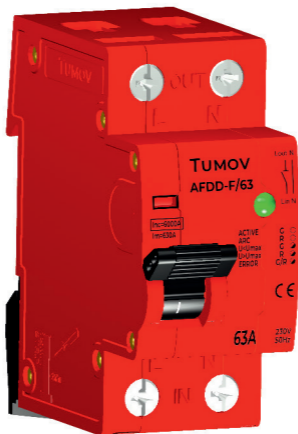


# Arc Fault Detection Device (AFDD-F)

## Operating manual

1



CE EAC MADE IN RUSSIA

Complies with IEC 62606

|   |    |
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- 1.1 Single-phase arc fault detection device AFDD-F/63 (hereinafter – DEVICE, the last two digits of the name correspond to the current rating of the DEVICE) belongs to the class of household devices intended for protection against arc fault (AFDD), in accordance with IEC 62606.
- 1.2 The DEVICE is used for automated prevention of fires from arcing in electrical circuits and electrical installations in buildings and structures and other locations.
- 1.3 The DEVICE provides:
  - detection of fire-dangerous arcing (arc fault), which occurs in case of malfunctions in electrical circuits and electrical appliances<sup>1</sup>;
  - disconnection of protected electrical circuits from external supply main in case of arcing to prevent fires;
  - overvoltage protection;
- 1.4 The DEVICE meets the requirements of IEC 62606

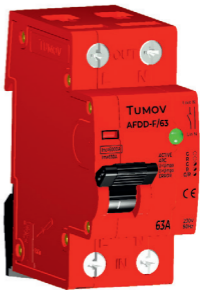


Fig. 1. Device

1. The DEVICE does not prevent fire-dangerous events not stipulated by IEC 62606



**Fig. 2. TEST UNIT**

- 1.5 The DEVICE is a general-purpose fixed electrical product, used in AC power supply and installed into switchboards, branch-circuit panel boards (apartment and floor distribution board), installation boards of individual electricity consumers, in buildings, structures and other facilities.
- 1.6 The DEVICE launches automatic self-checks (tests) of the functionality after each switching on and afterwards at least every 12 hours. If the result of self-check is negative, the device trips the protected circuit and displays the fault by relevant indication (for failure procedure see p. 9.4).
- 1.7 The DEVICE can be equipped with an operating area test unit (arc simulator) – AFDD-TU (hereinafter – TEST UNIT) (Fig. 2) in the form of a plug and plugged into standard sockets of the protected circuit. Information about TEST UNIT AFDD-TU in the kit is shown in the Packing List (p. 14).

## 2. TECHNICAL SPECIFICATION

2.1 Basic characteristics of the DEVICE are given in Table 1.

| It.    | Characteristic   | UoM | Values                                   |      |      |      |      |
|--------|--|-----|--|------|------|------|------|
|        |  |     | F-16                                     | F-25 | F-32 | F-40 | F-63 |
| 2.1.1  | Rated operation conditions   |     | Constant                                 |      |      |      |      |
| 2.1.2  | System configuration   |     | Standards<br>(TN-C, TN-S, TN-C-S,<br>TT) |      |      |      |      |
| 2.1.3  | Rated/minimum operating / maximum operating supply voltage   | V   | 230/115/275                              |      |      |      |      |
| 2.1.4  | Withstand voltage  | V   | 440                                      |      |      |      |      |
| 2.1.5  | Supply voltage frequency   | Hz  | 50                                       |      |      |      |      |
| 2.1.6  | Rated current  | A   | 16                                       | 25   | 32   | 40   | 63   |
| 2.1.7  | Overvoltage shutdown threshold   | V   | 275                                      |      |      |      |      |
| 2.1.8  | Break time for exceeding of voltage threshold  | s   | 0.2                                      |      |      |      |      |
| 2.1.9  | Break time for exceeding of voltage threshold 300 V  | ms  | 30                                       |      |      |      |      |
| 2.1.10 | Break time in case of arc detection  | ms  | meet the requirements of IEC 62606       |      |      |      |      |
| 2.1.11 | Parameters of varistor protection:<br>Level of voltage limitation at pulse current of 100A, not more | V   | 1200                                     |      |      |      |      |
|        | Maximum absorption energy (single pulse 2 ms)  | J   | 175                                      |      |      |      |      |
|        | Maximum absorption current, single pulse 8/20 $\mu$ s  | A   | 8000                                     |      |      |      |      |
|        | Response time of impulse protection  | ns  | <25                                      |      |      |      |      |

Table 1

Table 1

|        |   |                 |                    |     |     |     |     |
|--------|---|-----------------|--------------------|-----|-----|-----|-----|
| 2.1.12 | Power loss  | W               | 0,7                |     |     |     |     |
| 2.1.13 | Rated making and breaking capacity on one pole Im1                        | A               | 500                | 500 | 500 | 500 | 630 |
| 2.1.14 | Rated conditional short-circuit current on one pole Inc1                  | A               | 6000               |     |     |     |     |
| 2.1.15 | Connected conductors' section   | mm <sup>2</sup> | 0.5-24 (20-4 AWG)  |     |     |     |     |
| 2.1.16 | Torque applied to screws of contact clamps                                | N-m             | 2÷3                |     |     |     |     |
| 2.1.17 | Operating temperatures  | °C              | -25...+40          |     |     |     |     |
| 2.1.18 | Storage temperature   | °C              | -40...+70          |     |     |     |     |
| 2.1.19 | Lower value of atmosphere pressure / maximum altitude above the sea level | mmhg/m          | 550/2000           |     |     |     |     |
| 2.1.20 | Operating position  |                 | Any                |     |     |     |     |
| 2.1.21 | Overall dimensions (HxWxD)  | mm              | 85.6 x 35.6 x 77.0 |     |     |     |     |
| 2.1.22 | Weight netto  | g               | 150                |     |     |     |     |
| 2.1.23 | Service life, at least  | years           | 10                 |     |     |     |     |
| 2.1.24 | Connected conductor's material  |                 | copper aluminium   |     |     |     |     |

2.2 Characteristics of the TEST UNIT are given in Table 2.

Table 2

| It.   | Characteristic                             | UoM | Values      |
|-------|--|-----|-------------|
| 2.    | Rated/minimum/maximum power supply voltage | V   | 230/150/275 |
| 2.2.2 | Simulated arcing current acc. to IEC 62606 | A   | 2.5         |
| 2.2.3 | Operating temperatures                     | °C  | -40...+40   |
| 2.2.4 | Storage temperature                        | °C  | -40...+70   |
| 2.2.5 | Overall dimensions (HxWxD)                 | mm  | 71x31x12    |






- 2.3 T2.3 The DEVICE is designed for fixed installation on a standard 35 mm DIN rail (TN35 rail) in the switchboard equipment for mounting of fixed wiring.
- 2.4. Electrical safety and EMC of the DEVICE and the TEST UNIT meet the requirements of IEC 60947, IEC 335-1-91, IEC 62606.
- 2.5. Protection class of the DEVICE and TEST UNIT provided by casings correspond to the values stipulated by IEC 60529:2013.
  - 2.5.1. The DEVICE:
    - 1) device body - at least IP40;
    - 2) contacts is under power – at least IP20.
  - 2.5.2. The TEST UNIT:
    - 1) plug during plugging-in – at least IP20
    - 2) plug connected with the socket – at least IP40.
- 2.6. The weight of the complete set (gross) not more than 210 g.
- 2.7 Package size (HxWxD) – 85x45x105 mm.

### **3. DEVICE DESCRIPTION**

- 3.1 The DEVICE (Fig. 1) is non-separable, device body with screw terminals for the input and output of the phase and neutral lines, the control board and the mechanism of free decoupling of the input and output contacts of the phase line tripped by its command inside.
- 3.2 The front plate contains:
  - 3.2.1 A rectangular color indicator of contact tripping: red - “closed”, green color - “open” (located above the manual control handle);

- 3.2.2 a manual control handle. The top position indicates the “on” state (designated as “1”); the lower position is “off” (“0”);
- 3.2.3. LED indicator (indication status, see Table 3);
- 3.2.4. LED indication status (on the front panel of the DEVICE).

Table 3

| LED indication mode                 | Front panel explanation  | Device status   |
|-------------------------------------|--|---|
| Constant green                      | ACTIVE G<br>        | Normal operating.   |
| Constant red                        | ARC R<br>           | Tripping due to fire-dangerous arcing   |
| Flashing green                      | $U < U_{max}$ G<br> | Tripping due to the exceeding of the voltage threshold $U_{max}$ , and the input voltage has already returned to the acceptable value |
| Flashing red                        | $U > U_{max}$ R<br> | Tripping due to the exceeding of the voltage threshold $U_{max}$ , and the input voltage has not yet returned to the acceptable value |
| Flashing variable color (red/green) | ERROR G/R<br>     | Built-in self-test fault  |
| No light                            |  | No input voltage or it is below the minimum value   |



## 4. OVERALL, INSTALLATION AND CONNECTION DIMENSIONS

Main dimensions of the AFDD-F (in mm), see Fig.3.

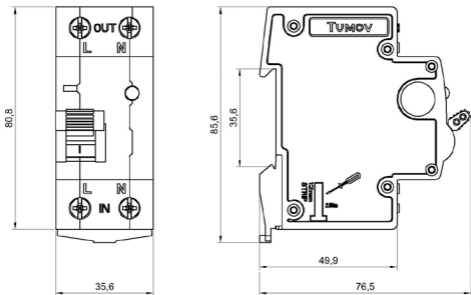


Fig. 3

## 5. CONNECTION

- 5.1 The DEVICE is series-connected to the automatic circuit breaker (IEC 60898-1:2002) or to a RCBO (IEC 61009-1:2010) with rated operating protection current not more than:

|            |      |
|------------|------|
| AFDD- F/16 | 16 A |
| AFDD- F/25 | 25 A |
| AFDD- F/32 | 32 A |
| AFDD- F/40 | 40 A |
| AFDD- F/63 | 63 A |

5.2 Types of connection diagrams complying with IEC 62606, see Fig. 4-6

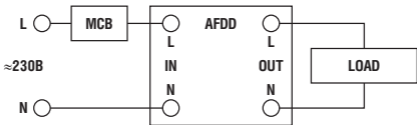


Fig. 4 Connection of DEVICE to MCB

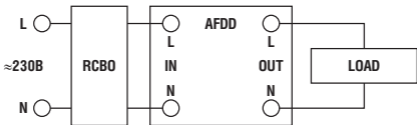


Fig. 5 Connection of DEVICE to RCBO

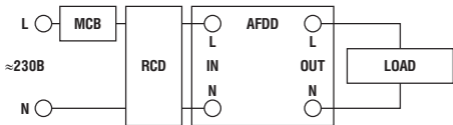


Fig. 6 Connection of DEVICE together with RCD (residual current device)

- 6.1 Installation of the DEVICE shall be carried out with the power line disconnected.
- 6.2. Installation, wiring and maintenance of the DEVICE shall be performed by certified staff.
- 6.3 Operation of the DEVICE shall be carried out under normal conditions, in the absence of conductive dust or contacts-destroying environment.
- 6.4. During the operation, current-carrying elements and contact groups of the DEVICE shall be inaccessible to the user.

## 7. INSTALLATION AND WIRING

- 7.1 Check the following prior to the installation of the DEVICE:
  - marking on the unit casing – the DEVICE shall conform to the name indicated in this manual;
  - appearance, integrity and the absence of moisture. The DEVICE should be free from mechanical damages, chips, cracks, dents and foreign spots;
  - the possibility of setting the switches in the required positions.
- 7.2 The DEVICE is installed into the switchboards (panels) with at least IP30 protection class in accordance with IEC 60529:2013.
- 7.3. The supply mains voltage is connected bottom the DEVICE, to the corresponding inputs “L” – phase and “N” – neutral, jointly marked “IN” (INPUT).

The protected circuit is connected to the relevant upper outputs designated as 'OUT'(OUTPUT).

- 7.4 Torque applied to screws of contact clamps -  $2\div 3$  N·m.
- 7.5 The operating conditions shall comply with the technical data (see Table 1).
- 7.6 After the installation of the DEVICE, attach a sticker with ADFP TUMOV LED INDICATION STATUS (See Table 3) inside the panel door, onto a visible place. The sticker is included.

## 8. OPERATION OF THE DEVICE

### 8.1 Preparing the DEVICE to operation.

- 8.1.1. No setting of the threshold of the controlled arcing current (DEVICE sensitivity) is required. This threshold is factory-set and complies with IEC 62606.

Other settings are not required.

**Now the DEVICE can be switched on. Turn the manual control handle (it 3.2.2) in the upper position ("I").**

### 8.2 Overvoltage shutdown

- 8.2.1. If the voltage in the protected circuit exceeds the threshold (p.2.1.7), the DEVICE trips the protected circuit from the external power supply. The light on the front panel of the DEVICE is flashing (Table 3). Flashing indicates a shutdown due to overvoltage. Follow the color of the flashing light.
- 8.2.2. Green flashing indicates that after tripping of the protected circuit, the voltage supplied from the external power supply does not exceed the set threshold. To resume the voltage the protected circuit, turn the manual control handle in the upper position ("I").

8.2.3. Red flashing indicates that after disconnection of the protected circuit, the voltage supplied from the external mains voltage exceeds the set voltage still under the threshold limit in the protected circuit. Possible actions of the user: do nothing (recommended), wait until the value of the power supply voltage corresponds to the set threshold and green light starts to flash (see 8.2.2). Turn manual handle in the upper position (“I”).

### 8.3 Shutdown in case of arc breakdown. Troubleshooting

When a fire-dangerous arcing is detected (in case of arc fault), the DEVICE trips the protected circuit. The shutdown is accompanied by constant red lighting (Table 3).

**Note.** The troubleshooting procedure is the same in the case of any type of automatic circuit protection devices switching off, and includes alternate switching on of the protected circuits and power-consuming units.

More detailed actions include the following:

- 1) If multiple load circuits are connected to the output of the DEVICE, the arc circuit must be localized first. For this purpose, all load circuits must be disconnected and then connected in turn. Circuits equipped with their own Miniature Circuit Breaker (MCB) are switched through them, circuits without MCB are switched manually. Switch on the DEVICE and turn on/off circuits one by one for working time about 10 seconds per circuit. Switching on of the DEVICE while you turn on the next circuits will detect a problem circuit. Further search is made within this circuit only.

**Note.** Therefore, it is necessary to switch on both the relevant circuit, and those electric appliances that have worked or could have worked in the mentioned circuit before shutting down.

Some devices do not switch on into full current consumption mode (only low-power signal circuits are switched on), when the voltage supply restores, they shall be switched on with their own circuit-breakers.

- 2) Disconnect all the operating power-consuming appliances within the detected arcing circuit by unplugging the plugs, cause arcing problem can be in one of power cords. Switch the DEVICE on. If the DEVICE keeps tripping with all the units disconnected, it indicates a malfunction of the electrical wiring (pinched or damaged wires, broken insulation), which can involve a very dangerous parallel arc fault. All possible measures must be taken to eliminate the possible fire hazard risk. If it is difficult to contain the fault in the wiring, contact a specialized electrical-installation company.
- 3) If the DEVICE stops tripping after the electrical appliances are switched off, connect and switch on the previously disconnected electrical appliances one by one. If the DEVICE is tripped when one of the electrical appliances is switched on, it is recommended to plug this device to another socket while plugging another device into this socket, thus determining the location of the fault. If wiring fault is detected, take all possible measures to exclude possibility of fire hazard. If there is a problem in defining the fault in the electrical wiring, contact a specialized electrical-installation company.

#### **8.4. The DEVICE operation area**

- 8.4.1. The operation area defines the area of the protected electrical circuit, in which the DEVICE detects arcing with the weakest current to be detected according to IEC 62606. Structurally, the operation area consists of a set of sockets of the protected circuit connected

by electrical wiring, as well as power-consuming units connected directly to the electrical circuit (via clamps, terminals, etc.). In fact, the operating area can be defined by all points accessible for connection of the TEST UNIT, in particular, by a set of electrical outlets, including outlets of extension cords.

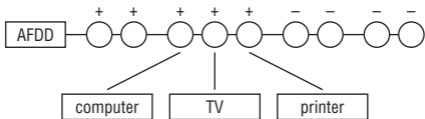
- 8.4.2. The capability of AFDD devices to detect arcing at remote points of the protected circuit is verified by test methods of IEC 62606. However, in actual circuits of a complex configuration of length, branching, number, type and location of the power-consuming units, the arcing signals can reach an AFDD with the heavier damping as compared to the tests of the above standard. Therefore, for a particular installation of any AFDD it is advisable to determine the actual area of its reaction to the arc fault.

For this purpose, the manufacturer of the DEVICE offers an EXCLUSIVE SERVICE FUNCTION – the definition of the DEVICE operation area. This function is implemented by coordinated capabilities of the DEVICE and the TEST UNIT (p. 1.7).

The TEST UNIT generates signals with features of an arc fault, which are detected by the DEVICE in the same way as signals from actual arcing. The intensity of such signals corresponds to an arc fault with the minimum current to be detected (2.5 A in accordance with IEC 62606).

- 8.4.3. To check the operation area, plug the TEST UNIT into all sockets one by one. The DEVICE must trip. The operation area is determined by the composition of the sockets, including the extension cord sockets, plugging into which triggers the DEVICE, and by the wiring, that connects these sockets. If there are electrical appliances within this circuit that cannot be switched off, they are included in the DEVICE operation area.

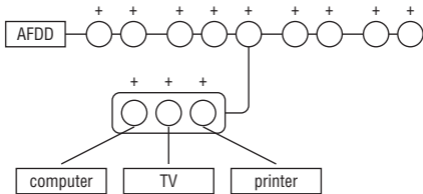
8.4.4. If the DEVICE is not trips, the connected socket is out of the operation area. If there is insufficient coverage of the protected circuit by the operation area, additional measures can be taken to expand it. Typically, an inadequate signal from arcing (and therefore from the TEST UNIT) may come from sockets following the circuit sockets, connected to the consumers with switched mode power supply units (computers, televisions, digital receivers, pulse transformers for power supply of halogen lamps, etc.) that attenuate the signal (see Fig. 7).



**Fig. 7** Lose of service area (example)

'+' indicates sockets in the service area, '-' – sockets out of the service area.

In this case, it is recommended to connect this group of consumers via a standard circuit extension cord 3 meters or more (see Fig.8).



**Fig. 8** Expanding service area with an extension cord (example)



- 9.1 Under normal operating conditions, the DEVICE should be inspected at least once a year.
- 9.2 Inspection includes:
- removal of dust and dirt;
  - checking of tightness of the screws of the current conductors;
  - checking the reliability of mounting of the DEVICE on a DIN rail;
  - switching the DEVICE on and off;
  - functional test using the TEST UNIT plugged into the standard sockets of the protected circuit;
  - checking of operation in the switchboard equipment, switching off of the DEVICE with switched off external circuit breaker or RCBO, protecting the DEVICE and the electric circuit from short-circuit over-currents;
  - other works necessary for normal operation of the Device and the protected electrical circuit.
- 9.3 If the DEVICE is switched off, the shutting down cause (arcing or overvoltage) are determined and eliminated. Then the DEVICE is switched on again.
- 9.4. In case the DEVICE is tripped after automatic self-check (see Table 3), switch the device on again. In case of repeated shutdown as a result of self-check, the DEVICE shall be replaced.
- 9.5. The DEVICE and the TEST UNIT are not subject to repair under operation (outside the manufacturer's factory)

## 10. TRANSPORTATION AND STORAGE

- 10.1 The device and the TEST UNIT, packed in individual packing.
- 10.2 Shelf-life of the DEVICES and the TEST UNIT in individual packing is up to 24 months, from the date of manufacture, indicated in the datasheet.

## 11. WARRANTY

- 11.1 The manufacturer guarantees the conformity of the characteristics of the DEVICE and the TEST UNIT stated in this manual, subject to compliance with the rules of transportation, storage, installation and operation by consumer.
- 11.2. Warranty service life of the DEVICE and the TEST UNIT is not less than 24 months from the date of its transfer to the consumer (date of sale). If it is impossible to establish the date of transfer, this period shall be calculated from the date of manufacture. The date of manufacture is indicated on the housing of the DEVICE and the TEST UNIT.

## 12. COMPLIANCE WITH THE REQUIREMENTS FOR ENVIRONMENTAL PROTECTION AND DISPOSAL

- 12.1 The materials of the DEVICE and the TEST UNIT pose no hazard to human life and health during and after the end of their working life.
- 12.2. The DEVICE and the TEST UNIT contain no toxic materials or components that are harmful to the environment.
- 12.3. Disposal should be carried out according to regular practices (in accordance with the applicable standards (methods) of electrical equipment waste disposal).

# 13. ARTICLE DESCRIPTION OF AFDD-F

|      |   |   |   |    |   |    |   |   |
|------|---|---|---|----|---|----|---|---|
| AFDD | - | f | / | 63 | / | 1P | / | 0 |
| 1    |   | 2 |   | 3  |   | 4  |   | 5 |

- 1 – Name of the DEVICE – Arc fault detection device (AFDD);
- 2 – Mounting type: F-fixed; P - portable; C - Cord;
- 3 – Rated current in the protected circuit (A);
- 4 – Poles;
- 5 – Suffix. Various information is included: rated voltage, rated frequency, additional control functions, number of controlled phases, neutral tripping function, remote monitoring, manufacturer's code, etc. A detailed description of the suffix can be found in the catalogue.

## 14. PACKAGING CERTIFICATE

| It. | Components                  | Name of the device | Q-ty, pcs. |   |
|-----|-----------------------------|--------------------|------------|---|
| 1.  | DEVICE                      | AFDD-F             |            |   |
| 2.  | Operating manual, datasheet | -                  | 1          | - |
| 3.  | TEST UNIT                   | AFDD-TU            |            |   |
| 4.  | Information sticker         | -                  | 1          | - |
| 5.  | Individual packing          | -                  | 1          | - |

---

position

signature

full name

date, month, year

# 15. ACCEPTANCE CERTIFICATE

20

| Device    | Name of the device |  |
|-----------|--------------------|--|
| DEVICE    | AFDD-F             |  |
| TEST UNIT | AFDD-TU            |  |
|           |                    |  |

position

signature

full name

date, month, year

# 16. PURCHASE CERTIFICATE

|  |               |
|--|---------------|
| Name of the DEVICE – in accordance with p.14   |               |
|  | Date of sale: |
| Name and address of the seller:  |               |
| Stamp and signature of the seller:   |               |
| Supply package and appearance of the device have been checked in the presence of the buyer.<br>Signature of the buyer: |               |

### ***Manufactured by***

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