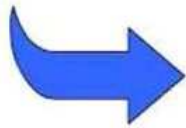


ELECTRONSYSTEM MID



- *Design and products for safety problem solving in low and high voltage electrical installations*

**FAULT IN ELECTRICAL
SWITCHBOARDS IN CASE
OF INTERNAL ARC**



Internal Arc Phenomenon

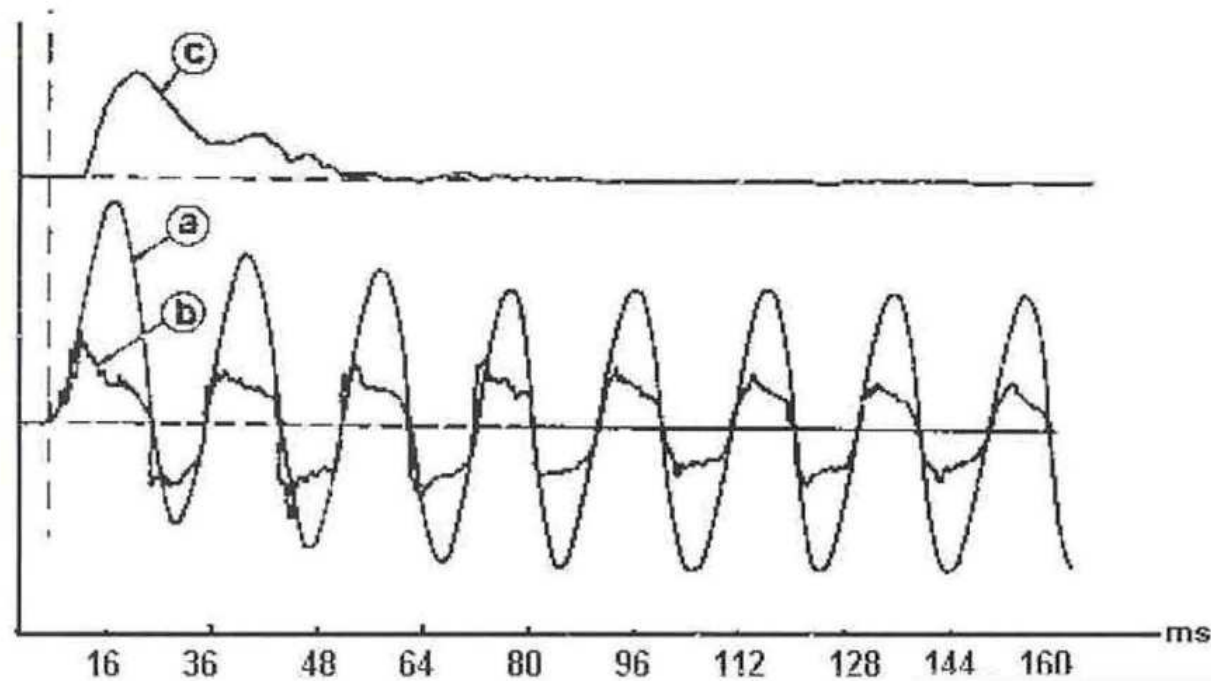


Internal Arc

- ▶ **The switchboard is a complex system which operates integrating many components designed and manufactured according their own standards.**
- ▶ **Part of components and the switchboard, when completed, are tested according its own standards, so the required integrated functionality and reliability is guaranteed.**
- ▶ **During the switchboard life, unexpected stress, unusual environmental condition, hidden component defects, or wrong application of operation procedures, can result in an internal fault, with arc at full short circuit current of the plant.**

Internal Arc

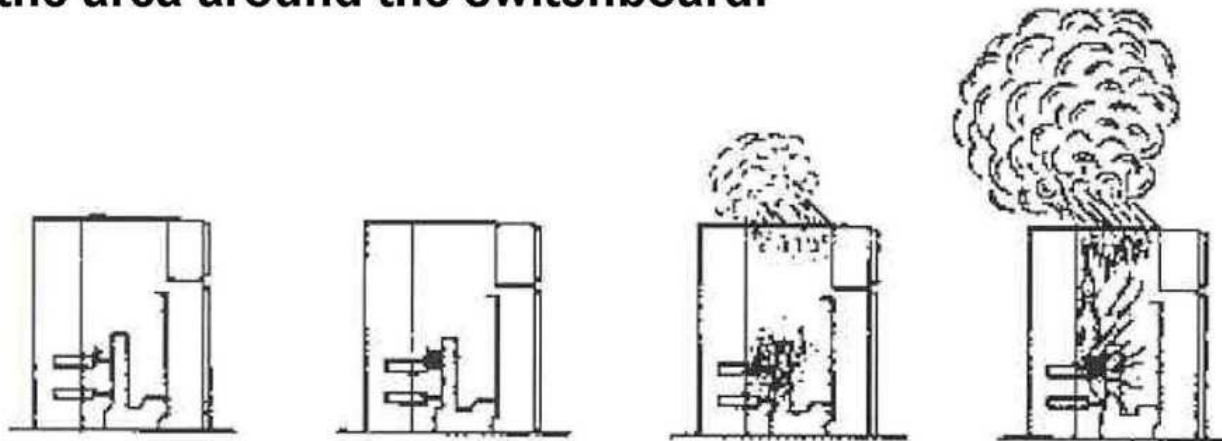
- ▶ The energy developed by the internal arc generates heat and pressure; ex:



- ◆ a: short circuit current (phase with max asymmetry)
- ◆ b: arc voltage
- ◆ c: internal pressure

Internal Arc

- ▶ The phenomenon has destructive effects on the active parts of the plant.
- ▶ The internal pressure and heating effect, can also result in high temperature gas release, dangerous for people in the area around the switchboard.



- ▶ The IEC Standard 298 specifies test procedures to verify the safety of people in the proximity of switchboard.

Internal Arc

- ▶ **So, a switchboard “with internal arc protection” ensures safety for people.**
- ▶ **As regard the impact on damages to equipments and environment, and out of service time, the difference between switchboards with or without internal arc protection is quite limited.**
- ▶ **The persistence of the arc causes high temperatures, combustion of organic insulation material, fire, release of toxic gas, projection of melted metal and suspended carbon compounds, with consequent conductive sediments on all parts, etc.**
- ▶ **Even after repairing and cleaning, the reliability of the plant is not fully restored.**

Internal Arc

- ▶ **The target is then limiting the consequence of the internal arc by:**
 - ◆ Reducing the fault energy
 - ◆ Preventing the propagation of fault
- ▶ **The fault energy depends from short circuit current and arcing time:**
 - ◆ The short circuit current is a plant parameter, which reduction may result in higher losses in normal service.
 - ◆ The reduction of arcing time requires timely and selective arc detection.
- ▶ **Differential relay or differential scheme is a possible mean for detecting arc.**
- ▶ **Direct arc detection is the optimal solution, ensuring fast, selective, and reliable operation, at minimal cost.**

Internal Arc

- ▶ **Two direct detection methods are available:**
 - ◆ **Pressure Arc Detector (detecting the wave of pressure of the gas generated by the arc).**
 - ◆ **Light Arc Detector (detecting the arc flash).**

- ▶ **The pressure arc detection consists of pressure sensor switches, with appropriate piping system and valves.**
 - ◆ **An appropriate damping on the pressure sensor ensures discrimination between low-energy self cleaning flash and high energy arc.**
 - ◆ **This method operates properly when the arc ambient is reasonably airtight (or makes possible the overpressure wave).**
 - ◆ **This solution has to be built in the switchboard in an intimate way, and is normally directly managed by the switchboard manufacturer.**

ELECTRONSYSTEM MD

***Electronsystem-MD
combined solution*** |

Electronsystem-MD detectors

▶ LAD/HS: The Sensitive Version

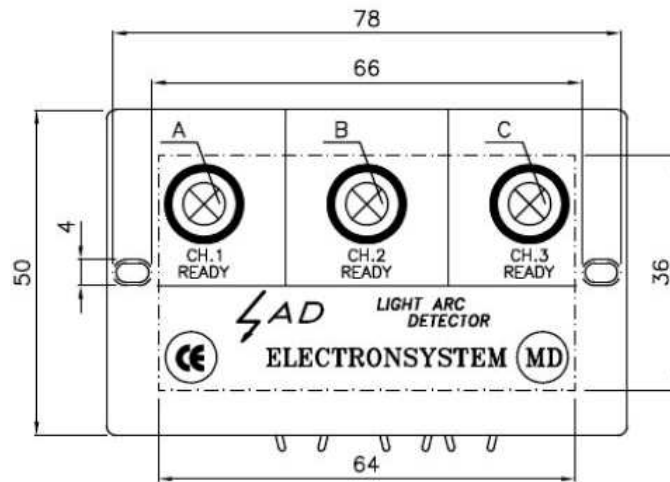
◆ LAD/HS/X/VVV

- X: number of channels: 2 or 3
- VVV: auxiliary voltage
 - 801: 110 VDC
 - 802: 24 VDC
 - 803: 48 VDC
 - 804: 220 VDC (on demand)
- One CO contact per channel
- Sensible to visible light
- Up to 100 m optical fibre connection
- <10 ms response time
- 200 ms pulse at light detection
- -30°C to +70°C

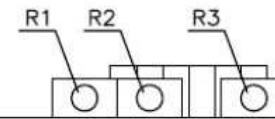


Electronsystem-MD detectors

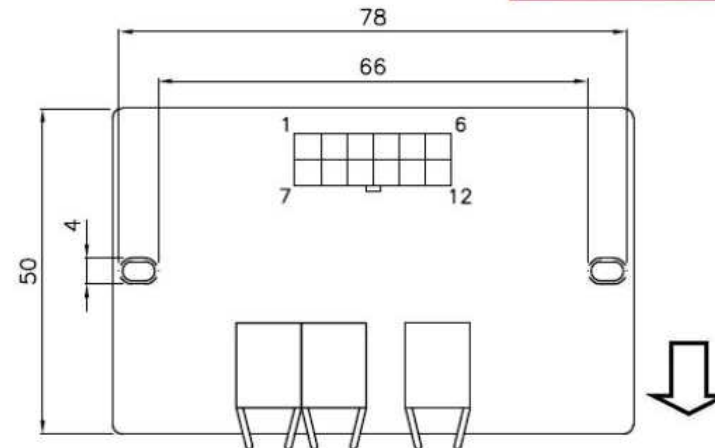
► LAD/HS



Front view



Top view



Rear view

Electronsystem-MD detectors

▶ LAD: The Infrared Version

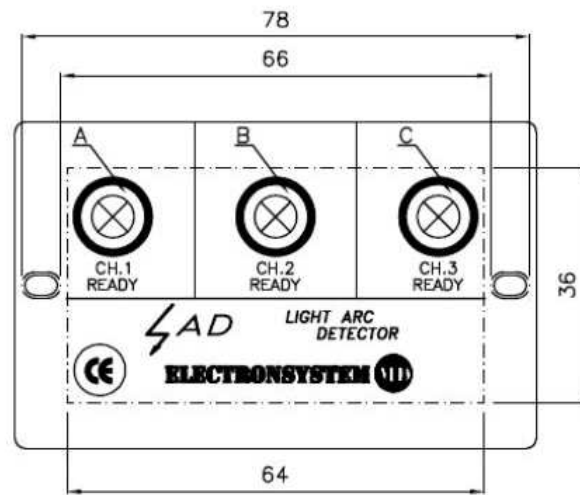
◆ LAD/X/VVV

- X: number of channels: 2 or 3
- VVV: auxiliary voltage
 - 801: 110 VDC
 - 802: 24 VDC
 - 803: 48 VDC
 - 804: 220 VDC (on demand)
- One CO contact per channel
- Sensible to infrared light
- Up to 4 m optical fibre connection
- <10 ms response time
- 200 ms output pulse at light detection
- -30°C to +70°C

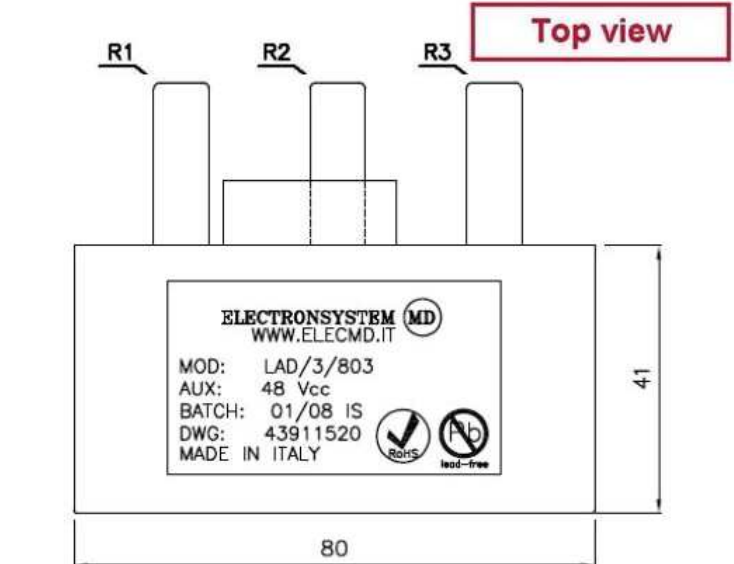


Electronsystem-MD detectors

► LAD

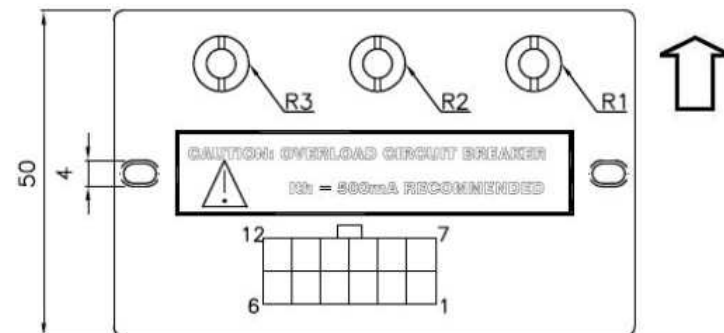


Front view



Top view

Rear view



Electronsystem-MD detectors

▶ LAD/HS

- ◆ It is the sensitive version, suitable for long optical fibre connection: up to 100 m.
- ◆ It may be sensitive to surrounding light, and then it must work in AND with a current threshold at short circuit level.
- ◆ It is the preferred solution in case of GIS.

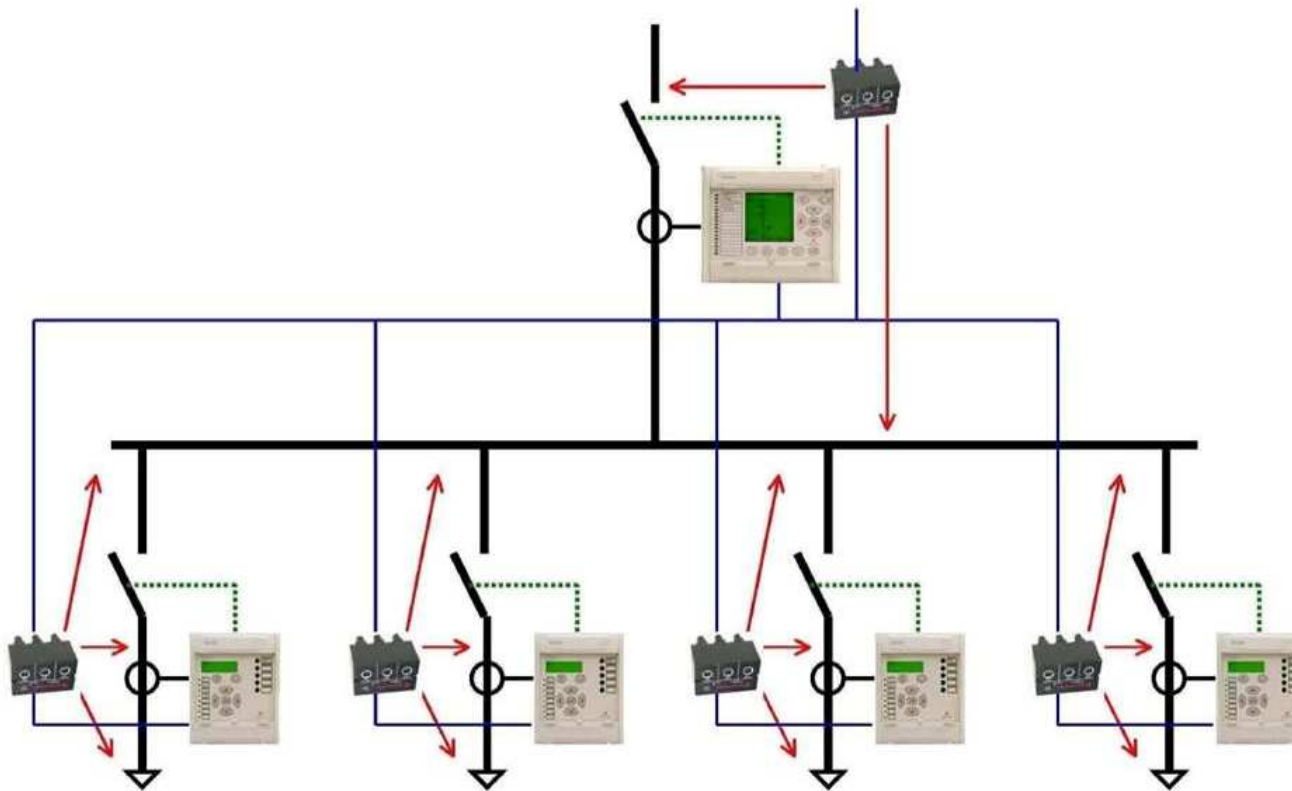
▶ LAD (Infrared Version)

- ◆ It is less sensitive, but the maximum optical fibre connection is 4 m.
- ◆ It is immune from surrounding light (sun, etc) and makes easier the settings, and safer and selective the operation.

- ▶ **LAD/HS or LAD can work in various combination with MiCOM relays, by using their output contacts to enable/block the output of one of the available MiCOM overcurrent thresholds.**

The two actions (o/c and LAD) are concurrent starting from fault, and then the expected operating time is the longer of two: \approx 20-30 ms.

► Application example



- ← Optical fibre sensing
- Relay interface (to PSL, enabling/blocking)
- CB control