate can be selected.

**Response Data**

OPE <bitrate_standard> = <integer>

**Example of Use**

```
OPE 3
OPE?
> OPE 3
```

**Note:**

When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
:OUTPut:CLOCk:FREQuency

Function
Compatible command: This command has the same function as :OUTPut:BITRate.

Syntax
:OUTPut:CLOCk:FREQuency <bitrate>
:OUTPut:CLOCk:FREQuency?

Example of Use
:OUTP:CLOC:FREQ 8500000
:OUTP:CLOC:FREQ?
>8500000

:OUTPut:CMU:FREQuency

Function
Compatible command: This command has the same function as :OUTPut:BITRate.

Syntax
:OUTPut:CMU:FREQuency <bitrate>
:OUTPut:CMU:FREQuency?

Example of Use
:OUTP:CMU:FREQ 8500000
:OUTP:CMU:FREQ?
>8500000
Appendix A  Command Compatibility With Existing Products

CRF

Function
Compatible command: This command has the same function as :OUTPut:BITRate.

Syntax
CRF <bitrate>
CRF?

Response Data
CRF <bitrate>

Example of Use
CRF 8500000
CRF?
>CRF 8500000

:OUTPut:CMU:RESolution

Function
Compatible command: This command is compatible with existing products, and sets and queries the unit of bit rate specified by the :OUTPut:CMU:FREQuency command.

Syntax
:OUTPut:CMU:RESolution KHZ|MHZ
:OUTPut:CMU:RESolution?

Parameter
KHZ|MHZ

Response Data
KHZ|MHZ

Example of Use
:OUTP:CMU:RES KHZ
:OUTP:CMU:RES?
>KHZ

Note:
Even if MHZ is specified by this command, the Bit Rate display in the screen will not change.
CRS

Function
Compatible command: This command has the same function as :OUTPut:CMU:RESolution.

Syntax
CRS 0|1
CRS?

Parameter
0 kHz
1 MHz

Response Data
CRS 0|1

Example of Use
CRS 0
CRS?
>CRS 0
**Appendix A  Command Compatibility With Existing Products**

**:OUTPut:COLCk:OFFSet:PPM**

**Function**

*Compatible command:* This command has the same function as :OUTPut:BITRate:OFFSet.

**Syntax**

:OUTPut:CLOCk:OFFSet:PPM <numeric>
:OUTPut:CLOCk:OFFSet:PPM?

**Example of Use**

:OUTP:CLOC:OFFS:PPM 100
:OUTP:CLOC:OFFS:PPM?
>100

**COP**

**Function**

*Compatible command:* This command has the same function as :OUTPut:BITRate:OFFSet.

**Syntax**

COP <numeric>
COP?

**Response Data**

COP <integer>

**Example of Use**

COP 100
COP?
>COP 100
PTS

Function

*Compatible command:* This command has the same function as `:SOURce:PATTern:TYPE` and `:SENSe:PATTern:TYPE`.

Syntax

```
PTS <ppg_ed>,<pattern>
PTS? <ppg_ed>
```

Parameter

- `<ppg_ed>`
  - 0: PPG
  - 1: ED

- `<pattern>`
  - 0: PRBS $2^7-1$
  - 1: PRBS $2^9-1$
  - 2: PRBS $2^{15}-1$
  - 3: PRBS $2^{23}-1$
  - 4: PRBS $2^{31}-1$
  - 5: Programmable Pattern
  - 6: 1/2 Clock Pattern
  - 7: 1/16 Clock Pattern

Response Data

```
PTS <pattern>
```

Example of Use

To set the ED test pattern to PRBS $2^{15}-1$:

```
PTS 1,2
PTS? 1
>PTS 2
```
LGC

Function
Compatible command: This command has the same function as :SOURce:PATTern:LOGic and :SENSe:PATTern:LOGic.

Syntax
LGC <ppg_ed>,<pos_neg>
LGC? <ppg_ed>

Parameter
<ppg_ed>
0 PPG
1 ED
<pos_neg>
0 Positive
1 Negative

Response Data
LGC <pos_neg>

Example of Use
To set the test pattern logic of the PPG to the negative logic:
LGC 0,1
LGC? 0
>LGC 1
**DLN?**

**Function**

*Compatible command:* This command has the same function as `:SOURce:PATTern:DATA:LENGth?` and `:SENSe:PATTern:DATA:LENGth?`.

**Syntax**

```
DLN? <ppg_ed>
```

**Parameter**

- `<ppg_ed>`
  - 0: PPG
  - 1: ED

**Response Data**

```
DLN <integer>
```

**Example of Use**

```
DLN? 1
>16384
```
Appendix A  Command Compatibility With Existing Products

DAP

Function
Compatible command: This command has the same function as :OUTPut:DATA:AMPLitude.

Syntax
DAP <numeric>
DAP?

Parameter
The parameter values are the same as for :OUTPut:DATA:AMPLitude.

Response Data
DAP <numeric>

Example of Use
DAP 0.5
DAP?
>DAP 0.5

DAT

Function
Compatible command: This command has the same function as :OUTPut:DATA:ATTFactor.

Syntax
DAT <numeric>
DAT?

Parameter
The parameter values are the same as for :OUTPut:DATA:ATTFactor.

Response Data
DAT <integer>

Example of Use
DAT 20
DAT?
>DAT 20
**PRO?**

**Function**

*Compatible command:* This command has the same function as :OUTPut:DATA:RELative?.

**Response Data**

PRO <numeric>

**Example of Use**

PRO?
>PRO 0.4

**EAD**

**Function**

*Compatible command:* This command has the same function as ::SOURce:PATTern:EADDition:SET.

**Syntax**

EAD 0|1|7
EAD?

**Parameter**

0   Does not generate error
1   Generates error
7   Sets to generate single error

**Response Data**

EAD 0|1

**Example of Use**

EAD 1
EAD?
>EAD 1
Appendix A  Command Compatibility With Existing Products

EAV

Function
Compatible command: This command has the same function as `SOURce:PAIrn:EADDition:VARiation`.

Syntax
EAV 0|1
EAV?

Parameter
0  Repeat
1  Single

Response Data
EAV 0|1

Example of Use
EAV 0
EAV?
>EAV 0

ESI

Function
Compatible command: This command has the same function as `SOURce:PAIrn:EADDition:SIngle`.

Example of Use
ESI
ERT

Function
Compatible command: This command has the same function as `:SOURce:PATTern:EADDition:RATE`.

Syntax
ERT 1,<integer>
ERT?

Parameter
1: Indicates a fixed-point part of the error addition rate is 1.
<integer> Exponent part of error addition rate
Range 2 to 12

Response Data
ERT 1,<integer>
<integer>
2 to 12

Example of Use
To set the error addition rate to 1E–9:
ERT 1,9
ERT?
>ERT 1,9
Appendix A  Command Compatibility With Existing Products

DSD

Function
Compatible command: This command has the same function as :INPut:DATA:INTerface.

Syntax
DSD 0|1|2|3
DSD?

Parameter
0  Electrical Single-Ended Data
1  Electrical Single-Ended XData
2  Differential 50 Ohm
3  Optical

Response Data
DSD 0|1|2|3

Example of Use
DSD 0
DSD?
>DSD 0

DTH

Function
Compatible command: This command has the same function as :INPut:DATA:THReshold.

Syntax
DTH <numeric>
DTH?

Parameter
The parameter values are the same as for :INPut:DATA:THReshold.

Response Data
DTH <integer>

Example of Use
DTH -85
DTH?
>DTH -85
SYN

Function

*Compatible command:* This command has the same function as \text{:SENSe:PATTern:SYNC:ASYnc}.

Syntax

\begin{verbatim}
SYN 0|1
SYN?
\end{verbatim}

Response Data

SYN 0|1

Example of Use

\begin{verbatim}
SYN 1
SYN?
>SYN 1
\end{verbatim}
Appendix A  Command Compatibility With Existing Products

SYE

Function
Compatible command: This command has the same function as :SENSe:PATTern:SYNC:THReshold.

Syntax
SYE <integer>
SYE?

Parameter
<integer>
0 1E–2
1 1E–3
2 1E–4
3 1E–5
4 1E–6
5 1E–7
6 1E–8
8 Internal

Response Data
SYE 0|1|2|3|4|5|6|8

Example of Use
SYE 0
SYE?
>SYE 0
SYM

Function
Compatible command: This command has the same function as :SENSe:PATTERn:SYNC:PSMode.

Syntax
SYM 0|1
SYM?

Parameter
0     SYNC Control Off
1     SYNC Control On

Response Data
SYM 0|1

Example of Use
SYM 0
SYM?
>SYM 0

FPS

Function
Compatible command: This command has the same function as :SENSe:PATTERn:SYNC:FPOSition.

Syntax
FPS <numeric>
FPS?

Parameter
<numeric>

Response Data
<integer>

Example of Use
FPS 1
FPS?
>FPS 1
Appendix A  Command Compatibility With Existing Products

HRE

Function
*Compatible command:* This command has the same function as :DISPlay:RESult:EALarm:HRESet.

Example of Use
HRE

MTR?

Function
*Compatible command:* This command has the same function as :CALCulate:DATA:MONitor?.

Syntax
MTR? 0|3|4

Parameter
0  Bit Error
3  CR Unlock
4  SYNC Loss

Response Data
MTR 0|1
0  When an alarm occurs
1  When no alarm occurs

Example of Use
MTR? 0
>MTR 0
ERS?

Function

*Compatible command:* This command is compatible with existing products and queries if a bit error has occurred at ED.

Response Data
ERS 0|1
0 Indicates a bit error has not occurred.
1 Indicates a bit error has occurred.

Example of Use
ERS?
>ERS 0
Appendix A  Command Compatibility With Existing Products

:SENSe:PARam:AEXecute?

Function
Compatible command only for MP210xA, MP2100B (version 4 or later):
This command performs BER measurement of 10 ms duration at Ch1 and Ch2.

Syntax
:SENSe:PARam:AEXecute?

Response Data
<ed1_er>,<ed1_ec>,<ed1_unlock>,<ed1_sync>,<ed2_er>,<ed2_ec>,<ed2_unlock>,<ed2_sync>
<ed1_er>/<ed2_er>
  Total bit error rate
  Range: 0.0001E–18 to 1.0000E–00
  (Form2)
<ed1_ec>/<ed2_ec>
  Total bit error count
  Range: 0 to 9999999 or 1.0000E+07 to 9.9999E+17
  (Form1)
<ed1_unlock>/<ed2_unlock>
  CR Unlock status
  Range: "Not Occur" or "Occur"
<ed1_sync>/<ed2_sync>
  SYNC Loss status
  Range: "Not Occur" or "Occur"

Example of Use
To stop the re-plotting processing, and query the measurement results with a gating time of 10 ms:
:SYST:DISP:RES OFF
:SENS:PAR:AEX?
>"0.0000E-07","0","Not Occur","Not Occur","1.0000E-02","850007","Not Occur","Not Occur"

Note:
If the measurement is performed with a gating time of 10 ms under the following conditions, an error occurs:

- When the re-plotting processing for the Scope screen is on
  Turn off the re-plotting processing for the Scope screen, and then send this command.
A.5 Compatible Commands and Descriptions

- When BER measurement is in progress
  Before executing this command, make sure that the measurement has completed, by using `SENSe:MEASure:EALarm:STATe?` for example.

- When the user pattern is being recalled
  If one of the following pattern file recall commands is executed, read the status register to make sure the recall processing is completed.

  `SOURce:MMEMory:PATTern:RECall`
  `SENSe:MMEMory:PATTern:RECall`

  When this command is used in MP2110A, an error (–113 Undefined Header) occurs because MP2110A does not support this command.
**END?**

**Function**

*Compatible command:* This command has the same function as :CALCulate:DATA:EALarm?.

**Syntax**

`END? {0|1|2},{1|2|3|4}`

**Parameter**

Specify the measurement data item to query, combining the first and second parameters.

Though CURRent or LAST can be specified for :CALCulate:DATA:EALarm?, this command queries only the results of the last measurement performed as specified by Gating Time.

- 0,1 Measurement Start Time
- 0,2 Measurement End Time
- 0,3 Measurement elapsed time
- 0,4 Measurement remaining time
- 1,3 SYNC Loss Seconds
- 1,4 CR Unlock Seconds
- 2,1 Bit Error Rate Total
- 2,2 Bit Error Count Total
- 2,3 Clock Count Total
- 2,6 Bit Error Rate Insertion
- 2,7 Bit Error Rate Omission
- 2,8 Bit Error Count Insertion
- 2,9 Bit Error Count Omission

**Response Data**

`END <result>`

Count, Seconds: 0 to 9999999 or 1.0000E+07 to 9.9999E+17 (Form1)
Rate: 0.0000E–18 to 1.0000E–00 (Form2)
“--------” if there is no data to return.

Start/end time: YY-MM-DD HH:MM:SS format
Elapsed/remaining time: D HH:MM:SS format
“ERR” if there is no data to return.

**Example of Use**

To query the measurement elapsed time:

```
END? 0,3
>END 0 00:00:25
```

To query the error rate:
END? 2,1
>END 1.0253E-06

ER?

Function
Compatible command: This command queries the bit error rate measured by the ED.

Response Data
ER <form2>|-------
<form2>: 0.0000E–18 to 1.0000E–00
-------: If there is no data.

Example of Use
ER?
>ER 3.8938E-02

EC?

Function
Compatible command: This command queries the bit error count measured by the ED.

Response Data
EC <form1>|------
<form1>: 0 to 9999999 or 1.0000E+07 to 9.9999E+17
------: If there is no data.

Example of Use
EC?
>EC 1.9469E+08
CC?

Function
Compatible command: This command queries the clock count measured by the ED.

Response Data
CC <form1> | ------
<form1> : 0 to 9999999 or 1.0000E+07 to 9.9999E+17
-------: If there is no data.

Example of Use
CC?
>CC 1.0000E-09

FRQ?

Function
Compatible command: This command queries the clock frequency measured by the ED.

Response Data
FRQ <integer>

Example of Use
FRQ?
>FRQ 8500000
MOD

Function
Compatible command: This command has the same function as :SENSe:MEASure:EALarm:MODE.

Syntax
MOD 0|1|2
MOD?

Parameter
0    Repeat
1    Single
2    Untimed

Response Data
MOD 0|1|2

Example of Use
To set the gating cycle of ED to Repeat:
MOD 0
MOD?
>MOD 0
Appendix A  Command Compatibility With Existing Products

PRD

Function
Compatible command: This command has the same function as :SENSe:MEASure:EALarm:PERiod.

Syntax
PRD <days>,<hours>,<minutes>,<seconds>
PRD?

Parameter
<days>,<hours>,<minutes>,<seconds>

Response Data
PRD <days>,<hours>,<minutes>,<seconds>
Each of the parameters in the response data is a two-digit number.

Example of Use
To set the gating time to 1 hour:
PRD 0,1,0,0
PRD?
>PRD 00,01,00,00

CUR

Function
Compatible command: This command has the same function as :DISPlay:RESult:EALarm:MODE.

Syntax
CUR 0|1
CUR?

Parameter
0  Off
1  On

Response Data
CUR 0|1

Example of Use
CUR 1
CUR?
>CUR 1
STA

Function
Compatible command: This command has the same function as :SENSe:MEASure:STARt.

Example of Use
STA

STO

Function
Compatible command: This command has the same function as :SENSe:MEASure:STOP.

Example of Use
STO

MSR?

Function
Compatible command: This command has the same function as :SENSe:MEASure:EALarm:STATe?.

Response Data
MSR 0|1
0 Measurement stops
1 During measurement

Example of Use
MSR?
>MSR 1

MSA?

Function
Compatible command: This command has the same function as :SENSe:MEASure:EALarm:STARt?.

Response Data
MSA <year>,<month>,<day>,<hour>,<minute>,<second>
0000,00,00,00,00,00 is returned if there is no time data to return.

Example of Use
MSA?
>MSA 2009,10,05,16,25,40
Appendix A  Command Compatibility With Existing Products

MSO?

Function
Compatible command: This command has the same function as `SENSe:MEASure:EALarm:STOP?`.

Response Data
MSO <year>,<month>,<day>,<hour>,<minute>,<second>
0000,00,00,00,00,00 is returned if there is no time data to return.

Example of Use
MSO?
>MSO 2009,10,05,16,25,40
MSO?
>MSO 0000,00,00,00,00,00

MLP?

Function
Compatible command: This command has the same function as `SENSe:MEASure:EALarm:ELAPsed?`.

Response Data
MLP <days>,<hours>,<minutes>,<seconds>

Example of Use
MLP?
>MLP 00,00,02,10

ETI?

Function
Compatible command: This command has the same function as `SENSe:MEASure:EALarm:TIMed?`.

Response Data
ETI <days>,<hours>,<minutes>,<seconds>

Example of Use
ETI?
>ETI 00,00,02,10
:FETCh:AMPLitude:MEASurement?

Function

Compatible command (Version 6 or later): This command queries the results of measurement items for the amplitude measurement function of Scope.

Syntax

:FETCh:AMPLitude:MEASurement?

Response Data

The measurement results of the items specified at <meas_item> are returned at <numeric> in the following sequence.

Current value, average value, standard deviation value, Minimum value, Maximum value

The response consists of 55 items and is output in the following order.

Table A.5-2 Data Order

<table>
<thead>
<tr>
<th>Item</th>
<th>&lt;current&gt;</th>
<th>&lt;average&gt;</th>
<th>&lt;std_dev&gt;</th>
<th>&lt;min&gt;</th>
<th>&lt;max&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Level*1</td>
<td>1</td>
<td>12</td>
<td>23</td>
<td>34</td>
<td>45</td>
</tr>
<tr>
<td>Zero Level*1</td>
<td>2</td>
<td>13</td>
<td>24</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td>Eye amplitude*1</td>
<td>3</td>
<td>14</td>
<td>25</td>
<td>36</td>
<td>47</td>
</tr>
<tr>
<td>Eye height*1</td>
<td>4</td>
<td>15</td>
<td>26</td>
<td>37</td>
<td>48</td>
</tr>
<tr>
<td>Crossing (%)</td>
<td>5</td>
<td>16</td>
<td>27</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>SNR</td>
<td>6</td>
<td>17</td>
<td>28</td>
<td>39</td>
<td>50</td>
</tr>
<tr>
<td>Average Power (dBm)*2</td>
<td>7</td>
<td>18</td>
<td>29</td>
<td>40</td>
<td>51</td>
</tr>
<tr>
<td>Average Power (mW)*2</td>
<td>8</td>
<td>19</td>
<td>30</td>
<td>41</td>
<td>52</td>
</tr>
<tr>
<td>Extinction Ratio*2</td>
<td>9</td>
<td>20</td>
<td>31</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>OMA (mW)*2</td>
<td>10</td>
<td>21</td>
<td>32</td>
<td>43</td>
<td>54</td>
</tr>
<tr>
<td>OMA (dBm)*2</td>
<td>11</td>
<td>22</td>
<td>33</td>
<td>44</td>
<td>55</td>
</tr>
</tbody>
</table>

*1: The unit for electrical channel is mV and the unit for optical channel is μW.

*2: When the optical channel is used, the value is returned. When the electrical channel is used, N/A is returned.

Example of Use

:FETC:AMFL:MEAS?

>35.12,-15.01,50.53,46.29,46,10.5,N/A,N/A,N/A,N/A,N/A,
36.98,-14.85,52.66,40.44,43.09,10.22,N/A,N/A,N/A,N/A,N/A,
0.23,0.15,1.46,1.25,0.69,0.38,N/A,N/A,N/A,N/A,N/A,
36.29,-15.3,48.28,36.39,41.02,9.08,N/A,N/A,N/A,N/A,N/A,
37.67,-14.4,57.04,44.19,45.16,11.36,N/A,N/A,N/A,N/A,N/A
Appendix A  Command Compatibility With Existing Products

Notes:

- Only in MP210xA and MP2100B: When Measure Item is not Amplitude/Time, N/As are returned as all response data.

- Only in MP2110A: The results of OMA at Crossing and VECP cannot be obtained.

:FETCH:TIME:MEASurement?

Function
Compatible command (Version 6 or later): This command queries the results obtained by the time measurement function of Scope.

Syntax
:FETCH:TIME:MEASurement?

Response Data
<current>,<average>,<std_dev>,<min>,<max>

The measurement results of the items specified at <meas_item> are returned at <numeric> in the following sequence.
- Current value, average value, standard deviation value,
- Minimum value, Maximum value

The response consists of 30 items and is output in the following order.

<table>
<thead>
<tr>
<th>Item</th>
<th>&lt;current&gt;</th>
<th>&lt;average&gt;</th>
<th>&lt;std_dev&gt;</th>
<th>&lt;min&gt;</th>
<th>&lt;max&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jitter p-p (ps)</td>
<td>1</td>
<td>7</td>
<td>13</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Jitter RMS (ps)</td>
<td>2</td>
<td>8</td>
<td>14</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Rise Time (ps)</td>
<td>3</td>
<td>9</td>
<td>15</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>Fall Time (ps)</td>
<td>4</td>
<td>10</td>
<td>16</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>Eye Width (ps)</td>
<td>5</td>
<td>11</td>
<td>17</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>DCD (%)</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
</tr>
</tbody>
</table>

Example of Use
:FETCH:TIME:MEAS?
>66.29,15.03,128.26,133.69,208.61,47.22,68.03,15.33,125.99,134.01,203.98,47.01,1.99,0.31,2.21,1.86,3.19,0.55,62.06,14.40,119.36,128.43,194.41,45.36,74.00,16.26,132.62,139.59,213.55,48.66

Notes:

- Only in MP210xA and MP2100B: When Measure Item is not Amplitude/Time, N/As are returned as all response data.

- Only in MP2110A: The jitter measurement results of MP2110A-096 cannot be obtained.
A.5 Compatible Commands and Descriptions

:MEASure:AMPLitude[:{CHA|CHB}]?

Function
Compatible command (Version 6 or later): This command sets Eye at Sampling Mode and Amplitude/Time at Measure Item of Scope and queries the result of the amplitude measurement.

Syntax
:MEASure:AMPLitude[:{CHA|CHB}]?

For Version 6 or later, this command can be used as a query by appending CHA|CHB.
For version 6 or older, CHA|CHB cannot be appended. The results of the active channel are obtained.

Response Data
The measurement results of the items in the following table are returned separated by commas. The results are output in the following sequence.

<table>
<thead>
<tr>
<th>One Level*1</th>
<th>Zero Level*1</th>
<th>Eye Amplitude*1</th>
<th>Eye Height*1</th>
<th>Crossing (%)</th>
<th>SNR</th>
<th>Average Power (mW)*2</th>
<th>Average Power (dBm)*2</th>
<th>Extinction Ratio (dB)*2</th>
<th>OMA (mW)*2</th>
<th>OMA (dBm)*2</th>
</tr>
</thead>
</table>

*1: The unit for electrical channel is mV and the unit for optical channel is μW.

*2: When the optical channel is used, the value is returned. When the electrical channel is used, N/A is returned.

Example of Use
:MEAS:AMPL?
>35.2,-15.1,50.3,46.2,46,10.5,N/A,N/A,N/A,N/A,N/A

Notes:
- Before using this command, set the Accumulation Type of the Setup dialog box to Limited and specify the measurement time.
Appendix A  Command Compatibility With Existing Products

- Each query does not return a response until the specified period of measurement time has elapsed. To prevent occurrence of timeout errors, set the sufficiently-long timeout for remote interface, with respect to the measurement time.

- Use :FETCh:AMPLitude:<meas_item>/? to obtain the current measurement results without performing the measurement.

- Only in MP2110A: The measurement results of OMA at Crossing and VECP cannot be obtained.

:MEASure:TIME?

Function
Compatible command (Version 6 or later): This command sets Eye at Sampling Mode and Amplitude/Time at Measure Item of Scope and queries the result of the time measurement.

Syntax
:MEASure:TIME?

Response Data
The measurement results of <numeric> for the 6 items separated by commas are output in the following sequence.
- Jitter P-P (ps), Jitter RMS (ps), Rise Time (ps), Fall Time (ps), Eye Width (ps), DCD (%)

Example of Use
:MEAS:TIME?
>66.2,15.3,128.2,133.6,208.6,47.2

Notes:
- Before using this command, sets the Accumulation Type of the Setup dialog box to Limited and the measurement time to Limit Type.

- Each query does not return a response until the specified period of measurement time has elapsed. To prevent occurrence of timeout errors, set the sufficiently-long timeout for remote interface, with respect to the measurement time.

- Use :FETCh:TIME:<meas_item>/? to obtain the current measurement results without performing the measurement.
**:MEASure:MASK?**

**Function**

*Compatible command (Version 6 or later):* This command sets **Eye** at Sampling Mode and **Mask Test** at Measure Item of Scope and queries the result of the measurement.

**Syntax**

:MEASure:MASK?

**Response Data**

The measurement results of `<integer>` for the 2 items separated by commas are returned in the following sequence.

- Total Samples, Total Failed Samples

**Example of Use**

:MEAS:MASK?

>16831,0

**Notes:**

- Before using this command, sets the Accumulation Type of the Setup dialog box to **Limited** and specify the measurement time.

- Each query does not return a response until the specified period of measurement time has elapsed. To prevent occurrence of timeout errors, set the sufficiently-long timeout for remote interface, with respect to the measurement time.

- Use :FETCh:MASK:<meas_item>? to obtain the current measurement results without performing the measurement.
Appendix A  Command Compatibility With Existing Products

:MEASure:HISTogram:AMPLitude?

Function
Compatible command (Version 6 or later): This command sets **Eye** at Sampling Mode and **Histogram** at Measure Item of Scope and queries the result of the amplitude axis histogram measurement.

Syntax
:MEASure:HISTogram:AMPLitude?

Response Data
<numeric>,<numeric>,<numeric>,<integer>
The response data is output in the following sequence:
Mean (mV/μW), Std Dev (mV/μW), P-P (mV/μW), Hits

Example of Use
:MEAS:HIST:AMPL?
>32.1,4.53,28.1,89632

Notes:
- Before using this command, sets the Accumulation Type of the Setup dialog box to **Limited** and specify the measurement time. And set the histogram measurement axis as the amplitude by :CONF:HISTAXIS AMPLitude.
- Each query does not return a response until the specified period of measurement time has elapsed. To prevent occurrence of timeout errors, set the sufficiently-long timeout for remote interface, with respect to the measurement time.
- Use :FETCh:HISTogram:AMPLitude:<meas_item>? to obtain the current measurement result without performing the measurement.
:MEASure:HISTogram:TIME?

Function

Compatible command (Version 6 or later): This command sets Eye at Sampling Mode and Histogram at Measure Item of Scope and queries the result of the time axis histogram measurement.

Syntax

:MEASure:HISTogram:TIME?

Response Data

<numeric>,<numeric>,<numeric>,<integer>

The response data is output in the following sequence:

Mean (ps), Std Dev (ps), P-P (ps), Hits

Example of Use

:MEAS:HIST:TIME?

>1.53,0.022,0.081,6831

Notes:

- Before using this command, sets the Accumulation Type of the Setup dialog box to Limited and specify the measurement time. And set the histogram measurement axis as the time by :CONF:HISTAXIS TIME.

- Each query does not return a response until the specified period of measurement time has elapsed. To prevent occurrence of timeout errors, set the sufficiently-long timeout for remote interface, with respect to the measurement time.

- Use :FETCh:HISTogram:TIME:<meas_item>? to obtain the current measurement result without performing the measurement.
Appendix B  Error Codes

Appendix B explains the code and message responses to the `SYSTem:ERrOr?` query command.

- Command error
- Execution error
- Device unique error

When these errors occur, the standard event status register bit becomes 1. A service request can be generated when an error occurs depending on the setting of the standard event status enable register bit and the service request enable register bit.

When an error occurs, the standard event status register bit that becomes 1 is listed in the table below.

### Table B-1  Relationship between Error Number and Standard Event Register

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Message</th>
<th>Error Name</th>
<th>Standard Event Register Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-113</td>
<td>Undefined header</td>
<td>Command error</td>
<td>5</td>
</tr>
<tr>
<td>-220</td>
<td>Parameter error</td>
<td>Execution error</td>
<td>4</td>
</tr>
<tr>
<td>-310</td>
<td>System error</td>
<td>Device Dependent error</td>
<td>3</td>
</tr>
</tbody>
</table>

**Command error**

The corresponding bit is set to 1 if the received program message is undefined, does not conform to the syntax or has a misspelling. Bit 5 of the standard event status register is set when the following errors occur. The errors are generated when the following events occur.

- When sending message not in conformance with syntax described in section 2.7 “Message Format”
  - Example:  
    - At typographical error in header
    - Header includes 2-byte character

- When sending message not in conformance with Common Commands or Device Unique Commands described in Chapter 3 “Message List” and Appendix A “Command Compatibility With Existing Products”

- When sending a module command, without specifying the module with :Module:ID
• When sending a message not described in Chapter 3
  Examples:  • The message contains a typing error(s).
            • The message contains a double-byte character(s).
            • The space that should separate the message and
              parameter is missing.
            • The semicolon that should separate messages is missing.
            • The upper-case (mandatory) character(s) in the message
              has been omitted.

• When the number of parameters in the message is incorrect
  Examples:  • Two parameters have been added to the message
              requiring one parameter when sending the message.
            • The comma(s) that should separate parameters is
              missing.

• When the parameter format is incorrect
  Examples:  • Character-string data has been specified in the message
              requiring a numeric value as a parameter, when sending
              the message.
            • Character-string data is not enclosed by quotation marks.

Execution error
Bit 4 of the standard event status register is set when the following errors
occur. The errors are generated when the following events occur.

• When header continuation parameter value out of setting range
  Example:  When 850000 set when bit rate setting range is 8500000 to
            11320000

• When message cannot be executed in current BERTWave status
  Example:  When sending message for setting Scope to instrument
            without Scope function

Device Dependent error
Bit 3 of the standard event status register is set when an error occurs
internally.
Appendix C  Sample Program

Appendix C explains the sample program for controlling BERTWave remotely. In MP2100B and MP2110A, the sample program is stored in the BERTWave built-in drive.

Copy the sample program to your PC to use it.

Storage location:
C:\Program Files\Anritsu\MP2100A\MX210000A\Examples\C#_SCPI_Sample

Refer to “Readme_en.pdf” (SCPI Sample Program Quick Reference Guide) stored in the above directory for details of the setup and method to execute the sample program.
Appendix D  Bibliography

3. IVI Foundation SCPI 1999
4. IEEE Std 802.3-2015 IEEE Standard for Ethernet
5. Anritsu Corporation SCPI Sample Program Quick Reference Guide
7. Anritsu Corporation Ideal Remote-Control Sequences
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