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

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

KDN
Industrial latching power relay, 8 pole
Part of D-platform

Description

Plug-in industrial bistable power relay with 8 C/O contacts. 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.

Optionally equipped with magnetic arc blow-out for high breaking capacity and long contact life. No external retaining clip needed as integrated 'snap-lock' will hold relay into socket under all circumstances and mounting directions.

The construction of the relay and choice of materials makes the KDN relay suitable to withstand low and high temperatures, shock & vibrating and dry to very humid environments.

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

Application

Rugged plug-in relays for extreme reliable, long endurance applications in harsh environment. These relays are designed for demanding industrial applications such as power utilities and petrochemical industries.

The KDN relay is used in applications where the contacts are set and reset with permanent power or impulses.

Features

- Latching (bistable) relay
- Compact plug-in design
- 8 C/O contacts
- 2 galvanic isolated coils
- Clear position indicator
- Flat, square and silver plated relay pins for excellent socket connection
- Wide range sockets
- 2 integrated snap locks
- Transparent cover
- High DC breaking capacity
- Optional positive mechanical keying relay to socket
- Flexibility by many options

Connection diagram

Red	Left				Right				Green
1	3	4	5	6	6	5	4	3	1
2	11 13	12 14	7 9	8 10	10 8	9 7	14 12	13 11	2
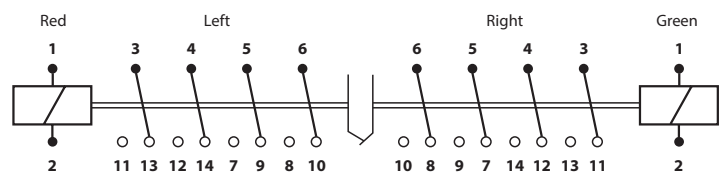
Please note the relay will leave production in open state (with open armature at the left side, flag is green) with all contacts in the position shown in the connection diagram. Due to severe shocks far exceeding maximum levels mentioned in IEC 61373 (Category I, Class B, Body mounted), it can happen the left armature closes and stayclosed. Therefore after installation all relays must be checked on correct state of the contacts and activate both coils 10 times alternately for correct operation.

Timing diagram
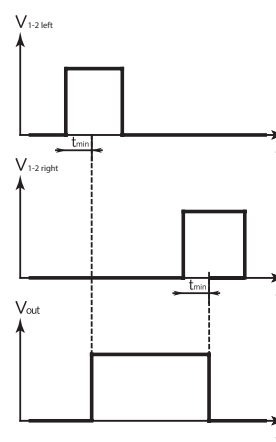
Compliancy

EN 60255

EN 60947

EN 60947-5-1

IEC 61810

CE

Options

- Magnetic arc blow-out
- Lower temperature (-40 °C)
- Back EMF protection diode
- Protection diode against back EMF
- Au; Gold plated contacts
- Extra dust protection
- High resistance to welding (AgSnO$_2$ contacts)
- Operating range: 0.7...1.25 Un
- Ambient temperature: -25 °C...+70 °C
- Double make/double break contacts

Remark: Not all combinations possible

Solve-All relay application concept

The unique KDN relay with all its options has been designed in close cooperation with customers from the power utility industry.

The Solve-All relay application concept offers ultimate flexibility to design and supply tailor made KDN relays.

Dimensions (mm)
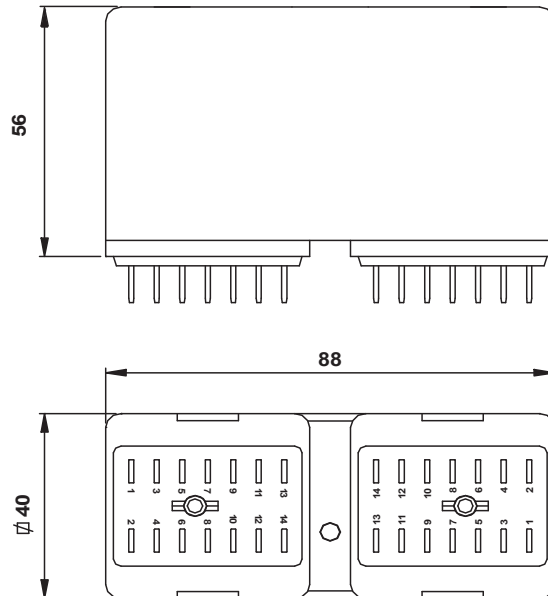
Sockets

		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	-
	Solder tag	-	-	V96	-
	Crimp	-	-	V97	-
	PCB	-	-	-	2x V32

For more information see the respective datasheets

Technical specifications

Coil characteristics AC-versions

Minimum impulse time	50 ms
Operating times as nominal voltage (typical):	
Operate time N/O contacts	max. 18 ms
Bounce time N/O contacts	4 ms
Inductance L/R at Unom (typical value):	
Energized	11 ms
Released	8 ms
Nominal power consumption	3.2 W
Operating voltage range	0.8 - 1.1 Unom

Type	U_{nom} (VAC)	U_{min} (VAC)	U_{max} (VAC)	R_{coil} * (Ω)
24 VAC	24	19.2	26.4	34
42 VAC	42	33.6	46.2	135
110 VAC	110	88	121	830
220 VAC	220	176	242	3200

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
• Always select the nominal voltage as close as possible to the actual voltage in the application

Coil characteristics DC-versions

Minimum impulse time	50 ms
Operating times an nominal voltage (typical):	
Operate time N/O contacs	max. 18 ms
Bounce time NO contacts	4 ms
Inductance L/R at Unom (typical):	
Energized	11 ms
Released	8 ms
Nominal power consumption	3.5 VA
Operating voltage range	0.8 - 1.1 Unom

Type	U_{nom} (VDC)	U_{min} (VDC)	U_{max} (VDC)	R_{coil} * (Ω)
12 VDC	12	9.6	13.2	44
24 VDC	24	19.2	26.4	172
48 VDC	48	38.4	52.8	691
60 VDC	60	48	66	1070
110 VDC	110	88	121	3680
125 VDC	125	100	137.5	4450
220 VDC	220	176	242	15000

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
• Always select the nominal voltage as close as possible to the actual voltage in the application

Contact characteristics

Amount and type of contacts	8 C/O
Maximum make current	16 A
Peak inrush current	200 A (withstand > 10 x 200 A @ 10 ms, 1 min)
Maximum continuous current	10 A
Maximum switching voltage	250 VDC, 440 VAC
Minimum switching voltage	12 V
Minimum switching current	10 mA
Maximum 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)

Mechanical characteristics

Mechanical life	2×10^6 operations
Maximum switching frequency	Mechanical: 3600 ops/h Electrical: 1200 ops/h
Weight	305 g (without options)

Environmental characteristics

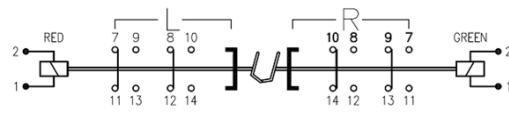|	
Environmental	IEC 61810
Vibration	IEC 61373, Category I, Class B, Body mounted
Shock	IEC 61373, Category I, Class B, Body mounted
Operating temperature	-25 °C...+55 °C (with option C and option Y: -40 ºC) -25 °C...+70 °C (with option V)
Humidity	95% (condensation is permitted temporarily)
Salt mist	IEC 60068-2-11, NaCi, 35 ºC for 4 days
Damp heat	IEC 60068-2-30, Test method Db variant 1
Protection	IEC 60529, IP40 (relay on socket) (with option K: IP50)
Insulation materials	Cover: polycarbonate Base: polyester

Compliancy

EN 60255	Relay design and environmental conditions
EN 60947	Low voltage switch gear and control gear
EN 60947-5-1	Electromechanical control circuit devices and switching elements
IEC 61810	Electromechanical elementary relays

Options

Available options for KDN-relay according the *Solve-All* relay application concept

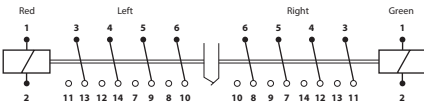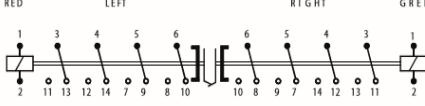| Code	Description	Remark	Can not be combined with
Standard options			
B	Magnetic arc blow-out. Ensures a high DC breaking capacity and longer contact life.		
C	Lower temperature (-40 °C).	Max contact current 8A	
D	Protection diode against back EMF. When a coil is switched off, a large Back EMF appears across the coil. This back EMF may be several hundred volts in value, enough to destroy a transistor.	DC coil only.	Q
E	Gold plated contacts. Low contact resistance and good resistance against corrosive atmospheres. Suitable for switching low level loads. Gold plated contacts characteristics: Material Ag, gold plated Max. switching voltage 60 V (higher voltages may be possible, contact Mors Smitt for more info) Max. 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) Min. switching voltage 5 V Min. switching current 1 mA		M
K	Extra dust protection. Cover sealed with sealant.	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. Coil protection against transient voltage.	DC coil only. Max. allowed peak voltage: 180 V. Higher voltage will damage the diode.	D
V	Wider operating range and ambient temperature. Operating range: 0.7 … 1.25 Unom Ambient temperature: -25 °C…+70 °C Up to 110 V	Power consumption 2.22 W @ U_{nom} Operating range AC can differ	
Y	Double break / double make contacts. Breaking capacity increased by 50% and longer contact life. To increase the breaking capacity and contact life more this option can be combined with option B.	4 C/O DM/DB contacts, -40 °C 	
Special options:			
M	$AgSnO_2$ contacts. Highly resistant to welding.	Min. contact current 100 mA.	E

Coloured cover and keying of relay on socket on request

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

In this section the most common breaking capacity for DC-voltage / inductive load possibilities are presented with the different options and contact configurations within the D-relays series.

Power relays, DC

KDN	KDN-B

- 8 C/O contact

- Contact gap: 0.7 mm

Breaking capacity

DC1	110 VDC	1 A
	220 VDC	0.7 A
L/R=40 ms	110 VDC	0.3 A
	220 VDC	0.1 A
DC13	110 VDC	-
	220 VDC	-

- 8 C/O contacts
- Magnetic arc blow out
- Contact gap: 0.7 mm

Breaking capacity

DC1	110 VDC	7 A
	220 VDC	3 A
L/R=40 ms	110 VDC	3 A
	220 VDC	1 A
DC13	110 VDC	-
	220 VDC	-

Electrical life expectancy and breaking capacity

The life expectancy values shown below are based on factory tests (test frequency at 1/3 Hz). These values could be different in real life applications as environmental conditions, switching frequencies and duty cycles will influence these values. Putting more contacts in series (Y) will increase breaking capacity and life expectancy significantly.
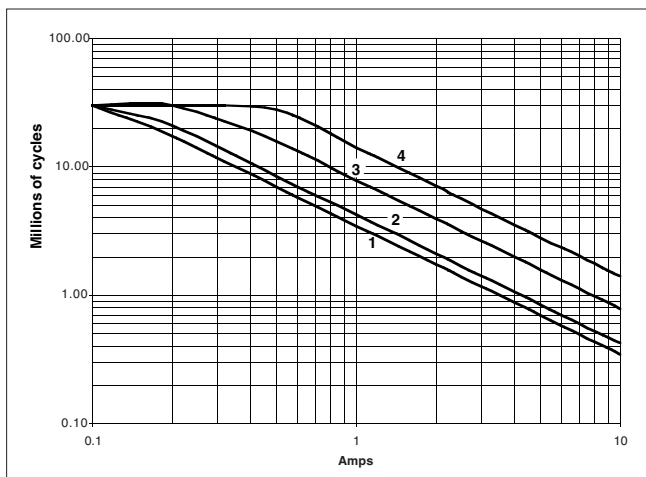
Breaking capacity relays (Resistive load DC1)
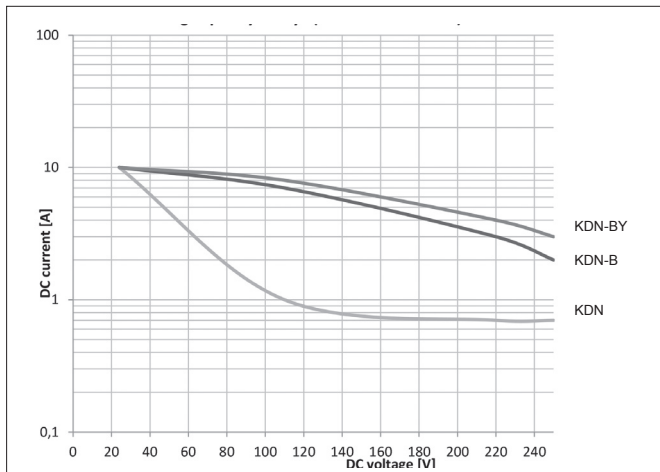
AC and DC current breaking capacity versus life expectancy in millions of cycles for KDN-B.
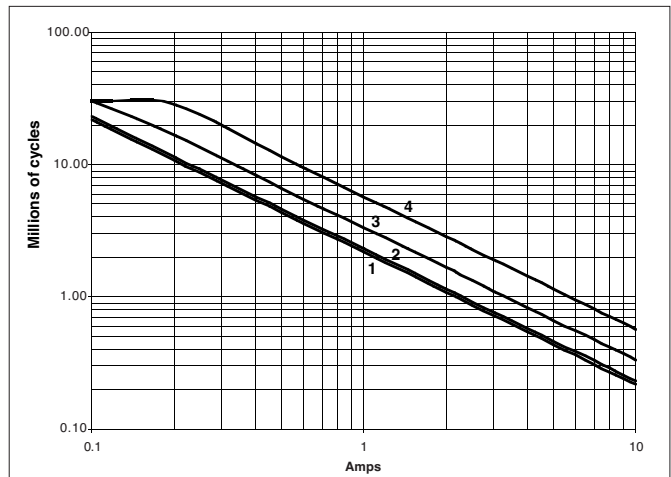Rate of contacts opening and closing = 1200 operations per hour.

AC Current breaking capacity at cosφ = 1

Curve	1	2	3	4
VAC	220	125	48	24

DC Current breaking capacity at L/R = 0

Curve	1	2	3	4
VDC	220	125	48	24

By connecting 2 contacts in series, the DC current breaking capacity is increased by 50%.

Mounting possibilities/sockets

V88	V89	V93	V93BR	V96
V97	V99	2x V32		
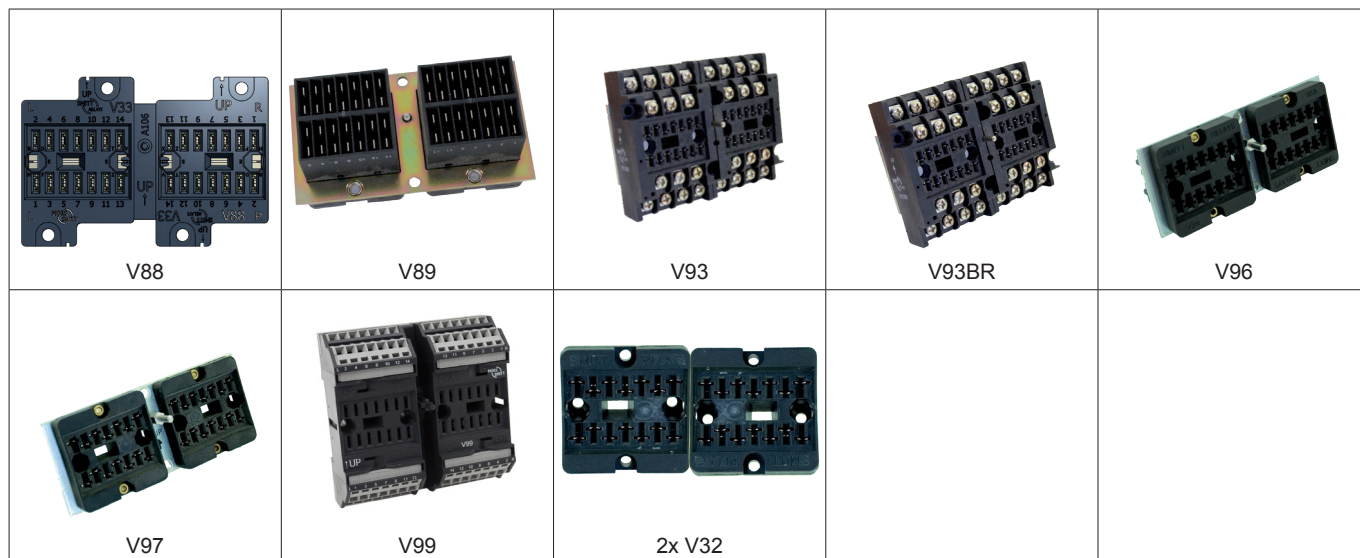
Surface/wall mounting

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

338001700	V88	Spring clamp socket, flush mount, rear dual connection (2.5 mm^2)
328001850	V89	Faston connection socket, rear dual connection (4.8 x 0.8 mm)
338100200	V96	Solder tag socket, panel mount, rear connection
338400100	V97	Crimp contact socket, panel mount, rear connection, A260 crimp contact

For PCB mount: use 2x V32 according to pin layout
For more details see datasheets of the sockets on www.morssmitt.com
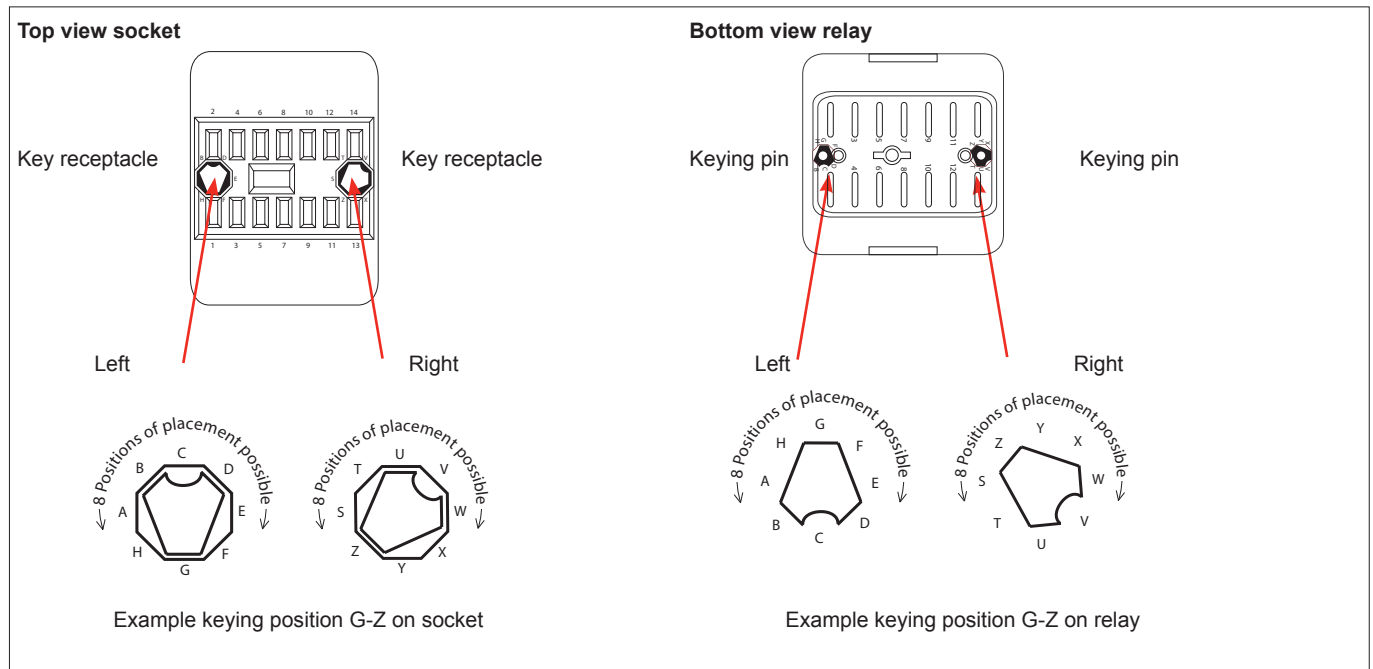
Mechanical keying relay and socket (optional)
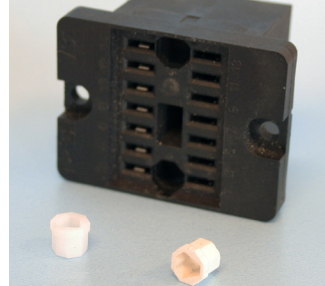
Function:
- To prevent wrong installation
- To prevent damage to equipment
- To prevent unsafe situations

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

Key receptacle   Key receptacle

Left   Right

Example keying position G-Z on socket

Bottom view relay

Keying pin   Keying pin

Left   Right

Example keying position G-Z on relay

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. To ensure correct working of the KDN relay, the relay should be mounted in horizontal position as the position indicator will not work correct in vertical position due to gravity. 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
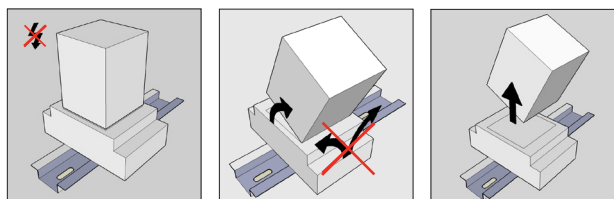
• Relays should never be swapped to other circuit positions when taken out of its socket for inspection or fault finding, always place it back into the original position to prevent contact resistance problems. Contact resistance problems can be created when swapping relays between different circuit loads 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 mecha-nically cleaned due to the positive wiping action. Sometimes a contact can build up increased contact resistance ($\leq$ 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

KDN-					Cannot be combined with

Options	**B**		Magnetic arc blow-out	
(add as many options as needed)	**C**		Low temperature (-40 °C) - Max contact current 8 A	
	D		Back EMF protection diode	Q
	E		Gold plated contacts	M
	K		Extra dust protection, IP50	
	Q		Double zener diode	D
	V		Operating range 0.7...1.25 Un, ambient temperature -25 °C...+70 °C	
	Y		Double make / double break (-40 °C)	
Special options				
(minimum order quantity: 20)	**M**		AgSnO$_2$ contacts, highly resistant to welding	E
Coil voltages		**12 VDC**		
(other voltages on request)		**48 VDC**		
		48 VDC		
		60 VDC		
		110 VDC		
		125 VDC		
		220 VDC		
		24 VAC	50-60 Hz	
		42 VAC	50-60 Hz	
		110 VAC	50-60 Hz	
		220 VAC	50-60 Hz	

Example: KDN-B 110 VDC

Description: KDN relay, magnetic arc blow-out, Unom: 110 VDC

🌍 Over 11 million Mors Smitt relays in use in applications worldwide!

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