/// Plug-in railway relay with 8 C/O contacts

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

KDN-U200N

Latching relay

Part of D-platform

(picture for reference only)

Description

Plug-in bistable railway relay with eight change-over contacts, for reliable switching of very low currents (1 mA @5 VDC) up to currents of 10A @ 110VDC. The contacts remain in the last powered position, the position is clearly shown via a position indicator.

Bistable by means of two coils and a mechanical rocker mechanism. The two separate coils are galvanically isolated.

The built-in magnetic arc blow-out ensures adequate DC breaking capacity resulting in long contact life. The integrated contact separation prevents cross pollution of contacts. On the relay cover the serial number and data matrix code are shown for ease of traceability.

The construction of the relay and choice of materials make the KDN-U200N relay suitable to withstand corrosive atmospheres, 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 orientations.

Compact design, choice of many options and a wide range of sockets makes the KDN-U200N relay an easy and flexible solution to use.

Features

- Latching (bistable) relay
- Compact plug-in design
- 8 C/O contacts
- 2 galvanic isolated coils
- Clear position indicator
- Magnetic arc blow-out ensuring long contact life
- Minimum switching current 1 mA
- Maximum continuous current 10 A
- Wide temperature range -40 ºC...+70 ºC
- Mechanical life > 2 million operations
- Electrical life e.g. > 10 million operations at 0.5 A, 24 VDC
- Data matrix with serial number for traceability
- Integrated snap-lock, no external retaining clip needed
- Transparent cover for visual inspection
- Many options and sockets available

Application

The KDN-U200N can be used in demanding rolling stock applications where eight contacts are used in one relay and the contacts are set and reset with permanent power or impulses.

Relays continue to play a vital role in reliable train operation. Key functions are galvanic isolation between control (computers/ PLC’s) and power circuits providing system isolation, contact multiplication and amplification.

Other unique features are:

- predictable failure behavior (Fail Safe) making system safety validation a lot more simple than using computer based solutions like PLC’s
- long term availability (no obsolescence)
- easy maintenance by plug-in feature and transparent cover
- unlike more sensitive electronics, relays are insensitive to EMI

Using these features one can build a hardwired, fail safe control system which is cyber secure and insensitive to electro magnetic disturbances and surges. Relays are ideal to use in trains for signal transfer/repeat, safety interlocking functions (brake - doors), load on-off switching and sub-system isolation.

Railway compliancy

EN 50155: 2017	IEC 61373: 2010
IEC 60571: 2012	EN 50121-3-2: 2016
IEC 60077-1: 2017	NF F16-101/102
IEC 60947-5-1: 2016	EN 45545-2: 2020
IEC 60947-5-4: 2002	

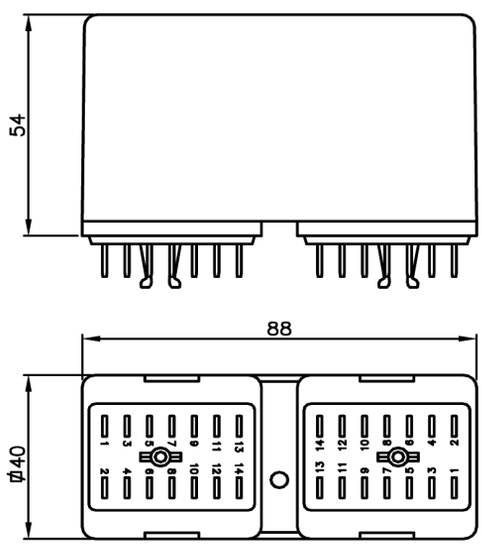
Latching relay
KDN-U200N

Options

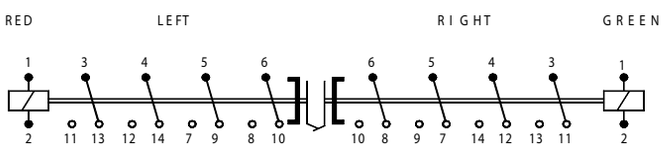
- Back EMF protection diode
- Gold plated contacts
- IP50 dust protection
- $AgSnO_2$ contacts, weld resistant for capacitive loads
- Double Zener diode
- Double make/double break contacts
- Keying (coding relay to correct socket)

Remark: Not all combinations possible

Dimensions (mm)



Connection diagram



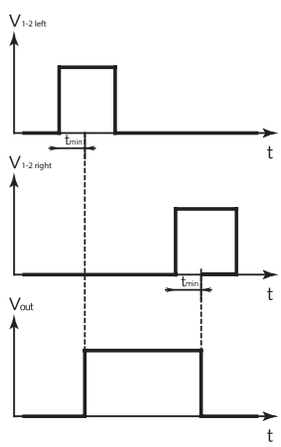
Please note the relay will leave production in open state (with open armature at the left side, flag is green) with all contacts in the position shown in the connection diagram. Due to severe shocks far exceeding maximum levels mentioned in IEC 61373 (Category I, Class B, Body mounted), it can happen the left armature closes and stay closed. Therefore after installation all relays must be checked on correct state of the contacts and activate

both coils 10 times alternately for correct operation.

Weight

~ 305 g

Timing diagram



Serializing

Each relay is marked with a unique serial number to which link important information and test results.

The GTIN (Global Trade Item Number) and part number are printed on each relay in both text and data matrix code according the worldwide recognized GS1 standard, being able to scan each relay for logistical and traceability purposes.

Sockets

		Mounting			
		Surface / Wall	35 mm rail	Panel / Flush	PCB
Terminal connection	Screw	V93	V93	-	-
	Screw - wide terminals	V92BR	V93BR	-	-
	Spring clamp	V99	V99	V88	-
	Faston	-	-	V89	-
	Crimp	-	-	V97	-
	Solder tag	-	--	V96	-
	PCB	-		-	2x V32

For more information see the respective datasheets

Technical specifications

Latching relay
KDN-U200N

Coil characteristics

Minimum impulse time	50 ms
Operating times at nominal voltage (typical):	
Operate time N/O contacts	max 18 ms
Bounce time N/O contacts	≤ 4 ms
Bounce time N/C contacts	≤ 8 ms
Inductance L/R at Unom (typical):	
Energized	11 ms
Released	8 ms
Operating voltage range	70 % - 125 % Unom

Type	U_{nom} (VDC)	U_{min} (VDC)	U_{max} (VDC)	$U_{drop-out}$ (VDC)	R_{coil} * (Ω)	P_{nom} (W)
KDN-U201N	24	16.8	30	9.6	174	3.3
KDN-U202N	48	33.6	60	19.2	666	3.5
KDN-U203N	72	50.4	90	28.8	1580	3.3
KDN-U204N	110	77	137.5	44.0	3680	3.3
KDN-U205N	96	67.2	120	38.4	2760	3.3
KDN-U206N	12	8.4	15	4.8	44	3.3
KDN-U207N	36	25.2	45	14.4	352	3.7

Other types on request
* The Rcoil is measured at room temperature and has a tolerance of ± 10%

Remarks:
- Umin is the must-operate voltage at which the relay has picked up in all circumstances (worst-case situation), in practice the relay picks up at a lower voltage
- Udrop-out is the must-release voltage at which the relay has dropped-out in all circumstances (worst-case situation), in practice the relay drops out at a higher voltage
- Always select the nominal voltage as close as possible to the actual voltage in the application

Contact characteristics

Contact configuration	8 C/O
Peak inrush current NF F 62-002	200 A (withstand > 10 x 200 A @ 10 ms, 1 min) 80 A (withstand > 10 x 80 A @ 200 ms, 1 min) 40 A (withstand > 10 x 40 A @ 500 ms, 1 min) 30 A (withstand > 10 x 30 A @ 1000 ms, 1 min)
Continuous current	10 A
Maximum switching voltage	250 VDC, 440 VAC
Minimum switching voltage*	5 V
Minimum switching current*	1 mA
Maximum breaking capacity (> 50.000 operations)	110 VDC, 10 A (resistive load) 72 VDC, 5 A (L/R ≤ 40 ms) 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

* Standard silver contacts tested in lab conditions. We strongly advice to always use gold plated contacts when switching very low currents, as long time reliable operation depends also on switching frequency and environmental conditions. Take recommendations for long time reliability on page 11 into account.

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Contact reliability according IEC 60947-5-4

Contact switching load	Contact material	Failure rate λ_c*	Mean number of operating cycles to contact failure m_c*
1 mA , 5 VDC resistive	Gold (option E)	$5x10^{-8}$	20.000.000
5 mA , 24 VDC resistive	Gold (option E)	$4x10^{-8}$	25.000.000
10 mA , 50 VDC resistive	Silver (standard)	$2x10^{-8}$	50.000.000

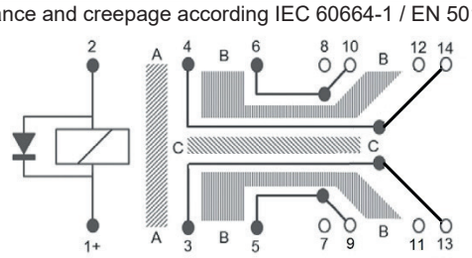
*at confidence level 90%

Note: tested in factory environment at ambient temperature 20 ºC. To underline the reliability of low current switching with the new D-U200N relay in parallel a 1 mA / 5 V test was done using standard silver contacts. The result was the same reliability. But since real train conditions are far different from Lab conditions we always recommend gold contacts for such low contact ratings.

Electrical characteristics

Dielectric strength	Pole-pole Cont-coil Open contacts	4 kV, 50 Hz, 1 min 2.5 kV, 50 Hz, 1 min 2.5 kV; 50 Hz; 1 min

Clearance and creepage according IEC 60664-1 / EN 50124-2



Section	Clearance	Creepage	Material group	Unom*
A	≥ 2.2 mm	≥ 3.0 mm	I (CTI600)	≤ 220 V
B	≥ 3.0 mm	≥ 3.0 mm	I (CTI600)	≤ 300 V
C	≥ 6.1 mm	≥ 6.1 mm	I (CTI600)	≤ 696 V

*For basic insulation, PD2 and OV3

Pulse withstanding	IEC 60255-5	5 kV (1.2/50 µs)
Insulation resistance	EN 50155	> 20 MΩ (test voltage 500 VDC)

Environmental characteristics

Vibration	IEC 61373, Category I, Class B, Body mounted
Shock	IEC 61373, Category I, Class B, Body mounted
Operating temperature	-40 °C...+70 °C
Operating temperature class	OT4
Humidity	98%
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
Dry heat	IEC 60068-2-2 test Be
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: nylon
Natural cooling or forced ventilation constraints for the equipment	None: no extra measures necessary, relays can be mounted tightly together to save space
REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals	European Regulation No 1907/2006

Latching relay
KDN-U200N

RAMS features

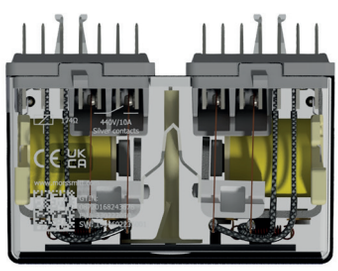
Life class	L4 (Useful life 20 years, take electrical life cycle curves into account)
Repairability	Non-repairable
Maintenance instructions	See inspection/maintenance on page 10/11
Reliability / lifetime Mechanical lifetime Low energy electrical lifetime High energy electrical lifetime	 > 2 million operations, maximum switching frequency 1 Hz (1 million operations at -50 °C) 5 million operations, maximum switching frequency 1 Hz See life cycle curves on page 7
Storage precautions	Storage temperature: -50 °C…+85 °C Store in original packaging

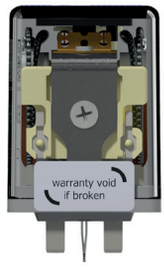
Product labeling

Part number identification	Part number mentioned on top side relay
Serial number identification	Serial number mentioned on top side relay Serial number = Lot number + year + week + reference number
Data matrix code	According GS1 standard, placed on top side relay 01 Global Trade Item Number 240 Part number 21 Serial number Example: 01123456789012324012345678921 1234562209001
Revision index identification	Linked to serial number
Terminals	Identification on bottom plate relay Relay to be used with Mors Smitt relay sockets which have clear terminal identification on each socket

Railway compliancy

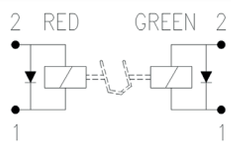
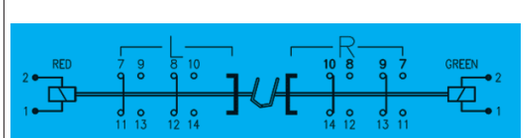
EN 50155: 2017	Railway applications - Rolling stock - Electronic equipment
IEC 60571: 2012	Railway applications - Electronic equipment used on rolling stock
IEC 60077-1: 2017	Railway applications - Electric equipment for rolling stock
IEC 60947-5-1: 2016 / IEC 60947-5-4: 2002	Low-voltage switchgear and controlgear
IEC 61373: 2010	Railway applications - Rolling stock equipment - Shock and vibration tests
EN 50121-3-2: 2016	Railway applications - Electromagnetic compatibility
NF F16-101/102	Railway rolling stock - Fire behavior
EN 45545-2: 2020	Railway applications - Fire protection on railway vehicles Part 2: Requirements for fire behavior of materials and components





Latching relay
KDN-U200N

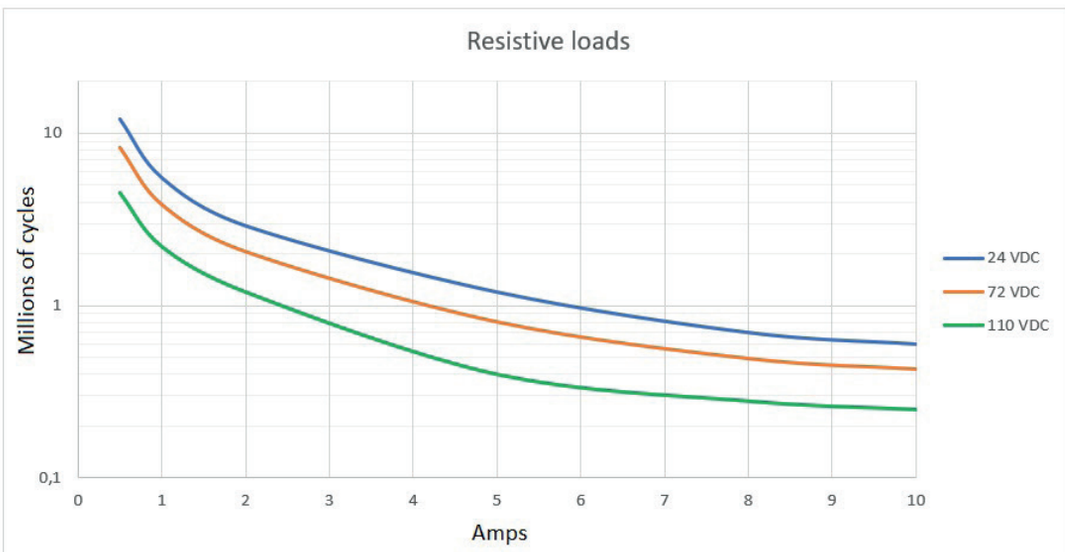
Options

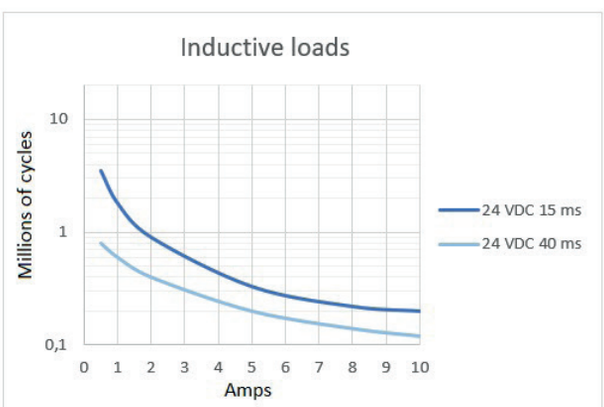
Code	Description	Remark	Cannot be combined with:
Standard options:			
D	Back EMF protection diode		
E*	Au; Gold plated contacts (10 µm)		M
K	Extra dust protection	IP50 Cat 2 for the relays mounted in a Mors Smitt socket. Application PD1/PD2 and contact load > 0.5 A.	
Q	Double zener diode over coil	Maximum allowed peak voltage 180 V, higher voltage will damage the diode	
Y	Double make/double break contacts	4 C/O DM/DB 	
Keying	Coil coding relay and socket		
Special options:			
M	$AgSnO_2$; “non-weldable” contacts, used for capacitive loads e.g. LED lighting	Icontact > 100 mA	E

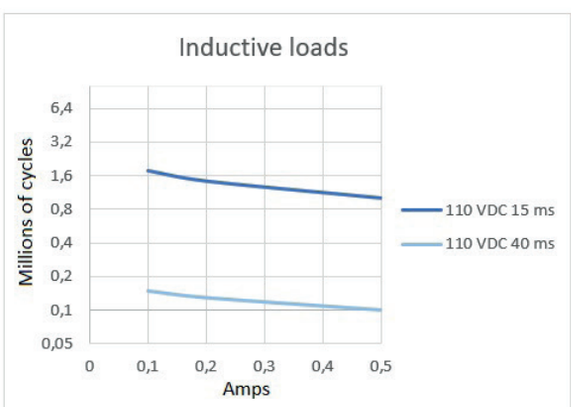
* Gold plated contacts characteristics	
Material	Ag, 10 µm gold plated
Maximum switching voltage	60 V (higher voltages may be possible, contact Mors Smitt for more information)
Maximum switching current	400 mA (at higher rate gold will evaporate, then the standard silver contact rating of minimum 10 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.

For highly inductive loads Mors Smitt A400/B400 relays with standard double make double break contacts are the optimal solution.

Self-cleaning contacts

Each contact attracts organic molecules. When the surface is loaded with a voltage, like a relay contact, the attracting force is even higher. Therefore on each contact surface there is organic “pollution”.

Mors Smitt relays are designed to clean itself during switching of the contacts:

1. Mechanical wiping action: the “pollution” is swept aside.
   The movement of opposing contacts when they make contact: this wiping action cleans the surface of both contacts. Mors Smitt relays are designed for optimal wiping action: enough to clean the surface and not too much to prevent contact wear.
2. Electrical cleaning: the “pollution” is burnt away.
   A current at sufficient level will evaporate organic “pollution”. When switching loads (typically of a current >100 mA), the “pollution” is totally burnt away and a clean contact surface is available.

The result is a good contact between two opposing contacts without interference due to polluted contacts.

Latching relay
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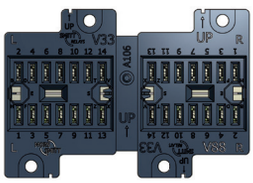
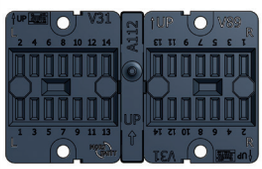
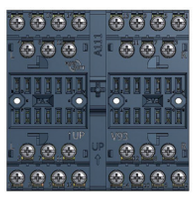
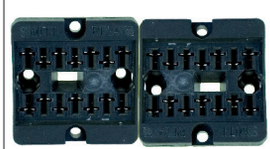
Mounting possibilities/sockets

 V88	 V89	 V93	 V93BR	 V96
 V97	 V99	 2x V32		

Surface/wall mounting

338002920	V92BR	Screw socket, wall mount, front connection (9 mm terminals)
338003900	V93	Screw socket, wall mount, front connection (7.5 mm terminals)
338003950	V99	Spring clamp socket, wall mount, front dual connection (2.5 mm^2)

Rail mounting

338003900	V93	Screw socket, rail mount, front connection (7.5 mm terminals)
338003925	V93BR	Screw socket, rail mount, front connection (9 mm terminals)
338003950	V99	Spring clamp socket, rail mount, front dual connection (2.5 mm^2)

Panel/flush mounting

328100200	V96	Solder tag socket, panel mount, rear connection
338400100	V97	Crimp contact socket, panel mount, rear connection, A260 crimp contact
338001850	V89	Faston connection socket, rear dual connection (4.8 x 0.8 mm)
338001700	V88	Push-in terminal socket, flush mount, rear dual connection (3.3 mm^2)

PCB mounting

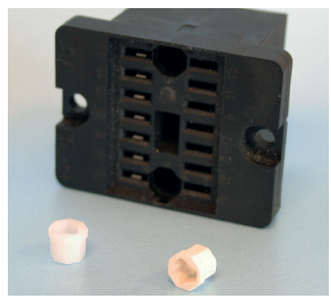
338000561	V32	PCB soldering socket

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

Latching relay
KDN-U200N

Mechanical keying relay and socket (optional)



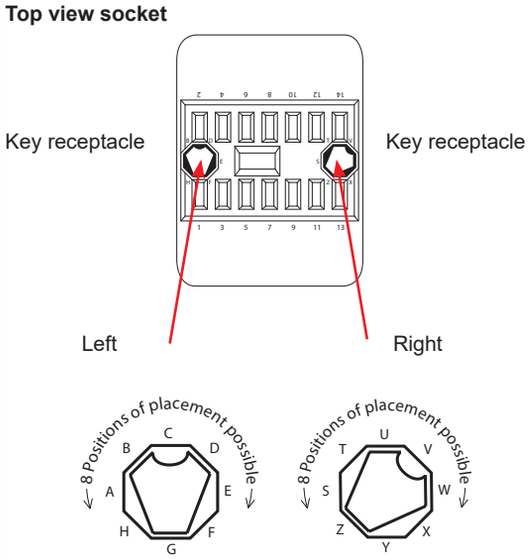
Function:
- To prevent wrong installation
- To prevent damage to equipment
- To prevent unsafe situations

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.

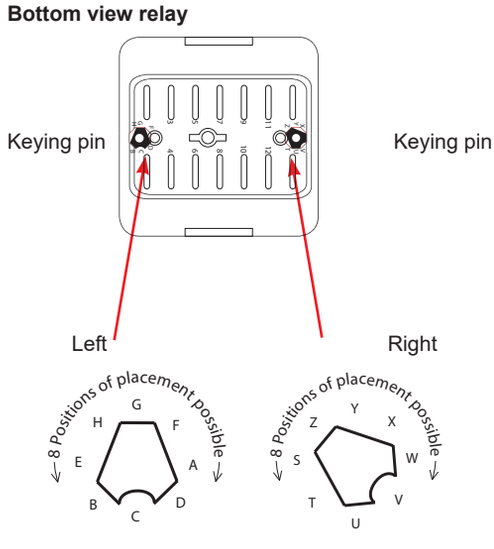
Remark: Sockets and relay shown are examples.

Top view socket



Example keying position G-Z on socket

Bottom view relay



Example keying position G-Z on relay

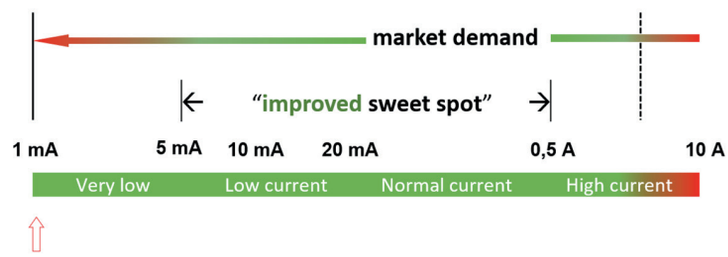
Latching relay
KDN-U200N

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.

Contact switching current

Each relay has a range of switching currents in which it performs optimally: the sweet spot. As switching currents are decreasing in field applications, the KDN-U200N relay has an improved sweet spot compared to its predecessors.



KDN-U200N relay with gold contacts

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.

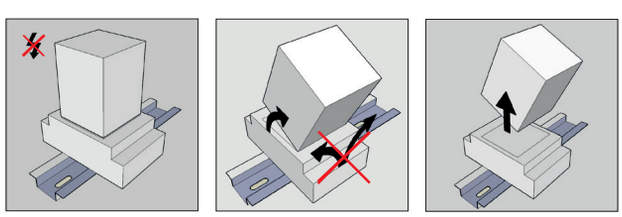
Therefore for long time contact reliability we recommend:
- Silver contacts: a minimum contact current of 20 mA per contact
- Gold contacts: a minimum contact current of 10 mA per contact
- Double Make Double Break contacts: a minimum contact current of 40 mA per contact
- When low currents are switched 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.

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

Latching relay
KDN-U200N

Ordering scheme

KDN-U2	N	-			
Coil voltages	01		24 VDC		
	02		48 VDC		
	03		72 VDC		
	04		110 VDC		
	05		96 VDC		
	06		12 VDC		Cannot be combined with:
	07		36 VDC		
Options		D	Back EMF protection diode		
(add as many options as needed)		E	Gold plated contacts		M
		K	Extra dust protection, IP50		
		Q	Double zener diode		
		Y	Double make/ double break		
Special options					
(minimum order quantity: 20)		M	$AgSnO_2$ contacts, highly resistant to welding		E

Example: KDN-U204N-DE
Description: KDN-U200N relay, Unom: 110 VDC, back EMF protection diode, gold plated contacts

Over 10 million Mors Smitt relays in use in rail transport applications worldwide!

Mors Smitt Asia Ltd.
26/F., Casey Aberdeen House
38 Heung Yip Road, Wong Chuk Hang
Hong Kong
Tel: +852 2343 555
sales.msa@wabtec.com

Mors Smitt France SAS
2 Rue de la Mandinière
72300 Sablé-sur-Sarthe, France
Tel: +33 (0) 243 92 82 00
sales.msf@wabtec.com

Mors Smitt UK
Graycar Business Park,
Burton on Trent, DE13 8EN, UK
Tel: +44 (0)1283 357 263
msu_sales@wabtec.com

Wabtec Netherlands B.V.
Darwinstraat 10,
6718 XR Ede, Netherlands
Tel: +31 (0)88 600 4500
wnl_salessupport@wabtec.com

Mors Smitt Technologies Ltd.
1010 Johnson Drive,
Buffalo Grove, IL 60089-6918, USA

RMS Mors Smitt
19 Southern Court,
Keysborough, VIC 3173, Australia
Tel: +61 (0)3 8544 1200
sales.rms@wabtec.com