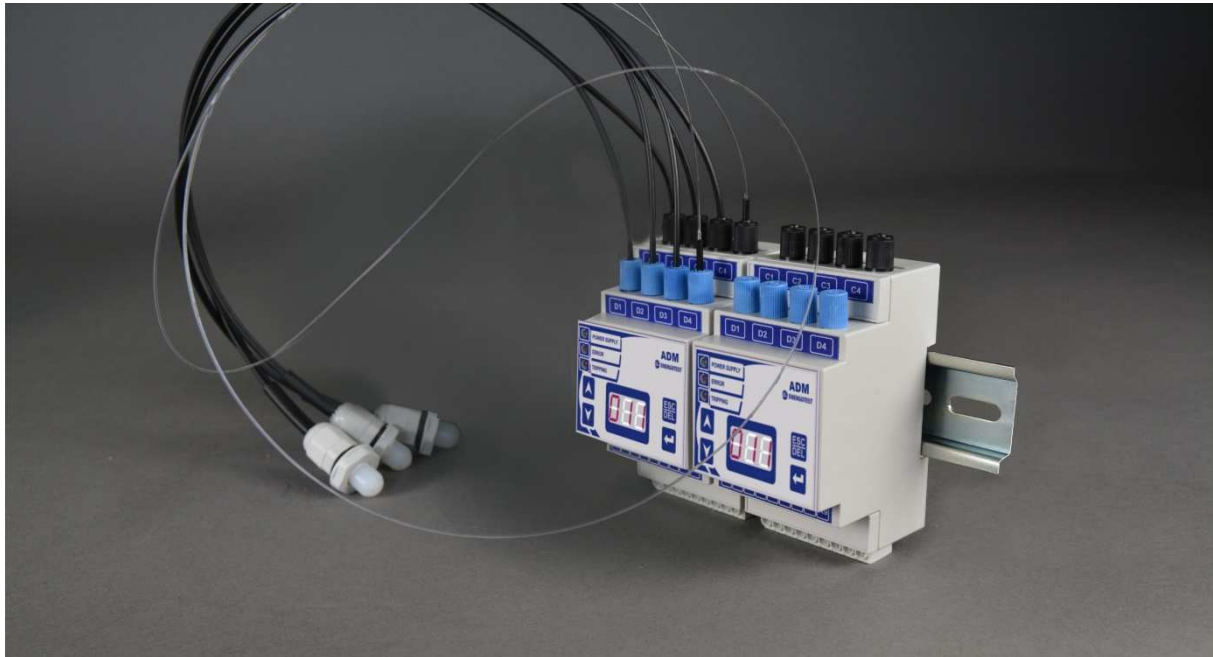


**ARC FAULT DETECTION
MODULE
ADM
Operating Manual**



Gliwice, October 2021

Documentation version	Table of contents points	Description
IU_ADM ANG 20181126		Original version
IU_ADM ANG 20190220	13	Update of the register table
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1. MEANING OF OPERATING MANUALS

In case of doubts regarding the appropriate interpretation of the manual's content we strongly advise you to contact the manufacturer for further explanation.

We will be grateful for any suggestions, opinions and critical remarks and we kindly ask our customers to deliver them. This may help us to make the manual easier to be used and give consideration to wishes and requirements of the users.

A device, to which the manual has been prepared, does not cover all potential dangers to people and material value. That is why every person, working with this device or performing any activities connected with operating and service of the device, has to be previously trained and has to know potential hazard. It requires careful reading, understanding and obeying the operating manual, particularly remarks concerning safety.

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2. INFORMATION ON COMPLIANCE

A device being the subject of this instruction has been constructed and prepared and it is now manufactured for the purpose of use in industrial environment.

This device is compatible with the following directives:

1. Compatibility System and Market Supervision Act of 13th April 2016 (Dz. U. 2016 pos. 542) as amended.
2. Compatibility System Act of 30th August 2002 (Dz. U. No. 166 pos. 1360) as amended.
3. Decree of Development Minister dated June 2nd 2016 (Dz. U. 2016 pos. 806) implementing the European Parliament Directive Low voltage LVD 2014/35/UE.
4. Polish Act of 13th April 2007 on electromagnetic compatibility (Dz. U. No. 82 pos. 556) implementing the European Parliament Directive EMC 2014/30/UE.

Compliance with the directives has been confirmed by tests performed in laboratory of SPIE Energotest and also independently of the manufacturer measurement and research laboratories in accordance with the requirements of the harmonized standards: PN-EN 60255-27:2014-06 (for the LVD directive) and PN-EN 60255-26:2014-01 (for the EMC directive).

3. Application of the ADM protection

Human errors e.g. wrong connections, bad work organization, cause most (60%) of arc faults. The best solution to protect people and electrical equipment against arc faults is specialized protection, that detects arc fault light. Such solution is the fastest and the most effective way of minimizing the damages effect of arc faults.

The majority of faults in medium or low voltage switchgears are accompanied by an electric arc, which causes significant damage to equipment and is a great hazard to human life. Breaking a fault within up to 100 ms enables the avoidance of the most serious damage to equipment and decreases a hazard to people in the vicinity of the place of fault occurrence. In case of a long duration of the fault severe injuries, i.e. burns, damage of eyesight etc., including loss of life, can occur. Besides, an irreversible and often complete damage to the switchgear is highly possible.

Because of serious hazard both to people and equipment, according to the regulations of the European countries, it is strongly recommended to undertake effective preventive measures in medium and low voltage switchgears as well as in transformer stations to reduce the effects of arc faults.

The arc fault detection module type ADM is dedicated to cooperation with any kind of protection relay or auxiliary relay with heavy-duty contacts. The ADM localizes arc fault immediately (<5ms). Considering the time of bay protection logic (10-50ms) and time of operation of

the circuit breakers (25-50 ms), the ADM protection guarantees that the switchgear or its specific bay will be switched off below 100 ms reducing to minimum the effects of arc faults.

Additional ADM features:

- ability to selective switch off the bays where short-circuit appears;
- ability to operate in case of arc fault;
- simplicity of solution and housing in already operating and newly built/constructed switchgears and transformer stations.

ADM is dedicated to LV and MV switchgears and transformer stations. Equipping a switchgear or a transformer station with the arc fault detection module type ADM is the optimal way to meet the requirements of appropriate standards of protection of the personnel and the equipment against destructive effects of arc faults.

4. Safety rules

The following chapter presents the information crucial to appropriate installation and operation of the product. It is assumed that the personnel installing and operating this device is properly qualified and is aware of the potential danger of electrical devices.

The device fulfills all the requirements of obligatory standards and rules regarding safety. It has been carefully constructed in order to meet the user security demand.

Device Installation



The device should be installed in such a location where proper environmental conditions specified in technical data are provided. Ensure adequate cooling of the device. Devices should be properly mounted, protected from mechanical damage and from accidental access of unauthorized persons. Wires cross-sections and types of connections should be consistent with the guidelines given in this manual. Casings are made of plastic and do not require grounding.

Commissioning of device

During a startup of the device its rating plate and the following elements should be carefully checked:

- continuity of grounding circuits,
- fuses,
- compliance of values of auxiliary power supply voltage,
- compliance of values of measured quantities (voltage),
- correctness of applied protections of voltage circuits (nominal values of fuse links or nominal - currents and characteristics of automatic circuit breakers),
- maximum load of relay outputs,

- compliance of voltage values of switching outputs,
- correctness of mounting all circuits .

Operating of device



The module should operate in the environment specified in technical data.

Personnel operating the device should be authorized and acquainted with operating manuals.

Opening the casing



Before starting any activities that require opening the device casing, one should obligatorily switch off all the measurement and auxiliary voltage supplies and disconnect all terminals blocks. The dangerous voltage may appear on the device elements during 1 min after isolating the circuit.

The applied integrated circuits are very sensitive to electrostatic discharges and that is why opening the module without special anti-electrostatic equipment may cause its damage.

Service

After installing the device does not require any additional service apart from periodic inspection required by applicable regulations. In case of appearance of any defect the user should ask the producer for help. The producer offers service related to activating, commissioning, guarantee and post guarantee service. Manufacturer's guarantee terms and conditions are described in the guarantee card.

Modifications and changes

For the sake of security all modifications and changes of the module functions are forbidden. Modifications of the device which have not been certified in writing by the manufacturer, cause loss of any liability claims made against SPIE Energotest Ltd.



Exchange of any elements or components the device is composed of, produced elsewhere, may cause hazard to users and eventually result in incorrect functioning. SPIE Energotest does not take any responsibility for damage caused by applying inappropriate elements or components of the device.

Nominal data, name plates and stickers

It is obligatory to obey instructions located on the device such as descriptions or name plates and stickers and it is necessary to keep them legible. Plates and stickers, which become damaged or illegible, should be exchanged.

Danger impossible to eliminate



Danger arising from on-load high voltage.

To avoid the electric shock it is suggested not to touch service terminals blocks.

5. ADM technical description

5.1. General information

The arc fault detection module type ADM is a device dedicated to diminish all kinds of damage caused by arc faults. It is achieved by fast identification of the fault and sending signal to break all feeder lines of the fault. The device generates signals to the protection relay or auxiliary relay with heavy-duty contacts. Appearance of arc fault flash is only condition for the fault identification that have to occur.

The protection is supplied by 24V DC. This voltage can be obtained from a site guaranteed 24V DC, or from a power supply suggested by the manufacturer supplied from the guaranteed 220V DC or 230V AC.

The arc fault detection module should be installed in every bay of the switchgear, i.e., incoming feeder, outgoing, coupling, voltage measurement bays, etc. Each module is equipped with 4 optic detectors:

- point sensor (maximal length 15 m),
- fiber optic loop (maximal length 5 m),

Optic detectors can be installed differently depending on a particular application (the only requirement is to maintain protection of all bay compartments).

For example:

In an outgoing bay detectors 1 and 2 are typically installed in the busbars and CB compartment, and detectors 3 and 4 in the cable drop compartment (see Fig. 1)

In case of more complicated switchgears with a greater number of compartments additional module may be required.

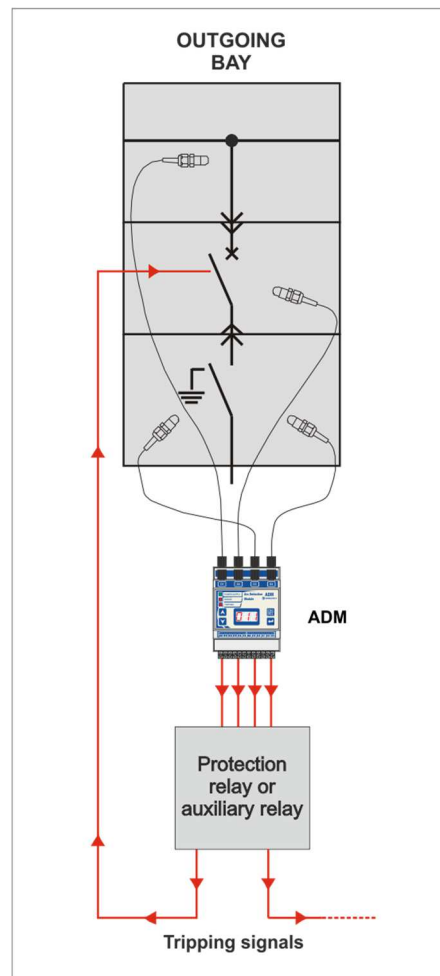


Fig. 1 Example of ADM installing.

5.2. Functions of ADM

5.2.1. ADM.

The arc fault detection module type ADM is responsible for detection of arc light and generation of the signal in the current bay. Each module is equipped with an optical detector control system.

The essential functions of the ADM are:

- configuration of optical detectors (on, off),
- detection of arc light in the protected area,
- generation of tripping signal to the protection relay in the current bay in case of detection of arc fault,
- testing optical detectors,
- generation of alarm signals in case of incorrect operation of the device,
- sending data by RS 485.

The ADM protection is equipped with:

- optical signalization (3 LEDs),
- operation panel (alphanumerical display and 4 buttons),
- 4 optical inputs for optical detectors,
- 4 optical outputs for optical detectors,
- 4 executive relay with closing contact (NO)
- RS-485 terminal block,
- 1 signaling relay with closing contact NC (error signalization).

5.2.2. Optical detectors.

Optical detectors are installed directly in the protected area of the switchgear (busbars, CB, cable connection compartment) and they detect light of the arc fault. This light is transmitted by a fiber to the optical detectors in the module. The construction of the fiber optics detector allows one for fiber integrity testing. Maximum length of a fiber optic cable for a point sensor is 15 m, while for the fiber optic loop it is 5 m. Detectors delivered by SPIE Energotest are ready for installation.

5.2.3. Power supply.





A power supply can be connected to the guaranteed 220V DC or 230V AC and is a source of 24V DC. Each module system should be supplied by a separate power supply. One is forbidden to supply other devices with the power supply designed for ADM protection.

5.3. ADM front panel



Fig. 2 Front panel of an arc fault detection module type ADM.

Front panel of an arc fault detection module type ADM is equipped with:

- 3 signaling LEDs:
 - “POWER SUPPLY” – indicates the presence of power supply voltage,
 - “ERROR” – indicates malfunctioning of the device, error code are displayed on LCD display,
 - “TRIPPING” – indicates that ADM has generated a signal after an arc fault detection,
- three digit seven segment LED display – indicates a state of the module, allows one to change a configuration of the module,
- 4 buttons – for operation of the panel control:
 -  UP – increasing the value, or menu scrolling,
 -  DOWN – decreasing the value, or menu scrolling,
 -  ENTER – settings approval, enter into menu mode,
 -  ESC /DEL – tripping reset, menu mode exit.

6. Technical data

Auxiliary voltage	Rated voltage Upn	24 V DC
	Operating range of voltage	0,8 ... 1,1 Upn
	Max voltage level	1,3 Upn (perm)
Relay	Max. switching voltage	220V DC; 250V AC
	Rated current/ Limiting continuous current	2A / 2A
	Switching power	60W; 62,5VA
	UL contact rating	30VDC, 2A, 60W 125VDC, 0.24A, 30W 220VDC, 0.24A, 60W 125VAC, 0.5A, 62.5VA 250VAC, 0.25A, 62.5VA
Initial surge withstand voltage between open contacts		1500V
Time	Up to the contact closing	< 5 ms
Environmental conditions	Rated temperature	-10 ... +55 °C
	Temperature limits	-25 ... +70 °C
	Humidity	45 ... 75%
	Atmospheric pressure	86 ... 106 kPa
Casing	to be mounted on a rail TS-35 type RAILTEC C	
	Dimensions	71 / 90 / 58 mm
	Weight	0,2kg
	Degree of protection	IP20
	clamps	Pluggable terminal block
Optical detector	Type	Point detector
	External diameter	2.2 x 4.4 mm
	Bending radius	25 mm
	Rated temperature limits	-50...+ 70° C
	Max tensile strength	5 N
	Length	max 15 m
	Type	Fiber loop detector
	External diameter	1 mm
	Bending radius	25 mm
	Rated temperature limits	-50...+ 70° C
	Max tensile strength	5 N
	Length	max 5 m

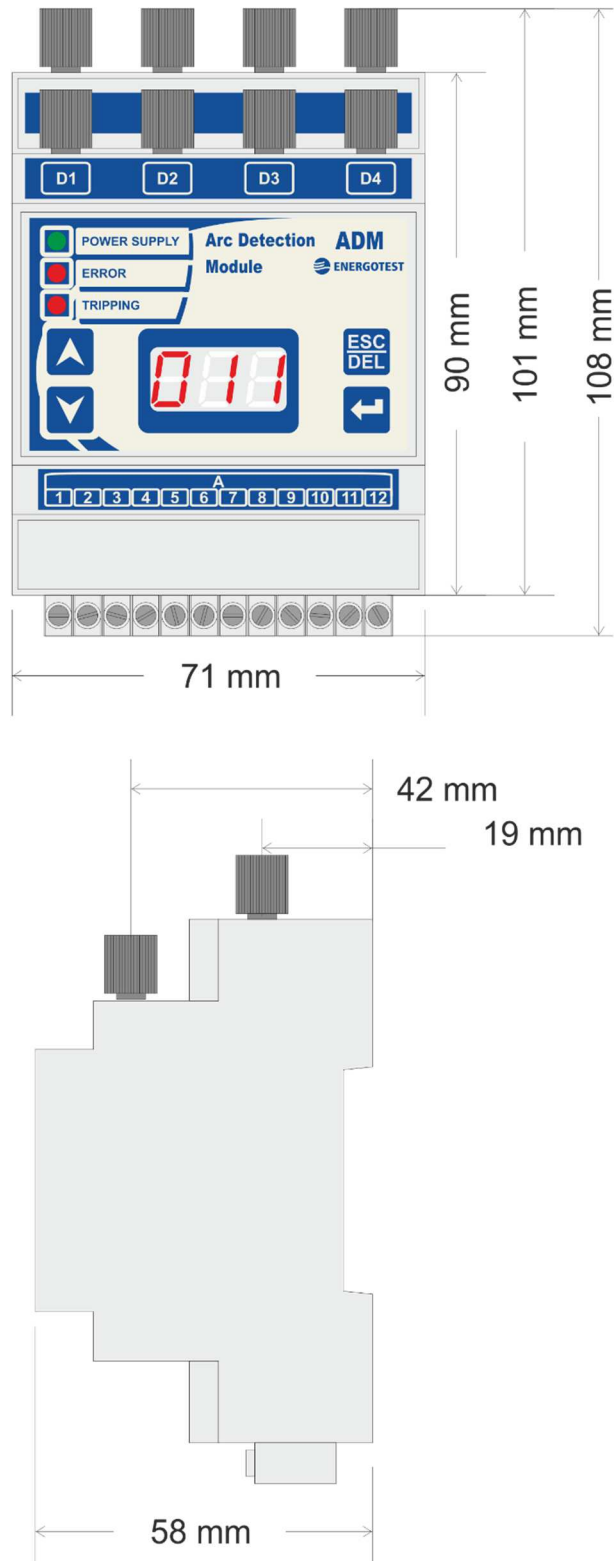


Fig. 3 ADM dimensions.

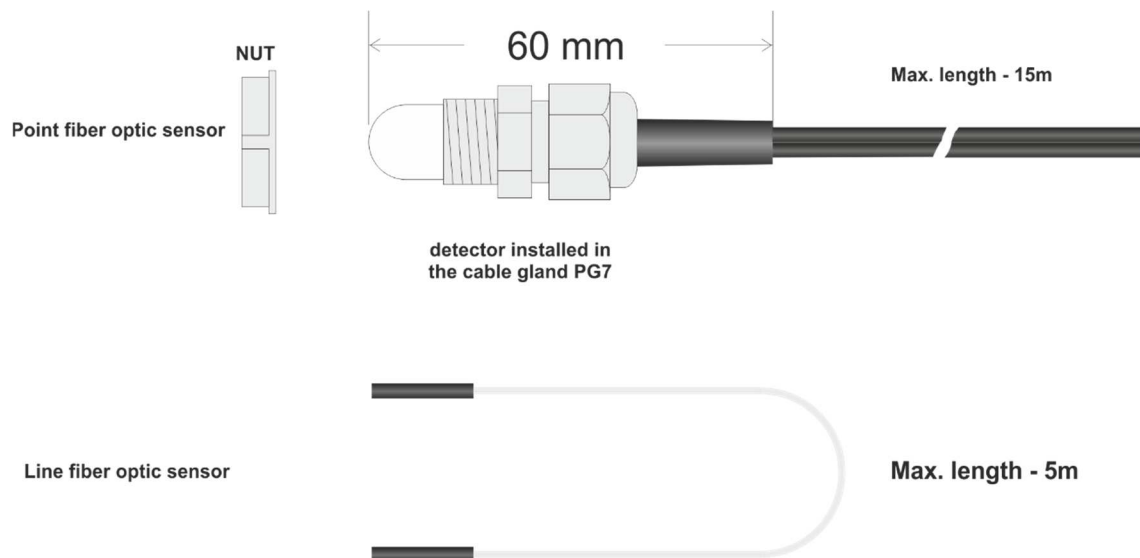


Fig. 4 Optical detector dimensions

7. List of applied standards

During constructing and producing of the arc fault detection module type ADM there have been such standards applied, which followed provide assumed rules and safety measures. However, it is possible under the condition that the user will follow the instruction and guidelines for installing, operating and maintenance of the device.

The arc fault detection module type ADM fulfills all the standards specified in respective directives: low-voltage and electromagnetic compatibility, in accordance with harmonized standards mentioned below.

PN-EN 60255-27:2014-06 Measuring relays and protection equipment. Part 27: Product safety requirements, harmonized with LVD directive;

PN-EN 60255-26:2014-01 Measuring relays and protection equipment. Part 26: Electromagnetic Compatibility Requirements, harmonized with EMC directive.

PN-EN 60255-1:2010E Measuring relays and protection equipment - Part 1: Common requirements.

8. Information on completeness

The delivery of the arc fault detection module type ADM includes:

- An arc fault detection module type ADM (number as ordered),
- Optical detectors, 4 pieces for each module. As a standard solution SPIE Energotest delivers 5m point detectors. Other fiber length should be specified in the order,
- Power supply,
- Product fiche,
- Guarantee certificate

Moreover, upon request the manufacturer delivers:

- Operating manual printed,
- Device test protocols.

9. Mounting



SPIE Energotest recommends that before the first plugging in the device should be placed in the room it is going to be installed, for at least two hours. This action is intended to compensate the temperature and avoid humidity.

All modules are dedicated to be mounted on rails type TS-35 inside relay compartments of the protected switchgear. It is recommended to locate ADM in such a place where fiber optic elements are easy to be installed. One needs to take into consideration the required value of the bending radius (in accordance with technical data of fiber optics) and the limited number of bends. Casings of modules do not require the grounding connection thanks to the type of the material they are composed of. Moreover, they do not demand applying additional mounting elements. In Fig. 5 space requirements for installing the device are presented.

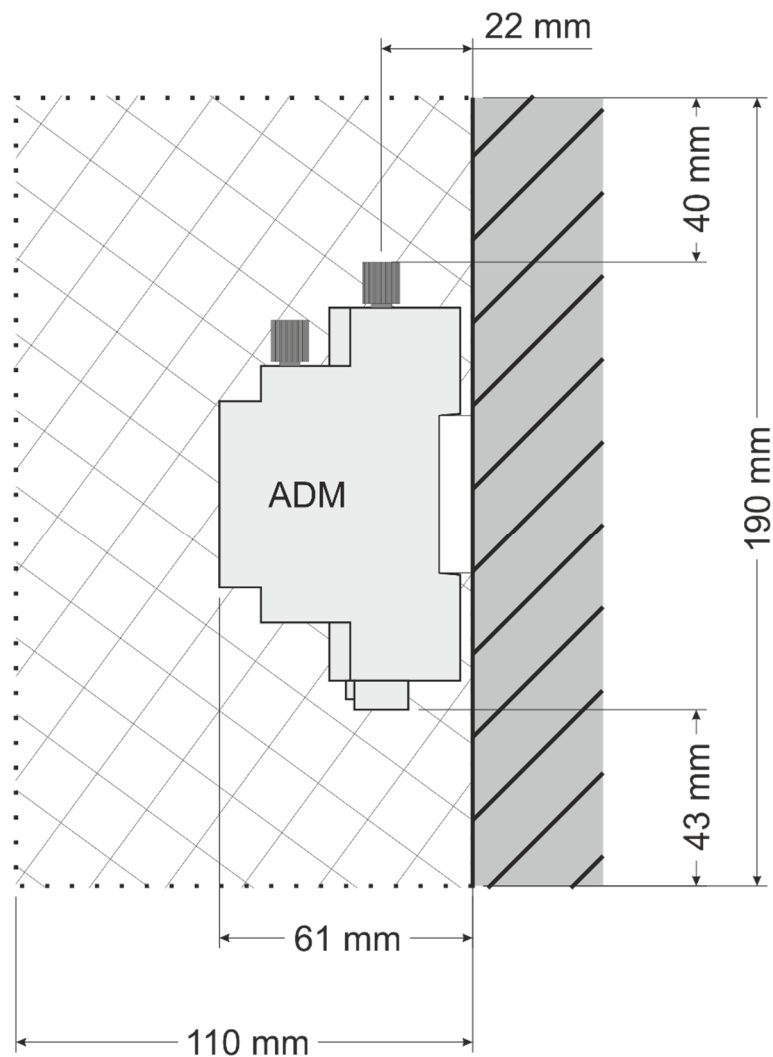


Fig. 5 Space requirements for installing the device.

Table 1 Conductors ensuring secure connections

	Conductor cross section	Rated data
External conductor connections	1.5 mm ²	250V rms;
RS485	0,35-0,75 mm ²	Dedicated cable to RS485
Grounding	≥ 2.5 mm ²	

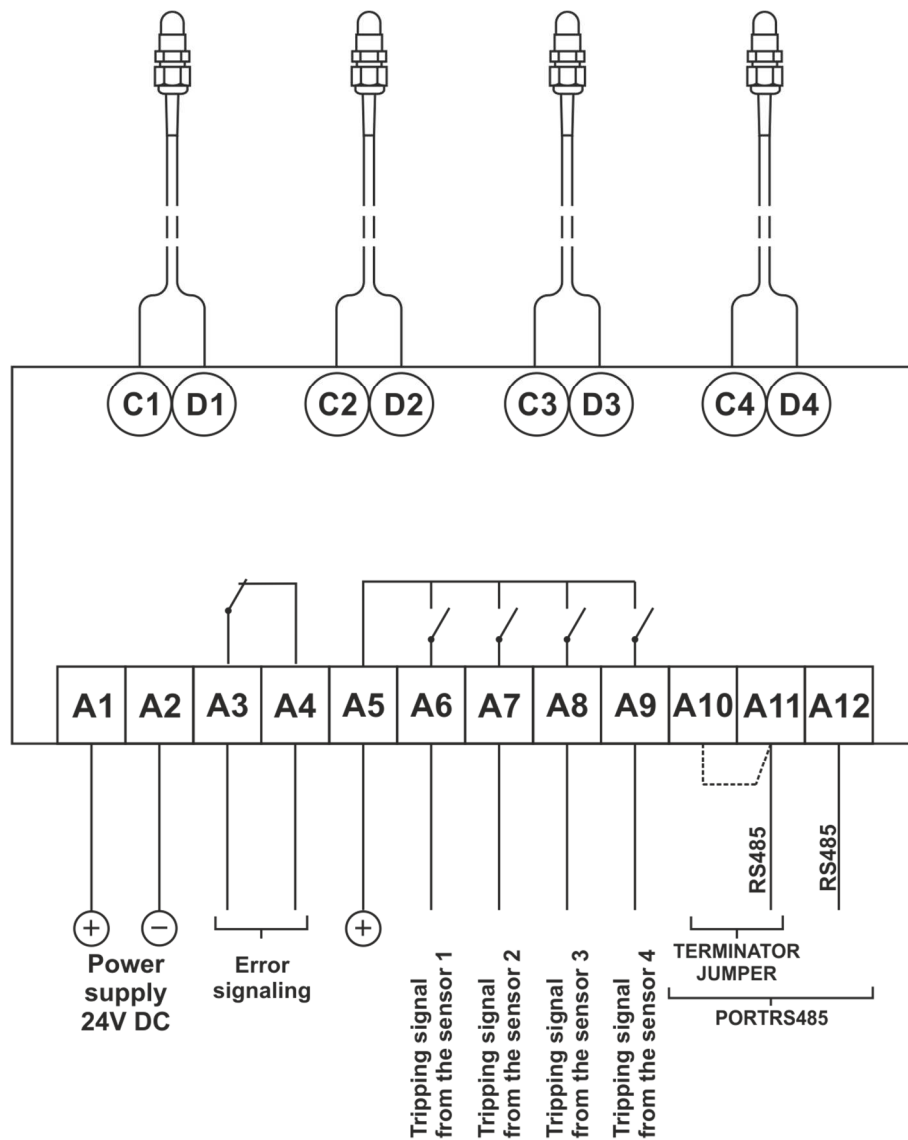


Fig. 6 ADM – external circuit connection.

Optical elements mounting

During installation of the protection device it is important to pay particular attention to the correct mounting of optic elements of the device, in particular:

- conservation of safe bend radius for fiber optic,
- arrangement of fiber optic in such places, where the damage during routine maintenance work is highly unlikely,
- keeping clear of moving parts of the switchgear: drives, pulling elements of interlocks, limit switches etc.,
- if possible, laying the fiber optics independently (apart from other conductors)
- limiting the length of fiber optic into a frontal sensor (without applying spare fiber).

The optic elements should be mounted with the use of plastic mounting strips and self-adhesive grips according to the tips mentioned above. Transitions of optic elements into par-

ticular compartments of the protected switchgear should be sealed with the use of plastic seals PG-7 for instance (13 mm diameter holes are necessary to use them).

Optical detectors with plastic fibers are connected to the optical inputs of ADM protection according to what is presented in Fig. 6. The point sensor and the fiber optic loop are interchangeable. Properly cut fiber optic cable does not need any additional preparations or connectors. Proper installation is ensured by the construction of the optical detector output of the ADM protection.

10. Starting up

10.1. First stage

Once the mounting of the optic elements of the arc fault detection module type ADM is completed and all the connections are checked, one is allowed to start up the device. One should also keep in mind that during the start-up process unnecessary tripping signals may be generated. After supplying module with 24V DC it is possible to start the device configuration. The first stage is to assign each module the network address ranged 1..200. The factory setting: No. 001. For more details on the network addresses check point 12.1 of the following manual.

10.2. Optical inputs configuration


Optical inputs are configured by the manufacturer. If any change in optical inputs is necessary follow the instruction point 12.3.

Default configuration:

- C1 input – off,
- C2 input – off,
- C3 input – off,
- C4 input – off.

10.3. Optical system checking

10.3.1. Check with an external light source



In order to activate optical system one has to use a light source of ~40 klux and place it 20 cm away from the sensor. It is also possible to use a flash light. Information on optical module activation will be visible on the ADM front panel – Fig. 8. “Tripping” LED will be illuminated continuous light. The corresponding contact of the executive relay (A6-A9) will be closed (according with schema in Fig. 6). After removing the light source, information on the temporary activation of the optical module will remain visible on the panel. It should be removed by pressing a button  on the ADM control panel.

Attention!

During optical system checking with an external light source, tripping signals will be generated.

10.3.2. Check with an embedded test.

Optical system (optical inputs, optical outputs and fiber optic detectors) can be checked with the use of embedded tests. One can run such tests from the configuration mode of the ADM.

- In order to run tests of optical system one needs to follow instructions given in 12.4 and 12.5 of this manual. The test result is visible on the front panel until being deleted. In case of the optical system malfunction detection error message  will appear on the display. At the same time "ERROR" LED will light on the front panel and the signaling relay contact (A3, A4) will be closed. Test results are stored until next test run or until being cleared by pressing button .

Attention!

Optical system checking with the use of the embedded tests is perfectly safe. There is no hazard of tripping signals generation.

11. ADM control panel

The ADM is equipped with a few optical signal LEDs and an LED display. Messages, which are important for a user, are presented by lighting LEDs. This allows one to verify the state of the module very quickly. In case of any abnormality it is possible to take immediate actions. Detailed information is showed on LED display. In case of detecting any problems with the module the signaling relay is tripped (the contacts A3, A4 are closed). Below it is presented how to use the control panel of ADM and some typical messages generated on the front panel.

11.1. Information of software version

Immediately after power supply connecting all the LED's and all the segments of the display are illuminated. After a few seconds an actual software version number will be displayed. Next the module will revert to "ready" status and its network address is visible on the display (Fig. 7). Standard setting is number 001.

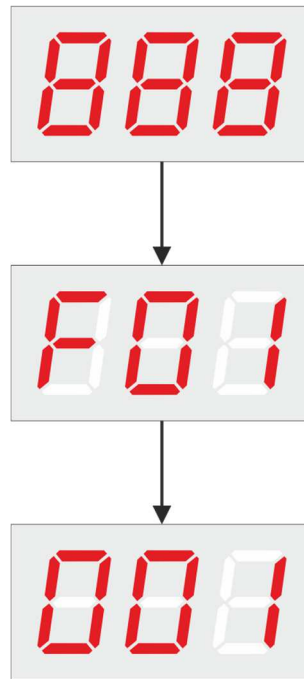




Fig. 7 Information displayed.

11.2. “Ready” status

“Ready” is the basic mode of ADM. In this mode green LED “POWER SUPPLY” is lighted on the operating panel. Network address is shown on the display. The ADM protection is ready for activation.

11.3. The optical inputs and executive relays status

Optical inputs status can be checked in this mode (see Fig. 8). It is possible after pressing  or  button. Each optical input has an executive relay assigned.

Information on the display:

Digit – number of an optical input,

“L” – low state of an optical input (light detector not activated), the contact of the executive relay is open,

“H” – high state of an optical input (light detector continuously activated), the contact of the executive relay is closed,

Pulsing “L” – information that the light detector has been temporarily activated but at the moment it is not activated, the contact of the executive relay is closed.

“–” – the input is off, the contact of the executive relay is open.

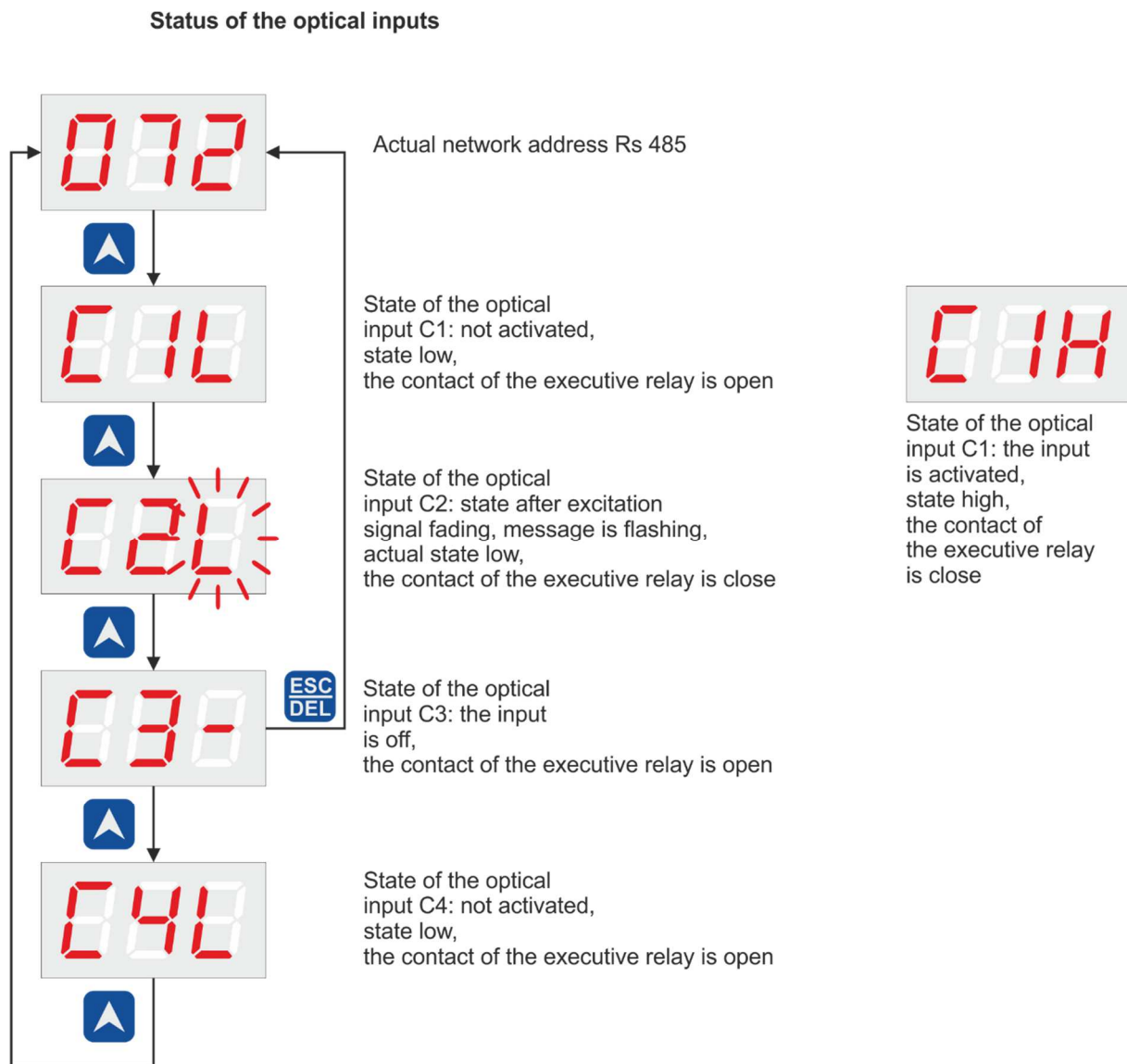


Fig. 8 Information on ADM front panel: states of optical inputs and executive relay.

11.4. „Tripping” mode

In case when in a switchgear the fault arc has appeared, the protection ADM will generate tripping signals. On the front panel of ADM “TRIPPING” LED is lighted and information in which protected zone the arc fault has been detected is displayed on the LCD display.

Deleting “TRIPPING” is realized by pressing  button on the front panel of a module for longer than 3s. The tripping of a module’s executive relay is deleted.

11.5. Error messages

When the optical system test result is negative on the device error number **ES** will be shown on the LED display. The “ERROR” LED is lighted, signaling relay contacts A3, A4 are closed.

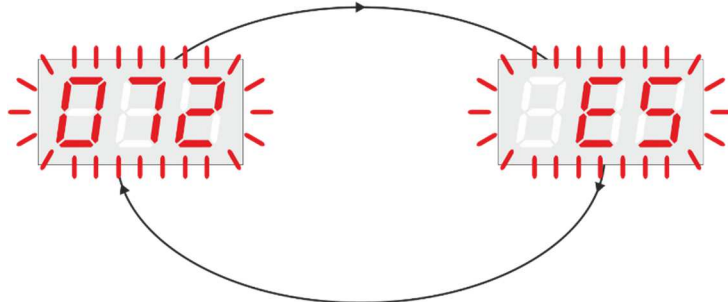


Fig. 9 Messages on the module display in case of the optical system test is negative.

The error message is viewed until being deleted by pressing **ESC** button or results of the next test run are positive.

12. Configuration mode

In order to enter into the “configuration” mode press **↵** button for 3 s. After that the configurable parameters will be displayed one by one (see Fig. 10)

The following parameters can be set in the configuration mode:

Adr The module network address (ranged 1....200). The procedure is described in details in section 12.1

btr Bit rates. Possible settings: 9600 (b96), 19200 (b19), 38400 (b38), 57000 (b57) bps. The procedure is described in details in section 12.2.

Con The optical inputs configuration. To change optical input status press **↵** button. There are 2 available status: on and off. For example:

C2o detector no. 2 on,

C2- detector no. 2 off.

The procedure is described in details in section 12.3.

opt Optical system checking (light source, fiber optic loop or fiber optic cable with point sensor, detector). The procedure is described in details in section 12.4.

Aut Automatic test of the fiber optic system. Possible settings: On, OFF. The procedure is described in details in section 12.5.

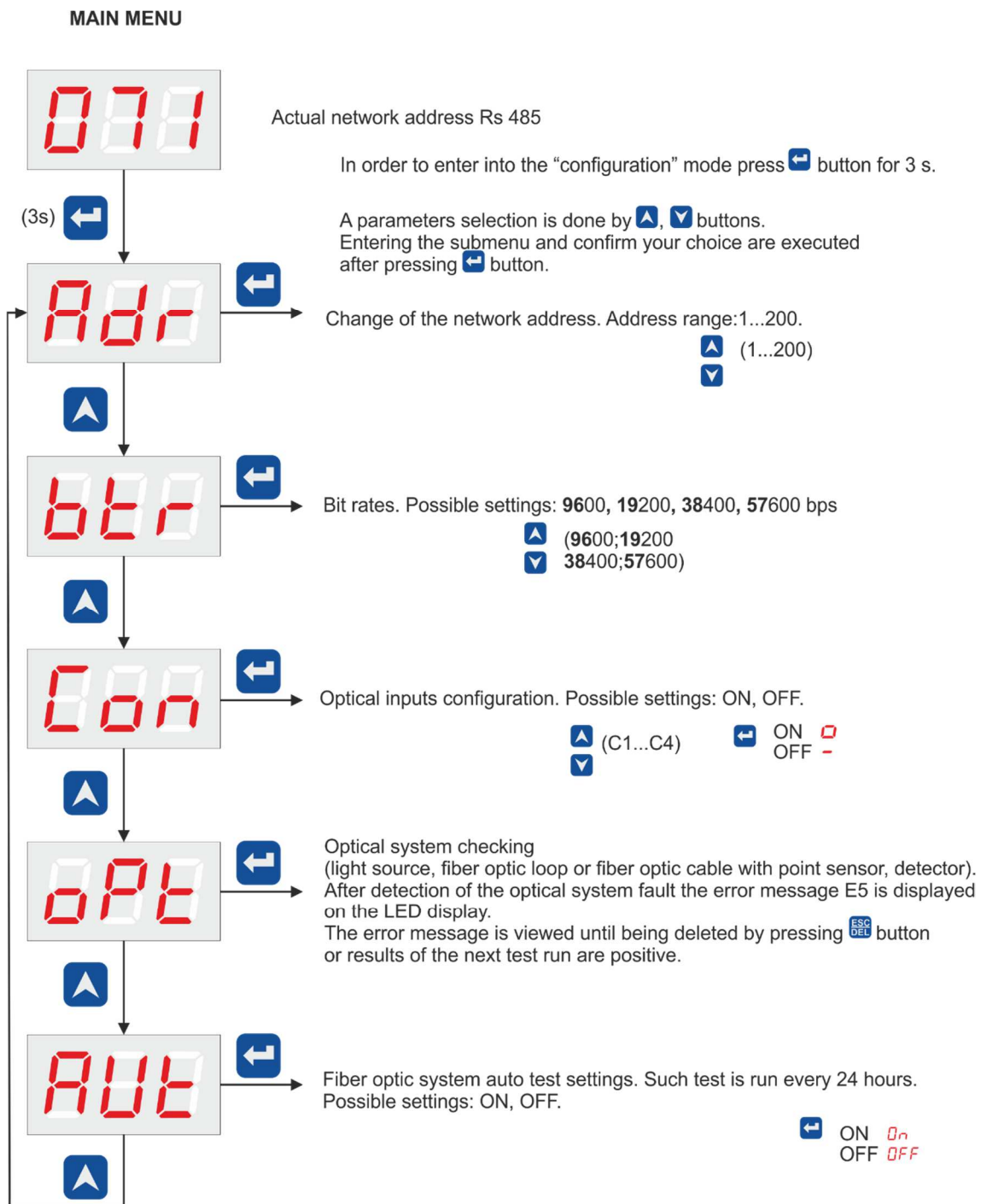


Fig. 10 “Configuration” mode.

12.1. The module network address

The address of the module can be changed from the ADM configuration menu. To change the address, follow in accordance with Fig. 11. Address range is from 1 to 200. The factory setting: No. 001.



Fig. 11 The ADM network address configuration.

12.2. RS485 configuration

The bit rates of the module can be changed from the ADM configuration menu. To change the bit rates, follow in accordance with Fig. 12. Possible settings: 9600 (b96), 19200 (b19), 38400 (b38), 57000 (b57) bps. The factory setting: 9600 bps.

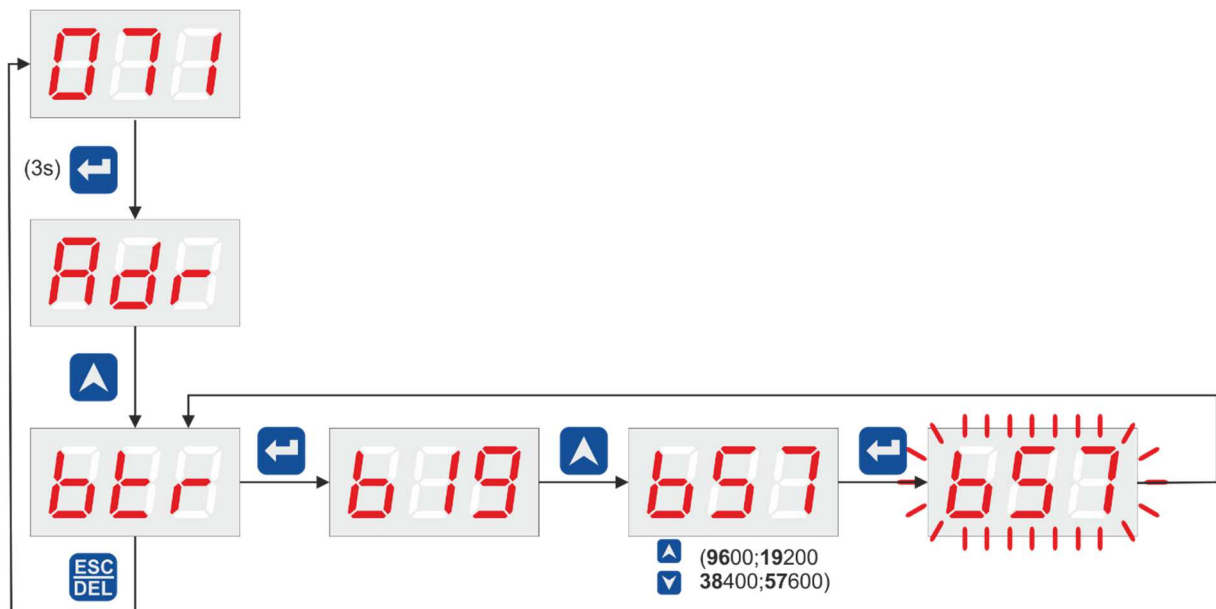


Fig. 12 The ADM bit rates configuration.

12.3. The optical inputs configuration

To configure the optical inputs, follow in accordance with Fig. 13. Possible configuration are: on and off. The factory setting: all optical inputs are on.



Fig. 13 The optical inputs configuration.

12.4. The optical system test

From the level of the configuring menu of the ADM it is possible to run a test of the optical system. In order to perform such test one needs to press the button for 3 s. Next press or button as soon as the following symbol appears on the screen of the ADM panel. To run optical system test press button (Fig. 14). The results of the test are visible on the ADM panel until being deleted. The way the results are presented is shown in Fig. 15.

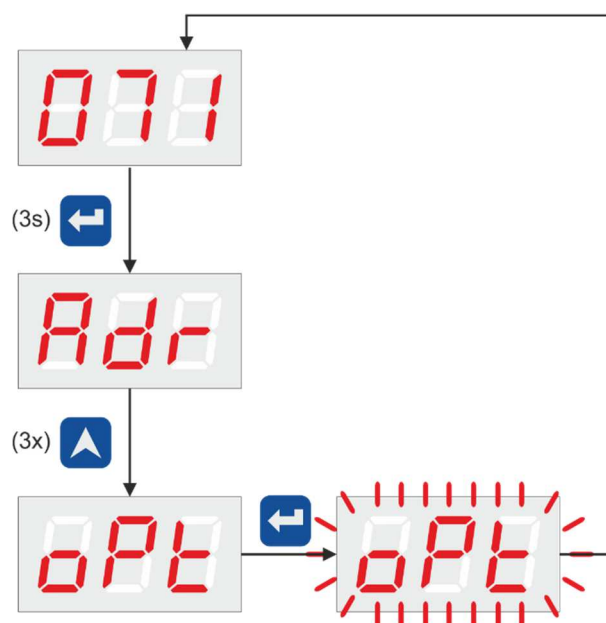


Fig. 14 Optical system test selection.

The result of the optical system test
(light source, fiber optic loop or fiber optic cable with point sensor, detector)

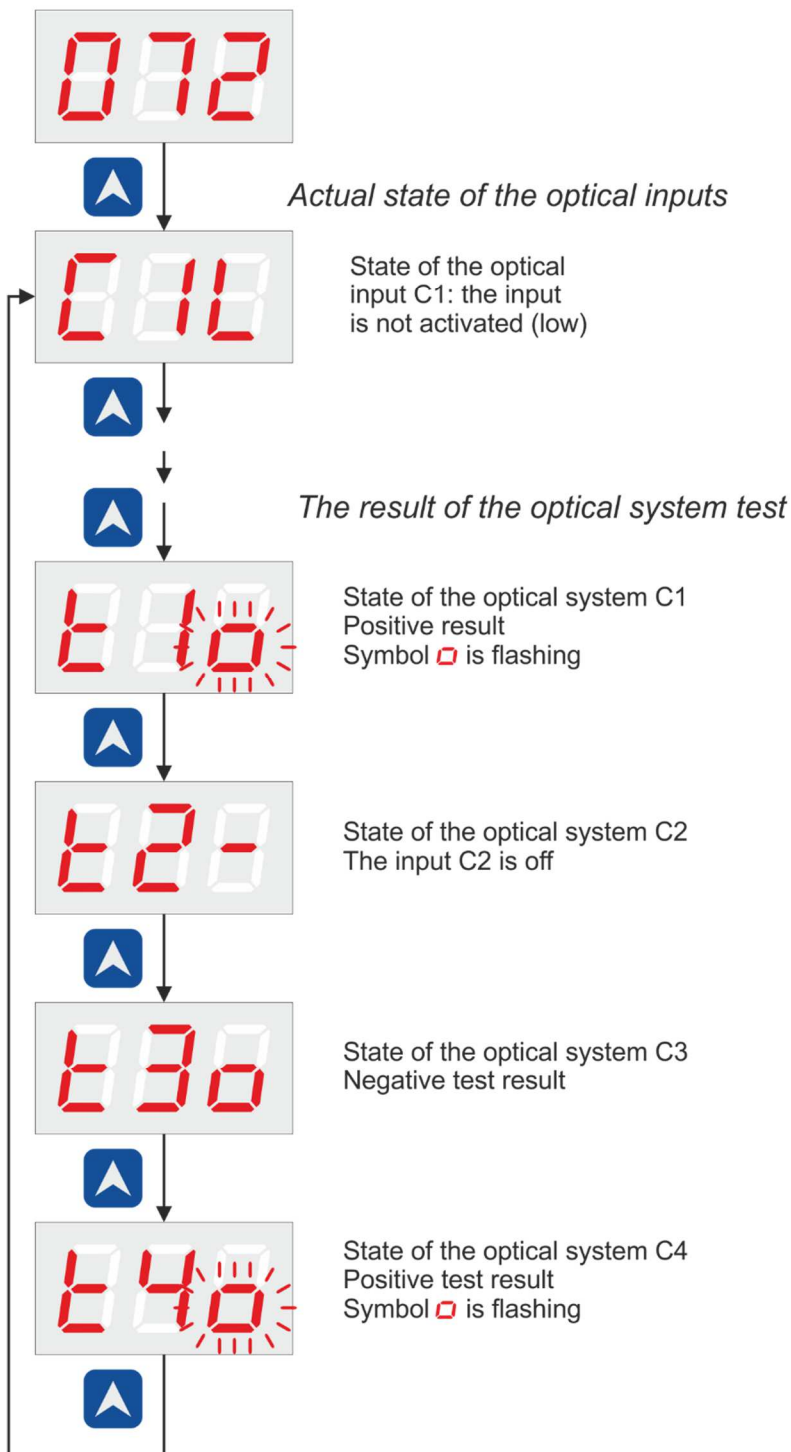




Fig. 15 Presentation of the optical detectors test results.

After detection of the optical system fault the error message  is displayed on the ADM panel. The error message is viewed until being deleted by pressing button  or results of the next test run are positive. For more details on the error message check point 11.5.

12.5. Automatic test of the optical system






From the level of the configuring menu of the ADM it is possible to run an automatic test of the optical system. Such test is run automatically every 24 hours. To configure the automatic test of the optical system, follow in accordance with Fig. 16. In order to configure such test one needs to press the button  as soon as the following symbol  appears on the screen of the ADM panel. Pressing by  or  button and next  button the user enables or disables (On/OFF) automatic test of all the optical system. The factory setting is OFF. Time is measured from the moment of supplying the auxiliary voltage.



Fig. 16 The automatic test of the optical system configuration.

13. RS485 Interface

The arc fault detection module type ADM has an isolated galvanic RS485 connection. RS485 connection can service MODBUS RTU protocol, which can be used for communication with a superior system.

RS485 parameters:

Transmission mode	differential voltage signaling
Type of transmission line	twisted-pair
Transmission Speed	Up to 57 600 bps 9 600 bps (factory settings)
Word length	8
Parity	No
Stop bits	1
Maximum length of the line	1 200 m
Transmitter output	min. $\pm 1,5$ V (for loading 54Ω)
Receiver sensitivity	± 200 mV

The device includes the Modbus RTU Slave protocol. There are the primary inquiries supported, namely #03 – Read Holding Registers, #06 – Preset Single Register, #16 – Preset Multiple Registers. In case of receiving a Modbus frame, which includes some errors, the device displays the error code according to the table below.

Error code	Meaning	Description
1	Illegal Function	Function is not supported
2	Illegal Data Address	Unacceptable register (or registers) address (or addresses)
3	Illegal Data Value	Unacceptable range of information (i.e. the amount of registers)
4	Slave Device Failure	Register record error – the value of register is beyond the acceptable range

Available registers.

Base address: 1000

There are the following 16-bit registers with the attribute read only [R] available:

offset	Register name	Description
0	UnitAddressReg	Device network address
1	SensorActivationReg	Device optical input activation status
2	FlashTestReg	Result of the optical system test
3	FlashTestUndoneReg	The optical test perform is unavailable
4	AutoTestStatusReg	The automatic test of the optical system status
5	SensorStatusReg	The optical input status

Register: SensorActivationReg

bit	7	6	5	4	3	2	1	0
	-	-	-	-	C4	C3	C2	C1

Bit number	Mnemonics	Description
7...4	-	Reserved
3	C4	Optical input No. 4 activation status (0 – not activated, 1 – activated)
2	C3	Optical input No. 3 activation status (0 – not activated, 1 – activated)
1	C2	Optical input No. 2 activation status (0 – not activated, 1 – activated)
0	C1	Optical input No. 1 activation status (0 – not activated, 1 – activated)

Register: FlashTestReg

bit	7	6	5	4	3	2	1	0
	T	-	-	-	C4	C3	C2	C1

Bit number	Mnemonics	Description
7	T	The optical system test status (0 – not executed, 1 – executed)
6...4	-	Reserved
3	C4	The result of the optical system test – optical input No. 4 (0 – positive, 1 – negative)
2	C3	The result of the optical system test – optical input No. 3 (0 – positive, 1 – negative)
1	C2	The result of the optical system test – optical input No. 2 (0 – positive, 1 – negative)
0	C1	The result of the optical system test – optical input No. 1 (0 – positive, 1 – negative)

Register: FlashTestUndoneReg

bit	7	6	5	4	3	2	1	0
	-	-	-	-	U4	U3	U2	U1

Bit number	Mnemonics	Description
7...4	-	Reserved
3	U4	Optical input No. 4 (1 – test undone)
2	U3	Optical input No. 3 (1 – test undone)
1	U2	Optical input No. 2 (1 – test undone)
0	U1	Optical input No. 1 (1 – test undone)

Register: AutoTestStatusReg

bit	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	-	S

Bit number	Mnemonics	Description
7..1	-	Reserved
0	S	The automatic test of the optical system status (0 – OFF, 1 – ON)

Register: SensorStatusReg

bit	7	6	5	4	3	2	1	0
	-	-	-	-	S4	S3	S2	S1

Bit number	Mnemonics	Description
7..4	-	Reserved
3	S4	The optical input No. 4 status (0 – OFF, 1 – ON)
2	S3	The optical input No. 3 status (0 – OFF, 1 – ON)
1	S2	The optical input No. 2 status (0 – OFF, 1 – ON)
0	S1	The optical input No. 1 status (0 – OFF, 1 – ON)

There are the following 16-bit registers with the attribute write only [W] available:

offset	Register name	Description
10	CommandReg	Command register

Enable command:

- 1 – execute the optical system test
- 2 – the automatic test of the optical system – ON
- 3 – the automatic test of the optical system – OFF
- 4 – delete all of errors and activations

14. Operating

14.1. Periodic check of the protection operation

During a properly managed operation of the arc fault detection module type ADM the check-up of the operation of the protection should be carried out during the periodic inspections of the switchgears or during their out-of-service time. The check-up should cover the control of:

- activation of optic detectors,
- external and internal signaling circuits,
- activation of all tripping circuits by simulating an arc fault.

At least once a year, apart from the functional check, the operate time of the protection should be checked.

14.2. Exchange of optic elements after an arc fault appearance

After an arc fault appearance the optical detectors of the ADM are usually not to be used anymore, even if they do not appear damaged. As a result of the arc acting the sensitivity of the optical detectors may be changed (due to smoke or temperature influence) and simultaneously the sensitivity of the whole protection is modified. Exchange of the optical detectors should be managed according to the manuals of the optical detectors.

14.3. Detection and elimination of the damage

The device possesses the self-diagnostics system that provides instantaneous signaling of most of inner failures. After detecting a failure by the self-diagnostics system or by the personnel it is necessary to describe symptoms of the failure and to consult them with the representative of the producer service in order to obtain instructions for further procedure. It is not recommended to make any repairs by the user without previous arrangement with the producer of the device.

15. Storing

Transport packaging should have the same vibrations and strokes endurance as it is specified in standards PN-EN 60255-21-1:1999 and PN-EN 60255-21-2:2000 for the sharpness of the class 1. The device delivered by the producer should be unpacked carefully not

with use of too much strength and not adequate tools. After unpacking it should be visually checked if the device has no external damage. The device should be stored in a dry and clean place. The temperature of the storage is in the range from -25°C up to $+70^{\circ}\text{C}$. Relative humidity should be in such a range that condensation and hoarfrost would not occur.

The devices should be installed at their workplaces about 2 hours before supplying. It is necessary to equalize temperature and to avoid humidity and condensation.

16. Utilization

If it is necessary to disassemble the device (and eventually remove it) as the result of a damage or the end of its operation life time, all the supplying and measurement units and other connections should be switched off before.

The disassembled device should be treated as electronic scrap which undergoes appropriate regulations concerning waste management.

17. Warranty and service

For the delivered device SPIE Energotest Ltd. provides a 12-month warranty from the date of purchasing (unless the contract states otherwise), based on the rules specified in the guarantee certificate.

The producer ensures technical assistance during the start-up of the device and provides warranty service under the commonly accepted conditions and after warranty service under the conditions mutually agreed on.

Not obeying the rules specified above causes the loss of warranty.

18. Ordering

The order should include:

- the amount of the ADM,
- the amount of the power supplies,
- the amount of the optical detectors with specified length,
- name and contact details of the person who can provide additional information on the order, installation and configuration of the protection.

The orders should be sent to the producer to the following address:

SPIE Energotest sp. z o.o.

ul. Chorzowska 44B; 44-100 Gliwice

phone: +48-32-270 45 18

e-mail: energotest@spie.com

<https://www.spie-energotest.pl>

----- End of operating manual -----