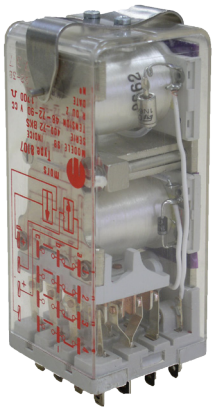
/// Plug-in railway relay with 4/3 contacts

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

SB
Latching relay



Description

The SB is a latching safety critical relay with 2 stable magnetically latched states. When 1 coil is energized, the relay actuates from magnetically latched position 1 to 2. When the other coil is energized, the relay actuates back from magnetically latched position 2 to 1.

Two types of configuration are available:
- 400 type contact relays have 4 changeover double break contacts (Form Z)
- 300 type contact relays have 3 changeover double break contacts (Form Z) a 4th double break contact is reserved for automatic coupling of the coils

The plug-in design offers secure locking feature for maximum ease of maintenance (no wires need to be disconnected or other hardware removed for relay inspection or replacement). The resistance to impact and vibration is conform to standards in force for Railway Transported Equipment.

Positive mechanical keying of relay to socket is built into relay and socket during manufacture and terminal identifications are clearly marked on identification plate that is permanently attached to the relay.

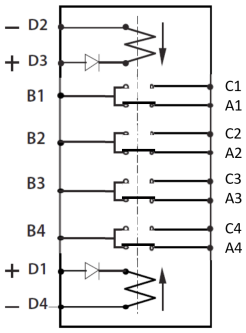
Application

The SB latching relay allows the memory of the state of the circuit in case of power interruption.

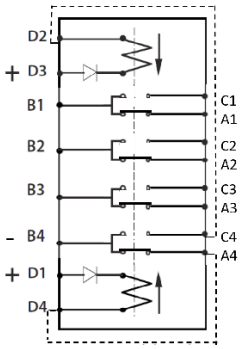
Features

- Latching relay using 2 separate coils and magnetic rocker mechanism
- Two types available with 4 C/O (type 400) or 3 C/O (type 300) contacts
- All contacts are double make - double break contacts (form Z), 8 A
- Plug-in design with secure locking feature for maximum ease of maintenance
- Optional Weld no transfer contacts
- Contact life (mechanical) of 100 million cycles
- -40°C...+80 °C operating temperature

Connection diagram



400 contact models ending in AK, DK & BK.



300 contact models ending in AL,DL & BL.

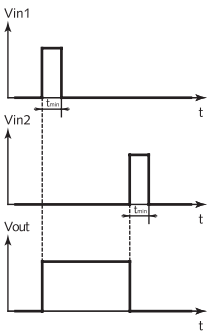
400 Contact Type Operation:

To operate this relay, it is recommended that the coil be actuated with a pulse of 50 ms min. duration. Assuming that before any voltage is applied to either coil all contacts are in position B-A, operation is as follows:
When a signal is applied to terminals D1-D4, the relay actuates and magnet-ically latches all contacts to the B-C position. A subsequent signal applied to termi-nals D2-D3 actuates the relay contacts from their magnetically latched position B-C back to their former magnetically latched position B-A. Note that a pulse of 50 ms min. duration is required to operate the relay and that only one coil can be energized at a time.

300 Contact Type Operation:

This relay is designed for actuation of the coil with a permanent voltage. After connecting the negative terminal of the power supply to terminal B4 and assuming that before any voltage is applied to either coil, all contacts are in position BA,operation is as follows;
When a positive signal from the power supply is applied to terminal D1, the relay actuates and magnetically latches all contacts to the B-C position. During this actuation, as contact B4-A4 switches to B4-C4, the power supply is effectively disconnected at positive terminal D1 and a new connection is made at terminal D3 so that power to the relay coil is ON only while B4-A4 is connected. A subsequent positive signal applied at terminal D3 actuates the relay contacts from their magnetically latched position B-C back to their former magnetically latched position B-A.
Note: Customer must make dotted connection shown exter-nal to socket as shown above.

Timing diagram

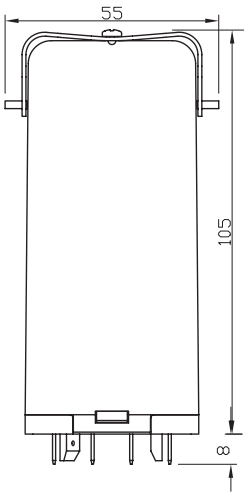


Railway compliancy

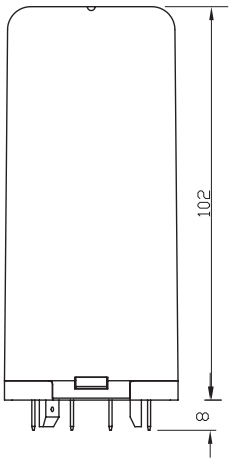
NF F 62-002
NF F16-101/102
EN 45445-2

Latching relay
SB

Dimensions (mm)



Used
with locking brackets



Used
with wire locking spring

This 2-pager is an introduction to this relay. For further detailed technical specifications and ordering information, download the full datasheet from www.morssmitt.com.

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

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Technical specifications

Latching relay
SB

Coil characteristics - DC versions

Type	Keying	U_{nom} (VDC)	$U_{operating}$ (VDC)	P_{nom} (W)	R_{coil} (Ω)[1]	L/R (ms)[2]
400*	AK	24	18 / 33	3	185	30
	CK	36	25 / 45	3	430	30
	DK	48	33.5 / 60	3	750	30
	BK	72	48 / 90	3	1700	30
	SX	110	75 / 138	3	4000	30
300	AL	24	18 / 33	3	185	30
	CL	36	25 / 45	3	430	30
	DL	48	33.5 / 60	3	750	30
	BL	72	48 / 90	3	1700	30
	SY	110	75 / 138	3	4000	30

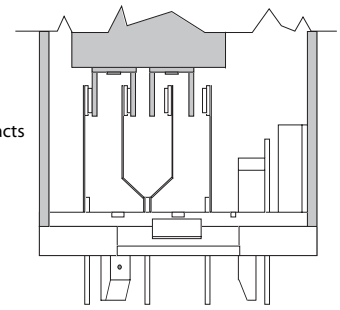
* 50 ms min pulse to permanent on (400 type only)
[1] Coil resistance tol.: ± 8 % at 20 °C
[2] Valid for closed relay

Contact data

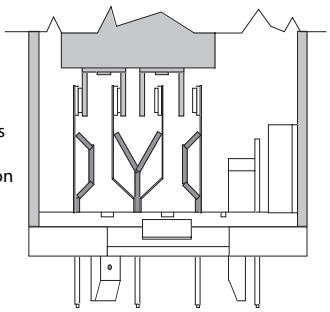
Nominal current	8 A resistive (5 A according CF 62-002)		
Nominal breaking capacity and life	1 A at 72 VDC	L/R: 0 ms	Electrical life: 2.5 x 10^5 operations
	350 mA at 72 VDC	L/R: 30 ms	Electrical life: 1.5 x 10^5 operations
	1 A at 220 VAC 50 Hz	cosØ=1	Electrical life: 1.5 x 10^5 operations
	Lamp filament circuit: 120 W at 72 VDC		Electrical life: 2.5 x 10^5 operations
Contact overload withstand	At 24 VDC: 100 A at L/R = 0 for 10 ms (10 operations at the rate of 1 operations per minute)		
Contact closure	< 40 ms (all contacts)		
Contact opening time	< 30 ms (all contacts)		
Minimum contact continuity	20 mA at 24 VDC		
Number of contacts	Type 400: 4 double make / double break contacts (form Z) Type 300: 3 double make / double break contacts (form Z)		
Contact material	Hard silver overlay laminated to copper		
Contact resistance, initial	10 mΩ max @ 5 A		
Contact resistance, end of life	40 mΩ max @ 5 A		

Contact design

Change Over
double break contacts



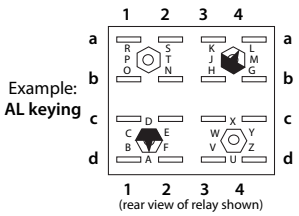
Change Over
double break contacts
with
Weld No Transfer option



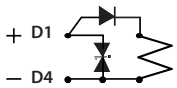
Latching relay
SB

Relay pin correspondence

Relay pin correspondence



Option S = Transil protection



400 contact models ending in
AKS, DKS & BKS

Electrical characteristics

Dielectric strength	2000 VAC, 1 min between contacts
Insulation resistance	≥ 1000 MΩ @ 500 VDC

Mechanical characteristics

Mechanical life	> 100 x 10^6 operations
Weight	450 g

Environmental characteristics

Vibration	NF F 62-002	The tests are conducted in the X, Y , Z planes at frequency between 10 & 150 cycles (sinusoidal) at 2 g
Shock	NF F 62-002	Tests are applied in both directions in the X, Y & Z planes. Then successive shocks are administered consisting of the positive component of sinusoidal with a value of 30 g, 18 ms. Other vibration and shock tests can be performed on request.
Operating temperature		-40 °C...+80 °C
Humidity		93% RH, 40 °C for 4 days
Salt mist		5% NaCl, 35 °C for 4 days
Protection		IP40 (relay on socket)
Fire & smoke		Materials: Polycarbonate (cover) / Polyester Melamine (base)

Note: These materials have been tested for fire propagation and smoke emission according to standards NF F 16-101, NF F 16-102, ASTM E162 and ASTM E662, and have been approved to be used on the English/French train channel shuttle.

Railway compliancy

NF F 62-002	Rolling stock - Instantaneous relays contacts and sockets
NF F16-101/102	Railway rolling stock - Fire behavior
EN 45445-2	Railway applications - Fire protection on railway vehicles Part 2: Requirements for fire behavior of materials and components

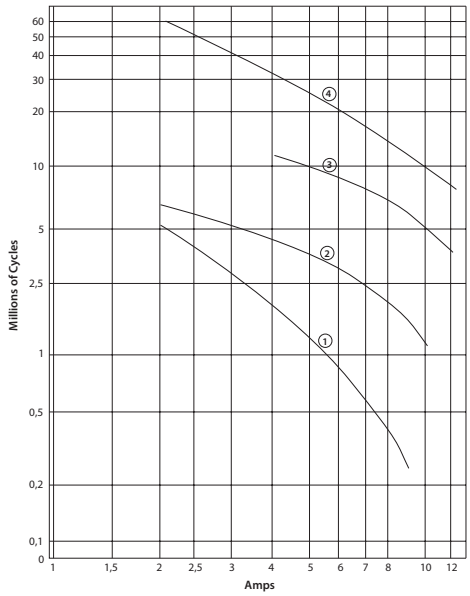
Latching relay
SB

Electrical life expectancy

Dynamic relay selection curve No 1

AC Current breaking capacity versus life expectancy in millions of cycles.
Rate of contacts opening and closing = 1200 operations per hour.
Curves shown for resistive load (Power Factor = 1).

Curve	1	2	3	4
VAC	220	125	48	24

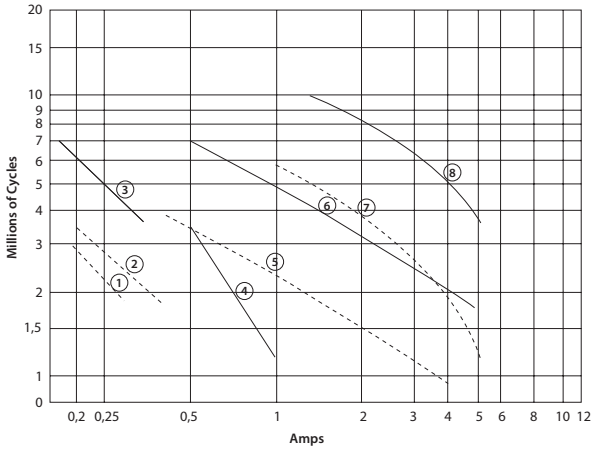


Dynamic relay selection curve No 2

DC Current breaking capacity versus life expectancy in millions of cycles.
Rate of contacts opening and closing = 1200 operations per hour.
Curves shown for inductive load:
——— L/R= 20 ms continuous current
– – – – L/R= 40 ms continuous current

* By connecting 2 contacts in series, DC current breaking capacity increases by 50 %

Curves	1-3	2-4	5-6	7-8
VDC	220	125	48	24

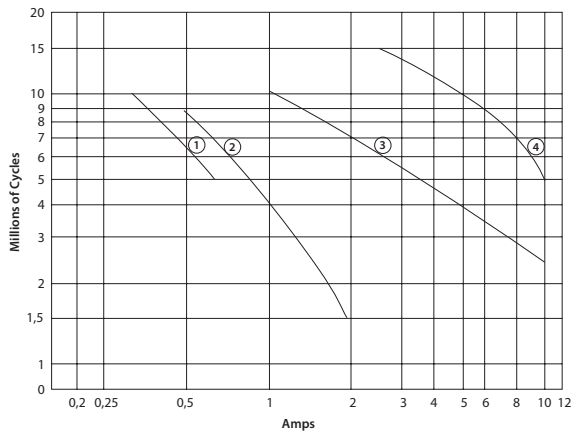


Dynamic relay selection curve No 3

DC Current breaking capacity versus life expectancy in millions of cycles.
Rate of contacts opening and closing = 1200 operations per hour.
Curves shown for resistive load (L/R = 0). Continuous current.

* By connecting 2 contacts in series, DC current breaking capacity increases by 50 %

Curve	1	2	3	4
VDC	220	125	48	24

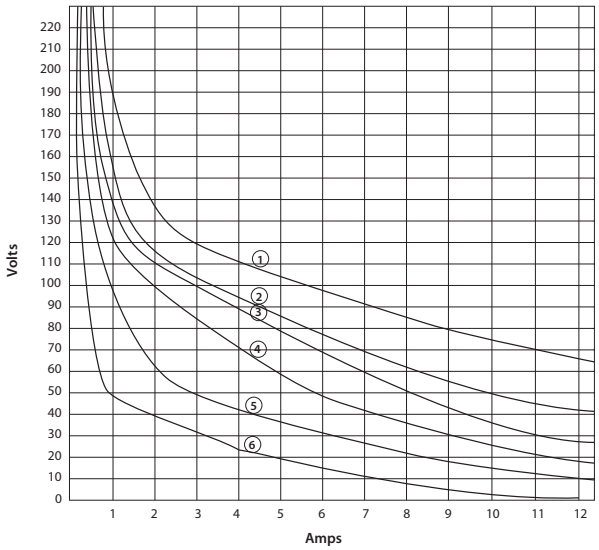


Dynamic relay selection curve No 4

Maximum contact breaking capacity versus voltage for a given L/R.
Rate of contacts opening and closing = 600 operations per hour.
Curves shown for resistive load (L/R=0) and inductive loads. Continuous current.

Life expectancy: 2 Millions of Cycles

Curve	1	2	3	4	5	6
L/R=	0ms	15ms	20ms	40ms	60ms	100ms



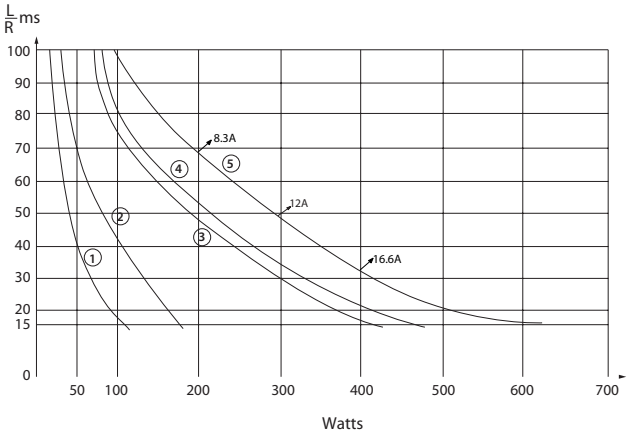
Latching relay
SB

Electrical life expectancy

Dynamic relay selection curve No 5

Maximum power interruption versus load time constant (L/R) for a given voltage.
Curves shown for resistive loads. I = P/V.

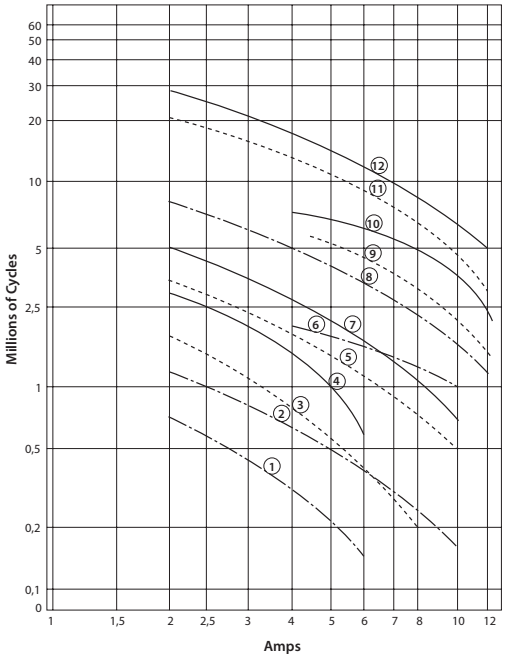
Curve	1	2	3	4	5
VDC	220	125	72	48	24



Dynamic relay selection curve No 6

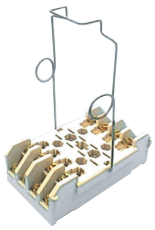
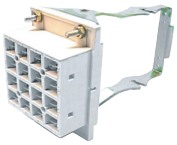
AC Current breaking capacity versus life expectancy in millions of cycles.
Rate of contacts opening and closing = 1200 operations per hour.
Values shown for inductive loads -
——— Cos Ø = 0.7
– – – – Cos Ø = 0.5
—·— Cos Ø = 0.3

Curves	1,3 &4	2,5 &7	6,9 &10	8,11 &12
VAC	220	125	48	24



Latching relay
SB

Mounting possibilities/sockets

 EA 102 B	 EA 103 BF	 EA 104 B	 EA 111 BF	 EA 112 BF

Panel/flush mounting

EA 102 B	Locking bracket (905843), rear connection, double Faston 5 mm
EA 102 BF	Wire locking spring (926853), rear connection, single Faston 5 mm
EA 104 B	Locking bracket (905843), rear connection, single Faston 5 x 0.8 mm
EA 104 BF	Wire locking spring (926853), rear connection, single Faston 5 x 0.8 mm
EA 111 BF	Spring clamp terminal, for surface or 35 mm rail, up to 2.5 mm^2 wire terminal
EA 112 BF	Wire locking spring (926853), rear connection, crimp contact

Panel/flush mounting

EA 103 BF*	Wire locking spring (926853), front connection, M3 screw 6,5 mm ring terminals (2.5 mm^2)
EA 103 BF*	Wire locking spring (926853), front connection, single Faston 5 mm (3/16”)

* Mounting possibility on 35 mm rail EN 50022 by adding suffix D to the part number (see socket datasheet)

Note: Keying of relay to socket can be specified by adding the keying letters in the part number. See all details in the related socket datasheet.

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.

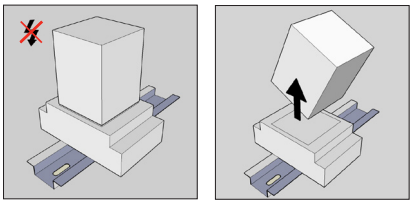
Therefore for long time contact reliability we recommend:
- Silver contacts: a minimum contact current of 20 mA per contact
- Gold contacts: a minimum contact current of 10 mA per contact
- Double Make Double Break contacts: a minimum contact current of 40 mA per contact
- When low currents are switched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

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



- 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 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
SB

Ordering scheme

SB		
Contact configuration	300	3 C/O double break contacts (form Z)
	400	4 C/O double break contacts (form Z)
Nominal voltage & keying	24 AL	Type 300, 24 VDC
	36 CL	Type 300, 36 VDC
	48 DL	Type 300, 48 VDC
	72 BL	Type 300, 72 VDC
	110 SY	Type 300, 110 VDC
	24 AK	Type 400, 24 VDC
	36 CK	Type 400, 36 VDC
	48 DK	Type 400, 48 VDC
	72 BK	Type 400, 72 VDC
	110 SX	Type 400, 110 VDC
Coil overvoltage protection	-	No coil protection
	S	Transil coil protection (Only with 400 type)
Weld no transfer option	-	Regular double break contacts
	C	Weld no transfer
Manual reset control lever	-	No manual reset control lever
	L	With manual reset control lever
Cover type	-	Relay cover with lock pins
	F	Relay cover with wire locking spring

Example: SB 300 24 AL C L
Description: SB relay, 3 C/O contacts, Unom: 24 VDC, keying AL, weld no transfer, with manual reset control lever

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

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