



High-Frequency Switch

VCH-604

Operating Manual

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List of Abbreviations

GPIB – general purpose interface bus (IEEE-488)

RS232 – serial port


REN – remote enable

T – talk (sending data through GPIB)

L – listen (receiving data through GPIB)

PCA – printed circuit assembly

1 Safety precaution

- 1.1 Carefully read the operating manual before working with the device and note the safety information.
- 1.2 Accessible conductive parts of the device are protected by basic insulation and electrically connected to the protective grounding.
- 1.3 The device is grounded via protective conductor in the power cable and protective earth terminal marked  on the rear panel.
- 1.4 The device is connected to the AC via three-wire power cable (two poles and ground) included in the device composition.

2 Device description

2.1 Description and operation

High-Frequency Switch VCH-604 is designed for switching high-frequency (1 – 100 MHz) and pulse TTL signals. VCH-604 can be controlled from PC via GPIB and RS-232 interfaces or directly from front panel keyboard. The device has two independent groups of channels, in each group one of the 25 inputs is directly connected to one of the 2 outputs.

Main applications are the time frequency measurements and reference measurement systems and telecommunications.

The device can be used as an integral part of the time and frequency high precision measurement systems and time and frequency etalon systems.

The external view of the device is given in Fig. 1.



Fig. 1

Normal operating conditions:

- Air temperature: $20 \pm 5^\circ\text{C}$
- Relative humidity: no more than 60% at $+25^\circ\text{C}$
- Atmospheric pressure 84 – 106 kPa (630-795 mm Hg)
- Power supply: $220 \pm 10\%$ V

Working operating conditions:

- Air temperature: $+5$ up to $+40^\circ\text{C}$
- Relative humidity: up to 80% at $+25^\circ\text{C}$
- Atmospheric pressure 84 – 106 kPa (450-795 mm Hg)
- Power supply: $220 \pm 10\%$ V;
- Power supply frequency: 50 Hz;
- External power supply: 22 to 30 V DC.

Utmost operating conditions:

- Air temperature: -40 up to $+50^\circ\text{C}$
- Relative humidity: up to 80% at $+25^\circ\text{C}$

2.2 Product specifications

- 2.2.1 The device has two independent groups of channels, in each group one of the 25 inputs is directly connected to one of the 2 outputs (numbers of connected input channels are indicated by seven-segment indicators, output channel numbers - single indicators).
- 2.2.2 Input/output line resistance no more than 1.5 Ohm.
- 2.2.3 Input/output isolation:
- 120 dB at 5 MHz;
 - 110 dB at 100 MHz.
- 2.2.4 Isolation between adjacent channels:
- 120 dB at 5 MHz;
 - 110 dB at 100 MHz.
- 2.2.5 The device is controlled from PC via GPIB and RS-232 interfaces. Interface can be selected by using a switch located on the rear panel. For management via GPIB interface control lines states are indicated by the "REN", "L", "T" indicators. RS-232 interface management is indicated by "REN" indicator.
- 2.2.6 The device provides its specifications in working conditions after a 15-minute warm-up time.
- 2.2.7 The device provides continuous non-stop operation in working conditions with all specifications preserved.
- 2.2.8 The switch preserves its specifications when powered by (220 ± 22) V AC or an external DC source $(22 - 30)$ V.
- 2.2.9 Power consumption is no more than 25 VA (AC)

2.2.10 Power consumption is no more than 20 W (DC) at nominal voltage 27 V.

2.2.11 Input and output channels in the device are connected via SMA sockets

2.2.12 The device is connected to the DC power source via power cable supplied with the device

2.2.13 The device preserves its specifications when provided working operating conditions, and after exposure to utmost conditions provided 6-hour warm-up time in normal or working operating conditions.

2.2.14 Weight and dimensions of the device without packing and in the packing case are shown in Table 1.

Table 1 – Weight and dimensions of the device

Designation	Netto		In packing case	
	dimensions, mm	weight, kg	dimensions, mm	weight, kg
High-Frequency Switch VCH-604	483×132,5×262,5	8	657×351×512,5	27
Spare parts kit		0,5		

2.3 Product composition

The device composition is given in Table 2.

Table 2 – Device composition

Type	Quantity
High-Frequency Switch VCH-604	1
Spare parts kit:	
Power cable 220V	1
Power cable for 27 V source	1
Fuse link FL2B-1V 3,15 A 250V	4
Fuse link FL1-1V 1 A 250V	2
Operating manual	1
Packing case	1

2.4 Basic configuration and operation

The device operation is based on converting input commands into voltages, controlling the respective switching elements. Miniature high-frequency relays with bandwidth up to 500 MHz are used as switching elements

Principle of operation of the device is illustrated by the block-diagram in Fig. 2.

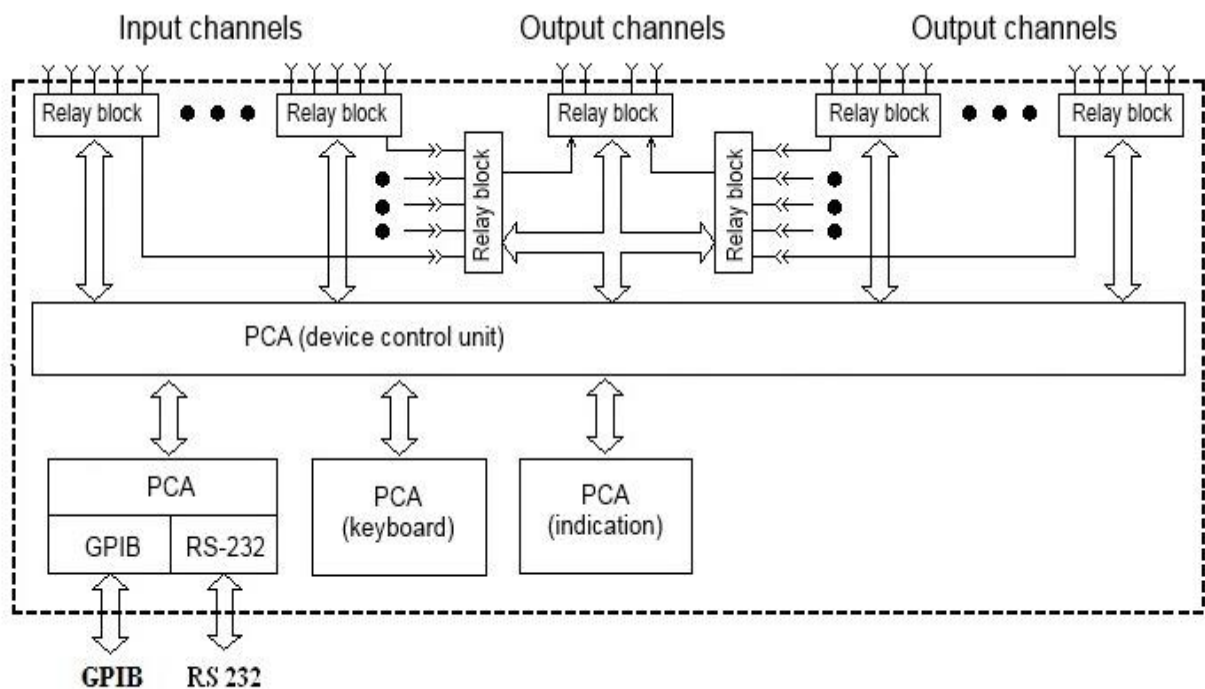


Fig 2

The device consists of these main parts:

- relay blocks;
- PCA (device control unit);
- PCA (interface unit);
- PCA (indication);
- PCA (keyboard).

Input commands for switching elements are sent to the control unit of the device from the front panel keyboard or via GPIB and RS232 interfaces and converted into control signals for corresponding relays. Numbers of the enabled channels can be read from the device via GPIB or RS232 interfaces.

The indication unit located on the front panel provides an indication for:

- Numbers of enabled input channels "GROUP 1 № \ominus " and "GROUP 2 № \ominus " on the seven-segment indicators;
- Numbers of enabled output channels "GROUP 1 № \ominus 1 or 2" and "GROUP 1 № \ominus 1 or 2" on single indicators;
- control lines states on single indicators.

2.5 Remote control commands

The device is controlled from PC by sending control command as ASCII character strings to the device, and reading numbers of input and output channels from the device. Control commands are given in Tables 3 and 4. The symbols used for programming the device parameters are given in Table 5.

Table 3 – Commands to write numbers of input and output channels

GPIB format	A Y ₁ Y ₂ X ₁ LF	for Group 1
GPIB format	B Y ₁ Y ₂ X ₁ LF	for Group 2
RS format	A Y ₁ Y ₂ X ₁ LF	for Group 1
RS format	B Y ₁ Y ₂ X ₁ LF	for Group 2
returned symbols	none	

Y1, Y2, X1 character values are given in Table 5.

Table 4 – Commands to read status of the device channels

GPIB format	C LF	Standard library function	for Group 1
GPIB format	D LF	Standard library function	for Group 2
RS format	C LF		for Group 1
RS format	D LF		for Group 2
returned symbols	d ₁ d ₂ d ₃ LF		


Table 5 – Symbols, used for the device parameters programming

Position	ASCII symbol	Symbol code (hex)	Parameter value set
-	A	41h	group 1 input and output channels numbers write symbol
-	B	42h	group 2 input and output channels numbers write symbol
-	C	43h	group 1 input and output channels numbers read symbol
-	D	44h	group 2 input and output channels numbers read symbol
Y ₁	from 0 to 2	30h ÷ 32h	digit – tens of the input channel number
Y ₂	from 0 to 9	30h ÷ 39h	digit – units of the input channel number
X ₁	1 or 2	31h or 32h	digit – connected output channel number
d ₁	from 0 to 2	30h ÷ 32h	digit – tens of the connected input channel number
d ₂	from 0 to 9	30h ÷ 39h	digit – units of the connected input channel number
d ₃	1 or 2	31h or 32h	digit – connected output channel number

3 Device operation

3.1 Safety requirements

Accessible conductive parts of the device are protected by basic insulation and electrically connected to the protective grounding

The device must be grounded before use via protective conductor in the power cable and protective earth terminal marked  on the rear panel

ATTENTION! Grounding failure makes the device unsafe. Operation of the ungrounded device is prohibited.

The device is connected to the AC via three-wire power cable (two poles and ground) included in the device composition.

ATTENTION! Usage of any other power plugs is STRICTLY PROHIBITED

Operation of the device must comply with the electrical safety regulations in force at the operating facility.

3.2 Location of control and connection systems

Control and connection systems on the front and rear panels of the device, are shown in Figures 3 and 4, respectively.

The purpose of control systems on the front and rear panels of the device and their default states are given in Tables 6 and 7, respectively

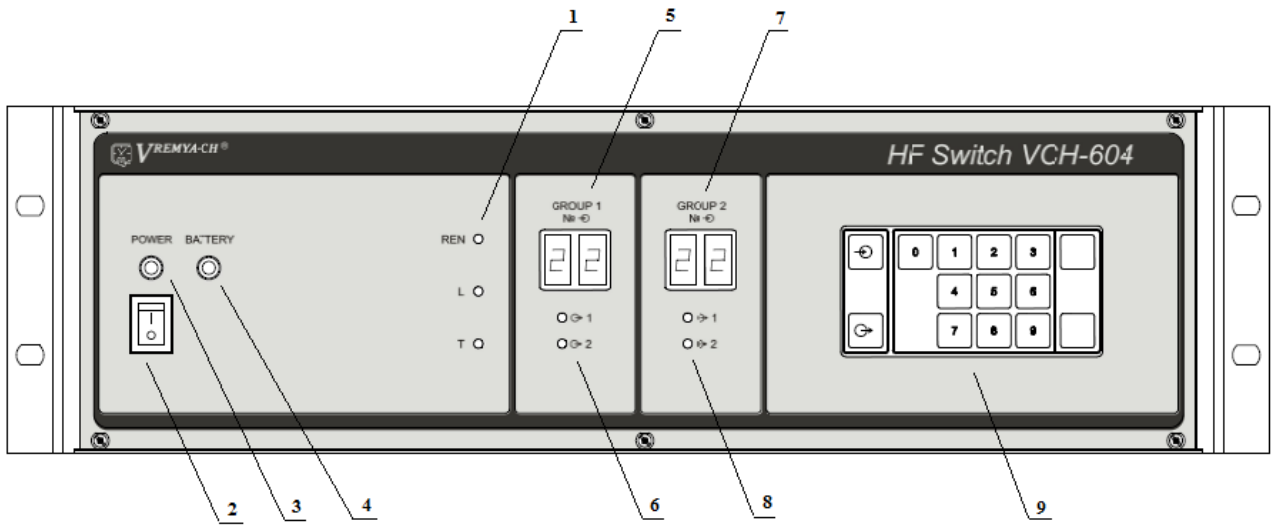


Fig.3 – Location of control and connection systems on the front panel

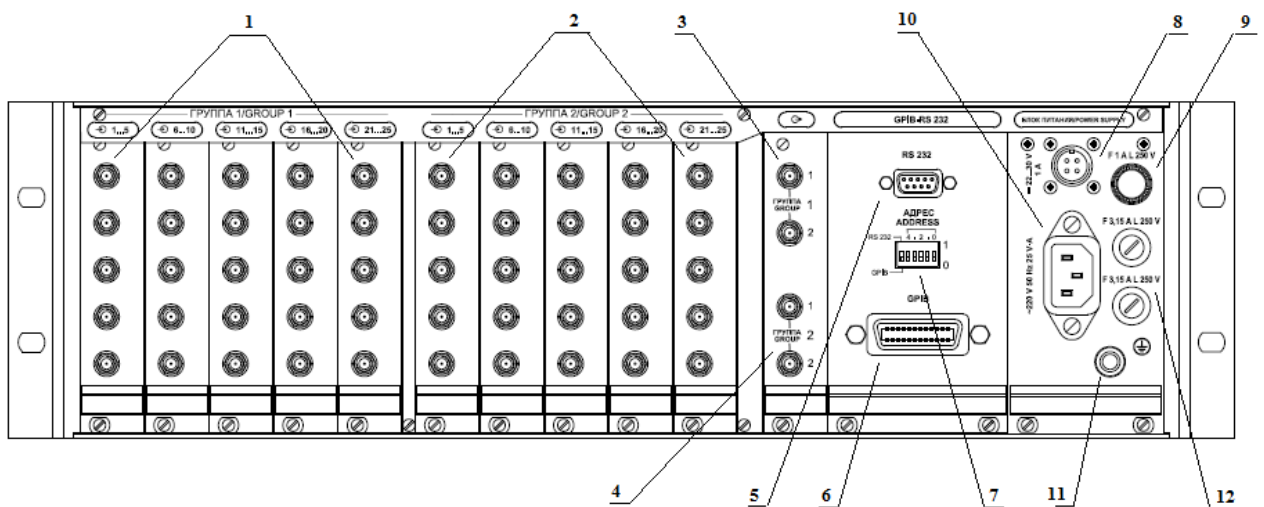


Fig.4 – Location of control and connection systems on the rear panel

Table 6 – Location of control and connection systems on the front panel







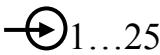
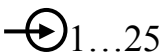



No.	Designation	Usage	Default state
1	remote management indicators:		
	REN	remote management indication	off
	T	GPIB talk mode indicator	off
	L	GPIB listen mode indicator	off
2	–	on/off switch	off
3	Power	power line indicator	off
4	Battery	DC battery usage indicator	off
5	Group 1 № 	group 1 input channel number indicator	off
6	Group 1  1  2	group 1 output channel number indicator	off
7	Group 2 № 	group 2 input channel number indicator	off
8	Group 2  1  2	group 2 output channel number indicator	off
9	–	keyboard for manual control	-

Table 7 – Location of control and connection systems on the rear panel

No.	Designation	Usage
1	Group 1 	twenty-five connectors for the input channels of the first group
2	Group 2 	twenty-five connectors for the input channels of the second group
3	Group 1 	two connectors for the output channels of the first group
4	Group 2 	two connectors for the output channels of the second group
5	RS 232	RS232 socket
6	GPIB	GPIB socket
7	Address	DIP switch of the type of control interface (GPIB or RS232) and device address when connected to the GPIB bus
8	27 V	DC (22-30)V power socket
9	1 AF	fuse link in the DC (22-30)V power source circuit
10	~220 V 50 Hz 25 VA	AC 220V 50Hz power socket
11		protective grounding terminal
12	3,15 AF	fuse link in the AC 220V 50Hz power source circuit

3.3 Using the device keyboard

Buttons, "←", "→", "0"..."9", "Enter" are active in manual mode when the REN indicator is off (No. 1 in Figure 3). Use these buttons to select numbers of input and output channels of the device.

After switching the device to remote control (GPIB or RS232) all buttons on the keypad are blocked, except for the "RTL" button (remote to local), that switches back to local control (in GPIB).

3.3.1 Selecting the input channel of the device in manual mode

Press the "←" button on the keyboard of the device to select the input channel of the first group of channels (01 - 25). The seven-segment "Group 1 № ←" indicators will turn on. Press the button second time to select the input channel of the second group, the seven-segment "Group 2 № ←" indicators will light up. To select the input channel number press one of the buttons "0"..."2" (tens of the input channel number), then press one of the "0"..."9" buttons (units of the input channel number) . Depending on the selected group the corresponding seven-segment indicators will show the number of the selected input channel. To finish selection of the input channel press "Enter", the lights on seven-segment indicators will turn off. To disable the input channel enter 00 number.

3.3.2 Selecting the output channel of the device in manual mode

Press the "→" button on the keyboard of the device to select the output channel of the first group of channels, press second time to select the output channel of the second group (depending on the selected group the corresponding seven-segment indicators "Group 1 № →" or "Group 2 № →" will light up). To select the output channel number press buttons "1" or "2". Complete selection by pressing "Enter". Depending on the selected output channels group the corresponding single indicator of

the selected channel on the front panel will light up. To turn off output channel press the "0" key and "Enter". Output channel indicator will then turn off.

When both channels are selected the corresponding signal passage line will turn on.

3.4 Switching ON

3.4.1 Preparing for use in manual mode

When preparing the device for manual control operation, do the following:

- a) connect the power cord and / or backup power cord
- b) turn the power on (toggle switch 2 in Figure 3)
- c) check device performance as follows:
 - push " \ominus " button on the device keyboard (dots on the seven-segment "GROUP 1 № \ominus " indicators will light up);
 - press buttons "1", "3" then " Enter ", after pressing "Enter" the seven-segment indicators will turn off;
 - push " \ominus " button on the device keyboard (dots on the seven-segment "GROUP 1 № \ominus " indicators will light up);
 - press button "1" then " Enter ";
 - push " \ominus " button twice (dots on the seven-segment "GROUP 2 № \ominus " indicators will light up);
 - press buttons "2", "4" then " Enter ", the seven-segment indicators will turn off;
 - push " \ominus " button twice (dots on the seven-segment "GROUP 2 № \ominus " indicators will light up);
 - press button "2" then " Enter ", the seven-segment indicators will turn off;
 - make sure that the indicators of "GROUP 1 № \ominus " now show the input channel 13 and the single indicator "Group 1 \ominus 1 " is on;
 - make sure that the indicators of "GROUP 2 № \ominus " now show the input channel 24 and the single indicator "Group 2 \ominus 2 " is on;
 - shut down the selected channels by setting the number of input channels to 00 and output channels to 0 in both groups.

3.4.2 Preparing for use in remote control mode

3.4.2.1 Setting up the device to work with RS232 interface

For remote control via the RS232 interface connect PC serial port (COM1) to RS232 connector of the device (pos. 5 in Figure 4) via RS232 serial cable. Device wiring diagram for remote control mode via the RS232 interface is shown on Figure 5

Set "RS232-GPIB" to RS232 on the rear panel DIP switch (pos. 7 in Figure 4). The switch settings are shown in Figure 6. The front panel "REN" indicator will light up.

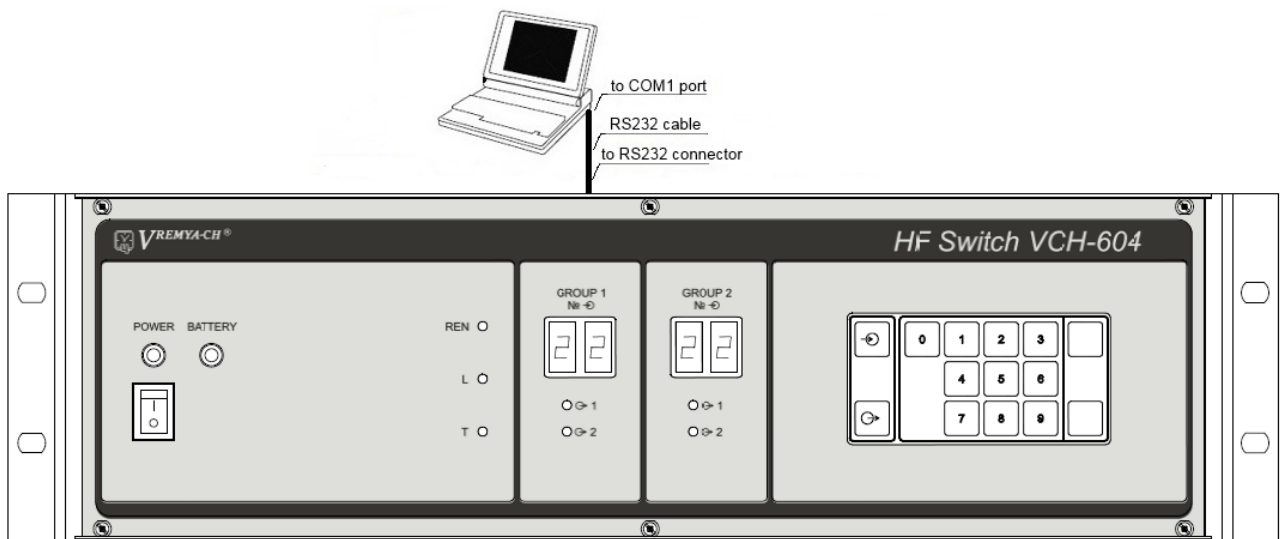


Fig. 5 – Wiring diagram for remote control mode via the RS232 interface

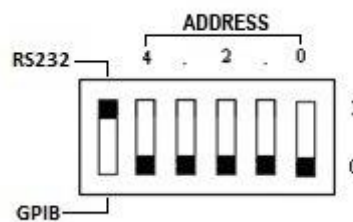


Fig. 6 – DIP switch settings for RS232 remote control

NOTE: When using the RS232 control mode, RS232 port of the PC must have the following connection parameters:

- a) Bits per second - 9600;
- b) Parity - None;
- c) Stop bits - 1;
- g) Data bits - 8;
- e) Flow control - None.

To turn off the remote control via RS232 interface set "RS232-GPIB" switch (pos. 7 in Figure 4) to GPIB and push the "RTL" button on the front panel (pos. 9 in Figure 3). "REN" indicator on the front panel will turn off.

3.4.2.2 Setting up the device to work with RS232 interface

For remote control via the GPIB interface you need to use an external USB-GPIB (LAN-GPIB) controller or a PC adapter, GPIB interface cable and the software required for the selected controller. It is recommended to use controllers and interface cables made by Agilent Technologies or National Instruments. Device wiring diagram for remote control mode via the GPIB interface is shown on Figure 7

Set "RS232-GPIB" to GPIB on the rear panel DIP switch (pos. 7 in Figure 4). The switch settings are shown in Figure 8. The front panel "REN" indicator will light up.

Set the binary code corresponding to the address of the device on the DIP switch "ADDRESS" (pos. 7 in Figure 4). Conversion between the decimal value of the device address and its binary representation on the "ADDRESS" switch is shown in Table 9. The switch settings are shown in Figure 8.

Table 8– Conversion between the decimal value of the device address and its binary representation

Decimal value of the device address	"ADDRESS" switch				
	4	.	2	.	0
1	0	0	0	0	1
2	0	0	0	1	0
4	0	0	1	0	0
8	0	1	0	0	0
16	1	0	0	0	0

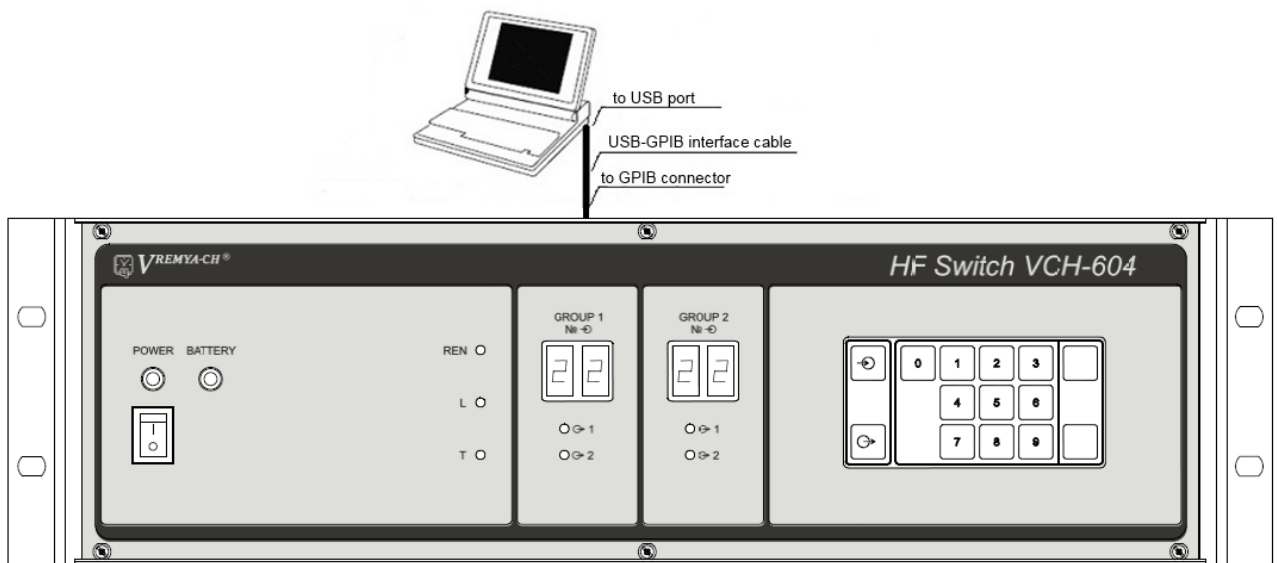


Fig.8 – Wiring diagram for remote control mode via the GPIB interface

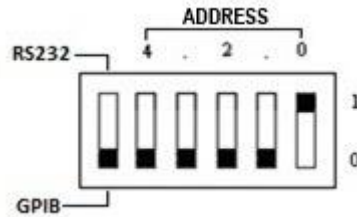


Fig.9 – DIP switch settings for RS232 remote control and device address "1"

To turn off the remote control via GPIB interface push the "RTL" button on the front panel (pos. 9 in Figure 3). "REN" indicator on the front panel will turn off.

3.5 Operating procedure

3.5.1 Operating procedure for use in manual mode.

To select the first group input channel number press the " \ominus " button to turn on the seven-segment "Group 1 № \ominus " indicators. Then press one of the buttons "0"... "2" (tens of the input channel number), one of the "0"... "9" buttons (units of the input channel number) and then "Enter". To select the output channel of the first group of channels press the " \ominus " button to turn on the seven-segment "Group 1 № \ominus " indicators. Then press button "1" or "2" and "Enter".

To select the second group input channel number press the " \ominus " button twice to turn on the seven-segment "Group 2 № \ominus " indicators. Then press one of the buttons "0"... "2" (tens of the input channel number), one of the "0"... "9" buttons (units of the input channel number) and then "Enter". To select the output channel of the second group of channels press the " \ominus " button twice to turn on the seven-segment "Group 1 № \ominus " indicators. Then press button "1" or "2" and "Enter".

3.5.2 Operating procedure for use in remote control mode.

Remote control via GPIB or RS232 interfaces should be performed with the use of library functions that are part of the standard programming language or library functions supplied by the communication equipment manufacturers. When writing control programs refer to the information given in Section 2.5 "Remote control commands"

4 Troubleshooting

When using the device, you may experience issues related to the limited resource of its components. A list of the most likely problems and guidance for their elimination are given in Table 9

Table 9 – Troubleshooting Guide

Problem	Probable cause	Solution	Notes
"Power" indicator is off	Power cord or fuse fault	Repair or replace the cable, replace the faulty fuse	
"Battery" indicator is off	Power cord or fuse fault	Repair or replace the cable, replace the faulty fuse	
"Group 1 № \ominus " or "Group 2 № \ominus " indicators won't turn on	Device malfunction	Factory repair	
"Group 1 \ominus 1 or 2" or "Group 2 \ominus 1 or 2" indicators won't turn on	Device malfunction	Factory repair	
The device can not be controlled via GPIB or RS 232	Interface cable fault Device malfunction	Repair or replace the cable Factory repair	