Pulse Distribution Unit

VCH-606

Operating Manual

Table of contents

1 List of abbreviations

PC – personal computer

RS232 – serial port

PDU – pulse distribution unit

2 Safety precaution

2.1 Carefully read the operating manual before working with the device and note the safety information.

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

2.3 The device is grounded via protective conductor in the power cable and protective earth terminal marked  on the rear panel.

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

3 Device description

3.1 Description and operation

Pulse distribution unit VCH-606 is designed for distributing high quality TTL pulse signals. The unit has 16 independent output channels for 50 Ohm loads. Unit trigger level and status information can be controlled via RS232C interface.

3.2 Key applications

– in metrology as an integral part of the storage systems and for transmitting high precision time and frequency signals;

– in scientific research;

– as an integral part of automated measurement systems. Built-in RS232C interface enables remote monitoring of signal states of the input and output channels of the device and control of the cutoff level of the input pulse signal amplitude.

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

Figure 1 – External view

Normal operating conditions:

— Air temperature: 20±5°C;

— Relative humidity: 65±25% at +25°C;

— Atmospheric pressure: 84 – 106 kPa (630-795 mm Hg);

— Power supply: 220±4.4 V.

Working operating conditions:

— Air temperature: +5 up to +40°C;

— Relative humidity: up to 80% at +25°C;

— Atmospheric pressure: 84 – 106 kPa (630-795 mm Hg);

— Power supply: 100 to 240 V;

— Power supply frequency: 50 or 60 Hz;

— External power supply: 22 to 30 V DC.

Utmost operating conditions:

— Air temperature: -40 up to +50°C;

— Relative humidity: up to 80% at +25 °C.

3.3 Product composition

The device composition is given in Table 1.

Table 1 – Device composition

Type	Quantity
Pulse distribution unit VCH-606	1
Spare parts kit:	
– Power cable 220V	1
– Power cable 685650.062 for 27 V source	1
Operating manual	1
Packing case	1

3.4 Product specifications

3.4.1 The device distributes high quality TTL pulse signal into 16 independent output channels.

3.4.2 Input signal parameters:

- positive polarity pulse;
- pulse repetition rates from 1 Hz to 10 MHz;
- pulse amplitude no more than 10 V at (50±1) Ohm;
- pulse duration not less than 50 ns.

3.4.3 Output signal parameters:

- positive polarity pulse;
- pulse amplitude 2.5 V – 5 V at (50±0,3) Ohm;
- rise/fall time no more than 1 ns;

3.4.4 Input/output delay no more than 20 ns.

3.4.5 Differential channel/channel delay no more than 150 ps.

3.4.6 Thermal coefficient of delay no more than 10 ps/°C.

3.4.7 Remote control is available via RS232C interface.

3.4.8 The device provides its specifications in working conditions after a 10-minute warm-up time.

3.4.9 The device provides continuous non-stop operation in working conditions with all specifications preserved.

3.4.10 The device is powered by 100–240V, 50/60 Hz AC or an external DC source (22–30) V. In the absence of AC voltage the device automatically switches to backup power from an external DC source. The device will retain its specifications during the AC/DC changeover.

3.4.11 Power consumption is no more than 20 VA (220V AC).

3.4.12 Power consumption is no more than 20 W (27 V DC).

3.4.13 Input and output channels in the device are connected via BNC sockets.

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

3.4.15 Operating conditions of the device must comply with values given in Table 2.

Table 2 – Operating conditions

Operating conditions	Temperature, °C	Relative humidity, %	Atmospheric pressure, kPa (mm Hg)	Power source	
				voltage, V	frequency, Hz
Normal	20 ± 5	65±25 at 25°C	84 – 106 (630 – 795)	220 ± 4,4	50/60
Working	+5 to +40	up to 80 at 25°C		100 to 240	50/60
Utmost	-40 to +50	up to 80 at 25°C		–	–

The device retains its specifications in working operating conditions, and after exposure to utmost conditions provided 3-hour warm-up time in normal or working operating conditions.

3.4.16 Weight and dimensions of the device without packing and in the packing case are shown in Table 3.

Table 3 – Weight and dimensions of the device

Designation	Netto		In packing case	
	dimensions, mm	weight, kg	dimensions, mm	weight, kg
Pulse distribution unit VCH-606	483×44×310	4	514×124×362	6
Spare parts kit		0.5		

3.5 Basic configuration and operation

3.5.1 Principle of operation

The operating principle of the PDU is generation of normalized pulsed signal with TTL levels for device circuits from the input pulse signal, and distribution of the signal through 16 output buffer amplifiers for transmission to 16 output interfaces.

3.5.2 Description of the circuit diagram

An electrical circuit diagram illustrating the operating principle of the device is shown in Fig. 2

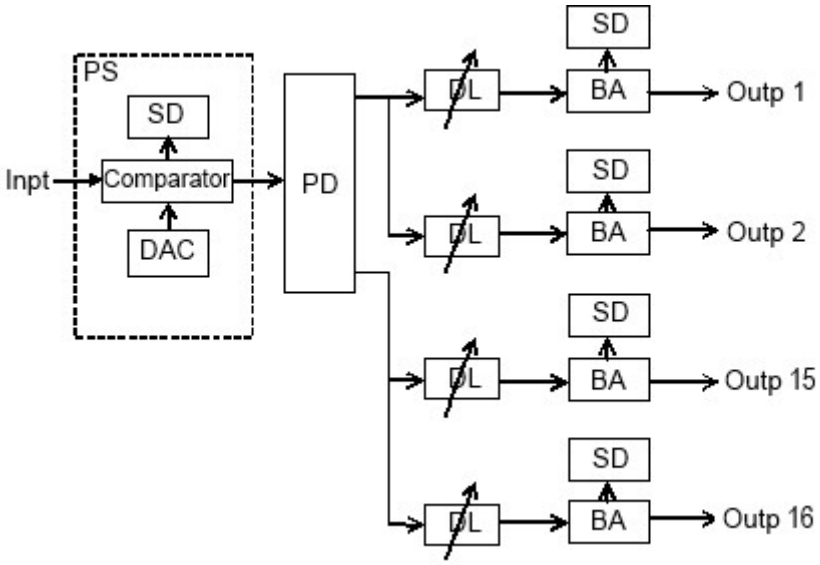

Figure 2 – Circuit diagram

The device consists of these main parts:

- pulse selector (PS);
- digital-to-analog converter (DAC);
- pulse distributor (PD);

- adjustable delay line (DL);
- signal detectors (SD);
- output buffer amplifiers (BA);
- control unit, interfaces and power supply.

Normalization of the input signal is performed in the PS that consists of a voltage divider that divides the voltage by 2, high-speed comparator, a digital-analog converter (DAC) which forms the input signal amplitude cutoff level for the comparator, and a signal detector. The device works with the input pulse amplitude of 0.5 V to 10 V and pulse duration of no less than 50 ns

Normalized pulse goes to the pulse distributor with 8 output channels. Each channel is connected to two output channels of the device through DL. DL is designed to adjust the asymmetry of working edges of signals in relation to the working edge of the pulse on channel 1

Each output BA contains a SD, which allows remote monitoring of the state of the output channels of the PDU.

The device receives control commands via RS232C interface.

3.5.3 Remote control commands

The device is controlled from PC by sending control commands in the form of ASCII character strings to set the unit trigger level, and reading DAC code and channel fault signals. Data is transmitted at 9600 bits / sec, without parity. Control commands are given in Tables 4, 5 and 6. The symbols used for programming the device parameters are given in Table 7. Conversion between the trigger level value and its binary representation is given in Table 8.

Table 4 – Command to set trigger level

	1 byte	2 byte	3 byte	4 byte	5 byte	
Format	**42h**	**30h ÷ 3Fh** (Y_1)	**30h ÷ 3Fh** (Y_2)	**45h**	**0Ah**	Symbol code (hex)

Y1, Y2 character values are given in Table 7.

Table 5 – Command to read trigger level

	1 byte	2 byte	
Format	**43h**	**0Ah**	Symbol code (hex)
	1 byte	**2 byte**	
Returned symbols	**00h ÷ FFh** (h_1)	**0Ah**	Symbol code (hex)

h1 – binary result code.

Table 6 – Command to read the channels states

	1 byte	2 byte			
Format	**41h**	**0Ah**	Symbol code (hex)		
	1 byte	**2 byte**	**3 byte**	**4 byte**	
Returned symbols	**00h or 01h** (d_1)	**00h ÷ FFh** (d_2)	**00h ÷ FFh** (d_3)	**0Ah**	Symbol code (hex)

d_1 ÷ d3 – binary result code.

Note. Channel diagnostics is run once in 10 - 15 seconds.

Table 7 – Symbols, used for the device parameters programming

Position	Symbol code (hex)	Parameter value set
-	41h	channel fault read symbol
-	42h	trigger level cade symbol
-	43h	trigger level read
-	45h	trigger level set symbol
-	0Ah	new line symbol
Y_1	30h ÷ 39h 3Ah ÷ 3Fh	digit or symbol – trigger level code (higher bits) $Y_1 – 0011X_8X_7X_6X_5$
Y_2	30h ÷ 39h 3Ah ÷ 3Fh	digit or symbol – trigger level code (lower bits) $Y_2 – 0011X_4X_3X_2X_1$
h_1	00h ÷ FFh	trigger level binary code (X_8 X_7 X_6 X_5 X_4 X_3 X_2 X_1), where X_8…X_1 – 0 or 1
d_1	00h or 01h	binary code of input channel state (0 0 0 0 0 0 0 Z) где Z = 0 – signal absent Z = 1 – signal present
d_2	00h ÷ FFh	binary code of output channels 1 to 8 state (Z_8 Z_7 Z_6 Z_5 Z_4 Z_3 Z_2 Z_1) where Z_8…Z_1 = 0 – signal absent Z_8…Z_1 = 1 – signal present
d_3	00h ÷ FFh	binary code of output channels 9 to 16 state (Z_{16} Z_{15} Z_{14} Z_{13} Z_{12} Z_{11} Z_{10} Z_9) where Z_{16}…Z_9 = 0 – signal absent Z_{16}…Z_9 = 1 – signal present

Table 8 – Binary code for trigger level value (not considering input signal voltage being divided in half)

X_8	X_7	X_6	X_5	X_4	X_3	X_2	X_1	Trigger level
1	1	1	1	1	1	1	1	5×255/256 V (+ 4,98V)
1	1	1	1	1	1	1	0	5×254/256 V (+ 4,96V)
1	0	0	0	0	0	0	1	5×129/256 V (+ 2,52V)
1	0	0	0	0	0	0	0	5×128/256 V (+ 2,5 V)
0	1	1	1	1	1	1	1	5×127/256 V (+ 2,48V)
0	0	0	0	0	0	0	1	5/256 V (+ 0,02V)
0	0	0	0	0	0	0	0	0 V

4 Operating procedure

4.1 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.

4.2 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 9 and 10, respectively.

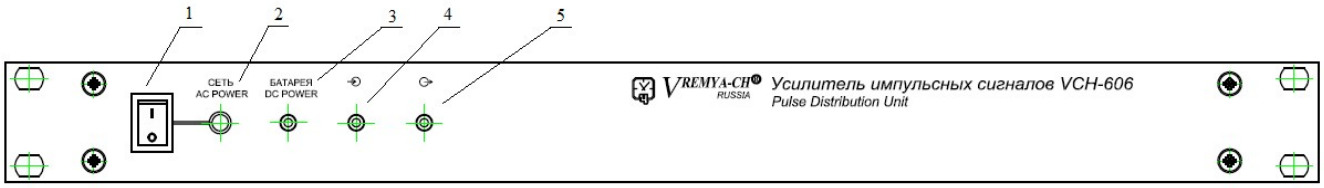

Figure 3 – Front panel

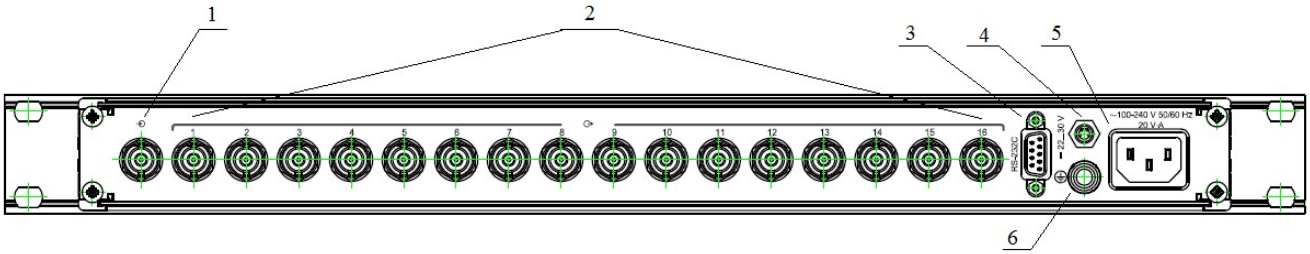

Figure 4 – Rear panel

Table 9 – Location of control systems on the front panel

No.	Designation	Usage	Default state
1	–	on/off switch	off
2	AC POWER	power line indicator	off
3	DC POWER	DC battery usage indicator	off
4		input signal indicator	off
5		output signal indicator	off

Table 10 – Location of control and connection systems on the rear panel

No.	Designation	Usage	Default state
1		connector for the input signal	-
2		connectors for the output signalss	-
3	RS 232C	RS232C socket	-
4	22 … 30 V	DC (22-30)V power socket	-
5	100 - 240 V 50/60 Hz 20 VA	AC 220V 50Hz power socket	-
6		protective grounding terminal	-

4.3 Preparing the device for use.

4.3.1 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 1 in Figure 3)

c) connect the 1Hz, 2.5V signal to the "  " connector

Test results are considered satisfactory if the front panel "  " and "  " indicators are lit.

4.3.2 Preparing for use in remote control mode

4.3.2.1 Setting up the device to work with RS232 interface

For remote control via the RS232 interface connect PC USB port to RS232C socket of the device (pos. 3 in Figure 4) via RS232 serial cable. Device wiring diagram for remote control mode via the RS232C interface is shown on Figure 5

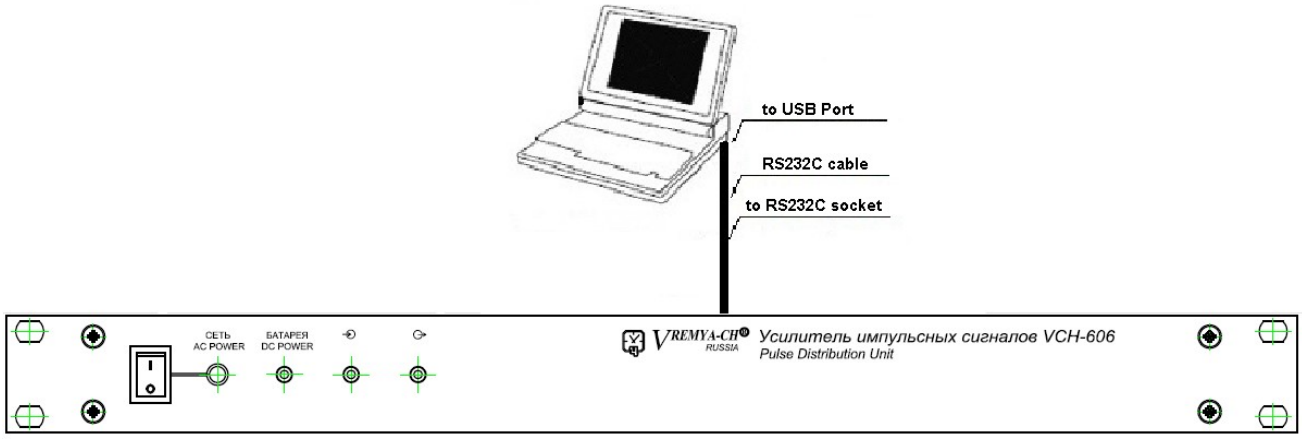

Figure 5 – Wiring diagram for remote control mode via the RS232C interface

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.

4.4 Operating procedure

4.4.1 Operating procedure for use in manual mode

Connect the 1Hz, 2.5V positive polarity signal to the "  " connector (in manual mode pulse selector is set to 1 V level). Front panel "  " and "  " indicators should light up.

4.4.2 Operating procedure for use in remote control mode

Remote control via RS232 interfaces should be performed with the use of library functions that are part of the standard programming language. When writing control programs refer to the information given in Section 3.5.3 "Remote control commands".

5 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 11.

Table 11 – Troubleshooting Guide

Problem	Probable cause	Solution	Notes
"POWER" indicator is off	Power cord fault Fuse fault	Repair or replace the cable Factory repair	
"DC POWER" indicator is off	Power cord fault Fuse fault	Repair or replace the cable Factory repair	
Front panel "⊕→" and "→⊖" indicators won't turn on	No input signal Device malfunction	Connect input signal Factory repair	
The device can not be controlled via RS 232C	Interface cable fault Device malfunction	Repair or replace the cable Factory repair	