R&S®HMC804x
Power Supply
SCPI Programmers Manual

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Test & Measurement

SCPI Programmers Manual

Version 01

ROHDE&SCHWARZ

Content

1 Introduction / Basics

This chapter provides basic information on operating an instrument via remote control.

1.1 Remote Control Interfaces

For remote control, LAN / USB (standard interface) or GPIB (optional interface) can be used. The optional GPIB interface has its own interface module slot on the rear panel of the HMC8012.

NOTICE

Within this interface description, the term GPIB is used as a synonym for the IEC/IEEE bus interface.

SCPI (Standard Commands for Programmable Instruments) SCPI commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules.

1.1.1 USB Interface

In addition to a LAN interface, the R&S®HMC804x includes a USB device port. For this interface, the user can select if the instrument is accessed via virtual COM port (VCP) or via USB TMC class. The traditional version of the VCP allows the user to communicate with the R&S®HMC804x using any terminal program via SCPI commands once the corresponding Windows drivers have been installed. Naturally, the free software "HMExplorer" is also available for the R&S®HMC804x. This Windows application offers the R&S®HMC804x a terminal function or the option to create screenshots.

The modern alternative to the virtual COM port is to remote control the R&S®HMC804x via USB TMC class. TMC stands for "Test & Measurement Class" which indicates that the connected measurement instrument can be recognized without special Windows drivers if VISA drivers are installed and that it can be used directly in corresponding environments. The GPIB interface serves as model to the structure of the TMC design. A major benefit of the USB TMC class is that by sampling specific registers the controlling software can determine if commands have been terminated and if they have been processed correctly. In contrast, the communication via VCP requires analysis and polling mechanisms within the controlling software which may significantly strain the interface of the measurement instruments. The TMC status registers solve this problem with the USB TMC in the same manner as is the case with the GPIB interface for the hardware, namely via corresponding control lines.

If you are using USB you need to install an USB driver, which can be downloaded free of charge from the R&S homepage.

NOTICE

The currently available USB driver is fully tested, functional and released for Windows XP™, Windows Vista™, Windows 7™ or Windows 8™, both as 32Bit or 64Bit versions.

The R&S®HMC804x USB interface has to be chosen in the HMC SETUP menu and does not need any setting.

NOTICE

If the virtual COM port will be used, you have to install the virtual COM port driver. The virtual COM port (VCP) will be activated in the PC device explorer.

1.1.2 Ethernet (LAN) Interface

The settings of the parameter will be done after selecting the menu item ETHERNET and the soft key PARAMETER. You can set a fix IP adress or a dynamic IP setting via the DHCP function. Please ask your IT department for the correct setting at your network.

IP address
To set up the connection the IP address of the instrument is required. It is part of the resource string used by the program to identify and control the instrument. The resource string has the form:

TCPIP::‹IP_address›::‹IP_port›::SOCKET

The default port number for SCPI socket communication is 5025. IP address and port number are listed In the „Ethernet Settings“ of the R&S®HMC804x, see also: chapter 1.2.2,“Configuring LAN Parameters“.

Example: If the instrument has the IP address 192.1.2.3; the valid resource string is:

TCPIP::192.1.2.3::5025::SOCKET

If the LAN is supported by a DNS server, the host name can be used instead of the IP address. The DNS server (Domain Name System server) translates the host name to the IP address. The resource string has the form:

TCPIP::‹host_name›::‹IP_port›::SOCKET

To assign a host name to the R&S®HMC804x, select SETUP button › Misc › Device name.

Example: If the host name is HAMEG1; the valid resource string is:

TCPIP::HAMEG1::5025::SOCKET

NOTICE

The end character must be set to linefeed (LF).

1.1.4 GPIB Interface (IEC/IEEE Bus Interface)

In addition to the GPIB functions which are available via USB TMC class, the R&S®HMC804x is optionally available with an integrated GPIB interface. This solution is particularly attractive for customers who already have an existing GPIB environment. With minimum efforts, an old instrument can be replaced by a model of the R&S®HMC804x.

To be able to control the instrument via the GPIB bus, the instrument and the controller must be linked by a GPIB bus cable. A GPIB bus card, the card drivers and the program libraries for the programming language must be provided in the controller. The controller addresses the instrument with the GPIB instrument address.

Characteristics

The GPIB interface is described by the following characteristics:

- Up to 15 instruments can be connected
- The total cable length is restricted to a maximum of 15m; the cable length between two instruments should not exceed 2m.
- A wired „OR"-connection is used if several instruments are connected in parallel.

GPIB Instrument Address

In order to operate the instrument via remote control, it must be addressed using the GPIB address. The remote control address is factory-set to 20, but it can be changed in the network environment settings or in the „Setup" menu under „Interface --> Parameter". For remote control, a GPIB address from 0 to 30 are allowed. The GPIB address is maintained after a reset of the instrument settings.

1.2 Setting Up a Network (LAN) Connection

1.2.1 Connecting the Instrument to the Network

The network card can be operated with a 10 Mbps Ethernet IEEE 802.3 or a 100 Mbps Ethernet IEEE 802.3u interface.

NOTICE

Risk of network failure

Before connecting the instrument to the network or configuring the network, consult your network administrator. Errors may affect the entire network.

NOTICE

To establish a network connection, connect a commercial RJ-45 cable to one of the LAN ports of the instrument and to a PC.

1.2.2 Configuring LAN Parameters

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- Automatically: DHCP or AutoIP. All address information can be assigned automatically.
- Manually: the address must be set manually.

By default, the instrument is configured to use automatically configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous instrument configuration.

NOTICE

If DHCP is used and the system cannot assign an IP address to the R&S HMC804x (for instance, if no Ethernet cable is connected or the network does not support DHCP), it may take up to three minutes until a timeout allows the interface to be configured again.

Configuring LAN parameters

- Press the SETUP key and then the INTERFACE softkey.
- Press the ETHERNET and then the PARAMETER softkey.

The „Ethernet Settings“ dialog box is displayed.

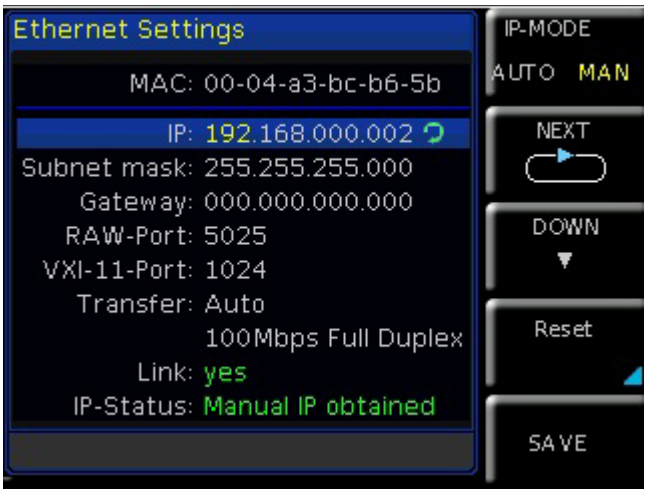

Fig. 1.1: Ethernet Settings dialog box

Some data is displayed for information only and cannot be edited. This includes the „MAC“ (physical) address of the connector and the „Link“ status information.

- Define the IP address of the instrument by entering each of the four blocks individually (manual mode) or choose the automatic IP-Mode.
  a) In manual mode (MAN) define the first block number using the knob.
  b) Press Next to move to the next block and define the number.
  c) When the IP address is complete, press Down to continue with the next setting.

- Define the „Subnetmask“ and „Gateway“ in the same way.

- Select the „RAW Port“ - the port number for SCPI socket communication.

- Select the „VXI-11- Port“ used by the instrument.

- Select the „Transfer“ mode. This mode can either be determined automatically („Auto“ setting), or you can select a combination of a transfer rate and half or full duplex manually.

- Press SAVE to save the LAN parameters.

NOTICE

The „Link“ and „IP-Status“ information at the bottom of the dialog box indicates whether a LAN connection was established successfully.

Checking LAN and SCPI connection

- Check the LAN connection using ping: `ping xxx.yyy.zzz.xxx`.

- If the PC can access the instrument, enter the IP address of the address line of the internet browser on your computer: http//:xxx.yyy.zzz.xxx

- The „Device Information“ page appears. It provides information on the instrument and the LAN connection.

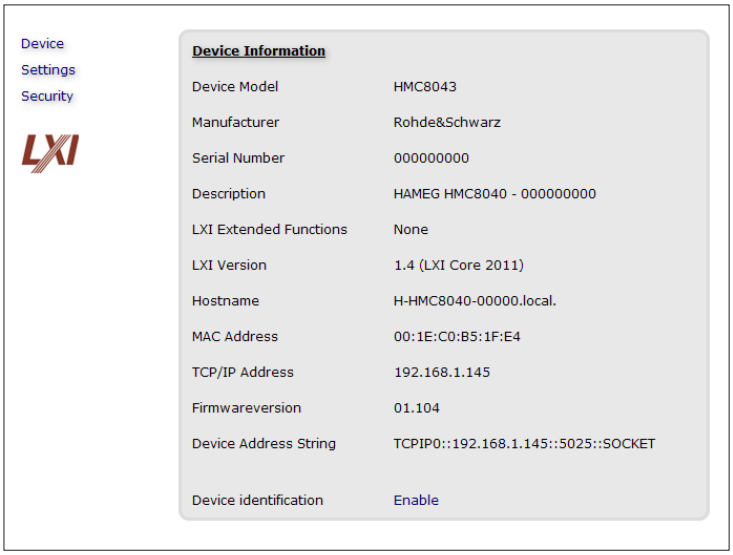

Fig. 1.2: The „Device Information“ page

1.3 Switching to Remote Control

When you switch on the instrument, it is always in manual operation state („local" state) and can be operated via the front panel. When you send a command from the control computer, it will be received and executed by the instrument. The display remains on, manual operation via the front panel is always possible.

1.4 Messages and Command Structure

1.4.1 Messages

Instrument messages are employed in the same way for all interfaces, if not indicated otherwise in the description.
See also:

- Structure and syntax of the instrument messages: chapter 1.4.2, „SCPI Command Structure".
- Detailed description of all messages: chapter 2, „Command Reference".

There are different types of instrument messages:

- Commands
- Instrument responses

Commands
Commands (program messages) are messages which the controller sends to the instrument. They operate the instrument functions and request information. The commands are subdivided according to two criteria:

According to the instrument effect:

- Setting commands cause instrument settings such as a reset of the instrument or setting the frequency.
- Queries cause data to be provided for remote control, e.g. for identification of the instrument or polling a parameter value. Queries are formed by appending a question mark to the command header.

According to their definition in standards:

- The function and syntax of the Common commands are precisely defined in standard IEEE 488.2. They are employed identically on all instruments (if implemented). They refer to functions such as management of the standardized status registers, reset and self test.
- Instrument control commands refer to functions depending on the features of the instrument such as voltage settings. Many of these commands have also been standardized by the SCPI committee. These commands are marked as „SCPI compliant" in the command reference chapters. Commands without this SCPI label are device-specific, however, their syntax follows SCPI rules as permitted by the standard.

Instrument responses
Instrument responses (response messages and service requests) are messages which the instrument is sent to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status.

GPIB Interface Messages
Interface messages are transmitted to the instrument on the data lines, with the attention line (ATN) being active (LOW). They are used for communication between the controller and the instrument and can only be sent by a computer which has the function of a GPIB bus controller. GPIB interface messages can be further subdivided into:

- **Universal commands:** act on all instruments connected to the GPIB bus without previous addressing
- **Addressed commands:** only act on instruments previously addressed as listeners

Universal Commands
Universal commands are encoded in the range 10 through 1F hex. They affect all instruments connected to the bus and do not require addressing. Addressed commands are encoded in the range 00 through 0F hex. They only affect instruments addressed as listeners.

1.4.2 SCPI Command Structure

SCPI commands consist of a so-called header and, in most cases, one or more parameters. The header and the parameters are separated by a „white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several mnemonics (keywords). Queries are formed by appending a question mark directly to the header.

The commands can be either device-specific or device-independent (common commands). Common and device-specific commands differ in their syntax.

Syntax for Common Commands
Common (= device-independent) commands consist of a header preceded by an asterisk (*) and possibly one or more parameters.

***RST**	Reset	Resets the instrument.
***ESE**	Event Status Enable	Sets the bits of the event status enable registers.
***ESR?**	Event Status Query	Queries the content of the event status register.
***IDN?**	Identification Query	Queries the instrument identification string.

Table 1.4: Examples of Common Commands

Syntax for Device-Specific Commands

- **Example**: MEASure:CURRent[:DC]?

Long and short form
The mnemonics feature a long form and a short form. The short form is marked by upper case letters, the long form corresponds to the complete word. Either the short form or the long form can be entered; other abbreviations are not permitted.

Example: MEASure:CURRent? is equivalent to MEAS:CURR?

NOTICE

Case-insensitivity

Upper case and lower case notation only serves to distinguish the two forms in the manual, the instrument itself is case-insensitive.

Optional mnemonics

Some command systems permit certain mnemonics to be inserted into the header or omitted. These mnemonics are marked by square brackets. The instrument must recognize the long command to comply with the SCPI standard. Some commands are shortened by these optional mnemonics.

Example:

FUSE[:STATe] { ON }

FUSE:STAT ON is equivalent to FUSE ON

NOTICE

Optional mnemonics with numeric suffixes

Do not omit an optional mnemonic if it includes a numeric suffix that is relevant for the effect of the command.

Special characters

|	**Parameters** A vertical stroke in parameter definitions indicates alternative possibilities in the sense of „or". The effect of the command differs, depending on the used parameter. **Example:** FUSE:LINK {1 | 2 | 3} FUSE:LINK 1 sets the fuse link CH1 for the selected channel FUSE:LINK 2 sets the fuse link of CH2 for the selected channel
[ ]	Mnemonics in square brackets are optional and may be inserted into the header or omitted. **Example:** FUSE[:STATe] { ON } FUSE:STAT ON is equivalent to FUSE ON
{ }	Parameters in curly brackets are optional and can be inserted once or several times, or omitted. **Example:** VOLTage[:LEVel][:IMMediate][:AMPLitude] {<voltage> I MIN I MAX I UP | DOWN } The following are valid commands: VOLT MAX VOLT MIN VOLT 10

Table 1.5: Special characters

SCPI Parameters
Many commands are supplemented by a parameter or a list of parameters. The parameters must be separated from the header by a „white space“ (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). Allowed parameters are:

- Numeric values
- Special numeric values
- Boolean parameters
- Text
- Character strings

The parameters required for each command and the allowed range of values are specified in the command description.

Numeric values
Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an „E“ or „e“. Entry of the exponent alone is not allowed.

Example: VOLT 500mV = VOLT 500e-3

Special numeric values
The text listed below are interpreted as special numeric values. In the case of a query, the numeric value is provided.
- MIN/MAX
- MINimum and MAXimum denote the minimum and maximum value.

Example:
VOLT 10
VOLT?, Response: 1.0000E+01

Queries for special numeric values
The numeric values associated to MAXimum/MINimum can be queried by adding the corresponding mnemonics to the command. They must be entered following the quotation mark.

Example:
VOLT:PROT? MAX
Returns the maximum numeric value.

Boolean Parameters
Boolean parameters represent two states. The „ON“ state (logically true) is represented by „ON“ or a numeric value 1. The „OFF“ state (logically untrue) is represented by „OFF“ or the numeric value 0. The numeric values are provided as the response for a query.

Example:
OUTPut[:STATe] ON
OUTPut[:STATe]?, Response: 1

Text parameters
Text parameters observe the syntactic rules for mnemonics, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example:
HCOPy:FORMat BMP
HCOPy:FORMat?, Response: BMP

Overview of Syntax Elements
The following table provides an overview of the syntax elements:

:	The colon separates the mnemonics of a command.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*****	The asterisk marks a common command.
"	Quotation marks introduce a string and terminate it.
	A „white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates the header from the parameters.

Table 1.6: Syntax Elements

Responses to Queries
A query is defined for each setting command. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- The requested parameter is transmitted without a header.

Example:
VOLTage:PROTection:MODE?, Response: measured

- Maximum values, minimum values and all other quantities that are requested via a special text parameter are returned as numeric values.

Example:
VOLT:PROT? MAX, Response: 32.500

- Truth values (Boolean values) are returned as 0 (for OFF) and 1 (for ON).

Example:
OUTPut ON
OUTPut ON?, Response: 1

1.5 Command Sequence and Synchronization

A sequential command finishes the execution before the next command is starting. In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line.

NOTICE

As a general rule, send commands and queries in different program messages.

1.5.1 Preventing Overlapping Execution

To prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI can be used. All three commands cause a certain action only to be carried out after the hardware has been set. The controller can be forced to wait for the corresponding action.

Command	Action	Programming the controller
***OPC**	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	• Setting bit 0 in the ESE • Setting bit 5 in the SRE • Waiting for service request (SRQ)
***OPC?**	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
***WAI**	Stops further command processing until all commands have been executed before *WAI.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed

Table 1.7: Synchronization using *OPC, *OPC? and *WAI

Command synchronization using *WAI or *OPC? appended to an overlapped command is a good choice if the overlapped command takes time to process. The two synchronization techniques simply block overlapped execution of the command. For time consuming overlapped commands it is usually desirable to allow the controller or the instrument to do other useful work while waiting for command execution. Use one of the following methods:

***OPC with a service request**

- Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1
- Set bit no. 5 in the SRE: *SRE 32 to enable ESB service request.
- Send the overlapped command with *OPC
- Wait for a service request

The service request indicates that the overlapped command has finished.

***OPC? with a service request**

- Set bit no. 4 in the SRE: *SRE 16 to enable MAV service request.
- Send the overlapped command with *OPC?
- Wait for a service request

The service request indicates that the overlapped command has finished.

Event Status Register (ESE)

- Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1
- Send the overlapped command without *OPC, *OPC? or *WAI
- Poll the operation complete state periodically (by means of a timer) using the sequence: *OPC; *ESR?

A return value (LSB) of 1 indicates that the overlapped command has finished.

***OPC? with short timeout**

- Send the overlapped command without *OPC, *OPC? or *WAI
- Poll the operation complete state periodically (by means of a timer) using the sequence: ‹short timeout›; *OPC?
- A return value (LSB) of 1 indicates that the overlapped command has finished. In case of a timeout, the operation is ongoing.
- Reset timeout to former value
- Clear the error queue with SYStem:ERRor? to remove the „-410, Query interrupted“ entries.

Using several threads in the controller application

As an alternative, provided the programming environment of the controller application supports threads, separate threads can be used for the application GUI and for controlling the instrument(s) via SCPI. A thread waiting for a *OPC? thus will not block the GUI or the communication with other instruments.

1.6 Status Reporting System

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. Both can be queried via GPIB bus or LAN interface (STATus... commands).

1.6.1 Structure of a SCPI Status Register

Each standard SCPI register consists of 2 or 3 parts (Event, Condition and Enable register). Each part has a width of 16 bits and has different functions. The individual bits are independent of each other, i.e. each hardware status is assigned a bit number which is valid for all 2 or 3 parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integers.

A STATus:QUEStionable:INSTrument:ISUMmary1 exists as often as device channels are available (e.g. R&S®HMC8043 = 3 channels = 3 status register). Accordingly, the description text of the channel information changes in Fig. 1.1 (e.g. instrument 1 = channel 1, instrument 2 = channel 2 etc.).

NOTICE

Depending on the value of the read register conclusions on the current status of the device can be drawn. For example, when the unit operates in constant voltage, the result of the returned ISUM register is a decimal "2" which corresponds the binary value of "0000000000000010".

Any part of a status register system can be read by query commands. A decimal value is returned and represents the bit pattern of the requested register. Each SCPI register is 16 bits wide and has various functions. The individual bits are independent, i.e. each hardware status is assigned to a bit number.
Bits 11-13 are still „free" resp. unused (always return a „0"). Certain areas of the registers are not used. The SCPI standard defines only the „basic functions". Some devices offer an advanced functionality.

Each channel of the power supply is considered as separate „instrument" (SCPI standard definition). Therefore, e.g. the register „Status: Questionable: Instrument: Isumary" of the HMC8043 is also present three times (Isummary1-3).

Description of the status register parts (please refer to fig. 1.1)

The SCPI standard differs two different status register:

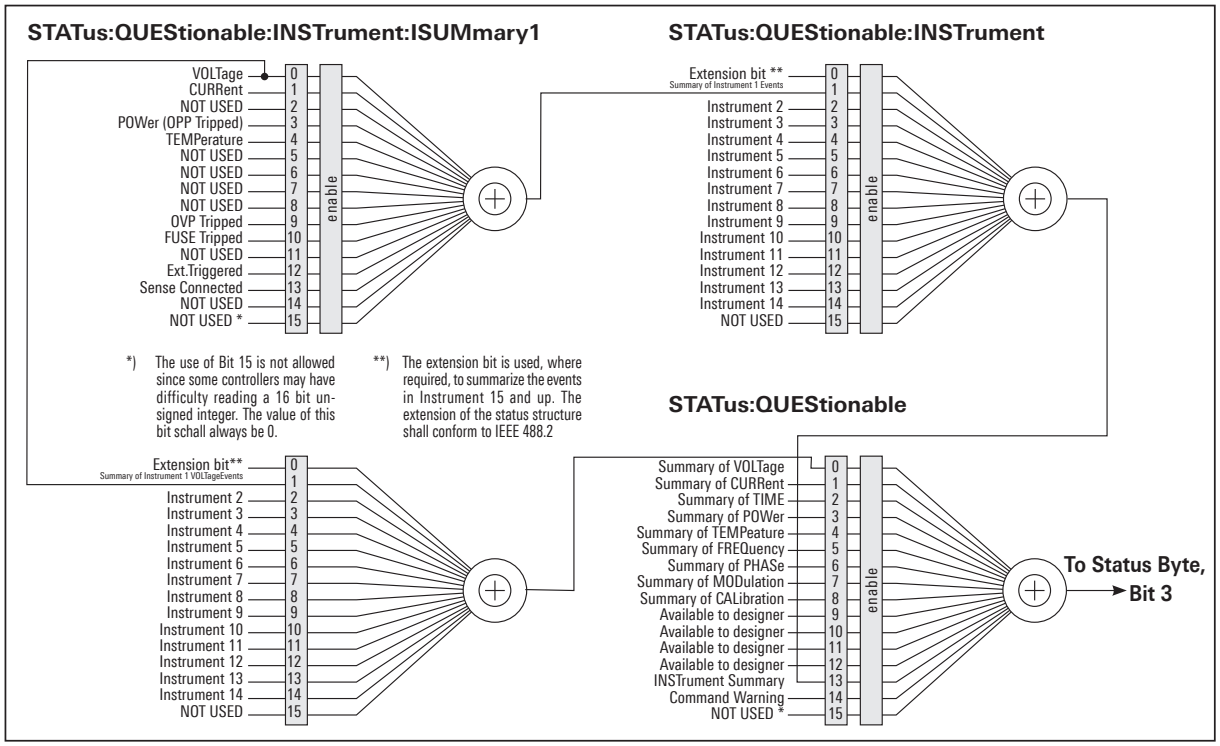

Fig. 1.4: Structure of the status register (HMC8042 and HMC8043)

CONDition

- The CONDition register queries the actual state of the instrument. If you want to query the constant voltage or current mode, you have to use the CONDition register.

NOTICE

The CONDition register delivers a „1" (first bit set) in constant current mode (CC) and a „2" (second bit set) in constant voltage mode (CV).

If the correct channel is selected and the red LED of the channel button lights up (CC mode), the query of the CONDition register has to be deliver a „1".

Example:

STAT:QUES:ISUM1:COND?

EVENt

- The EVENt status register is set (1) until it is queried. After reading (query) the EVENt status register is set to zero.

NOTICE

The description of registers is only used for general explanation. Due to the complexity we recommend the general accessible SCPI standard document for more detailed information.

For further descriptions of the status register, please refer to chapter 2.

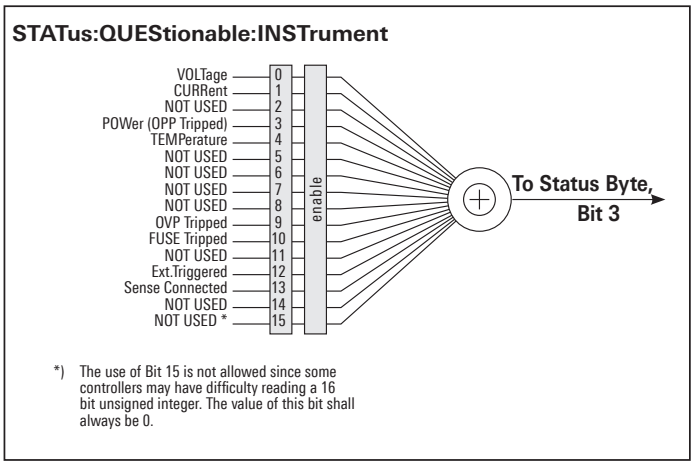

Fig. 1.5: Structure of the status register (HMC8041)

Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENt part of a SCPI register. The event status register can be read out using command *ESR?. The ESE corresponds to the ENABle part of a SCPI register. If a bit is set in the ESE and the associated bit in the ESR changes from 0 to 1, the ESB bit in the STB is set. The ESE register can be set using the command *ESE and read using the command *ESE?.

STATus:QUEStionable Register

This register contains information about different states which may occur. It can be read using the commands STATus:QUEStionable:CONDition? and STATus:QUEStionable[:EVENt]? .

Bit No.	Meaning
0	**Voltage** This bit is set while the instrument is in constant current mode (CC). This means that the voltage will be regulated and the current is constant.
1	**Current** This bit is set while the instrument is in constant voltage mode (CV). This means that the current is variable and the voltage is constant.
2	**Not used**
3	**Not used**
4	**Temperature overrange** This bit is set if an over temperature occurs.
5-8	**Not used**
9	**OVP Tripped** This bit is set if the over voltage protection has tripped.
10	**Fuse Tripped** This bit is set if the fuse protection has tripped.
11 to 15	**Not used**

Table 1.8: Bits of the STATus:QUEStionable register (please refer to fig. 1.1)

Query of an instrument status

Each part of any status register can be read using queries.

There are two types of commands:

- The common commands *ESR?, *IDN?, *STB? query the higher-level registers.
- The commands of the STATus system query the SCPI registers (STATus:QUEStionable)

The returned value is always a decimal number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Decimal representation of a bit pattern (binary weights)

The STB and ESR registers contain 8 bits, the status registers 16 bits. The contents of a status register are specified and transferred as a single decimal number. To make this possible, each bit is assigned a weighted value. The decimal number is calculated as the sum of the weighted values of all bits in the register that are set to 1.

Fig. 1.7: Decimal representation of a bit pattern

Error Queue

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain text error messages that can be looked up in the error log or queried via remote control using SYSTem:ERRor[:NEXT]?. Each call of SYSTem:ERRor[:NEXT]? provides one entry from the error queue. If no error messages are stored, the instrument responds with 0, „No error".

For further description of the error queue and the device error codes, please refer to chapter 2.

2 Command Reference

This chapter provides the description of all remote commands available for oscilloscopes HMO series. The commands are sorted according to the menu structure of the instrument. A list of commands in alphabetical order ist given in the „List of Commands“ at the end of this documentation.

2.1 Common Commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices.The headers of these commands consist of „*“ followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

***CLS**
CLear Status

Sets the status byte (STB), the standard event register (ESR) and the EVENt part of the QUEStionable to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

Usage: Setting only

***ESE <Value>**
Event Status Enable

Sets the event status enable register to the specified value. The query *ESE? returns the contents of the event status enable register in decimal form.

Parameters:
<Value> Range: 0 to 255

***ESR?**
Event Status Read

Returns the contents of the event status register in decimal form and subsequently sets the register to zero.

Return values:
<Contents> Range: 0 to 255

Usage: Query only

***IDN?**
IDeNtification

Returns the instrument identification string.

Return values:
<ID> ROHDE&SCHWARZ,‹device type›,‹serial number›,‹hardware›,‹firmwareversion›

Example: Rohde&Schwarz,HMC8043,000000000,HW42000000,SW01.000

Usage: Query only

***OPC**
OPeration Complete

Sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request. The query *OPC? writes a „1“ into the output buffer as soon as all preceding commands have been executed. This is used for command synchronization.

NOTICE

The R&S®HMC804x does not support parallel processing of remote commands. If the query *OPC? returns a „1“, the device is able to process new commands.

***RST**
ReSeT

Sets the instrument to a defined default status.

Usage: Setting only

NOTICE

We recommend to start a program by *RST in order to set the instrument to a defined status prior to starting a program.

***SRE <Contents>**
Service Request Enable

Sets the service request enable register to the indicated value. This command determines under which conditions a service request is triggered. The query *SRE? returns a decimal value of the service request enable register which corresponds to the binary-weighted sum of all bits.

Parameters:
<Contents> Contents of the service request enable register in decimal form.
Bit 6 (MSS mask bit) is always 0.

Range: 0 to 255

NOTICE

The SRE is an enable register. Consequently, there are no denotations about the bits. This register conduce for the „OR" combination of the bits in the status byte.

***STB?**
STatus Byte query

Returns the contents of the status byte in decimal form.

Usage: Query only

***TST?**
self TeST query

Triggers selftests of the instrument and returns an error code in decimal form. „0" indicates no errors occured.

Usage: Query only

***WAI**
WAIt to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed.

Usage: Event

2.2 System related commands

SYSTem:BEEPer:STATe <Mode>
Activates or deactivates the front panel control beeper.

Parameters:
<Mode> ON | OFF

ON: The front panel control beeper will be activated.
OFF: The front panel control beeper will be disabled.

*RST: ON

SYSTem:BEEPer:STATe?
Queries the state of the front panel control beeper. Returns “0” for deactivated (OFF) and “1” for activated (ON) control beeper.

Return values: 0 | 1

0: OFF - Control beeper is deactivated.
1: ON - Control beeper is activated.

*RST: 1

Usage: Query only

SYSTem:BEEPer[:IMMediate]
The instrument returns a single beep immediately.

Usage: Setting only

SYSTem:ERRor[:NEXT]?
Queries an error and removes it from the queue. Positive error numbers are instrument-dependent. Negative error numbers are reserved by the SCPI standard. If the queue is empty the response is 0, "No error".

Return values:
0, "No error"
-100, "Command error"
-102, "Syntax error"
-**221**, "Settings conflict"
-350, "Queue overflow"

Usage: Query only

SYSTem:LOCal
Sets the system to front panel control. The front panel control is unlocked. If the front panel control was locked with the SCPI command SYSTem:RWLock, the message box of the locked front panel on the HMC display will be disappeared.

Usage: Setting only

SYSTem:REMote
Sets the system to remote state. The front panel control is locked. By pushing the softkey button UNLOCK KEYS the front panel control will be activated.

Usage: Setting only

SYSTem:RWLock
Sets the system to remote state. The front panel control is locked and a message box is shown on the HMC display. You are only able to unlock the front panel control via SCPI command SYSTem:LOCal.

Usage: Setting only

SYSTem:VERSion?
Returns the firmware version and the version of the SCPI (= Standard Commands for Programmable Instruments) standard.

Usage: Query only

2.3 Display commands

DISPlay:TEXT:CLEar
Clears the text message box on the front display.

Usage: Setting only

DISPlay:TEXT[:DATA] „<String>“
Displays a text message box on the front display.

Example: DISP:TEXT „HMC804x TEST“

2.4 Trigger commands

TRIGger:SLOPe {POSitive | NEGative}
Defines the slope type of the external trigger input (terminal block).

Parameters: POSitive | NEGative

POSitive: Rising edge
NEGative: Falling edge

TRIGger:SLOPe?
Queries the slope type of the external trigger input (terminal block)

Return values: POS | NEG

2.5 Configuration Commands

2.5.1 Channel selection

INSTrument[:SELect] {OUTPut1 | OUTPut2 | OUTPut3 | OUT1 | OUT2 | OUT3}
Selects a channel. Each channel of the power supply is considered as separate „instrument“, which is required by the SCPI standard.

Parameters:
OUTPut1, OUT1 = channel 1 (CH1)
OUTPut2, OUT2 = channel 2 (CH2)
OUTPut3, OUT3 = channel 3 (CH3)

NOTICE

R&S®HMC8042: OUTPut3, OUT3 is not supported.
R&S®HMC8041: This command is not supported.

INSTrument[:SELect]?
Queries the channel selection.

Return values:
1 = channel CH1
2 = channel CH2
3 = channel CH3

Example:
INST OUT1
INST?, Response: 1

INSTrument:NSELect {1 | 2 | 3}
Numerical selction of a channel. Each channel of the power supply is considered as separate „instrument“, which is required by the SCPI standard.

Parameters:
1 = channel 1 (CH1)
2 = channel 2 (CH2)
3 = channel 3 (CH3)

NOTICE

R&S®HMC8042: :NSELect {3} is not supported.
R&S®HMC8041: This command is not supported.

INSTrument:NSELect?
Queries the numerical channel selection.

Return values:
1 = channel 1 (CH1)
2 = channel 2 (CH2)
3 = channel 3 (CH3)

Example:
INST:NSEL 3
INST:NSEL?, Response: 3

2.3.2 Voltage setting

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] {<Voltage>| MIN | MAX}}
Sets the voltage value of the selected channel.

Parameters:
<Voltage> 0.000V to 32.050V (adjustable in 1mV steps)

MIN 0.000E+00
MAX 3.2050E+01

Example:
VOLT 10

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MIN I MAX]
Queries the voltage value of the selected channel.

Example:
INST OUT1
VOLT? MAX, Response: 3.2050E+01

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] {UP I DOWN}
Increases resp. decreases the voltage value of the selected channel. The voltage step size will be defined with the VOLT:STEP command.

Parameters: UP | DOWN

UP: The voltage value will be increased.
DOWN: The voltage value will be decreased.

Example:
INST OUT1
VOLT:STEP 4
VOLT UP (= if CH1 is set to 1V the VOLT UP command sets the voltage value to 5.000V)

[SOURce:]VOLTage[:LEVel]:STEP[:INCRement) {<Numeric Value>| DEFault}
Defines the voltage step size for the VOLT UP (VOLT DOWN) command.

Parameters:
<Numeric Value> 0.000E+00 to 3.2050E+01 (adjustable in 1mV steps)

DEF: 1.000E+00

[SOURce:]VOLTage[:LEVel]:STEP[:INCRement)? [Default)
Queries the voltage step size.

Example:
INST OUT1
VOLT:STEP 4
VOLT:STEP?, Response: 4.000E+00

2.3.3 Current setting

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] {<Current>| MIN | MAX}
Sets the current value of the selected channel.

Parameters:

<Current> Current value depending on the instrument type.
Adjustable in 0.1mA (I<1A) / 1mA (I≥1A) steps.

MIN: 0.5mA
MAX: 3.000A (R&S®HMC8043)
5.000A (R&S®HMC8042)
10.000A (R&S®HMC8041)

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MIN I MAX]
Queries the current value of the selected channel.

Example:
INST OUT1
CURR 3
CURR?, Response: 3.0000E+00

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] {UP I DOWN}
Increases resp. decreases the current value of the selected channel. The current step size will be defined with the CURR:STEP command.

Parameters: UP | DOWN

UP: The current value will be increased.
DOWN: The current value will be decreased.

Example:
INST OUT1
CURR:STEP 2
CURR UP (= if CH1 is set to 1A the CURR UP command sets the current value to 3.000A)

[SOURce:]CURRent[:LEVel]:STEP[:INCRement) {<Numeric Value>| DEFault}
Defines the current step size for the CURR UP (CURR DOWN) command.

Parameters:

<Numeric Value> Current value depending on the instrument type.
Adjustable in 0.1mA (I<1A) / 1mA (I≥1A) steps.

5.0000E-04 to 3.000E+00 (R&S®HMC8043)
5.0000E-04 to 5.000E+00 (R&S®HMC8042)
5.0000E-04 to 1.0000E+01 (R&S®HMC8041)

DEF: 1.0000E-01

[SOURce:]CURRent[:LEVel]:STEP[:INCRement]? [Default]
Queries the current step size.

Example:
INST OUT1
CURR:STEP 1
CURR:STEP?, Response: 1.0000E+00

2.3.4 Combined setting of voltage and current

APPLy {<Voltage>|DEF|MIN|MAX} [,{<Current>|DEF|MIN|MAX}][,{OUT1|OUT2|OUT3}]
Sets the voltage and current value of the selected channel.

Parameters:

<voltage>

MIN: 0.000E+00
MAX: 3.2050E+01
DEF: 1.000E+00

<current> Current value depending on the instrument type.

MIN: 5.0000E-04
MAX: 3.000E+00 (R&S®HMC8043)
5.000E+00 (R&S®HMC8042)
1.0000E+01 (R&S®HMC8041)
DEF: 1.0000E-01

Example:
INST OUT1
APPLY 6,2 (= channel 1 will be set to 6V and 2A)

APPLy?
Queries the voltage and current value of the selected channel.

Return values:
e.g. R&S®HMC8043 6.000E+00, 2.0000E+00

NOTICE

The execution of the APPLY command needs more time (approx. 100ms) than a single instrument setting command (e.g. INST OUT1).

2.3.5 Output setting

OUTPut[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the previous selected channel and turning on the master output. The selected channel and master output LED lights up. If the output will be turned off with OUTP OFF only the previous selected channel will be deactivated. After sending OUTP OFF command the master output button is still activated.

Parameters:
ON | 1: Channel and master output will be activated.
OFF | 0: Channel will be deactivated.

*RST: OFF | 0

Example:
INST OUT1
OUTP ON (= channel CH1 output and master output will be activated; CH1 ON/OFF and MASTER ON/OFF LED will light up)

OUTPut[:STATe]?
Queries the output state.

Return values:
1: ON - Channel output is activated
0: OFF - Channel output is deactivated

Usage: Query only

OUTPut:CHANnel[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the previous selected channel. The channel output LED ligths up.

Parameters:
ON | 1: Channel output will be activated
OFF | 0: Channel output will be deactivated

*RST: OFF | 0

Example:
INST OUT1
OUTP:CHAN ON (= channel CH1 output will be activated; CH1 ON/OFF LED will light up)

OUTPut:CHANnel[:STATe]?
Queries the channel output state.

Return values:
1: ON - Channel output is activated.
0: OFF - Channel output is deactivated.

OUTPut:MASTer[:STATe] {OFF | ON | 0 | 1}
Turning on / off all previous selcted channels simultaneously.

Parameters:
ON | 1 Master output will be activated.
OFF | 0 Master output will be deactivated.

Example:

INST OUT1	
Volt 12	
Curr 0.1	
OUTP:CHAN ON	CH1 ON/OFF LED lights up.
INST OUT2	
Volt 12	
Curr 0.2	
OUTP:CHAN ON	CH2 ON/OFF LED lights up.
OUTP:MAST ON	Master output will be activated. All previous activated channels will be activated simultaneously. The MASTER ON/OFF LED lights up.

OUTPut:MASTer[:STATe]?
Queries the master output state.

Return values:
1: ON - Master output is activated.
0: OFF - Master output is deactivated.

NOTICE

With R&S®HMC8041 the OUTP:CHANnel[:STATe] and OUTP:MASTer[:STATe] commands are not available.

2.3.6 Fuse setting

FUSE[:STATe] {ON | OFF | 0 | 1}
Activates or deactivates the fuse for the previous selected channel.

Parameters:

ON | 1:	Fuse will be activated.
OFF | 0:	Fuse will be deactivated.

*RST: OFF | 0

FUSE[:STATe]?
Queries the fuse state of the previous selected channel.

Return values:

1:	ON - Fuse is activated.
0:	OFF - Fuse is deactivated.

Example:
INST OUT1
FUSE ON
FUSE?, Response: 1; fuse of CH1 is activated

FUSE:DELay {<Delay>| MIN | MAX}
Defines a fuse delay for the previous selected channel.

Parameters:

<Delay>	10ms to 10s (adjustable in 1ms steps)
MIN:	1.000E-02
MAX:	1.000E+01

Example:
FUSE:DEL 0.1 (= fuse delay time of 100ms)

FUSE:DELay? [MIN I MAX]
Queries the fuse delay time for the previous selected channel.

Example:
INST OUT1
FUSE:DEL 0.1
FUSE:DEL?, Response: 1.000E-01

FUSE:LINK {1 | 2 | 3}
Combines the channel fuses (fuse linking) for the previous selected channel. Each channel fuse can be linked together (depending on the instrument type).

Parameters:
1 = channel CH1
2 = channel CH2
3 = channel CH3

NOTICE

R&S®HMC8042: Channel 3 (CH3) is not available.
R&S®HMC8041: The FUSE:LINK command is not available.

Example:
INST OUT1
FUSE:LINK 2 (= Fuse CH1 is linked with CH2)

FUSE:LINK? {1 | 2 | 3}
Queries the combined fuses. If the fuse of channel 1 is linked with fuse of channel 2, a „1“ is returned; when the fuse of channel 1 is not linked to the fuse of channel 2, it returns a „0“.

Return values:
1: Fuse is linked.
0: Fuse is not linked.

Example:
INST OUT1
FUSE:LINK 2
FUSE:LINK? 2, Response: 1 (= Fuse of CH1 is linked with CH2)

FUSE:UNLink {1 | 2 | 3}
Unlinks the channel fuses (fuse linking).

Parameters:
1 = channel CH1
2 = channel CH2
3 = channel CH3

NOTICE

R&S®HMC8042: Channel 3 (CH3) is not available.
R&S®HMC8041: The FUSE:UNLink command is not available.

Example:
INST OUT1
FUSE:LINK 2 (= Fuse CH1 is linked with CH2)
FUSE:UNL 2 (= Fuse CH1 is unlinked with CH2)

FUSE:TRIPed?
Queries the fuse trip of the previous selected channel.

Return values
1: Fuse is tripped.
0: Fuse is not tripped.

Example:
INST OUT1
FUSE:TRIP?, Response: 0 (= Fuse of CH1 has not triped)

2.3.6 OVP setting

[SOURce:]VOLTage:PROTection[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the OVP for the previous selected channel.

Parameters:
ON | 1: OVP will be activated.
OFF | 0: OVP will be deactivated.

*RST: OFF | 0

[SOURce:]VOLTage:PROTection[:STATe]?
Queries the OVP state of the previous selected channel.

Return values: **1:** ON - OVP is activated.
0: OFF - OVP is disabled.

Example:
INST OUT1
VOLT:PROT ON
VOLT:PROT?, Response: 1; OVP of CH1 is activated

[SOURce:]VOLTage:PROTection:LEVel {<Voltage>| MIN | MAX | DEF}
Sets the OVP value of the previous selected channel.

Parameters:
<Voltage> 0V to 32.50V (adjustable in 1mV steps)

MIN: 0.000E+00
MAX: 3.2050E+01
DEF: 3.2050E+01

Example:
INST OUT1
VOLT:PROT 5 (= OVP channel CH1 will be set to 5V)

[SOURce:]VOLTage:PROTection:LEVel? [MIN | MAX | DEF]
Queries the OVP value of the previous selected channel.

Example:
INST OUT1
VOLT:PROT? MAX, Response: 3.2050E+01

[SOURce:]VOLTage:PROTection:TRIPped?
Queries the OVP state of the previous selected channel.

Return values **1:** OVP is tripped.
0: OVP is not tripped.

Example:
INST OUT1
VOLT:PROT:TRIP?, Response: 0 (= OVP of CH1 has not triped)

[SOURce:]VOLTage:PROTection:CLEar
Resets the OVP state of the selected channel. If the OVP has tripped the OVP message on the display will be cleared for the selected channel.

[SOURce:]VOLTage:PROTection:MODE {MEASured | PROTected}
Sets the OVP mode for the previous selected channel.

Parameters: MEASured | PROTected

MEASured: The OVP switches off if the measured value exceeds the threshold

PROTected: If the adjusted threshold is exceeded the output of the instrument will be not switched on; additionally the measured value is monitored (please also refer to function **MEASured**)

Example:
INST OUT1
VOLT:PROT:MODE PROT (= sets OVP protected mode for CH1)

[SOURce:]VOLTage:PROTection:MODE?
Returns the OVP mode for the previous selected channel.

Return values: MEAS | PROT

Example:
INST OUT1
VOLT:PROT:MODE PROT
VOLT:PROT:MODE?, Response: PROT

2.3.6 OPP setting

[SOURce:]POWer:PROTection[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the OPP for the previous selected channel.

Parameters:
ON | 1: OPP will be activated.
OFF | 0: OPP will be deactivated.

*RST: OFF | 0

[SOURce:]POWer:PROTection[:STATe]?
Queries the OPP state of the previous selected channel.

Return values:
1: ON - OPP is activated.
0: OFF - OPP is disabled.

Example:
INST OUT1
POW:PROT ON
POW:PROT?, Response: 1; OPP of CH1 is activated

[SOURce:]POWer:PROTection:LEVel {<Power>| MIN | MAX | DEF}
Sets the OPP value of the previous selected channel.

Parameters:
<Voltage> 0W to 33W (adjustable in 10mW steps)

MIN: 0.000E+00
MAX: 3.300E+01
DEF: 3.300E+01

Example:
INST OUT1
POW:PROT:LEV 10 (= OPP channel CH1 will be set to 10W)

[SOURce:]POWer:PROTection:LEVel? [MIN | MAX | DEF]
Queries the OPP value of the previous selected channel.

Example:
INST OUT1
POW:PROT? MAX, Response: 3.300E+01

[SOURce:]POWer:PROTection:TRIPped?
Queries the OPP state of the previous selected channel.

Return values
1: OPP is tripped.
0: OPP is not tripped.

Example:
INST OUT1
POW:PROT:TRIP?, Response: 0 (= OPP of CH1 has not triped)

[SOURce:]POWer:PROTection:CLEar
Resets the OPP state of the selected channel. If the OPP has tripped the red blinking OPP message on the display will be cleared for the selected channel.

2.4 Measurement Commands

MEASure[:SCALar]:CURRent[:DC]?
Queries the measured current value of the previous selected channel.

Return values e.g. 1.000E+00

MEASure[:SCALar][:VOLTage][:DC]?
Queries the measured voltage value of the previous selected channel.

Return values e.g. 1.000E+00

MEASure[:SCALar]:POWer?
Queries the measured power value of the previous selected channel.

Return values e.g. 3.00E+00

MEASure[:SCALar]:ENERgy?
Queries the measured the current released energy value of the previous selected channel. Please notice that the energy meter has to be activated to measure the current released energy value.

Return values e.g. 5.382E+00 (value in Ws)

MEASure[:SCALar]:ENERgy:STATe {ON | OFF | 0 | 1}
Activates or deactivates the energy meter function.

Parameters:
ON | 1: Energy meter will be activated.
OFF | 0: Energy meter will be deactivated.

*RST: OFF | 0

MEASure[:SCALar]:ENERgy:STATe?
Queries the energy meter state of the the previous selected channel.

Return values: **1:** ON - Energy meter is activated.
0: OFF - Energy meter is disabled.

Example:
INST OUT1
MEAS:ENER:STAT ON
MEAS:ENER:STAT?, Response: 1; Energy meter of CH1 is activated

MEASure[:SCALar]:ENERgy:RESet
Resets the energy meter value of the previous selected channel.

Usage: Setting only

2.5 Arbitrary commands

ARBitrary[:STATe] {ON | OFF | 0 | 1}
Activates or deactivates the arbitrary function for the previous selected channel.

Parameters: **ON | 1:** Arbitrary function will be activated.
OFF | 0: Arbitrary function will be deactivated.

*RST: OFF | 0

ARBitrary[:STATe]?
Queries the arbitrary function state of the the previous selected channel.

Return values:
1: ON - Arbitrary function is activated.
0: OFF - Arbitrary function is disabled.

Example:
INST OUT1
ARB ON
ARB?, Response: 1; Arbitrary function of CH1 is activated

ARBitrary:DATA <Data>
Defines the arbitrary points for the previous selected channel. Max. 512 arbitrary points can be defined. The dwell time between 2 arbitrary points is specified from 10ms to 10 min..

Parameters:
<Data> voltage1,current1,time1,interpolation mode1,voltage2,current2, ...
Voltage and current setting depending on the instrument type.

Interpolation mode
1: Y - Interpolation mode activated.
0: N - Interpolation mode disabled.

Example:
INST OUT1
ARB:DATA 10,1,0.5,0
Defines one arbitrary point with:
Voltage1 = 10V
Current1 = 1A
Time1 = 500ms
Interpolation mode = 0 (disabled)

ARBitrary:DATA?
Queries the defined arbitrary points for the previous selected channel.

Return values: e.g. 10.000,1.000,0.50,1

ARBitrary:REPetitions <Repetitions>
Defines the repetition rate of the defined arbitrary waveform for the previous selected channel. Up to 255 repetitions are possible. If the repetition rate „0" is selected the arbitrary waveform of the previous selected channel will be repeated infinitely.

Parameters: 0 to 255 repetitions

Example: ARB:REP 10

ARBitrary:REPetitions?
Queries the defined repetition rate of the previous selected channel.

Return values: 0 to 255

Example:
INST OUT1
ARB:REP 10
ARB:REP?, Response: 10; the repetition rate of the CH1 arbitrary waveform is 10

ARBitrary:ENDPoint <Endpoint>
Defines the arbitrary waveform endpoint of the selected channel. Max. 512 arbitrary points can be defined.

Parameters:
<Endpoint> 1 to 512 arbitrary points

ARBitrary:ENDPoint?
Queries the defined arbitrary waveform endpoint of the selected channel.

Return values: 0 to 512

Example:
INST OUT1
ARB:ENDP 30
ARB:ENDP?, Response: 30; the arbitrary waveform of channel CH1 will be repeated 30 times

ARBitrary:CLEar
Clears the previous defined arbitrary waveform data for the selected channel.

ARBitrary:TRIGgered[:STATe] {ON | OFF | 0 | 1}
Activates or deactivates the trigger input on the rear connector (terminal block) for arbitrary functionality.

Parameters:
ON | 1: Trigger input will be activated.
OFF | 0: Trigger input will be deactivated.

*RST: OFF | 0

ARBitrary:TRIGgered[:STATe]?
Queries the trigger input state of the the previous selected channel.

Return values: **1:** ON - Trigger input is activated.
0: OFF - Trigger input is disabled.

Example:
INST OUT1
ARB:TRIG ON
ARB:TRIG?, Response: 1; Trigger input on the rear connector is activated for CH1 arbitrary waveform

ARBitrary:TRIGgered:MODE {SINGle | RUN}
Selects the arbitrary trigger mode of the previous selected channel.

Parameters: SINGle | RUN

RUN
A trigger event starts the whole arbitrary sequence (with all repititions).

SING
A trigger event starts only one arbitrary sequence.

ARBitrary:TRIGgered:MODE?
Queries the arbitrary trigger mode of the previous selected channel.

Return values: RUN | SING

ARBitrary:FNAMe {<"File_Name">},[{INT | EXT | DEF}]
Defines the file name and storage location for the arbitrary function.

Parameters:
<File_Name> e.g. "ARB01.CSV",INT

INT: Internal memory
EXT: USB stick
DEF: Internal memory

ARBitrary:FNAMe?
Queries the file name and storage location for the arbitrary function.

Return values: e.g. „ARB01.CSV", INT

INT: Internal memory
EXT: USB stick
DEF: Internal memory

ARBitrary:SAVE
Stores the previous defined arbitrary points of the selected channel to the selected memory with the defined file name.

Example:
INST OUT1
ARB:DATA 10,1,0.5,0
ARB:REP 10
ARB:FNAM „ARB03.CSV“,INT
ARB:SAVE

ARBitrary:LOAD
Loads the stored arbitrary waveform of the previous selected channel and memory.

2.6 Advanced operating functions

2.6.1 Analog In

[SOURce:]VOLTage:AINPut[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the Analog In function for the previous selected channel.

Parameters:
ON | 1: Analog In function will be activated.
OFF | 0: Analog In function will be deactivated.

*RST: OFF | 0

[SOURce:]VOLTage:AINPut[:STATe]?
Queries the Analog In function state of the the previous selected channel.

Return values:
1: ON - Analog In function is activated.
0: OFF - Analog In function is disabled.

Example:
INST OUT1
VOLT:AINP ON
VOLT:AINP?, Response: 1; Analog In function of CH1 is activated

[SOURce:]VOLTage:AINPut:INPut {VOLTage | CURRent}
Selects the input unit of the Analog In connector (terminal block) on the rear panel.

Parameters: VOLTage | CURRent

[SOURce:]VOLTage:AINPut:INPut?
Queries the input unit of the Analog In connector (terminal block) on the rear panel.

Return values: VOLT | CURR

[SOURce:]VOLTage:AINPut:MODE {LINear | STEP}
Selects the mode of the Analog In connector (terminal block) on the rear panel.

Parameters: LINear | STEP

LINear: Output voltage linear to the input voltage.
STEP: Reference value or zero depending on threshold.

[SOURce:]VOLTage:AINPut:MODE?
Queries the mode of the Analog In connector (terminal block) on the rear panel.

Return values: LIN | STEP

[SOURce:]VOLTage:AINPut:THReshold {<Threshold>| MIN | MAX | DEF}
Sets the threshold for the Analog In mode STEP.

Parameters:
<Threshold> 0V to 10V (adjustable in 100mV steps)

MIN: 0.0E+00
MAX: 1.00E+01
DEF: 1.0E+00

[SOURce:]VOLTage:AINPut:THReshold?
Queries the threshold of the Analog In mode STEP.

Return values: e.g. 5.0E+00

Example:
INST OUT 1
VOLT:AINP ON
VOLT:AINP:MODE STEP
VOLT:AINP:THR 5
VOLT:AINP:THR?, Response: 5; the threshold of the Analog In mode STEP is set to 5V

2.6.2 EasyRamp

[SOURce:]VOLTage:RAMP[:STATe] {OFF | ON | 0 | 1}
Activates or deactivates the EasyRamp function for the previous selected channel.

Parameters:
ON | 1: EasyRamp function will be activated.
OFF | 0: EasyRamp function will be deactivated.

*RST: OFF | 0

[SOURce:]VOLTage:RAMP[:STATe]?
Queries the EasyRamp function state of the the previous selected channel.

Return values:
1: ON - EasyRamp function is activated.
0: OFF - EasyRamp function is disabled.

Example:
INST OUT1
VOLT:RAMP ON
VOLT:RAMP?, Response: 1; EasyRamp function of CH1 is activated

[SOURce:]VOLTage:RAMP:DURation {<Duration>| MIN | MAX | DEF}
Sets the duration of the voltage ramp.

Parameters:
<Duration> 10ms to 10s

MIN: 1.00E-02
MAX: 1.000E+01
DEF: 1.00E-02

[SOURce:]VOLTage:RAMP:DURation?
Queries the duration of the voltage ramp.

Return values: e.g. 4.00E+00

2.6.3 Sequencing

SEQuence[:STATe] {ON | OFF | 0| 1}
Activates or deactivates the power sequencing function.

Parameters:
ON | 1: Sequencing function will be activated.
OFF | 0: Sequencing function will be deactivated.

*RST: OFF | 0

SEQuence[:STATe]?
Queries the power sequencing function state.

Return values:
1: ON - Sequencing function is activated.
0: OFF - Sequencing function is disabled.

Example:
SEQ ON
SEQ?, Response: 1; Sequencing function is activated

SEQuence:CHANnel[:STATe] {ON | OFF | 0 | 1}
Activates or deactivates the power sequencing delay of the previous selected channel.

Parameters:
ON | 1: Sequencing delay will be activated.
OFF | 0: Sequencing delay will be deactivated.

*RST: OFF | 0

SEQuence:CHANnel[:STATe]?
Queries the power sequencing dely of the previous selected channel.

Return values:
1: ON - Sequencing delay is activated.
0: OFF - Sequencing delay is disabled.

Example:
INST OUT1
SEQ:CHAN ON
SEQ:CHAN?, Response: 1; Sequencing delay for channel CH1 is activated

SEQuence:DELay {<Delay>| MIN | MAX}
Defines the power sequencing delay of the previous selected channel.

Parameters:
<Delay> 1ms to 60s

MIN: 1.000E-03
MAX: 6.0000E+01

SEQuence:DELay?
Queries the power sequencing delay of the previous selected channel.

Return values: e.g. 2.000E+00

SEQuence:TRIGgered {ON | OFF | 0 | 1}
Activates or deactivates the power sequencing trigger function of the previous selected channel.

Parameters:
ON | 1: Trigger function will be activated.
OFF | 0: Trigger function will be deactivated.

*RST: OFF | 0

SEQuence:TRIGgered?
Queries the state of the power sequencing trigger function.

Return values:
1: ON - Trigger function is activated.
0: OFF - Trigger function is disabled.

Example:
SEQ:TRIG ON
SEQ:TRIG?, Response: 1; Trigger function is activated

2.7 Data and File Management

[DATA]LOG[:STATe] {ON | OFF | 0 | 1}
Turns the data logging function on or off.

Parameters:

ON / 1: Data logging function will be activated.
OFF / 0: Data logging function will be deactivated.

*RST: OFF | 0

[DATA:]LOG[:STATe]?
Queries the state of the data logging function.

Return values:

1: ON - Data logging function is activated.
0: OFF - Data logging function is disabled.

[DATA:]LOG:CHANnel[:STATe] {ON | OFF | 0 | 1}
Turns the data logging function for the previous selected channel on or off.

Parameters:
ON / 1: Data logging function for the previous selected channel will be activated.
OFF / 0: Data logging function for the previous selected channel will be deactivated.

[DATA:]LOG:CHANnel[:STATe]?
Queries the state of the data logging function.

Return values:
1: ON - Data logging function for the previous selected channel is activated.
0: OFF - Data logging function for the previous selected channel is disabled.

[DATA:]LOG:FNAMe {<"File_Name">},[{INT | EXT | DEF}]
Defines the file name and storage location for the logging function.

Parameters:
<File_Name> e.g. "Test01.CSV",INT

INT: Internal memory
EXT: USB stick
DEF: Internal memory

[DATA:]LOG:FNAMe?
Returns the file name and storage location for the logging function.

Return values: e.g. "/INT/DATA/Test01.CSV"

INT: Internal memory
EXT: USB stick
DEF: Internal memory

[DATA:]LOG:FORMat {CSV | TXT}
Defines the data logging file format.

Parameters:
CSV: Comma separated values
TXT: Text file

*RST: CSV

[DATA:]LOG:FORMat?
Returns the data logging file format.

Return values: CSV | TXT

[DATA:]LOG:MODE {UNLimited | COUNt | TIME}
Selects the data logging mode.

Parameters:
UNLimited: Infinite data capture.
COUNt: Number of measurement values to be captured.
TIME: Duration of the measurement values capture.

*RST: UNL

[DATA:]LOG:MODE?
Queries the data logging mode.

Return values: UNL | COUN | TIME

[DATA:]LOG:TIME <Time in sec>
Sets the data logging time.

Parameters:
<Time in seconds> Depending on instrument settings.

[DATA:]LOG:TIME?
Queries the duration of the measurement values capture.

Return values: e.g. 5.00000E+04

[DATA:]LOG:COUNt <No of samples>
Sets the number of measurement values to be captured.

Parameters:
<No of samples> Depending on instrument settings.

[DATA:]LOG:COUNt?
Queries the number of measurement values to be captured.

Return values: e.g. 1.00E+01

Usage: Query only

[DATA:]LOG:INTerval <Interval in seconds>
Selects a logging measurement interval. The measurement interval describes the time between the recorded measurements.

Parameters:
<Interval in seconds> 1ms to 3600s

[DATA:]LOG:INTerval?
Queries the selected logging measurement interval.

Return values: e.g. 1.0E+00

[DATA:]LOG:TRIGgered {ON | OFF | 0 | 1}
Turns the manual trigger for the data logging function on or off. The TRIG button will be illuminated.

Parameters:
ON / 1: Manual trigger function will be activated.
OFF / 0: Manual trigger function will be deactivated.

*RST: OFF | 0

[DATA:]LOG:TRIGgered?
Queries the manual trigger state of the data logging function.

Return values:
1: ON - Manual trigger function is activated.
0: OFF - Manual trigger function is disabled.

DATA:DATA? {<"Filename">},[{INT | EXT | DEF}]
Returns the logging file data values of the selected storage location and file name. If no logging file is found, the message „No Logging Files found" is displayed. If no storage location is selected, the instrument queries the internal memory. Please notice that the logging function has to be activated, if you want to use the manual trigger mode (trigger via TRIG button). Without activating the logging function in manual trigger mode, the instrument is not able to save a logging file internally or on the USB stick.

Return values: e.g. "LOG0029.CSV"

INT: Internal memory
EXT: USB stick
DEF: Internal memory

Example: External logging file (USB stick), count = 5
DATA:DATA? „LOG0001.CSV",EXT

U1[V];I1[A];U2[V];I2[A];U3[V];I3[A];Timestamp
0.019;2.0310;1.000;0.0000;1.000;0.0000;03:45:29:376
0.020;2.0310;1.000;0.0000;1.000;0.0000;03:45:30:375
0.020;2.0310;1.000;0.0000;1.000;0.0000;03:45:31:374
0.020;2.0310;1.000;0.0000;1.000;0.0000;03:45:32:373
0.019;2.0310;1.000;0.0000;1.000;0.0000;03:45:33:372

DATA:DELete {<"Filename">},[{INT | EXT | DEF }]

Deletes the logging file data values of the selected storage location and file name. If no storage location is selected, the instrument uses the internal memory. Please notice that the logging function has to be activated, if you want to use the manual trigger mode (trigger via TRIG button). Without activating the logging function in manual trigger mode, the instrument is not able to save a logging file internally or on the USB stick.

Parameters:

<File_Name> e.g. "LOG0001.CSV"

INT: Internal memory
EXT: USB stick
DEF: Internal memory

Example: DATA:DEL „LOG0001.CSV",EXT

DATA:POINts? {<"Filename">},[{INT | EXT | DEF }]

Queries the number of log file values of the selected storage location and file name. If no storage location is selected, the instrument queries the internal memory. Please notice that the logging function has to be activated, if you want to use the manual trigger mode (trigger via TRIG button). Without activating the logging function in manual trigger mode, the instrument is not able to save a logging file internally or on the USB stick.

Return values: Depending on the log file.

Example: External logging file (USB stick), count = 5
DATA:POIN? „LOG0001.CSV",EXT

Query: 5

DATA:LIST? [{INT | EXT | DEF}]

Queries all saved logging files of the selected storage location. If no storage location is selected, the instrument queries the internal memory. Please notice that the logging function has to be activated, if you want to use the manual trigger mode (trigger via TRIG button). Without activating the logging function in manual trigger mode, the instrument is not able to save a logging file internally or on the USB stick. If you store the logging file on the USB stick, the query returns all files depending on the storage format (CSV or TXT files).

Return values:
INT: Internal memory
EXT: USB stick
DEF: Internal memory

Example: DATA:LIST? EXT

Query: „LOG0001.CSV", "LOG0002.CSV","LOG0003.CSV"

HCOPy:DATA?
Returns the actual display content (screenshot). The DATA? query responses the screenshot data in binary format.

Usage: Query only

HCOPy:FORMat {BMP | PNG}
Selects the data format of the screenshot.

Parameters: BMP | PNG

BMP: Windows Bitmap Format
PNG: Portable Network Graphic

*RST: BMP

HCOPy:FORMat?
Returns the current setting of the screenshot format.

Return values: BMP | PNG

HCOPy:SIZE:X?
Returns the horizontal expansion of the screenshots.

Usage: Query only

HCOPy:SIZE:Y?
Returns the vertical expansion of the screenshots.

Usage: Query only

***SAV {0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9}**
Stores the current instrument state in the specified storage location. Any state previously stored in the same location is overwritten (no error is generated).

***RCL {0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9}**
Recalls the current instrument state of the specified storage location.

2.7.1 Logging Example of CH1 and CH2

```
*RST
APPLY 12,1,OUT1
APPLY 18,0.1,OUT2
INST OUT1
OUTP:STAT ON
LOG:CHAN ON
INST OUT2
OUTP:STAT ON
LOG:CHAN ON
LOG:FNAM „Test.txt“,EXT
LOG:FORM TXT
LOG:MODE UNL
LOG:INT 1
LOG:STAT ON
```

The instrument will log the measurement values from channel CH1 and channel CH2 simultaneously in 1s steps.

NOTICE

Please notice that the correct storage space (in this case USB stick / EXT) is selected.

Example of the saved TXT file:

```
#Device;HMC8043
#Device Name;NO NAME
#Format;LOG
#Date;2015-08-27
#Version;01.300-02.420-03.720
#Serial No.;020600485

#Mode;Unlimited
#Logging Interval[s];1.000
#Specified Logging Count;-----
#Specified Logging Time[s];-----
#Sequence;Off

#CH1 Voltage Target[V];12.000
#CH1 Current Target[A];1.000
#CH1 Sequence Delay[s];-----
#CH1 EasyArb;Off
#CH1 OVP;Off
#CH1 OPP;Off
#CH1 Ramp;Off
#CH1 Analog in;Off
```

#CH2 Voltage Target[V];18.000
#CH2 Current Target[A];0.100
#CH2 Sequence Delay[s];-----
#CH2 EasyArb;Off
#CH2 OVP;Off
#CH2 OPP;Off
#CH2 Ramp;Off
#CH2 Analog in;Off

#Start Time;15:20:11
#Stop Time;15:20:19

#Actual Count; 9

U1[V];I1[A];U2[V];I2[A];Timestamp
12.000;0.0002;18.000;0.0000;15:20:11:311
12.000;0.0002;18.000;0.0000;15:20:12:310
12.000;0.0002;18.000;0.0000;15:20:13:309
12.000;0.0002;18.000;0.0000;15:20:14:308
12.000;0.0002;18.000;0.0000;15:20:15:307
12.000;0.0002;18.000;0.0000;15:20:16:306
12.000;0.0002;18.000;0.0000;15:20:17:305
12.000;0.0002;18.000;0.0000;15:20:18:304
12.000;0.0002;18.000;0.0000;15:20:19:303

2.8 Status Reporting

2.8.1 STATus:OPERation Register

The commands of the STATus:OPERation subsystem control the status reporting structures of the STATus:OPERation register:
See also:

- chapter 1.6.1, „Structure of a SCPI Status Register“, on page 16
- „STATus:OPERation Register“, on page 19
- Diagram on page 22

The following commands are available:

STATus:OPERation:CONDition?
Returns the of the CONDition part of the operational status register.

Return values: Condition bits in decimal representation.
Range: 1 to 65535

Usage: Query only

STATus:OPERation:ENABle <Enable_value>

Parameters:
<Enable_Value> Range: 1 to 65535

STATus:OPERation:ENABle?
Enables the bits in the enable register for the Standard Operation Register group.

STATus:OPERation[:EVENt]?

Return values: Range: 1 to 65535

Usage: Query only

2.8.2 STATus:QUEStionable Registers

The commands of the STATus:QUEStionable subsystem control the status reporting structures of the STATus:QUEStionable registers:

See also:
- chapter 1.6.1, „Structure of a SCPI Status Register“, on page 15
- „STATus:QUEStionable Register“, on page 17
- Diagram on page 16

The following commands are available:

STATus:PRESet
Resets all bits of the STATUS:QUESTIONALBLE and Standard Operation enable register.

Usage: Event

STATus:QUEStionable[:EVENt]?
Queries the contents of the EVENt part of the status register to check whether an event has occurred since the last reading. Reading an EVENt register deletes its contents.

Return values: Event bits in decimal representation
Range: 1 to 65535

Usage: Query only

STATus:QUEStionable:ENABle <Enable_value>
Sets the enable mask that allows true conditions in the EVENt part to be reported in the summary bit. If a bit in the enable part is set to 1 and its associated event bit transitions to true, a positive transition occurs in the summary bit and is reported to the next higher level.

Parameters:
<Enable_value> Bit mask in decimal representation
Range: 1 to 65535

STATus:QUEStionable:ENABle?
Queries the enable register and returns a decimal value which corresponds to the binary-weighted sum.

STATus:QUEStionable:INSTrument[:EVENt]?
Queries the contents of the EVENt part of the status register to check whether an event has occurred since the last reading. Reading an EVENt register deletes its contents.

Return values:
<Event> Event bits in decimal representation
Range: 0 to 65535

Usage: Query only

STATus:QUEStionable:INSTrument:ENABle <Enable value>
Sets the enable mask that allows true conditions in the EVENt part to be reported in the summary bit. If a bit in the enable part is set to 1 and its associated event bit transitions to true, a positive transition occurs in the summary bit and is reported to the next higher level.

Parameters:
<Enable_Value> Bit mask in decimal representation
Range: 0 to 65535

STATus:QUEStionable:INSTrument:ENABle?
Queries the enable register and returns a decimal value which corresponds to the binary-weighted sum.

STATus:QUEStionable:INSTrument:ISUMmary<n>[:EVENt]?
Queries the contents of the EVENt part of the status register to check whether an event has occurred since the last reading. Reading an EVENt register deletes its contents.

Return values:
<Event> Event bits in decimal representation
Range: 0 to 65535

Usage: Query only

STATus:QUEStionable:INSTrument:ISUMmary<n>:CONDition?
Queries the contents of the CONDition part of the status register to check the actual instrument states. Reading the CONDition registers does not delete the contents.

Return values:
<Condition> Condition bits in decimal representation
Range: 0 to 65535

Usage: Query only

STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle <Enable value>
Sets the enable mask that allows true conditions in the EVENt part to be reported in the summary bit. If a bit in the enable part is set to 1 and its associated event bit transitions to true, a positive transition occurs in the summary bit and is reported to the next higher level.

Parameters:
<Enable_Value> Bit mask in decimal representation
Range: 0 to 65535

STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle?
Queries the enable register and returns a decimal value which corresponds to the binary-weighted sum.

3 SCPI Commands

in alphabetic order

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Customer Support: www.customersupport.rohde-schwarz.com
Service: www.service.rohde-schwarz.com

5800.5682.02 │Version 01 │R&S®HMC804x

The following abbreviations are used throughout this manual: R&S®HMC804x is abbreviated as R&S HMC804x.