

REMOTE CONTROL OF MULTIPLE DC POWER SUPPLIES R&S®NGL200 AND R&S®NGM200

Products:

- ▶ R&S®NGL201
- ▶ R&S®NGL202
- ▶ R&S®NGM201
- ▶ R&S®NGM202

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1 Overview

Applications requiring higher voltages or currents, or a stack of voltage sources with taps in-between, demand the combination of several DC power supply channels in series or in parallel.

All channels of DC power supplies R&S®NGL200 and R&S®NGM200 are isolated against the grounding equipment conductor and against the digital ground of the instrument. Therefore, channels can be connected in parallel for increasing the current capability, or in series for achieving higher voltages or dual-voltage supplies.

When a large number of power supply channels is used, it is desirable to have a tool for configuring all instruments and channels from one user interface, and for keeping an overview over the states and measurement values from all channels.

The application program provided with this application note provides such a tool. This document contains background information and user manual for the software.

2 Preparations

2.1 Prerequisites

This software needs .Net framework 4.0 or higher installed on the PC. The instrument remote control requires a virtual instrument software architecture (VISA). R&S® VISA can be downloaded from the Rohde & Schwarz web site [1].

2.2 Remote control connections

Remote control can be established via Ethernet, USB or GPIB, depending on the configuration of the DC power supplies.

For USB connections, the USB class on the R&S®NGL200 / NGM200 has to be set to "TMC". Open the settings menu with the "≡" button, select the device tab and tap on the ">" sign in the "Interfaces" line.

2.3 Installing the software

Copy file "1GP127_100.msi" to the controlling PC and open it. Follow the instructions on the screen.

3 Getting Started

3.1 Configuring the layout

Each power supply is assigned to a tile in a grid of n columns and m rows. Tiles, which are not required to represent a certain power supply, can be left unassigned.

Upon first start of the software, the layout configuration window opens automatically. If you want to re-configure the layout later, use menu item Setup → Layout. Note that this also requires a new assignment of power supplies to tiles by entry of VISA instrument ident strings in the tiles.

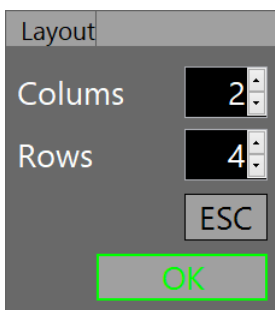


Figure 3-1 Layout configuration window

Set the desired number of columns and rows and close the window with "OK".

3.2 Connecting the instruments

When the main window with the tiles has opened, instruments have to be assigned to tiles by connecting the remote control. To show the tabs with the controls for the remote connections, use menu item View → Show Remote Configuration".

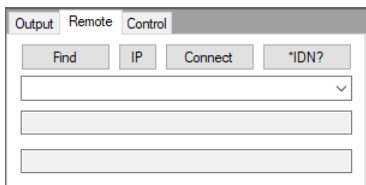


Figure 3-2 Remote configuration tab

To perform a VISA search on USB and GPIB interfaces, click the "Find" button.

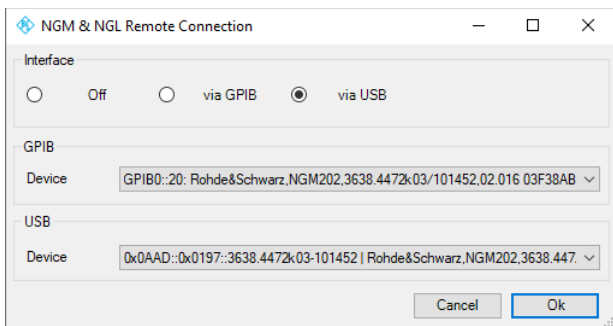


Figure 3-3 Search window for instruments found on the GPIB and USB interfaces

Select the desired interface with the radiobuttons on top and select one of the instruments listed in the combobox for the selected interface. Click the "Ok" button.

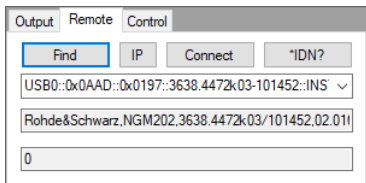


Figure 3-4 Remote configuration tab with R&S@NGM202 connected

The combobox below the buttons shows the VISA resource string for the connected instrument, and the textbox below it shows the ident string returned from the instrument in response to the "*IDN?" command.

To establish a connection via ethernet, click the "IP" button in the remote configuration tab. A template resource string for TCP/IP connections is shown in the combobox.

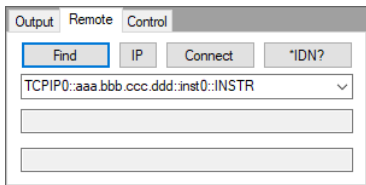


Figure 3-5 Remote configuration tab with template for TCP/IP connection

Enter the IPv4 address at the places marked with "aaa", "bbb", "ccc" and "ddd". Make sure to keep the dots inbetween. Click the "Connect" button.

3.3 Toggling between configuration screens and display screens

3.3.1 Common settings

Use the "View" menu to toggle between the display screens and configuration tabs of all instruments.

3.3.2 Individual settings

Click with the right mouse button in the black area of the display screen of the instrument and click "configure" in the context menu to change to the configuration screen. Click the desired tab in the configuration screen to display the output controls, remote configuration controls or remote controls. Click with the right mouse button in the gray area besides the tabs of the configuration screen and click "Show Channels" in the context menu to change to the display screen.

3.4 Setting voltages and current limits

3.4.1 Common settings for all instruments

Use menu item "Setup → Set Voltage on all NGx" or "Setup → Set Current on all NGx".

Enter the desired value in the numeric entry field and click the "OK" button.

3.4.2 Individual settings

Click on the gray field with the voltage of current setting. Set the desired voltage or current, respectively, in the input window and click the "OK" button.

3.5 Enabling and disabling the outputs

3.5.1 Common setting for all instruments

Use menu items "Setup → Outputs On" and "Setup → Outputs Off" to switch the outputs of all connected instrument channels simultaneously.

If menu item "Setup → Outputs Master-Slave" is checked, only one instrument is controlled by SCPI command and the other instruments are controlled via the Digital I/O connections. Note that the digital output settings and trigger settings must be configured appropriately on all instruments for this operation mode.

If menu item "Setup → Outputs Master-Slave" is not checked, SCPI commands are sent sequentially to all connected instruments. Note that the outputs may not switch absolutely synchronously in this mode.

3.5.2 Individual settings

Change to the "Output" tab of the instrument in question and use the buttons "Output", "Ch1" and "Ch2" to operate the functionality pertaining to these buttons on the instrument front panel.

3.6 Display update

The measurement values in the channel displays are only updated if continuous update is running. In this mode the control software cyclically queries the measurement values from all connected channels and updates the channel displays in the user interface.

With menu item "Measurement → Start Update", the continuous update is started. With menu item "Measurement → Stop Update", the continuous update is stopped. While the continuous update is running, the "Measurement" menu item in the menu strip is highlighted in light green.

If menu item "Measurement → Monitor Output State" is highlighted in addition to a running continuous measurement, the state of all available output controls on each power supply is also queried and displayed in the output control tab. Even without explicitly querying the output states, the displays of any channel which is not on appears as "-----V" and "-----A", respectively, with a running continuous measurement.

4 User Interface

4.1 Main Window

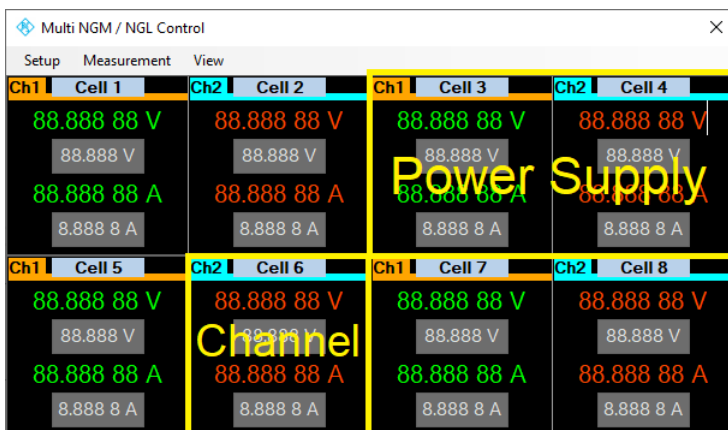


Figure 4-1 Main window of the application program

The main window contains the main menu and n rows and m columns of power supplies. The number of rows and columns is configurable. Each power supply has one or two channels.

4.2 Main Menu

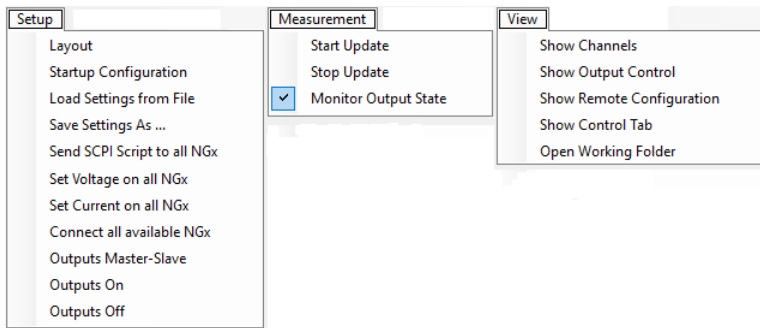


Figure 4-2 Main menu of the application software

The main menu strip has three menus.

- ▶ The setup menu provides configuration functions.
- ▶ The measurement menu starts, stops and configures the continuous display update.
- ▶ The view menu changes the views of all power supplies simultaneously.

4.2.1 Layout

This menu item allows to configure the number of power supplies and the arrangement of the user interfaces in the application program.

See section 3.1 above.

4.2.2 Startup configuration

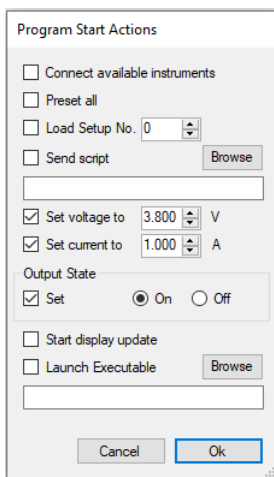


Figure 4-3 Configuration window for actions to be performed after the startup of the application program

The application program stores all its settings to a file when it is closed, and loads them after the next startup.

In addition it is possible to prepare the connected instruments by performing a selection of actions after the start of the application programs. These actions are configured in this window.

- ▶ "Connect available instruments" automatically re-connects all instruments found under the specified resource strings. This is prerequisite for subsequent action specified in this window.

- ▶ "Preset all" sends a "*RST" command to all connected instruments.
- ▶ "Load Setup No. n" loads an instrument state stored in the instrument under the specified number. The SCPI command sends "*RCL n". Note that there is no manual control available in the user interface to store an instrument setup in these locations. Instead, use the remote control tab of the respective power supply to send SCPI command "*SAV n". N is an integer number between 0 and 9, inclusively.
- ▶ "Send script" opens an ASCII file containing SCPI commands and sends them line by line to all connected power supplies. This is useful for preparing certain settings while keeping others at their previous state. To start the SCPI scripting from a defined state, activate "Preset all" or include "*RST" as first SCPI command in the script file.
The script file can be selected with a file selector box by clicking the "Browse" button. The path name of the script file is entered in the textbox below.
- ▶ Common voltage and current settings can be achieved in all channels with the options "Set voltage to ..." and "Set current to ...".

4.2.3 Load settings from file

The settings for this program (not for the connected power supplies) are automatically stored to a file when closing the application window, and read from this file when the program is started. This allows to resume work at the point the application program had been closed.

In addition it is possible to save multiple different settings to separate files, e.g. for different numbers and / or types of connected power supplies. Use menu item "Setup ..-> Save settings as ..." to store the current state of all program settings to a file. Use menu item "Setup ..-> Load settings from file" to browse to a settings file saved previously and retrieve the settings stored therein.

4.2.4 Save settings as ...

See section 4.2.3 above.

4.2.5 Send SCPI script to all NGx

This menu item opens a file selector box to browse to a SCPI script file. If a valid file is selected, and the file selector box is closed with the "Ok" button, the script file is opened, and the commands are read one by one. Each SCPI command is sent to all available instruments. To be available, an instrument must be selected with its resource string in one of the power supply fields. Furthermore it must have been connected at least once, using the "Connect" button in the "Remote" tab of the power supply or the menu item "Connect all available NGx" (see section 4.2.8 below).

4.2.6 Set voltage on all NGx

In addition to individual setting of the target voltage on each channel, all available channels can be set to the same target voltage, using this menu item.

4.2.7 Set current on all NGx

In addition to individual setting of the current limit on each channel, all available channels can be set to the same current limit, using this menu item.

4.2.8 Connect all available NGx

This menu item corresponds to the "Connect" button on the "Remote" tab of each individual instrument. All instruments which can be reached with the currently entered VISA resource string, are connected.

4.2.9 Outputs master-slave

Check this menu item if the digital I/Os of the connected power supplies are wired for synchronous switching of the channel outputs. For details please see application note 1GP126 [2].

4.2.10 Outputs on

This menu item turns the outputs of all connected channels on. In master-slave mode, only one instrument is controlled. If the master-slave mode is not active, commands are sent sequentially for all connected channels. In this mode switching of the outputs is not absolutely synchronized. Slight delays between the single channels have to be expected.

4.2.11 Outputs off

Turns the outputs of all connected channels off. Regarding synchronization, please see 4.2.10.

4.2.12 Start update

Starts the continuous update of the voltage and current measurement results in all connected channels. The values are queried sequentially from all connected instruments.

4.2.13 Stop update

Stops the continuous update of the voltage and current measurement results, e.g. in order to change settings on the instruments,

4.2.14 Monitor output state

If this menu item is enabled and a continuous update of measurement results is running, the software queries also the output state (on or off) of each power supply channel. Inactive channels are displayed in the user interface as it is known from the graphical user interface of the power supplies.

If this menu item is disabled, any invalid measurement result is interpreted as "channel off".

4.2.15 Show channels

This menu item exists in the "View" menu item of the main menu strip as well as in the context menu of any power supply (see 4.3.1). It brings the channel displays to the front, hiding the tab controls for the remote control. If clicked in the "View" menu of the main menu strip, it works on all power supplies simultaneously.

4.2.16 Show output control

This menu item hides the channel displays on all power supplies and shows the tab controls for remote control. The tab for output control (see 4.3.2) is selected.

4.2.17 Show remote configuration

This menu item hides the channel displays on all power supplies and shows the tab controls for remote control. The tab for remote control configuration (see 4.3.3) is selected.

4.2.18 Show control tab

This menu item hides the channel displays on all power supplies and shows the tab controls for remote control. The tab for remote control operation (see 4.3.4) is selected.

4.2.19 Open working folder

Opens the working folder of the software in the Windows file explorer. The working folder contains a file with the settings of this software and a log file with messages from its execution. It can also be used as storage location for SCPI scripts used with this application software.

4.3 Power supply

"Power supply" in this context means a tile in the main window of the graphical user interface (see 4.1), which can be assigned to a physical power supply instrument by connecting it in remote control.

4.3.1 Context menu

To show the power supply context menu, click with the right mouse button into an area which does not belong to a control or a tab page. This is the black area in a channel display or the dark gray area besides the tabs in the tab control.

- ▶ "Show Channels" hides the control tabs and shows the channel displays of available channels.
- ▶ "Send SCPI Script" opens a file selector box to browse for an ASCII file containing a script of SCPI remote control commands. If a valid SCPI script file is selected, the file is opened, and the SCPI commands are read line by line and sent to the power supply.

4.3.2 Output control tab

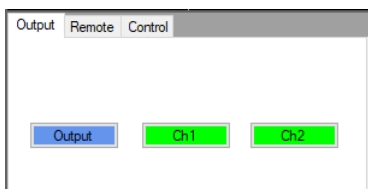


Figure 4-4 Output control tab of a power supply

Depending on the power supply model connected, this tab either has three buttons as shown in Figure 4-4 or, in the case of a R&S®NGL201 or a R&S®NGM201, only an "Output" button. This corresponds to the configuration of the front panel of the instrument.

If menu item "Monitor output state" of the View menu in the main menu strip is activated (see 4.2.14), and a continuous update of measurement results is running, the colors of the buttons reflect the state of the respective output and power supply channel, same as on the instrument front panel.

4.3.3 Remote configuration tab

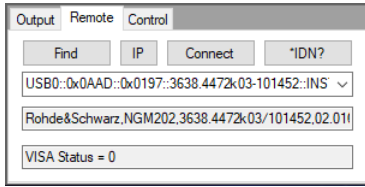


Figure 4-5 Remote configuration tab of a power supply

The remote configuration tab helps to establish a connection to the power supply.

The "Find" button opens a window showing VISA resource strings and ident strings of all instruments found on GPIB and USB interfaces.

If more than one instrument is found on an interface, one of the instruments can be selected with the respective combobox.

If instruments are found both on GPIB and USB, the interface can be selected with the radiobuttons on top.

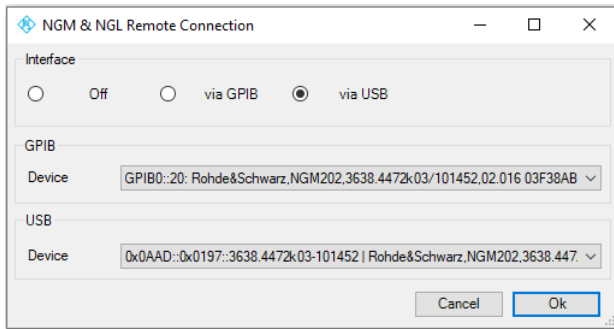


Figure 4-6 Window with devices found on the GPIB and USB interfaces

Click the "Connect" button to establish the remote control connection to the instrument belonging to the VISA resource string shown in the combobox.

4.3.4 Remote control tab

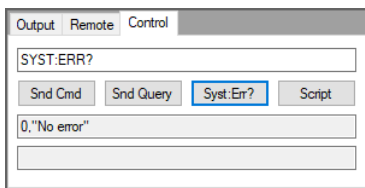


Figure 4-7 Remote control tab of a power supply

The remote control tab allows communication with the instrument using SCPI commands and queries. The command or query is entered in the textbox on top. Accordingly, click button "Snd Cmd" or "Snd Query" as appropriate.

For querying the error queue in the instrument, there is a separate button "Syst:Err?". The error queue stores all error messages caused by inappropriate SCPI commands in a last in - first out manner. To empty the error queue, the "Syst:Err" button may have to be clicked multiple times until "0,"No error" appears as response.

4.4 Channel

"Power supply" in this context means a tile in the main window of the graphical user interface (see 4.1), assigned to a channel of a physical power supply instrument. Depending on the power supply model, a power supply tile can have one or two channel tiles.

4.4.1 Context menu

The context menu is displayed by clicking with the right mouse button in the black area of a channel display.

- ▶ "Configure" hides the channel displays of this power supply and displays the tab control for output control, remote configuration and remote control.
- ▶ "Send SCPI Script" opens a file selector for selecting a script file. If a valid script file is selected, and the file selector box is closed with "Ok", the script is sent to the power supply to which the channel belongs.

4.4.2 Measurement results

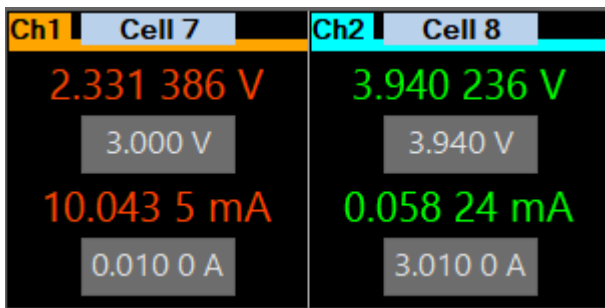


Figure 4-8 Channel displays with settings and measurement results in constant current mode (left) and constant voltage mode (right)

The channel display shows the measured voltage and current values. The values are only updated a continuous update is running (see section 4.2.12). The displays are green if the output is in constant voltage mode and red if the output is in constant current mode.

4.4.3 Voltage and current settings

The grey fields in the channel displays show the set voltage and current limit. Clicking on one of them opens an entry window with which the values can be changed.

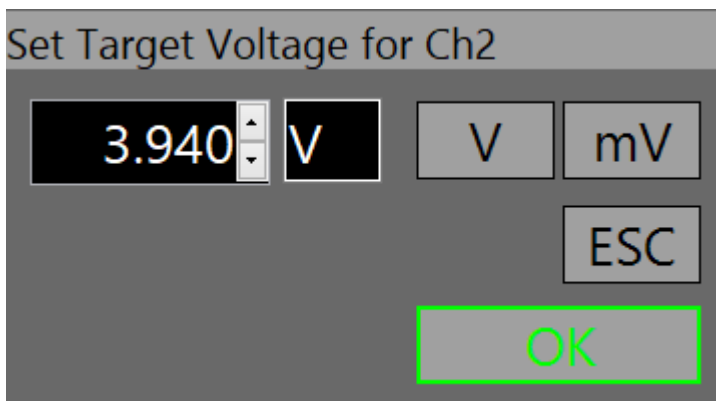


Figure 4-9 Window for value entry

Enter the desired value in the numeric entry field and select the correct unit. If the window is closed with "Ok", the values are transferred to the connected instrument. The window can be closed with the "ESC" button without changing the previous setting.

5 Literature

- [1] Rohde & Schwarz, "R&S@VISA," Rohde & Schwarz GmbH & Co. KG, 11 May 2018. [Online]. Available: https://www.rohde-schwarz.com/search_63238.html?term=R%26S+VISA+software+library. [Accessed 27 June 2019].
- [2] T. Lechner, "Switching outputs of multiple DC power supplies R&S@NGL200 / R&S@NGM200," 6 July 2020. [Online]. Available: <https://www.rohde-schwarz.com/appnote/1GP126>. [Accessed 6 July 2020].
- [3] Rohde & Schwarz, "R&S@NGL200 Power Supply Series User Manual," 13 April 2020. [Online]. Available: <https://www.rohde-schwarz.com/manual/ngl200/>.
- [4] Rohde & Schwarz, "R&S@NGM200 Power Supply Series User Manual," 30 March 2020. [Online]. Available: <https://www.rohde-schwarz.com/manual/ngm200/>.

6 Ordering Information

Designation	Type	Order No.
Power Supply	R&S®NGL201	3638.3376.02
Power Supply	R&S®NGL202	3638.3376.03
IEEE 488 (GPIB) Interface	R&S®NGL-B105	3652.6356.02
Power Supply	R&S®NGM201	3638.4472.02
Power Supply	R&S®NGM202	3638.4472.03
IEEE 488 (GPIB) Interface	R&S®NGM-B105	3641.6220.02

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