

/// Plug-in voltage monitoring railway relay with 4 C/O contacts

Rugged plug-in relays for extreme reliability, within long endurance applications and harsh environments

MTDV4-U200

Voltage monitoring, timer delay-on/off relay

Part of D-platform



Description

Plug-in electronic voltage monitoring relay with optional delay-on and delay-off timer function and four change-over contacts. The delay time is adjustable with a lockable knob (either delay-on or delay-off, the other delay is fixed). The relay can also be supplied with fixed time delays (no knob). The pull-in voltage (U_{on}) and drop-out voltage (U_{off}) are both adjustable via internal screws. The relay can also be supplied with a fixed pull-in and drop-out voltage. Suitable for monitoring DC voltages.

The MTDV4-U200 offers a very small hysteresis (difference between pull-in and drop-out voltage). The relay is equipped with a LED which indicates the status of the relay contacts and activation of the time delay. Delay-off function for voltage drop up to 50% of minimum pull-in voltage, no auxiliary supply necessary.

Standard equipped with magnetic arc blow-out for high breaking capacity and long contact life.

The construction of the relay and choice of materials makes the MTDV4-U200 relay suitable to withstand low and high temperatures, shock & vibrating and dry to humid environments. No external retaining clip needed as integrated 'snap-lock' will hold relay into socket under all circumstances and mounting directions.

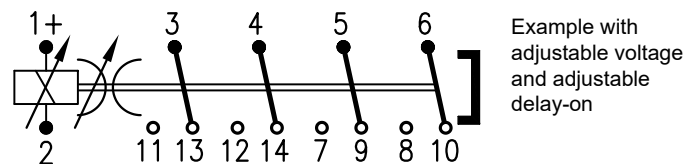
Application

These relays are designed for demanding rolling stock applications. The MTDV4-U200 is used in applications for voltage monitoring with or without time delay(s).

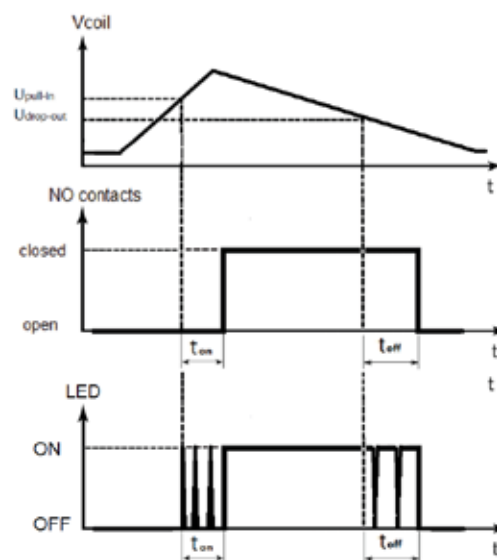
Features

- DC voltage monitoring relay with time delay
- Compact plug-in design
- 4 C/O contacts
- Drop-out and pull-in voltage adjustable via internal screws
- Also available with fixed pull-in and drop-out voltage (no internal screws)
- Very small hysteresis possible
- Time delay on pull-in and/or drop-out
- 1 delay time adjustable with a lockable knob, other delay time fixed
- Also available with fixed time delays (no knob)
- Time delay range: 0...60 s
- No auxiliary supply necessary
- 1 LED for status indication
- Flat, square and silver plated relay pins for excellent socket connection
- Integrated snap lock
- Optional positive mechanical keying to socket

Connection diagram



Timing diagram



Railway compliancy

| | | |
|-----------|-----------|----------------|
| EN 50155 | IEC 60947 | EN 45545-2 |
| IEC 60571 | IEC 61373 | NF F16-101/102 |
| IEC 60077 | EN 50121 | NF F 62.002 |



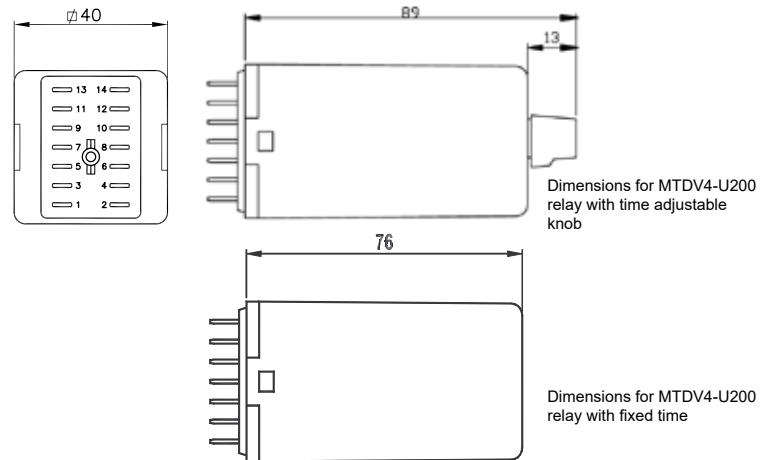
Voltage monitoring relay MTDV4-U200

Options

- Gold plated contacts
- Extra dust protection (only for fixed voltage setting)
- AgSnO₂ contacts, high resistant to welding
- No magnetic arc blow-out
- Double zener diode
- Double make / double break contacts

Remark: Not all combinations possible

Dimensions (mm)



Coil characteristics

| Type | Drop-out Uadjustable (VDC) | Pull-in Uadjustable (VDC) | Current consumption (mA) monitoring only, relay switched off | Current consumption (mA) relay switched on |
|------------|-------------------------------|------------------------------|--|---|
| MTDV4-U201 | 15-60 | 20-60 | 2 | 21 |
| MTDV4-U202 | 30-120 | 40-120 | 2.5 | 12 |
| MTDV4-U204 | 45-180 | 60-180 | 3 | 9 |
| MTDV4-U213 | 60-240 | 80-240 | 3.5 | 9 |
| MTDV4-U215 | 75-300 | 100-300 | 4 | 8 |

Other types on request

Remark: Maximum adjustable voltage is also the maximum allowable voltage, otherwise the relay can be damaged.

Remark: In June 2019 the coil tape color is changed to yellow. This change has no effect on any of the relay specifications or technical performance.

Example: MTDV4-U204 with drop-out voltage 95 VDC and pull-in voltage 110 VDC and:

| Application voltage (VDC) | Current consumption (mA) | Power (W) |
|---------------------------|--------------------------|-----------|
| 30 | 3 | 0.1 |
| 90 | 3 | 0.3 |
| 100* | 3 | 0.3 |
| 100** | 9 | 0.9 |
| 120 | 9 | 1.1 |

* Before relay has pulled in

** After relay has pulled in

Voltage monitoring relay

MTDV4-U200

Technical specifications

Voltage characteristics

| | | |
|--|--|--|
| Voltage settings | | Drop-out and pull-in both adjustable, or both fixed value |
| Minimal hysteresis | | 2 % x Upull-in |
| Accuracy | Fixed voltages | Max. ± 0.25 % deviation |
| | Adjustable voltages pre-set in factory | Max. ± 1 % deviation of maximum adjustable value. Remark: when checking pre-set voltages on required values take the time delay into account! For series production when required values are known, fixed values instead of pre-set values should be used for optimal accuracy. |
| | Repeatability | Max. ± 0.5 % deviation |
| | Temperature variation | Max. ± 0.02 % / degree (compared to 20 °C) |
| Example Pull-in voltage set on 110.0 VDC. The ambient temperature is 40 °C which is 20 degrees different compared to the standard 20 °C. This results in 0.4 % extra voltage variation. The total maximum voltage variation is then 0.5 % (due to repeatability) + 0.4 % (due to temperature) = 0.9 %. In this case every pull-in voltage will be between 109.0 and 111.0 VDC. | | |

Time delay characteristics

| | | | | | | |
|--|-----------------------|---|---------|----------|----------|----------|
| Time delay functions | | Delay on pull-in and/or delay on drop-out | | | | |
| Available time ranges | Fixed | Any value between 0...60 s | | | | |
| | Adjustable (xx) | 0...3 s | 0...6 s | 0...10 s | 0...30 s | 0...60 s |
| | | Other time ranges on request | | | | |
| Accuracy - set required value | Fixed time delay | Max. \pm 0.5 % deviation of set value | | | | |
| | Adjustable time delay | Max. \pm 10 % deviation of full scale After adjusting / fixed time setting: no variation in setpoint | | | | |
| Accuracy | Repeatability | < 2 % | | | | |
| | Temperature variation | Max. \pm 0.02 % / degree (compared to 20 °C) | | | | |
| | Voltage variation | Max. \pm 0.05 % / % mentioned average pull-in voltage | | | | |
| Operating times at nominal voltage without time delay: | | | | | | |
| | Pull-in time | < 75 ms (increasing voltage) < 350 ms (voltage switched from 0 to U _{max}) | | | | |
| | Release time | < 75 ms (decreasing voltage) < 50 ms (voltage switched from U _{max} to 0) | | | | |
| Remarks: | | | | | | |
| <ul style="list-style-type: none">• Delay on pull-in: Relay only pulls-in when voltage doesn't drop below pull-in voltage during delay time• Delay on drop-out: Relay only drops-out when voltage keeps below drop-out voltage during delay time, when voltage drops below 50% of minimum pull-in voltage the relay will drop-out immediately without time delay• Adjustable-fixed time delays: Either delay-on or delay-off can be adjustable, not both at the same time | | | | | | |
| <u>Example</u> | | | | | | |
| Type: MTDV4-U204 | | | | | | |
| Average pull-in voltage is mentioned in table Coil characteristics: 120 VDC | | | | | | |
| Delay-on: adjustable 0...3 s | | | | | | |
| Delay-on: time delay set on 2 s : delay will be between 1.7 s...2.3 s. | | | | | | |
| For example: 2.0 s. The ambient temperature is 40 °C which is 20 degrees different compared to the standard 20 °C. This results in 0.4 % extra time variation. The applied voltage is 84 VDC which is 30% different compared to the above mentioned voltage. This results in 1.5 % extra time variation. The total maximum time variation is then 2 % (repeatability) + 0.4 % (temperature variation) + 1.5 % (voltage variation) = 3.9 %. In this case every pull-in delay will be between 1.92 and 2.08 s. | | | | | | |

Voltage monitoring relay

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Contact characteristics

| | |
|--|---|
| Amount and type of contacts | 4 C/O |
| Maximum make current | 16 A |
| Peak inrush current | NF F 62-002 200 A (withstand > 10 x 200 A @ 10 ms, 1 min) |
| Maximum continuous current | 8 A |
| Maximum switching voltage | 250 VDC, 440 VAC |
| Minimum switching voltage | 12 V |
| Minimum switching current | 10 mA |
| Maximum breaking capacity (> 50.000 operations) | 72 VDC, 5 A (L/R ≤ 40 ms) 110 VDC, 10 A (resistive load) 110 VDC, 0.5 A (L/R ≤ 40 ms) |
| Contact resistance | 15 mΩ (initial) |
| Material | Ag standard (optional AgSnO ₂ , Au on Ag) |
| Contact gap | 0.7 mm |
| Contact force | > 200 mN |

Electrical characteristics

| | | |
|---------------------|---------------|----------------------|
| Dielectric strength | Pole-pole | 4 kV, 50 Hz, 1 min |
| | Cont-coil | 2.5 kV, 50 Hz, 1 min |
| | Open contacts | 2.5 kV; 50 Hz; 1 min |
| Pulse withstanding | IEC 60255-5 | 5 kV (1.2/50 μs) |
| EMC | EN 50121-3-2 | Compliant |

Mechanical characteristics

| | |
|---------------------------------|--|
| Mechanical life | 1 x 10 ⁶ operations |
| Maximum switching frequency | Mechanical: 3600 ops/h Electrical: 1200 ops/h |
| Torque value screw to lock knob | 0.2-0.4 Nm |
| Weight | 190 g (with adjustable knob) |

Environmental characteristics

| | |
|-----------------------|--|
| Environmental | EN 50125-1 |
| Vibration | IEC 61373, Category I, Class B, Body mounted |
| Shock | IEC 61373, Category I, Class B, Body mounted |
| Operating temperature | -40 °C...+70 °C |
| Humidity | 93% |
| Maximum altitude | 2000 meter. Higher altitudes are possible but have consequences mentioned in IEC 60664 (for example 5000 meter with bigger clearance distance) |
| Salt mist | IEC 60068-2-11, class ST4 |
| Damp heat | IEC 60068-2-30, Test method Db variant 1 |
| Protection | IEC 60529, IP40 (relay on socket) (with option K: IP50) |
| Fire & smoke | NF F 16-101, NF F 16-102, EN 45545-2: HL3 for requirements R22, R23, R26 |
| Insulation materials | Cover: polycarbonate Base: polyester |

Voltage monitoring relay

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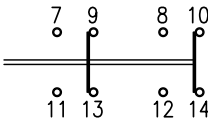
Railway compliancy

| | |
|----------------|--|
| EN 50155 | Railway applications - Rolling stock - Electronic equipment |
| IEC 60571 | Railway applications - Electronic equipment used on rolling stock |
| IEC 60077 | Railway applications - Electric equipment for rolling stock |
| IEC 60947 | Low-voltage switchgear and controlgear |
| IEC 61373 | Railway applications - Rolling stock equipment - Shock and vibration tests |
| EN 50121 | Railway applications - Electromagnetic compatibility |
| NF F16-101/102 | Railway rolling stock - Fire behavior |
| EN 45545-2 | Railway applications - Fire protection on railway vehicles Part 2: Requirements for fire behavior of materials and components |
| NF F 62-002 | Railway rolling stock - On-off contact relays and fixed connections |

Voltage monitoring relay

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Options

| Code | Description | Remark | Cannot be combined with: |
|-------------------|-----------------------------------|---|--------------------------|
| Standard options: | | | |
| E* | Au; Gold plated contacts | | M |
| K | Extra dust protection | Only for fixed voltage settings. IP50 Cat 2 for the relays mounted in a Mors Smitt socket. Application PD1/PD2 and contact load > 0.5 A. | |
| N | No magnetic arc blow-out | | |
| Q | Double zener diode over coil | Maximum allowed peak voltage 180 V, higher voltage will damage the diode | |
| Y | Double make/double break contacts | 2 C/O DM/DB  | |
| Keying | Coil coding relay and socket | For details see page 9 | |

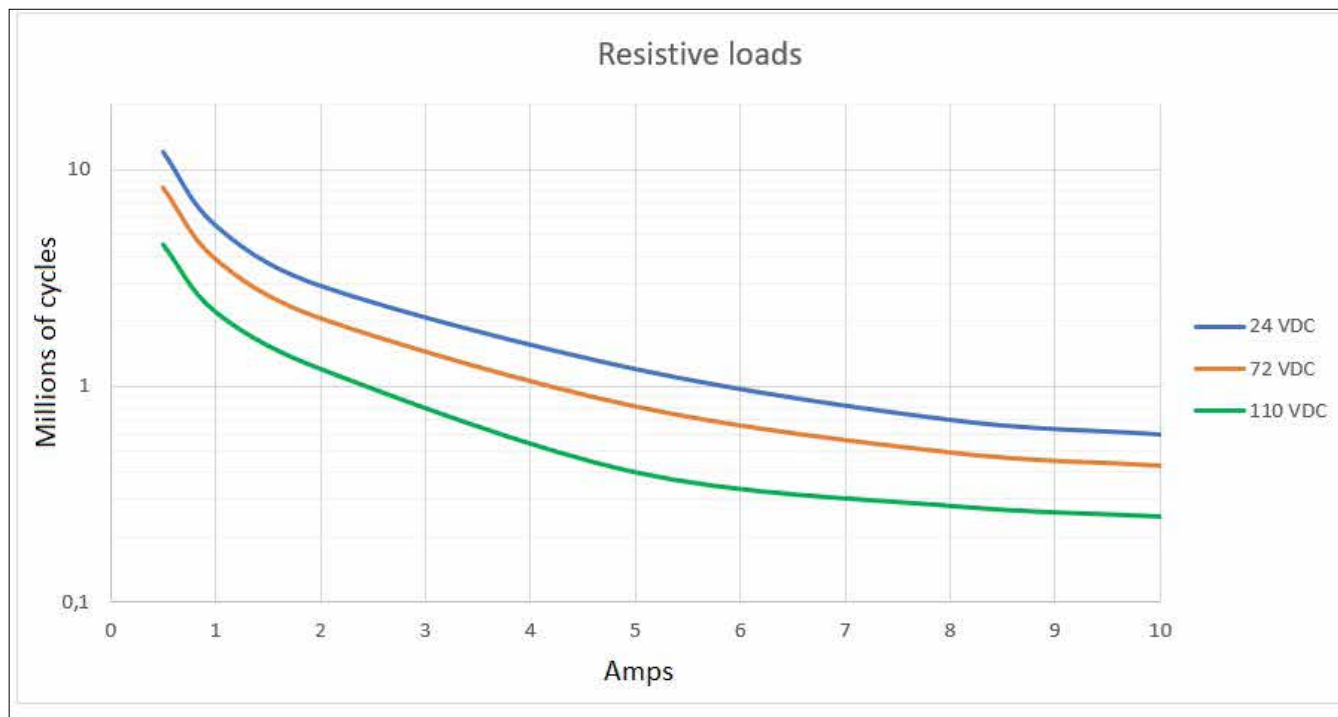
| | | | |
|------------------|--|-------------------|---|
| Special options: | | | |
| M | AgSnO ₂ ; "non-weldable" contacts | Icontact > 100 mA | E |

| | | | |
|--|---|--|--|
| * Gold plated contacts characteristics | | | |
| Material | Ag, gold plated | | |
| Maximum switching voltage | 60 V (higher voltages may be possible, contact Mors Smitt for more information) | | |
| Maximum switching current | 400 mA (at higher rate gold will evaporate, then the standard silver contact rating of minimum 10 mA and 12 V is valid) | | |
| Minimum switching voltage | 5 V | | |
| Minimum switching current | 1 mA | | |

Remark: For application support or technical product support, contact your local Mors Smitt sales office (see contact details on last page).

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Electrical life expectancy



By connecting 2 contacts in series the DC current breaking capacity is increased by 50 %. Electrical lifetime is tested under laboratory conditions with switching frequency 0.33 Hz.

Note: The actual electrical lifetime in the application is affected by the switching frequency, type of contact (N/O or N/C), environmental conditions, etc.

Expected electrical lifetime inductive loads:

| Inductance | Voltage | % of resistive load | Remark |
|------------|---------|---------------------|--------------------|
| 15 ms | 24 VDC | 30 % | |
| 15 ms | 72 VDC | 25 % | Tested up to 8 A |
| 15 ms | 110 VDC | 20 % | Tested up to 0.5 A |
| 40 ms | 24 VDC | 10 % | |
| 40 ms | 72 VDC | 4 % | Tested up to 5 A |
| 40 ms | 110 VDC | 2 % | Tested up to 0.5 A |

For other contact loads: contact Mors Smitt.

Voltage monitoring relay MTDV4-U200

Mounting possibilities/sockets

| | | | | |
|--|--|--|---|--|
|  V3 |  V22BR |  V23 |  V23BR |  V26 |
|  V29 |  V31 |  V32 |  V33 | |

Surface/wall mounting

| | | |
|-----------|-------|---|
| 338000302 | V22BR | Screw socket, wall mount, front connection (9 mm terminals) |
| 338000580 | V23 | Screw socket, wall mount, front connection (7.5 mm terminals) |
| 338000610 | V29 | Spring clamp socket, wall mount, front dual connection (2.5 mm ²) |

Rail mounting

| | | |
|-----------|-------|---|
| 338000580 | V23 | Screw socket, rail mount, front connection (7.5 mm terminals) |
| 338000402 | V23BR | Screw socket, rail mount, front connection (9 mm terminals) |
| 338000610 | V29 | Spring clamp socket, rail mount, front dual connection (2.5 mm ²) |

Panel/flush mounting

| | | |
|-----------|-----|---|
| 338100100 | V3 | Solder tag socket, panel mount, rear connection |
| 328400100 | V26 | Crimp contact socket, panel mount, rear connection, A260 crimp contact |
| 338000560 | V31 | Faston connection socket, rear dual connection (4.8 x 0.8 mm) |
| 338000670 | V33 | Push-in terminal socket, panel mount, rear dual connection (3.3 mm ²) |

PCB mounting

| | | |
|-----------|-----|----------------------|
| 338000561 | V32 | PCB soldering socket |
|-----------|-----|----------------------|

No external retaining clip needed as the 'snap-lock' will hold the relay into the socket under all circumstances and mounting directions (according shock & vibration requirements IEC 61373, Category I, Class B, Body mounted). If regulations require external retaining clips, these are available as well.

For more details see datasheets of the sockets on www.morssmitt.com

Voltage monitoring relay MTDV4-U200

Mechanical keying relay and socket (optional)



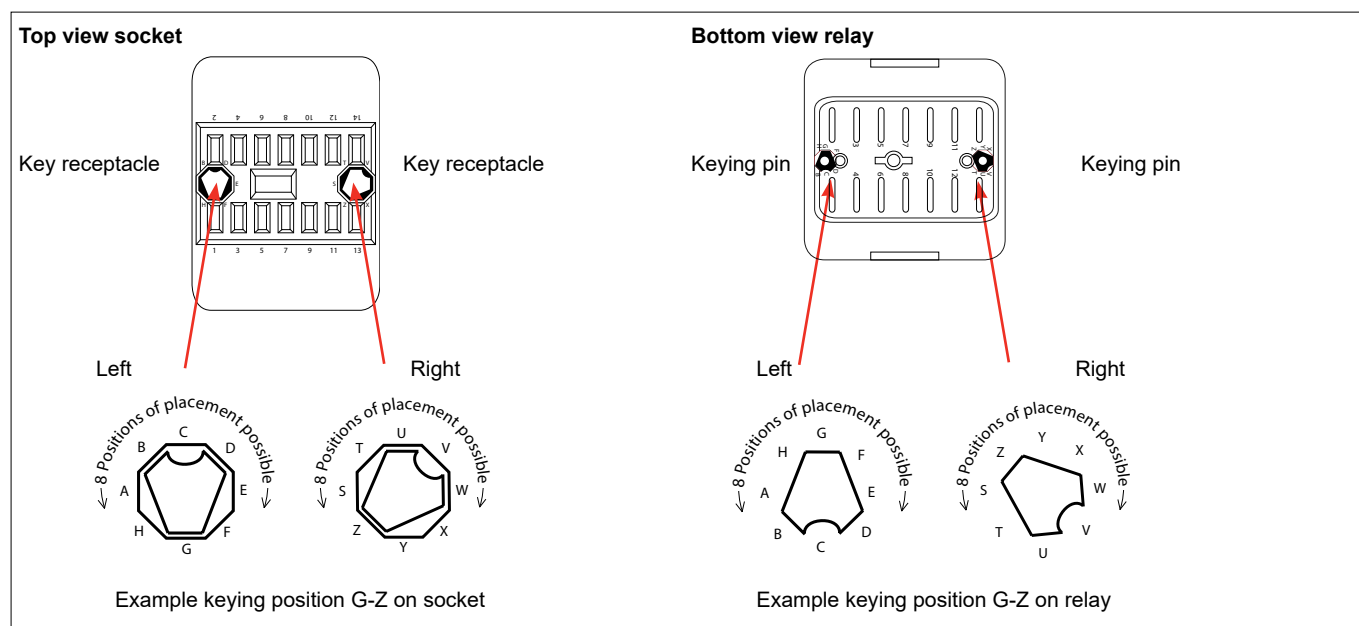
Function:

- To prevent wrong installation
- To prevent damage to equipment
- To prevent unsafe situations

Using keyed relays and sockets prevents a relay is inserted in a wrong socket. For example it prevents that a 24 VDC relay is put in a 110 VDC circuit. Positive discrimination is possible per different function, coil voltage, timing, monitoring, safety and non-safety.

The D relay socket keying option gives $8 \times 8 = 64$ possibilities. Upon ordering the customer simply indicates the need for the optional keying. Mors Smitt will assign a code to the relay and fix the pins into the relay. The sockets are supplied with loose key receptacles. Inserting the keys into the socket is very simple and self explaining.

Remark: Sockets and relay shown are examples.



Keying codes

| | Coil voltage code | | | | |
|-----------------------------|-------------------|------|------|------|------|
| | U201 | U202 | U204 | U213 | U215 |
| Silver contacts (standard) | AS | AT | AV | AX | AY |
| Gold contacts (option E) | DT | HU | HV | HX | HY |
| Silver tin oxide (option M) | GT | GU | GW | GX | GY |

Voltage monitoring relay MTDV4-U200

Important for relay selection and operation

Make sure the relay is suitable for the application. For critical applications (for example: green loop applications) relays should be checked on correct working during periodic inspection.

Recommendations for long time contact reliability

For relays to enable failure free performance over a very long operational time, it is important to create the right circumstances. In any relay, contact usage and atmospheric conditions influence the contact surface. To counter this effect it is common practice to use a safety factor of > 2 to ensure long time contact reliability.

Therefore for long time contact reliability we recommend:

- Silver contacts: a minimum contact current of 20 mA per contact
- Gold contacts: a minimum contact current of 10 mA per contact
- Double Make Double Break contacts: a minimum contact current of 40 mA per contact
- When low currents are switched and not frequently, e.g. 10 mA once a day, it is advised next to gold plated contacts to put similar contacts within the same relay in parallel
- With higher load switching, e.g. 110 VDC and > 1 A, put relay contacts in series
- Rule of thumb: any relay works best with switching currents > 20 mA in DC environment when frequently switched. When not switched frequently a higher switching current like 50 mA is better for a long reliable operational time
- Check relays regularly, for example with the Mors Smitt Portable Relay Tester and visually through the transparent cover

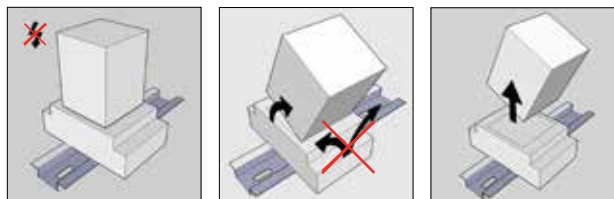
Instructions for use

Installation

Before installation or working on the relay: disconnect the power supply first (no hot swapping)! Install socket and connect wiring according to the terminal identification. Plug relay into the socket ensuring there is no gap between the bottom of relay and the socket. Reverse installation into the socket is not possible due to the mechanical blocking snap-lock feature. Check to ensure that the coil connection polarity is not reversed. Relays can be mounted tightly together to save space. When rail mounting is used, always mount the socket in the direction of the UP arrow, to have proper fixation of the socket on the rail. Torque value screw to lock knob: 0.2-0.4 Nm.

Warning!

- Never use silicon in the proximity of the relays
- Do not use the relay in the presense of flammable gas as the arc generated from switching could cause ignition
- To remove relays from the socket, employ up and down lever movements. Sideway movement may cause damage to the coil wires



- Relays should never be swapped to other circuit positions when taken out of its socket for inspection or fault finding, always place it back into the original position to prevent contact resistance problems. Contact resistance problems can be created when swapping relays between different circuit loads due the contact wear/condition having changed during its operational life.

Operation

After installation always apply the rated voltage to the coil to check correct operation. Long term storage may corrode the silver on the relay pins. When plugging the relay into the socket, the female bifurcated or trifurcated receivers will automatically cut through the corrosion on the pins and guarantee a reliable connection.

Before actual use of relays, it is advised to switch the load several times with the contacts. The contacts will both be electrically and mechanically cleaned due to the positive wiping action. Sometimes a contact can build up increased contact resistance (≤ 15 m Ω when new). When using silver contacts one can clean the contact by switching a contact load a few times using > 24 VDC & ~ 2 A. Increased contact resistance is not always problematic, as it depends on circuit conditions. In general a contact resistance of 1 Ω is no problem, consult Mors Smitt for more information.

Condensation in the relay is possible when the coil is energised (warm) and the outside, environmental temperature is cold. This is a normal phenomenon and will not affect the function of the relay. Materials in the relay have no hygroscopic properties.

Voltage monitoring relay **MTDV4-U200**

Inspection / maintenance

Correct operation of the relay can easily be checked as the transparent cover provides good visibility of the moving contacts. If the relay does not seem to operate correctly, check for presence of the appropriate coil voltage and polarity using a suitable multimeter. If a LED is fitted, it indicates voltage presence to the coil. If coil voltage is present, but the relay does not operate, a short circuit of the suppression diode is possible (This may have been reversed due to the coil connection).

Relays can easily be tested with the Mors Smitt Relay Tester. More information on: www.morssmitt.com.

If the relay doesn't work after inspection, replace the relay unit with a similar model. Do not attempt to open the relay cover or try to repair. Contacts are calibrated and in balance, touching can affect proper operation. Also resoldering may affect correct operation. Since 2009 relays have tamper proof seals fitted and once broken, warranty is void.

Most relay defects are caused by installation faults such as overvoltage, spikes/transients, high/short current far exceeding the relay specifications. When returning the relays for investigation, please provide all information on the RMA form. Send defective relays back to the manufacturer for repair or replacement. Normal wear and tear or external causes are excluded from warranty.

RMA procedure see www.morssmitt.com

Voltage monitoring relay

MTDV4-U200

Ordering scheme

| MTDV4-U2 - C | | | | | | | | | | Code |
|---|-----|---|---|-----|---|--|--|--|--|--|
| Coil voltages | 01 | | | | | | | | | Drop-out 15-60 VDC, pull-in 20-60 VDC |
| | 02 | | | | | | | | | Drop-out 30-120 VDC, pull-in 40-120 VDC |
| | 04 | | | | | | | | | Drop-out 45-180 VDC, pull-in 60-180 VDC |
| | 13 | | | | | | | | | Drop-out 60-240 VDC, pull-in 80-240 VDC |
| | 15 | | | | | | | | | Drop-out 75-300 VDC, pull-in 100-300 VDC |
| Standard options (add as many options as needed) | C | | | | | | | | | Low temperature (-40 °C) |
| | E | | | | | | | | | Gold plated contacts |
| | K | | | | | | | | | Extra dust protection, IP50 |
| | N | | | | | | | | | No magnetic arc blow-out |
| | Q | | | | | | | | | Double zener diode |
| Special option (minimum order quantity: 20) | Y | | | | | | | | | Double make/ double break |
| | M | | | | | | | | | AgSnO ₂ contacts, highly resistant to welding |
| | ... | S | / | ... | S | | | | | Fixed: Any value between 0...60 s Adjustable: 0...3 s 0...6 s 0...10 s 0...30 s 0...60 s |
| | ... | S | / | ... | S | | | | | Remark: for standard applications delay-on and delay-off times minimal 0.5 s is recommended to avoid unwanted switching due to short voltage variations. |
| | ... | S | / | ... | S | | | | | See coil voltages |
| Drop-out voltage / Pull-in voltage | | | | | | | | | | See table on page 9, leave blank for no keying |
| - Adjustable: don't mention voltage range in code | | | | | | | | | | |
| - Fixed: mention drop-out / pull-in voltage | | | | | | | | | | |
| - Special: Adjustable but preset in factory | | | | | | | | | | |
| - For factory preset value put it between brackets () | | | | | | | | | | |
| - It can be one voltage or both | | | | | | | | | | |
| Remark: both pull-in and drop-out voltages must be either adjustable or fixed | | | | | | | | | | |
| Keying code | | | | | | | | | | |

| Examples | Options | Pull-in time delay | Drop-out time delay | Drop-out voltage | Pull-in voltage | Keying |
|--|--|--------------------|---------------------|---|---|-----------|
| MTDV4-U201-C 0.5s/0.5s | | 0.5 s fixed | 0.5 s fixed | 15-60 VDC adjustable | 20-60 VDC adjustable | No keying |
| MTDV4-U202-CE 2s/1s 35/65 VDC code HU | Gold contacts | 2 s fixed | 1 s fixed | 35 VDC fixed | 65 VDC fixed | Code HU |
| MTDV4-U204-CQY 0-60s/12s 105/120 VDC code AV | Double zener diode Double make / double break | 0-60s adjustable | 12 s fixed | 105 VDC fixed | 120 VDC fixed | Code AV |
| MTDV4-U213-C 3s/0-10s (130)/(150) VDC | | 3 s fixed | 0-10 s adjustable | 60-240 VDC adjustable Factory set on 130 VDC | 80-240 VDC adjustable Factory set on 150 VDC | No keying |

Voltage monitoring relay **MTDV4-U200**

 Over 11 million Mors Smitt relays in use in rail transport applications worldwide!

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