



**POWER LINE CARRIER
WITH TELEPROTECTION
SIGNALLING SYSTEM**

CVK-16 RZPA

Power Line Carrier with teleprotection signalling system CVK-16 RZPA

The CVK-16 RZPA Power Line Carrier (PLC) system with teleprotection signalling system can be used to transmit:

- voice;
- data;
- teleprotection signals.

CVK-16 RZPA offers flexible programmable transmission bandwidth 4, 8, 12, 16, 20, 24 kHz with programmable nominal bandwidth frequency without hardware changes.

CVK-16 RZPA maintain all of the functionality of PLC system CVK-16 (Rev. 3) with more than thousand units in operation in Russia and CIS countries since 2004 and extends it's functionality with teleprotection signalling feature.

Analog operation mode

Analog operation mode allows you to use each 4 kHz transmission channel as a traditional analog channel with analog speech using lowpass filter and up to 4 narrowband FSK modems for data transmission with programmable data rates 100 to 1200 bps or use it as singlepurpose channel with transparent transmission data rate of 2400 bps.

Teleprotection signals

Fist 4 kHz channel can be used to transmit up to 4 blocking/permissive signals and up to 28 direct tripping signals according to IEC 608341.

CVK-16 RZPA offers variety of teleprotection transmission operation modes:

- singlepurpose mode: transmits protection signals only;
- simultaneous multipurpose mode: transmits voice and data simultaneously to the protection signals;
- alternate multipurpose mode: voice and data transmission are interrupted during the protection signal transmission.

Digital operation mode

Any two of 4 kHz channels can be used in digital operation mode which allows number of the integrated configurable user data ports and compressed voice channels that are time-division multiplexed by the internal adaptive multiplexer for up to 28800 bps data rate.

Automatic FAX detection for FAX transmission available in digital operation mode.

Integrated multiplexer

Multiplexed data ports:

- up to 4 digital compressed voice channels (G.729D ITU-T);
- up to 4 fully transparent and/or UART compliant transmission of asynchronous data;
- Ethernet LAN bridge channel connection;
- up to 4 G.703 E1 time slots.

Flexible setting of communication capacity allows various sets of data ports being configured using service software utility.



Dynamic speed adaptation

Dynamic speed adaptation allows to automatically adjust the data rate in 9 userdefined steps according to the prevailing line condition. Adaptation increases the availability of critical services by preventing the collapse of data transmission in case of link degradation (noise) that is significantly affected by changing weather conditions.

Adaptation adjust data rate of aggregate communication stream in range 28800 bps to 3200 bps.

G.703 E1

CVK-16 has integrated G.703 E1 digital communication interface for flexible connection to a digital telephone exchange. A fully digital telephone network over PLC systems becomes possible using CVK-16.

User interface software

We offer Intuitive and easy to use, our Windows based MMI software utility.

MMI software utility main features:

- system health control;
- upload and display of recorded events;
- setting all of configuration parameters;
- remote terminal access via the integrated service channel;
- integrated measures and statistics;
- secure management access;
- auxiliary signals generation.

Monitoring and network features

CVK-16 RZPA supports monitoring and supervision using SNMP and IEC 608705104 for easy SCADA integration. All of remote PLC terminals can be easily accessed using standard TCP/IP network protocols.

Clock synchronization

CVK-16 RZPA has integrated satellite GPS/GLONASS receiver for 1m accuracy clock synchronization. Teleprotection command events and alarm events are guaranteed timestamp 1ms accuracy.

System parts

PLC system CVK-16 RZPA consists of two terminals:

- CVK-16 (Rev.4) Terminal;
- RZPA Terminal.

RZPA Terminal protection signalling system is used to transmit protection signals. RZPA terminal is connected to CVK-16 (Rev.4) via IEEE C37.94 fiberoptic interface or G.703 E1 interface.

RZPA Terminal can be used as standalone protection signalling system using IEEE C37.94 fiberoptic interface or G.703 E1 interface transmission line.

CVK-16 Terminal can be used as a standalone PLC system with data and voice transmission functions. In this case all of the features available except for the teleprotection signal transmission.

CVK-16 RZPA Technical Data

1. HF-interface:

HF-frequency range	16 – 1000 kHz
HF nominal bandwidth	4, 8, 12, 16, 20, 24 kHz (each direction)
HF nominal bandwidth frequency	programmable without hardware changes in steps of 4 kHz (1 kHz as option)
Modulation	amplitude modulation with single sideband transmission; single step frequency conversion
Output power	40 W, 80 W (46 dBm, 49 dBm)
Nominal output impedance	<ul style="list-style-type: none"> • 75 Ohm (unbalanced); • 150 Ohm (balanced)
Allowable HF path attenuation	<ul style="list-style-type: none"> • 80 dB — theoretical; • 60 dB — practical limit
Receiver sensitivity of control tone in analog operating mode	<ul style="list-style-type: none"> • -35 dBm (nominal); • -50 dBm (maximum)
Receiver sensitivity of operating signal in digital operating mode	<ul style="list-style-type: none"> • -30 dBm (nominal); • -45 dBm (maximum)
Receiver sensitivity of teleprotection signal	<ul style="list-style-type: none"> • -20 dBm to 0 dBm
Channel-forming system	CVK-16 (Rev. 4) Terminal
Teleprotection signals system	RZPA Terminal
Spurious emission according IEC 60495 ($B_N = 4\text{kHz}$)	<ul style="list-style-type: none"> • at a distance of 4 kHz from the transmission band ≤ -60 dB; • at a distance of 8 kHz from the transmission band ≤ -70 dB; • at a distance of > 8 kHz from the transmission band ≤ -80 dB
Receiver selectivity, voice and data transmission channel	<ul style="list-style-type: none"> • at a distance of 0.1 kHz from the band edges +37 dB in analog op. mode; • at a distance of 0.1 kHz from the band edges +43 dB in digital op. mode
Receiver selectivity, teleprotection transmission channel	<ul style="list-style-type: none"> • at a distance of 0.1 kHz from the band edges +20 dB; • at a distance of 4 kHz from the band edges +46 dB

AGC (Automatic Gain Control)	<ul style="list-style-type: none"> • 40 dB range — “normal” receiver mode; • 80 dB range — “low” receiver state, analog operating mode; • 80 dB range — “low” receiver state, digital operating mode
Control tone, pilot tone	<ul style="list-style-type: none"> • analog op. mode — 3900 Hz; • digital op. mode — 100Hz; 3900 Hz
Teleprotection guard tone	100 Hz

2. Teleprotection (RZPA)

Separate external terminal digital interface	<ul style="list-style-type: none"> • fiberoptic connection IEEE C37.94; • G.703 E1
Signal transmission mode	<ul style="list-style-type: none"> • simultaneous voice and data transmission mode; • voice and data transmission interruption, with signal boosting transmission mode
Power subchannel distribution	programmable between 4 kHz subchannels
Number of blocking/permissive commands	up to 4, single-frequency
Number of direct tripping commands	up to 28, dual-frequency
Transmission duration	20 to 100 ms range, programmable
Tracking command	<ul style="list-style-type: none"> • any command, single-frequency tracking transmission duration up to 15 s

Nominal transmission time at SNR 6 dB:	<ul style="list-style-type: none"> blocking 18 ms, dependability $P_{mc} < 10^{-3}$, security $P_{uc} < 10^{-4}$; permissive tripping 20 ms, dependability $P_{mc} < 10^{-3}$, security $P_{uc} < 10^{-5}$; direct tripping 30 ms, dependability $P_{mc} < 10^{-4}$, security $P_{uc} < 10^{-6}$
Inputs	<ul style="list-style-type: none"> voltage: 220 VDC (110 VDC option); input current: 20–25 mA
Outputs	<ul style="list-style-type: none"> output type: dry contact; tripping voltage: 220 V DC (110 V DC option); tripping current: 250 mA continuous
Tripping pickup delay	1 to 5 ms programmable in steps of 1ms
Tripping hold delay	100 to 1000 ms, programmable in step of 100 ms
Alarm relay outputs	<ul style="list-style-type: none"> alarm; warning; command receive; command transmit
Integrated LED display	
Configuration and testing using PC	
Clock synchronising via integrated satellite GPS/GLONASS receiver	
Clock synchronising via NTP	

3. VF-interface (for each 4 kHz channel)

3.1. Digital operation mode

Time-division multiplexing data and voice channels number:	<ul style="list-style-type: none"> up to 4 voice channels; up to 4 data channels
Programmable data rates of an aggregate communication stream	28800; 25600; 22400; 19200; 16000; 12800; 9600; 6400; 3200 bps
Time-division multiplexing with data flow control and dynamic speed adaptation according to noise level and aggregate capacity	
Digital speech channels according to G.729D ITU-T	
E1 interface	<ul style="list-style-type: none"> up to 4 time slots; selection and adding time slots feature
Multiplexer frame rate	100 Hz
Boot up ready time	80 sec maximum
Maximum abrupt change in the transmission line rate without disconnection	4 dB

3.2. Analog operation mode (for each 4 kHz channel)

Speech low-pass filter cut-off frequency	1,8 to 3,4 kHz programmable in steps of 200 Hz
Уровень собственного шума на выходе телефонного окончания	минус 55 дБм0п
Telephony services	<ul style="list-style-type: none"> 4-wire PAX connection with E&M signalling, ADASE signalling; 2-wire point-to-point, 2-wire remote subscriber FXS, FXO; DTMF signalization
Automatic FAX detection	
Number of 4 kHz transmission channels	up to 6

3.3. Equalization

Automatic adaptive equalization	equalization up to ± 12 dB amplitude response and up to 1 ms group delay distortion
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3.4. Service phone

Service phone services	<ul style="list-style-type: none"> local side — remote side; local side local — subscriber; local side remote — subscriber
2-wire connection	
Integrated control tone generator	1200, 1600 Hz

3.5. Integrated measures features

Integrated measures features	<ul style="list-style-type: none"> amplitude response; group delay distortion; noise spectral density; SNR
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4. Data services

4.1. Digital operation mode

Number of data ports	up to 4
Programmable data rates	<ul style="list-style-type: none"> transparent code independent mode: 100, 200, 300, 600, 1200 bps; asynchronous UART up to 28800 bps
Physical layer	RS232, RS485, RS422 data rate up to 230000 bps, Ethernet
Maximum data rate	28800 bps
Dynamic data speed adaptation according to aggregate capacity	
LAN ports	number of LAN ports: 1
Connector	electrical 10/100 BaseT (shielded twisted pair, STP), connector RJ45
Physical layer	auto or manual negotiation (full/half duplex and 10/100 Mbps)
Link layer	confirms to IEEE 802.3 / Ethernet 2
Operation mode	transparent bridge with packet filtering

4.2. Analog operation mode

Number of narrowband modems	up to 4
Programmable data rates above telephone channel	100, 200, 300, 600, 1200 bps
Data rates data channel only	2400 bps
Modulation characteristics 100, 200 bps data rate	according to R37, R38 ITU-T

5. LAN services and monitoring

SNMP v1, v2c local and remote side

Monitoring IEC 8705104 local and remote side

Web-interface

6. Power supply and consumption

Power supply	<ul style="list-style-type: none"> 48, 60, 110, 220 V DC; 220 V AC 50 Hz
Power consumption	<ul style="list-style-type: none"> CVK-16 (Rev. 4) Terminal 130–180 W according to output power and channel number; RZPA Terminal 60 W

7. Mechanical design

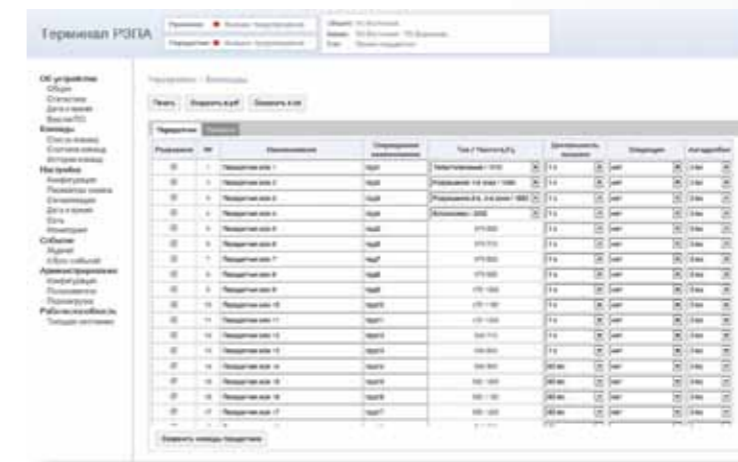
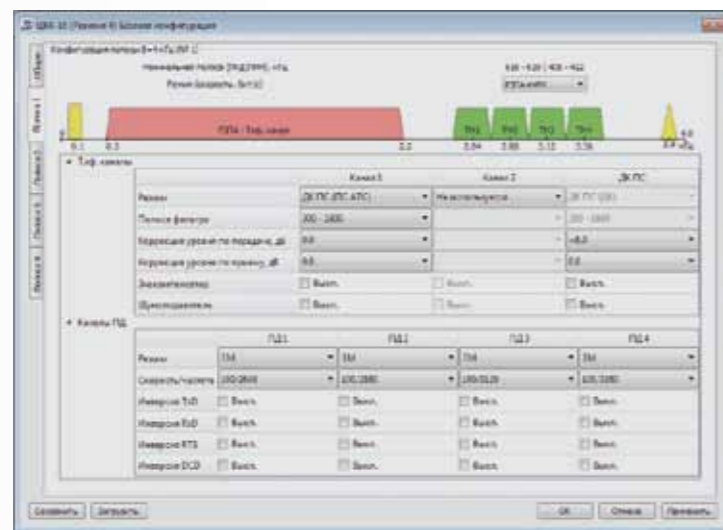
19" frame according to IEC 60297	
Dimensions / weight	<ul style="list-style-type: none"> CVK-16 (Rev. 4) width: 84HP, height: 6U, depth: 309 mm, weight: 14,7 kg; RZPA width: 84HP, height: 6U, depth: 309 mm, weight: 12,3 kg
19" enclosure 42U	width: 600 mm, depth: 600 mm, weight: 102 kg

8. Ambient operation conditions

Climatic conditions	IEC60721-3-3, Class 3K4
Temperature range	0 to +45°C
Humidity	≤ 95%, non-condensing
Mechanical conditions	M40 according to GOST R 17516.1-90

User interface software

- User friendly software utility with multilanguage support
- Setting of the teleprotection commands, setting out-of service commands, testing commands
- Upload and display of recorded events for local and remote sides
- Recorded events management
- Integrated measures and statistics (amplitude response, group delay distortion, noise spectral density)
- SNR integrated measures
- System health status and testing
- Secure management access with authentication and access logging
- PC with Windows XP, Windows Vista or Windows 7
- Service PC Port RS-232 (USB with optional interface converter)
- Ethernet as option
- Supervision of sytem state and HF-channel via SNMP and IEC 870 -5 -104
- SCADA integration via IEC 870-5 -104





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