R&S®NGL200
Power Supply
User Manual

1178873602

User Manual

Version 02.01

ROHDE&SCHWARZ

This manual describes the following R&S®NGL200 models and options:

- R&S®NGL201 1 Channel PSU 60W (3638.3376.02)
- R&S®NGL202 2 Channel PSU 120W (3638.3376.03)
- R&S®NGL-K102 Option Wireless LAN (3652.6362.02)
- R&S®NGL-K103 Option Digital I/O (3652.6385.02)
- R&S®NGL-B105 Option GPIB Interface (3652.6356.02)

The contents of this manual correspond to firmware version 1.00 or higher.

The software contained in this product uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" document, which is available for download from the R&S NGL200 product page at www.rohde-schwarz.com/product/ngl200 > " Downloads > Firmware ".
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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1178.8736.02 | Version 02.01 | R&S®NGL200

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®NGL200 is indicated as R&S NGL200.

Safety Instructions
Instrucciones de seguridad
Sicherheitshinweise
Consignes de sécurité

⚠ WARNING

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury or instrument damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" delivered as printed brochure with the instrument.
- Read and observe the safety instructions in the following sections. Note that the data sheet may specify additional operating conditions.
- Keep the "Basic Safety Instructions" and the product documentation in a safe place and pass them on to the subsequent users.

⚠ ADVERTENCIA

Riesgo de lesiones y daños en el instrumento

El instrumento se debe usar de manera adecuada para prevenir descargas eléctricas, incendios, lesiones o daños materiales.

- No abrir la carcasa del instrumento.
- Lea y cumpla las "Instrucciones de seguridad elementales" suministradas con el instrumento como folleto impreso.
- Lea y cumpla las instrucciones de seguridad incluidas en las siguientes secciones. Se debe tener en cuenta que las especificaciones técnicas pueden contener condiciones adicionales para su uso.
- Guarde bien las instrucciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

⚠ WARNUNG

Gefahr von Verletzungen und Schäden am Gerät

Betreiben Sie das Gerät immer ordnungsgemäß, um elektrischen Schlag, Brand, Verletzungen von Personen oder Geräteschäden zu verhindern.

- Öffnen Sie das Gerätegehäuse nicht.
- Lesen und beachten Sie die "Grundlegenden Sicherheitshinweise", die als gedruckte Broschüre dem Gerät beiliegen.
- Lesen und beachten Sie die Sicherheitshinweise in den folgenden Abschnitten; möglicherweise enthält das Datenblatt weitere Hinweise zu speziellen Betriebsbedingungen.
- Bewahren Sie die "Grundlegenden Sicherheitshinweise" und die Produktdokumentation gut auf und geben Sie diese an weitere Benutzer des Produkts weiter.

⚠ AVERTISSEMENT

Risque de blessures et d'endommagement de l'appareil

L'appareil doit être utilisé conformément aux prescriptions afin d'éviter les électrocutions, incendies, dommages corporels et matériels.

- N'ouvrez pas le boîtier de l'appareil.
- Lisez et respectez les "consignes de sécurité fondamentales" fournies avec l’appareil sous forme de brochure imprimée.
- Lisez et respectez les instructions de sécurité dans les sections suivantes. Il ne faut pas oublier que la fiche technique peut indiquer des conditions d’exploitation supplémentaires.
- Gardez les consignes de sécurité fondamentales et la documentation produit dans un lieu sûr et transmettez ces documents aux autres utilisateurs.

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

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ROHDE&SCHWARZ

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Contents

1 Preface

1.1 Documentation Overview

This section provides an overview of the R&S NGL200 user documentation.

1.1.1 Manuals and Instrument Help

You find the manuals on the product page at:

www.rohde-schwarz.com/product/ngl200

Getting started manual

Introduces the R&S NGL200 and describes how to set up the product. A printed English version is included in the delivery.

User manual

Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance and instrument interfaces. Includes the contents of the getting started manual.

The *online version* of the user manual provides the complete contents for immediate display on the internet.

Basic safety instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists. The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS, https://gloris.rohde-schwarz.com).

1.1.2 Data Sheet

The data sheet contains the technical specifications of the R&S NGL200. It also lists the options with their order numbers and optional accessories.

See www.rohde-schwarz.com/brochure-datasheet/ngl200

1.1.3 Release Notes and Open Source Acknowledgment

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation. The open source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/ngl200. The open source acknowledgment document can also be read directly on the instrument.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
[Keys]	Key and knob names are enclosed by square brackets.
`Filenames, commands, program code`	Filenames, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Conventions for Procedure Descriptions

When operating the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

1.2.3 Notes on Screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as many as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

1.2.4 Other Conventions

Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters.

Additional text in lowercase characters is for information only.

2 Welcome to R&S NGL200

The one or two-channel power supply series are based on a classical transformer concept with linear regulators. This concept allows the instrument to achieve highest accuracy and lowest residual ripple.

The R&S NGL200 power supply series feature galvanically isolated, floating overload and short-circuit proof outputs. The outputs can be connected in parallel and serial to get higher voltages, thus making high currents available.

Multi-purpose protection functions are available for each channel which you can set separately, such as overcurrent protection (OCP), overvoltage protection (OVP) and overpower protection (OPP). If such a limit is reached, the affected output channel is automatically turned off and an indicator icon (C, V, P) blinks on the display. In the case of two-channel power supply, NGL202, the overcurrent protection can be linked to the other channel. In this case, the linked channel is turned off when the other channel reaches a limit.

Additionally, the R&S NGL200 is protected with overtemperature protection (OCP). This safey feature protects the R&S NGL200 from getting overheated, when activated, the channel outputs are turned off.

The Arbitrary function allows a freely definable voltage and current sequences with a timeframe as short as 10 ms. It allows you to vary the voltage or current limit during a test sequence, for example to simulate different charging conditions of a battery. With Ramp function, the R&S NGL200 provides the operating condition to simulate the continuous rise of the supply voltage within a defined timeframe of 10 ms to 10 s.

All R&S NGL200 power supply series are equipped with a color LCD display (800 x 480 pixels). The R&S NGL200 comes with a USB and LAN (LXI) interface. Equipped with a wireless LAN (WLAN) option, you can establish a network connection wirelessly .

The digital I/O interfaces installed at the rear panel is activated with an option, it provides a set of 4-bit digital interfaces that can be individually used as trigger inputs or outputs.

The user manual contains description of the functionalities that the instrument provides. The latest version is available for download at the product homepage (http://www.rohde-schwarz.com/product/ngl200).

3 Important Notes

3.1 Symbols


Caution, general danger zone


Ground


PE terminal

ON (supply voltage)


OFF (supply voltage)


Ground terminal

3.2 Ambient Conditions

The allowed operating temperature ranges from +5 °C to +40 °C (pollution category 2). The maximum relative humidity (without condensation) is at 80 %.

During storage and transport, the temperature must be between -40 °C and +70 °C. In case of condensation during transportation or storage, the instrument will require approximately two hours to dry and reach the appropriate temperature prior to operation. The instrument is designed for use in a clean and dry indoor environment. Do not operate with high dust and humidity levels, if danger of explosion exists or with aggressive chemical agents.

Any operating position may be used; however adequate air circulation must be maintained. For continuous operation, a horizontal or inclined position (integrated stand) is preferable.

Specifications with tolerance data apply after a warm up period of at least 30 minutes at a temperature of 23 °C (tolerance -3 °C/+ 7 °C).

The heat produced inside the instrument is guided to the exterior via temperature-controlled fan. Each channel has multiple temperature sensors which check the heat generation in the instrument and control the fan speed.

It is necessary to ensure that there is sufficient space around the instrument sides for heat exchange. If the temperature inside the instrument increases to more than

~72 °C, a channel-specific overheat protection intervenes. Affected outputs will automatically be switched off.

⚠ CAUTION

Air circulation

Do not obstruct the ventilation holes!

3.3 Measurement Categories

This instrument is designed for supplying power on circuits that are only indirectly connected to the low voltage mains or not connected at all. The instrument is not intended for measurements within the measurement categories II, III or IV; the maximum potential against earth generated by the user must not exceed 250 V peak in this application.

The following information refers solely to user safety. Other aspects, such as the maximum voltage, are described in the technical data and must also be observed.

The measurement categories refer to transients that are superimposed on the mains voltage. Transients are short, very fast (steep) current and voltage variations which may occur periodically and non-periodically. The level of potential transients increases as the distance to the source of the low voltage installation decreases.

- Measurement CAT IV: Measurements at the source of the low voltage installations (e.g. meters)
- Measurement CAT III: Measurements in building installations (e.g. power distribution installations, power switches, firmly installed sockets, firmly installed engines etc.)
- Measurement CAT II: Measurements on circuits electronically directly connected to the mains (e.g. household appliances, power tools, etc.)
- 0 (instruments without measured measurement category): Other circuits that are not connected directly to the mains

3.4 Mains Voltage

The instrument applies 50 Hz / 60 Hz mains voltages ranging from 100 VAC, 115 VAC or 230 VAC (tolerance ± 10 %). Mains voltage switching is not intended. The input line fuse is accessible externally. Power socket and fuse holder form a single unit.

You need to first disconnect the power cord from the connector before you can safely replace the fuse (as long as the fuse holder is undamaged). Next, the fuse holder must be pried out using a screwdriver. The starting point is a slot next to the contacts. The fuse can then be forced out of its mounting and must be replaced with an identical fuse (see information about the fuse type on the rear panel). The fuse holder will be inserted against the spring pressure until it locks into place. The use of mended fuses or short

circuiting the fuse holder is prohibited. Resulting damages are not covered by the warranty.

NOTICE

Safe operation

If the instrument is to remain unattended for a longer time period, it must be switched off at the mains switch for safety reasons.

3.5 Limits

The R&S NGL200 is equipped with a protective overload feature. The protective overload feature prevents damage to the instrument and is intended to protect against a possible electrical shock. The maximum values for the instrument must not be exceeded. The protection limits are listed on the front panel of the R&S NGL200 to ensure the safe operation of the instrument.

These protection limits must be adhered to:

Specification	Limits
Maximum output voltage	20 VDC
Maximum output current	6 A (<= 6 V) 3 A (> 6 V)
Maximum voltage against earth	250 V peak
MAximum counter-voltage (same polarity)	22 V
Maximum reverse voltage (opposite polarity)	0.5 V
Maximum reverse current sink current	3 A
Power supply	100 VAC, 115 VAC or 230 VAC (tolerance ± 10%)
Frequency	50 Hz/60 Hz
Maximum power output	120 W (R&S NGL202), 60 W (R&S NGL201)

4 Getting Started

4.1 Putting into Operation

This chapter describes the steps to set up the R&S NGL200 for the first time.

WARNING

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury, or damage.

- Do not open the instrument casing
- Read and observe the "Basic Safety Instructions" delivered as a printed brochure with the instrument. Note that the basic safety instructions also contain information on operating conditions that prevent damage to the instrument

In addition, read and observe the safety instructions in the following sections.

Notice that the data sheet may specify additional operating conditions.

WARNING

Risk of radio interference

This instrument is compliant with Class A of CISPR 32. In a residential environment, this instrument may cause radio interference.

NOTICE

Risk of instrument damage during operation

An unsuitable operating site or test setup can cause damage to the instrument and the connected devices. Ensure the following operating conditions before you switch on the instrument:

- The instrument is dry and shows no sign of condensation
- The instrument is positioned as described in Chapter 4.1.4.1, "Bench Operation", on page 18
- The ambient temperature does not exceed the range specified in the data sheet
- Signal levels at the input connectors are all within the specified ranges
- Signal outputs are correctly connected and not overloaded

EMI impact on measurement results

Electromagnetic interference (EMI) may affect the measurement results.

To suppress the generated EMI:

- Use suitable shielded cables of high quality, for example, LAN cables
- Note the EMC classification in the data sheet

4.1.1 Safety

This instrument was built in compliance with DIN EN 61010-1 (VDE 0411 part 1), safety regulations for electrical instruments, control units and laboratory equipment.

It has been tested and shipped from the plant in safe condition. It is also in compliance with the regulations of the European standard EN 61010-1 and the international standard IEC 61010-1.

To maintain this condition and ensure safe operation, you must observe all instructions and warnings given in this user manual. Casing, chassis and all measuring ports are connected to a protective earth conductor. The instrument is designed in compliance with the regulations of protection class I.

For safety reasons, the instrument may only be operated with authorized safety sockets. The power cord must be plugged in before signal circuits may be connected.

Never use the product if the power cable is damaged. Check regularly if the power cables are in perfect condition. Choose suitable protective measures and installation types to ensure that the power cord cannot be damaged and that no harm is caused by tripping hazards or from electric shock, for instance.

DANGER

Risk of electric shock

It is prohibited to disconnect the earthed protective connection inside or outside of the instrument!

If it is assumed that a safe operation is no longer possible, the instrument must be shut down and secured against any unintended operation.

Safe operation can no longer be assumed as follows:

- Instrument shows visible damage
- Instrument includes loose parts
- Instrument no longer functions properly

– After an extended period of storage under unfavorable conditions (e.g. outdoors or in damp rooms)
– After rough handling during transport (e.g. packaging that does not meet the minimum requirements by post office, railway or forwarding agency)

DANGER

Exceeding the low voltage protection

Use insulated wires and not bare wires for the terminal connection.

It is assumed that only qualified and trained personnel service the power supplies and the connected loads.

Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If it is necessary to set a different voltage, the power fuse of the product may have to be changed accordingly.

4.1.2 Intended Operation

The instrument is intended only for use by personnel familiar with the potential risks of measuring electrical quantities.

For safety reasons, the instrument may only be connected to properly installed wall outlets. Separating the ground is prohibited.

The power plug must be inserted before signal circuits may be connected.

Use only the power cord included in the delivery package. See "Delivery package" on page 18.

Before each measurement, measuring cables must be inspected for damage and replaced if necessary. Damaged or worn components can damage the instrument or cause injury.

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer’s specifications are not observed, this can result in electric shock, fire and / or serious personal injury, and in some cases, death.

Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

The instrument is designed for use in the following sectors: Industrial, residential, business and commercial areas and small businesses.

The instrument is designed for indoor use only. Before each measurement, you need to verify at a known source if the instrument functions properly.

To disconnect from the mains, unplug the IEC socket on the back panel.

See Table 4-1 for the general data on the instrument specification. For more information, see the instrument datasheet (PN: 5216.1057.12).

Table 4-1: General data on instrument specification

General data		
Mains nominal voltage	AC 100 / 115 / 230 V (±10 %) 50 Hz to 60 Hz	
Maximum input power	400 W	
Mains fuses	IEC 60127-2 / 5 T4.0H 250 V	
Operating temperature range	+5 °C to +40 °C	
Storage temperature range	-20 °C to +70 °C	
Humidity Non-condensing	5 % to 80 %	
Display	5 " (Resolution 800 x 480, WVGA)	
Input Method	Capacitive touch input	
Rack mount capability	R&S HZN96 rack adapter 2U (P/N: 3638.7813.02)	
Dimensions (W x H x D)	222 mm x 97 mm x 436 mm (8.74 in x 3.82 in x 17.17 in)	
Weight	R&S NGL201	7.1 kg (15.65 lb)
	R&S NGL202	7.3 kg (16.09 lb)

4.1.3 Unpacking and Checking the Instrument

Unpack the R&S NGL200 carefully and check the content of the package.

- Check the equipment for completeness using the delivery note and package contents list for the various items.
- Check the instrument for any damage and loose parts. If there is any damage, immediately contact the carrier who delivered the instrument.

Packing material

Retain the original packing material. If the instrument needs to be transported or shipped at a later date, you can use the material to protect the control elements and connectors.

NOTICE

Risk of damage during transportation and shipment

Insufficient protection against mechanical and electrostatic effects during transportation and shipment can damage the instrument.

- Always ensure that sufficient mechanical and electrostatic protection are provided
- When shipping an instrument, the original packaging should be used. If you do not have the original packaging, use sufficient padding to prevent the instrument from moving around inside the box. Pack the instrument in antistatic wrap to protect it from electrostatic charging
- Secure the instrument to prevent any movement and other mechanical effects during transportation

Delivery package

The package contents contain the following items:

- R&S NGL200 power
- Four power cables
- One printed Getting Started manual
- One document folder containing a printed Basic Safety Instructions

4.1.4 Setting Up the Instrument

The R&S NGL200 is designed for benchtop and rackmount.

4.1.4.1 Bench Operation

On a benchtop, the R&S NGL200 can either lie flat or stand on its feet. As shown in Figure 4-1, feet on the bottom can be folded out to set the instrument in an inclined position.

Figure 4-1: Operating positions

NOTICE

Positioning of instrument

The instrument must be positioned in a manner that allows the user to disconnect the unit from the mains at any time and without restrictions.

4.1.4.2 Rack Mounting

The instrument can be installed in a 19 " rack-mount using a rack adapter kit.

NOTICE

Ambient temperature

Place the R&S NGL200 in an area where the ambient temperature is within +5 °C to +40 °C. The R&S NGL200 is fan-cooled and must be installed with sufficient space along the sides to ensure free flow of air.

4.2 Instrument Tour

This chapter provides an overview of all the controls available in the R&S NGL200 models and steps to switch on the instrument for the first time.

4.2.1 Overview of Controls

4.2.1.1 Front Panel

The front panel of the R&S NGL200 is as shown in Figure 4-2. The function keys and navigation controls are located beside the display. The various connectors are located right of the display.

The R&S NGL200 has one output channel for NGL201 model and two output channels for NGL202 model .

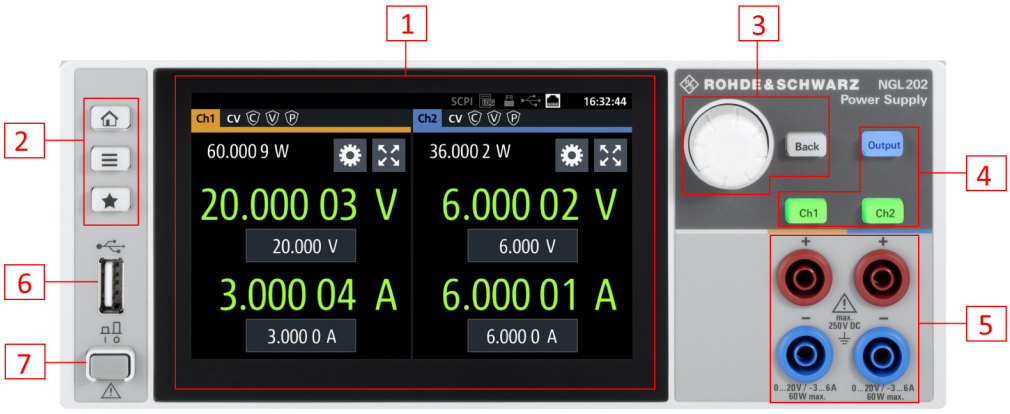


Figure 4-2: Front panel of R&S NGL200

1 = Display with touch screen
2 = Menu control keys
3 = Navigation keys
4 = Output and channels keys
5 = Output terminals (one channel with sense NGL201, two channels NGL202)
6 = USB connector
7 = Power key

Display (1)

The display is a color LCD screen. Depending on the instrument model, up to two channels are shown on the display. The respective measurement settings and functions are displayed in the individual channel display area. There is a status bar in the device level and channel level, showing the device operating mode and respective channel settings of the instrument.

For a detailed description on-screen layout, see section "Display Overview" in the User Manual.

Menu control keys (2)

The menu control keys allow you to navigate to the home window, main menu window and user button key in the instrument.

For a detailed description on navigation keys, see section "Menu Controls" in the User Manual.

Navigation keys (3)

The navigation keys are used for menu navigation and value adjustment in the instrument.

For a detailed description on navigation, see section "Navigation Controls" in the User Manual.

Output and channel keys (4)

Depending on the instrument type, up to two output channels are available to source or sink power to and from the output terminals.

Each channel is capable to source 0 V to 6 V with a current of 6 A or 6 V to 20 V with a current of 3 A. In sink mode, each channel can consume 0 A to 3 A at an input voltage of 0 V to 20 V.

Output terminals (5)

Both instrument models are equipped with 4 terminals. The R&S NGL201 provides both the output plus the sense connectors at the front panel while the R&S NGL202 provides only output terminals for both channels.

USB connector (6)

The USB connector is a Type-A connector. You can connect a USB flash drive to this connector to perform a firmware update, store logging data or screen shots.

Power key (7)

The [Power] key switches the instrument on and off.

4.2.1.2 Rear Panel

Figure 4-3 shows the rear panel of the R&S NGL200 with its connectors.

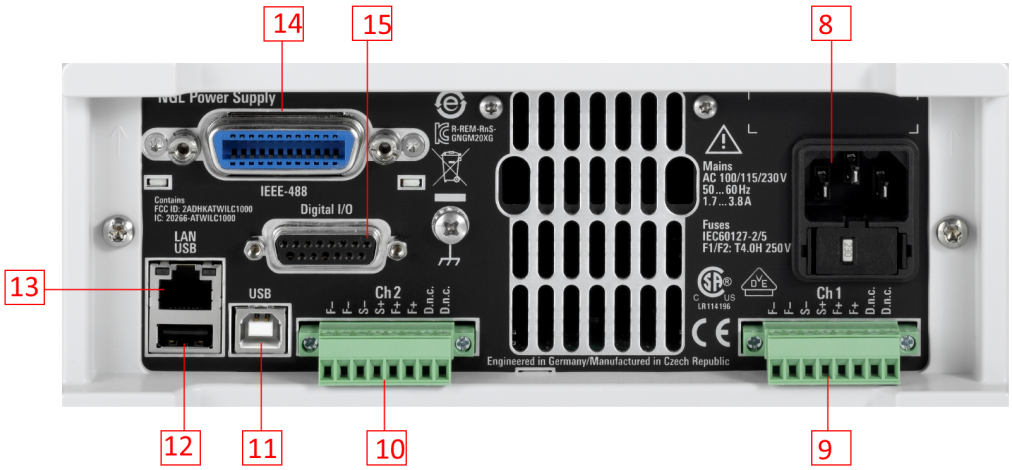


Figure 4-3: Rear panel of R&S NGL200

8 = AC inlet with fuse holder and voltage selector
9 = Channel 1 rear panel connector
10 = Channel 2 rear panel connector (NGL202 model)
11 = USB connector (Device)
12 = USB connector (Host)
13 = Ethernet (LAN) connector
14 = Cover for optional IEEE 488 (GPIB) Interface
15 = Digital I/O connector

AC inlet with fuse holder and voltage selector (8)

Main supply cord

Do not use detachable mains supply cord with inadequate rating.

For safety reasons, the instrument can only be operated with authorized safety sockets.

The power cable must be plugged in before signal circuits can be connected. Never use the product if the power cable is damaged. See Chapter 4.2.2, "Switching On the Instrument", on page 23 for more information.

The built-in voltage selector selects the mains voltage between 100 V, 115 V and 230 V. All voltage settings are using the same fuse rating.

Channel connectors (9, 10)

NOTICE

Output Terminals

Either the output terminals at the front panel or those at the back panel can be used. Using both terminals at the same time can cause instrument malfunction.

DVM pins on the channel connector are only available in the NGM types power supply.

The channel connectors contain both output ("F+", "F-") and sense ("S+", "S-") connections. Connector for "Ch 2" is only available in the R&S NGL202 model.

USB connectors (11, 12)

The USB host connector (Type-A) can be used for mass storage devices like the USB connector at the front panel.

The USB device connector is a Type-B connector for remote control operation.

Ethernet connector (13)

This connector is used for establishing remote control via SCPI.

See section "Ethernet Setup" in the user manual for more information on the connection setup.

Option GPIB interface (14)

An IEEE488 GPIB interface can be ordered (NGL-B105). This interface is not user installable.

Digital I/O connector (15)

The Digital I/O connector is a terminal block for external input or output.

The Digital Trigger I/O option (NGL-K103) must be installed for this function to be available in the instrument.

4.2.2 Switching On the Instrument

Before switching on the instrument, check if the value on the voltage selector corresponds to the mains voltage (100 V, 115 V or 230 V). Switch it on, if necessary.

Fuse rating

The R&S NGL200 is using the same fuse ratings for all main voltages.

To change power fuse:

1. Peel off the yellow label sticker on the AC inlet.
2. Release the latch of the fuse holder which is located directly below the socket and pull it out.
3. Pull out the removable part of the fuse holder.
4. Turn this part until correct voltage label (100, 115 or 230) is displayed in the window of the holder.
5. Return the fuse holder to its position in the panel.

To switch on instrument:

1. Connect the power cable to the AC power connector on the rear panel of the R&S NGL200.
2. Connect the power cable to the socket outlet.
3. Press [Power] key on the front panel.
   The instrument performs a system check, boots the operating system, and starts the R&S NGL200 firmware.

By default, all output channels are turned off when the instrument is switched on to prevent connected loads from being damaged unintentionally.

During startup, the R&S NGL200 is loaded with the last saved instrument settings from internal memory. See Chapter 6.9, "Store and Recall ", on page 65.

To switch off instrument:

1. Press [Power] key.
   All current settings are saved to internal memory and the firmware shutdown.

2. Disconnect the AC power cable from the AC power supply.

4.3 Trying Out the Instrument

This chapter describes some basic functions that you can perform with the R&S NGL200.

Source and sink current

The R&S NGL200 series are 2 quadrant power supplies which may both source and sink current. This function needs no separate configuration or mode switching. As soon as the voltage across the output terminal exceeds the set voltage, current flows into the instrument. This is an intended feature and it is safe.

On the display, sink mode is shown as negative current.

4.3.1 Setting the Output Voltage and Current

1. Press [Home] key.
   The R&S NGL200 displays the home window.
2. Select voltage or current parameter in the home window
   The R&S NGL200 displays an on-screen keypad to set the value.
3. Enter the required value.
4. Confirm value with the unit key (for voltage - V or mV, for current A or mA).

4.3.2 Activating the Channels Output

The output voltages can be switched on or off regardless of the operating mode the instrument is in.

To switch on or off channel output.

1. Select desired channel key ([Ch1] or [Ch2]) on the front panel.
2. Press [Output] key.
   The R&S NGL200 output the set voltage level on the selected output channel terminal.

Depending on the mode which the channels are operated in, the followings are observed:

CR mode

CR mode is a special case of sink mode in which the instrument behaves like a constant resistor. Only in this mode, the respective channel keys and display font color in the home window turns cyan.

In "normal" sink mode, the colors are the same as in source mode: green if the current flowing into the R&S NGL200 is below the set current and red if the current is limited to the set value. The only visible indication of sink mode is the change of the sign of the current readout change to "Minus".

Color illuminated on front panel keys and display font color of voltage and current in home window	Operating mode
Green	Constant voltage mode (CV)
Red	Constant current mode (CC)
Cyan	Constant resistance mode (CR) Note: Instrument is operated in sink mode and "Constant Resistance" is activated.

Also, the operating symbol mode (CV, CC or CR) is displayed at the channel status bar of the respective channel.

4.4 Maintenance

Before cleaning the instrument, ensure that it has been switched off and power cable is disconnected.

Clean the outer case of the instrument at regular intervals, using a soft, lint-free dust cloth.

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances that may damage the instrument. For example, cleaning agents that contain a solvent may damage the front panel labeling, plastic parts, or the display.

Never use cleaning agents such as solvents (thinners, acetone, etc.), acids, bases, or other substances.

The display may only be cleaned with an appropriate glass cleaner. Rub the display down with a dry, clean and lint-free cloth. Do not allow cleaning fluid to enter the instrument.

5 Operating Basics

5.1 Display Overview

The following displays the home window of R&S NGL200. It shows the output voltage and current level, status bar information and control settings of the instrument.

Figure 5-1: Home window of R&S NGL200 with 2 channels

1 = Device status bar
2 = Channel status bar
3 = Expand/Collapse channel button
4 = Settings button
5 = Output voltage level
6 = Set voltage level
7 = Output current level
8 = Set current level
9 = Channel display area of Ch2
10 = Channel display area of Ch1
11 = Output power measurement

5.1.1 Status Bar Information

There are two levels of status bar information. One is the device status information and the other is the individual channel status information.

Device status bar

Function	Description
GPIB/IEEE488 interface	If GPIB/IEEE488 interface is installed, the icon is highlighted in white.
SCPI command	If active, the icon is highlighted in white. If an error is in the remote command, the icon is highlighted in red. See Chapter 7, "Remote Control Commands", on page 79.
USB host interface	If USB stick is present, the icon is highlighted in white.
Data Logger	If data logging is present, the icon is highlighted in white. If an error is present, the icon is highlighted in red. See Chapter 6.7, "Data Logger", on page 61.
USB device interface	If a host command is received in USB interface, the icon is highlighted in white.
Ethernet/LAN interface	If active, the icon is highlighted in white. See Chapter 6.10, "Interfaces", on page 67.
Time	Display of time in hh:mm:ss format. See Chapter 6.11.4, "Date and Time", on page 76.
Touchscreen	If disabled, the icon is highlighted in white. See Chapter 5.2, "Using the Touchscreen", on page 30.

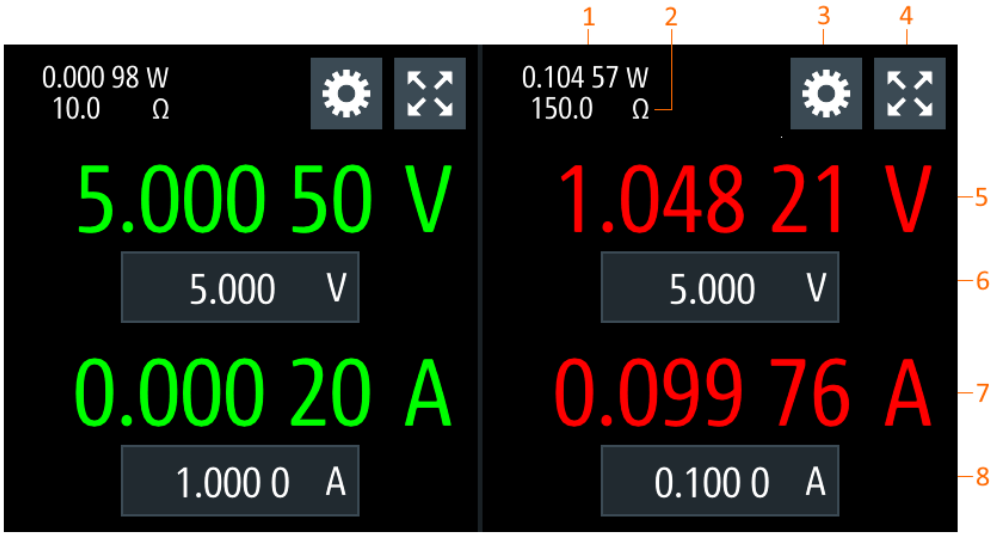
Channel status bar

Function	Description
Channel number	Indication of channel 1 or channel 2 display.
Operation mode	The R&S NGL200 has three operating modes: • CV: Constant voltage mode • CC: Constant current mode • CR: Constant resistance mode. The R&S NGL200 goes into this mode when operates in sink mode and the "Constant Resistance" mode is activated. For more information, see Chapter 5.5, "Output Modes", on page 37.
"Over Current Protection" (OCP),	If enabled, the icon is highlighted in white. If triggered, the icon blinks. See Chapter 6.3.1, "Over Current Protection (OCP)", on page 45.

Function	Description
"Over Voltage Protection" (OVP),	If enabled, the icon is highlighted in white. If triggered, the icon blinks. See Chapter 6.3.2, "Over Voltage Protection (OVP)", on page 46.
"Over Power Protection" (OPP),	If enabled, the icon is highlighted in white. If triggered, the icon blinks. See Chapter 6.3.3, "Over Power Protection (OPP)", on page 47.
"Arbitary Editor" mode,	If enabled, the icon is highlighted in white. If active, the icon blinks. See Chapter 6.4.1, "Arbitrary", on page 49.
"Ramp" mode,	If enabled, the icon is highlighted in white. If active, the icon blinks. See Chapter 6.4.2, "Ramp", on page 53.
"Fast Transient Response",	If enabled, the icon is highlighted in white. The time taken for voltage recovery (<=20 mV) switches between 30 µs and 100 µs. See Chapter 6.2.2, "Fast Transient Response", on page 42.
"Internal Impedance",	If enabled, the icon is highlighted in white.
"Safety Limits",	If enabled, the icon is highlighted in white. See Chapter 6.3.4, "Safety Limits", on page 48.
"Output Delay",	If enabled, the icon is highlighted in white. The delay is the time between activation of the output and applying voltage to the output. See Chapter 6.2.3, "Output", on page 43.
Calibration mode,	If user calibration is active, the icon is highlighted in white. By default, the factory calibration is in use.
Sense connection,	If sense connection is detected, the icon is highlighted in white.

5.1.2 Channel Display Area

The R&S NGL200 shows a two channels on the channel display area for NGL202 model and a single channel area display for the R&S NGL201 model. The respective channel settings and functions are displayed in the individual channel.



1 = Display output power in Watt
2 = Display constant resistance in Ohms
3 = Settings button which opens instrument main menu window
4 = Expand/Collapse channel button which toggles between home window and channel overview window
5 = Output voltage displays in Volt. The display resolution for voltage is five digits after the decimal point
6 = Set voltage level. This level is limited by the set value defined in "Safey Limits"
7 = Output current displays in Ampere. The display resolution for current is five digits after the decimal point
8 = Set current level. This level is limited by the set value defined in "Safey Limits"

Operating mode

Different font colors on the screen are used to differentiate the various output status and operating condition of the instrument. It is easy to know and confirm the different output status and operating conditions of the instrument by looking at the colors.

Figure 5-2: Color coding of operating condition

Color	Operating mode	Description
☐	Inactive mode	Display only
■	Editing mode	A solid blue background is shown when an item is selected
■	CV mode	Active outputs are operated in a constant voltage mode

Color	Operating mode	Description
■	CC mode	Active outputs are operated in a constant current mode
■	CR mode	Active outputs are operated in a constant resistance mode. This condition occurs if the set voltage is below the voltage applied externally at the output connectors (sink mode) and constant resistor is switched on in channel menu.

5.2 Using the Touchscreen

The R&S NGL200 provides a touch-sensitive screen which can be disabled (seeChapter 6.5, "User Button Key", on page 59) in the instrument settings. The following illustrates the touchscreen gestures and highlight the different touchscreen features that can be performed on the instrument.

5.2.1 Using Gestures

Tap

Tap on the screen to select or toggle the value.

Swipe up and down

Swipe in the menu to scroll it.

5.2.2 Accessing Functionality in the Home Window

The following illustrates various ways of accessing functions in the home window.

5.2.2.1 Settings Button

The "Settings" button navigates to the main menu window where you can set device or individual channel settings on the instrument.

1. Select the "Settings" button.
   The R&S NGL200 displays main menu window.
2. Select "Device" or respective channel tab ("Channel 1" or "Channel 2") to open the menu.
3. Scroll up or down for the available items in the menu.
4. Select the required item to configure the settings.
5. Select the back arrow key or press [Back] key to close the menu.

Figure 5-3: Navigation on home window>main menu window>channel menu window

5.2.2.2 Voltage and Current Buttons

You can directly change the voltage and current level in the respective channel display area.

1. Select the voltage or current field in the channel display area.
   The R&S NGL200 displays the on-screen keypad to enter value.
2. Set the required value.
   See Chapter 5.2.3, "Input Data", on page 32.
   Note: The value is set within the value configured in the "Safety Limits" dialog.
3. Confirm value by selecting a unit key.
   Alternatively, select the "tick" key to confirm your value.

Figure 5-4: Set voltage and current in home window

5.2.2.3 Expand/Collapse Button

You can expand the selected channel window by using the expand/collapse button. The expand/collapse channel icon changed when toggled.

1. Select the expand/collapse button.
   The R&S NGL200 expands the selected channel window.
2. Select the expand/collapse button to revert to the home window.

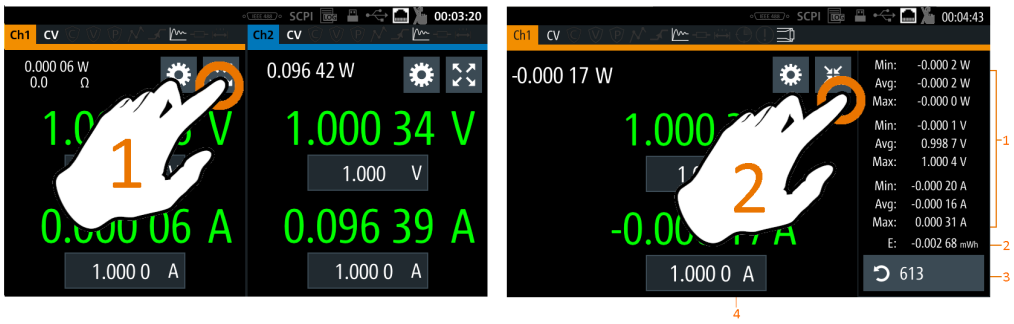


Figure 5-5: Display of channel overview window

1 = Minimum, maximum and average value for power, voltage and current
2 = Calculation of energy result
3 = Number of samples collected
4 = Channel display area of selected channel

5.2.3 Input Data

The R&S NGL200 provides an on-screen keypad for you to enter numerical values. Use the error key on the keypad to position the input of the numerical values.

1. Select a menu item to enter the numeric value.
   The R&S NGL200 displays the on-screen keypad.
2. Enter the required value.

3. Confirm value with the unit key.
   Alternatively, select the "tick" key to confirm your value.

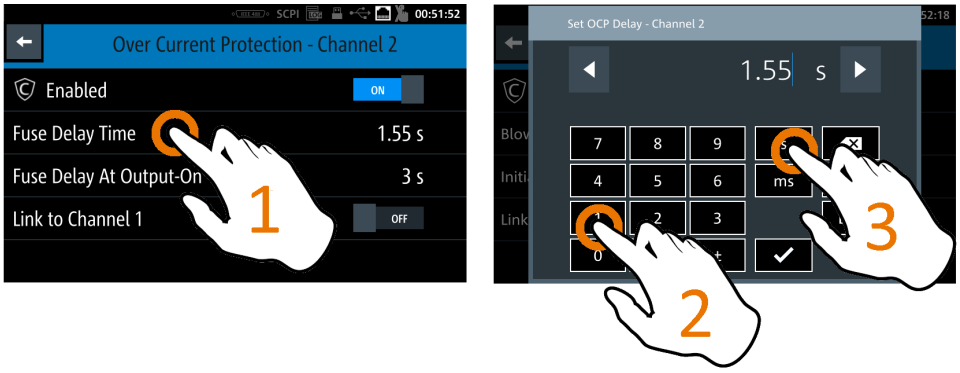


Figure 5-6: Enter numerical value and unit

For alphanumeric input, the on-screen keypad works the same way.

1. Select the arrow key to switch between capital letters and small letters.
   The arrow key toggles between displaying in green and gray.
2. Select "&123" or "ABC" key to switch between alphabet and numeric input data.

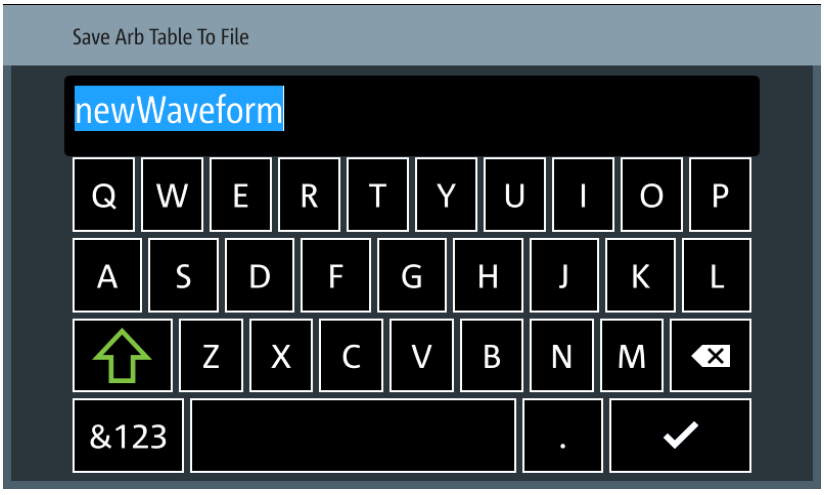


Figure 5-7: Alphanumeric input data

5.3 Front Panel Keys

For an overview of the front panel keys, see Figure 5-1.

5.3.1 Menu Controls

The menu controls keys provide navigation on the available menus in the instrument.

5.3.1.1 Home Button

Navigate to the instrument home window. See Figure 5-1.

5.3.1.2 Settings Button

Navigate to the main menu window which consists of the "Device" menu and up to two channels ("Channel 1", "Channel 2") menu.

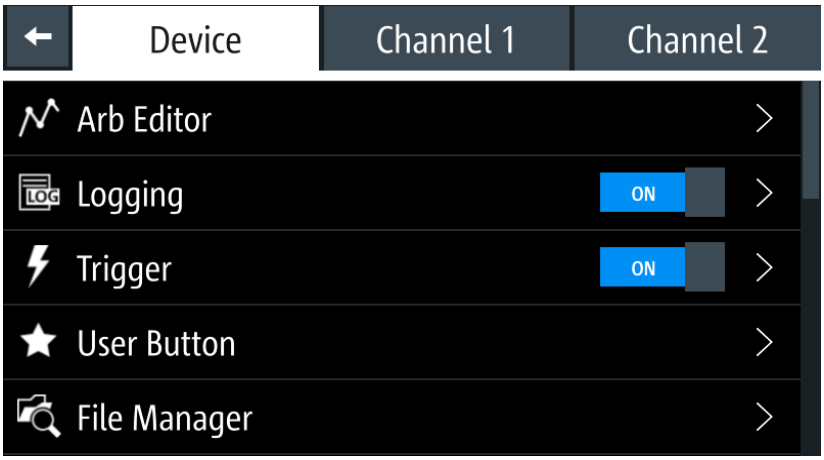


Figure 5-8: Main menu window

Device menu

The "Device" menu provides access to general instrument settings, file arrangement and user button key configuration. You can also obtain the instrument information via the menu.

1. Press [Home] key.
   shortcut
   The R&S NGL200 displays the home window.
2. Select the "Settings" button on Ch1 or Ch2 channel display area.
   Alternatively, press [Settings] key.
3. Select "Device" tab to access device menu.

Menus	Description
"Arb Editor"	Programs the waveform of voltage and current settings for the channel output.
"Logging"	Data logging on the instrument timestamp, voltage and current.
"Trigger"	Activates the trigger source for SCPI command (*TRG).
"User Button"	Configures the shortkey key action (screenshot, trigger, toggle logging, reset statistics, toggle touch).
"File Manager"	File transfer function between instrument internal memory and USB stick.
"Interfaces"	Configures the network (WLAN, Wireless LAN), USB interface and GPIB address
"Screenshot"	Captures screen image of the instrument
"Licenses"	Displays license information and install license options.
"Appearance"	Configures brightness level for screen display and frontpanel keys.
"Sound"	Enables/Disables sound when events occur.
"Data & Time"	Configures date, time and clock format of the instrument.
"Device Infos"	Displays instrument information.
"Update Device"	Performs firmware update on the instrument.
"Save/Recall Device Settings"	File management on the instrument settings. Resets instrument settings with factory default.
"CSV Settings"	Configures the file formatting for CSV file.
"Digital Output"	Configures the output fault, output 1 and output 2.

Channel menu

The "Channel 1" or "Channel 2" menu provides access to settings on channel output, channel trigger conditions and output limit settings.

1. Press [Home] key.
   The R&S NGL200 displays the home window.
2. Select the "Settings" button on Ch1 or Ch2 channel display area.
   Alternatively, press [Settings] key to access "Channel 1" or "Channel 2" menu.

Menus	Description
"Over Current Protection (OCP)"	Configures OCP protection settings ("Blowing Delay", "Initial Delay" and linking channel) for the instrument.
"Over Voltage Protection (OVP)"	Configures OVP protection settings (OVP level) for the instrument.

Menus	Description
"Over Protection Protection (OPP)"	Configures OPP protection settings (OPP power) for the instrument.
"Arbitrary"	Selects the file used in the arbitrary function.
"Ramp"	Configures ramping time apply on the channel output.
"Output"	Configures the output impednace, output delay time before voltage is output on the channel and the trigger action on output when activated.
"Fast Transient Response"	Enables/Disables "Fast Transient Response" function on the channel output.
"Constant Resistance"	Configures the resistance used in the sink mode.
"Safety Limits"	Configures voltage and current limit of the channel output
"Output Delay"	Configures the time of the output delay before voltage is output on the channel.

5.3.1.3 User Button

The [*] key provides a shortcut function to one of the followings: screenshot, trigger, data logging, reset statistics or toggle touchscreen input.

The shortcut key is configurable in the "Device">"User Button" menu. See Chapter 6.5, "User Button Key", on page 59.

5.3.2 Navigation Controls

Navigation in the menu and value settings can be done via rotary knob and [Back] key.

Rotary knob

The rotary knob has several functions depending on the mode it is in.

- Increments (clockwise direction) or decrements (counter-clockwise direction) any kind of numeric value when in editing mode
- Navigates up (clockwise direction) or down (counterclock-wise direction) the menu or menu items when rotated
- When pressed and rotates, the rotary knob navigates along the set voltage or current position in home window.

[Back] key

Using the [Back] key, you can do several things:

- Navigate to the previous menu window.
- Close or discard changes made on the on-screen keypad.
- Close the instrument pop-up messages

5.3.3 Output and Channel Controls

Only applicable for R&S NGL202, these keys control the channel output settings of the instrument.

Function keys	Description
[Ch1], [Ch2]	Selects the respective channel for output.
[Output]	Toggles the selected channel output on or off.

5.4 Power Derating

The NGL202 includes two identical channels with a continuous voltage range of 0 V to 20 V. The instrument provides a source of up to 6 A for voltage below 6 V and 3 A for voltage range from 6 V to 20 V.

Similar to NGL202, the NGL201 provides a single channel wiith an output power of up to 60 W.

Combination of the set voltage and current limit results in the following output performance graph.

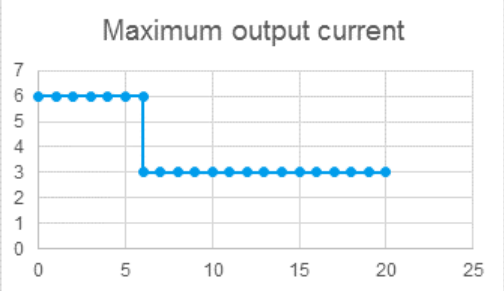


Figure 5-9: Output performance graph

5.5 Output Modes

The R&S NGL200 includes three operating modes, i.e. the constant voltage (CV), constant current (CC) and constant resistance (CR). The instrument switches automatically between CV and CC depending on the connected load. In CR mode, the instrument is not switched automatically into sink more. Instead, the instrument operates in the CR mode (if configured) as soon as it switches from soure mode to sink mode.

CV mode

Figure 5-10 shows that in the range of voltage regulation, the output voltage V_{out} remains constant while the current may increase to its maximum value I_{max} when the connected load is increasing. In CV mode, the font text in the channel display area changes to green.

See Figure 5-2.

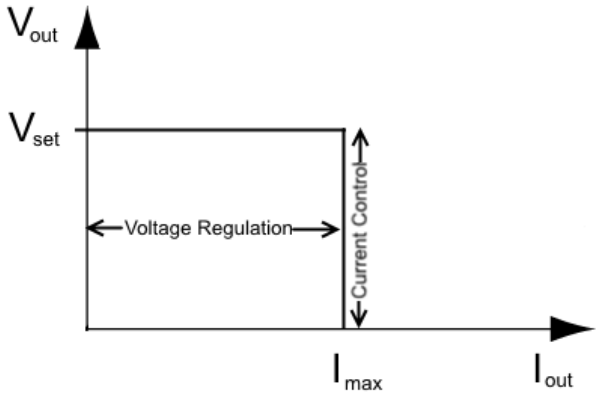


Figure 5-10: Current limit

CC mode

The current I_{max} corresponds to the current setting adjustable in the instrument.

If I_{out} reaches I_{max}, the instrument switches to CC mode, i.e. the output current remains constant and limited to I_{max} even if the load increases. Instead, the output voltage V_{out} decreases to almost zero with a short circuit. In CC mode, the font text in the channel display area changes to red.

See Figure 5-2.

CR mode

To go into CR mode, the R&S NGL200 must operates in sink more where current flows into the instrument and the "Constant Resistance" is enabled.

With "Constant Resistance" enable and configured, the R&S NGL200 can vary the resistance in sink mode, this allows the R&S NGL200 to behave like an electronic load which is useful in battery test application.

In CR mode, the font text in the channel display area changes to cyan. See Figure 5-2.

6 Instrument Functions

6.1 Setting the Channels Voltage and Current

NGL202 comes with two channels and NGL201 comes with single channel.

Toggle the respective channel key ([Ch1],[Ch2]) on the front panel to select these channels. When a channel is selected, the respective channel key illuminates.

Figure 6-1: Ch2 key illuminates when selected

Set output voltage and current

The R&S NGL200 adjust voltage values between 0 V to 20 V with a step size of 1 mV and current values between 0 A to 6 A with a step size of 0.1 mA.

The setting of current value corresponds to the I_{max} of the respective channel. It is advisable to set the current limit prior to operating the instrument to prevent damage to the load and instrument in the case of malfunction like short-circuit.

1. Press [Home] key.
   The R&S NGL200 displays the home window.
2. Set voltage or current in the home window.
   The R&S NGL200 displays an on-screen keypad to set value.
3. Enter the voltage or current value.
   The R&S NGL200 displays the on-screen keypad to enter value.
4. Confirm value with the unit key.
5. Press the channel key ([Ch1] or [Ch2]) on the front panel.
   The selected channel key is illuminated. See Figure 6-1.
6. Press the [Output] key on the front panel.
   The R&S NGL200 output the set voltage of the selected channel and displays the corresponding values in the home window.
   For more information on the output mode, see Chapter 6.2, "Activating the Channels Output", on page 40.

Figure 6-2: Voltage and current settings in the instrument

6.2 Activating the Channels Output

The outputs of all the channels (Ch1, Ch2) can be switched on or off by toggling the [Output] key on the front panel.

By default, the output is turned off when the instrument is switched on. The output is also automatically turned off when no channel is selected. This design prevents a connected load from being damaged unintentionally.

1. Press the required channel keys.
   Selected channel keys (Ch1, Ch2) illuminate.
2. Press [Output] key.
   The R&S NGL200 output the set voltage of the selected channel.
   Depending on the operating mode, the font text in the channel display area shows green when in CV mode, red when in CC mode and blue when in CR mode.
   Note: The R&S NGL200 goes into CR mode when operated in sink mode.
   See Chapter 5.5, "Output Modes", on page 37.

Figure 6-3: Output of Ch2 in CV mode

Multiple outputs can be turned on or off at the same time.

See also Chapter 5.4, "Power Derating", on page 37.

6.2.1 Set Constant Resitance

CR

By enabling the constant resistance (CR) mode, you can operate the R&S NGL200 as an electronic load in sink mode. This allows you to perform testing that requires a constant load resistor in your application.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to apply constant resistance.
   The R&S NGL200 displays the selected channel menu.
3. Select "Constant Resistance" from the menu.
   The R&S NGL200 displays the "Constant Resistance" dialog.
4. Activate the "Enabled" menu item.
   When operates in sink mode condition, the R&S NGL200 displays the "Constant Resistance" icon on the selected channel status bar information.
5. Set the required resistance.
   The R&S NGL200 displays an on-screen keypad to set the value.
6. Confirm value with the unit key (mΩ or Ω).

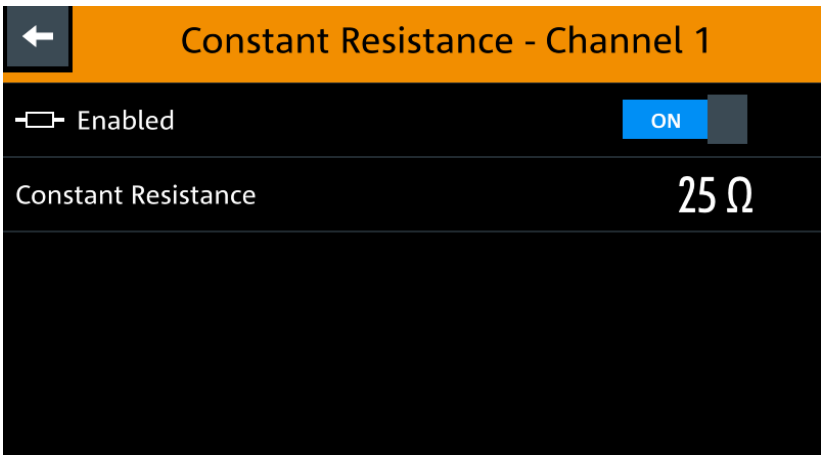


Figure 6-4: Constant resistance dialog

6.2.2 Fast Transient Response

With fast transient response, the R&S NGL200 is able to quickly stabilize the output voltage upon a step change in the load current.

Load transient recovery time is between 30 µs or 100 µs for the output voltage to recover and stay within 20 mV of the nominal output voltage follows by a step change in the load current, typically equal to the full load current rating of the supply.

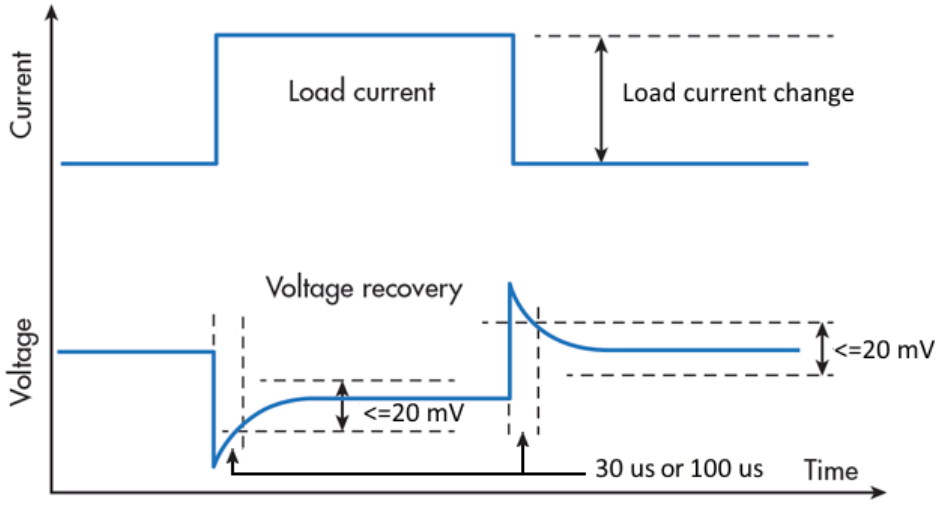


Figure 6-5: Transient response graph

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to apply fast transient response.
   The R&S NGL200 displays the selected channel menu.
3. Activate the "Fast Transient Response" from the menu.

The R&S NGL200 applies the fast transient response on the operating condition and displays the "Fast Transient Response" icon on the selected channel status bar information.

6.2.3 Output

The "Output" dialog provides the settings for output impedance, output delay and trigger action on the output mode.

The output delay is the time taken for the output switches to operating condition after applying the power supply, see "Output delay" on page 44.

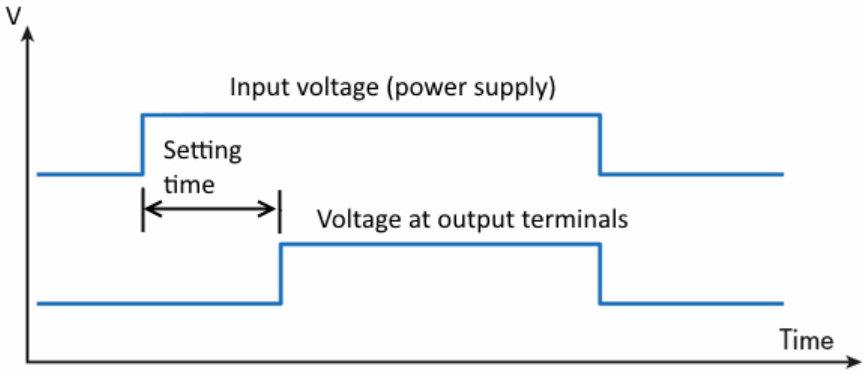


Figure 6-6: Setting time at the output terminals

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to apply output delay.
   The R&S NGL200 displays the selected channel menu.
3. Select "Output" menu item.
   The R&S NGL200 displays the "Output" dialog.

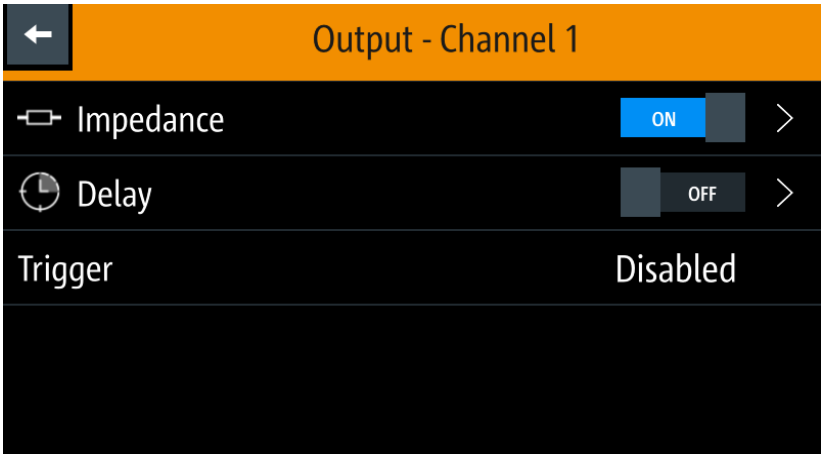


Figure 6-7: Output delay dialog

4. Select the "Impedance", "Delay" and "Trigger" menu items to configure the required values.
   The R&S NGL200 displays an on-screen keypad to set the value for output impedance and output delay.
   For setting trigger mode, the R&S NGL200 displays a "Select Trigger" dialog to set the trigger mode.
   - Disabled: If triggered, the selected output channel is disabled.
   - Output On: If triggered, the selected output channel is turned on.
   - Output Off: If triggered, the selected output channel is turned off.
   - Gated: If triggered, the selected output channel is gated.
5. Activate the "Enabled" menu item to activate the settings for "Impedance" and "Delay".
   The R&S NGL200 displays the "Impedance" and "Delay" icon on the selected channel status bar information.

Output delay

When the instrument output delay is activated, the front panel of the respective channel key (i.e [Ch1], [Ch2]) blinks in green and a "DELAY" red text is displayed at the channel display area of the respective channel. See Figure 6-8.

These operating behaviour resume to normal after the delay time.

Figure 6-8: Delay text at channel display area

6.3 Protection

There are various ways in which the R&S NGL200 protects itself and the connected load from damage due to overvoltage, overcurrent and overpower drawn by the load during testing.

6.3.1 Over Current Protection (OCP)

When the drawn current is exceeding the limit sets in the respective channels, an alert is triggered and the affected channels are turned off according to the settings configured in the OCP dialog.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure OCP.
   The R&S NGL200 displays the selected channel menu.
3. Select "Over Current Protection (OCP)" from the menu.
   The R&S NGL200 displays the "Over Current Protection (OCP)" dialog.

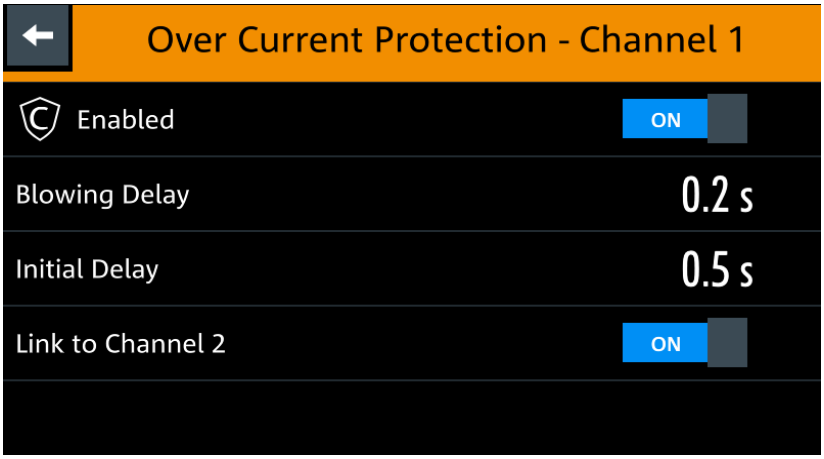


Figure 6-9: Over current protection dialog

4. Activate the "Enabled" menu item.
   The R&S NGL200 enables the OCP and displays the "Over Current Protection (OCP)" icon on the selected channel status bar information.
5. Set the required "Blowing Delay" and "Initial Delay".
   The R&S NGL200 displays an on-screen keypad to set the value.
   a) "Blowing Delay": The time taken to turn off the affected channel after OCP is triggered.
   b) "Initial Delay": The time taken before OCP is put into operation.
6. Confirm value with the unit key (ms or s).
7. Activate the "Link to Channel 2" or "Link to Channel 1" menu item.
   - ON: The linked channel is turned off when an OCP event is triggered.
   - OFF: The linked channel is not affected when an OCP event is triggered.

6.3.2 Over Voltage Protection (OVP)

When the output voltage is exceeding the limit set in the respective channel, an alert is triggered and the affected channel is turned off according to the settings configured in the OVP dialog.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure OVP.
   The R&S NGL200 displays the selected channel menu.
3. Select "Over Voltage Protection (OVP)" from the menu.
   The R&S NGL200 displays the "Over Voltage Protection (OVP)" dialog.

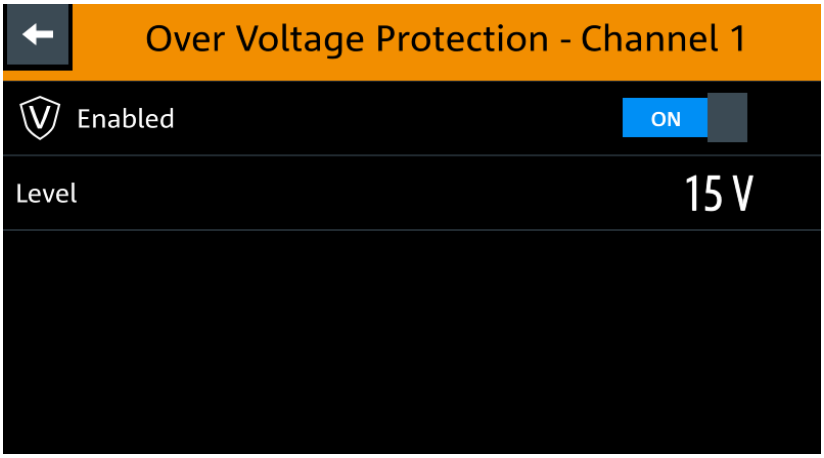


Figure 6-10: Over voltage protection dialog

4. Activate the "Enabled" menu item.
   The R&S NGL200 enables the OVP and displays the "Over Voltage Protection (OVP)" icon on the selected channel status bar information.
5. Set the required level for OVP.
   The R&S NGL200 displays an on-screen keypad to set the value.
6. Confirm value with the unit key (mV or V).

6.3.3 Over Power Protection (OPP)

When the output power is exceeding the limit sets in the respective channels, an alert is triggered and the affected channels are turned off according to the settings configured in the OPP dialog.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure OPP.
   The R&S NGL200 displays the selected channel menu.
3. Select "Over Protection Protection (OPP)" menu item.
   The R&S NGL200 displays the "Over Protection Protection (OPP)" dialog.

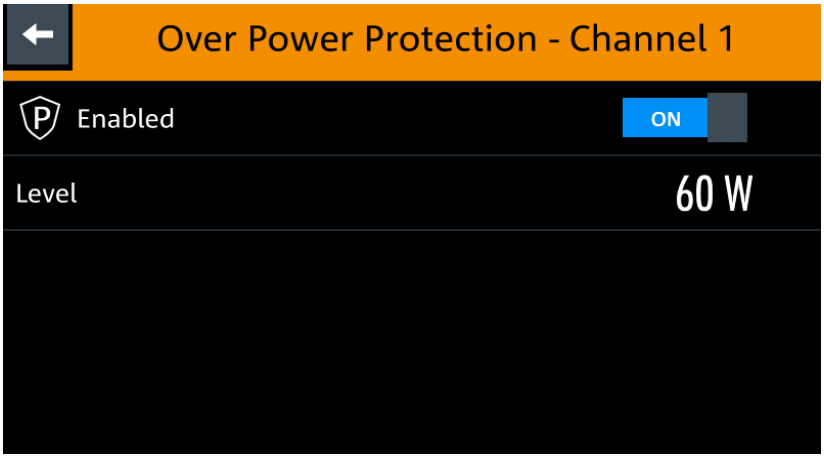


Figure 6-11: Over power protection dialog

4. Activate the "Enabled" menu item.
   The R&S NGL200 enables the OPP and displays the "Over Protection Protection (OPP)" icon on the selected channel status bar information.
5. Set the required level for OPP.
   The R&S NGL200 displays an on-screen keypad to set the value.
6. Confirm value with the unit key (mW or W).

6.3.4 Safety Limits

With safety limits set in the instrument, the range of the output voltage and / or output current can be limited. This prevents inadvertently settings of values dangerous for the connected DUT.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure OPP.
   The R&S NGL200 displays the selected channel menu.
3. Select "Safety Limits" from the menu.
   The R&S NGL200 displays the "Safety Limits" dialog.

Figure 6-12: Safety limits dialog

4. Activate the "Enabled" menu item.
   The R&S NGL200 limits the set voltage and current level and displays the "Safety Limits" icon on the selected channel status bar information.
5. Set the required minimum and maximum voltage and current level.
   The R&S NGL200 displays an on-screen keypad to set the value.
6. Confirm value with the unit key.

6.4 Advanced Features

The "Arbitrary" and "Ramp" are two functions which can be used to control the waveform of voltage and current output.

6.4.1 Arbitrary

The "Arbitrary" dialog allows you to generate freely programmable waveforms which can be reproduced within the Safety Limits for voltage and current.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure arbitrary function.
   The R&S NGL200 displays the selected channel menu.
3. Select "Arbitrary" from the menu.
   The R&S NGL200 displays the "Arbitrary" dialog.

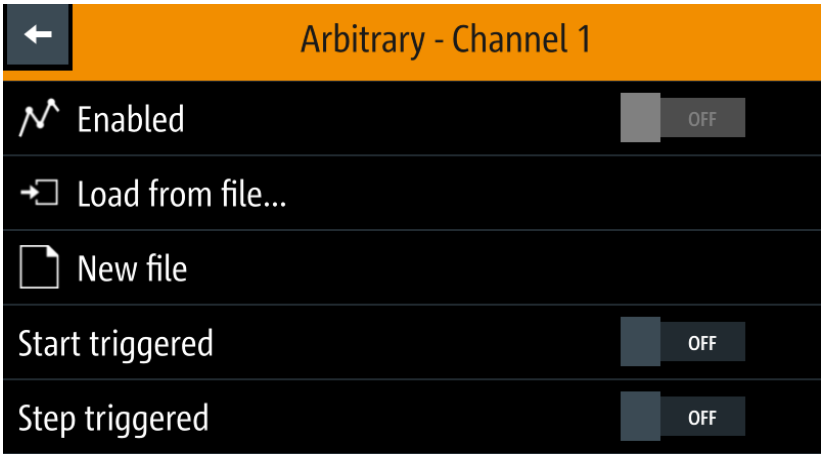


Figure 6-13: Select source and file location

4. Activates the "Enabled" menu item.
   The R&S NGL200 enables the arbitrary function and displays the "Arbitrary" icon on the selected channel status bar information.

5. Selects "Load from file.." to load the arbitrary file.
   The R&S NGL200 opens a dialog to select the source and file location.

6. Selects the required source and file location.
   Alternatively, select "New file" to edit a new arbitrary file. The R&S NGL200 opens the arbitrary editor dialog to edit the arbitrary file.
   See Chapter 6.4.1.1, "Arbitrary Editor", on page 51.

7. Select "Load" to load the selected file.
   The R&S NGL200 loads the selected arbitrary file.

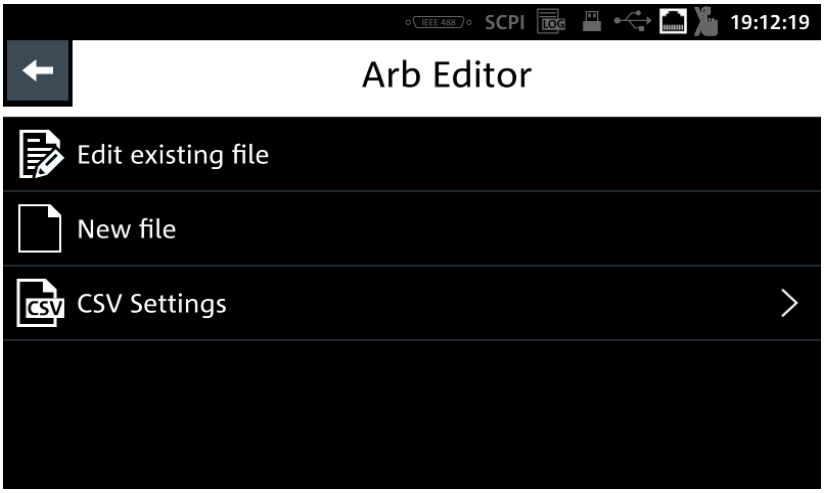
8. Only applicable with R&S NGL-K103, Digital Output option, see Chapter 6.4.3, "Digital I/O", on page 54.
   Activate "Start triggered" or "Step triggered" if the arbitrary function is executed under triggered condition.
   - "Start triggered": If triggered, the complete arbitrary function is executed.

- "Step triggered": If triggered, every arbitrary step needs a trigger signal to execute (note: step time from "Arb Editor" is ignored).

6.4.1.1 Arbitrary Editor

To edit the arbitrary file:

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select "Device" tab to edit the arbitrary file.
   The R&S NGL200 displays the "Device" menu.
3. Select "Arb Editor" from the menu
   The R&S NGL200 displays the "Arb Editor" dialog.



4. Select "Edit existing file" to edit an existing arbitrary file.
   The R&S NGL200 opens a dialog to select the source and file to edit existing file.

5. Select the required source and file for editing.
6. Select "Open" to open the file for editing.
   Alternatively, select "New file" to edit a new arbitrary file.

The R&S NGL200 opens the arbitrary editor dialog to edit the arbitrary file.

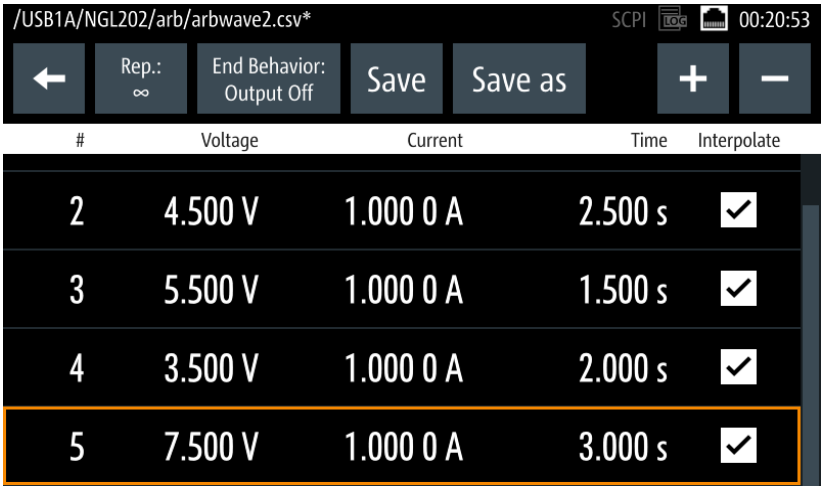
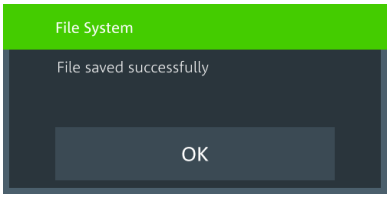


Figure 6-14: Arbitrary editor dialog

7. Configure the "Arb Editor" with the required voltage, current and duration.
   The R&S NGL200 displays the on-screen keypad for data entry.
8. Confirm values with the unit keys.
9. Select the interpolation checklist to toggle on/off the interpolation function on the arbitrary data.
10. Select the "Plus" or "Minus" icon to add or delete the arbitrary data from the dialog.
    - "+": A new row of arbitrary data is added to the end of the table. The new addition is a copy of the last arbitrary data in the table.
    - "-": To delete, select the row of arbitrary data for deletion follows by the "Minus" icon.
11. Set the "Rep" to configure repetition cycle for the arbitrary data.
    By default, the repetition cycle is set to infinity.
12. Set the "End Behavior" to handle the way to end the automation of the arbitrary function.
    - "Off": The output of the selected channel is turned off after performing the arbitrary function.
    - "Hold": The last voltage and current values remains at the output terminal of the instrument.
13. Select "Save" (New file) or "Save as" (Existing file) to save the arbitrary data.
    The R&S NGL200 displays a popup message to shows that file saved successfully.



6.4.2 Ramp

The Ramp function provides you the operating condition to output a constant rise of the supply voltage within a set timeframe. The output voltage can be increased continuously within a 10 ms to 10 s timeframes. See Figure 6-15

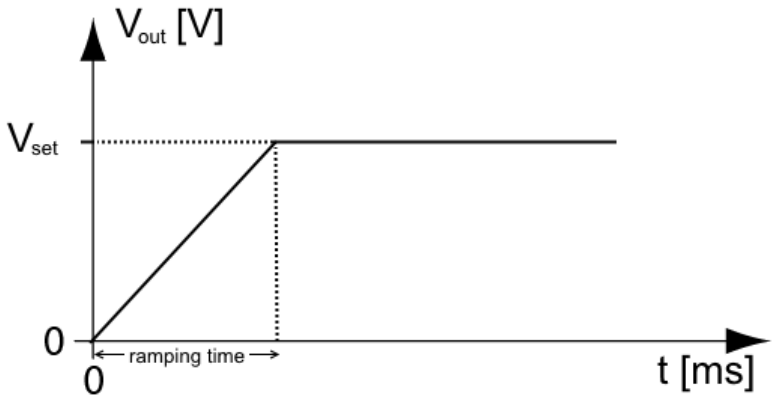


Figure 6-15: Ramping voltage output

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the required channel tab to configure ramp function.
   The R&S NGL200 displays the selected channel menu.
3. Select "Ramp" from the menu.
   The R&S NGL200 displays the "Ramp" dialog.

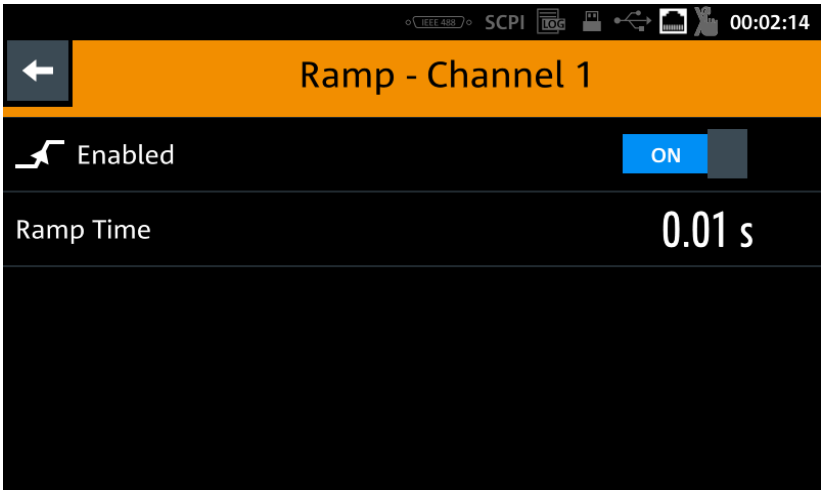


Figure 6-16: Ramp dialog

4. Activate the "Enabled" menu item.
   The R&S NGL200 enables the ramping function and displays the "Ramp" icon on the selected channel status bar information.
5. Enter the required ramping time.
   The R&S NGL200 displays an on-screen keypad to set the value.
6. Confirm value with the unit key.

6.4.3 Digital I/O

CAUTION

Digital I/O Pins Voltage Rating

Do not exceed the maximum voltage rating of the Digital I/O pins (5.25 V max) when supplying voltages to the pins.

R&S NGL-K103 (3652.6385.02) option is required for the Digital I/O signals.
Option is not required for "User Button" and "*TRG" trigger-in signals.

With an optional digital I/O, you can apply a single trigger-in signal and control multi trigger-out signals on the instrument. These trigger-out signals can be used to perform function such as triggering the data logger to record instrument when a channel output is active or protection event is used to trigger the digital out pin, which in turn can be used for fuse linking between two NGLs.

See Figure 6-17 for an overview of the trigger IO system.

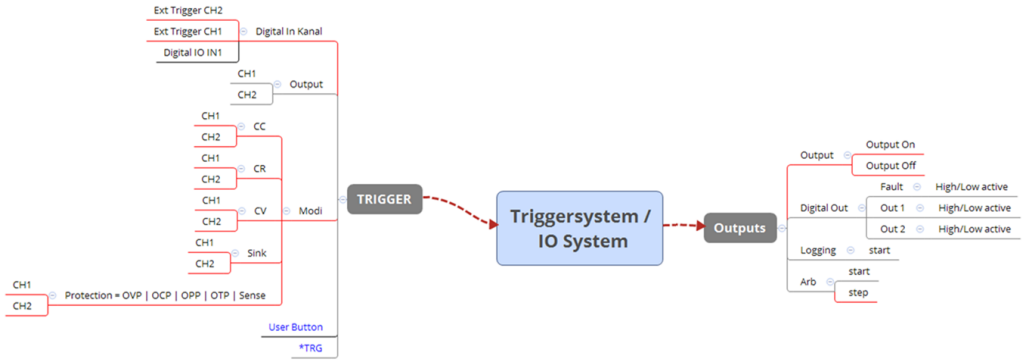


Figure 6-17: Overview of trigger IO system

Red lines = Hardware function
Black line = Software function
Blue = Option is not required for these trigger-in signals

Table 6-1: Trigger-in signals

Trigger-in parameters	Source	Descriptions
Inhibit Ch1 Inhibit Ch2	Pin 1 of DIO connector Pin 2 of DIO connector	If detected, respective channel output is turned off if the inhibit goes active.
Ext trigger Ch1 Ext trigger Ch2	Digital In, pin 2 of DIO connector Digital In, pin 10 of DIO connector	If detected, corresponding trigger-out parameters are triggered. See Table 6-2.
In	Digital In, pin 3 of DIO connector	If detected, corresponding trigger-out parameters are triggered. See Table 6-2.
Output channel 1 Output channel 2	Output	If respective channel output is turned on, corresponding trigger-out parameters are triggered. See Table 6-2.
CC, CV, CR, Protection, Sink	Operation Mode	If respective channel output modes, protection event or sink mode is detected, corresponding trigger-out parameters are triggered. See Table 6-2.
User button *TRG	User button SCPI command (*TRG) remotely send to instrument	If detected, corresponding trigger-out parameters are triggered. See Table 6-2.

Table 6-2: Trigger-out signals

Trigger-out parameters	Trigger conditions	Descriptions
Output channel	Output On Output Off Gated	If a trigger is detected, respective channel output of the instrument turns on or off.
Digital Output Fault	CC, CV, CR, Protection and Sink	If respective channel output modes, protection event or sink mode is detected, a trigger signal is sent out at pin 11 of the DIO connector.
Out 1	Trigger-in signal Output On Ch 1	If detected, a trigger signal is sent out at pin 4 of the DIO connector.
Out 2	Trigger-in signal Output On Ch 2	If detected, a trigger signal is sent out at pin 12 of the DIO connector.
Logging	Trigger-in signal	If detected, the data logger starts recording the instrument.
Arb	Start triggered Stop triggered	If a trigger is detected, respective channel starts as a complete arbitrary signal or steps through the arbitrary signal for every trigger signal detected. The step time from the arbitrary signal is ignored in the case when trigger condition is set as "Stop triggered".

DIO connector

The digital I/O connector is located below the GPIB connector, see Chapter 4.2.1.2, "Rear Panel", on page 21.

The following shows the DIO connector and pins layout of the connector. See Figure 6-18 and Table 6-3.

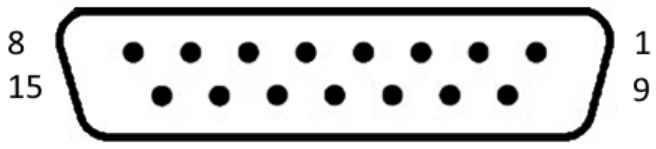


Figure 6-18: DIO connector (female socket front view)

Table 6-3: DIO pin layout

Pin	Signal	Direction	Pin	Signal	Direction
1	Inhibit Ch1	Trigger in signal	9	Inhibit Ch2	Trigger in signal
2	Trigger Ch1	Trigger in signal	10	Trigger Ch2	Trigger in signal
3	In	Trigger in signal	11	Output Fault	Trigger out signal
4	Out1	Trigger out signal	12	Out2	Trigger out signal
5	Gnd	-	13	Gnd	-
6	Gnd	-	14	Gnd	-
7	Gnd	-	15	Gnd	-
8	Gnd	-			

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select "Trigger" menu item to set the trigger-in parameter.
   The R&S NGL200 displays the "Trigger" dialog.

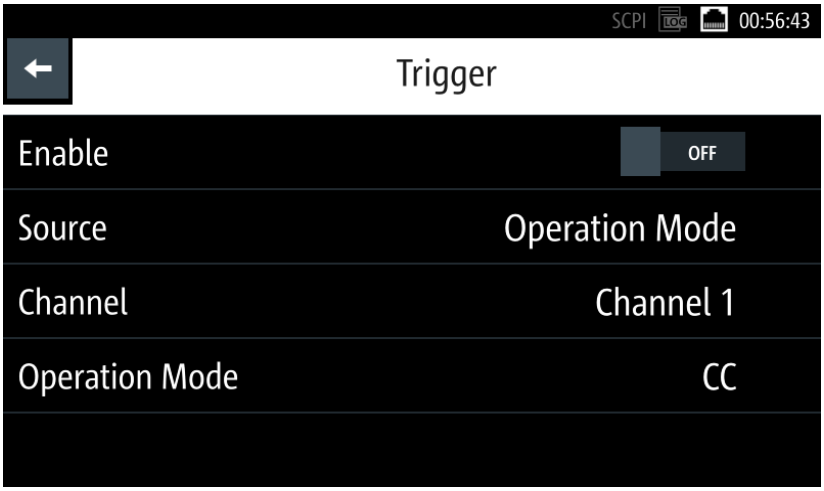


Figure 6-19: An example if Operation Mode is selected as Source

3. Select the "Source" to configure the trigger-in parameter.
   See Table 6-1 for details of the trigger-in parameters.
4. Select "Enable" and set it "On" to enable the trigger-in setting.
5. Select "Back" to go back to "Device" menu.
6. Select "Digital Output" to configure the trigger-out parameter.
   The R&S NGL200 displays the "Digital Output" dialog.

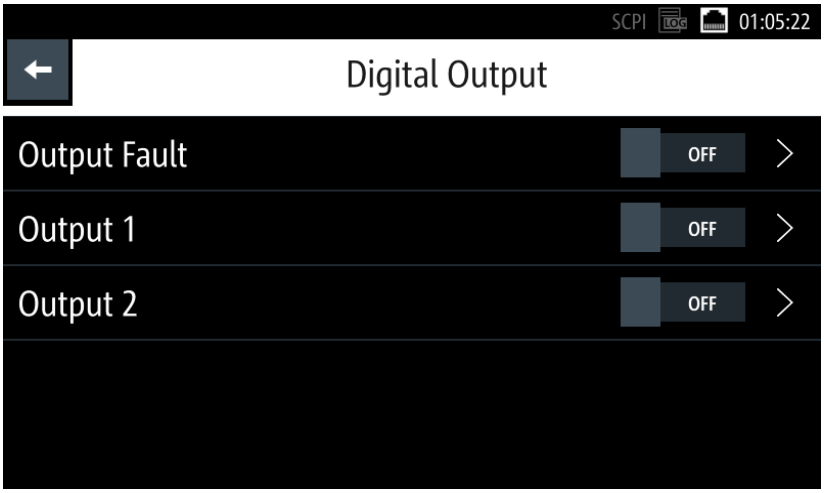


Figure 6-20: Digital Out dialog

7. Depending on your requirement, select the digital output accordingly.
   See Table 6-2 for details of the trigger-out parameters.
8. Select the respective "Digital Output" menu items and set "On" to enable the trigger-out parameters.
9. Select "Back" to go back to "Device" menu.
10. If "User Button" is set as a trigger-in signal, select "User Button" menu item.
    The R&S NGL200 displays the "User Button" dialog.
    See also Chapter 6.5, "User Button Key", on page 59.
11. Select "User Button Action" and set as "Trigger".
    The R&S NGL200 generates a trigger-in signal when user button key is pressed.
12. If "Logging" is set as a trigger-out signal, select "Logging" menu item.
    The R&S NGL200 displays the "Logging" dialog.
    See also Chapter 6.7, "Data Logger", on page 61.
13. Select "Triggered" and set as "On".
    The R&S NGL200 starts the data logging of the instrument when a trigger is detected.
14. If "Arbitrary" is set as a trigger-out signal, select "Arbitrary" menu item from the respective channel menu.
    The R&S NGL200 displays the "Arbitrary" dialog.
    See also Chapter 6.4.1, "Arbitrary", on page 49.
15. Depending on your requirement, select "Start triggered" or "Step triggered" menu item and set "On".
    The R&S NGL200 starts or steps through the arbitrary signal when a trigger is detected.

6.5 User Button Key

The R&S NGL200 allows you to configure the user key action for one of the following functions:

- Screenshot image from instrument
- Instrument trigger function
- Toggle data logging function
- Reset sample count (see index 4 of Figure 5-5)
- Toggle touchscreen function

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" menu tab to configure user key.
   The R&S NGL200 displays the device menu.
3. Select "User Button" from the menu.
   The R&S NGL200 displays the "User Button" dialog.

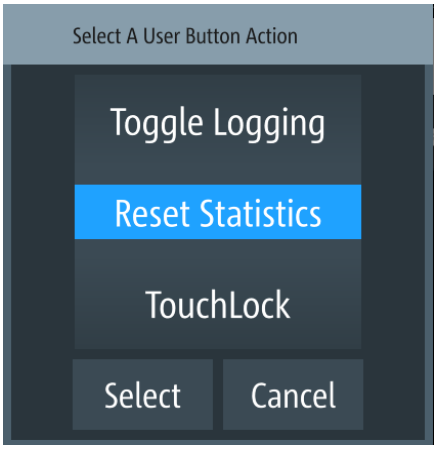


Figure 6-21: User button action

4. Select the "User Button Action" to configure the user key action.
   The R&S NGL200 displays a dialog to configure the user key action.
5. Select the required user key action.
   - "Screenshot": Capture the current screen image of the instrument
   - "Trigger": User button is use to activate the instrument trigger function
   - "Toggle Logging": Enable/Disable the data logger function
   - "Reset Statistics": Reset the sample count parameter in the home window
   - "TouchLock": Enable/Disable the touchscreen function of the instrument
6. Select "Set" to confirm the action.

6.6 Screenshot

With screenshot, you can capture image easily from the instrument. The images can be stored in the USB stick or internal memory of the instrument. By default, the screen images are stored in the USB device under the target folder: `/USB1A/NGL202/screenshot`.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab to configure screenshot file location.
   The R&S NGL200 displays the device menu.
3. Select "Screenshot" from the menu.
   The R&S NGL200 displays the "Screenshot" dialog.

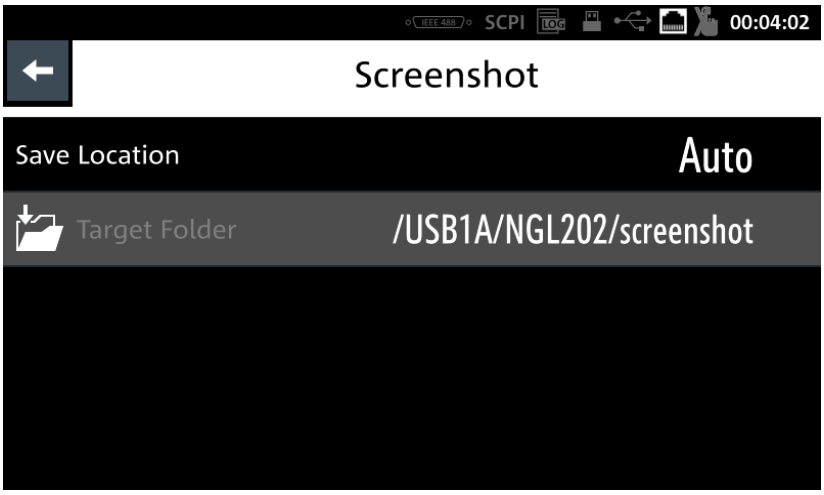


Figure 6-22: Screenshot dialog

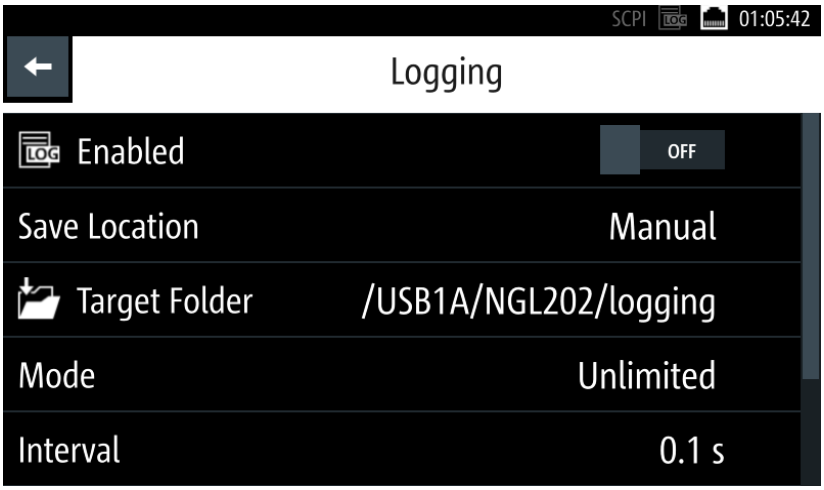
4. Select the "Save Location" to configure the screenshot file location.
   - "Auto": Target folder is set to default file location: `/USB1A/NGL202/screenshot`
   - "Manual": Choice of target folder to default file location or internal memory location at `/int/screenshot`.
5. Select the required save location.
6. Configure the "Target Folder".
   The R&S NGL200 displays the target folder dialog.
   - "USB1A": Target folder is set to `/USB1A/NGL202/screenshot`
   - "int": Target folder is set to `/int/screenshot`
7. Select the required target folder.
8. Select "Set" to confirm the selection.

6.7 Data Logger

When data logging is activated, the R&S NGL200 records the voltage and current data and stores it in the predefined target folder. The data can be stored in the USB stick or in the internal memory. By default, data is stored in the USB device under the target folder: `/USB1A/NGL202/logging`.

The Logging dialog

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab to configure data logger.
   The R&S NGL200 displays the device menu.
3. Select "Logging" from the menu.
   The R&S NGL200 displays the "Logging" dialog.



4. Select the "Save Location" to configure the target folder for the data logger.
   - "Auto": Target folder is set to default file location: `/USB1A/NGL202/logging`
   - "Manual": Choice of target folder to default file location or internal memory location at `/int/logging`.
5. Select the required save location.
   If "Auto" is selected, the target folder is fixed to default file location.
6. Configure the "Target Folder".
   The R&S NGL200 displays the target folder dialog.

Figure 6-23: Target folder dialog

- "USB1A": Target folder is set to `/USB1/NGM202/logging`.
- "int": Target folder is set to `/int/logging`.

7. Set the required target folder.
8. Select "Set" to confirm the selection.
9. Select "Mode" to set logging duration.
   - "Duration": Time taken for data logging with duration and time interval setting.
   - "Span": Time taken for data logging with start time, time interval and duration setting
   - "Unlimited": Data logging with time interval setting. The data logging continuous until function is deactivated.
   - "Count": Data logging with number of counts and time interval setting
10. Depending on the mode selected, configure the required settings for the logging duration.
11. Set the "CSV Settings".
    See Chapter 6.7.1, "CSV Settings", on page 62.
12. Only applicable with R&S NGL-K103, Digital Output option, see Chapter 6.4.3, "Digital I/O", on page 54.
    Activated the "Triggered" if logging of data is to be excuted under triggered conditions.
    If activated, the R&S NGL200 will execute the logging of data when a trigger is detected.
13. Select "Enabled" to activate the file logging function.
    The R&S NGL200 starts the data logging and displays the "data logging" icon at the device status bar information.
    Note: The data logging dialog is not configurable if logging is enabled.

6.7.1 CSV Settings

A CSV file stores tabular data (numbers and text) in plain text. Each line of the file is a data record and each record consists of one or more fields, separated by a file delimiter. The "CSV Settings" provides you ways to format the fields that are stored in the data logging. See Figure 6-24

#Device	NGM202					
#Calibration Ch1	factory					
#Calibration Ch2	factory					
Timestamp	U1[V]	I1[A]	P1[W]	U2[V]	I2[A]	P2[W]
12:51.3	5.1801	0.00161	0.00835	11.0004	0.00059	0.00652;;;;;;;;;;
12:51.4	5.1801	0.0016	0.00831	11.0003	0.0006	0.00665;;;;;;;;;;
12:51.5	5.1801	0.00161	0.00836	11.0004	0.0006	0.00657;;;;;;;;;;
12:51.6	5.1801	0.0016	0.0083	11.0004	0.0006	0.00658;;;;;;;;;;
12:51.7	5.1801	0.00161	0.00832	11.0004	0.00062	0.00679;;;;;;;;;;
12:51.8	5.1801	0.00162	0.00838	11.0003	0.00062	0.00682;;;;;;;;;;
12:51.9	5.1801	0.00161	0.00836	11.0003	0.0006	0.00660;;;;;;;;;;
12:52.0	5.1801	0.00161	0.00835	11.0004	0.0006	0.00662;;;;;;;;;;
12:52.1	5.1801	0.00161	0.00834	11.0004	0.0006	0.00663;;;;;;;;;;
12:52.2	5.1801	0.00162	0.00837	11.0004	0.00062	0.00683;;;;;;;;;;
12:52.3	5.1801	0.00162	0.00838	11.0004	0.00062	0.00686;;;;;;;;;;
12:52.4	5.1801	0.00161	0.00836	11.0004	0.00063	0.00695;;;;;;;;;;
12:52.5	5.1801	0.00161	0.00836	11.0004	0.00062	0.00681;;;;;;;;;;
12:52.6	5.1801	0.00161	0.00834	11.0004	0.00062	0.00683;;;;;;;;;;
12:52.7	5.1801	0.00161	0.00833	11.0004	0.00062	0.00684;;;;;;;;;;
12:52.8	5.1801	0.0016	0.00829	11.0003	0.00062	0.00682;;;;;;;;;;
12:52.9	5.1801	0.00159	0.00825	11.0004	0.00062	0.00683;;;;;;;;;;
12:53.0	nan	nan	nan	nan	nan	nan
12:53.1	nan	nan	nan	nan	nan	nan
12:53.2	nan	nan	nan	nan	nan	nan

Figure 6-24: Sample of data logging

1. Select "CSV Settings" from "Device" menu or "Logging" menu in respective channel menu...
   The R&S NGL200 displays the "CSV Settings" dialog.

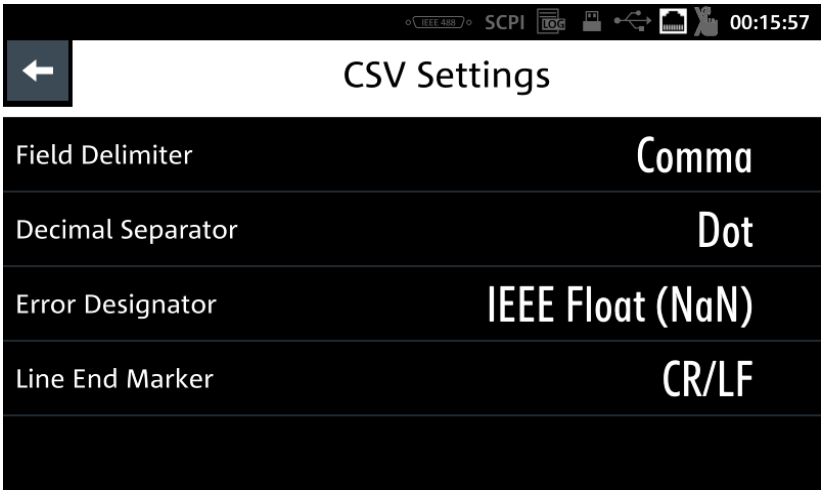


Figure 6-25: CSV settings dialog

2. Set the CSV settings parameters.
   The R&S NGL200 displays the respective dialog for setting the CSV parameters.
   See Table 6-4.

3. Set the required value.
4. Select "Set" to confirm the value.

Table 6-4: CSV settings

CSV Settings	Selective fields in the dialog
Field Delimiter	"Comma", "Semicolon"
Decimal Separator	"Dot", "Comma"
Error Designator	"IEE Float (NaN)", "Empty"
Line End Marker	"CR/LF", "LF"

6.8 File Manager

The "File Manager" provides the files transfer function between USB stick and the internal memory of the instrument. You can copy and delete files in both the USB stick and the internal memory of the instrument.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab to configure file settings for store and recall function.
   The R&S NGL200 displays the device menu.
3. Select "File Manager" from the menu.
   The R&S NGL200 displays the file manager dialog.

Figure 6-26: File manager dialog

4. Select the file that you want to copy or delete.
5. Select the required action in the file manager dialog.
   See Table 6-5.

Table 6-5: File manager action

Action	Description
← Copy	Copy from internal memory to USB.
→ Copy	Copy from USB to internal memory.
Delete	Delete the selected file.

6.9 Store and Recall

Upon power-up, the instrument loads the last stored settings from internal memory location. Auto saved parameters are also applied during startup.

The R&S NGL200 output states of all channels (Ch1, Ch2) are disabled when the recall function is activated.

Auto saved instrument settings

Auto saved of instrument settings are applied when any of the following parameters are changed:

- Chapter 6.11, "General Instrument Settings", on page 73
- USB connection mode
- Ethernet settings

Inaddition of the auto saved instrument settings, the following instrument settings are stored or recalled in the internal memory:

- Set voltage and current level
- Settings in the Protection Function, Safety Limits
- Arbitrary andRamp settings
- User button key function
- Data Logging settings
- GPIB Address

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab to configure file settings for store and recall function.
   The R&S NGL200 displays the device menu.
3. Select "Save/Recall Device Settings".
   The R&S NGL200 loads the "Save/Recall Device Settings" dialog.

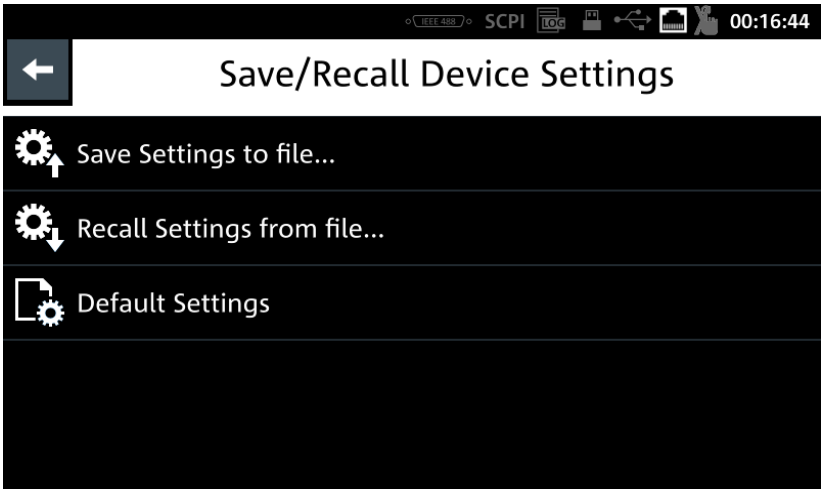
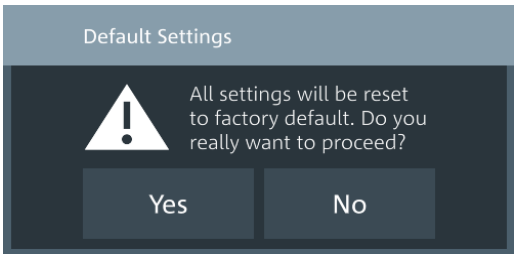


Figure 6-27: Save/Recall device settings dialog

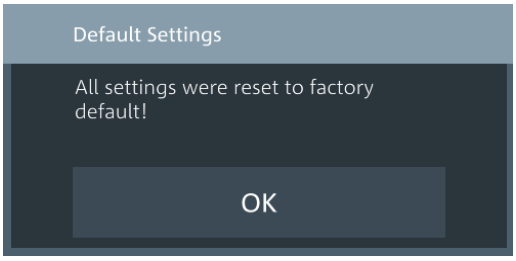
4. Select "Save Settings to file" to save current instrument settings.
   The R&S NGL200 opens a dialog to select source and file location.
   You can save to existing file or create a file for saving.
5. Set the source and file location.
   The R&S NGL200 save the current instrument settings.
6. Similar, you can select "Recall Settings from file." to load instrument settings.
   The R&S NGL200 opens a dialog to select source and file location.
7. Set the source and file location.
   The R&S NGL200 resets the instrument with the loaded instrument settings.

To reset the instrument settings to factory default:

1. Select "Default Settings" from the "Save/Recall Device Settings" dialog.
   The R&S NGL200 displays a popup message.



2. Select "Yes" to overwrite instrument settings to factory default.
   The instrument reset current instrument settings to factory default.
3. The R&S NGL200 displays a popup message to show that all settings are reset to factory default.



6.10 Interfaces

There are various of ways how the R&S NGL200 can be remotely access and controlled.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab to configure network connection.
   The R&S NGL200 displays the device menu.
3. Select "Interfaces".
   The R&S NGL200 displays the "Interfaces" dialog.

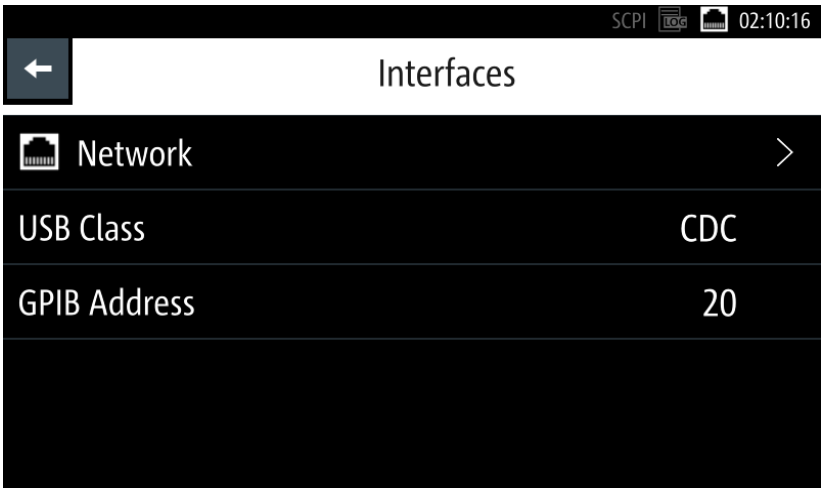


Figure 6-28: Interfaces dialog

4. Select the connected interface (Network, USB Class or GPIB Address) to configure the necessary parameters required.

- Network Connection....68
- USB Connection....71
- GPIB Address....72

6.10.1 Network Connection

There are two methods to establish a local area network (LAN) connection with the R&S NGL200 for remote control operation.

- LAN
- Wireless LAN

1. Select "Network" from the Figure 6-28.
   The R&S NGL200 displays the "Network" dialog.

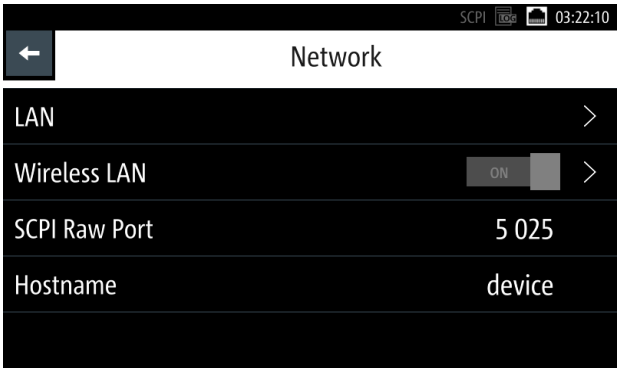


Figure 6-29: Network dialog

2. Set the required "SCPI Raw Port" and "Hostname".
   The R&S NGL200 displays the on-screen keypad to enter the port number and hostname.
   - "SCPI Raw Port": A port number used to open a raw TCP/IP connection to send raw SCPI commands to the instrument
   - "Hostname": The name assigned to the instrument used to identify it in the network

When the connection is alive, the network icon is highlighted in white on the device status bar information.

6.10.1.1 LAN Connection

The R&S NGL200 is equipped with a network interface and can be connected to an Ethernet LAN (local area network). A LAN connection is necessary for remote control of the instrument, and for access from a computer using a web browser.

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.

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

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

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), and a DHCP server is available, all address information can be assigned automatically.
- Otherwise, the address must be set manually. Automatic Private IP Addressing (APIPA) is not supported.

By default, the instrument is configured to use dynamic TCP/IP 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

Risk of network errors

Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the instrument to the LAN. Contact your network administrator to obtain a valid IP address.

1. Connect the LAN cable to the LAN connector at the rear panel of the instrument.
2. Select "LAN" to set LAN connection.
   The R&S NGL200 displays the "Ethernet Settings" dialog.
   Note: The "MAC Address" is fixed.

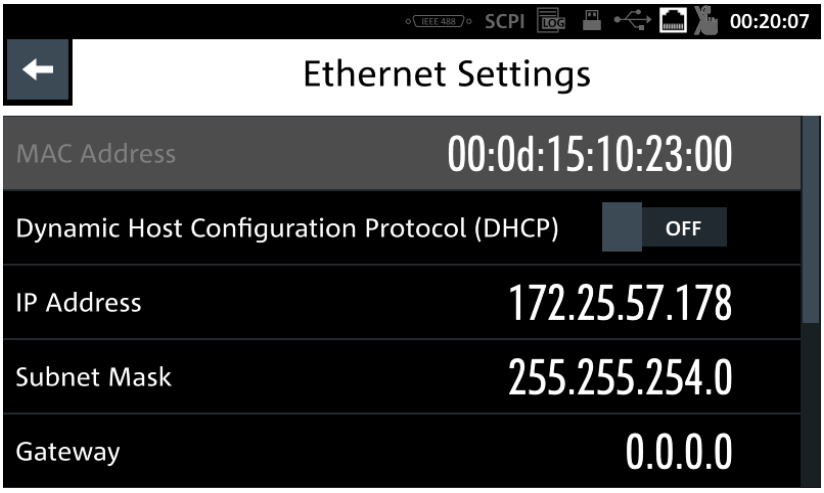


Figure 6-30: Ethernet settings dialog

3. Set the "Dynamic Host Configuration Protocol (DHCP)".

- "ON": Enables DHCP for automatic network parameter distribution and shows the values of the IP Address. By default, the instrument is configured to use dynamic configuration and obtain all address information automatically.
- "OFF": To be used if the network does not support dynamic host configuration protocol (DHCP). The addresses must be set manually.

4. Set the required DHCP mode.
   If DHCP mode is set "OFF", the following "Ethernet Settings" are not required
5. Configure the "IP Address", "Subnet Mask" and "Gateway".
   The R&S NGL200 displays the IP dialog for configuration.

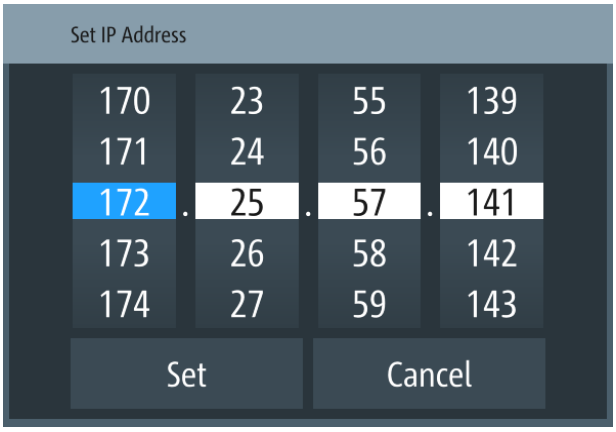


Figure 6-31: IP dialog

6. Set the required IP for "IP Address", "Subnet Mask" and "Gateway"
7. Select "Set" to confirm the value.

6.10.1.2 Wireless LAN Connection

R&S NGL-K102 (3652.6362.02) option is required to connect the R&S NGL200 to a network via wireless LAN connection.

An alterative to connection in local area network is wireless LAN connection. With the presence of an authenticated Wi-Fi signal, the R&S NGL200 automatically connects to a network and navigation can be made via the web browser according to the WLAN IEEE 802.11 b/g/n standards.

1. Select "Wireless LAN" to set LAN connection.
   The R&S NGL200 displays the "Wireless LAN Settings" dialog.

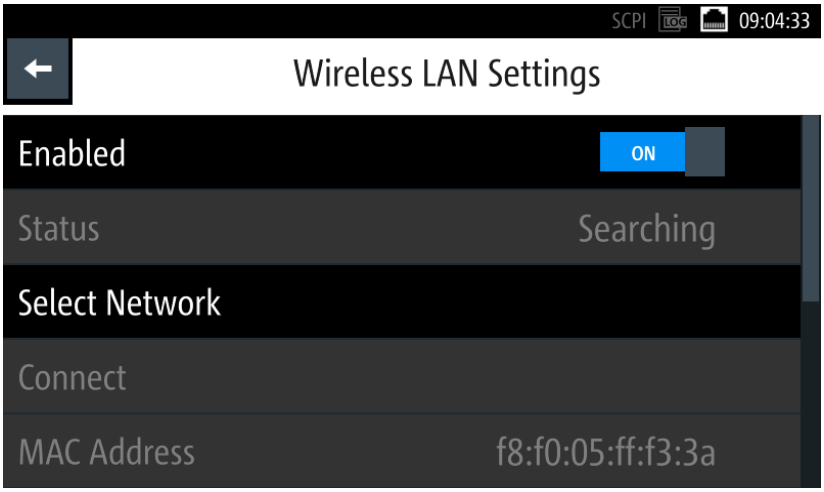


Figure 6-32: WLAN settings dialog

2. Select "Enable" menu item to set "On" to enable wireless LAN.
   The R&S NGL200 began searching available WiFi network and the "Status" shows "Searching".
3. Select the "Select Network" to connect the required WiFi network.
   If connection is successful, the "Status" shows "Connected". See Figure 6-33.
   When the connection is alive, the WLAN icon turns white on the device status bar. See device status bar.

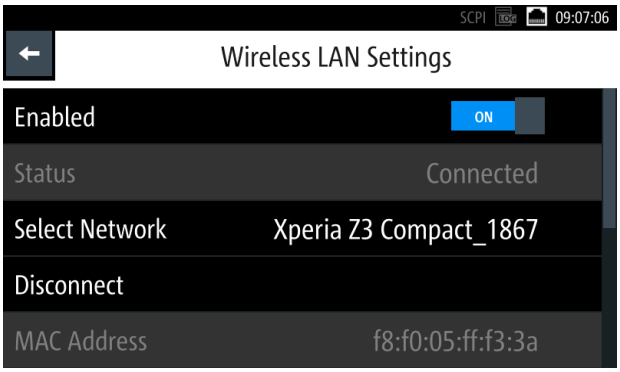


Figure 6-33: WLAN connected

4. To disconnect, select the Disconnect in the "Wireless LAN settings" dialog.

6.10.2 USB Connection

Alternatively, connect a USB cable to the USB port (see Figure 4-3) and PC for a USB connection. The R&S NGL200 supports USB CDC and USB TMC connection.

1. Select "USB Class" from the "Network Connections" dialog.
   The R&S NGL200 displays the USB class dialog to select the USB connection.

Figure 6-34: USB dialog

2. Set the USB class.
3. Select "Set" to confirm the selection.

6.10.3 GPIB Address

R&S NGL-B105 (3652.6356.02) option is required to install for the remote command of R&S NGL200 via GPIB interface.

The GPIB interface, sometimes called the General Purpose Interface Bus (GPIB), is a general purpose digital interface system that can be used to transfer data between two or more devices. Some of its key features are:

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

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 must address the instrument with the GPIB instrument address.

GPIB instrument address

In order to operate the instrument via remote control, it must be addressed using the GPIB address. The default remote control address is factory-set at 20, the addresses of 0 through 30 are allowed.

The GPIB address is maintained after a reset of the instrument settings.

1. Select "GPIB Address" from the Figure 6-28.
   The R&S NGL200 displays an on-screen keypad to set the value.

2. Enter the required value.
3. Confirm value with the enter key

6.11 General Instrument Settings

The following chapters provide the general instrument information and utilities services in "Device" menu.

1. Press [Settings] key.
   The R&S NGL200 displays the main menu window.
2. Select the "Device" tab.
   The R&S NGL200 displays the device menu.

6.11.1 Licenses

Options are enabled by entering a registered license key code.

You may choose to install from an xml file on USB or by manually entering the key code.

► Select "Licenses" to install license key code.
   The R&S NGL200 displays the license dialog.

- Active: Options that are currently active in the instrument
- Inactive: Options that are currently not active in the instrument
- Deactivation: Options that are expried or removed in the instrument

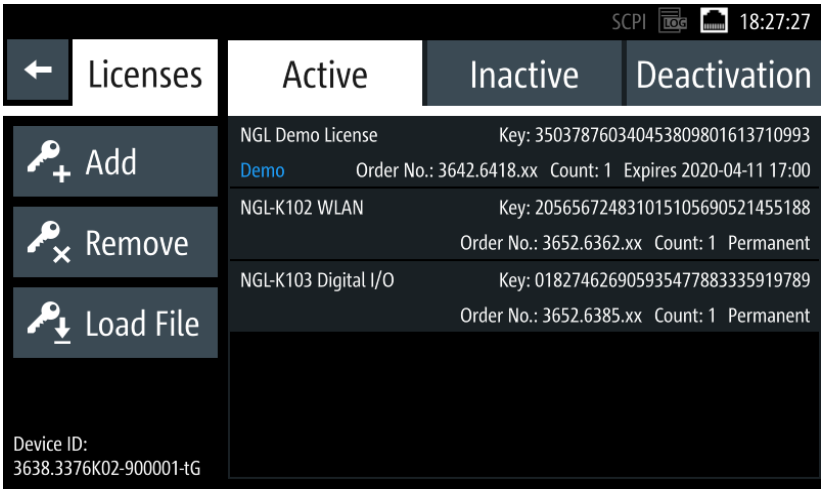


Figure 6-35: License dialog

To install an xml file, proceed as follows:

1. Copy the xml file containing the registered key code into the USB flash drive.
2. Connect the USB flash drive to the USB port of the instrument.
3. Select "Load File" to load the license file from the USB stick.
4. Select the license file to install in the instrument.
   The R&S NGL200 install the license option accordingly.
   If the installation is successful, the option is displayed in the "Active" window.

To manually enter the key code, proceed as follows:

1. Select "Add" key to invoke the license key on-screen keyboard.

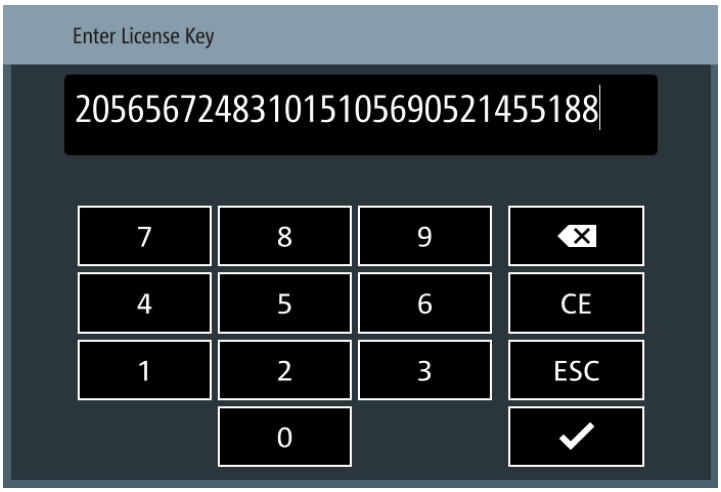


Figure 6-36: License key on-screen keyboard

2. Enter the key code (30-digit number) of the option in the entry box.

3. Confirm entry with the enter key .
   If the correct key code is entered, the R&S NGL200 popup a message "Devicekey is installed" and the option is displayed in the "Active" window.
4. To remove the option, select "Remove" from the license dialog.
   The R&S NGL200 displays the license key on-screen keyboard. See Figure 6-36.
5. Enter the key code (30-digit number) of the option in the entry box.
6. Confirm entry with the enter key .
   If the correct key code is entered, the R&S NGL200 popup a message "Devicekey is removed" and the option is displayed in the "Deactivation" window.

6.11.2 Appearance Settings

► Select the "Appearance" to set display and key brightness.
The R&S NGL200 displays the appearance dialog.

Figure 6-37: Appearance dialog

6.11.3 Sound Settings

1. Select the "Sound Settings" to set sound settings.
   The R&S NGL200 displays the sound settings dialog.

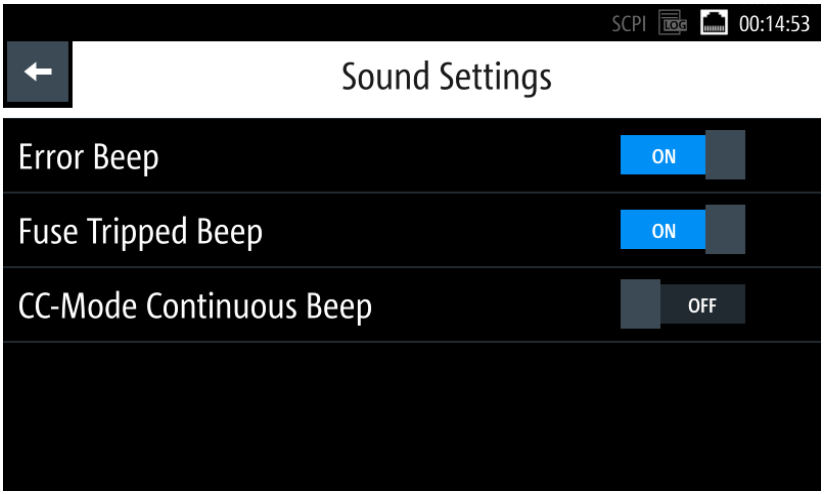


Figure 6-38: Sound settings dialog

2. Select the required fields to set alert.
   - "Error Beep": A single beep alert when error occurs.
   - "Fuse Tripped Beep": A single beep alert when a fuse tripped occurs. See Chapter 6.3, "Protection", on page 45.
   - "CC-Mode Continuous Beep": A continue beep sound alert when the selected output channel go into CC mode. See CC mode.

6.11.4 Date and Time

1. Select the "Date & Time" to set date and time format.
   The R&S NGL200 displays the date and time dialog.

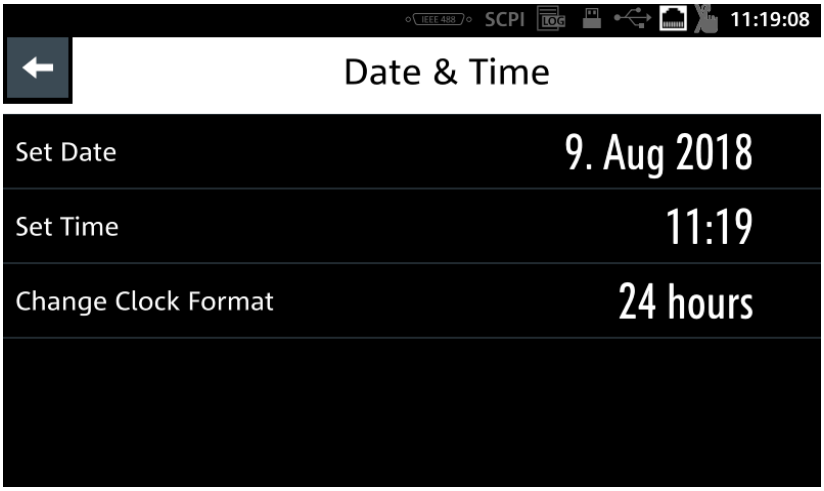


Figure 6-39: Sound settings dialog

2. Select the required field to configure.

The R&S NGL200 reset the instrument date and time accordingly.

6.11.5 Device Information

General instrument information of R&S NGL200.

► Select the "Instrument Information" to display the device information.
The R&S NGL200 displays the device information dialog.

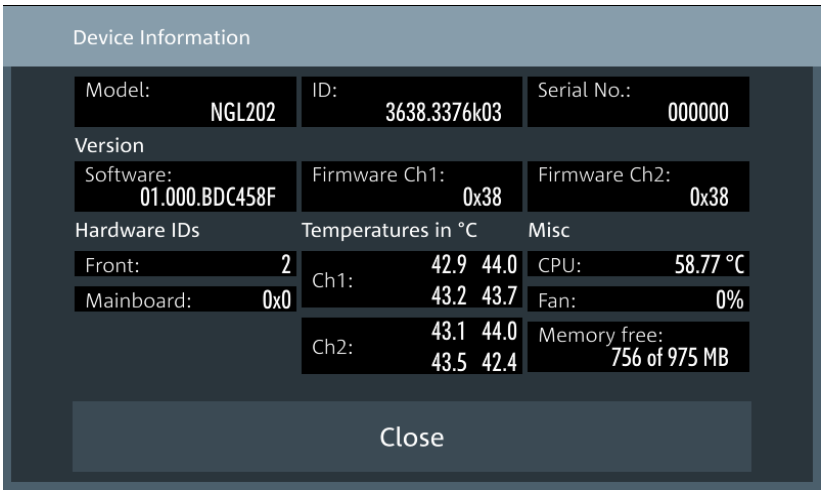


Figure 6-40: Device information dialog

Device information	Description
Model	Model of the instrument, i.e NGL201 or NGL202
ID	Instrument orderable part number.
Serial No.	Unique identification number for the instrument.
Version	Software version that is installed in the instrument.
Hardware IDs	Unique serial number of the front and mainboard of the instrument
Temperatures	Temperature in degree measured in both Ch1 and Ch2. If the temperature exceeded the specification, "Over Temperature Protection" (OTP) is triggered and the respective output terminal is turned off.
Misc	Temperature measures for CPU. Fan speed and memory capacity in the instrument.

6.11.6 Update Device

1. Select the "Update Device" to update instrument firmware.
   The R&S NGL200 displays the update device dialog.

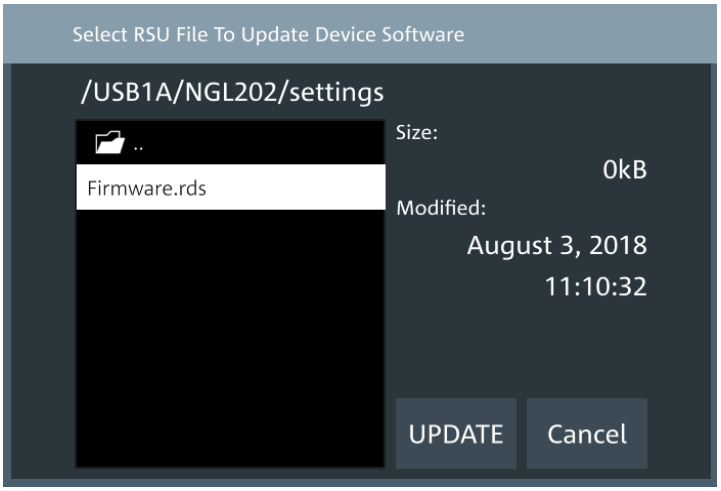


Figure 6-41: Update device dialog

2. Select the source and file location to update instrument firmware.
3. Select "UPDATE" to update the instrument firmware.
   The R&S NGL200 update the instrument firmware accordingly.

7 Remote Control Commands

This chapter provides the description of all remote commands available for the R&S NGL200 series. The commands are sorted according to the menu structure of the instrument. A list of commands in alphabetical order is given in the "List of Commands" at the end of this documentation.

7.1 Common Setting 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.

***CLS**

Clear status

Sets the status byte (STB), the standard event register (ESR) and the `EVENt` part of the `QUEStionable` and the `OPERation` registers 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 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 then sets the register to zero.

Return values:
<Contents> Range: 0 to 255

Usage: Query only

***IDN?**

Identification

Returns the instrument identification.

Return values:
<ID> "Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>"

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 writes a "1" into the output buffer when all preceding commands have been executed, which is useful for command synchronization.

***RST**

Reset

Sets the instrument to a defined default status. The default settings are indicated in the description of commands.

Usage: Setting only

***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.

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

Range: 0 to 255

***STB?**

Status byte query

Reads the contents of the status byte in decimal form.

Usage: Query only

***TRG**

Recall

Triggers all actions waiting for a trigger event. In particular, *TRG generates a manual trigger signal. This common command complements the commands of the `TRIGger` subsystem.

Usage: Event

***TST?**

Self-test query

Initiates self-tests of the instrument and returns an error code.

Return values:

<ErrorCode> **integer > 0 (in decimal format)**
An error occurred.

0
No errors occurred.

Usage: Query only

***WAI**

Wait to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed and all signals have settled (see also command synchronization and `*OPC`).

Usage: Event

***SAV** <Number>

Save

Stores the current instrument settings under the specified number in an internal memory. The settings can be recalled using the command `*RCL` with the associated number.

***RCL** <Number>

Recall

Loads the instrument settings from an internal memory identified by the specified number. The instrument settings can be stored to this memory using the command `*SAV` with the associated number.

7.2 System Settings Commands

The `SYSTem` subsystem contains the commands for general functions, which do not affect signal generation directly.

SYSTem:BEEPer:STATe <Mode>
SYSTem:BEEPer:STATe?

Activates/Deactivates or Queries the beeper tone.

Parameters:

<Mode> 1 | 0

ON
OFF - Control beeper is deactivated.

OFF
ON - Control beeper is activated.

*RST: ON

Example: `SYSTem:BEEPer:STATe ON`
The front panel control beeper is activated.

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

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 NGL display will be disappeared.

Usage: Setting only

SYSTem:REMote

Sets the system to remote state. The front panel control is locked. By pushing the soft-key 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 NGL display. You are only able to unlock the front panel control via SCPI command SYSTem:LOCal.

Usage: Setting only

SYSTem:KEY:BRIGhtness <brightness>
SYSTem:KEY:BRIGhtness?

Sets/Queries the front panel key brightness.

Parameters:

<brightness> Sets the key brightness.

Range: 1.0 to 1.0
Increment: 0.1
*RST: 1.0

Example:
```
SYSTem:KEY:BRIGhtness 1.0
SYSTem:KEY:BRIGhtness? -> 1.0
```
Returns key brightness value: 1.0.

SYSTem:DATE <year>, <month>, <day>
SYSTem:DATE?

Sets/Queries the system date.

Parameters:

<year> Sets year of the date.

<month> Sets month of the date.

<day> Sets day of the date.

Example:
```
SYSTem:DATE 2018, 10, 15
SYSTem:DATE? -> 2018, 10, 15
```
Returns the system date.

SYSTem:TIME <hh>, <mm>, <ss>
SYSTem:TIME?

Sets/Queries the system time.

Parameters:

<hh> Sets the hours of the system time.

<mm> Sets the minutes of the system time.

<ss> Sets the seconds of the system time.

Example:
```
SYSTem:TIME 12, 30, 59
SYSTem:TIME? -> 12, 30, 59
```
Returns system time.

7.3 Display Commands

The `DISPlay` subsystem contains the commands for display functions, which do not affect signal generation directly.

DISPlay:BRIGhtness <brightness>
DISPlay:BRIGhtness?

Sets/Queries the display brightness.

Parameters:

<brightness> Displays brightness for the instrument.

Range: 0.0 to 1.0
Increment: 0.1
*RST: 1.0

Example:
```
DISPlay:BRIGhtness 0.5
DISPlay:BRIGhtness? -> 0.5
```
Returns the display brightness value.

DISPlay[:WINDow]:TEXT:CLEar

Clears the text message box on the front display.

Usage: Setting only

DISPlay[:WINDow]:TEXT[:DATA] <string>

Displays a text message box on the front display.

Setting parameters:

<string> Text message for display.

Example:
```
DISPlay:TEXT "NGL Test"
```

Usage: Setting only

7.4 Trigger Commands

The `TRIGger` subsystem contains the commands for signal triggering.

TRIGger:SLOPe <slope>

Sets/Queries the type of external trigger input.

Parameters:

<slope> POSitive | NEGative

POSitive
Rising edge of the external trigger input.

NEGative
Falling edge of the external trigger input.

Example:
```
TRIGger:SLOPe POSitive
TRIGger:SLOPe? -> POS
```
Queries the type of EXTERNAL trigger input

7.5 Configuration Commands

The following subsystems contain the commands for channel selection, voltage and current settings for the instrument.

7.5.1 Channel Selection

The `INSTrument:Select` subsystem contains the commands for selecting the output channels.

Each channel of the power supply is considered as separate "instrument", which is required by the SCPI standard. Therefore, the SCPI commands use the `INSTRument` node to select a channel.

You can only address the number of channels a device is equipped with, e.g. a maximum of two channels for the R&S NGL202, or one channel for the R&S NGL201.

Example: Selecting a channel

You can select a channel either with an `OUTput` parameter, or just by the channel number. This example lists all ways how you can select and query a selected channel.

```
// ***********************************************
// Select a channel
// ***********************************************
INST OUT1
// selects channel 1
INST?
// queries the channel selection
// response: "OUT1"
// ***********************************************
// Select a channel by its number
// ***********************************************
INST:NSEL 1
// selects channel number 1
INST:NSEL?
// queries number of the channel selection
// response: 1
```

INSTrument:NSELect <channel>
INSTrument:NSELect?

Selects/Queries the channel by number.

Setting parameters:

<channel> 1 | 2 | 3 | 4

Range: 1 to 2

Example: See Example "Selecting a channel" on page 86.

INSTrument[:SELect] <channel>
INSTrument[:SELect]?

Selects/Queries the channel by keyword.

Setting parameters:

<channel> OUT1 | OUTP1 | OUTPut1 | 1 | OUT2 | OUTP2 | OUTPut2 | 2

OUT1 | OUTP1 | OUTPut1 | 1
Channel 1 (Ch1)

OUT2 | OUTP2 | OUTPut2 | 2
Channel 2 (Ch2)

Range: 1 to 2

Example: See Example "Selecting a channel" on page 86.

7.5.2 Voltage Setting

The `SOURce:VOLTage` subsystem contains the commands for setting the voltage of the output channels. The default unit is V.

Example: Configuring the output voltage

This example contains all commands to configure and query the output voltage.

```
// ************************************************
// Select the channel
// ************************************************
INST OUT1
// ************************************************
// Set upper or lower voltage safety limit
// ************************************************
ALIM 1
//sets the safety limits to enable
ALIM?
//queries the safety limits state
//response: "1"
VOLT:ALIM 15
//sets the safety limits for the upper voltage
VOLT:ALIM?
//queries the safety limits for the upper voltage
//reponse: "15.000"
VOLT:ALIM LOW 0
//sets the safety limits for the lower voltage
VOLT:ALIM?
//queries the safety limits for the lower voltage
//reponse: "0.000"
// ************************************************
// Set the voltage value
// ************************************************
VOLT 10
// selects a channel and sets the voltage
VOLT MAX
VOLT MIN
// sets the voltage to maximum or minimum respectively
VOLT?
// queries the output voltage of a channel
// response: "10.000"
// ************************************************
// Query the range of the voltage values
// ************************************************
VOLT? MIN
// reponse: "0.000"
VOLT? MAX
// queries the upper and lower limit of the output voltage
// reponse: "32.050"
// ************************************************
// Increase or decrease the voltage stepwise
// ************************************************
INST OUT1
VOLT:STEP 4
VOLT UP
```

```
// selects the output channel, sets the step width
// and increases the voltage in the selected channel
// by the set 4 Volts
VOLT DOWN
// decreases the voltage in the selected channel
// by the set 4 Volts
VOLT:STEP?
// queries the voltage step size
// repsonse: "4.000"
```

[SOURce:]ALIMit[:STATe] <state>
[SOURce:]ALIMit[:STATe]?

Activates/Deactivates or Queries the safety limit for voltage.

Parameters:

<state> 1 | 0

1
Activates the safety limit for voltage.

0
Deactivates the safety limit for voltage.

Example: See Example "Configuring the output voltage" on page 88.

[SOURce:]VOLTage[:LEVel][:IMMediate]:ALIMit:LOWer <voltage>
[SOURce:]VOLTage[:LEVel][:IMMediate]:ALIMit:LOWer?

Sets/Queries the lower safety limit for voltage.

Setting parameters:

<voltage> numeric | MIN | MAX

numeric
Numeric value for safety limit.

MIN
Min value for lower safety limit.

MAX
Max value for lower safety limit.

Range: 0.000E+00 to 2.000E+01
Increment: 0.001
*RST: 0.000E+00

Example: See Example "Configuring the output voltage" on page 88.

[SOURce:]VOLTage[:LEVel][:IMMediate]:ALIMit[:UPPer] <voltage>
[SOURce:]VOLTage[:LEVel][:IMMediate]:ALIMit[:UPPer]?

Sets/Queries the upper safety limit for voltage.

Setting parameters:

<voltage> numeric | MIN | MAX

numeric
Numeric value for upper safety limit.

MIN
Min value for upper safety limit.

MAX
Max value for upper safety limit.

Range: 0.000E+00 to 2.000E+01
Increment: 0.001
*RST: 2.000E+01

Example: See Example "Configuring the output voltage" on page 88.

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <voltage>
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]?

Sets/Queries the voltage value of the selected channel.

Parameters:

<voltage> numeric | MIN | MAX | UP | DOWN

numeric
Numeric value in V.

MIN
Minimum voltage at 0.000 V.

MAX
Maximumm voltage at 20.000 V.

UP
Increase voltage by a defined step size. See `[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement]` on page 91.

DOWN
Decrease voltage by a defined step size. See `[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement]` on page 91.

Range: 0.000 to 20.00
Default unit: V

Example: See Example "Configuring the output voltage" on page 88.

[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement] <stepsize>
[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement]? [<stepsize>]

Sets/Queries the incremental step size for the `VOLT UP | VOLT DOWN` command.

Setting parameters:

<stepsize> numeric | DEFault

numeric
Step value in V.

DEFault
Default value of stepsize.

Range: 0.001 to 5.000
Increment: 0.001
*RST: 0.100
Default unit: V

Query parameters:

<stepsize> DEFault

Queries the default voltage step size.

Example:

```
INST OUT1
VOLT:STEP 0.001
VOLT:STEP DEF
VOLT:STEP? DEF -> 0.10
```

Returns the default stepsize voltage.
See also Example "Configuring the output voltage" on page 88.

7.5.3 Current Setting

The `SOURce:CURRent` subsystem contains the commands for setting the current limit of the output channels. The default unit is A.

Example: Configuring the current limit

```
// ************************************************
// Select the channel
// ************************************************
INST OUT1
// ************************************************
// Set upper or lower current safety limit
// ************************************************
ALIM 1
//sets the safety limits to enable
ALIM?
//queries the safety limits state
//response: "1"
VOLT:ALIM 6
//sets the safety limits for the upper current
VOLT:ALIM?
//queries the safety limits for the upper current
//reponse: "6.000"
VOLT:ALIM LOW 0.001
//sets the safety limits for the lower current
VOLT:ALIM?
//queries the safety limits for the lower current
//reponse: "0.001"
// ************************************************
// Set the current value
// ************************************************
CURR 2
// selects a channel and sets the current
CURR?
// queries the current of the selected channel
// response: 2.000
// ************************************************
// Query the range of the current values
// ************************************************
CURR? MIN
// reponse: 0.005
CURR? MAX
// reponse: 3.000
// queries the upper and lower limit of the current
// ************************************************
// Increase or decrease the current stepwise
// ************************************************
INST OUT1
CURR:STEP 1
CURR DOWN
// selects the output channel, sets the step width
// and decreases the current in the selected channel
// by the set 1 Ampere
CURR UP
// increases the current in the selected channel
```

```
// by the set 1 Ampere
CURR:STEP?
// queries the current step size
// repsonse: 1.000
```

[SOURce:]CURRent[:LEVel][:IMMediate]:ALIMit:LOWer <current>
[SOURce:]CURRent[:LEVel][:IMMediate]:ALIMit:LOWer?

Sets/Queries the lower safety limit for current.

Setting parameters:

<current> numeric | MIN | MAX

numeric
Numeric value for lower safety limit.

MIN
Min value for lower safety limit.

MAX
Max value for lower safety limit.

Range: 0.001E+00 to 6.000E+00
Increment: 0.001
*RST: 0.001E+00

Example: See Example "Configuring the current limit" on page 92.

[SOURce:]CURRent[:LEVel][:IMMediate]:ALIMit[:UPPer] <current>
[SOURce:]CURRent[:LEVel][:IMMediate]:ALIMit[:UPPer]?

Sets/Queries the upper safety limit for current.

Setting parameters:

<current> numeric | MIN | MAX

numeric
Numeric value for upper safety limit.

MIN
Min value for upper safety limit.

MAX
Max value for upper safety limit.

Range: 0.001E+00 to 6.000E+00
Increment: 0.001
*RST: 6.000E+00

Example: See Example "Configuring the current limit" on page 92.

[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement] <stepsize>
[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement]? [<stepsize>]

Sets/Queries the incremental step size for the `CURR UP | CURR DOWN` command.

Setting parameters:

<stepsize> numeric | DEFault

numeric
Step value in A.

DEFault
Default value of stepsize.

Range: 0.0001 to 2.000
Increment: 0.0001
*RST: 0.010
Default unit: A

Query parameters:

<stepsize> DEFault

Queries the default voltage step size.

Example:

```
INST OUT1
CURR:STEP 0.005
CURR:STEP DEF
VOLT:STEP? DEF -> 0.1000E+00
```

Returns the default stepsize for current.
See also Example "Configuring the current limit" on page 92.

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <current>
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [<current>]

Sets/Queries the current value of the selected channel.

Setting parameters:

<current> numeric | MIN | MAX | UP | DOWN

numeric
Numeric value in the range of 0.000 to 6.000.

MIN
Minimum current at 0.010 A.

MAX
Depending on the set voltage level, the maximum set current is 6.000 A.
For voltage range from 0 V to 6 V, maximum set current is 6 A.
For voltage > 6 V, maximum set currernt is 3 A.

UP
Increase current by a defined step size. See `[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement]` on page 94.

DOWN
Decrease current by a defined step size. See `[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement]` on page 94.

Query parameters:

<current> MIN | MAX

MIN
Return minimum current.

MAX
Return maximum current.

See also Example "Configuring the current limit" on page 92.

7.5.4 Resistance Setting

The `SOURce:RESistance` subsystem contains the commands for setting the resistance limit of the output channels. The default unit is ohms.

Example: Configuring the resistance limit

```
// ***********************************************
// Select the channel
// ***********************************************
INST OUT1
// ***********************************************
// Set the resistance value
// ***********************************************
RES 10
// selects a channel and sets the resistance
RES?
// queries the current of the selected channel
// response: 10.000
// ***********************************************
// Query the range of the resistance values
// ***********************************************
RES? MIN
// reponse: 0.000
RES? MAX
// reponse: 10000
// queries the upper and lower limit of the resistance
// ***********************************************
// Aactivate the constant resistance mode
// ***********************************************
RES:STAT 1
// selects a channel and activate the constant resistance mode
RES:STAT?
// queries the constant resistance mode
// response: 1
```

[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude] <resistance>
[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude]? [<resistance>]

Sets/Queries the constant resistance target value.

Setting parameters:

<resistance> numeric | MIN | MAX | UP | DOWN

numeric
Numeric value in the range of 0.000 to 10000 ohms.

MIN
Minimum resistance at 0.000 ohm.

MAX
Maximumm resistance at 10000 ohms.

UP
Increase resistance by a defined step size.

DOWN
Decrease resistance by a defined step size.

Increment: 0.1 ohms
Default unit: ohms

Query parameters:

<resistance> MIN | MAX

Return minimum or maximum resistance value.

Example: See Example "Configuring the resistance limit" on page 96.

[SOURce:]RESistance:STATe <state>
[SOURce:]RESistance:STATe?

Activates/Deactivates or Queries the constant resistance mode.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Deactivates constant resistance mode.

ON | 1
Activates constant resistance mode.

Example: See Example "Configuring the resistance limit" on page 96

7.5.5 Combined Setting of Voltage and Current Setting

The `APPLy` subsystem provides a command that enables you to set the current and voltage of a channel in one step.

The combined voltage and current setting command takes approximately 100 ms, i.e. longer than the setting of a single value.

APPLy <voltage> [,<current>][,<output>]
APPLy?

Sets/Queries the voltage and current value of the selected channel.

Parameters:

<voltage> numeric | MIN | MAX | DEFault

numeric
Numeric value for voltage in the range of 0.000 to 20.000.

MIN
Min voltage at 0.000 V.

MAX
Max value for voltage at 20.000V.

DEFault
Default voltage.

*RST: 1.000
Default unit: V

<current> numeric | MIN | MAX | DEFault

numeric
Numeric value for current in the range of 0.000 to 6.000.

MIN
Min current at 0.000 A.

MAX
Max value for current at 6.000 A.

DEFault
Numeric value for current.

*RST: 1.000
Default unit: A

<output> OUT1 | OUTP1 | OUTPut1 | OUT2 | OUTP2 | OUTPut2

OUT1 | OUTP1 | OUTPut1
Output for channel 1

OUT2 | OUTP2 | OUTPut2
Output for channel 2

Example:
```
INST OUT1
APPL 6,2
```
Sets the output of channel 1 to 6 V and 2 A
```
APPL? -> 6.000, 2.000
```
Queries the voltage and current of the selected channel.

7.5.6 Output Setting

The `OUTPut` subsystem contains the commands for activating the output channels.

Example: Activating the channels

You can activate a selected channel and turn on or off the outputs either individually or all outputs simultaneously. This example lists all ways how you can activate and query the outputs.

```
// ***********************************************
// Activate a channel
// ***********************************************
INST OUT1
OUTP:SEL 1
// activates the selected channel
OUTP 1
// activates channel 1 and its output
OUTP?
// queries the output state
// response: 1
// ***********************************************
// Turn on all selected channels simultaneously
// ***********************************************
INST:OUT1
VOLT 12
CURR 0.1
OUTP:SEL 1
INST:OUT2
VOLT 12
CURR 0.2
OUTP:SEL 1
// selects channels 1 and 2
// sets the voltage and current values for both channels
// activates both channels
OUTP:GEN 1
// turns on the output of both channels
```

OUTPut:GENeral[:STATe] <state>
OUTPut:GENeral[:STATe]?

Switches ON/OFF or queries all previous selected channels simultaneously

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Switches off previous selected channels simultaneously.

ON | 1
Switches on previous selected channels simultaneously.

Example: See Example "Activating the channels" on page 99

OUTPut[:STATe] <state>
OUTPut[:STATe]?

Switches ON/OFF or queries the output of the previous selected channels.

Parameters:
<state> OFF | ON | 0 | 1

OFF | 0
Switches off previous selected channels.

ON | 1
Switches on previous selected channels.

Example: See Example "Activating the channels" on page 99

OUTPut:DELay:DURation <duration>
OUTPut:DELay:DURation?

Sets/Queries the duration for output delay.

Parameters:
<duration> numeric | MIN | MAX

numeric
Numeric value of the duration in seconds.

MIN
Minimum value of the duration at 0.001 seconds.

MAX
Maximum value of the duration at 10.00 seconds.

Range: 0.001 to 10.00
*RST: 0.001
Default unit: s

Example:
```
OUTPut:DELay:DURation 1
OUTPut:DELay:DURation? -> 1
```
Return output delay of 1 s.

OUTPut:DELay[:STATe] <state>
OUTPut:DELay[:STATe]?

Activates/Deactivates or queries the output delay for the selected channel.

Parameters:
<state> OFF | ON | 0 | 1

OFF | 0
Deactivates output delay for the selected channel.

ON | 1
Activates output delay for the selected channel.

Example:
```
OUTPut:DELay 1
OUTPut:DELay? -> 1
```
Return output delay state as on.

OUTPut:FTResponse <state>
OUTPut:FTResponse?

Activates/Deactivates or queries the fast transient response.

Parameters:
<state> OFF | ON | 0 | 1

OFF | 0
Deactivates fast transient response.

ON | 1
Activates fast transient response.

Example:
```
OUTPut:FTResponse 1
OUTPut:FTResponse? -> 1
```
Return fast transient response state as on.

OUTPut:IMPedance <resistance>
OUTPut:IMPedance?

Outputs/Queries source impedance for the signal specified in ohms.

Parameters:
<arg0> numeric | MIN | MAX | DEFault

numeric
Numeric value of the impedance ohm.

MIN
Minimum value of the impedance at -0.05 ohms.

MAX
Maximum value of the impedance at 100 ohms.

DEF
Default value of the impedance at 0 ohms.

*RST: 0
Default unit: ohm

Example:
```
OUTPut:IMPedance 1
OUTPut:IMPedance? -> 1
```
Return output impedance of 1 ohm.

OUTPut:IMPedance:STATe <state>
OUTPut:IMPedance:STATe?

Activates/Deactivates or Queries the impedance target for the selected channel.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Deactivates output impedance for the selected channel.

ON | 1
Activates output impedance for the selected channel.

Example:
```
OUTPut:IMPedance 1
OUTPut:IMPedance:STAT? -> 1
```
Return output impedance state as on.

OUTPut:SELect <state>
OUTPut:SELect?

Activates/Deactivates or Queries the selected channel.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Deactivates the selected channel.

ON | 1
Activates the selected channel.

*RST: OFF | 0

Example: See Example "Activating the channels" on page 99

7.5.7 Fuse Setting

The FUSE subsystem contains the commands for activating fuses and setting fuse parameters of the output channels.

The delay function of the fuses takes effect when the corresponding channel is activated (Output On).

Example: Configuring fuses

This example contains all commands to configure and query the fuse states and settings.

```
// ***********************************************
// Activate a fuse
// ***********************************************
INST OUT1
FUSE 1
```

```
// selects a channel and activates the fuse
FUSE?
// queries the state of the fuse in the selected channel
// response: 1
// ************************************************
// Set a delay time for the fuse. The delay time
// takes effect when the channel output is turned on.
// ************************************************
FUSE:DEL 50
// sets 50 ms delay for the fuse and
// turns on the output of the channel
FUSE:DEL?
// queries the currently set delay time of the fuse
// in the selected channel
// response: 50
FUSE:DEL MAX
FUSE:DEL MIN
// sets the delay time to maximum, minimum respectively
// ************************************************
// Query the range of the fuse delay time
// ************************************************
FUSE:DEL? MIN
// response: 0
FUSE:DEL? MAX
// queries the upper and lower limit of the
// fuse delay time in ms
// response: 10000

// ************************************************
// Set a initial delay time for the fuse. During
// the timefrane, fuse tripping is inhibited.
// ************************************************

FUSE:DEL:INIT 100
// sets 100 ms for the initial fuse delay
FUSE:DEL:INIT?
// queries the currently set initial fuse delay
// in the selected channel
// response: 100
FUSE:DEL:INIT MAX
FUSE:DEL:INIT MIN
// sets the initial fuse delay to maximum, minimum respectively
// ************************************************
// Query the range of the fuse delay time
// ************************************************
FUSE:DEL? MIN
// response: 10
FUSE:DEL? MAX
// queries the upper and lower limit of the
// fuse delay time in ms
```

```
// response: 60000

// ***********************************************
// Link the electronic fuses of the channels logically
// ***********************************************
INST OUT1
FUSE:LINK 2
// links the fus e of channel 1 with channel 2
FUSE:LINK?2
// queries the combined fuses of the selected channel

// ***********************************************
// Unlink linked fuse
// ***********************************************
FUSE:UNLink 2
FUSE:LINK?2
// queries the combined fuses of the selected channel
//response 0
```

FUSE:DELay:INITial <delay>
FUSE:DELay:INITial?

Sets/Queries an initial delay time for the fuse to take effect.

Parameters:

<delay> numeric | MIN | MAX

numeric
Numeric value for linitial fuse delay.

MIN
Min value for lowe linitial fuse delay.

MAX
Max value for linitial fuse delay.

Range: 0.00 to 60.00
*RST: 0
Default unit: s

Example: See Example "Configuring fuses" on page 102.

FUSE:DELay[:BLOWing] <delay>
FUSE:DELay[:BLOWing]?

Sets/Queries a delay time for the fuse to take effect.

Parameters:

<delay> numeric | MIN | MAX

numeric
Numeric value for the linitial fuse delay.

MIN
Min value for linitial fuse delay.

MAX
Max value for linitial fuse delay.

Range: 0.00 to 10.00
*RST: 0
Default unit: s

Example: See Example "Configuring fuses" on page 102.

FUSE:LINK <arg0>
FUSE:LINK? <arg0>

Sets/Queries the fuses of several serlected channels (fuse linking).

Parameters for setting and query:

<arg0> 1 | 2 | 3 | 4

Example:
```
INST OUT1;:FUSE:LINK 2
```
Channel 2 is linked with channel 1
```
INST OUT1;:FUSE:LINK?2
```
Return 1 if channel 1 is linked with channel 2
See Example "Configuring fuses" on page 102.

FUSE:TRIPped?

Queries the status if fuse has tripped in the selected channel.

Parameters:

<State> OFF | ON | 0 | 1

ON | 1
Fuse is tripped.

OFF | 0
Fuse is not tripped.

Example: See Example "Configuring fuses" on page 102.

Usage: Query only

FUSE:UNLink <channel>

Dissolves linked fuses.

Parameters:
<channel> 1 | 2 | 3 | 4

Example: See Example "Configuring fuses" on page 102.

Usage: Setting only

FUSE[:STATe] <state>
FUSE[:STATe]?

Sets/Queries the fuse function in the selected channel.

Parameters:
<state> OFF | ON | 0 | 1

ON | 1
Fuse function is activated.

OFF | 0
Fuse function is not activated.

Example: See Example "Configuring fuses" on page 102.

7.5.8 OVP Setting

The `VOLTage:PROTection` subsystem contains the commands for setting the overvoltage protection parameters for the output channels. The default unit is V.

Example: Configuring the overvoltage protection

```
// ***********************************************
// Set the overvoltage protection value
// ***********************************************
INST OUT1
VOLT:PROT 1
//activates the OVP of the previous selected channel
VOLT:PROT:LEV 5
// selects a channel and sets the OVP
VOLT:PROT:LEV?
// queries the output overvoltage value of a channel
// response: 5
VOLT:PROT?
// queries the OVP state of the previous selected channel
// response: 1
VOLT:PROT:LEV MAX
VOLT:PROT:LEV MIN
// sets the overvoltage protection to maximum,
// or minimum respectively
// ***********************************************
// Query the range of the overvoltage protection values
// ***********************************************
VOLT:PROT:LEV? MIN
// reponse: 0.100
VOLT:PROT:LEV? MAX
// queries the upper and lower limit
// reponse: 20.000
// ***********************************************
// Query a tripped overvoltage protection
// ***********************************************
INST OUT1
VOLT:PROT:TRIP?
// queries whether the OVP in channel 1 has tripped
// response: 1 OVP is tripped
// response: 0 OVP is not tripped
VOLT:PROT:CLEar
// resets a tripped OVP in the selected channel
// ***********************************************
// Set the overvoltage protection mode
// ***********************************************
INST OUT1
VOLT:PROT:MODE PROT
// sets OVP protected mode for channel1
VOLT:PROT:MODE PROT?
// queries the OVP mode
// repsonse: "protected"
```

[SOURce:]VOLTage:PROTection[:STATe] <state>
[SOURce:]VOLTage:PROTection[:STATe]?

Sets/Queries the OVP state of the previous selected channel.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
OPP is deactivated

ON | 1
OPP is activated

Example: See Example "Configuring the overvoltage protection" on page 107.

[SOURce:]VOLTage:PROTection:CLEar

Resets the OVP state of the selected channel. If an OVP event has occurred before, the reset also erases the message on the display.

Example: See Example "Configuring the overvoltage protection" on page 107.

Usage: Event

[SOURce:]VOLTage:PROTection:LEVel <voltage>
[SOURce:]VOLTage:PROTection:LEVel?

Sets/Queries the overvoltage protection value of the selected channel.

Parameters:

<voltage> numeric | MIN | MAX

numeric
Numeric value for the overvoltage protection value in V.

MIN
Minimum value for the overvoltage protection value at 0.00 V.

MAX
Maximum value for the overvoltage protection value at 20.00 V.

Range: 0.000 to 20.00
*RST: 20.00
Default unit: V

Example: See Example "Configuring the overvoltage protection" on page 107.

[SOURce:]VOLTage:PROTection:MODE <mode >
[SOURce:]VOLTage:PROTection:MODE?

Sets/Queries the OVP mode for the previously selected channel.

Parameters for setting and query:

<mode> MEASured | PROTected

MEASured
The OVP turns off if the measured value exceeds the threshold.

PROTected
If the adjusted threshold is exceeded, you cannot turn on the output of the instrument. In addition, the measured value is monitored.

Example: See Example "Configuring the overvoltage protection" on page 107.

[SOURce:]VOLTage:PROTection:TRIPped? <state>

Queries the OVP state of the selected channel.

Example: See Example "Configuring the overvoltage protection" on page 107.
`VOLT:PROT:TRIP?`
Response 1, the OVP is tripped.
Response 0, the OVP is not tripped.

Usage: Query only

7.5.9 OPP Setting

The POWer:PROTection subsystem contains the commands for setting the overpower protection parameters for the output channels. The default unit is W.

Example: Configuring the overpower protection

```
// ***********************************************
// Set the overpower protection value
// ***********************************************
INST OUT1
POW:PROT 1
//activates the OPP of the previous selected channel
POW:PROT:LEV 5
// selects a channel and sets the OPP
POW:PROT:LEV?
// queries the output overvoltage value of a channel
// response: 5
POW:PROT?
// queries the OPP state of the previous selected channel
// response: 1
POW:PROT:LEV MAX
POW:PROT:LEV MIN
// sets the overvoltage protection to maximum,
// or minimum respectively
// ***********************************************
// Query the range of the overpower protection values
// ***********************************************
POW:PROT:LEV? MIN
// reponse: 0.100
POW:PROT:LEV? MAX
// queries the upper and lower limit
// reponse: 100.000
// ***********************************************
// Query a tripped overpower protection
// ***********************************************
INST OUT1
POW:PROT:TRIP?
// queries whether the OPP in channel 1 has tripped
// response: 1 OPP is tripped
// response: 0 OPP is not tripped
POW:PROT:CLEar
// resets a tripped OPP in the selected channel
```

[SOURce:]POWer:PROTection[:STATe] <state>
[SOURce:]POWer:PROTection[:STATe]?

Sets/Queries the OPP state of the previous selected channel.

Parameters:
<state> OFF | ON | 0 | 1

OFF | 0
OPP is deactivated

ON | 1
OPP is activated

Example: See Example "Configuring the overpower protection" on page 110.

[SOURce:]POWer:PROTection:CLEar

Resets the OPP state of the selected channel. If an OPP event has occurred before, the reset also erases the message on the display.

Example: See Example "Configuring the overpower protection" on page 110.

Usage: Event

[SOURce:]POWer:PROTection:LEVel <power>
[SOURce:]POWer:PROTection:LEVel?

Sets/Queries the overvoltage protection value of the selected channel.

Parameters:
<power> numeric | MIN | MAX | DEFault

numeric
Numeric value of the power protection level in watts.

MINimum
Minimun value of the power protection level at 0.00 W.

MAXimum
Maximum value of the power protection level at 60.00 W.

Range: 0.00 to 60.00
*RST: 60.00
Default unit: W

[SOURce:]POWer:PROTection:TRIPped?

Queries the OPP state of the selected channel.

Example: See Example "Configuring the overvoltage protection" on page 107.
`POW:PROT:TRIP?`
Response 1, the OPP is tripped.
Response 0, the OPP is not tripped.

Usage: Query only

7.6 Measurement Commands

The MEASure subsystem provides commands to query the voltage and current values of a channel.

MEASure[:SCALar]:CURRent[:DC]?

Queries the currently measured current of the selected channel.

Example: MEAS:CURR? -> 1.000E +00

Usage: Query only

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.

Example: MEAS:ENER? -> 5.382E+00 (value in Wh)

Usage: Query only

MEASure[:SCALar]:ENERgy:RESet

Resets the energy counter for the selected channel.

Usage: Event

MEASure[:SCALar]:ENERgy:STATe <state>
MEASure[:SCALar]:ENERgy:STATe?

Activates/Deactivates or Queries the energy counter for the selected channel.

Parameters:

<state> OFF | ON | 0 | 1

ON |1
Activates the energy counter.

OFF | 0
Deactivates the energy counter.

Example:
```
INST OUT1
MEAS:ENER:STAT ON
MEAS:ENER:STAT?
MEAS:ENER:STAT? -> 1
```
Energy counter of Ch1 is enabled.

MEASure[:SCALar]:POWer?

Queries the currently emitted power of the selected channel

Example: `MEAS:POW?` -> 3.00E+00

Usage: Query only

MEASure[:SCALar][:VOLTage][:DC]?

Queries the currently measured voltage of the selected channel.

Example: `MEAS:VOLT?` -> 1.000E+00

Usage: Query only

7.7 Arbitrary Setting Commands

The `ARBitrary` subsystem contains the commands for configuring an arbitrary sequence for the output channels.

Example: Configuring an arbitrary sequence

This programming example generates an arbitrary sequence for a selected channel. The sequence starts at 1 V and 1 A for 1 sec, and both values are incremented each second by 1. The generated arbitrary waveform is transferred to Ch1. When activated, the R&S NGL200 provides the arbitrary waveform at the output of the selected channel, and repeats it 10 times.

```
// ***********************************************
// Define and start the arbitrary sequence
// ***********************************************
INST OUT1
ARB:DATA 1,1,1,2,2,1,3,3,1
// selects channel1
// defines the sequence, i.e. starting at 1V, 1A for 1sec,
// and increments the voltage and current each second by 1
ARB:REP 10
// sets the repetition rate
// ARB:REP? queries the set number of repetitions
ARB:BEH:END HOLD
//sets the arbitrary endpoint behavior, when the arbitrary function is finished
ARB:TRAN 1
// transfers the arbitrary points to channel
ARB:STAT 1
// starts the sequence
// ARB:STOP 1 stops the sequence in the selected channel
OUTP ON
// turns on the output
//ARB:BEH:END? queries the arbitrary endpoint behavior
INST OUT1
ARB:CLEAR 1
// deletes the arbitrary waveform data of the selected channel
// ***********************************************
// Save and recall an arbitrary sequence
// ***********************************************
ARB:SAVE 1
// saves the sequence into the internal memory
ARB:REST
// loads a previously saved sequence from the internal memory
```

ARBitrary[:STATe] <state>
ARBitrary[:STATe]?

Activates/Deactivates or Queries the arbitrary function for the previous selected channel.

Parameters:

<state> OFF | ON | 1 | 0

ON | 1
Arbitrary function will be activated..

OFF | 0
Arbitrary function will be deactivated..

*RST: OFF | 0

Example:

```
Arbitrary function will be deactivated.
ARB ON
ARB? -> 1
```

Arbitrary function of Ch1 is activated.
See Example "Configuring an arbitrary sequence" on page 114.

ARBitrary:BEHavior:END <state>
ARBitrary:BEHavior:END?

Sets/Queries the arbitrary endpoint behavior, when arbitrary function is finished.

Parameters:

<state> HOLD | OFF

OFF
If the arbitrary function is finished, the respective channel will be deactivated automatically.

HOLD
If the arbitrary function is finished, the last arbitrary point of the user-defined arbitrary list will be held.

*RST: OFF

Example: See Example "Configuring an arbitrary sequence" on page 114.

ARBitrary:CLEar

Clears the previous defined arbitrary waveform data for the selected channel.

Example: See Example "Configuring an arbitrary sequence" on page 114.

Usage: Event

ARBitrary:DATA <data>
ARBitrary:DATA?

Sets/Queries 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 10 ms to 10 minutes.

Parameters:

<data> voltage1, current1, time1, interpolation mode1, voltage2, current2, time2, interpolation mode2, ...

Voltage and current setting depending on the instrument type. The interpolation mode if sets 1 indcates that interpolation mode is activated and if sets 0, indcates that interpolation mode is disabled.

Example:

```
INST OUT1
ARB:DATA 10,1,0.5,0
```

Defines one arbitrary point with: Voltage1 = 10 V and Current1 = 1 A, Time1 = 500 ms and Interpolation mode1 = 0 (disabled).

```
ARB:DATA -> 10.000, 1.000, 0.50, 1
```

Return defined arbitrary points for the previous selected channel.

See Example "Configuring an arbitrary sequence" on page 114.

ARBitrary:ENDPoint <endpoint>
ARBitrary:ENDPoint?

Queries the defined arbitrary waveform endpoint of the selected channel.

Parameters:

<endpoint> Range: 0 to 512

Example:

```
INST OUT1
ARB:ENDP 30
ARB:ENDP? -> 30
```

The the arbitrary waveform of channel Ch1 will be repeated 30 times

ARBitrary:FNAMe <filename>[,<location>]
ARBitrary:FNAMe? [<location>]

Sets/Queries the file name and storage location for the arbitrary function.

Parameters for setting and query:

<filename> Filename of the arbitrary function.

<location> INT | EXT | DEF

INT
Internal memory

EXT
USB stick

DEF
Internal memory

Example:
```
ARB:FNAM "01.CSV"
ARB:FNAM? INT -> "01.CSV"
```

ARBitrary:LOAD

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

Usage: Event

ARBitrary:REPetitions <repetition_rate>
ARBitrary:REPetitions?

Sets/Queries 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:
repetition_rate Range: 0 to 65535
The "0" indicates infinite repetition.

Example:
```
INST OUT1
ARB:REP 10
ARB:REP? -> 10
```
The return repetition rate of the Ch1 arbitrary waveform is 10.

ARBitrary:SAVE

Save the current arbirary table to a file (filename specified with 'arb:fname').

Example:
```
INST OUT1
ARB:DATA 10,1,0.5,0
ARB:REP 10
ARB:FNAM "ARB03.CSV",INT
ARB:SAVE
```
Save a predefined arbitrary data to a filename `ARB03.CSV` in the internal memory location.

Usage: Event

ARBitrary:TRANsfer <channel>

Transfers the defined arbitrary table to the selected channel.

Parameters:
<channel> 1 | 2 | 3 | 4

Example: See Example "Configuring an arbitrary sequence" on page 114.

Usage: Setting only

ARBitrary:TRIGgered:MODE <mode>
ARBitrary:TRIGgered:MODE?

Sets/Queries the arbitrary trigger mode of the previous selected channel.

Parameters:

<mode> SINGle | RUN

SINGle
A trigger event starts only one arbitrary sequence.

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

ARBitrary:TRIGgered[:STATe] <state>
ARBitrary:TRIGgered[:STATe]?

Activates/Deactivates or Queries the trigger input at the rear connector (terminal block) for arbitrary functionality..

Parameters:

<state> 0 | 1

0
OFF - Trigger input is deactivated.

1
ON - Trigger input is activated.

Example:

```
INST OUT1
ARB:TRIG ON
ARB:TRIG? -> 1
```

Trigger input on the rear connector is activated for Ch1 arbitrary waveform

7.8 Advanced Operating Commands

The `VOLTage:RAMP` and `Sequencing` subsystem contains the commands for configuring the ramp function and sequencing function for the output channels.

7.8.1 Ramp

[SOURce:]VOLTage:RAMP[:STATe] <state>
[SOURce:]VOLTage:RAMP[:STATe]?

Activates/Deactivates or Queries the Ramp function for the previous selected channel.

Parameters:

<state> 0 | 1

0
EasyRamp function will be deactivated.

1
EasyRamp function will be activated.

*RST: 0

Example:
```
INST OUT1
VOLT:RAMP ON
VOLT:RAMP? -> 1
```
EasyRamp function of Ch1 is activated

[SOURce:]VOLTage:RAMP:DURation <duration>
[SOURce:]VOLTage:RAMP:DURation?

Sets/Queries the duration of the voltage ramp.

Parameters:

<duration> numeric | MIN | MAX | DEFault

numeric
Duration of the ramp function in seconds.

MIN
Minimum duration of the ramp function at 0.00 s.

MAX
Minimum duration of the ramp function at 10 s.

DEF
Default duration of the ramp function at 0.01 s.

Range: 0.01 to 10.00
*RST: 0.01
Default unit: s

Example:
```
VOLT:RAMP:DUR 4
VOLT:RAMP:DUR? -> 4
```
Duration of the ramp function is set at 4 s.

7.9 Data and File Management Commands

The `DATA` and `HCOPy` subsystem contains commands for managing the files in the instrument and external USB stick.

The LOG subsystem contains the commands for managing the data logging of the instrument.

DATA:DATA? <filename>[,<location>]

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.

Parameters:

<filename> Filename of the logging file data.

<location> INT | EXT | USB

INT
Internal memory

EXT
USB stick

DEF
Internal memory

Example:
```
DATA:DATA? "LOG0001.CSV",EXT ->
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
```
External logging file (USB stick), count = 5.
Return as follows: U1[V];I1[A];U2[V];I2[A];U3[V];I3[A];Timestamp

Usage: Query only

DATA:DELete <filename>[,<location>]

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.

Setting parameters:

<filename> Filename of the logging file data to be deleted.

<location> INT | EXT | USB

INT
Internal memory

EXT
USB stick

DEF
Internal memory

Example:
```
DATA:DEL "LOG0001.CSV",EXT
```
Delete filename `LOG0001.CSV` from USB stick

Usage: Setting only

DATA:LIST? [<location>]

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).

Parameters:

<location> INT | EXT | USB

INT
Internal memory

EXT
USB stick

DEF
Internal memory

Example: `DATA:LIST? EXT - > "LOG0001.CSV", "LOG0002.CSV","LOG0003.CSV"`

Usage: Query only

DATA:POINts? <filename>[,<location>]

Queries the number of measurements from the selected storage location and filename.

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.

Parameters:

<filename> Filename of the logging file data.

<location> INT | EXT | USB

INT
Internal memory.

EXT
USB stick.

DEF
Internal memory.

Example: `DATA:POIN? "LOG0001.CSV",EXT -> 5`
Return 5 log files counts from `LOG0001.CSV` in USB stick.

Usage: Query only

HCOPy:DATA?

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

Usage: Query only

HCOPy:FORMat <arg0>
HCOPy:FORMat?

Sets/Queries the data format of the screenshot. The FORM? query returns the format of the the screenshot (BMP, PNG).

Parameters for setting and query:

<arg0> BMP | PNG

BMP
Windows Bitmap Format.

PNG
Portable Network Graphic.

*RST: BMP

Example: `HCOPY:FORM? -> BMP`
Return the current setting of the screenshot format.

HCOPy:SIZE:X?

Returns the horizontal expansion of the screenshots.

Usage: Query only

HCOPy:SIZE:Y?

Usage: Query only

Returns the vertical expansion of the screenshots.

LOG[:STATe] <state>
LOG[:STATe]?

Sets/Queries the data logging function on or off.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Data logging function will be activated.

ON | 1
Data logging function will be deactivated.

*RST: OFF | 0

Example:
```
LOG ON
LOG? -> 1
```
Data logging function is activated.

LOG:CHANnel[:STATe] <state>
LOG:CHANnel[:STATe]?

Sets/Queries the data logging function for the previous selected channel on or off.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Data logging function for the previous selected channel will be deactivated.

ON | 1
Data logging function for the previous selected channel will be activated.

*RST: OFF | 0

Example:

```
LOG:CHAN ON
LOG:CHAN? -> 1
```

Data logging function for the previous selected channel is activated.

LOG:COUNt <count>
LOG:COUNt? [<count>]

Sets/Queries the number of measurement values to be captured.

Setting parameters:

<count> numeric_value | MIN | MAX

numeric_value
Number of measurement values to be captured is set in the range of 1 to 10000000.

MIN
Minimum number of measurement values to be captured is set at 1.

MAX
Maximum number of measurement values to be captured is set at 10000000.

Query parameters:

<count> MIN | MAX

Return the number of measurement values.

Example:

```
LOG:COUN MAX
LOG:COUN? MAX -> 10000000
```

LOG:DURation
LOG:DURation? []

Sets/Queries the duration of the data logging.

Setting parameters:

 numeric_values | MIN | MAX

numeric_values
Duration of the data logging captured in the range of 0 s to 3.49*10^5 s.

MIN
Minimum duration of the data logging captured at 0 s.

MAX
Maximum duration of the data logging captured at 3.49*10^5 s.

Default unit: s

Query parameters:

 MIN | MAX

Return the duration of the data logging.

Example:

```
LOG:DUR MAX
LOG:DUR? MAX -> 349000
```

LOG:FNAMe <filename>[,<loaction>]
LOG:FNAMe? [<location>]

Sets/Queries the filename and storage location for the logging function.

Setting parameters:

<filename> Filename of the data logging function.

<location> INT | EXT | DEF

INT
Internal memory.

EXT
USB stick.

DEF
Internal memory.

Query parameters:

<location> INT | EXT | DEF

Storage location for the logging function.

Example:

```
LOG:FNAM "Test01.CSV",INT
LOG:FNAM? -> "/INT/DATA/Test01.CSV"
```

LOG:INTerval <interval>
LOG:INTerval? [<interval>]

Sets/Queries the data logging measurement interval. The measurement interval describes the time between the recorded measurements..

Setting parameters:

<interval> numeric_value | MIN | MAX

numeric_value
Measurement interval in the range of 0.1 s to 600 s.

MIN
Minimum measurement interval is set at 0.1 s.

MAX
Maximum measurement interval is set at 600 s.

Default unit: s

Query parameters:

<interval> MIN | MAX

Return the measurement interval.

Example:

```
LOG:INT 10
LOG:INT? -> 10
```

LOG:MODE <mode>
LOG:MODE?

Sets/Queries the data logging mode.

Parameters:

<mode> UNLimited | COUNt | DURation | SPAN

UNLimited
Infinite data capture.

COUNt
Number of measurement values to be captured.

DURation
Duration of the measurement values capture.

SPAN
Interval of the measurement values capture.

Example:

```
LOG:MODE DUR
LOG:MODE? -> DUR
```

LOG:STIMe <Year>, <Month>, <Day>, <Hour>, <Minute>, <Second>
LOG:STIMe?

Sets/Queries the start time of the data logging fucntion.

Parameters:

<Year> Sets the year for the data logging function.

Setting parameters:

<Month> Sets the month for the data logging function.

<Day> Sets the day for the data logging function.

<Hour> Sets the hour for the data logging function.

<Minute> Sets the minute for the data logging function.

<Second> Sets the second for the data logging function.

Example:
```
LOG:STIM 2018,08,18,08,18,18
LOG:STIM? -> 2018,08,18,08,18,18
```

LOG:TRIGgered <state>
LOG:TRIGgered?

Sets/Queries the manual trigger for the data logging function.

Parameters:

<state> OFF | ON | 0 | 1

OFF | 0
Manual trigger function will be deactivated.

ON | 1
Manual trigger function will be activated.

Example:
```
LOG:TRIG ON
LOG:TRIG? -> 1
```

7.10 Status Reporting

7.10.1 STATus:OPERation Registers

The commands of the `STATus:OPERation` subsystem control the status reporting structures of the `STATus:OPERation` register.

The suffix at <Channel> selects the instrument. The range is <1...2>.

See also:

- Chapter A.3.1, "Structure of a SCPI Status Register", on page 138
- STATus:OPERation Register

STATus:OPERation:INSTrument:CONDition?
STATus:OPERation:INSTrument:ISUMmary<Channel>:CONDition? <Condition>

Returns the contents of the CONDition part of the status register to check for operation instrument or measurement states. Reading the CONDition registers does not delete the contents.

Suffix:
<Channel> 1..n

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

Usage: Query only

STATus:OPERation:INSTrument:ENABle <arg0>
STATus:OPERation:INSTrument:ISUMmary<Channel>:ENABle <arg0>

Controls/Queries the ENABle part of the STATus:OPERation register. The ENABle defines which events in the EVENt part of the status register are forwarded to the OPERation summary bit (bit 7) of the status byte. The status byte can be used to create a service request.

Suffix:
<Channel> 1..n

Parameters:
<Enable> Range: 1 to 65535
Increment: 1

Example: `STATus:OPERation:INSTrument:ISUMmary1:ENABle?`
Reads the enable register for the Standard Operation Register group

STATus:OPERation:INSTrument[:EVENt]?
STATus:OPERation:INSTrument:ISUMmary<Channel>[:EVENt]?

Returns 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.

Suffix:
<Channel> 1..n

Return values:
<Event> Range: Range: 1 to 65535

Usage: Query only

STATus:OPERation:INSTrument:NTRansition <NegativePosition>
STATus:OPERation:INSTrument:ISUMmary<Channel>:NTRansition <arg0>

Sets/Queries the negative transition filter. Setting a bit in the negative transition filter shall cause a 1 to 0 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register.

Suffix:
<Channel> 1..n

Parameters:
<NegativeTransition> Range: <1 to 65535>

Example: `STATus:OPERation:INSTrument:ISUMmary1:NTRansition?`
Query for negative transition.

STATus:OPERation:INSTrument:PTRansition <PositiveTransition>
STATus:OPERation:INSTrument:ISUMmary<Channel>:PTRansition <arg0>

Sets/Queries the positive transition filter. Setting a bit in the positive transition filter shall cause a 0 to 1 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register.

Suffix:
<Channel> 1..n

Parameters:
<PositiveTransition> Range: <1 to 65535>

Example: `STATus:OPERation:INSTrument:ISUMmary1:PTRansition?`
Query for positive transition.

7.10.2 STATus:QUEStionable Registers

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

The suffix <n> at Channel selects the instrument. The range is <1...2>.

- Chapter A.3.1, "Structure of a SCPI Status Register", on page 138
- STATus:QUEStionable Register

STATus:QUEStionable:INSTrument:CONDition?
STATus:QUEStionable:INSTrument:ISUMmary<Channel>:CONDition? <Condition>

Returns the contents of the CONDition part of the status register to check for questionable instrument or measurement states. Reading the CONDition registers does not delete the contents.

Suffix:
<Channel> 1..n

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

Usage: Query only

STATus:QUEStionable:INSTrument:ENABle <arg0>
STATus:QUEStionable:INSTrument:ISUMmary<Channel>:ENABle <Enable_Value>

Set/Query 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 1, and the corresponding EVENt bit is true, a positive transition occurs in the summary bit. This transition is reported to the next higher level.

Suffix:
<Channel> 1..n

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

Example: `STATus:QUEStionable:INSTrument:ISUMmary1:ENABle?`
Queries the event register for the Standard QUEStionable Register group.

STATus:QUEStionable:INSTrument[:EVENt]?
STATus:QUEStionable:INSTrument:ISUMmary<Channel>[:EVENt]?

Returns 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.

Suffix:
<Channel> 1..n

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

Usage: Query only

STATus:QUEStionable:INSTrument:NTRansition <arg0>
STATus:QUEStionable:INSTrument:ISUMmary<Channel>:NTRansition
<NegativeTransition>

Sets/Queries the negative transition filter. Setting a bit in the negative transition filter shall cause a 1 to 0 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register.

Suffix:
<Channel> 1..n

Parameters:
<NegativeTransition> Range: <1 to 65535>

Example: `STATus:QUEStionable:INSTrument:ISUMmary1:NTRansition?`
Query for negative transition.

STATus:QUEStionable:INSTrument:PTRansition <arg0>
STATus:QUEStionable:INSTrument:ISUMmary<Channel>:PTRansition
<PositiveTransition>

Sets/Queries the positive transition filter. Setting a bit in the positive transition filter shall cause a 0 to 1 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register.

Suffix:
<Channel> 1..n

Parameters:
<PositiveTransition> Range: <1 to 65535>

Example: `STATus:QUEStionable:INSTrument:ISUMmary1:PTRansition?`
Query for positive transition.

Annex

A Additional Basics on Remote Control

A.1 Messages and Command Structure

A.1.1 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 A.1.2, "SCPI Command Structure", on page 133
- Detailed description of all messages: Chapter 7, "Remote Control Commands", on page 79

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:

Effects on the instrument:

- Setting commands cause instrument settings such as a reset of the instrument or setting the output voltage.
- Queries return data 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.

Applied standards:

- The function and syntax of the common commands are precisely defined in standard IEEE 488.2. If implemented, they are used identically on all instruments. 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 sends 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 PC 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; 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** only act on instruments previously addressed as listeners; addressed commands are encoded in the range 00 through 0F hex. They only affect instruments addressed as listeners.

A.1.2 SCPI Command Structure

SCPI commands consist of a so-called header and, usually, one or more parameters. The header and the parameters are separated by a whitespace. The headers can 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.

Table A-1: Examples of Common Commands

Command	Command Name	Description
`*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.

Syntax for Device-Specific Commands

For demonstration purposes only, assume the existence of the following commands for this section:

- `MEASure:CURRent[:DC]?`
- `MEASure:VOLTage[:DC]?`
- `FUSE[:STATe] {ON | OFF | 0 | 1}`
- `FUSE[:STATe]?`

Long and short form

The mnemonics feature a long form and a short form. The short form is marked by uppercase letters, the long form corresponds to the complete word. You can enter either the short form or the long form; other abbreviations are not permitted.

Example:

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

Case-insensitivity

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

Optional mnemonics

Some command systems permit inserting or omitting certain mnemonics in the header. 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`

Special characters

Table A-2: Special characters

|	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 can be inserted into the header or be 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 be omitted. Example: • `VOLTage[:LEVel][:IMMediate][:AMPLitude] {<voltage> | MIN | MAX | UP | DOWN }` The following are valid commands: – `VOLT MAX` – `VOLT MIN VOLT 10`

SCPI Parameters

Many commands are supplemented by a parameter or a list of parameters. The parameters must be separated from the header by a whitespace (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
- Block data

The required parameters and the allowed value range are specified in the command description.

Numeric values

You can enter numeric values in the following form. Values exceeding the resolution of the instrument are rounded up or down.

Example:

`VOLT 10V` = `VOLT 10`

`VOLT 100mV` = `VOLT 0.1`

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:PROT? MAX`

Returns the maximum numeric value.

Boolean parameters

Boolean parameters represent two states:

- **On** (logically true), is represented by "On" or the numeric value "1"
- **Off** (logically false), is represented by "Off" or the numeric value "0"

The instrument returns the numerical value when queried.

Example:

`OUTP:STAT ON`

`OUTP:STAT?`, Response: 1

Overview of Syntax Elements

The following table provides an overview of the syntax elements:

Table A-3: Syntax Elements

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

Responses to Queries

You can query each setting command by adding a question mark. According to SCPI, the responses to queries are partly subject to stricter rules than in the standard IEEE 488.2.

- The requested parameter is transmitted without a header.
  `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.
  `VOLT:PROT? MAX`, Response: 32.500
- Boolean values are returned as 0 (for Off) and 1 (for On).
  `OUTPut:STATe?`, Response: 1

A.2 Command Sequence and Synchronization

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

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

A.2.1 Preventing Overlapping Execution

*Table A-4: Synchronization using *OPC, *OPC? and *WAI*

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. It occurs 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

To prevent an overlapping execution of commands 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.

The R&S NGL200 series does not support parallel processing of remote commands. If `OPC?` returns a "1", the device is able to process new commands.

A.3 Status Reporting System

The status reporting system stores all information on the current operating state of the instrument and errors which have occurred. This information is stored in the status registers and in the error queue. You can query both via RS-232, USB, GPIB or LAN interface (`STATus`... commands).

A.3.1 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 controller can process contents of the register parts as positive integers.

A `STATus:QUEStionable:INSTrument:ISUMmary1` exists as often as device channels are available (e.g. NGL201 = 2 channels = 2 status register). Accordingly, the description text of the channel information changes in Figure A-1 (e.g. instrument 1 = channel 1, instrument 2 = channel 2 etc.).

Depending on the value of the read register, you can draw conclusions on the current status of the device. 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 9 to 12 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 NGL202 is also present two times (Isummary1-2).

Description of the status register parts

The SCPI standard provides two different status registers:

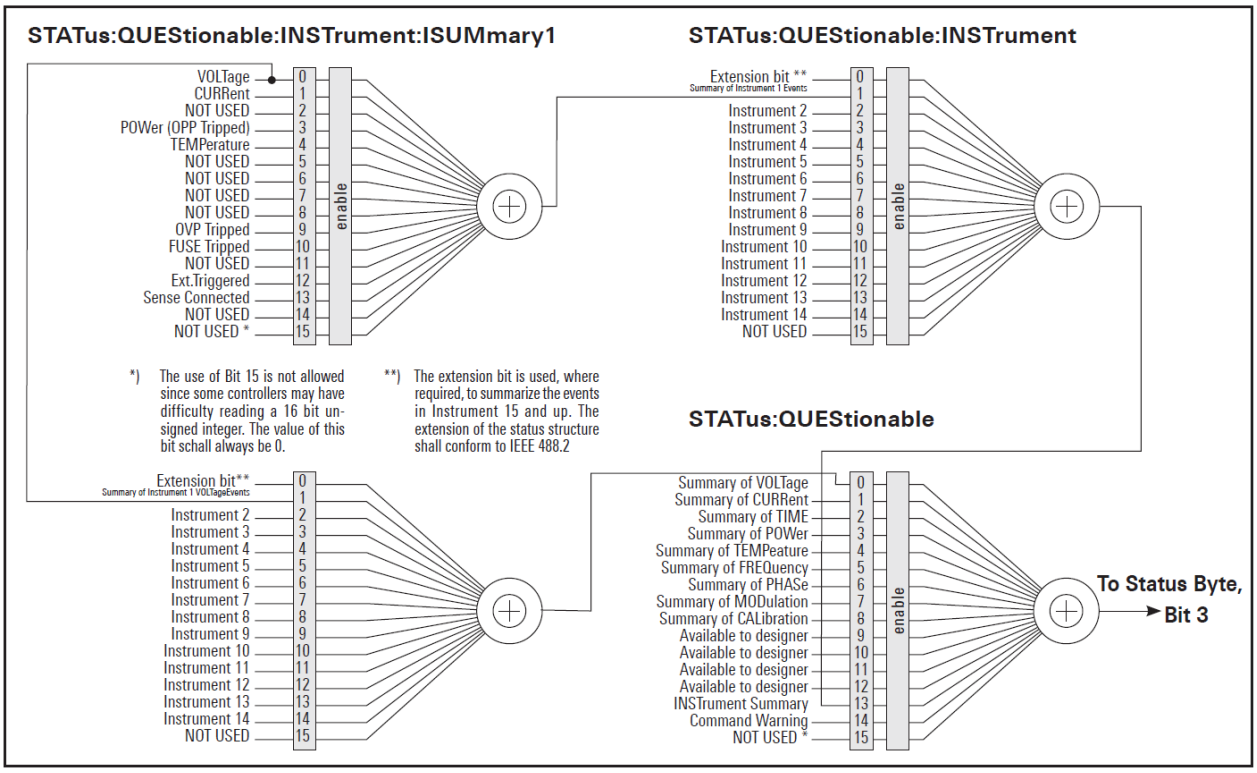


Figure A-1: Structure of the status QUEStionable register

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.

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 must deliver a "1".

Example:

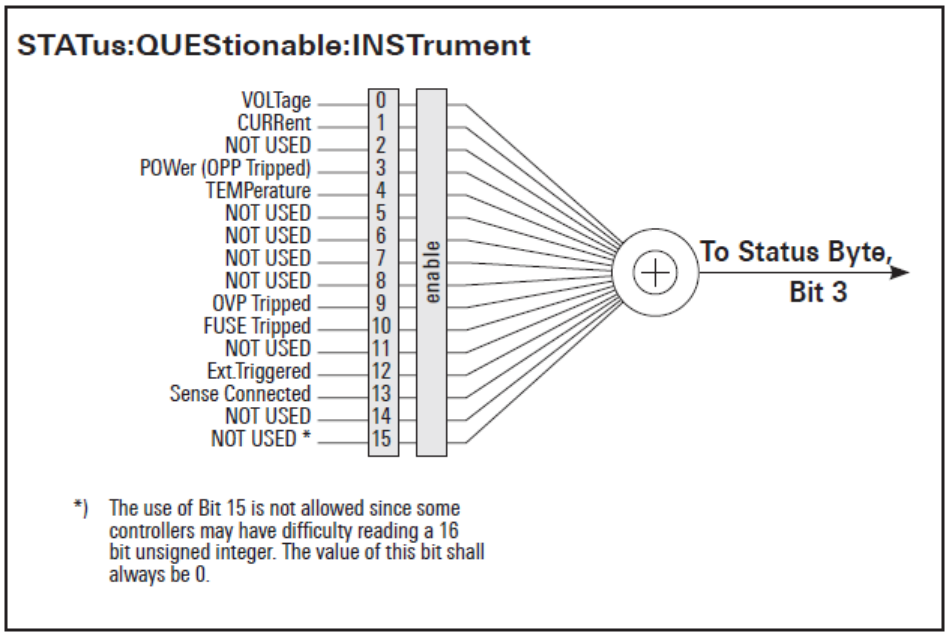
```
STAT:QUES:ISUM1:COND?
```

EVENt

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

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 description of the status register, see Chapter 7.10, "Status Reporting", on page 127.



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 an SCPI register. The event status register can be read out using the command `*ESR?`. The ESE corresponds to the `ENABle` part of an 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:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last reading. It can be read using the commands STATus:OPERation:CONDition? or STATus:OPERation[:EVENt]?.

Bit No.	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 14	Not used
15	This bit is always 0

STATus:QUEStionable Register

This register contains information about different states which can occur. It can be read using the commands `STATus:QUEStionable:CONDition?` and `STATus:QUEStionable[:EVENt]?`. See also Figure A-1.

Table A-5: Bits of the STATus:QUEStionable register

Bit No.	Meaning
0	**Voltage** This bit is set while the instrument is in constant current mode (CC). The voltage is regulated and the current is constant.
1	**Current** This bit is set while the instrument is in constant voltage mode (CV). The current is variable and the voltage is constant.
2 to 3	**Not used**
4	**Temperature overrange** This bit is set if an over temperature occurs.
5 to 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**

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.

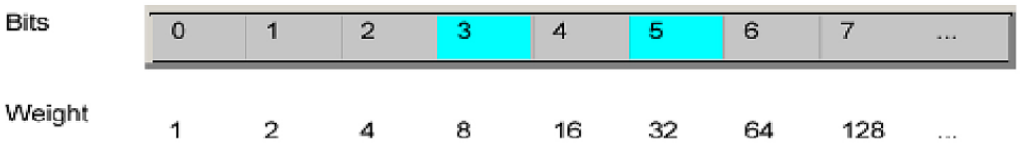


Figure A-2: Decimal representation of a bit pattern

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. You can look them up in the error log or 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".

List of Commands

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