



RF SWITCH NETWORK RFB 6000A

USER MANUAL



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This manual is based on firmware version 2:02.

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1. SAFETY ADVICE



These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be observed.

Neither AMETEK CTS Europe GmbH nor any of its subsidiary sales organizations can accept any responsibility for personal, material or consequential injury, loss or damage that results from improper use of the equipment and accessories.



WARNING: Improper or careless handling can be fatal!
Use of the RF Switch Network is restricted to authorized and trained specialists

1.1. General

- ▶ Use of the RF Switch Network is restricted to authorized and trained personnel only.
- ▶ The RF Switch Network is to be used only for the purposes indicated by the manufacturer..

1.2. Connection to the mains and PE

- ▶ The instrument conforms to protection class 1.
- ▶ Operation without a protective earth connection is forbidden!
- ▶ Unplug the power cord when not using the unit for a long periods of time
- ▶ Handle the power cord carefully. Hold the plug when unplugging the cord.
- ▶ Never use the product if the power cable is damaged.

1.3. Disconnection from the mains

- ▶ Always set the power switch to the "Off" position and wait few seconds before disconnecting the power cord.
- ▶ Disconnect the power cord and all connection cords when moving the unit.

1.4. Risk of electric shock

- ▶ To reduce the risk of electric shock, do not remove parts from the housing.
- ▶ There are no user serviceable parts inside the unit. Certain parts inside the instrument work at mains voltage or at high frequency and are not provided with any protection against being touched.
- ▶ Only approved accessory items, connectors, adapters, etc. are to be used to ensure safe operation.

1.5. Operating Environment

- ▶ Operate the equipment only in dry surroundings. Allow any condensation that occurs to evaporate before putting the instrument into operation. Do not exceed the permissible ambient temperature, humidity or altitude. Operate the unit not in explosive surroundings.
- ▶ No objects filled with liquids, such as coffee cups, shall be placed on the unit.
- ▶ Avoid high temperatures. Allow for sufficient heat dispersion when installed in a rack. Do not place the product on radiators or fan heaters. The ambient temperature must not exceed the maximum specified temperature of this product.

1.6. Test execution

- ▶ Check once again that all connections are proper and that there are not problems with the connection cords. The test area must be organized that no unauthorized persons have access during execution of a test.
- ▶ Operating the product requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to operate the products; otherwise injuries or material damage may occur.
- ▶ EUTs together with all accessories and cables are to be regarded as being live during the execution of a test.
- ▶ The safety instructions concerning all the instruments and associated equipment involved in the test setup are to be observed.
- ▶ The configuration of the test setup is to be strictly in compliance with the methods described in the relevant standard to ensure that the test is executed in a compliant manner.



Caution: **Never operate the switch with RF power on.**
Switching by absence of RF power only!

1.7. Applicable safety standards

- Development and manufacture of the instrument complies with ISO 9001.
- The equipment conforms with the essential requirements of the EMC Directive 2014/30/EU and Low Voltage Directive (LVD) 2014/35/EU based on the following specifications applied: DIN EN 61326-1:2013 and DIN EN 61010-1:2011.
- It is the user's responsibility to ensure that the test setup does not emit radiation which could disrupt other equipment.

2. STORAGE, TRANSPORT, UNPACKING AND DELIVERY INFORMATION

2.1. General

Save all packing materials! They will be needed in order to safely package the equipment for calibration service or repair.

Packaging materials

- Carton: Cardboard
- Padding: CFC-free polystyrene foam
- Plastic bags: Polyethylene





► Avoid the risk of condensation!

If a large temperature difference has occurred, allow time for the temperature to stabilize. This may take several hours.

2.2. Storage and transport

- Do not stack, either packaged or unpacked.
- Do not stand on end; arrows on the packaging must always point upwards.
- Protect from dampness, heat, cold and rain.
- Do not throw.
- Do not sit or stand on the instrument and packaging.

2.3. Unpacking

- | | | | |
|--|--------|---|------------------------|
| ■ Is the packaging damaged? | If YES |  | transportation company |
| ■ Are all the packages present and correct? | If NO |  | transportation company |
| ■ Open the packaging, remove the accessories. | | | |
| ■ Grip the instrument at the sides and lift it from the packaging. | | | |
| ■ Are the instrument or accessories damaged? | If YES |  | transportation company |
| ■ Are the contents of the package complete? | If NO |  | Teseq sales office |
| ■ Keep the instruction manual with the instrument. | | | |
| ■ Keep the packaging. | | | |

2.4. Scope of delivery

- RFB 6000A mainframe
- RF switch plug-in module(s) and power meter interface as ordered separately
- Operating manual
- Spare fuses (2)
- RS232 cable (Nullmodem)
- Mains cable GB, CH, USA/JP and EU
- LAN cable, crossover, 3 m
- USO 4013 (USB to serial/optical converter with 20 m optical cable)
- USB stick with drivers and tool software

3. DESCRIPTION OF THE INSTRUMENT

3.1. General

The RF switch network can be configured to switch RF signals in a wide range of automatic test systems. Various switch configurations are available, connecting one input to either two or six outputs. The 3HU main frame consists of a power supply and remote interface and can accept any combination of plug-in modules up to the maximum dimension of the main frame. In addition up to 8 power meters can be connected to measure the forward power close to the antenna, e.g. in a separate amplifier room. A control signal port (User port) allows switching of amplifiers and other functions. Each switch as well as the additional functions can be individually controlled through the front panel touch screen, e.g. for installation and maintenance purpose. An USB to serial / optical converter with 20 m optical cable allows always a safe and secure remote control of the device, also in a noisy and electromagnetically disturbed environment.

All RF switches are high quality with an operating lifetime of at least one million operations. While able to pass high power levels, they are designed to switch only during absence of RF power.

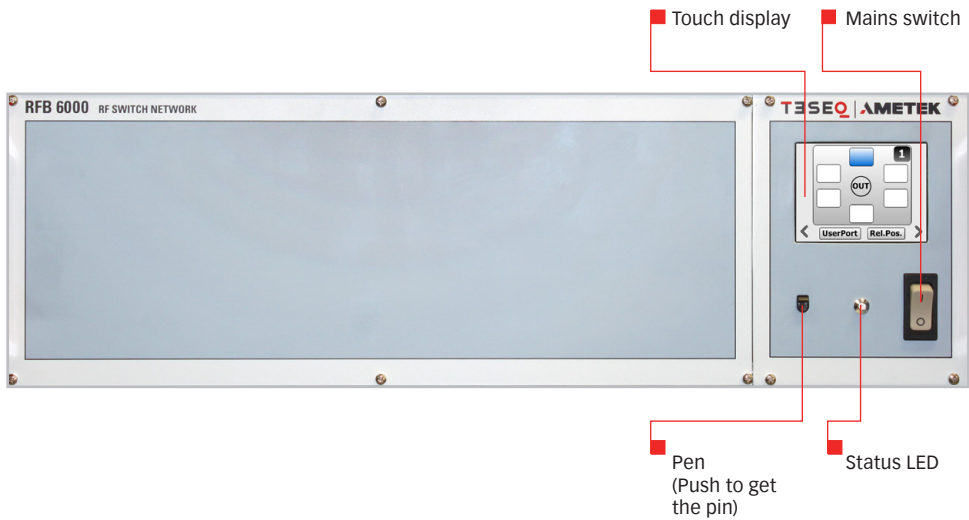
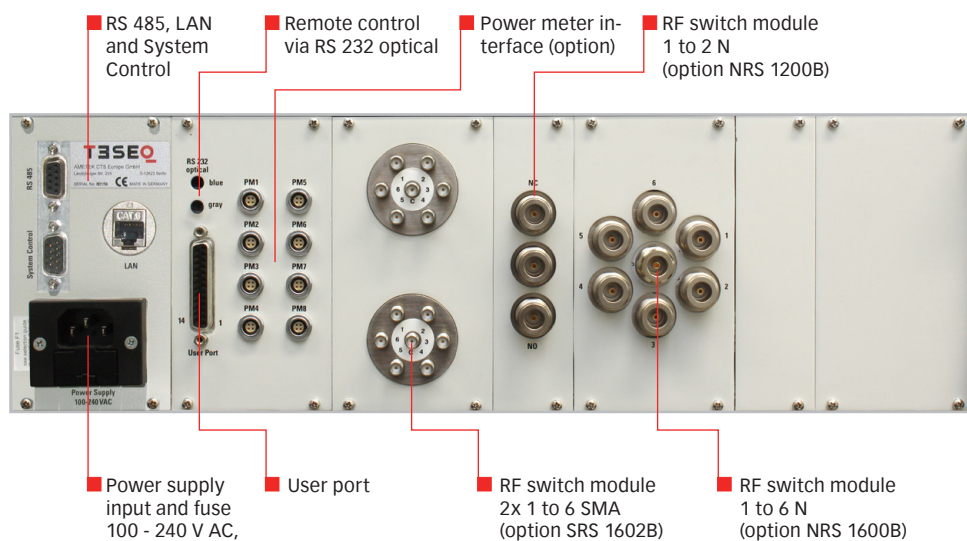


Figure 1: Front panel



Figure 2: View to the touch panel



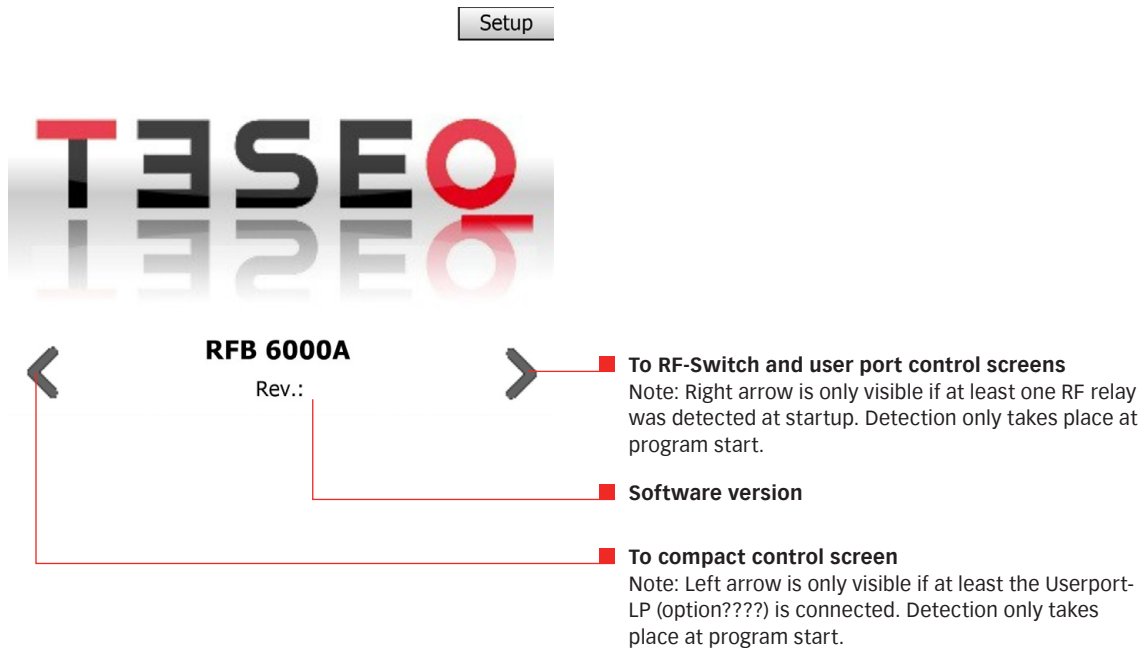
Note: View to the back panel, example with power meter interface RFI 6008, RF switch SRS 16002B: 2x 1 to 6 SMA type, RF switch NRS 1200B: 1 to 2 N type, RF switch SRS 1600B: 1 to 6 N type

Figure 3: Back panel

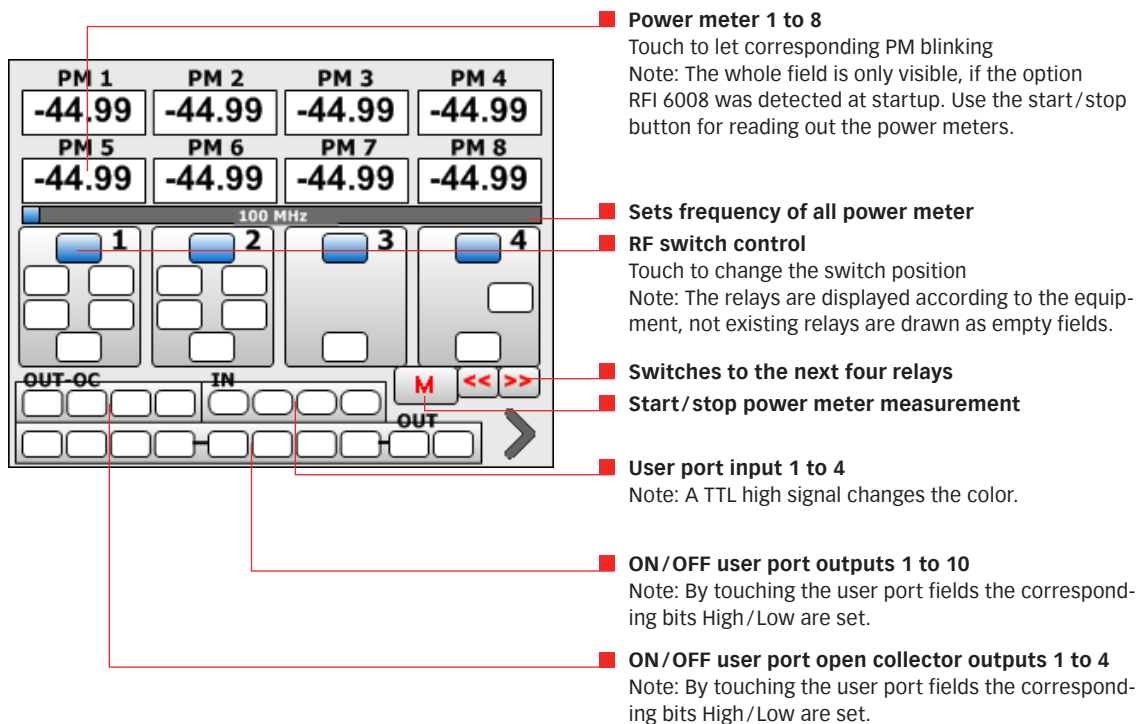
3.2. Touch screen

The unit has a touch screen for manual control of the RF relays. In addition to the individual control of the relays, 5 freely programmable range keys allow simultaneous switching of several relays and optionally available user port outputs. With the appropriate assignment of these keys, switching between different frequency ranges of an amplifier rack is possible with just one key press.

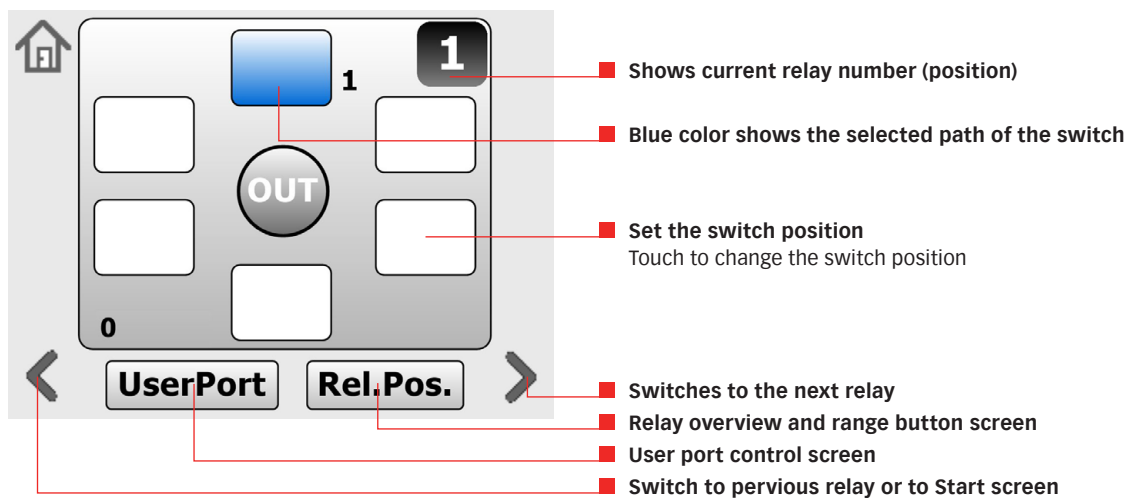
3.2.1. Start screen



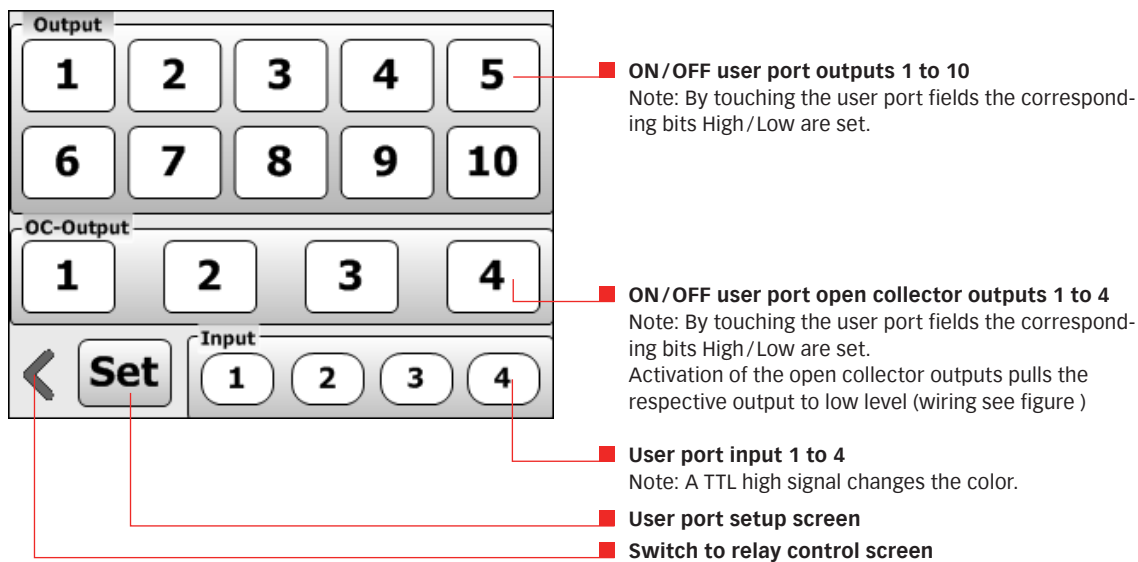
3.2.2. Compact control screen



3.2.3. Relay control screen



3.2.4. User port control screen



3.2.5. User port setup screen

Setup RANGE BUTTONS 1..5

PortNr.	1	2	3	4	5	6	7	8	9	10
Passive ON	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Passive Level	0	0	0	0	0	0	0	0	0	0

Range buttons are switching relais positions and User Port bits together. To allow cold switching a adjustable time window around the relay switch event can be activated, where the User Port-Bit goes to the defined Passive Level.

pre-actv. [ms]

100

↓

↑

post-actv. [ms]

100

↓

↑

STORE

■ Selects a user port Bit for Passive Level switching

■ Defines the Passive Level 0 / 1 of the related Bit

■ Saving the changes for further use in the internal FLASH

■ Defines the pre- and post-activation time of the user port bits.

Pre- and post-times are activated if passive level ON is set for at least one of the user port outputs. With a check mark, the corresponding User Port Bit goes to the set passive level. Without a check mark, the corresponding bit is set to the value stored in the Range Button. After the pre-time has elapsed, the relays have been switched and the post time has elapsed, the corresponding user port bits are set from the passive level to the value stored in the range button.

The time window around relay switching is approx. -30 ms to +100 ms. The 100 ms result from the response time of the PIC on the relay control module. Without a check mark, the corresponding bit is not changed during relay switching or is immediately set to the stored value. Via the passive level, amplifiers can be deactivated by low or high level during relay switching.

3.2.6. Relay position and range buttons

1	2	3	4	OFF	6	OFF	OFF	9	10
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1

2

3

4

5

Button State

Recall

■ Shows the relay number

■ Shows the relay position

■ Range Buttons 1..5
Allow common switching of relays and user port Bits

■ Saving the changes of the Range Button function for further use in the internal FLASH: Store/Recall

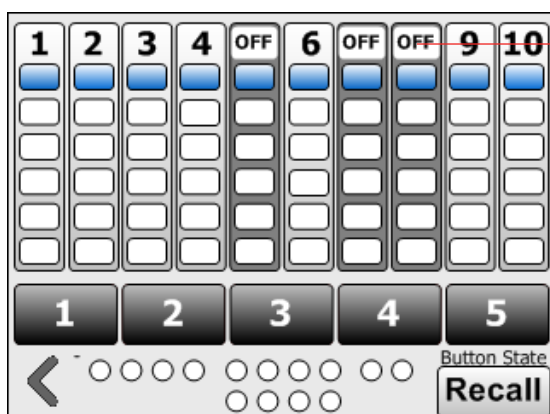
■ Display of user port bits 1 to 10

■ Display of user port open collector bits 1 to 4

■ Switch to relay control screen

The lower four fields indicate the state of the open collector outputs. In STORE mode, the current relay and user port settings are stored in the FLASH memory by pressing the RANGE keys.

RFB 6000A



■ Touch here to toggle in the OFF state

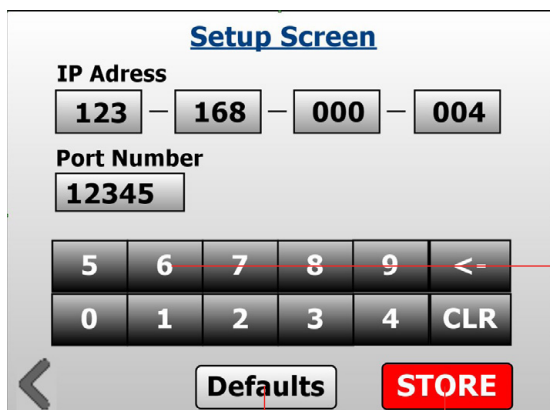
Example: Three relays (5, 7 and 8) are excluded from the switching with a Range Button

By pressing the relay numbers, the respective relay can be brought into a passive state before programming a Range button. After programming, the switching position of such relays is not changed when the Range key is pressed.

This means that individual relays or relay groups can be excluded from being influenced by the corresponding Range button.

3.3. Remote interface

The remote interfaces are located on the rear panel of the device. This allows full access to all RF relays and can be easily controlled from any PC. The remote port will be selected automatically. Settings for the LAN port can be changed in the setup menu.



■ Key pad

Select the desired field of the IP address or port number field first and use the key pad for entering the numbers.

■ Saves the changes

■ Recalls the default values

3.4. User port and power meter interface

The control panel is equipped with a 25-pin user port and up to 8 power meter inputs (Option RFI 6008) for the PM 600x. These additional components enable

- via the user port the switching on and off of amplifiers, amplifier areas and standby functions (10 outputs TTL level; output level 0.55 V and 3.8 V at 16 mA max)
- switching of loads up to 40 V/3 A (e.g. relays for antenna control) via 4 OC outputs of the user port
- the query of up to 8 power meters for measuring the forward/reverse power at 4 directional couplers.
- the power supply of additional loads with 5 V and 12 V, each with 0.7 A

3.5. RF switch module configuration

Each RF switch module is supplied with two DIP switches to configure position and type of the RF switch. The DIP switch SW 1 is used to set the type of the RF switch. The following drawing shows the settings.

The DIP switch SW 2 is used to set the position of the RF switch. The following drawing shows the settings.

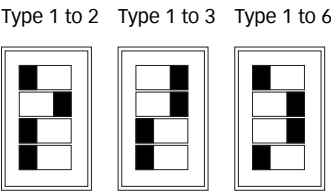


Figure 4: DIP switch SW 1: Sets the type of the RF switch

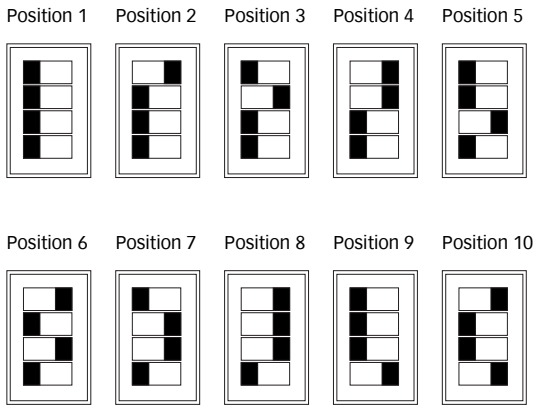


Figure 5: DIP switch SW 2: Sets the position (number) of the RF switch

4. OPERATION

4.1. General

After switching on, an attempt is made to detect all available relay modules. The software is designed for processing up to 10 relay modules. If no relay boards are found, the arrow for calling the Relay Control Screen is not displayed. Only empty fields are available at all relay positions in the Compact Control Screen.

Furthermore, the Userport module, power meter module 1 and 2 are detected and the result of this test determines the graphical representation of the respective components in the program. Without Userport module, the Compact Control Screen and the User Port Screen cannot be called up.

Without power meter module 1 and 2, the corresponding measured value boxes are not displayed in the Compact Control Screen. The user port outputs remain in a high-impedance state until the first user port output. Output takes place when the User Port keys User Port Screen and Compact Control Screen are pressed and when the Range keys are pressed. The state of the keys is not saved.

The switching state of the relays is not stored. The state of the relays after switching on depends on the relay type. With changeover switches, the output is connected to one of the inputs, with 3 to 1 or 6 to 1 switches, the output is not connected to any input for pressing a key

4.2. Cold Switching

Cold switching is synonymous with switching the RF relays in the powerless state. This is a particular problem when pressing one of the 5 Range buttons, as the relays and the user port outputs switch virtually simultaneously. Therefore, when using individual userport outputs for switching RF amplification on/off, a time window can be defined in the Setup Range Buttons 1...5 window in which these outputs change to an adjustable level and thus switch off the amplifier during this time window. The time window is adjustable (pre-actv. / post-actv.) and embeds the switching of the relay modules. According to the settings in the Setup Range Buttons 1...5 window, the behavior of the User Port outputs is as follows:

- The time window is inactive if none of the checkmarks at Passive On is set. I.e. first the relays switch, immediately afterwards the user port outputs.
- Outputs activated with Passive ON change at the beginning of the time window to the level defined in Passive Level (amplifier switched off), remain there until the end of the time window and then change to the level defined with the Range buttons (amplifier on).
- Outputs not activated with Passive On change immediately at the beginning of the time window to the level defined with the Range buttons (with at least one output activated).

4.3. Remote control and USO 4013

The RF Switch Network can be remote controlled via the optical RS232 interface. Included in the delivery of RFB 6000A is an USB-to-serial converter, USO 4013, which allows to connect the RF Switch Network with a PC with USB interface.

The RFB 6000A bus parameters are as following:

- 115200 baud
- 8 bit
- 1 stop bit
- no parity

All send commands have to be terminated by CR (carriage return).

For using the USO 4013 it also necessary to install a driver on the control PC in the following way:

- Plug in the USB adapter in the PC.
- The PC detects a new hardware and searches for a driver.
- Insert the delivered USB stick in the PC and install the driver from there. The file USO4013_Util_Inst.EXE is a self extracting file. It has to be copied and then started there into a new, self created folder. The real program USO4013_Util.EXE can then be called about a combination on the desktop.
- Follow the instruction, which can be found in the driver folder.



Caution: **Never operate the switch with RF power on.
Switching by absence of RF power only!**

5. APPLICATIONS

5.1. Introduction

Many cases especially in high frequency technology demands to switch signals in wide frequency and power ranges. Not all components of the system are available in the full broadband. Example of system components with less broadband compatibility are:

- Power amplifier
- Directional coupler
- Antenna

The requirement on the RF switch is, beside the switch functionality, to transmit all signals in best quality with low transmission error. The height of the transmission error is described by following frequency depending parameters:

- Insertion Loss
- Isolation
- VSWR

5.2. Example

The RF switch network can be configured to switch RF signals in a wide range of automatic test systems. Various switch configurations are available, as needed for the emission or/and immunity test system. The following system drawings provide application examples.

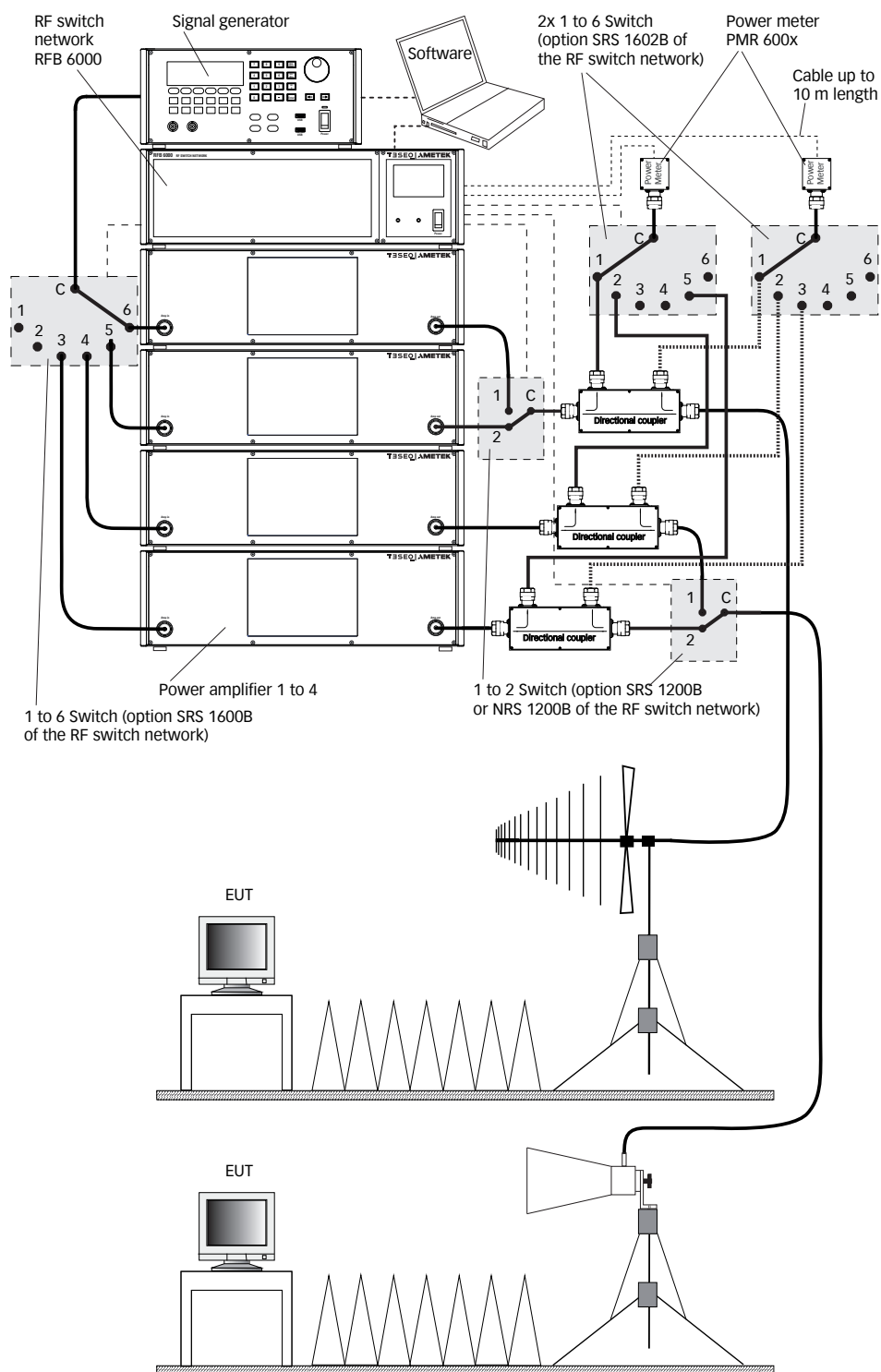
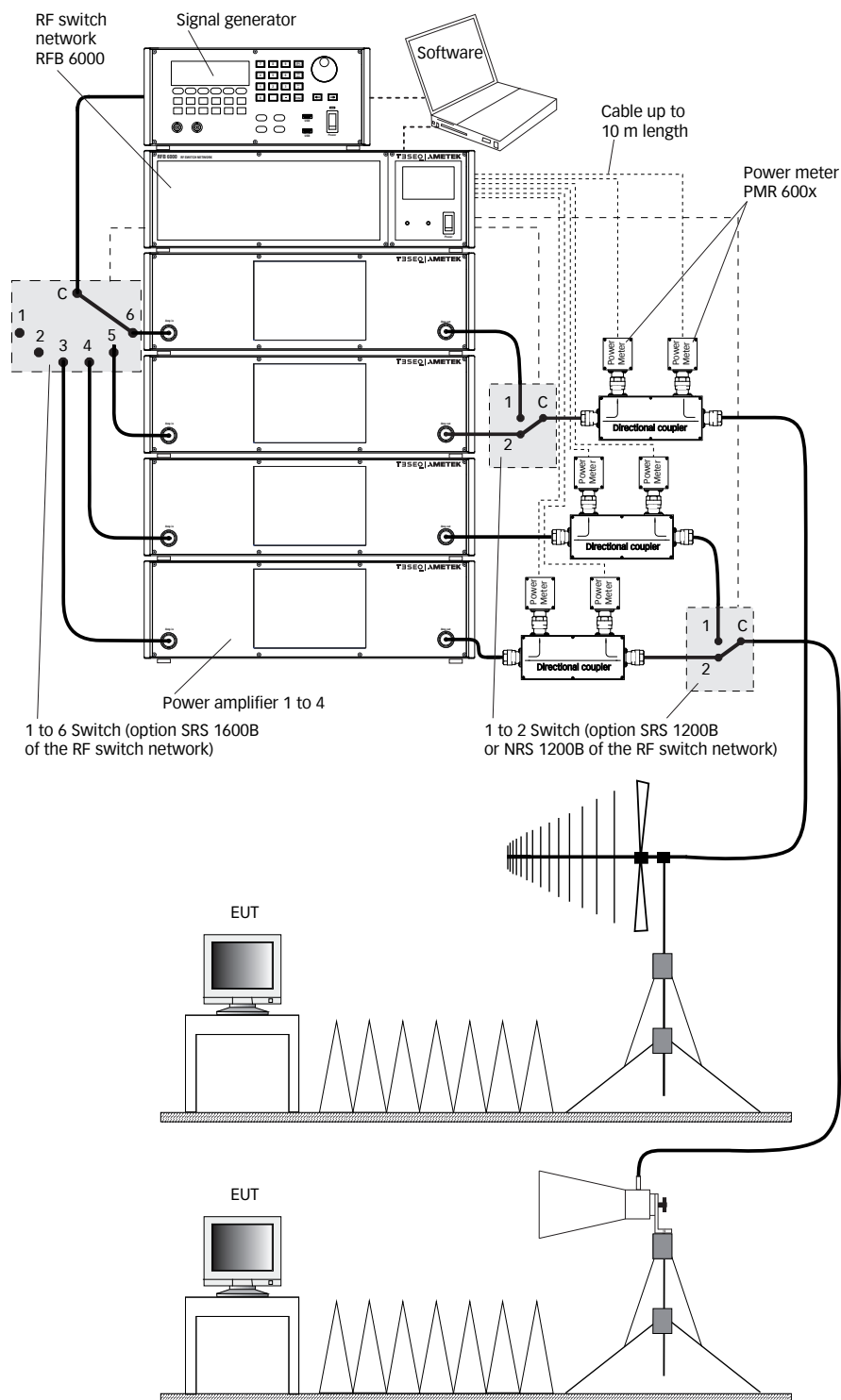


Figure 6: Example of a setup with 2 power amplifiers, 1 directional coupler, 1 power meter, 1 antenna and measuring receiver



Note:

This example shows the recommended short RF connection between directional coupler and power meter for avoiding measuring errors.

Figure 7: Example of a setup with 4 power amplifier, 3 directional couplers, 1 power meter and 2 antennas

6. SOFTWARE COMMANDS

6.1. Construction of a command line:

A command line can contain one command

- The command line is completed by New Line (NL, 0AH) and/or Carriage Return (CR, 0DH)
- No distinction is made between upper and lower case.
- The abbreviation of command headers is possible, and either the full command or the defined abbreviation must be employed.

In the following command description, the abbreviated form of the header is characterized by capital letters (no distinction is made between upper and lower case)

Example: MONITOR:USEROUT
 MONITOR:USEROUT is equivalent to MON:UOUT or moN:UOut ,
 while MON:USEROUT causes an error message.

Most of the control commands also exist in a query version, which only delivers a "0" as answer. This is implemented to simplify the time synchronisation of control program and RFB 6000A. Especially the relay commands (and all depending commands like *RST?) needs longer processing time.

All *ARR? commands use a composed string for all target states. The first entry in this string is related to the first target device (e.g. first switch address or first user port). The second entry related to the second target device and so on.

6.2. Common Commands

6.2.1. *IDN?

Delivers the devices identification string. This string is composed of the device name, the devices serial number and its software version.

Command: *IDN?

Return: TESEQ RFB 6000A,000123,V1.01

6.2.2. *GTL

This command switches the device back to local mode. Front panel operation is then permitted.

Command: *GTL

6.2.3. *RST?

This command resets relays to position1 and all user port outputs are turned Low.

Command: *RST?

Return: 0

6.3. Device Depended Commands

6.3.1. REBOOT

Reboots the Firmware of the RFB 6000A.

Command: REBOOT

6.3.2. IDN_PM?

The RFB 6000A provides connectors for up to 8 external PM 600x power meter probes (optional). This command delivers the devices identification string of the connected power meter probes. The string is composed of the device name, its software version and its serial number. The command needs the power meter channel 1..8 as parameter.

Unconnected power meter channels deliver "???".

Command: IDN_PM? 1

Return: Teseq PM 6006,V1.0,0000000123

6.3.3. UPD_PM_CONF; UPD_PM_CONF?

Detects the currently connected power meters. Future measurements on unconnected power meter ports will be skipped immediately without any timeout time. Unconnected power meters still deliver a value of "-999". After calling this command the first time, a differentiation between

- power meter not connected; delivers "-999"
- error event power meter time out; delivers "-111"

is possible.

The command must be called after every change of the power meter connections.

Command: UPD_PM_CONF?

Return: 0

6.3.4. RST_PM_CONF; RST_PM_CONF?

Resets the power meter configuration information to its initial state. After that, a controlling program can react immediately on changings in the power meter configuration. Every power meter port delivers a real measurement value or a "-999" if not connected. But in this state a differentiation between "not connected" and a "time out" error is not possible.

6.3.5. HW_CONF?

Reads the hardware configuration of the RFB 6000A. This command delivers an identification string with three numbers. They are standing for the BCB with user port string and optical connectors, the PCB with power meter connectors 1...4 and the PCB with power meter connectors 5...8.

Not existing PCBs deliver a "0".

Command: HW_CONF?

Return: 1, 1, 1 -> if all components available (for optical remote control the first number is always 1)

6.3.6. POW?

Measure the power and return the measured value. This command needs a frequency parameter and a power meter channel number between 1..8. The frequency parameter must be specified in full MHz steps. The command returns the currently measured power in dBm.

Unconnected power meter channels deliver a value of "-999".

Command: POW? 1000 2

Return: 4.75

6.3.7. POWARR?

Measure the power of all 8 power meter channels and return a single string with all measured values. This command needs a common frequency parameter for all power meters. The frequency parameter must be specified in full MHz steps. The command returns the currently measured power in dBm.

For not connected power meters a "-999" is inserted into the string.

Command: POWARR? 1000

Return: 4.83,-42.15,-999,12.78,-999,-999,-45.37,-999

6.3.8. AVG; AVG?

Set the averaging count for the power meter measurements. The device averages this amount of measurements, before returning the result. This command expects the number of averages in the range of 1 to 10000 and a power meter channel number between 1..8.

No reaction happens for unconnected power meters.

Command: AVG? 25 2

Return: 0

6.3.9. BLINK; BLINK?

This command causes the corresponding devices green led to blink for about 6 seconds. This helps to identify the device in a complex measurement setup. The command needs the power meter channel 1..8 as parameter. No reaction happens for unconnected power meters.

Command: BLINK? 1

Return: 0

Bit	Input
0	User Input 0
1	USER INPUT 1
2	USER INPUT 2
3	USER INPUT 3

6.3.10. MONitor:UserOUT; MONitor:UserOUT?

The RFB 6000A has 14 digital outputs (10 x TTL and 4 x OC) which can be used for control purposes like amplifier and antenna switching. These outputs are user output 1-14 on the user port. The command requires a pin number and a logic level (high or low) parameter.

For the pin assignment of the user port see table A.1 in appendix A on page 9.

Command: MON:UOUT 7 1 or

MON:UOUT? 4 low

Return: 0

6.3.11. MONitor:DIGital?

Reads all digital inputs on the rear panel of the RFB 6000A and returns a byte with a bit for each input set. For the structure of the returned byte please see table 5.1. For the pin assignment of the user port see table A.1 in appendix A on page 9.

Command: MON:DIG?

Return: 0...15

6.3.12. GET:POS?

Delivers the relay type of a certain relay. All switches in the RFB 6000A are addressed by the letters A...J. They have to be used as the parameter for relay selection. Depending on the relay type, the returned string may be 2TO1, 6TO1....

The query of nonexistent switches deliver the string "---".

Command: GET:POS? B

Return: 6TO1

6.3.13. GET:POSARR?

Detects the relay type of all available switches in the RFB 6000A and returns a single string with a type entry for every of the possible relays. The relay type is a number which correspond to the relay maximum switch positions in the range of 2..6.

Nonexistent switches deliver a -.

Command: GET:POSARR?

Return: 6, 2, -, -, -, 3, -, -, 6

6.3.14. GET:STATE?

Delivers the current switch position of a certain relay in the range of 0...6. All switches in the RFB 6000A are addressed by the letters A...J. They have to be used as the parameter for relay selection. A state of 0 indicates that the COM input is not connected with any output.

Nonexistent switches deliver a -.

Command: GET:STATE? A

Return: 2

6.3.15. GET:STATEARR?

Detects the current relay position of all available relays and returns a single string with this positions in the range of 0...6.

Nonexistent switches deliver a -.

Command: GET:STATEARR?

Return: 0, 1, -, -, -, 3, -, 6

6.3.16. GET:UPOUTARR?

Detects the current user port settings and returns a single string with a 0...1 for every port.

Command: GET:UOUTARR?

Return e.g.: 0, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1 (the last 4 numbers for the open collector outputs)

6.3.17. GET:TEMPerature?

Returns the temperature measurement value of the internal temperature sensor in °C.

Requires: TEMP_CONT is set to 1 (or true)

Command: GET:TEMP?

Return e.g.: 22 °C

6.3.18. SET:END_TEMPerature, SET:END_TEMPerature?

Sets the end-temperature for PWM-controlling of the van in the parameter range of 32...100. The van is controlled about a PWM signal that raises in 10 steps from 30 °C to the end-temperature.

Command: SET:TEMP? 45

Return: 0

6.3.19. SET:TEMPerature_CONTROL, SET:TEMPerature_CONTROL?

Sets the TEMP_CONT value to 0 or 1 (false or true). This is necessary to activate temperature measurement and activating of the PWM signal for the van.

Command: SET:TEMP_CONT? 1 (true)

Return: 0

6.3.20. SET:PWM_DUTY, SET:PWM_DUTY?

Sets the duty cycle of the PWM signal for the van in the range of 0...100%. It is necessary to activate the Temperature_Control mode for an active PWM signal.

Command: SET:PWM_DUTY? 55

Return: 0

6.3.21. SET:STATE, SET:STATE?

Sets a switch position in the range 0...6 of an addressed relay. All switches in the RFB 6000A are addressed about the letters A...J. They have to be used as the parameter for relay selection. The second parameter is the switch position, whereby position 0 indicates that the COM input is not connected with any output. This position is not available for SPDT switches (1 to 2).

Command: SET:STATE? B 2

Return: 0

6.3.22. SET:STATEARR?

In junction with SET:USPOARR and WRT_FLASH? commands used to program the configuration of the range buttons. This command set the switch position of all possibly available ten relays. The necessary parameters are a number 1...5 for button selection and a string with all switch positions.

Command: SET:STATEARR? 4 0,2,-,-,3,-,-,6 for range button 4

Return: 0

6.3.23. SET:USPOARR?

In junction with SET:STATEARR and WRT_FLASH? commands used to program the configuration of the range buttons 1...5. These command sets the Level of all 14 user port outputs. The necessary parameters are a number 1...5 for button selection and a string with all 14 logic levels. Note that outputs 11...14 are open collector outputs with inverted logic levels.

Command: SET:USPOARR? 4 0,1,0,0,0,1,0,0,0,1,1,10,0 for range button 4

Return: 0

6.3.24. WRT:FLASH?

Writes all settings which were made with SET:STAEARR? and SET:USPOARR? into the internal FLASH memory of the RFB 6000A.

Command: WRT:FLASH?

Return: 0

7. RFB 6000 CONTROL PROGRAM

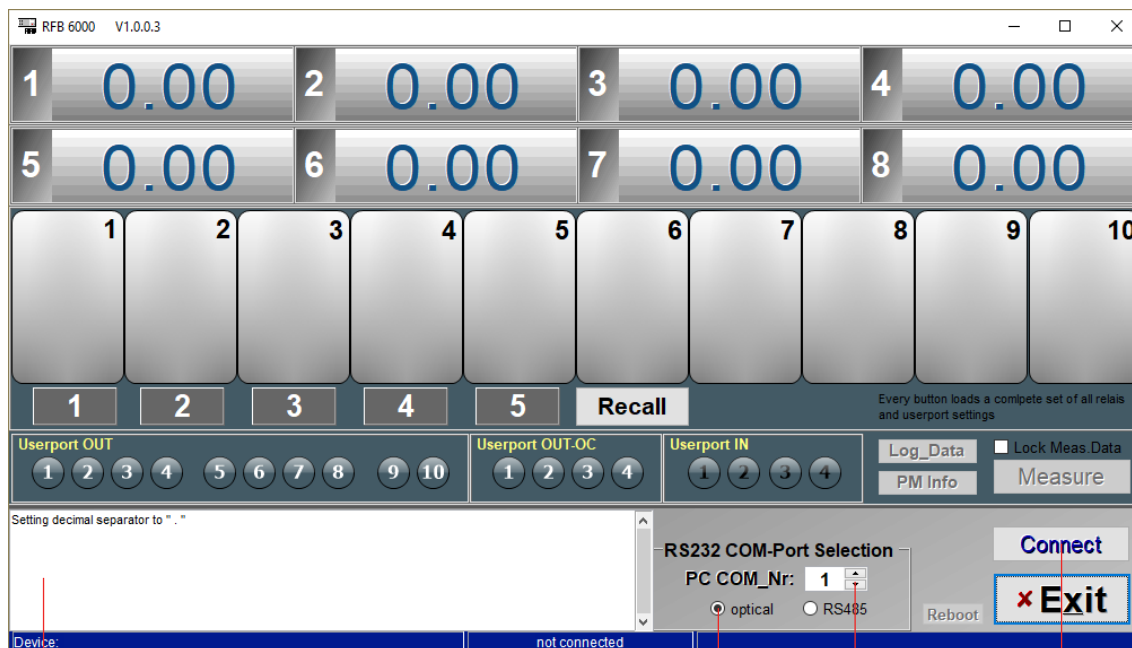
7.1. Basic functions

The program provides the following basic functions:

- Establishing a remote control connection via RS484 or optical fibre.
- Detection, display and control of the existing relay modules.
- Control the userport outputs and read in the userport inputs (if available).
- Continuous measurement with up to 8 power meters (if available).
- Display of information of the connected power meters.
- Power meter identification via flashing function.
- 5 freely programmable range keys which switch all relays and userport outputs simultaneously at the push of a button.
- Transfer of the range key assignment to the RFB 6000A and programming into the internal flash memory.

7.2. Description of the program

After selecting the remote control interface and the corresponding COM port, a remote control connection to the RFB 6000A can be established using the Connect button. The type and switching position of the existing relay modules are automatically detected.



■ Status field of the remote connection

■ Select "optical" for using USO 4013 on the optical port. Select "RS485" for using the electrical port for the remote operation.

■ Select the desired COM port for the remote operation.

■ Press the "CONNECT" button to activate the remote control connection.

Figure 8: Start screen

The control elements are inactive until the remote control connection is established.

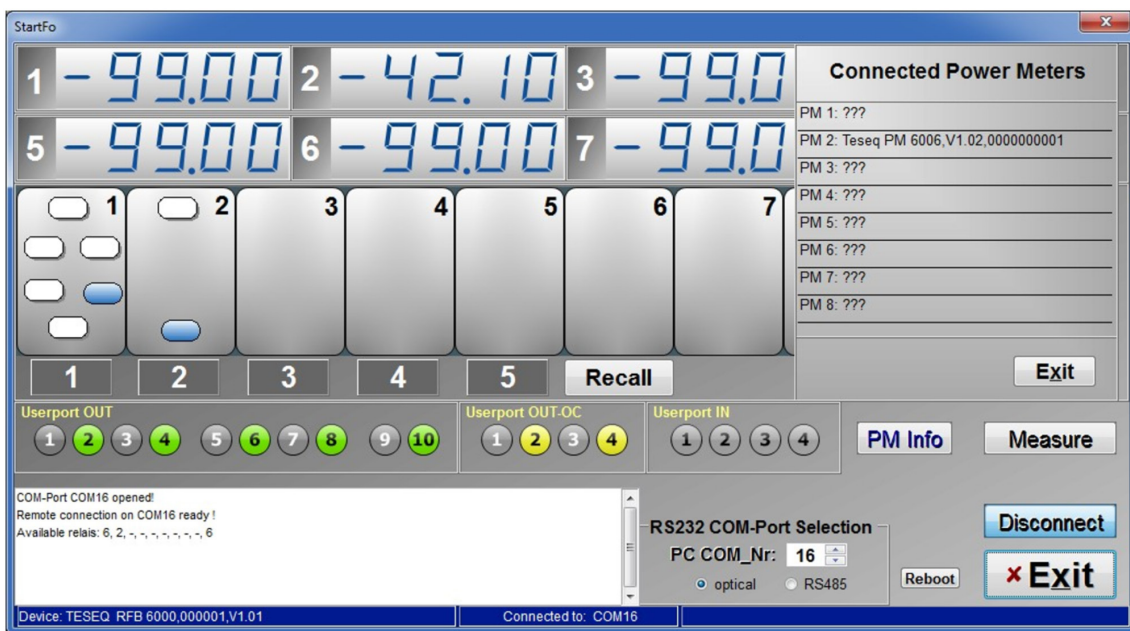
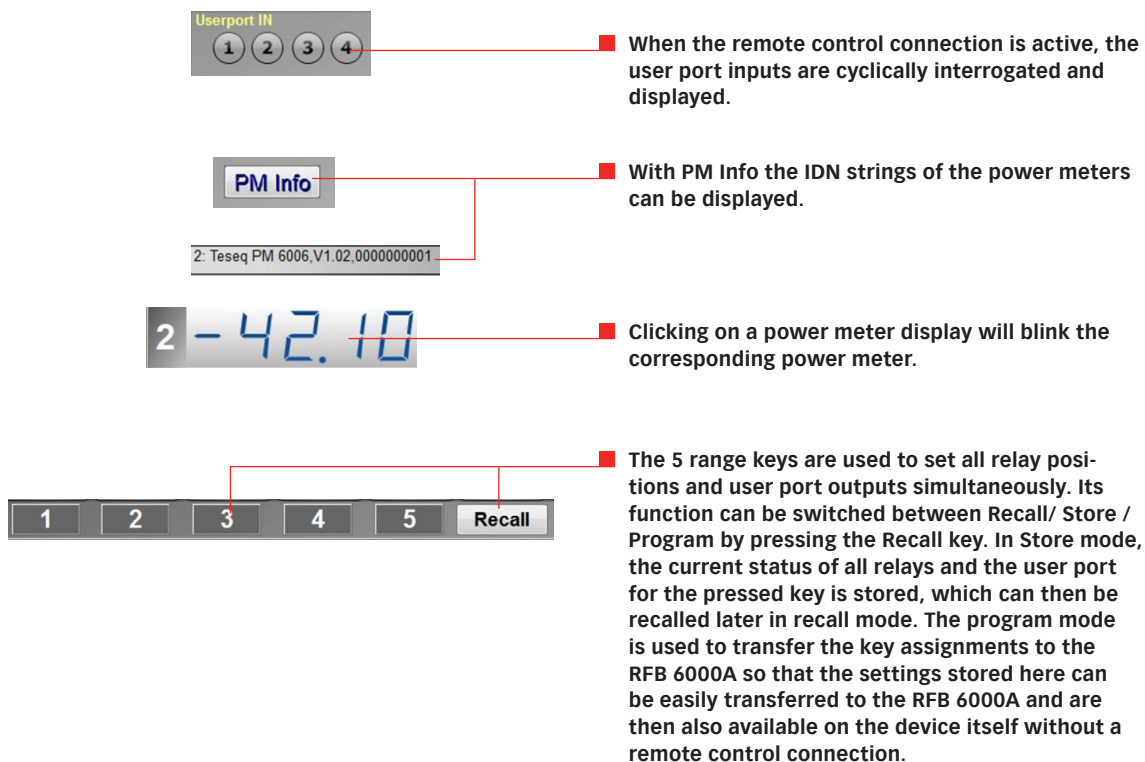


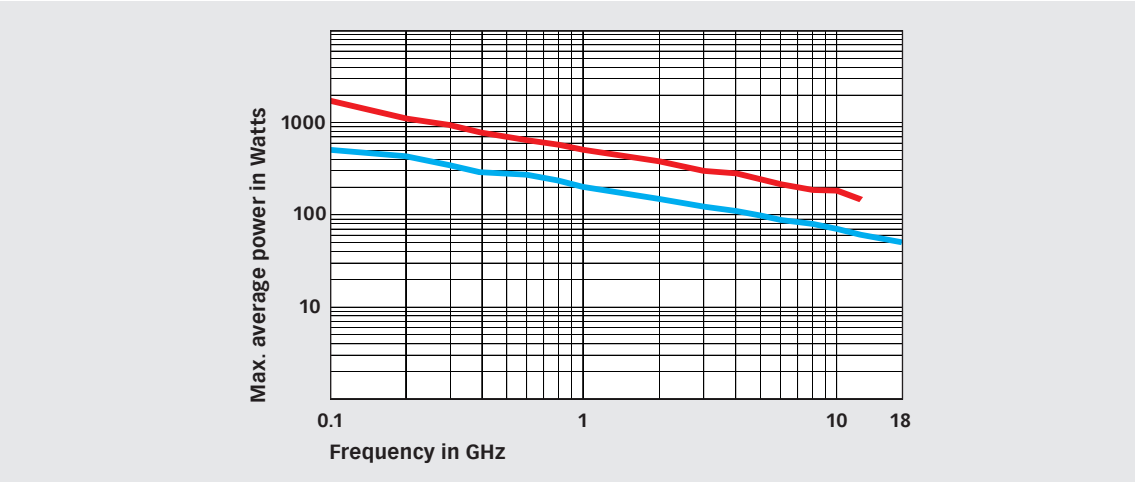
Figure 9: Main screen



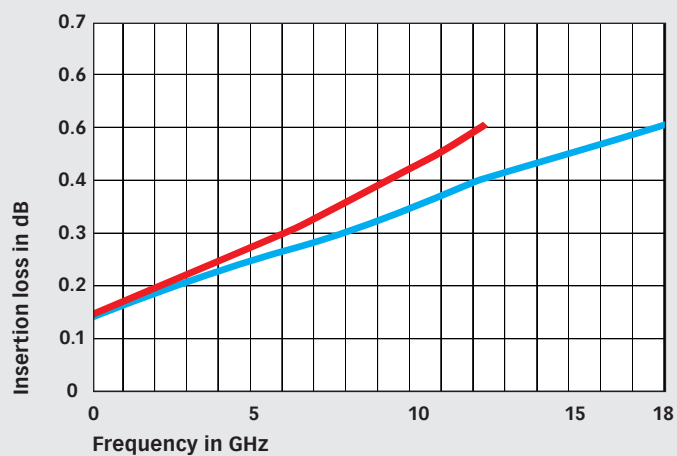
8. TECHNICAL SPECIFICATIONS

Power supply:	100 - 240 V AC / 47 - 63 Hz
Display:	3" TFT with touch, 320x240 pix.
Remote control	
RS485:	Connector D-Sub 9 pole, up to 9600 Bd (for RF switches only)
RS232 optical:	Connector 2 x HFBRx523 socket for 1 mm fiber optic cable with standard length of 20 m, for other distances on request
	115200 Bd, 8, N, 1
User port:	D-Sub 25 pole
	4 TTL inputs
	10 TTL outputs
	4 open drain outputs 40 V, 3 A
	+12 V / 700 mA, +5 V / 700 mA power supply
RF Impedance of the switches:	50 Ω
RF Isolation between the ports:	≥55 dB
Switch life time:	1M switch cycles (absence of RF power during switching required)
Operating temperature:	5 - 40°C
Humidity:	< 80% (not condensation)
Dimensions (W/H/D in mm):	483 x 150 x 423
Weight:	approx. 10 kg

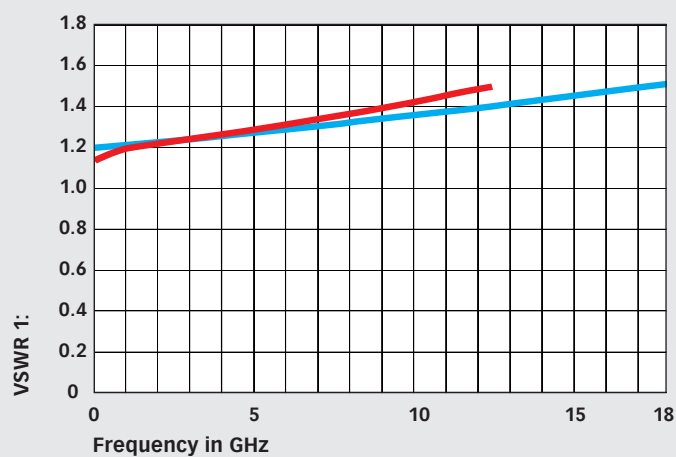
Max. average power — N type, — SMA type



Insertion loss — N type, — SMA type



VSWR — N type, — SMA type



Pin configuration of the User Port

Pin number	Name	Description
1	DI_0	User Port input 0 (TTL level)
2	DI_1	User Port input 1 (TTL level)
3	DI_2	User Port input 2 (TTL level)
4	DI_3	User Port input 3 (TTL level)
5	GND	Supply voltage
6	DO_7	User Port output 7 (LV logic, 1.5/3.5 V, ± 16 mA)
7	DO_6	User Port output 6 (LV logic, 1.5/3.5 V, ± 16 mA)
8	DO_5	User Port output 5 (LV logic, 1.5/3.5 V, ± 16 mA)
9	DO_4	User Port output 4 (LV logic, 1.5/3.5 V, ± 16 mA)
10	DO_3	User Port output 3 (LV logic, 1.5/3.5 V, ± 16 mA)
11	DO_2	User Port output 2 (LV logic, 1.5/3.5 V, ± 16 mA)
12	DO_1	User Port output 1 (LV logic, 1.5/3.5 V, ± 16 mA)
13	DO_0	User Port output 0 (LV logic, 1.5/3.5 V, ± 16 mA)
14	GND	Supply voltage
15	DOC_3	User Port output Open Collector 3 (max. 40 V; 3 A)
16	DOC_2	User Port output Open Collector 2 (max. 40 V; 3 A)
17	DOC_1	User Port output Open Collector 1 (max. 40 V; 3 A)
18	DOC_0	User Port output Open Collector 0 (max. 40 V; 3 A)
19	DO_9	User Port output 9 (LV logic, 1.5/3.5 V, ± 16 mA)
20	DO_8	User Port output 8 (LV logic, 1.5/3.5 V, ± 16 mA)
21	RxD	RS232 receive data (parallel to LWL)
22	TxD	RS232 transmit data (parallel to LWL)
23	+5V	Supply voltage (max. 0.7 A)
24		
25	+12V	Supply voltage (max. 0.7 A)

9. MAINTENANCE

9.1. General

The RF Switch Network needs no special maintenance. The maintenance is limited to the cleaning of the contacts. The life time of the connectors and switches are limited because of the contact durability. Teseq can replace the worn out connectors and switches.

No modifications are to be carried out on the RF Switch Network and accessories by the user.

9.2. Cleaning

The cleaning shall be done with dry cloth. If a wet cleaning would become necessary, make sure that no humidity will enter inside of the unit and clean the instrument housing with a damp cloth using a little mild, non-abrasive household cleanser if necessary.

Chemicals must not be used for cleaning purposes

10. DISPOSAL

The unit is constructed that it can be dismantled right down to the component level.

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