

# MOK-V2

SERIES

## MEASURING RELAYS WITH ADJUSTABLE HYSTERESIS, 2 CONTACTS



### APPLICATIONS



### OVERVIEW

- MOK-V2 voltage threshold relays
- Pick-up and drop-out thresholds adjustable by way of two independent potentiometers
- Electronic circuit requiring no auxiliary power supply
- Solid and rugged construction for heavy or intensive duty
- Considerable long-life
- Excellent shock and vibration resistance
- Wide range of sockets
- Retaining clip for secure locking of relay on socket
- Positive mechanical keying for relay and socket

### DESCRIPTION

Products of the MOK series are measuring relays with adjustable hysteresis.

The device measures an electrical quantity (voltage or current, depending on the model) registering in a monitored circuit; the contacts switch to 'make' status when this same quantity exceeds the pick-up threshold, selected by the user and expressed as a percentage of the nominal voltage/current.

The relay reverts to 'break' status when the measured quantity drops below the drop-out threshold (also selected by the user), expressed as a percentage of the pick-up threshold.

These models are suitable for the supervision and protection of electrical equipment used in the most demanding of sectors such as, for example, electricity generating stations, electrical transformer stations, industries using continuous production processes, railways / fixed equipment and rolling stock alike.

The MOK-V2 is a measuring relay with two adjustable voltage thresholds: Pick-up voltage and Drop-out voltage.

The setting, which is made by way of the potentiometers located on the top of the relay, pilots an electronic circuit that does not require an auxiliary power supply.

The pick-up voltage can be set at between 60% and 120% of nominal voltage.

The drop-out voltage can be set at between 70% and 98% of the pick-up voltage.

The MOK-V2 model is equipped with two change-over contacts rated 8A.

In the case of the direct current version, the relay is equipped with a polarization diode that protects the circuits against an accidental inversion of polarities.

Particularly suitable for monitoring battery voltages in the rail-tram-trolley vehicles sector.

### STANDARD COMPLIANCE

|            |               |
|------------|---------------|
| EN 61810-1 | EN 60695-2-10 |
| EN 61810-2 | EN 61000      |
| EN 61810-7 | EN 60529      |



| MODELS  | RESPONSE TIME | THRESHOLD SETTING |          | NUMBER OF CONTACTS |
|---------|---------------|-------------------|----------|--------------------|
|         |               | Pick-up           | Drop-out |                    |
| MOKV2x1 | Standard      | •                 | •        | 2                  |
| MOKV2x9 | Fast acting   | •                 | •        | 1                  |



FOR PRODUCT CODE CONFIGURATION, SEE THE "ORDERING SCHEME" TABLE



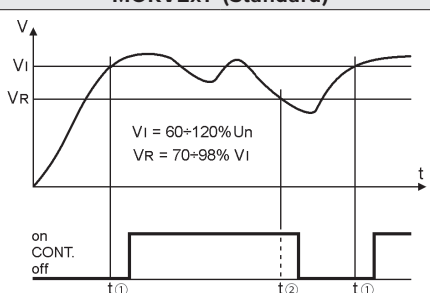
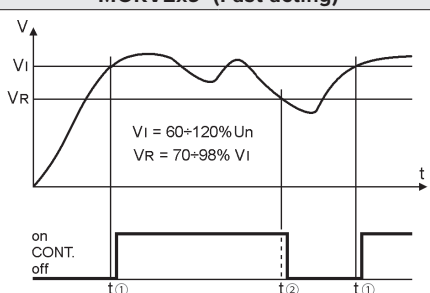
## COIL DATA

|                                |  |
|--------------------------------|--|
| Nominal voltages Un            | DC: 24-36-48-72-110-125-132-144-220 - AC: 24-48-110-125-220 <sup>(1)</sup> |
| Max. consumption at UN (DC/AC) | 3.5 W / 4 VA   |
| Maximum operating range        | 125% Un permanent  |
| Type of duty                   | Continuous   |

(1) Other values on request.

| OPERATING THRESHOLDS   | STANDARD VERSION                                       | FAST ACTING VERSION |
|--|--|---------------------|
| Setting  | By way of potentiometers, with flat head slotted screw |                     |
| Pick-up threshold  | $V(i) = 60\% \div 120\% U_n$                           |                     |
| Drop-out threshold   | $V(r) 70\% \div 98\% V(i)$                             |                     |
| Accuracy, setting ( $t=20^\circ\text{C}$ )                     | $\pm 1.5\% U_n$  |                     |
| Additional error ( $-40^\circ\text{C}$ , $+70^\circ\text{C}$ ) | $+1\% U_n$   |                     |
| Accuracy, repeatability  | 1%   |                     |

|       |  |  |
|-------|--|--|
| Front |  |  |
|-------|--|--|

| Functional diagram   | MOKV2x1 (Standard)   |  | MOKV2x9 (Fast acting)  |   |
|--|--|--|--|---|
|  |  |  |  |   |
| ① Pick-up delay<br>(closing of the NO contact) <sup>(1)</sup>  | <b>Vi = 60%</b>  | <b>Vi = 80...100%</b>  | <b>Vi = 60%</b>  | <b>Vi = 80...100%</b>   |
|  | relay powered<br>0.05...1.9 s<br><br>relay not powered<br>0.5...2.7 s              | relay powered<br>0.8...4 s<br><br>relay not powered<br>1...4 s | relay powered<br>0.05...0.2 s<br><br>relay not powered<br>0.5...0.8 s                | relay powered<br>0.07...0.2 s<br><br>relay not powered<br>0.5...0.8 s |
| ② Drop-out delay<br>(closing of the NC contact) <sup>(1)</sup> | 0.2...3.5 s  |  | 0.05...0.2 s   |   |
| Electronic reset time in case of power failure                 | $\leq 3 \text{ s} @ V < 5\% U_n$   |  | $\leq 0,7 \text{ s} @ V < 5\% U_n$   |   |

**Attention:** the drop-out voltage Vr is expressed as a percentage of the pick-up thresholds.

(1) Tolerances on time indicated: 10%.

## STANDARD VERSION

Switching of contacts is delayed.

- when the pick-up threshold is reached, a delay to pick-up is introduced.
- when the drop-up threshold is reached, a delay to drop-up is introduced.

Delay time is a consequence of several factors:

- the selected threshold
- the initial voltage value
- the final voltage value
- amplitude of the change ( $\Delta V$ )

## FAST ACTING VERSION

The fast acting version has considerably lower contact switching times than the standard version.

See the table "Operating thresholds".

## CONTACT DATA



|  |   |    |
|--|---|----|
| Number and type                                      | 2 SPDT, form C  |    |
| Current  | Nominal <sup>(1)</sup>  | 8A |
| Example of electrical life expectancy <sup>(2)</sup> | 8 A – 250 Vac – $\cos\phi = 1$ : $10^5$ operations<br>0,2 A – 110 Vdc – L/R = 40 ms : $10^5$ operations |    |
| Minimum load <sup>(3)</sup>                          | 100mW (10V, 5mA)  |    |
| Maximum breaking voltage                             | 150 Vdc / 400 Vac   |    |
| Contact material                                     | AgSnO   |    |

(1) Nominal current: on all contacts simultaneously.

(2) 450 operations / hour.

## INSULATION



|   |  |                             |
|---|--|-----------------------------|
| Insulation resistance (at 500Vdc)   |  |                             |
| between electrically independent circuits and between these circuits and ground |  | > 1,000 MΩ                  |
| between open contact parts  |  | > 1,000 MΩ                  |
| Withstand voltage at industrial frequency                                       |  |                             |
| between electrically independent circuits and between these circuits and ground |  | 2 kV (1 min.) - 2.2kV (1 s) |
| between open contact parts  |  | 1 kV (1 min.) - 1.1kV (1 s) |
| Impulse withstand voltage (1.2/50μs - 0.5J)                                     |  |                             |
| between electrically independent circuits and between these circuits and ground |  | 5 kV                        |
| between open contact parts  |  | 3 kV                        |

## MECHANICAL SPECIFICATIONS



|   |                               |
|---|-------------------------------|
| Mechanical life expectancy                | 10x10 <sup>6</sup> operations |
| Degree of protection (with relay mounted) | IP40                          |
| Dimensions (mm) <sup>(1)</sup>            | 48x48x118.5                   |
| Weight (g)                                | ~ 180                         |

(1) Excluding output terminals and adjuster knob, if specified.

## ENVIRONMENTAL SPECIFICATIONS



|                                  |                       |  |
|----------------------------------|-----------------------|--|
| Operating temperature            | Rolling stock version | -25 to +55°C                           |
|                                  |                       | -25 to +70°C                           |
| Storage and shipping temperature |                       | -50 to +85°C                           |
| Relative humidity                |                       | Standard: 75% RH, Tropicalized: 95% RH |
| Resistance to vibrations         |                       | 5g - 10 to 55 Hz - 1min.               |
| Resistance to shock              |                       | 20g - 11ms                             |
| Fire behaviour                   |                       | V0 - to EN 60695-2-10                  |

See the "Operation" chapter of this document for more information and operating notes.

## STANDARDS AND REFERENCE VALUES



|                                    |   |
|------------------------------------|---|
| EN 61810-1, EN 61810-2, EN 61810-7 | Electromechanical elementary relays         |
| EN 60695-2-10                      | Fire behaviour                              |
| EN 61000                           | Electromagnetic compatibility               |
| EN 60529                           | Degree of protection provided by enclosures |

Unless otherwise specified, the products are designed and manufactured according to the requirements of the above-mentioned European and International standards.

In accordance with EN 61810-1, all items of technical data are referred to ambient temperature 23 °C, atmospheric pressure 96kPa and 50% humidity.

## RAILWAYS, ROLLING STOCK - STANDARDS



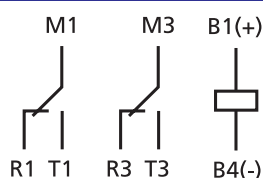
|                 |   |
|-----------------|---|
| EN 60077        | Electric equipment for rolling stock - general service conditions and rules |
| EN 50155        | Electronic equipment used on rolling stock                                  |
| EN 61373        | Shock and vibration tests, Cat 1, Class B                                   |
| EN 45545-2      | Fire behaviour, Cat E10, Requirement R26, V0                                |
| ASTM E162, E662 | Fire behaviour  |

## CONFIGURATIONS - OPTIONS



|                 |   |
|-----------------|---|
| P2              | Tropicalization of coil with epoxy resin for use with 95% RH (@ T 50 °C). This treatment also protects the coil against corrosion which could occur by the combination of humidity with certain chemical agents, such as those found in acid or saline atmospheres. |
| LOW TEMPERATURE | Minimum operating temperature -40°C, only for rolling stock version (option "L").   |

## WIRING DIAGRAMS



Selection of the range is made by connecting to the respective terminal.



## ORDERING SCHEME

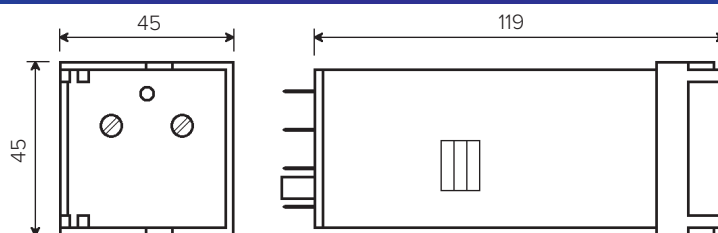
| PRODUCT CODE | APPLICATION <sup>(1)</sup>   | CONFIGURATION A                             | CONFIGURATION B                    | TYPE OF POWER SUPPLY                                | NOMINAL VOLTAGE (V) <sup>(2)</sup>                                 | FINISH <sup>(3)</sup>        | KEYING POSITION CODE <sup>(4)</sup> |
|--------------|--|---|------------------------------------|---|--|------------------------------|-------------------------------------|
| MOK-V2       | <b>E:</b> Energy<br><b>F:</b> Railway Fixed Equipment<br><b>R:</b> Railway Rolling Stock | <b>1:</b> Standard<br><b>9:</b> Fast acting | <b>0:</b> Standard<br><b>2:</b> P2 | <b>C:</b> Vdc <sup>(5)</sup><br><b>A:</b> Vac 50 Hz | 024 - 036 - 048<br>072 - 110 - 125<br>128 - 132 - 144<br>220 - 230 | <b>L:</b><br>Low temperature | XX                                  |

|         |  |   |   |   |   |     |  |
|---------|--|---|---|---|---|-----|--|
| Example | MOKV2  | R | 1 | 2 | C | 024 |  |
|         | MOKV2R12-C024 - MOK-V2 relay, ROLLING STOCK series, 24Vdc coil, with P2 coil tropicalization |   |   |   |   |     |  |

- (1) **E = ENERGY:** all applications except for railway ROLLING STOCK. Usable on plants of production, transport and distribution energy, railway fixed plants, petrochemical, heavy industry.  
**R = RAILWAYS, ROLLING STOCK:** application on board rolling stock (rail-tram-trolley vehicles). Electrical characteristics according to EN60077.
- (2) Other values on request.
- (3) Optional value.
- (4) The positive mechanical keying (error proof pin) is applied according to the manufacturer's model.
- (5) Railways and Rolling Stock version, Vdc only available.



## DIMENSIONS



## SOCKETS AND RETAINING CLIPS

|  | RETAINING CLIPS     |      |
|--|---------------------|------|
| Number of terminals (dimensioni normalizzate 5 x 0.8 mm) | 16                  |      |
| For wall or rail mounting                                |                     |      |
| Spring clamp, wall or DIN H35 rail mounting              | PAIR160             | RM48 |
| Screw, wall or DIN H35 rail mounting                     | 48BIP20-I DIN       | RM48 |
| Screw, wall mounting                                     | 48BL                | RM48 |
| For flush mounting                                       |                     |      |
| Retaining clips  | PRIR160             | RM48 |
| Double faston (4.8 x 0.8mm)                              | ADF2                | RM48 |
| Screw  | 43IL <sup>(1)</sup> | RM43 |
| For mounting on PCB                                      | 65                  | RM43 |

(1) Insert the clip before fastening the socket on the panel.



## INSTALLATION, OPERATION AND MAINTENANCE

### Installation

Before installing the relay on a wired socket, disconnect the power supply.

The preferential mounting position is on the wall, with the relay positioned horizontally in the "reading orienting" of marking so that the label is readable in the correct sense.

Spacing: the distance between adjacent relays depends on use conditions.

If a relay is used in the "less favorable" conditions that occur with "simultaneously":

- Power supply: the maximum allowed, permanently
- Ambient temperature: the maximum allowed, permanently
- Current on the contacts: the maximum allowed, permanently
- Number of contacts used: 100%

it is strongly recommended to space relay at least 5 mm horizontally and 20 mm vertically, to allow for proper upward heat dissipation and increase the longevity of the component.

Actually, relays could be used in less severe conditions. In this case, the distance between adjacent relays can be reduced or abolished. A correct interpretation of the use conditions allows the optimization of the available spaces. Contact AMRA for more information.

To increase relay longevity, we recommend mounting relays intended for "continuous use" (permanent power supply), alternating them with relays intended for less frequent use.

For a safe use, the retaining clip is recommended.

For use on rolling stock, relays have been tested to EN 61373 standard equipped with retaining clip(s).

## Operation

**Before use:** if relay is not used, for example after long storage periods, contact resistance may increase due to a natural and slight oxidation or polluting deposits.

In order to restore the optimal conductivity and for standard contacts (**NOT gold plated**) it is recommended to switch several time a load of at least 110Vdc - 100mA or 24Vdc - 500mA. The contacts will be "cleaned" thanks to the electric arc generated during the current interruption and the mechanical self-cleaning action.

The common contact rubs against the fixed poles (NO and NC contacts) both when opening and when closing, which ensures a self-cleaning action.

An increase in contacts' resistance, in most cases, does not represent a problem. Many factors contribute to the correct use of contact and consequently to the relay' long-term reliability:

- **Load:** the current switching generates an electric arc with cleaning effects. For proper electrical cleaning and performance keeping we recommend:
  - o Standard contacts: Minimum current = 20mA
  - o Gold plated contacts: Minimum current = 10mA
- **Operating frequency:** relays are components that can operate with a wide range of switching frequency. High frequency operation also allows a continuous cleaning effect by "sliding" (mechanical cleaning). In case of low frequency operation (for example few time a day), we advise:
  - o Use of contact with currents twice compared to those indicated.
  - o For currents lower than 10mA, use gold plated contacts and connect 2 contacts in parallel, in order to reduce the equivalent contact resistance
- **Pollution:** the presence of pollution can cause impurities on contact surface. Electric charges attract organic molecules and impurities that are deposited on the contact surface. Electrical and mechanical cleaning, respectively, burn and remove such impurities. In pollution presence, the minimum recommended currents must be respected. In extreme cases, provide double the cleaning current.

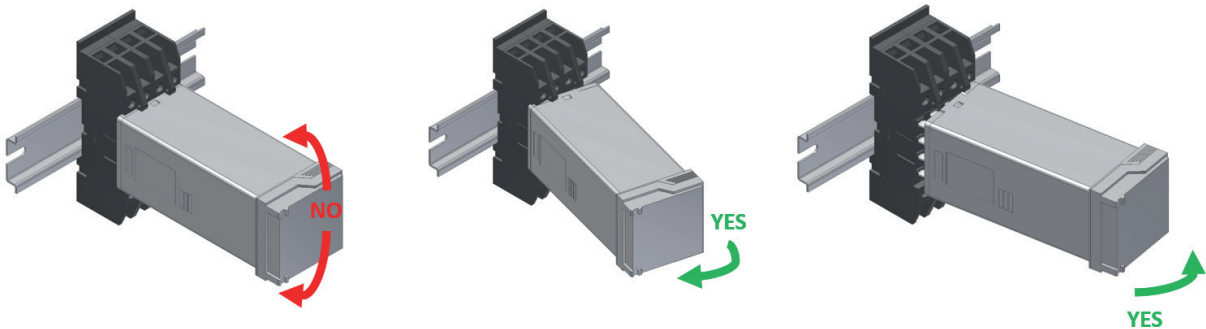
The possible formation of condensation inside the relay, when it is powered and the external ambient temperature is cold, is a normal phenomenon that has no effect on the electrical safety of the relay. In case of polluted or saline atmosphere, any condensation deposits on the contacts can degrade their performance in terms of conductivity.

## Maintenance

No maintenance is required.

In case of normal relay wear (reaching the end of electrical or mechanical life), the relay cannot be restored and must be replaced.

To check the component, relay removal must be carried out with slight lateral movements. An "up and down" movement can cause terminals damage.



Often the malfunctions are caused by power supply with inverted polarity, by external events or by use with loads exceeding the contact performance.

In case of suspected malfunction, energize relay and observe if mechanical operation of contacts / relay mechanism is performed. Pay attention to the power supply polarity, if relay is equipped with polarized components (example: diode, led).

- In case of expected operation, clean the contacts (see paragraph "OPERATION") and check if the circuit load ranges within the contact performance. If necessary, replace with relays with gold contacts. Note: the electrical continuity of contacts must be checked with adequate current.
- If it does not work, we recommend to use a relay of the same model and configuration.

If an investigation by AMRA is required, pull-out the relay from the socket, don't remove the cap, avoid any other manipulation and contact us. You will be asked for the following data: environmental conditions, power supply, switching frequency, contact load, number of operations performed.

The fault can be described through the "TECHNICAL SUPPORT" section of the website [www.amra-chauvin-arnoux.it](http://www.amra-chauvin-arnoux.it).

In any case, the relay cannot be repaired by the user.

## Storage

Storage conditions must guarantee the environmental conditions (temperature, humidity and pollution) required for the product conservation, in order to avoid deterioration.

The product must be stored in an environment sheltered from atmospheric agents and not polluted, with an ambient temperature between -50 and +85°C with max 75% RH. In any case, there must be no condensation. Before use, please read carefully "OPERATION" section.