“SKB ELEKTRONMASH” ALC

Addressable fire detection system CV2000

Design guidelines

Contents

1. **Introduction**

These guidelines are dedicated to design of a system intended for fire detection, fire alarm and shaping of corresponding control responses based on components.

The following components are a part of system:

- Fire alarm control panel CV2000;
- Addressable loop units – CV1510;
- Addressable and non-addressable detectors;
- Addressable input/output units – CV1514;
- information board CV1504.

Based on these components, you can build a system of any complexity – both in terms of information value and functionality. At the same time, this system can solve not only tasks related to object fire protection but also when using corresponding sensors and actuation mechanisms control any other parameters related to industrial safety and life support (gas, power, water and heat supply, drains and sewage, building integrity, etc.).

The system is decentralized both on logical and physical level.

Physical decentralization implies that addressable loop controllers CV1510 can be taken away from the main device.

Decentralization on logical level implies that the principle of “distributed intelligence” is implemented in the system. All actuation device control algorithms are recorded in the input/output unit channels (CV1514) and are not stored in a centralized manner. In case of change of the status of any system component (detector, input/output unit), information about it comes to the loop and is accepted by all devices where this parameter is an argument of a performed function in one cycle.

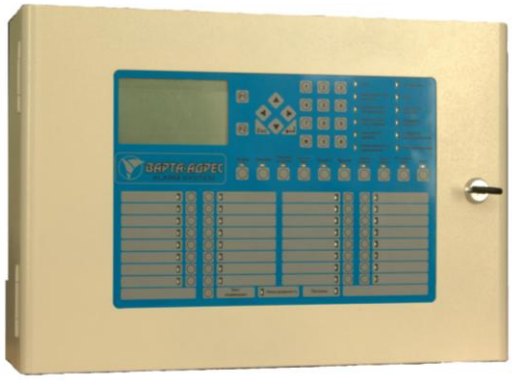
If required, one can implement a duplicated control and management system by programming different channels and units to perform the same function and turning on these units using “or”.

In case of failure of communication line with the addressable loop unit CV1510, it will continue operation in autonomous mode, supporting the information exchange procedure between system components and thus ensuring fire protection of the facility.

All detectors have an embedded short circuit isolator which, together with increased system survivability, allows automatic addressing of components.

System continuously controls the detector functioning parameters creating messages on their failure and need of maintenance.

2. **Basic device**.



The basic system consists of an alarm signaling controller which includes:

Control unit CV1501 – an addressable network controller performing acceptance and processing of signals from alarm loops and information display for indication;

Output signal unit CV1503. Contains outputs to light and acoustic annunciators, Fire output, Failure relay output.

Addressable loop unit CV1510 – addressable loop controller. The number of CV1510 in a system determines the number of addressable loops. Up to two CV1510 may be installed in a device or all loop units may be remote.

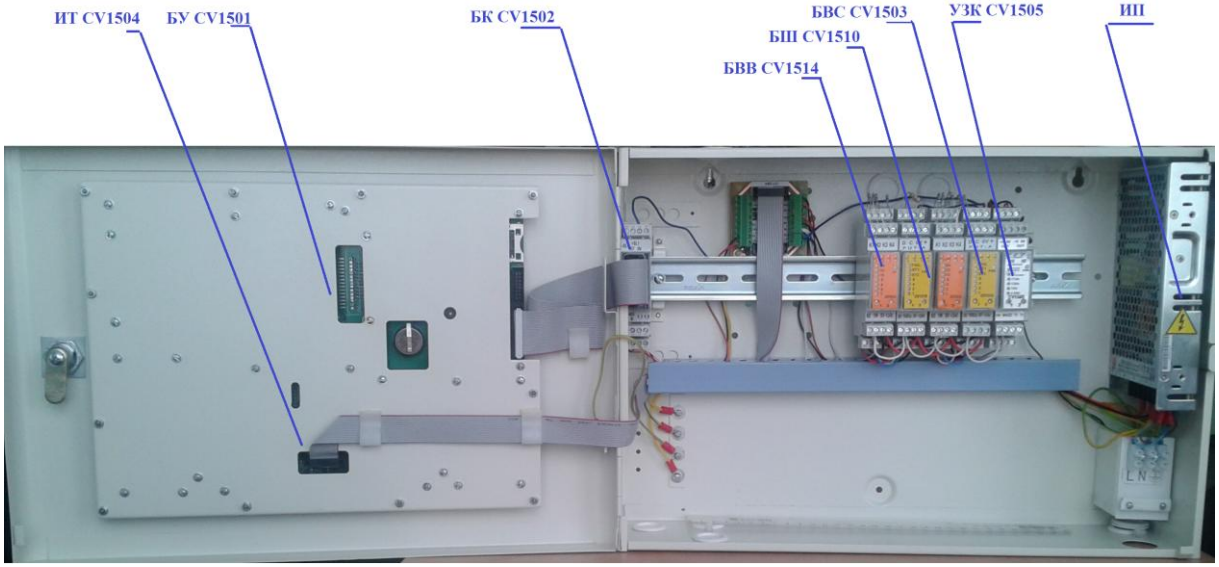
Cross unit CU CV1502. Switches intra-system (SL1), inter-system (SL2), RS-485 interfaces, communicates with telephone communicator

Control and charging device CV1505. Ensures battery charging from 4 to 17 A· h, battery status and main power control.

Information board CV1504 – freely programmable 32 indicators and 32 buttons for display of component status and management of actuation mechanisms.

TC – telephone communicator to transfer messages about fire, failure and other system statuses

PS – power supply.

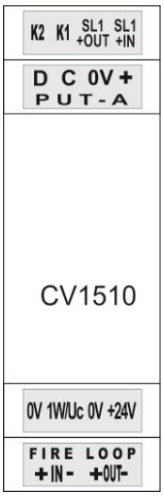


3. Main components

The constant composition of FASC-A includes (see Fig.):

- control and indication unit CU CV1501 – required number in a device – 1 pcs.;
- output signal unit OSU CV1503, required number in a device – 1 pcs.;
- cross unit CU CV1502, required number in a device – 1 pcs.;
- charge and control device CV1505 – 1 pcs.;
- IO-A addressable input/output unit CV1514, maximum possible number in a device – 2 pcs.; in a loop – up to 40, in a system – (up to 40*15 = 600);
- ALU addressable loop unit CV1510, maximum possible number in a device – 2 pcs.;
- IB CV1504 Information board, maximum possible number in a device – 1 pcs.; in a system – up to 16
- power supply, maximum possible number in a device – 1 pcs.;

3.1 Addressable loop unit ALU CV-1510



Addressable loop unit (hereinafter – "ALU") ensures:

- power of addressable ring loop;
- communication in the addressable ring loop;
- automated addressing of addressable annunciators;
- management of freely programmable keys K1 and K2 (can be programmed for output of FIRE and FAILURE statuses)

Can be installed both in a device and remotely at a distance up to 500 m.

Terminals and contacts (available for user)

- Power +24V, 0V – screw terminals for power connection;
- 1W – power failure input (with CCD).
- FIRE LOOP +IN, FIRE LOOP-IN, FIRE LOOP +OUT, FIRE LOOP -OUT – screw terminals for addressable ring loop connection.
- +OUT SL1, +IN SL1 – screw terminals for connection of system internal interface.
- K1, K2 – output key terminals (24 V, 50 mA).
- PUT-A: D, C, 0V, + terminals for process equipment connection (connect only in accordance with operation documents).

Detailed information can be found in the document Addressable loop unit CV1510 operation manual 421243.092RE

3.2. Addressable input/output unit IO-A CV1514

Input/output unit (hereinafter – "IO-A") ensures:

- Input and output of signals.

- Transfer of key (input channel) statuses to the addressable ring loop.
- Acceptance of logical statuses of other components of address system and processing of operation logic programmed according to them.

Terminals and contacts (available for user)

- Power
- +24V, 0V – screw terminals for power connection;
- 1W – power failure output (to device units).
- FIRE LOOP +IN, FIRE LOOP-IN, FIRE LOOP +OUT, FIRE LOOP -OUT – screw terminals for addressable ring loop connection.
- +K1, +K2, +K3, +K4 – input/output channels.

Detailed information can be found in the document Addressable input/output unit CV1514 Operation manual 426436.060RE

3.4 Cross unit CU CV1502

The unit is designed to transfer **SL1**, **SL2**and **RS-485** interfaces from CU to the system, as well as to connect a telephone communicator

3.5 Control and charging device CCD CV1505

Control and charging device (hereinafter, “CCD”) ensures:

- automatic switch to backup power in case of main power fallout;
- automatic switch to main power when it is restored;
- charge and control of battery functionality;
- device power shutoff upon deep battery discharge (in case of powering from backup supply);

power failure signal annunciation.

4. System structure

The system allows installation up to 15 addressable loop units CV1510 (**maximum fifteen addressable loop unit** of alarm).

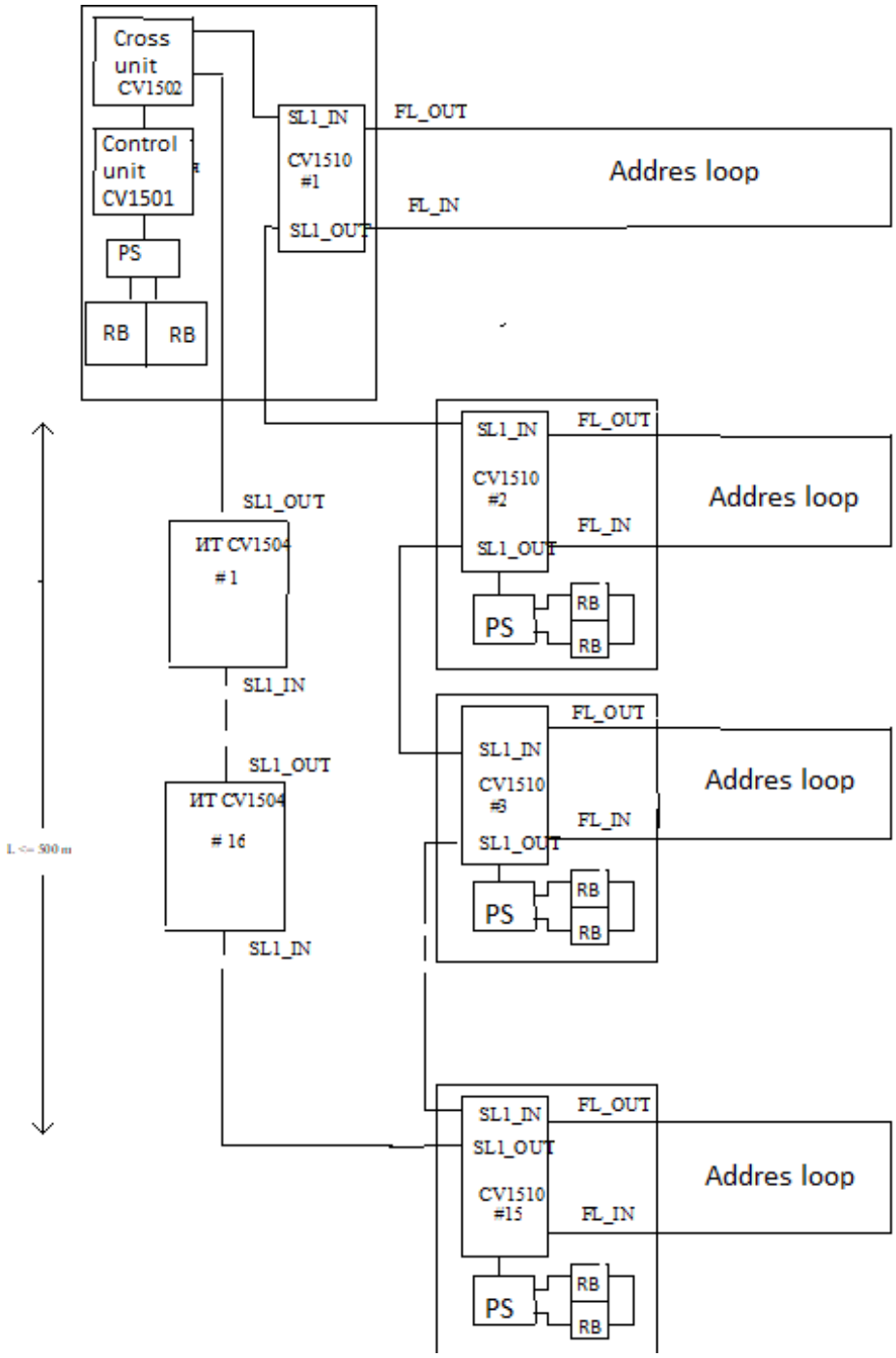
As it was noted above, system decentralization on physical level is ensured by remote installation of loops (CV1510 units) beyond the main casing.

This is done using a system internal interface SL1.

Maximum offset of the CV1510 unit from the device – 500 m (Fig. 1).

Communication between loop units in the system is effected using a wire with a section of at least **0.75 mm².**

Figure 1



5. Connection wires.

Special requirements for connection wires in the system are not set (screened, twisted pair, etc.). Limits may be imposed by fire safety regulatory documents, for example, required use of fire-resistant wires in certain cases.

The only requirement related to system functioning is resistance of communication lines.

Addressable detectors are included in the loop. The **length** of an addressable loop is **determined by its resistance**. Loop resistance **shall not exceed 50+2 Ohm.**

Instrument wire is selected considering its resistance per unit length. Resistance value of 1 km of copper wire depending on section is presented in Table 1.

Table 1

S, mm²	R, Ohm
0.35	50.4
0.5	36.0
0.75	24.5

Recommended wire for system installation – 0.75 mm² section.

6. Addressable loop unit CV1510

In case of need to increase the number of addressable loops, the required number of loop units is installed additionally into a separate cabinet or cabinets.

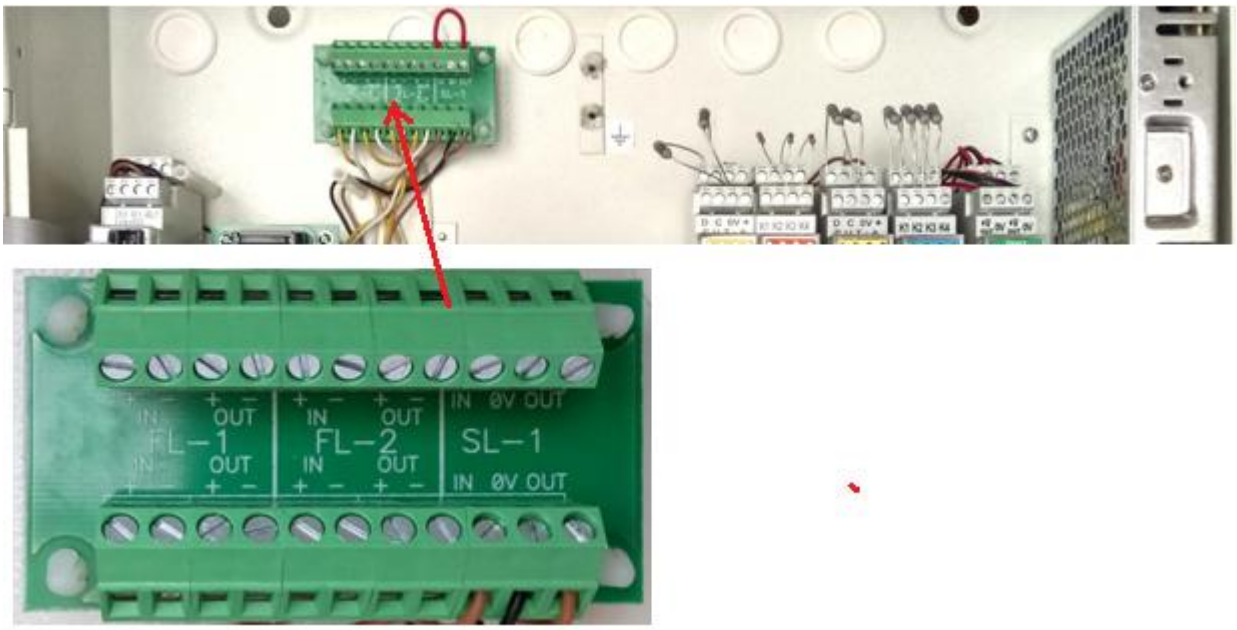
The total number of loops in the system shall not exceed 15.

Each unit shall be assigned its own address (loop number). The task of address is described in the CV1510 unit manual. Addressing is effected in binary code. There can be no devices with a zero address, and address duplication is not allowed. Addresses are allocated from the first to the fifteenth.

Output (SL_1Out) of the interface located at the cross unit CV1502 in the device is connected to the SL_1In input on loop units CV1510. The next loop unit's input SL_1In is connected to the SL_1Out output of the previous loop unit. The SL_1Out output of the last unit is returned to the SL_1In input of the cross unit CV1502, closing the loop and ensuring access to all loops at single break of system bus (see Fig. 1). Zero wire (0V, COM) is the second wire in the interface.

Fire loop is connected to contacts, **FL_out +, FL_out -** and returned to contacts **FL_in +,FL_in -.**

For connection convenience, a UI unit is installed in every cabinet where all internal connections are manufactured at the plant. Connections going out of the cabinet are connected to SL1 and FL terminals.



Unit is powered from a stabilized power supply +24 V. Power is supplied to terminals with the same name. Signal on power system status is sent to the 1W input. Power, system interface and 1W signal inside the cabinet is distributed at the manufacturing plant.

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7. Fire alarm loop.

This section is informative for the designer but it is required for correct system building.

It is due to the fact that detectors have an embedded short circuit isolator, which opens power on —. The **+FL_out** output is connected in series to “1” contacts of all detectors. **-FL_out** is connected to “4” contact (input) and passed from “3” contact (output) to “4” contact of the next detector.

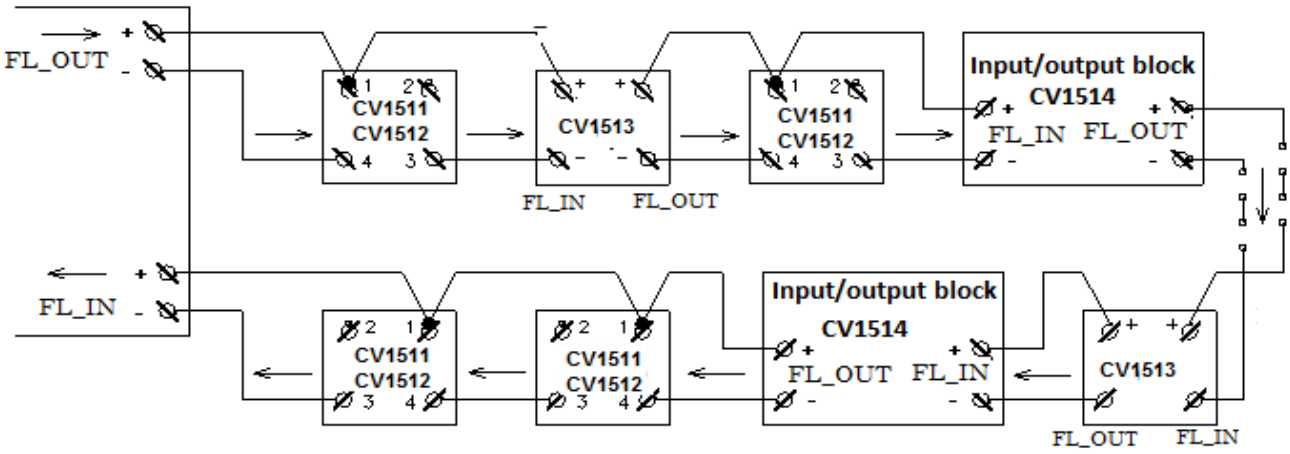
In handheld detectors and input/output units, connection is done to terminals **+FL_in, -FL_in:**, and from **+FL_out and -FL_out"** the line goes to the next detector or input/output unit taking into account polarity.

The loop is closed on the loop unit CV1510 with a connection to terminals **FL_in**.

Up to 127 addressable fire detectors and handheld detectors and up to 40 input/output units can be connected to the alarm loop. Limitations are only conditioned by the alarm loop length and functional purpose of the loop.

General appearance of an alarm loop is shown in Fig. 2.

Figure 2



8. Peripheral cabinets

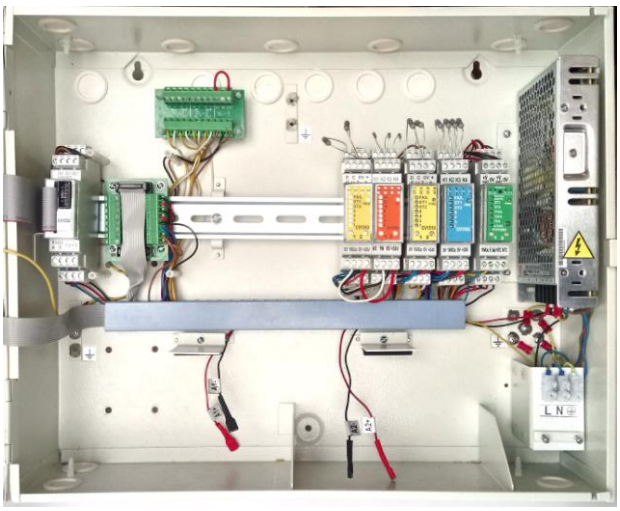
As it was mentioned above, in order to save cable production and increase reliability, loop units CV1510 and input/output units CV1514 can be installed remotely at the facility. Cabinets are used for that purpose. Why cabinets? Firstly, access to units should be restricted. Secondly, both main and backup power should be ensured. Backup power (batteries) assumes availability of a charging device, battery availability and status control device, etc.

Thus, in order to facilitate design and installation, such solution is suggested.

Several types of cabinets are suggested:

1. Central device cabinet;

   AFSDA is a basic device consisting of a control unit CV1501, output signal unit CV1503, cross unit CU CV1502, information board CV1504, control and charging device CV1505, and power supply PS.



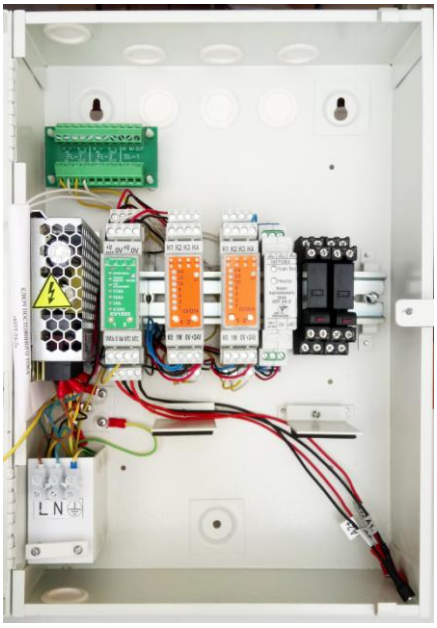
2. Information board cabinet;

3. Cabinets for ALU and IO installation

VRA 01 – addressable peripheral cabinet (430 × 350 × 142 mm) with ability to install CV1510 units (ALU) (maximum – 2 pcs.) and CV1514 units (IO-A) (maximum – 8 pcs.).

VRA 02 – addressable peripheral cabinet (360 × 350 × 142 mm) with ability to install CV1514 units (IO-A) (maximum – 10 pcs.), KPT, relays, and terminal blocks.

VRA 03 – addressable peripheral cabinet (240 × 350 × 110 mm) with ability to install CV1514 units (IO-A) (maximum – 6 pcs.), KPT, relays, terminal blocks.

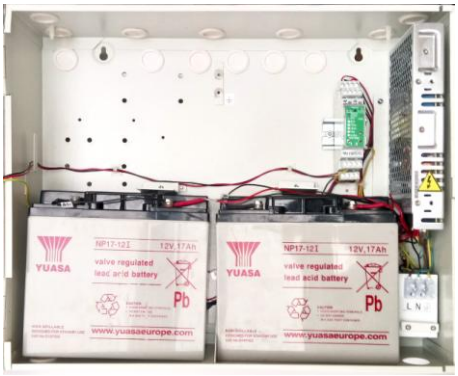


4. Cabinet for placement of control relays and keys.

VRA 05 – addressable peripheral cabinet (240 × 350 × 110 mm) without a power supply for installation of relays and terminal blocks.

5. Backup power cabinet.

VRA 04 – power cabinet (430 × 350 × 142 mm). Uninterrupted power cabinet with a 12V × 17A· h battery – 2 pcs.



Installation and mounting of ALU and IO in additional cabinets is effected at the manufacturing plant. Required design documents (specifications) shall be submitted for this purpose for accurate system completion

The following components can be used in VRA cabinets:
S – CV1510 ALU unit (23 mm) ;
B – CV1514 IO-A unit (23 mm);
KPT24 – DC key KPT24 (18 mm);
KPT220 – AC key KPT220 (36 mm);
Km – terminal blocks (6 mm);
R24P2 – relay with coil voltage of 24 V for 2 contact groups (16 mm);
R24P4 – relay with coil voltage of 24 V for 4 contact groups (30 mm);
R220P2 – relay with coil voltage of 220 V for 2 contact groups (16 mm).
R220P4 – relay with coil voltage of 220 V for 4 contact groups (30 mm).

Procedure of recording of peripheral VRA cabinets:

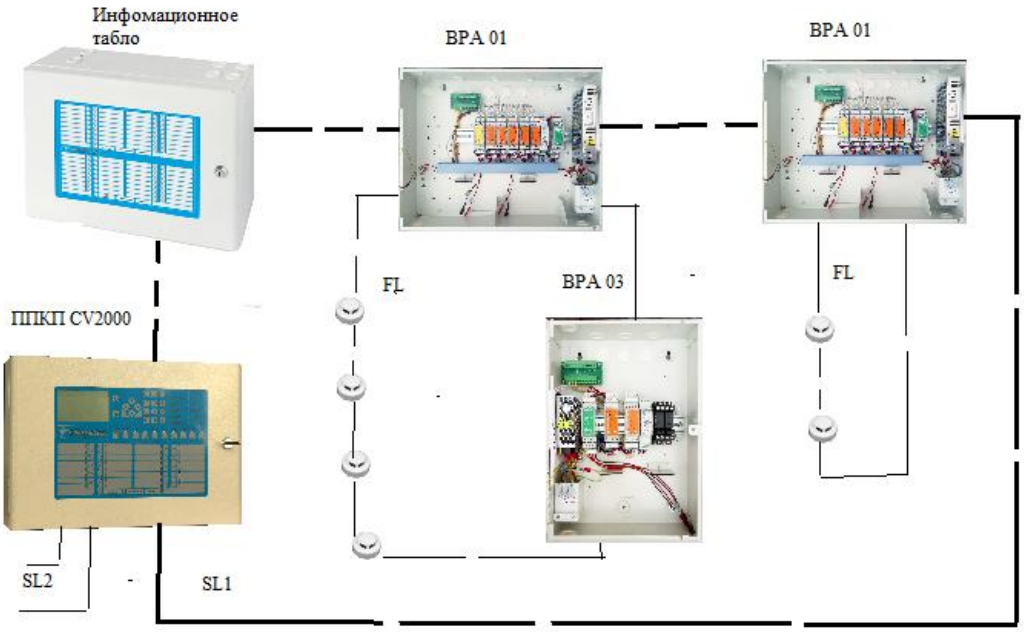
VRA 0x-xS-xB-xKRT24,
where
0x is peripheral cabinet index;
xS is number of CV1510 units (ALU) (**maximum – 2 pcs.);**
xB is number of CV1514 units (IO-A) (maximum – 8 pcs.);
xKPT24 is number of KPT24 DC keys.

Procedure of recording of peripheral VRA cabinets with relays:
VRA 0x – xKPT220- xRVPn,
where
xKPT220 is number of AC keys;
xRVPn is number of relays with coil voltage V (V=24 for 24 V DC, V=220 for 220 V AC) and number of contacts for Pn switching (n equals 2 or 4).

In case of absence of any unit, its code number is not stated in the peripheral cabinet designation.

Cabinet designation examples:
1. Peripheral cabinet with two ALUs, three IO-A, one KPT24-
VRA 01-2S-3B-1KPT24.
2. Peripheral cabinet with one KPT220, two relays with 24 V coils for 4 contact groups and two relays with 220 V coils for 2 contact groups and 6 terminal blocks-
VRA 03-1KPT220-2R24P4-2R220P2-6Km.

Thus, diagrams of Fig. 1 and Fig. 2 have approximately the following form implemented in particular cabinets. It should be repeated that VRA cabinets can be installed remotely over the facility.



9. Backup power.

With rare exceptions, only loop units CV1510 and input/output units CV1514 are installed in the cabinets of the first and third types.

Own consumption of loop unit CV1510 and 127-and detectors is 100-110 mA.

Own consumption of IO (with keys off) is 7 mA. Additionally, each channel can consume from 10 to 50 mA, depending on the implemented function (for example, status polling of end contacts) and plus load current of a key turned on.

In case of no mains voltage, at least 30 hours of battery power shall be available.

Thus**, it is not allowed to install more than two ALUs CV1510 in device cabinet and peripheral cabinets with battery capacity of 12 A· h.**

4,7,12 or 17A· h capacity batteries can be installed in cabinets. The charging device is designed for these types. Energy issues shall be considered in design. Limit the number of units so that their consumption with continuously connected loads does not exceed the capacity of the selected battery.

Main energy goes for loop and detector power, which is why their number in a cabinet determines the battery type:

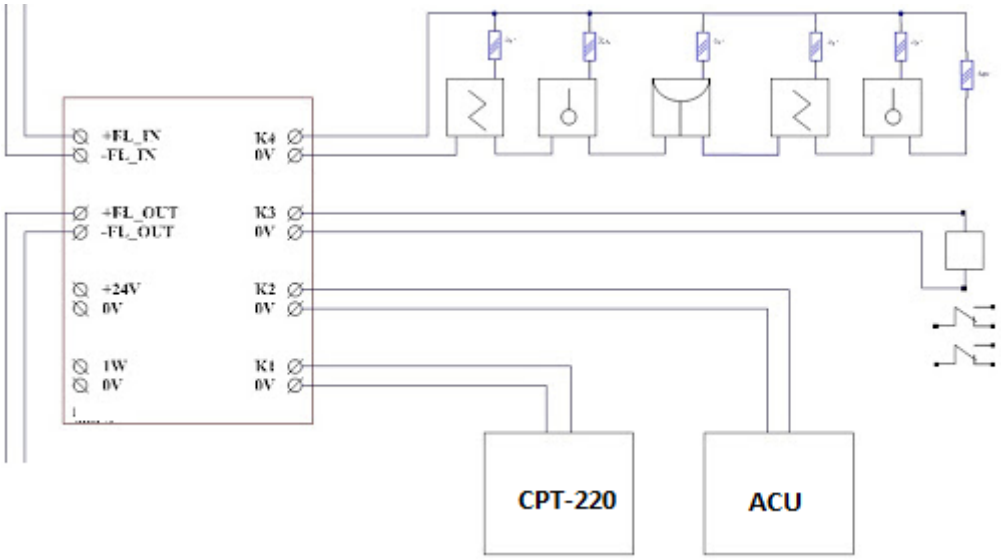
- Cabinet with one ALU – 2 batteries, 7 A· h each;
- Cabinet with two ALUs – 2 batteries, 12 A· h each;

Power supplies with output voltage of 29.5 V are installed in all cabinets. The power consumed from each cabinet network shall not exceed 100 W.

10. Connection of sensors, actuation devices and detectors to IO units

General connection of different devices to IO units is shown in Fig. 6. Channels are programmed freely for input, output or connection of addressless detectors.

Fig. 6.



1. Input/output circuits have the common 0V wire.

2. Channel 2 is set for input. For example, control unit of ACU actuation mechanism is on (signal input with voltage of ~ 220 V).

3. Channels 3, 1 are set for output (example of turning on of an electromagnetic relay) or AC key CPT-200 (~ 220 V, up to 10 A).

4. Channel 4 is set for fire operation mode (connection of addressless detectors). - smoke, - heat, - handheld.

10.1 Signal input from end contacts.

Diagrams according to Fig. 7 or Fig. 8 (for current increase on closure) are used for signal input from end contacts.

Figure 7

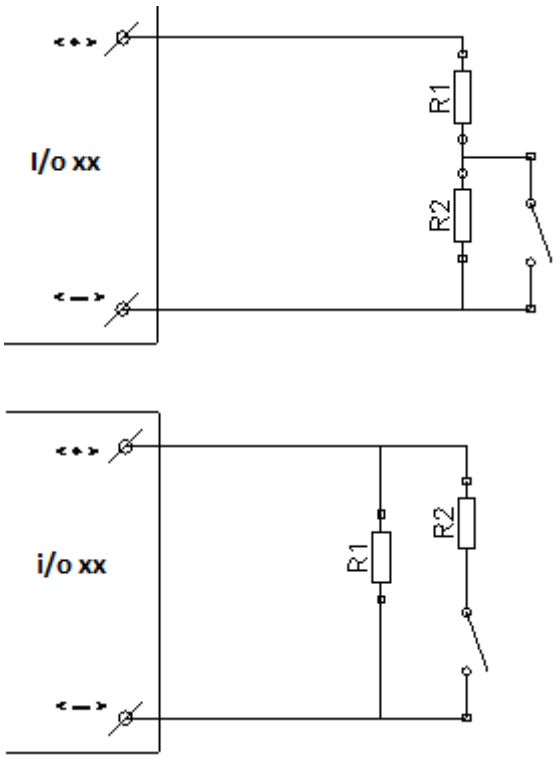


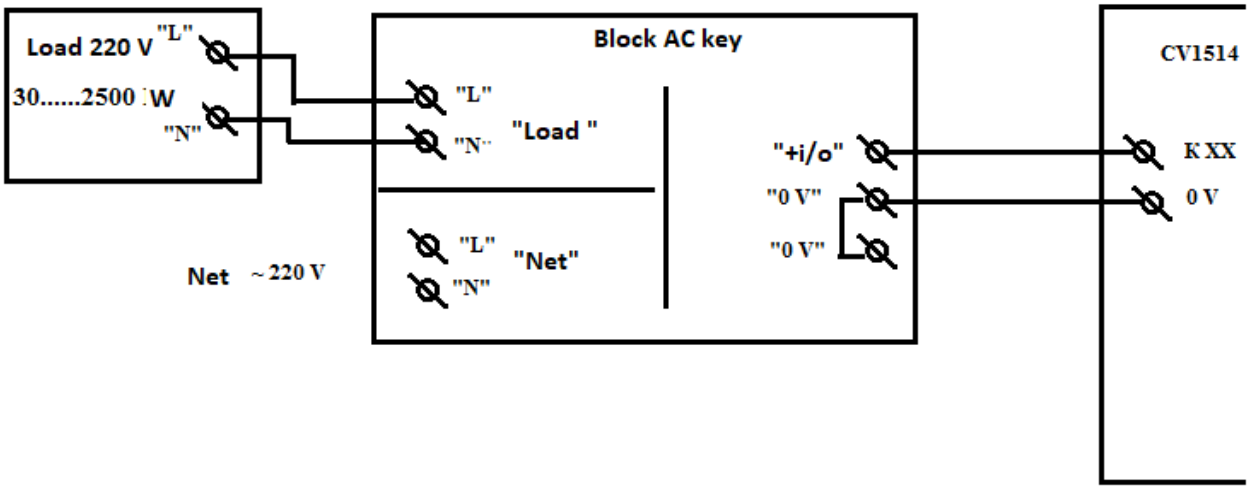
Figure 8

Nominal values of resistors shall be selected based on logical levels which should be implemented in this diagram.

10.2 AC signal output.

Relay or KPT-220 key (load line control) can be used for switching of AC signals. Connection of KPT-220 is shown in Fig. 9.

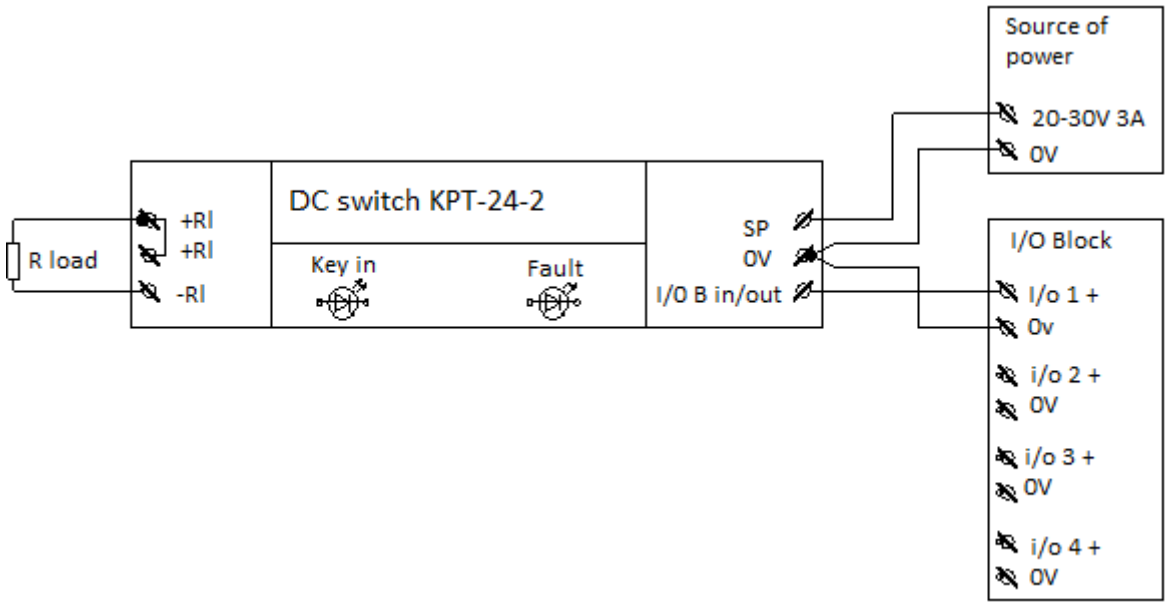
Fig. 9.



10.3 DC signal output.

Relay or KPT-24-2 key can be used for switching of DC signals. The key is used if it is required to control integrity of communication lines with load (for example, in case of annunciation management). Connection of KPT-24-2 is shown in Fig. 10.

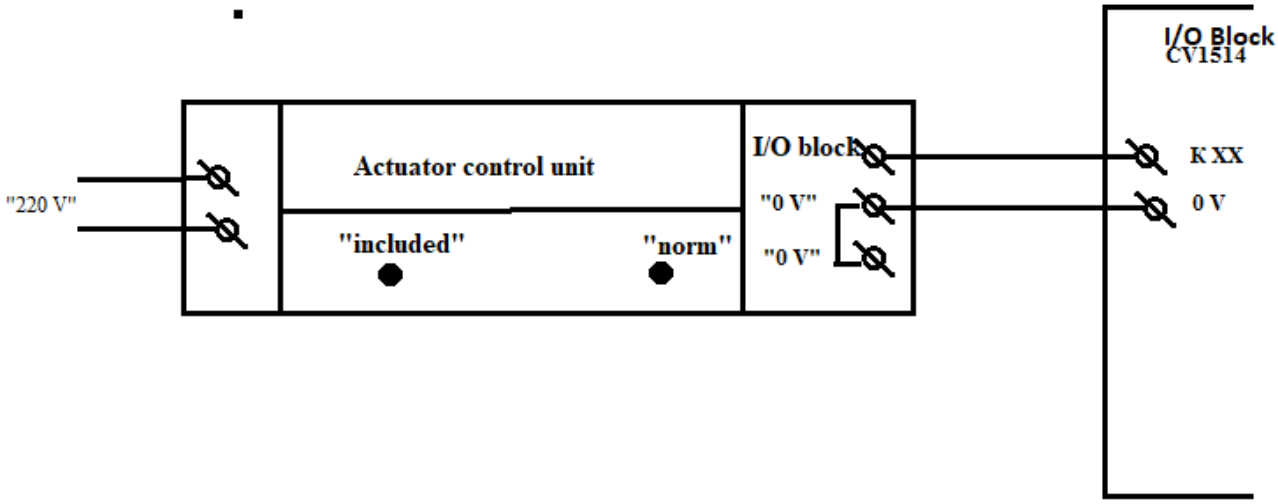
Fig. 10.



10.4 AC signal input.

If an actuation mechanism emits a signal about its status, it is required to ensure electrical isolation of this signal and normalize it to the level acceptable by the input/output unit. ACU connection is shown on Fig. 11.

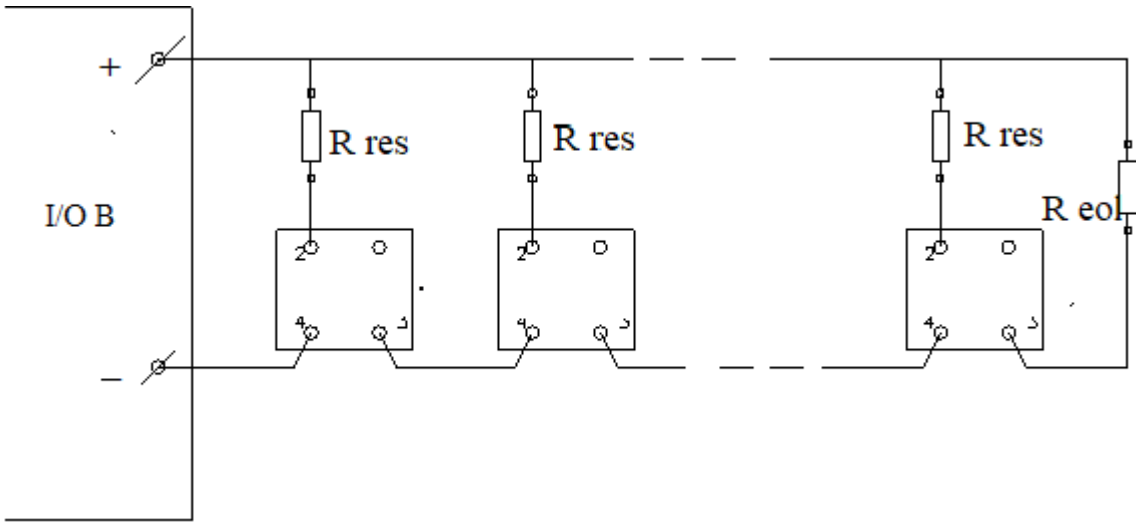
Fig. 11.



10.5 Connection of addressless detectors.

Addressless detectors are connected to the unit by conventional two-wire diagram. Up to 32 detectors can be connected to one channel.

Figure 12



Contact numbers are shown as an example. Connection of detectors and limiting resistor R_{rec} shall be effected according to manufacturer documents.

R_{eol} = 3.9 kOhm

11. Connection of information boards CV1504.

The board is intended for visualization of system conditions. They contain 32 LEDs and 32 buttons for control signal transfer to the system. Functional purpose of LEDs and buttons is programmed. Up to sixteen IBs can be connected to one device. They are connected to the same SL1 system bus as ALU (see Fig. 1).

12. Combining multiple devices

If you need to create a large system for a couple of thousand of detectors and input/output units, a hierarchic structure including up to fifteen addressable FASCs shall be built. They are combined over the SL2 ring interface and perform data exchange. In this case, an event in any loop of one device can initiate switching on of an actuation channel in the loop of another device. All devices can additionally be united over RS-485 interface for combined programming and monitoring.