



Multi-Channel Controller UPES

COMMISSIONING, OPERATING AND MAINTENANCE MANUAL

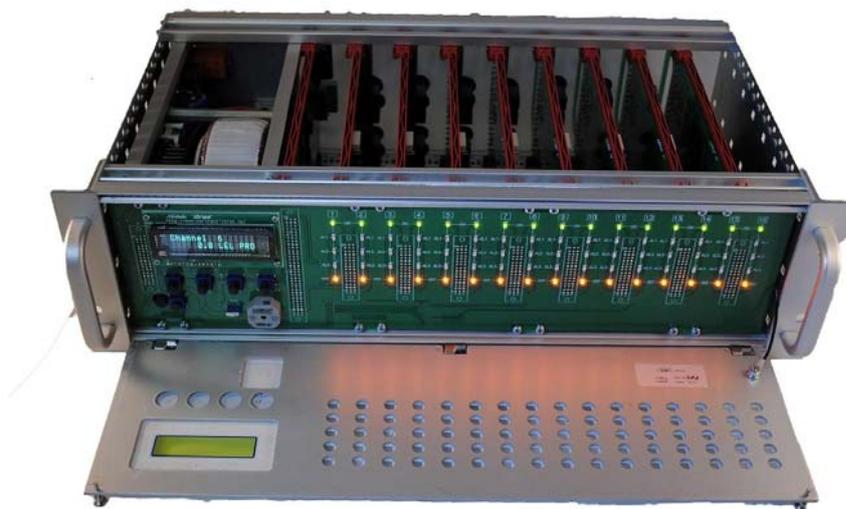


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1. Purpose of UPES

Threshold device UPES as composed of SGAES-TGM gas control system is intended for measuring of volume fraction of combustible gases, oxygen and carbon dioxide, mass concentration of harmful substances, as well as dangerously explosive concentrations of combustible gases in air of working area and signaling outputting about exceeding of levels.

Gas control systems are installed for measuring of gas levels in proximity to technological equipment of oil and gas transit stations of main trunk lines, storage tank farms, loading racks, oil refining and other gas facilities. GCS is intended for outputting warning and alarm signaling for purpose of facility automatic protection programs and actuation of gas emergency ventilation in facility control automation system.

Gas control system SGAES-TGM is consists of:

- UPES control panel (16 measuring channels)
- Primary measuring transducers (from 1 to 16)

As the primary measuring transducers are included to SGAES system can be:

- SGOES Gas Analyzers (may be included the UPES-903M threshold device)
- SSS-903 Fixed gas analyzers with plug-in sensors (SSS-903 consists of threshold device UPES-903M and one of gas sensors PGT (thermocatalytic), PGE (electrochemical), PGF (Photoionized) or PGO (optical).

Measuring data communication between transducers and UPES is realized by means of unified analog current signal (4-20)mA.

UPES control panel provides alarm actuation on three adjustment levels, activation and failure signaling of each measuring channels.

SGAES operating principle by measuring channels with transducers:

- SGOES and SSS-903 with PGO sensor - optical-absorptive;
- SSS-903 with PGT sensor – thermocatalytic;
- SSS-903 with ЗПУ sensor – electrochemical;
- SSS-903 with PGF sensor – photoionized.

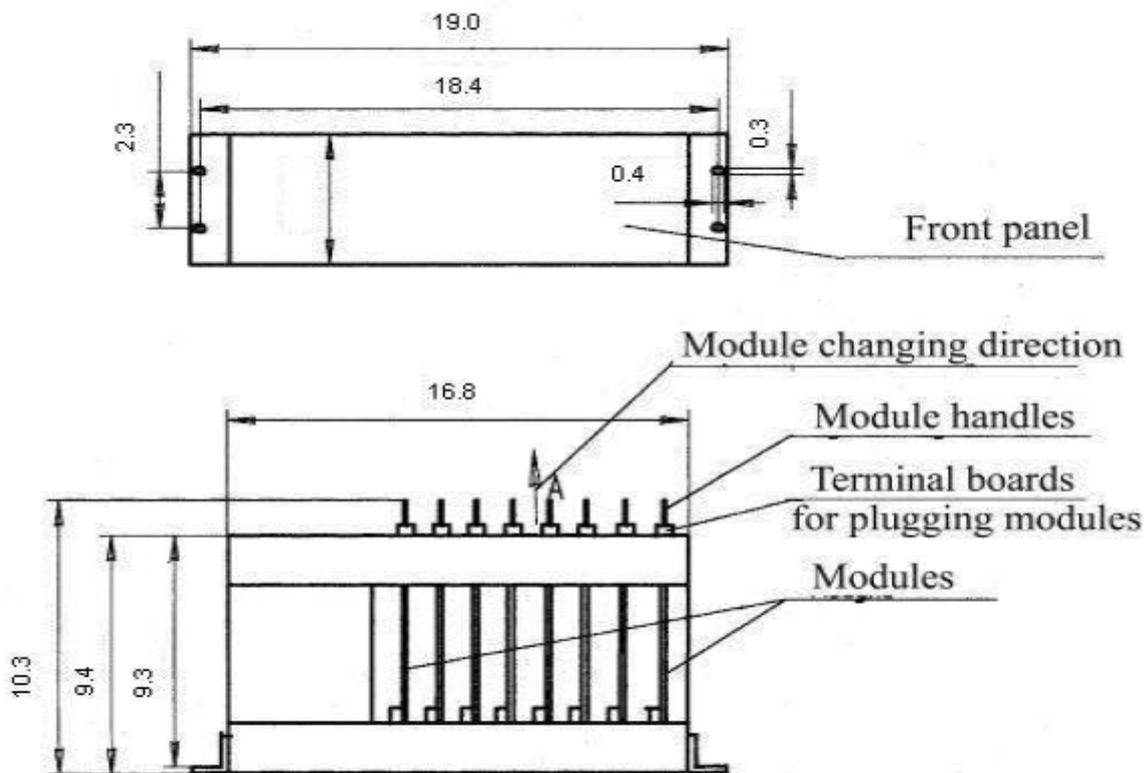
2. Basic Technical Characteristics

UPES general-purpose control panel is intended for exploitation at temperature from 14 °F to 113 °F and relative humidity up to 95% at temperature 95 °F.

- Dust and water protection is corresponding to IP54 (Type 3S) of UPES construction.
- AC power supply of 110V with frequency 60Hz.
- It is recommended to connect the UPES using UPS module, which provides no-break power at short-time power disconnection (up to 8 minutes) or brownouts.
- Outputs relay are provided current switching up to 5 A at AC voltage of 250 VAC and up to 5A at 30 VDC.
- Weight of UPES control panel is not more 37,47 lb (17.0 kg)
- Maximum power consumption does not exceed 300 VA.
- UPES provides data communication on digital output RS-485 and MODBUS protocol.

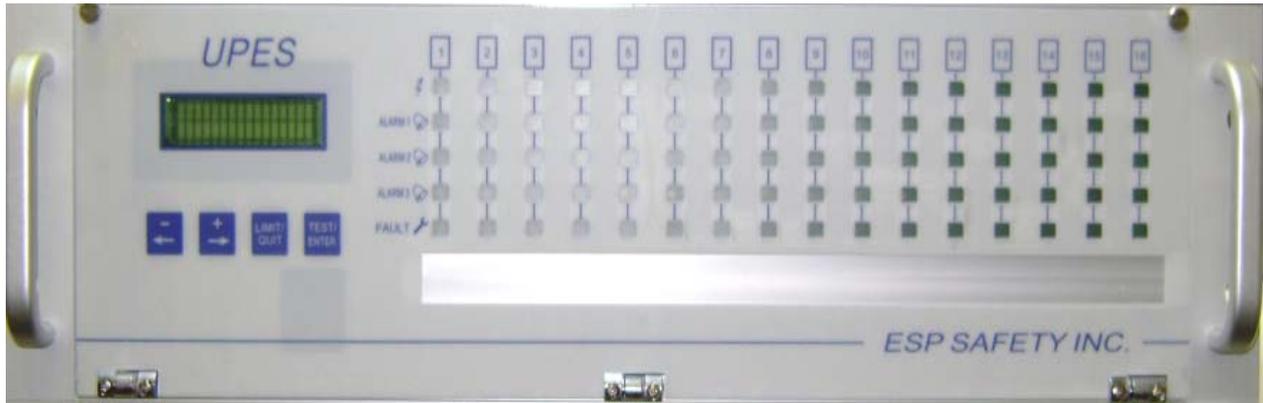
Overall dimensions are corresponding to Rack 3U × 19", and intended for integration into cabinet:

- Length 19 in (482 mm)
- Width 93 in (266 mm)
- Height 5,19 in (132 mm)



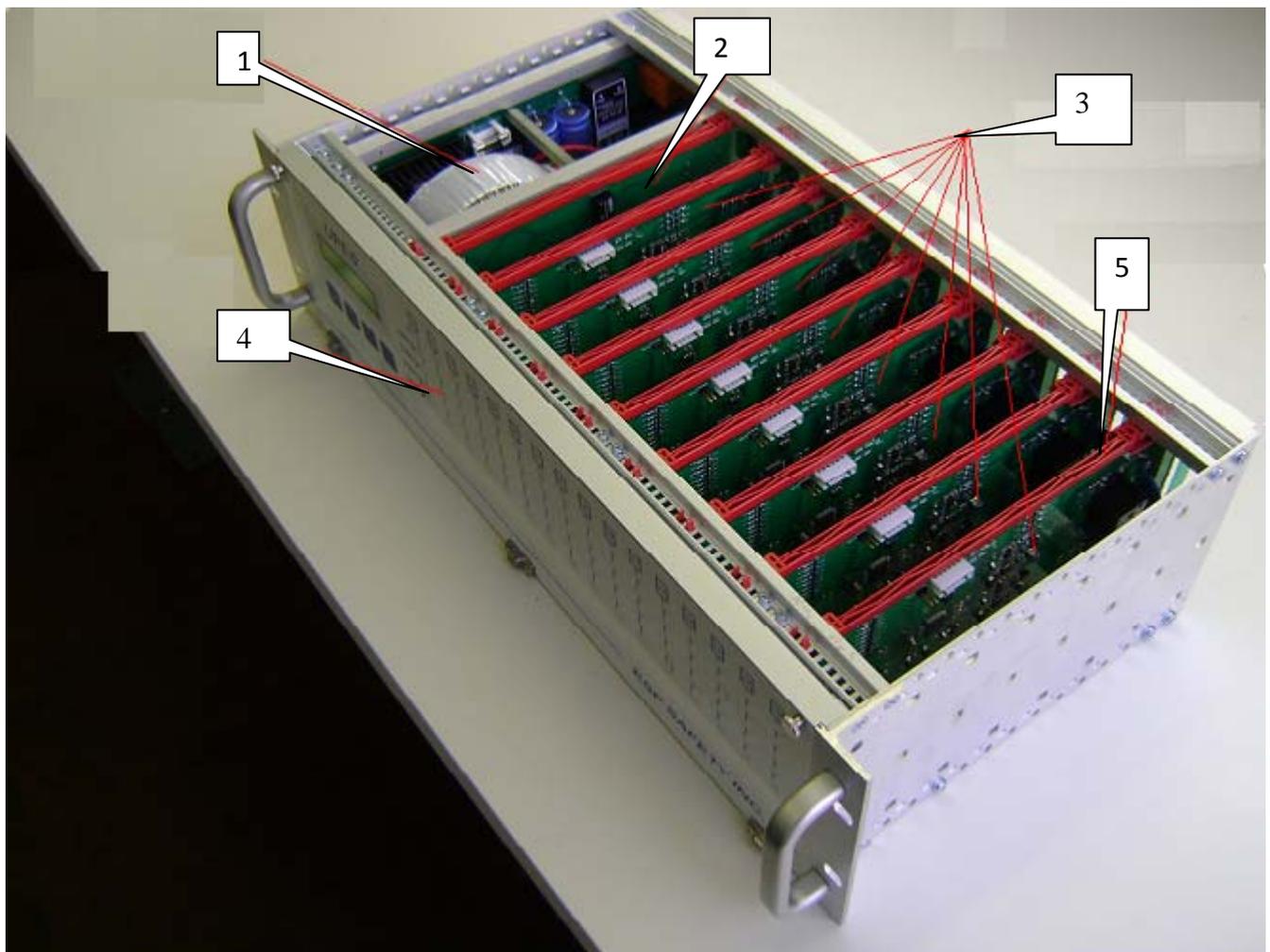
Threshold device UPES in as a standard block type 3U19
designed for placing in the rack

3. UPES construction



UPES is constructed on main modularity.

The power module, controller module and up to eight double-channel microprocessor-based modules of signaling devices on three alarm thresholds for each channel are integrated in a frame. **Fig.1.**

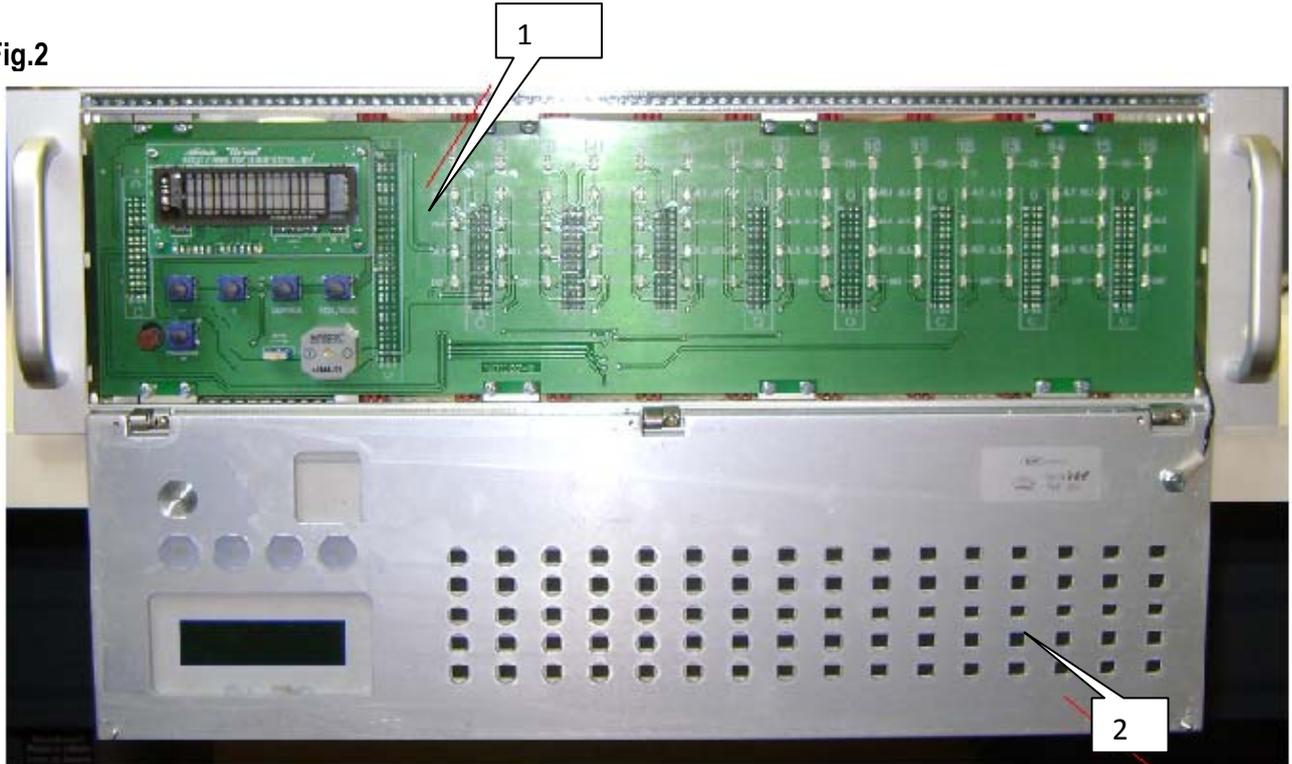


1. Power module
2. Micro board
3. 8 "measuring line" boards with 2 channels each

4. False panel
5. Slide Bar

FRONT interconnection board is under the UPES false panel.

Fig.2

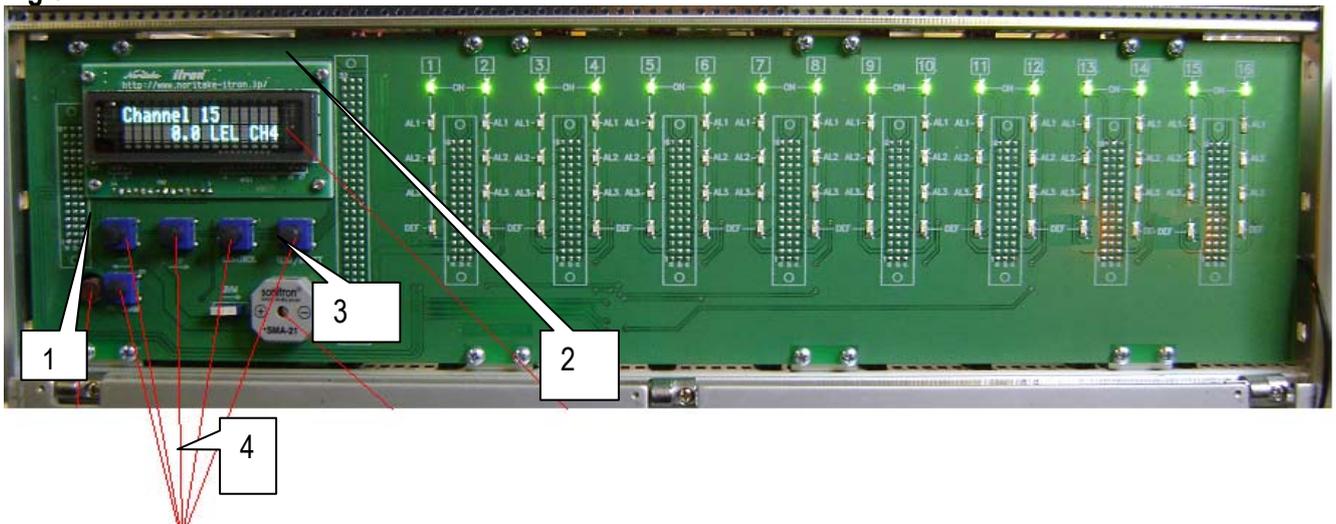


- 1. Interconnection board.
- 2. False panel.

On the UPES front panel is the fluorescent display panel with 16 digital symbols in line, provided visual information about system operation.

The functional keyboard is placed under display and contains 5 push-buttons for system control. Controller On/Off button and on/off buzzer toggle button.

Fig.3

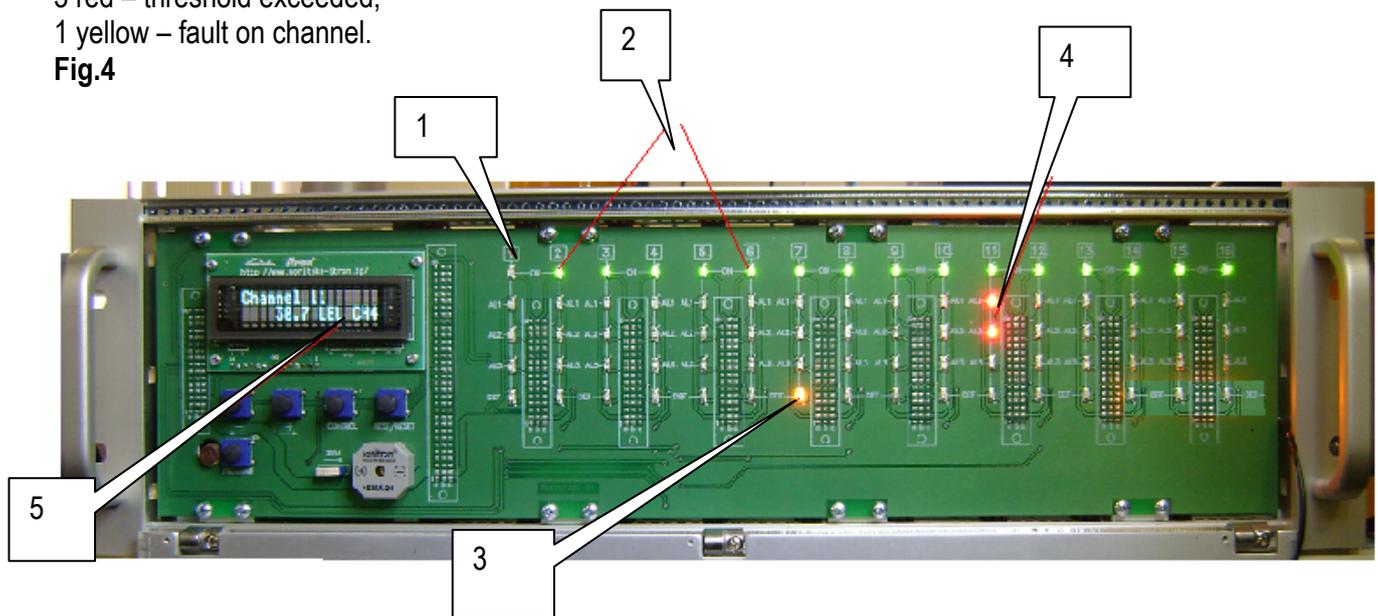


- 1. UPES On/Off push-button
- 2. Fluorescent display panel
- 3. Buzzer
- 4. Keypad and operating functions

Each channel is equipped with five LEDs (visible and identified on the front panel of UPES):

- 1 green – channel in service;
- 3 red – threshold exceeded;
- 1 yellow – fault on channel.

Fig.4

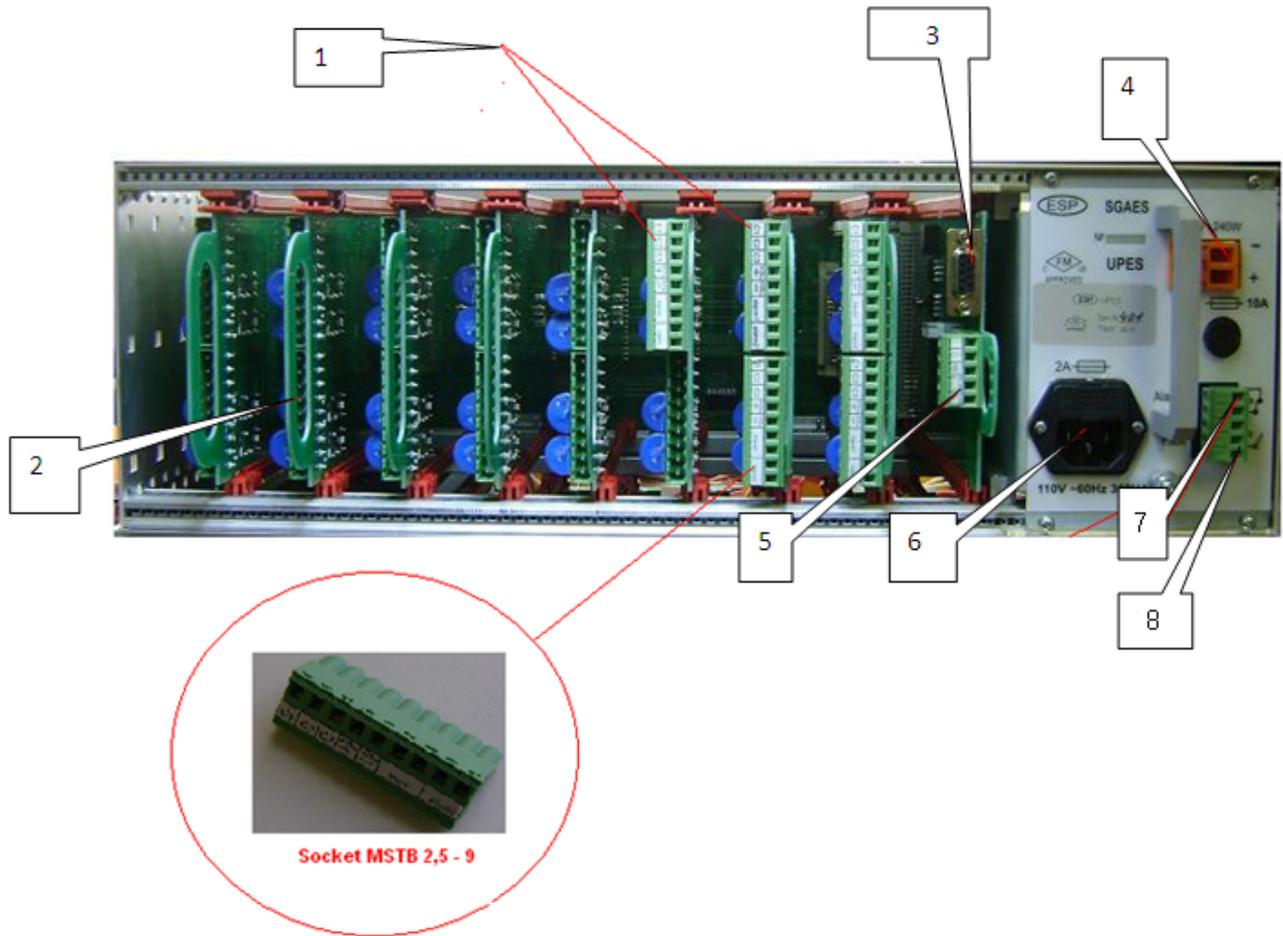


1. **GREEN LED** is extinguished - the channel not in service or fault.
2. **GREEN LED** from 2 to 16 channels is illuminated in steady mode – channel in service, power is switch on.
3. **YELLOW LED** on seven channel – fault on channel, open-circuit fault between detector and UPES and Gas Analyzer fault.
4. **TWO RED LEDs** on eleven channel is illuminated in steady mode – threshold exceed, gas level exceeded. If gas concentration of detection component is exceeded of set values of thresholds or any channel the in-built audio warning device is triggered.
5. Indication of **Gas content** is corresponding to channel 11.

The UPES threshold device is equipped with "dry contact" relays for locking of 1st and 2nd threshold of each channel, and one common "dry contact" relay for 3^d threshold of all channels. "Fault" relay is common for all channels.

On the UPES back panel is located sectional screw terminal connectors for connecting the cables from the detectors and external actuating devices (ventilators, valves, buzzers, etc.), as well as power and backup power supply connectors, and connectors for communication of the system with PC and other equipment by means of RS-323C and RS-485.

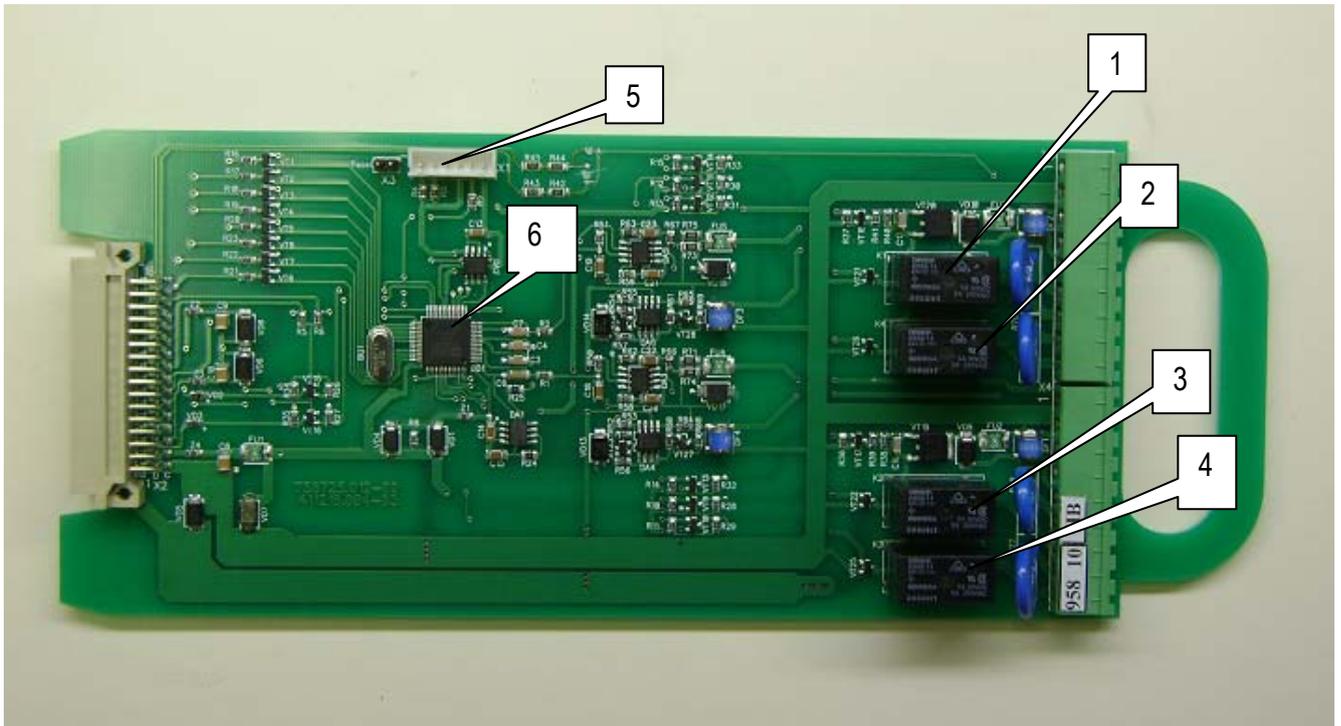
UPES back view. Fig.5



1. Screw terminal connectors
2. Measuring channel board
3. RS-232 output
4. Terminals for power backup
5. RS-485 contacts output
6. Power input 110V
7. The 3d threshold relay contacts (common for all channels)
8. Fault relay contacts.

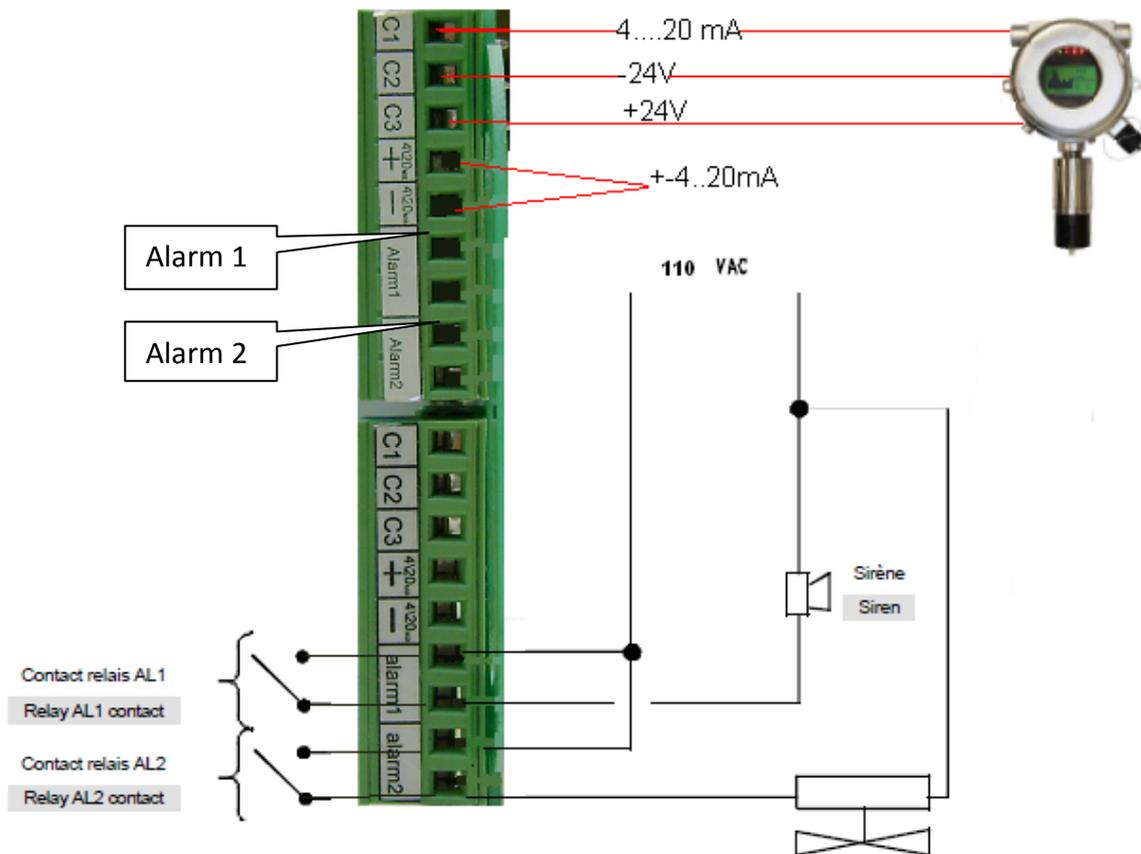
Measuring Double Channel Board.

Fig.6

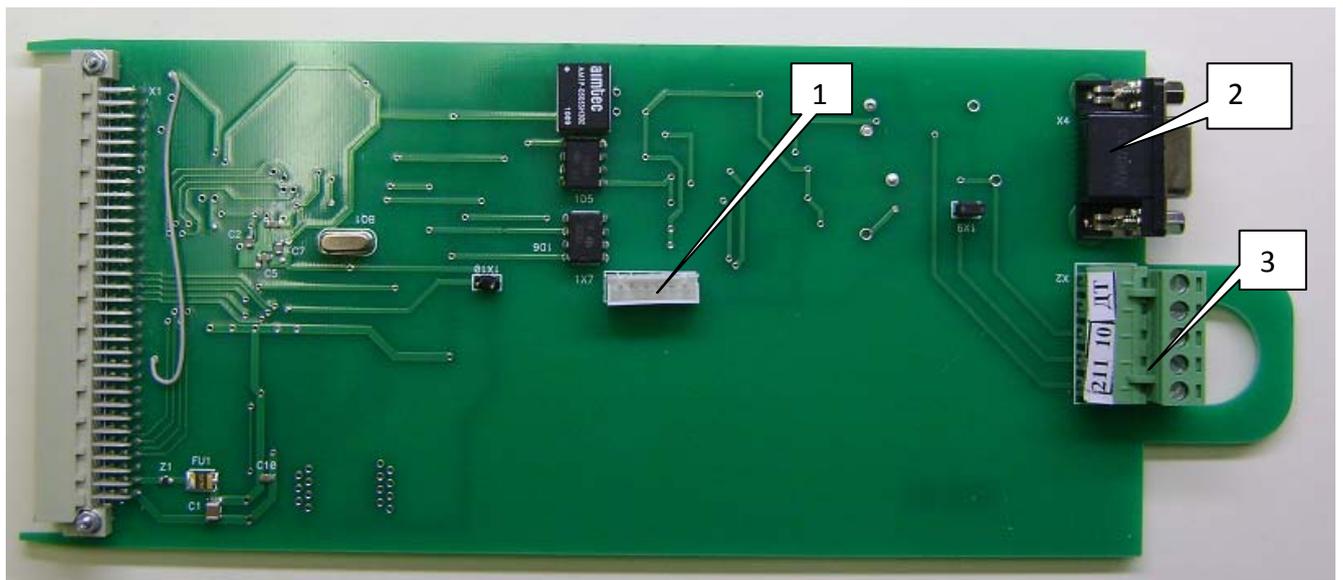


1. 1st threshold relay, first channel
2. 2nd threshold relay, first channel
3. 1st threshold relay, second channel
4. 2nd threshold relay. Second channel
5. Programming technological connector
6. Microcontroller

**Measuring Double Channel Board with screw terminal connectors.
Back view. Fig.7**

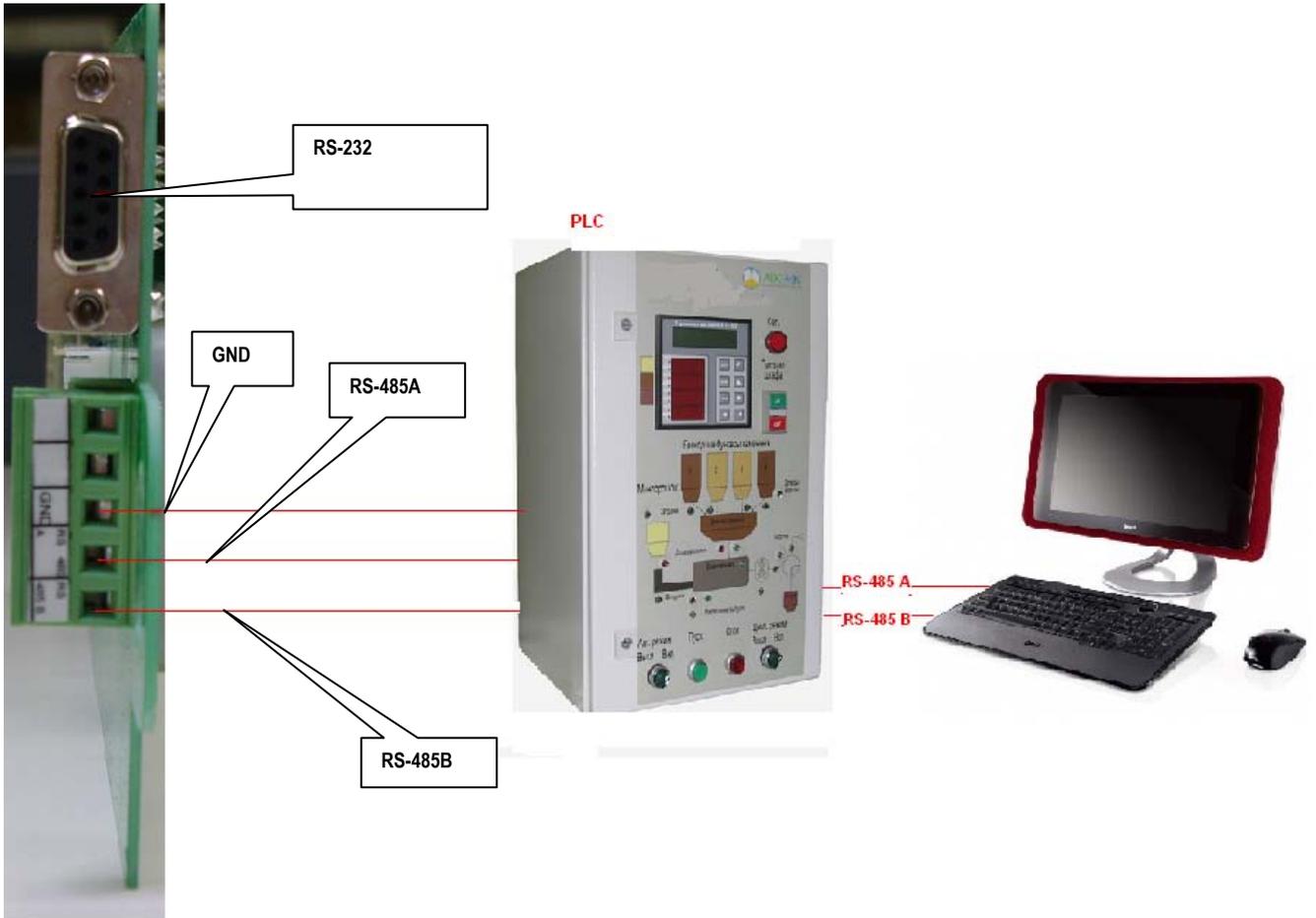


Processor Board.

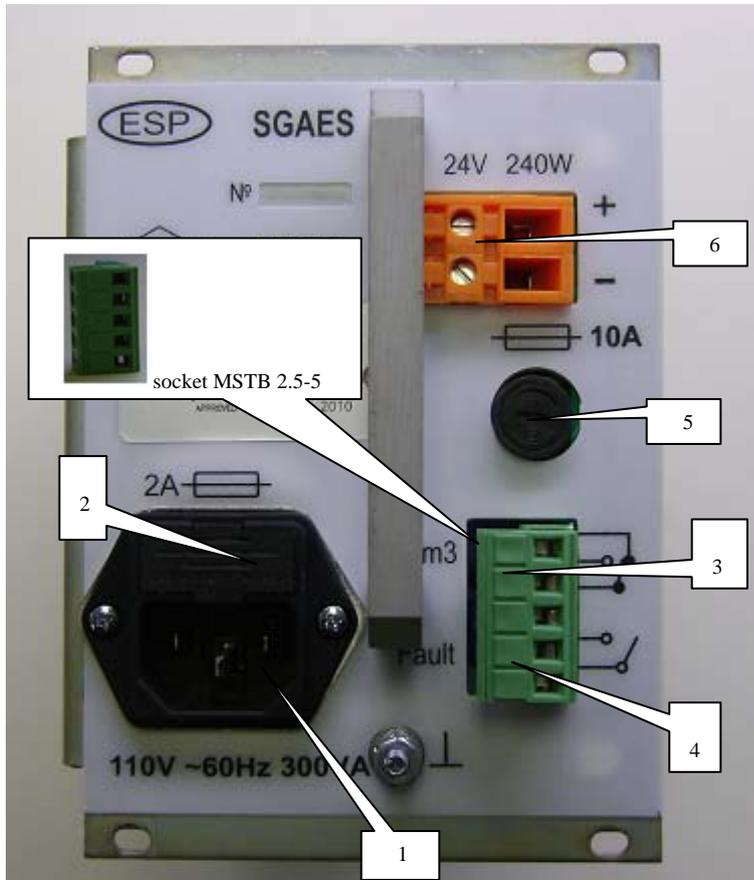


- 1. Technological terminal for programming
- 2. RS-232C port
- 3. RS-485 output contacts

Processor board. Back view.



Fault, Alarm 3, Power backup relay contacts configuration on the back power board of UPES



1. Basic power circuit input 110V, 60Hz. (220 V available)
2. Safety device of power supply 2A.
3. 3d threshold relay contacts (common for all 16 channels)
4. Fault relay contacts (common for all 16 channels)
5. Safety device of power backup circuit 10A
6. Power backup contacts.

4. UPES switching and operation.

To start up the system it is need to ease two screws on the front panel, swivel down the front panel and press the On/OFF button of threshold device. The unit then goes into self-test mode. During this test all green LEDs of operation channels are lighting continuously, but red and yellow LEDs are blinking, buzzer sounds continuously (at ON buzzer position).

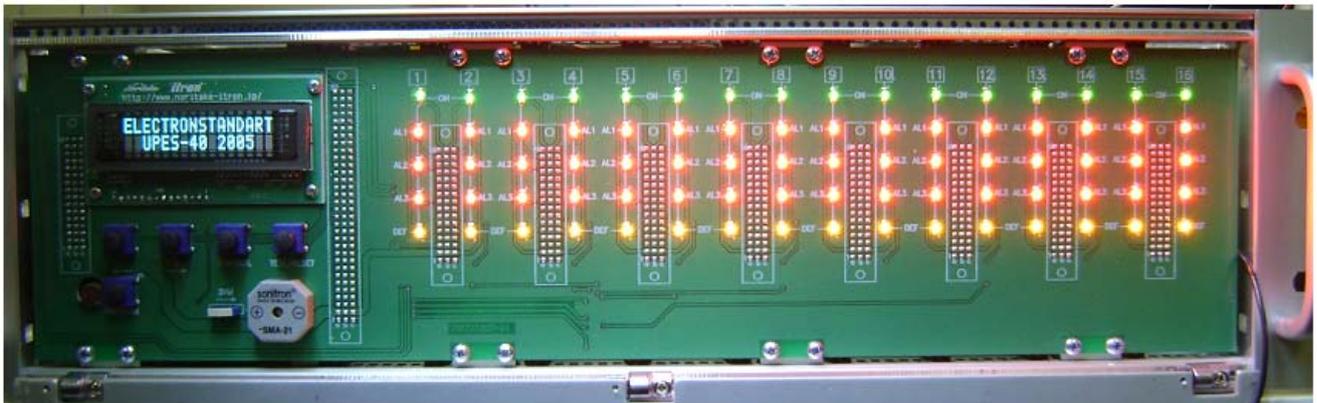
The UPES display panel then shows following notices:

*** AUTOTEST

*** ELECTRONSTANDART

UPES – 40 2005

UPES – 40 2005



It is possible to carried out a “manual-self test” by pressing the Test/Reset button at any time. It is possible to interrupt self-test cycle before it is completed by pressing “CONTROL” button (UPES)

After test is completed all red and yellow LED indicators blow out, buzzer switched off, and green LED indicators are lightning continuously, that meaning about actuation of all channels of the system if all channels and communication lines are in operability condition and if gas concentration is low of the first threshold concentration in gas detectors' installation area. Indication on the display panel will be following, for example:



The system is ready to operation.

When the system passed to operation mode user can check the actuation of the channel by lighting of green LEDs of corresponding channels and absents of faults in the channels by no lighting yellow LEDs. If green LED indicator is not lighting user can go to programming mode and check channel actuation.

For this procedure is need to:

- UPES must be actuated and front panel should be swivel down;
- Set the number of checking channel at display by means of "+" and "-";

If gas concentration at the detectors' installation area is increased the set concentration thresholds, relays a1, a2, a3 are actuated with delay of 1-5 seconds after increasing (LEDs switching). Normal open "dry" contact relays a1, a2 are output on screw terminals connectors on each channel module. Relay's contacts are closed and remain in closed state until the gas concentration return to low before-threshold value.

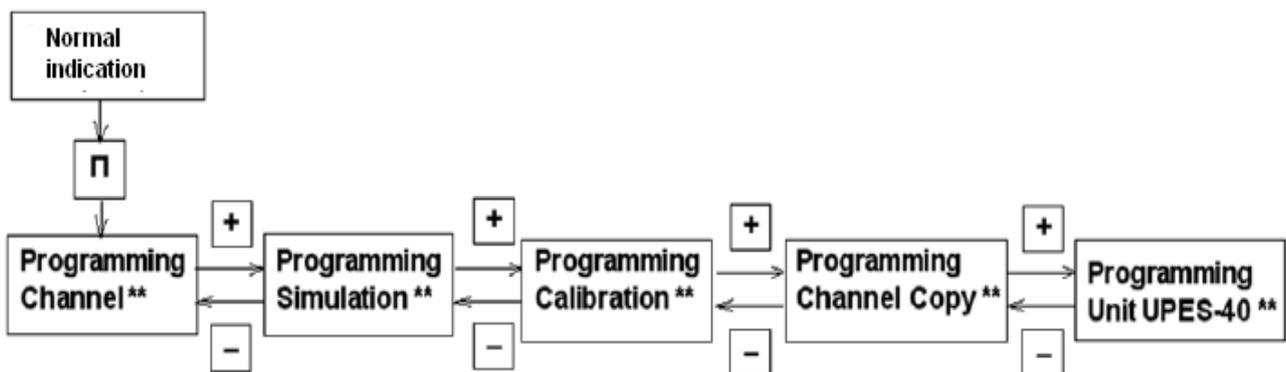
5. Examination of channel parameters. Menu Operation.

Review and changing of thresholds values and others channel parameters is made as described above. To press the "PROGRAM" bottom (UPES) requested times user can review the current values of the channel parameters.:

Block diagram for chosen requested menu:

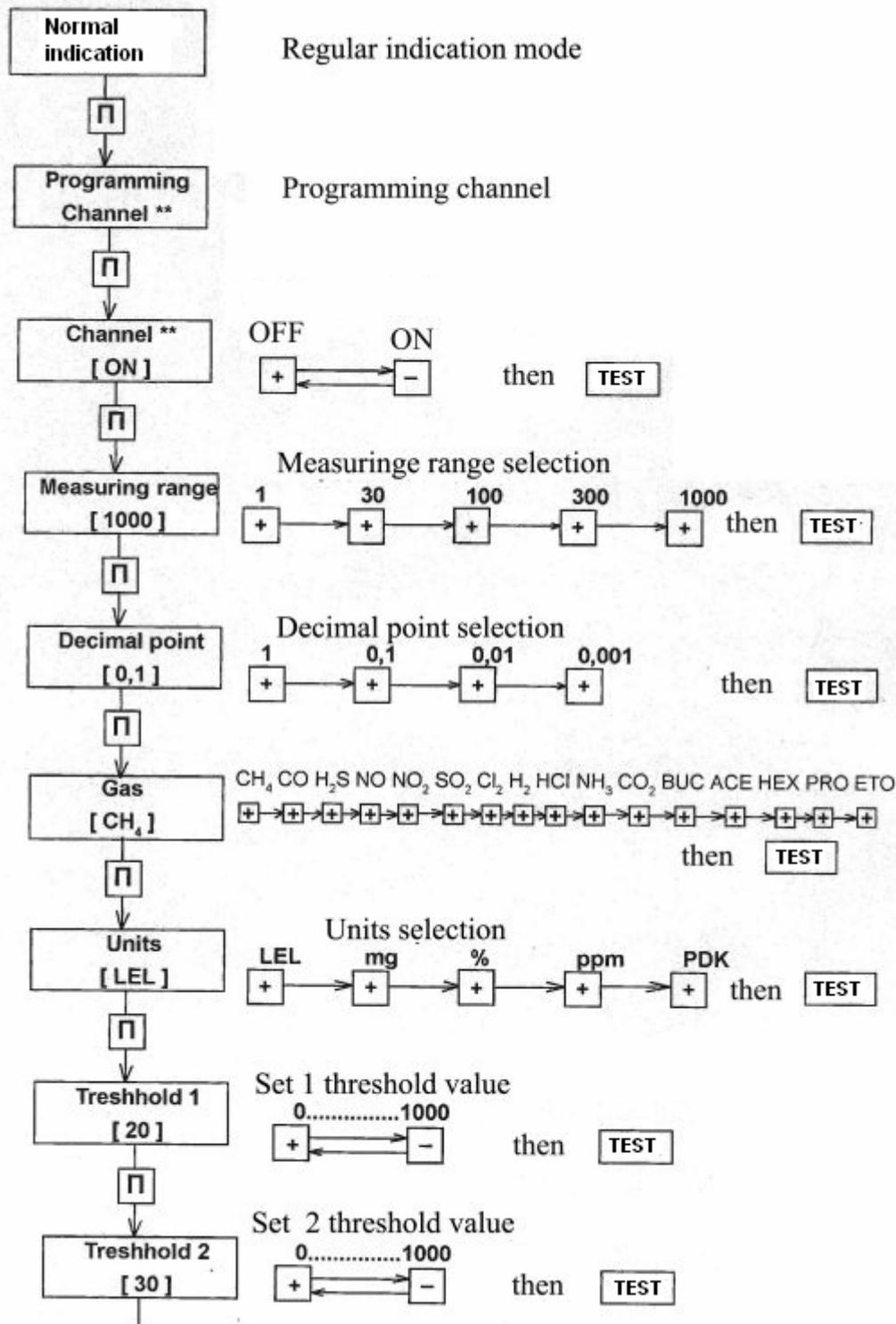
UPES can be programmed on 5 menus:

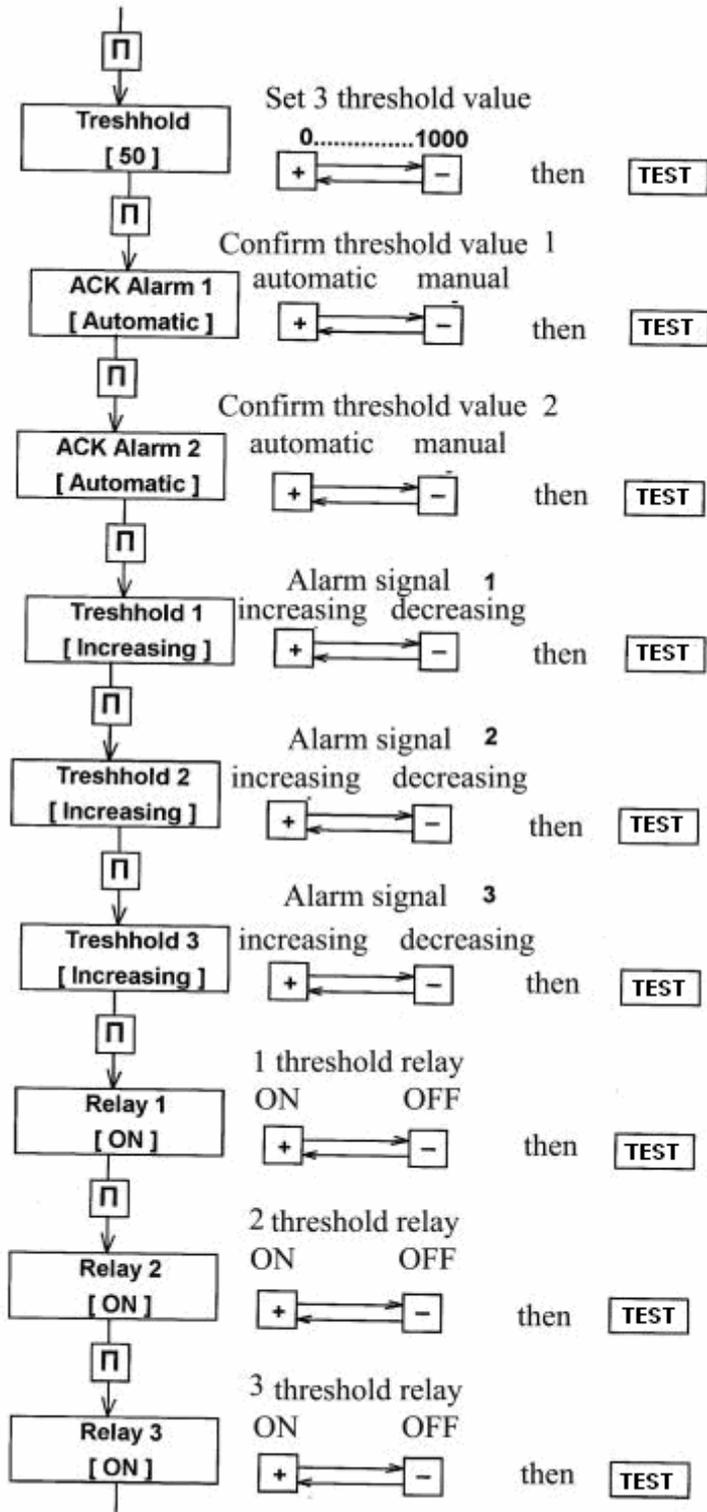
- programming channel;
- programming simulation;
- programming calibration;
- channel copy;
- programming unit UPES.

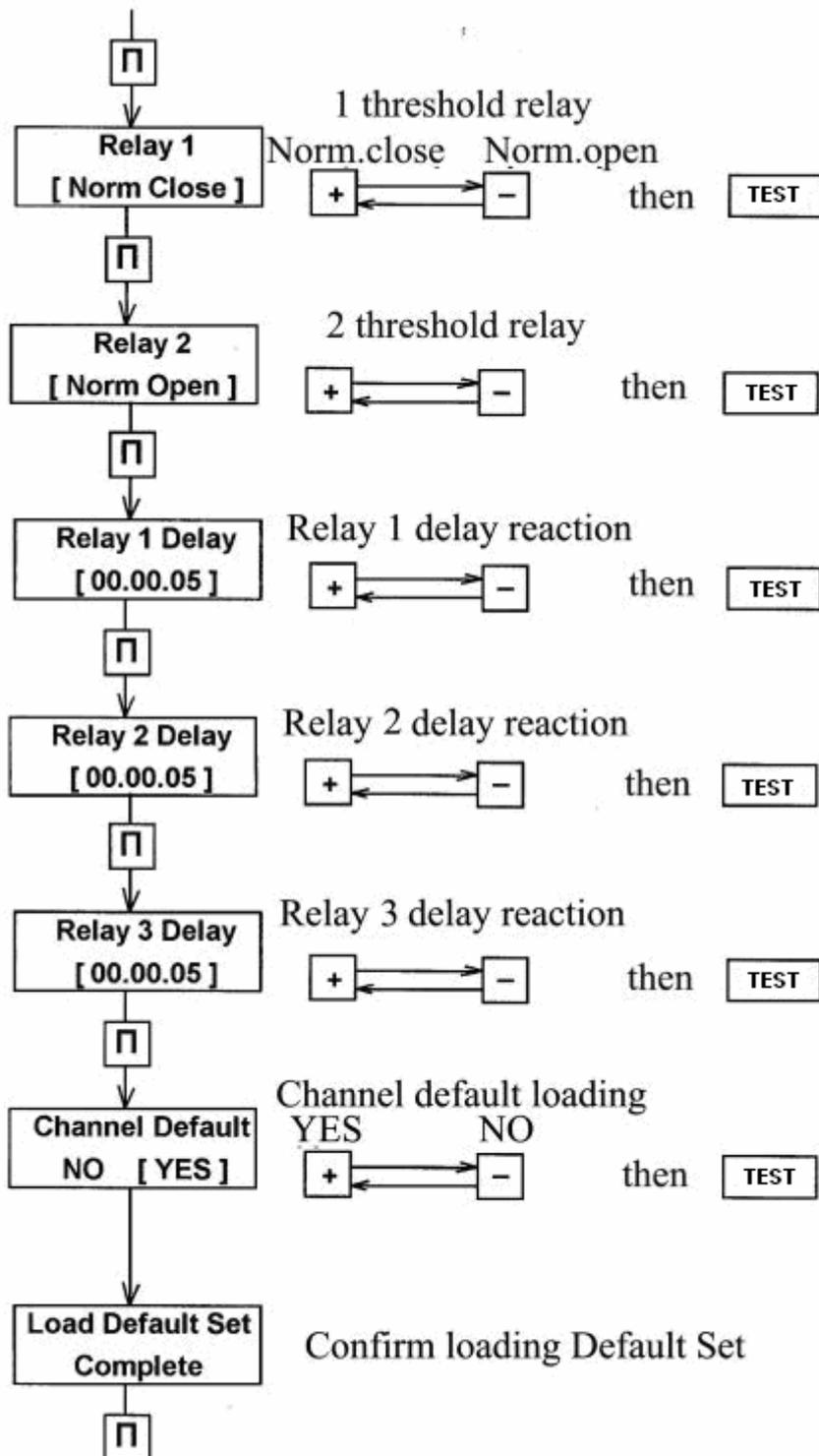


Block Diagram of UPES menu is given below.

PROGRAMMING OF UPES CHANNEL

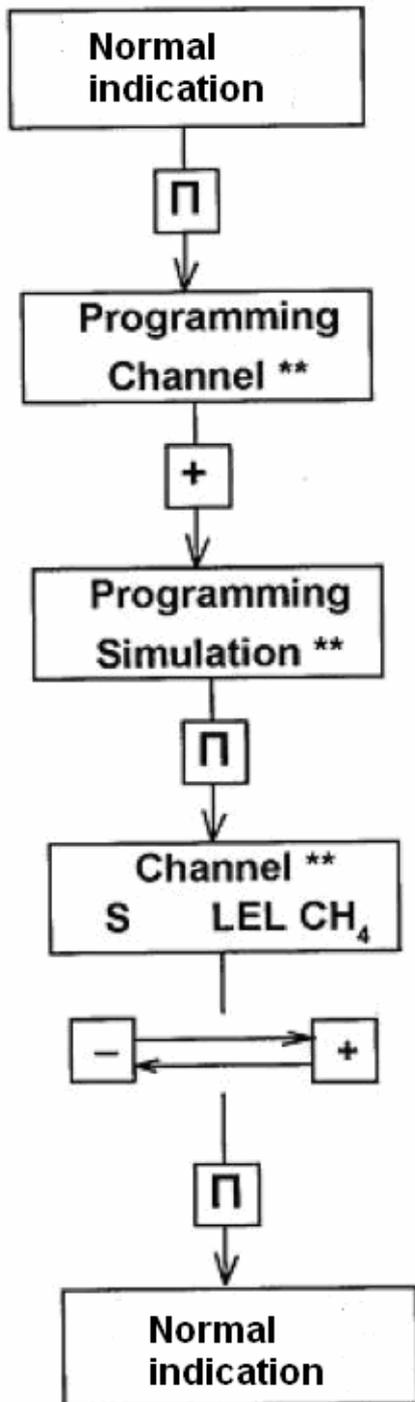






PROGRAMMING MENU FOR MODELLING UPES CHANNEL

The present function is allowed to increase artificially the gas concentration on each channel and check operability of each relay and light alarm indication.



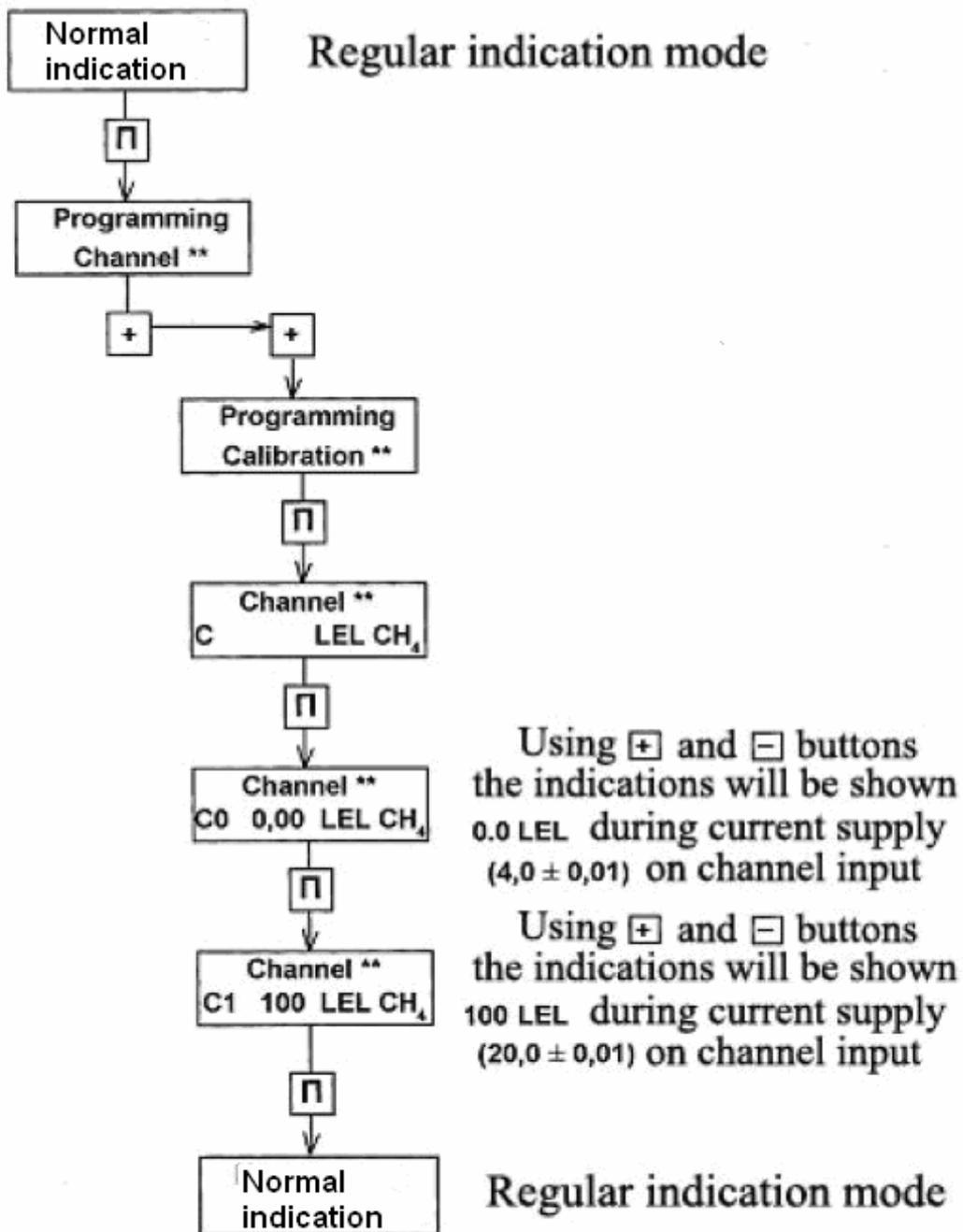
Regular indication mode

S means that the present channel is in simulation mode

In order to change indicators readings artificially and switch on alarm signals (LED and relay)

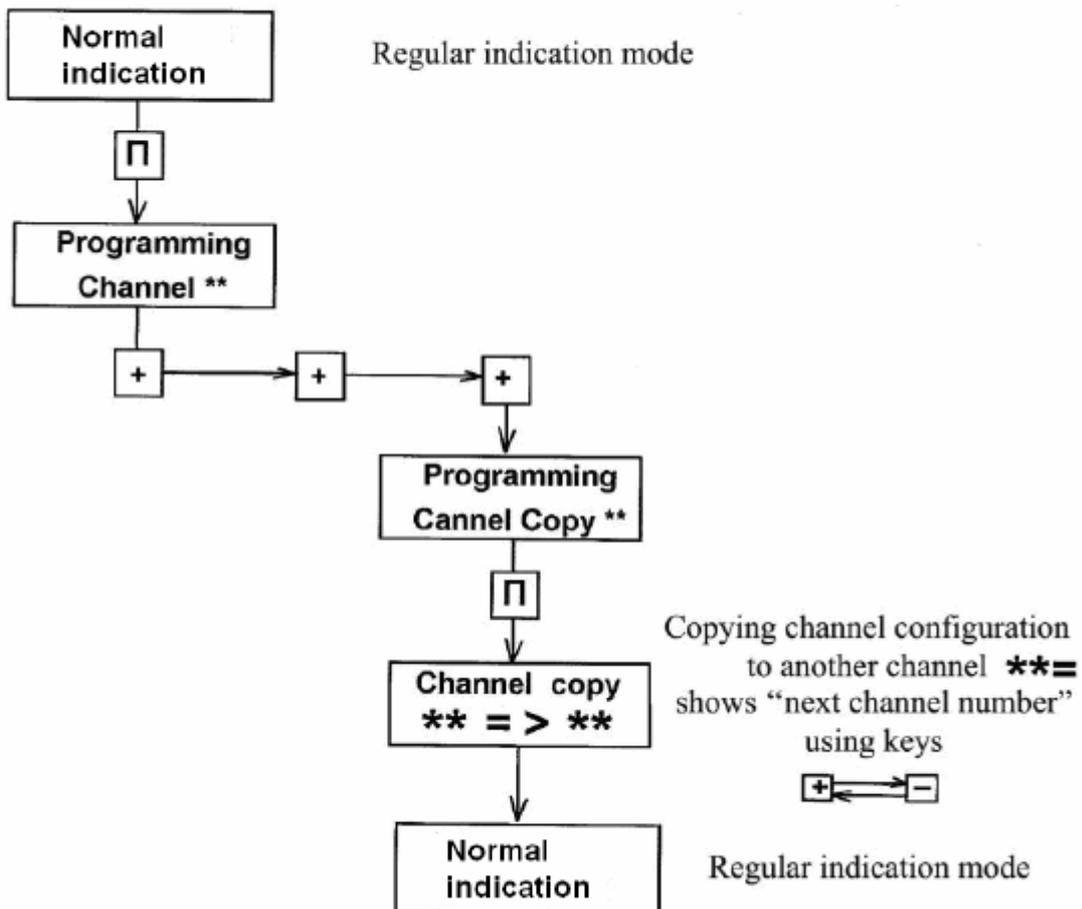
Regular indication mode

CALIBRATION MENU FOR UPES CHANNEL

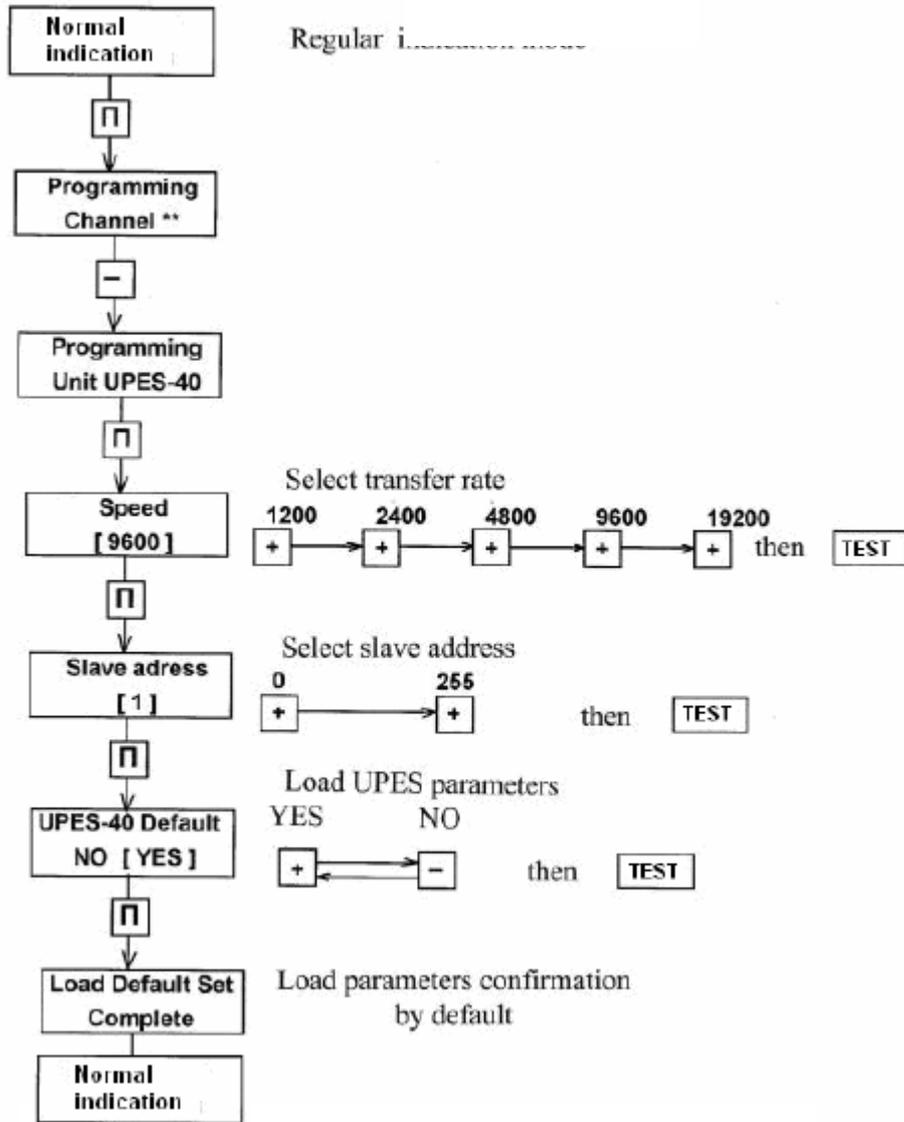


Repeat calibration of the channel 3-4 times until there are indications on 0.0 LEL indicator with deviation of no more than 1.1 LEL

COPY MENU FOR UPES CHANNEL



UPES PROGRAMMING MENU



6. UPES Channel Adjustment and calibration on various gas types.

Programming and calibration the UPES measurement channel with SSS-903M gas analyzer with hydrogen sulfide calibration.

Calibration procedure:

- UPES must be actuated, the false panel is swiveled down;
- set the number of programming channel by "+" and "-" bottoms;
- press "PROGRAM" (UPES) bottom three times. Displayed information will be following:

Measuring Range

[1000]

Set Measuring range by "+" and "-" bottoms:

Measuring Range

[30]

Confirm the setting press "Test" button. Подтвердить выбор путем нажатия кнопки «Test».

Then press "PROGRAM" bottom, the displayed information will be following:

Decimal Point

[0.1]

To set decimal point by "+" and "-" bottoms:

Decimal Point

[1]

Confirm the setting press "Test" button..

Then press "PROGRAM" bottom, the displayed information will be following:

Gas

[CH₄]

To set gas type by "+" and "-" bottoms:

Gas

[H₂S]

Confirm the setting press "Test" button.

Then press "PROGRAM" bottom, the displayed information will be following:

Units

[LEL]

To set units by “+” and “-“ bottoms:

Units

[mg]

Confirm the setting press “Test” button.

Then press “PROGRAM” bottom, the displayed information will be following:

Threshold 1

[20]

To change threshold value by “+” and “-“ bottoms on:

Threshold 1

[10]

Confirm the setting press “Test” button.

To set the values of 30 and 40 for Threshold 2 and Threshold 3 accordingly with procedure given above.

Then press “CONTROL” bottom to go to normal indication mode.

Then remain in normal indication mode to press “PROGRAM” bottom.

The displayed information will be following:

Programming

Chanel

Then pres “+” bottom twice, the displayed information will be following:

Programming

Calibration (№ channel).

Then press "PROGRAM" bottom – **twice** the displayed information will be following:

Channel 0

C0 0 mg H2 S

Then press and hold "-" bottom to set value «**-420**» in the up right corner of indicator.

The displayed information must be following:

Channel -420

C0 0 mg H2 S

Then press "PROGRAM" once, the displayed information will be following:

Channel 4000

C1 0 mg H2 S

Then press and hold "-" bottom to set value «**5650**» in the up right corner of indicator.

The displayed information must be following

Channel 5650

C1 0 mg H2 S

Then press "CONTROL" bottom to go to normal indication mode.

Calibration and value setting for measuring hydrogen sulfide concentration is completed.

Programming and calibration values for UPES measurement channels according to the type of gases.

Gas	Measuring Range	Decimal Point	C0	C1	Threshold 1	Threshold 2	Units
H ₂ S	30	1	-420	5650	10	30	mg
CO	100	1	-110	4445	20	100	mg
NH ₃ (0-99)	100	1	0	4100	20	60	ppm
NH ₃ (0-700)	1000	1	400	2405	100	200	ppm
SO ₂	30	1	-520	6040	10	30	mg
Cl	300	1	400	2362	1	5	mg
HF	300	1	598	1960	2	7	mg
NO ₂	300	1	280	3130	2	10	mg
CO ₂	100	1	400	2430	1	2	%
O ₂	300	1	0	4025	19.5 (limitation)		%
H ₂	30	0.1	-270	5050	1	2	%
CH ₄	1000	0.1	0	4000	20	30	LEL
C ₃ H ₈	1000	0.1	0	4000	20	30	LEL

7. Digital outputs RS-485, RS-232 performance test. UPES test program.

For performance test of the UPES RS-485 digital output is required the following equipment:

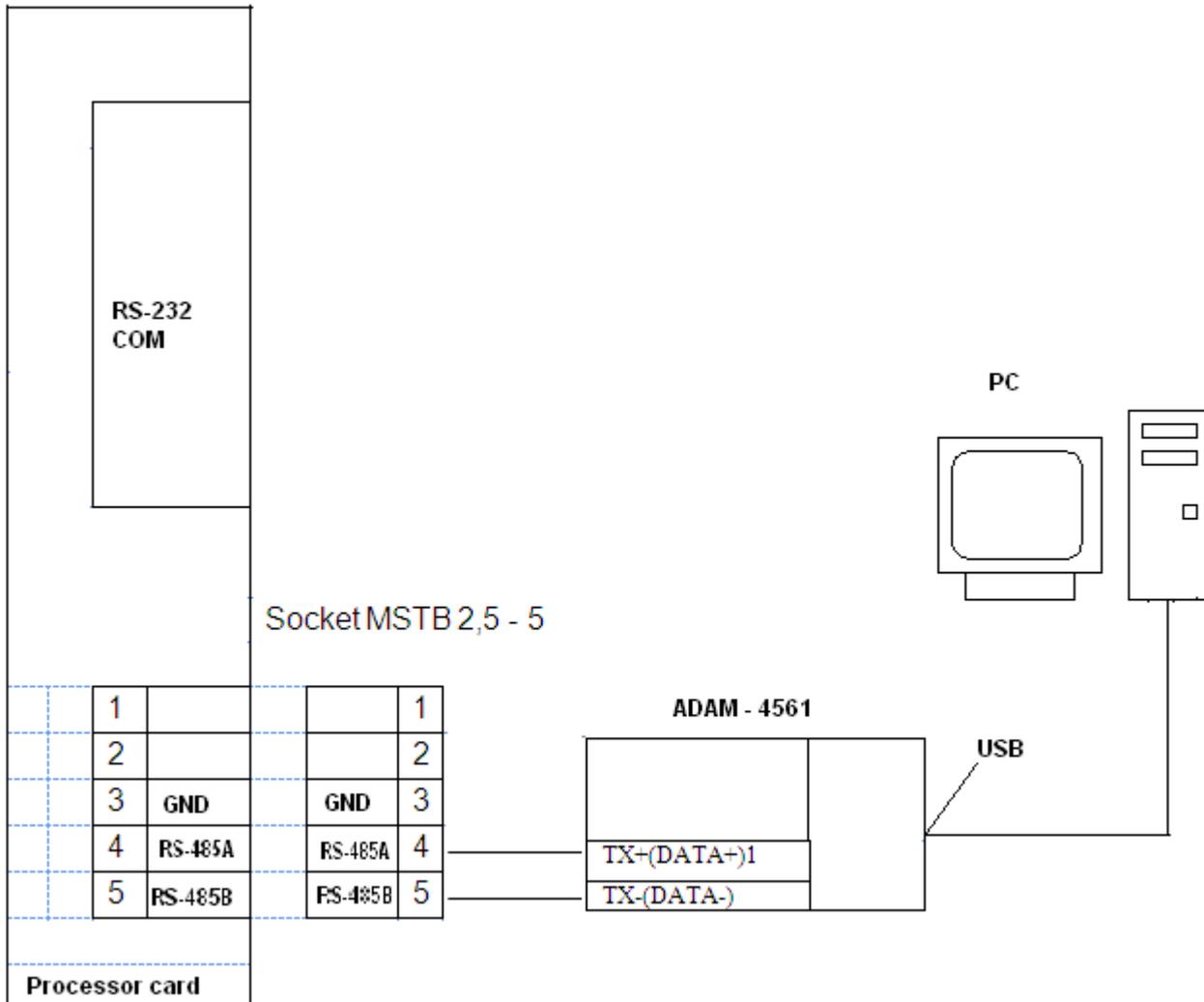
- UPES-40
- PC with Windows 98, 2000 или XP operation system;
- UPES-40 checking program;



- Convertor RS232<->RS485, for example, convertor ADAM – 4561RS-232/422/485 or ADAM – 4520 4561RS-232/422/485.



Connect UPES-40 to PC in accordance with scheme:



Run UPES-40 program

Device: UPES 40 | Port: COM2 | Bit rate: 9600 | Slave number: 1 | Read function: 3 | Language: English | Received: 11436

Channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Concentration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	
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"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Alarm 1	<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"/>	
Alarm 2	<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"/>	
Alarm 3	<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"/>	
Defect	<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"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Limit 1	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20.0	>20	>10	
Limit 2	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>60	>30	
Limit 3	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>90	>40	
Delay 1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Delay 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Delay 3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Relay 1	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	
Relay 2	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	
Relay 3	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	+ HP	
Acknowl. 1	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	
Acknowl. 2	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	ABT	
Dec. point	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	
Range	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	100	30	
Unit	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	LEL	ppm	?
Gas	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	CH4	NH3	H2S	

To set the connection with port (position 1), to select network number from list (position 2) in accordance with UPES-40 network number. If the connection is made successful the program displayed setting of each channel. Under pressing on the cells displaying the current values (position 3) can be changed the values by choosing or set data manually with keyboard or from drop-list.

In case of fault connection or RS-485 digital output fault the program window will be followed:

Device: UPES 40 | Port: COM2 | Bit rate: 9600 | Slave number: 1 | Read function: 3 | Language: English

Channel	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Concentration																
On	<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"/>
Alarm 1	<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"/>
Alarm 2	<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"/>
Alarm 3	<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"/>
Defect	<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"/>
Limit 1																
Limit 2																
Limit 3																
Delay 1																
Delay 2																
Delay 3																
Relay 1																
Relay 2																
Relay 3																
Acknowl. 1																
Acknowl. 2																
Dec. point																
Range																
Unit																
Gas																

For performance test and UPES-40 setup under RS-323 the RS 232/485 convertor is not required. UPES 40 connection to the PC is executed with link cable is available with UPES.

Link cable for UPES 40 connection to PC on RS-232.



8. Troubleshooting

Failures	Causes	Remedies
Display channel not lit up and no indicator light on.	No supply voltage Mains fuses blown. Power back-up fault Voltage convertors E15-21 or DW 05-25A breakdown	Replace fuses located in inside of wall plug at the back of power supply block of the UPES unit (2 A). Replace fuses (10A) located at back of the power supply block. Replace voltage convertors.
Fault yellow indicator light on (in steady mode).	Faulty electrical connections on the telemetry line (wires and detector). Faulty detector.	Check the connections on the UPES terminal block and the detector terminal block. Repair or replace the detector
An LED does not light up even though the corresponding threshold is exceeded and the buzzer and relay are actuated.	Faulty LED.	Replace LED
An alarm is triggered but the slaving controls are not actuated.	The relays are faulty. Faulty electrical connections.	Replace relay on corresponding module.
Indication is not displayed.	Faulty display. Faulty of processor board.	Solder the display. Replace processor board.

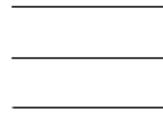
9. Power supply cable connection scheme

Contact	Chain
1	≈ 110 V
2	chassis ground
3	≈ 110 V

UPES

socket P587

Chain	Contact
≈ 110 V	1
chassis ground	2
≈ 110 V	3

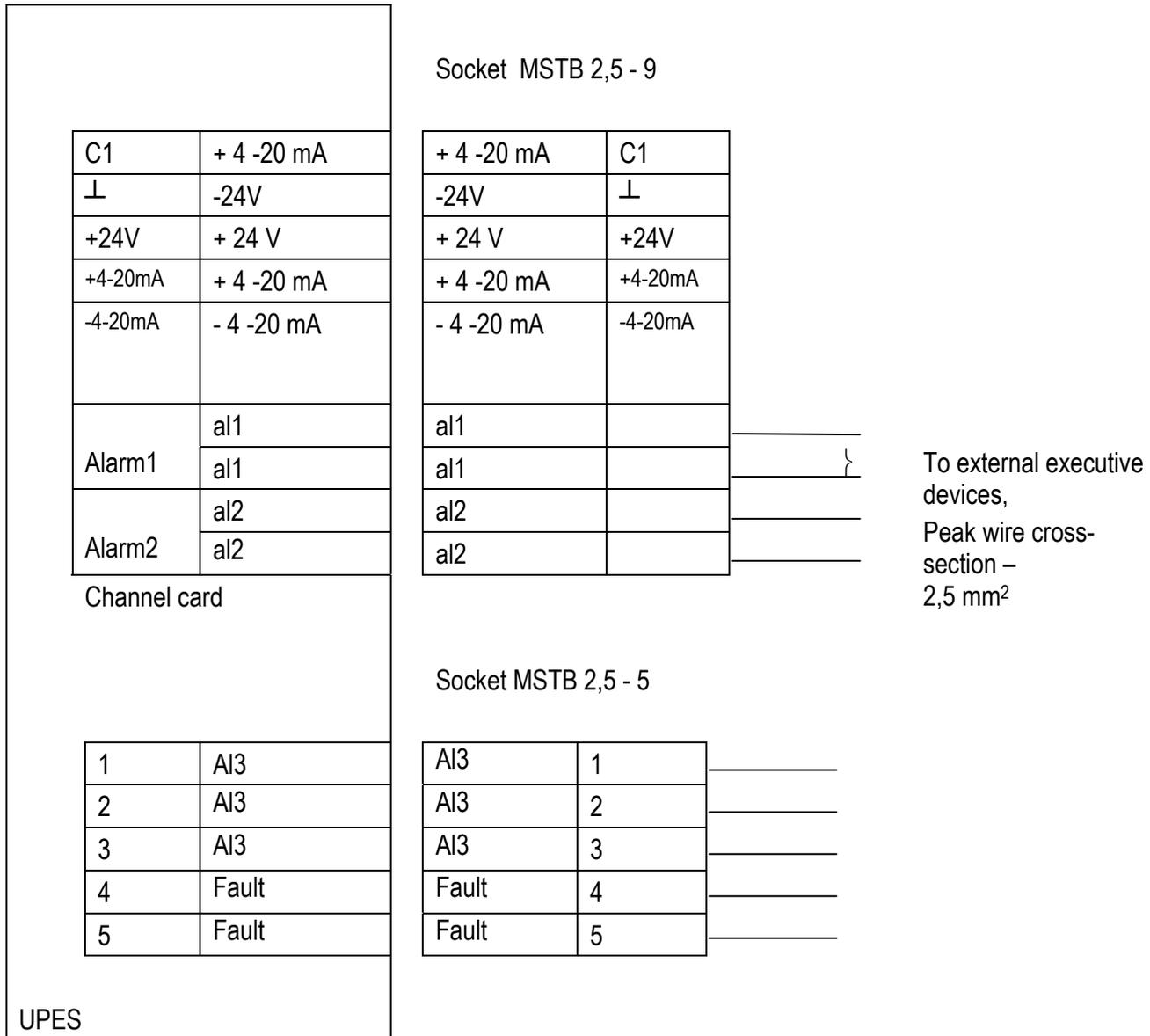


To an alternating current network 110V frequency – 60 Hz.



E

10. Basic connection scheme of relay automatic cables to UPES unit

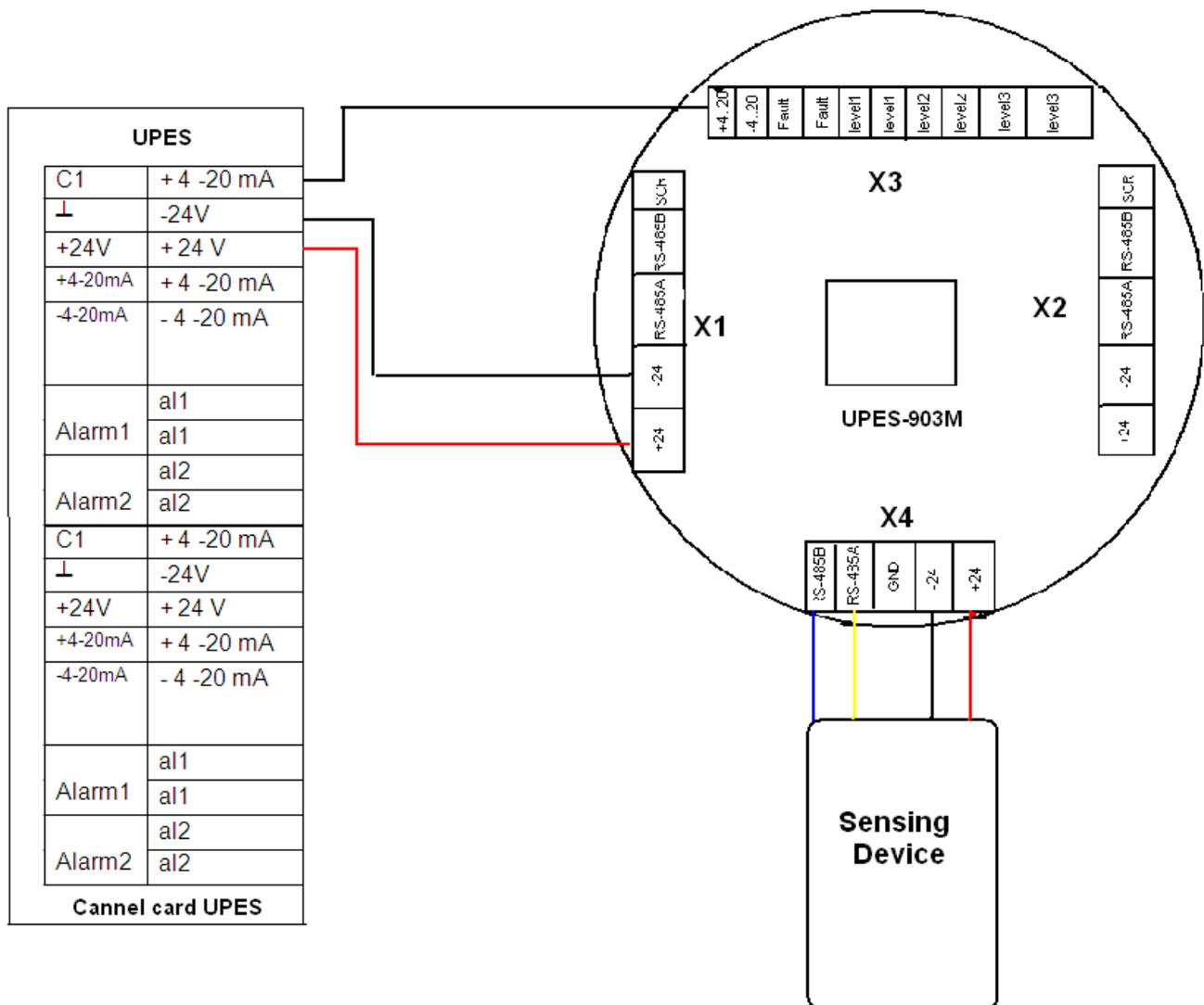


- al1 – Contact relay I threshold channel
 al2 – Contact relay II threshold channel
 al3 – Contact relay III threshold channel (common for all channel)
 Fault – Fault contact relays(common for all channel) normally open

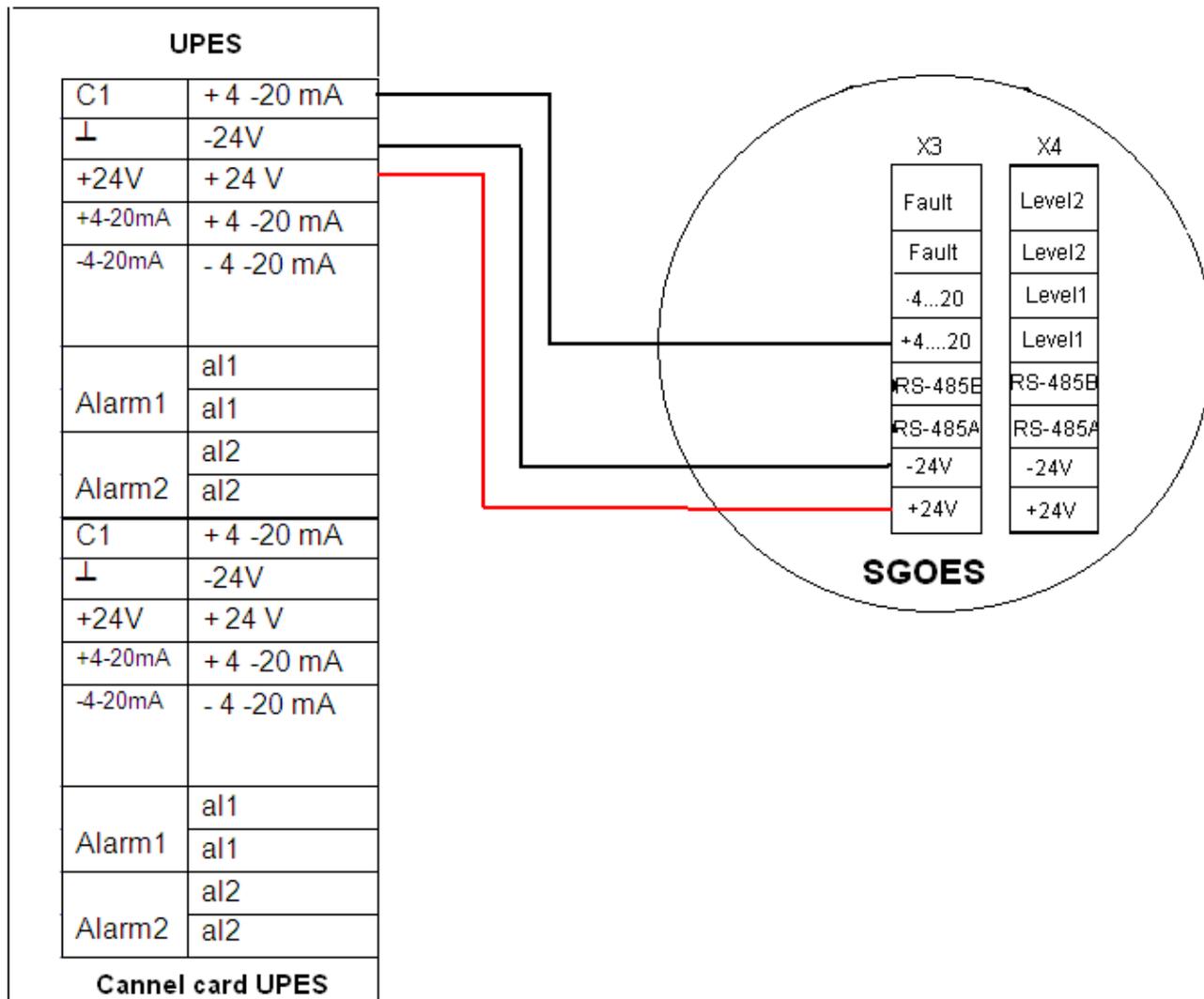
Contact relay parameters:

Current up to 5A at 250VAC and up to 5A at 30VDC.

Annexure 1. Connection of SSS-903M to UPES-40.



Annexure 2. Connection of SGOES Gas Analyzer to double channel board of UPES-40.



Annexure 3. Connecting of UPES-903M to UPES-40 with sensing device SGOES.

