/// 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 (Uon) and drop-out voltage (Uoff) 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.

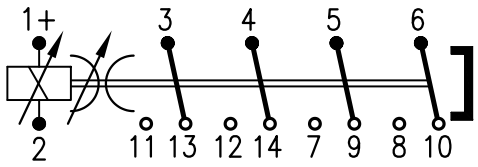
Application

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

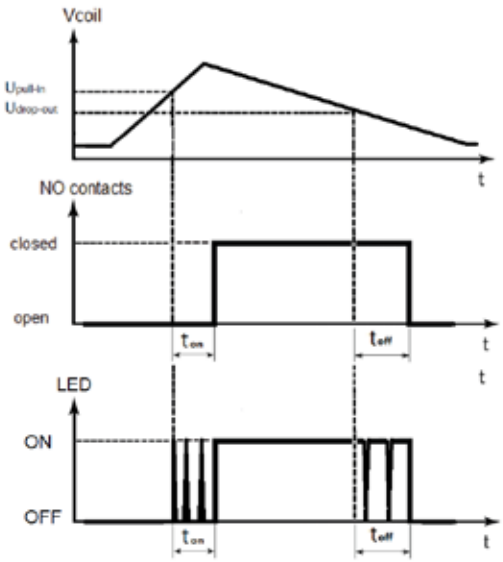
- DC voltage monitoring relay with time delay
- Compact plug-in design
- 4 C/O contacts
- Drop-out and pull-in voltage adjustable via internal screws
- Also available with fixed pull-in and drop-out voltage (no internal screws)
- Very small hysteresis possible
- Time delay on pull-in and/or drop-out
- 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 relay to socket

Connection diagram



Example with adjustable voltage and adjustable delay-on

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

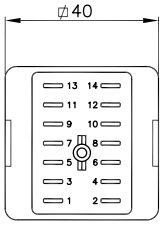
Voltage monitoring relay
MTDV4-U200

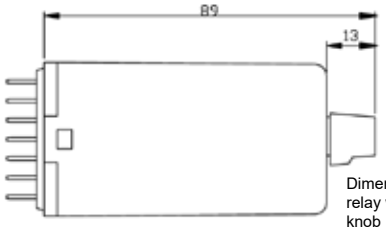
Options

- Gold plated contacts
- Extra dust protection (only for fixed voltage setting)
- $AgSnO_2$ contacts, high resistant to welding
- No magnetic arc blow-out
- Double zener diode
- Double make / double break contacts

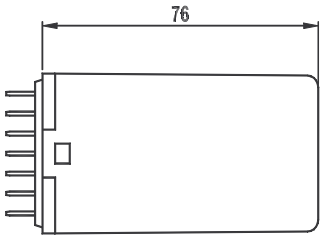
Remark: Not all combinations possible

Dimensions (mm)





Dimensions for MTDV4-U200 relay with time adjustable knob



Dimensions for MTDV4-U200 relay with fixed time

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

Technical specifications

Voltage monitoring relay
MTDV4-U200

Voltage characteristics

Voltage settings		Drop-out and pull-in both adjustable, or both fixed value
Minimal hysteresis		2 % x $U_{pull-in}$
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. ± 0.5 % deviation of set value
	Adjustable time delay	Max. ± 10 % deviation of full scale After adjusting / fixed time setting: no variation in setpoint
Accuracy	Repeatability	< 2 %
	Temperature variation	Max. ± 0.02 % / degree (compared to 20 °C)
	Voltage variation	Max. ± 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:
- 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

Example
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

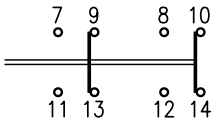
Environmental	EN 50125-1
Vibration	IEC 61373, Category I, Class B, Body mounted
Shock	IEC 61373, Category I, Class B, Body mounted
Operating temperature	-40 °C...+70 °C
Humidity	93%
Maximum altitude	2000 meter. Higher altitudes are possible but have consequences mentioned in IEC 60664 (for example 5000 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

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
MTDV4-U200

Options

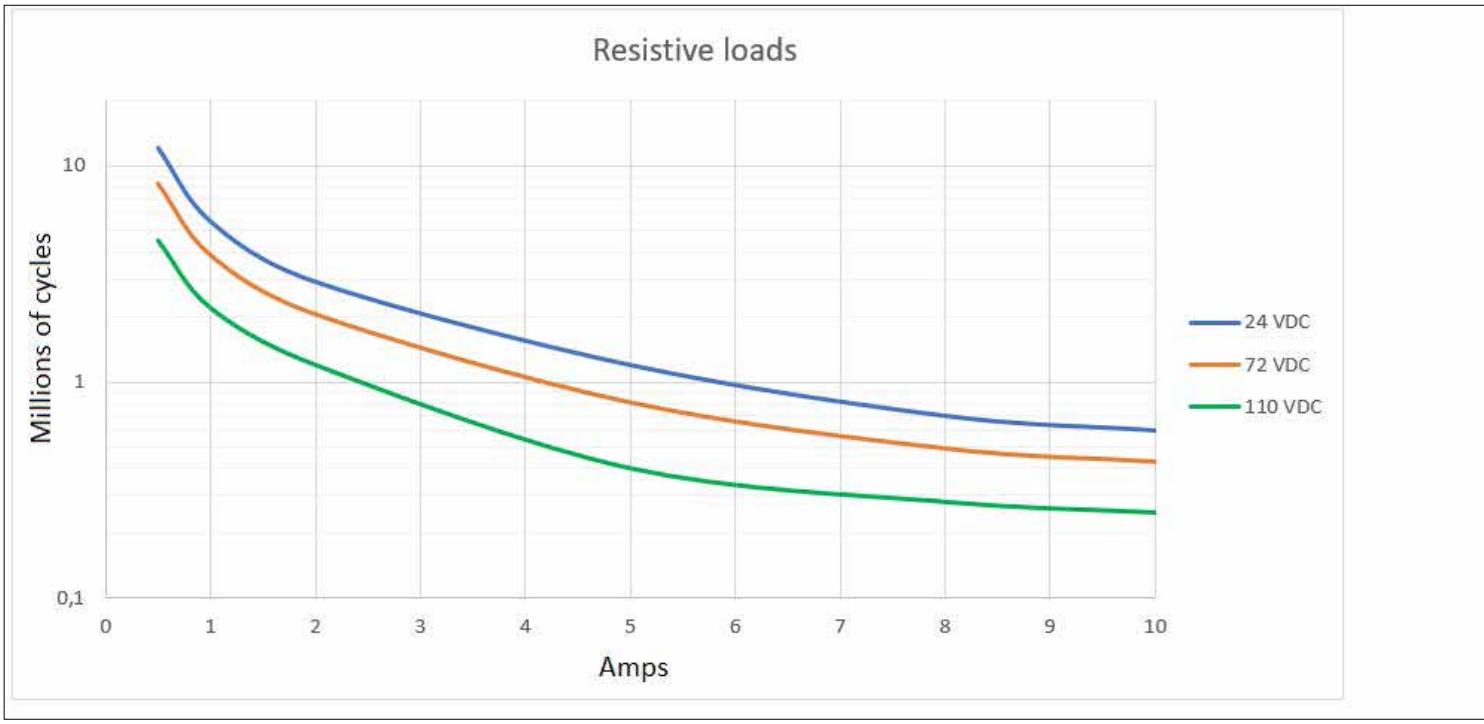
Code	Description	Remark	Cannot be combined with:
Standard options:			
E*	Au; Gold plated contacts (10 µm)		M
K	Extra dust protection	Only for fixed voltage settings. IP50 Cat 2 for the relays mounted in a Mors Smitt socket. Application PD1/PD2 and contact load > 0.5 A.	
N	No magnetic arc blow-out		
Q	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, 10 µm 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).

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)

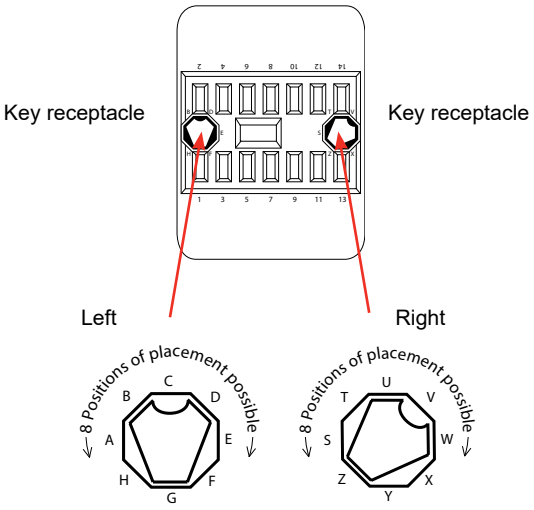
Function:
- To prevent wrong installation
- To prevent damage to equipment
- To prevent unsafe situations

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 x 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.

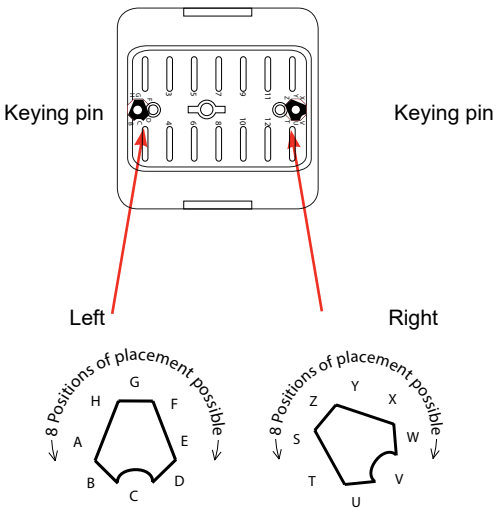
Remark: Sockets and relay shown are examples.

Top view socket



Example keying position G-Z on socket

Bottom view relay



Example keying position G-Z on relay

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.

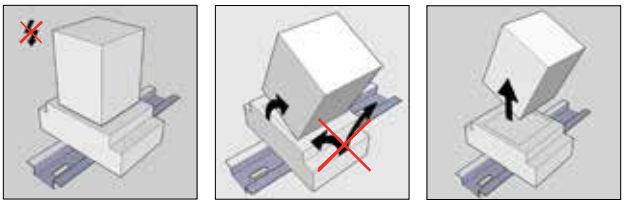
Therefore for long time contact reliability we recommend:
- Silver contacts: a minimum contact current of 20 mA per contact
- Gold contacts: a minimum contact current of 10 mA per contact
- Double Make Double Break contacts: a minimum contact current of 40 mA per contact
- When low currents are switched 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 mΩ when new). When using silver contacts one can clean the contact by switching a contact load a few times using >24 VDC & ~ 2A. 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.

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

Ordering scheme

MTDV4-U2 [ ] - C [ ] / [ ] [ ] / [ ] Code [ ]

			Cannot be combined with:
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	
	C	Low temperature (-40 °C)	
Standard options	E	Gold plated contacts	M
(add as many options as needed)	K	Extra dust protection, IP50	
	N	No magnetic arc blow-out	
	Q	Double zener diode	
	Y	Double make/ double break	
Special option			
(minimum order quantity: 20)	M	$AgSnO_2$ contacts, highly resistant to welding	E
Pull-in time delay / Drop-out time delay - Both fixed or 1 fixed and 1 adjustable	... 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 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.	
Drop-out voltage / Pull-in voltage - 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	..... / .... VDC	See coil voltages	
Keying code		See table on page 9, leave blank for no keying	

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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