#### **RH Series Compact Power Relays**

#### **Key features**

- SPDT through 4PDT, 10A contacts
- Compact power type relays
- Miniature power relays with a large capacity
- 10A contact capacity
- Compact size saves space







TÜV



#### **Part Number Selection**

		Part I	Number	
Contact	Model	Blade Terminal	PCB Termi- nal	Coil Voltage Code (Standard Stock in bold)
	Standard	RH1B-U 🗌	RH1V2-U 🗌	
SPDT	With Indicator	RH1B-UL 🗌	—	AC6V, AC12V, AC24V, AC110V, AC120V,
TO DO	With Check Button	RH1B-UC	—	AC220V, AC240V DC6V, DC12V, DC24V,
	With Indicator and Check Button	RH1B-ULC	—	DC48V, DC110V
	Top Bracket Mounting	RH1B-UT	—	
10-	With Diode (DC coil only)	RH1B-UD 🗌	RH1V2-UD	DC6V, <b>DC12V</b> , <b>DC24V</b> , DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD	—	DC12V, DC24V, DC48V, DC110V
2227	Standard	RH2B-U 🗌	RH2V2-U 🗌	
DPDT	With Indicator	RH2B-UL 🗌	RH2V2-UL 🗌	AC6V, AC12V, AC24V, AC110-120V,
VALA	With Check Button	RH2B-UC	—	AC220-240V
	With Indicator and Check Button	RH2B-ULC	—	DC6V, <b>DC12V</b> , <b>DC24V</b> , DC48V, DC100-110V
	Top Bracket Mounting	RH2B-UT 🗌	—	
and allow which	With Diode (DC coil only)	RH2B-UD 🗌	RH2V2-UD	
	With Indicator and Diode (DC coil only)	RH2B-ULD	RH2V2-ULD	DC6V, <b>DC12V</b> , <b>DC24V</b> , DC48V, DC100-110V
	Standard	RH3B-U 🗌	RH3V2-U 🗌	
3PDT	With Indicator	RH3B-UL 🗌	RH3V2-UL 🗌	AC6V, AC12V, <b>AC24V</b> , AC110V, <b>AC120V</b> ,
as and a second	With Check Button	RH3B-UC 🗆	—	AC220V, AC240V DC6V, DC12V, DC24V,
	With Indicator and Check Button	RH3B-ULC 🗌	—	DC48V, DC110V
Sale /	Top Bracket Mounting	RH3B-UT 🗌	—	
an allog a state of the	With Diode (DC coil only)	RH3B-UD 🗌	_	
	With Indicator and Diode (DC coil only)	RH3B-ULD	—	DC6V, DC12V, DC24V, DC48V, DC110V
1997	Standard	RH4B-U 🗌	RH4V2-U 🗌	
IPDT	With Indicator	RH4B-UL	RH4V2-UL 🗌	AC6V, AC12V, <b>AC24V</b> , AC110V, <b>AC120V</b> ,
Victoria	With Check Button	RH4B-UC	_	AC220V, AC240V DC6V, DC12V, DC24V, DC48V
	With Indicator and Check Button	RH4B-ULC	_	DC110V
and the second s	Top Bracket Mounting	RH4B-UT 🗌	_	-
and the second se	With Diode (DC coil only)	RH4B-UD 🗌	RH4V2-UD	
	With Indicator and Diode (DC coil only)	RH4B-ULD 🗌	_	DC6V, DC12V, DC24V, DC48V, DC110V

Part No.

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## Sockets (for Blade Terminal Models)

		,				
t Ligh	Relays	Standard DIN Rail Mount <sup>1</sup>	Finger-safe DIN Rail Mount 1	Through Panel Mount	PCB Mount	
Pilot	RH1B	SH1B-05	SH1B-05C	SH1B-51	SH1B-62	-
es &	RH2B	SH2B-05	SH2B-05C	SH2B-51	SH2B-62	1. DIN Rail mount socket comes with two
Switches	RH3B	SH3B-05	SH3B-05C	SH3B-51	SH3B-62	horseshoe clips. Do
Sw	RH4B	SH4B-05	SH4B-05C	SH4B-51	SH4B-62	not use unless you plan to insert pullover
Signaling Lights	Hold Dowr	Springs & Clips	A The	No De		wire spring. Replace- ment horseshoe clip part number is Y778-011.
Signa				For DIN	For Through Panel &	
	Appearance	Item	Relay			

#### Hold Down Springs & Clips

Appearance	Item	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket	
$\wedge$		RH1B	SY2S-02F1 <sup>2</sup>		2.
$\leq$ $\backslash$	Pullover Wire Spring	RH2B	SY4S-02F1 <sup>2</sup>	SY4S-51F1	•
1,	Pullover Wire Spring	RH3B	SH3B-05F1 <sup>2</sup>	3143-3171	3.
$\sim$		RH4B SH4B-02F1 <sup>2</sup>			υ.
N.C.S.	Leaf Spring (side latch)	RH1B, RH2B, RH3B, RH4B	SFA-202 <sup>3</sup>	SFA-302 <sup>3</sup>	
1	Leaf Spring (top latch)	RH1B, RH2B, RH3B, RH4B	SFA-101 <sup>3</sup>	SFA-301 <sup>3</sup>	

2. Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011. 3. Two required per relay.

## **AC Coil Ratings**

			Rated C	Current (n	n <b>A)</b> ±15%	at 20°C			Coil Resistance (Ω) Operation Characteristics						cs
Voltage		AC 50Hz			AC 60Hz					±10% at 20°C (against rated values at 20°C)				0°C)	
(V)	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	170	240	330	387	150	200	280	330	330	9.4	6.4	5.4		80% maximum	
12	86	121	165	196	75	100	140	165	165	39.3	25.3	21.2			30% minimum
24	42	60.5	81	98	37	50	70	83	83	153	103	84.5			
110	9.6	_	18.1	21.6	8.4	_	15.5	18.2	18.2	_	2,200	1,800			
110-120	_	9.4- 10.8	_	_	_	8.0-9.2	_	_	_	_	_	_	110%		
120	8.6	_	16.4	19.5	7.5	_	14.2	16.5	16.5	_	10,800	7,360			
220	4.7	_	8.8	10.7	4.1	_	7.7	9.1	9.1	_	10,800	7,360			
220-240	_	4.7-5.4	_		_	4.0-4.6			_	18,820	_	_			
240	4.9	_	8.2	9.8	4.3	_	7.1	8.3	8.3	_	12,100	9,120			

#### **DC Coil Ratings**

Voltage	Rated (	Current (m	A) ±15%	at 20°C	Coil Resistance (Ω) ±10% at 20°C			)	Operation Characteristics (against rated values at 20°C)				
(V)	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage		
6	128	150	240	250	47	40	25	24					
12	64	75	120	125	188	160	100	96					
24	32	36.9	60	62	750	650	400	388	80% 10%			Standard coil volt-	
48	18	18.5	30	31	2,660	2,600	1,600	1,550	110%	maximum	minimum		ages are in <b>BOLD</b> .
100-110	_	8.2-9.0	_	_	_	12,250	_	_					
110	8	_	12.8	15	13,800	_	8,600	7,340					



Relays & Sockets

Timers

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#### **Contact Ratings**

		Maximum C	ontact Capacit	y				
	Continuous	Allowable Co	ontact Power	Rated Load				
Model	Current	Resistive Load	Inductive Load	Voltage (V)	Res. Load	Ind. Load		
				110 AC	10A	7A		
SPDT	10A	1540VA 300W	990VA 210W	220 AC	7A	4.5A		
		00011	21011	30 DC	10A	7A		
DPDT				110 AC	10A	7.5A		
3PDT	10A	1650VA 300W	1100VA 225W	220 AC	7.5A	5A		
4PDT		000	22000	30 DC	10A	7.5A		
No	te: Inductive load	for the rated load -	— cos ø = 0.3, L/R =	= 7 ms				

### **TÜV Ratings**

Voltage	RH1	RH2	RH3	RH4
240V AC	10A	10A	7.5A	7.5A
30V DC	10A	10A	10A	10A

AC: cos ø = 1.0, DC: L/R = 0 ms

#### **Socket Specifications**

	Sockets	Terminal	Electrical Rating	Wire Size	Torque
DIN Rail	SH1B-05	(Coil) M3 screws (contact) M3.5 screws with captive wire clamp	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in∙lbs 9 - 11.5 in∙lbs
Mount Sockets	SH2B-05 SH3B-05 SH4B-05	M3.5 screws with captive wire clamp	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in • lbs
Finger-safe	SH1B-05C	(coil) M3 screws (contact) M3.5 screws with captive wire clamp, fingersafe	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in∙lbs 9 - 11.5 in∙lbs
DIN Rail Mount	SH2B-05C SH3B-05C SH4B-05C	M3.5 screws with captive wire clamp, fingersafe	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in • lbs
Through Panel Mount Socket	SH1B-51 SH2B-51 SH3B-51 SH4B-51	Solder	300V, 10A	—	_
	SH1B-62	PCB mount	250V, 10A	_	_
PCB Mount Socket	SH2B-62 SH3B-62 SH4B-62	PCB mount	300V, 10A	_	

#### Accessories

ltem	Appearance	Use with	Part No.	Remarks
Aluminum DIN Rail (1 meter length)		All DIN rail sockets	BNDN1000	The BNDN1000 is designed to accommodate DIN mount sockets. Made of durable extruded aluminum, the BNDN1000 measures 0.413 (10.5mm) in height and 1.37 (35mm) in width (DIN standard). Standard length is 39" (1,000mm).
DIN Rail End Stop	A REAL PROPERTY AND A REAL	DIN rail	BNL5	9.1 mm wide.
Replacement Hold-Down Spring Anchor		DIN mount sockets and hold down springs.	Y778-011	For use on DIN rail mount socket when using pullover wire hold down spring. 2 pieces included with each socket.

## **UL Ratings**

		Resistive	)	Ge	neral Us	e	Horsepower Rating			
Voltage	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4	
240V AC	10A	7.5A	7.5A	7A	6.5A	5A	1/3 HP	1/3 HP	—	
120V AC	—	10A	10A	—	7.5A	7.5A	1/6 HP	1/6 HP	—	
30V DC	10A	10A	—	7A	—	_	—	_	—	
28V DC	—	—	10A	—	—	—	—	_	—	

#### **CSA** Ratings

Voltage		Resi	stive			Gener	Horse- power Rating		
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	RH1, 2, 3
240V AC	10A	10A	—	7.5A	7A	7A	7A	5A	1/3 HP
120V AC	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6 HP
30V DC	10A	10A	10A	10A	7A	7.5A	—	—	_

Switches & Pilot Lights

**Terminal Blocks** 

#### **Specifications Contact Material**

Operating Time <sup>2</sup>

Release Time <sup>2</sup>

**Power Consumption** 

Insulation Resistance

Dielectric Strength <sup>3</sup>

**Operating Frequency** 

Vibration Resistance

Shock Resistance

Mechanical Life

**Electrical Life** 

Operating

Temperature <sup>4</sup>

**Operating Humidity** 

Weight (approx.)

(approx.)

Contact Resistance 1

Minimum Applicable Load

Silver cadmium oxide

24V DC, 30 mA; 5V DC, 100 mA (reference value)

DC: 0.8W

DC: 0.9W

DC: 1.5W

DC: 1.5W

1,800 operations/hour maximum

18,000 operations/hour maximum

10 to 55Hz, amplitude 0.5 mm

10 to 55Hz, amplitude 0.5 mm

200m/s<sup>2</sup> (20G - SPDT, DPDT) 100m/s<sup>2</sup> (10G - 3PDT, 4PDT)

1,000m/s2 (100G)

2,000V AC, 1 minute

2,000V AC, 1 minute

2,000V AC, 1 minute

2,000V AC, 1 minute

50mΩ maximum

20ms maximum

25ms maximum

20ms maximum

25ms maximum

AC: 1.1VA (50Hz), 1VA (60Hz)

AC: 2VA (50Hz), 1.7VA (60Hz)

AC: 2.5VA (50Hz), 2VA (60Hz)

Between live and dead parts:

Between live and dead parts:

Between contact and coil:

Electrical:

Mechanical:

Damage limits:

Damage limits:

Operating extremes:

Operating extremes:

50,000,000 operations minimum

-25 to +70°C (no freezing)

45 to 85% RH (no condensation)

500,000 operations minimum (120V AC, 10A)

200,000 operations minimum (120V AC, 10A)

SPDT: 24g, DPDT: 37g, 3PDT: 50g, 4PDT: 74g

Between contact and coil:

100MΩ minimum (500V DC megger)

Between contacts of the same pole: 1,000V AC, 1 minute

Between contacts of different poles: 2,000V AC, 1 minute

Between contacts of the same pole: 1,000V AC, 1 minute

AC: 1.4VA (50Hz), 1.2VA (60Hz)

SPDT

DPDT

3PDT

4PDT SPDT

DPDT

3PDT

4PDT SPDT

DPDT

3PDT

4PDT

SPDT

DPDT

3PDT

4PDT

DPDT

SPDT

3PDT

4PDT

SPDT

DPDT

3PDT 4PDT

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Terminal Blocks

Note: Above values are initial values.

Measured using 5V DC, 1A voltage drop method

Measured at the rated voltage (at 20°C), excluding contact bouncing 2.

Release time of relays with diode: 40 ms maximum 3. Relays with indicator or diode: 1000V AC, 1 minute

4. For use under different temperature conditions, refer to Continuous Load Current vs. Operating Temperature Curve. The operating temperature range of relays with indicator or diode is -25 to +40°C.



#### **Characteristics (Reference Data)**

DC Load

1000

500

(RH1)

#### **Electrical Life Curves**

Load Current (A)

1.0

0.5

0.1





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DC resistive

200 300

DC inductive

Load Voltage (V)

Continuous Load Current vs. Operating Temperature Curve (Basic Type, With Check Button, and Top Bracket Mounting Type)



#### Internal Connection (View from Bottom) Basic Type



#### With Indicator (-L type)



#### With Diode (-D type)





DPDT



4PI	T
	3 7 11 12 (+) 14

Contains a diode to absorb the back emf generated when the coil is de-energized. The release time is slightly longer. Available for DC coil only. • Diode Characteristics

Reverse withstand voltage: 1,000V Forward current: 1A



#### With Indicator LED & Diode (-LD type)



#### **Dimensions (mm)**

#### RH1B-U/RH1B-UL/RH1B-UD/RH1B-ULD



#### RH2B-U/RH2B-UL/RH2B-UD/RH2B-ULD



#### RH3B-U/RH3B-UL/RH3B-UD/RH3B-ULD





RH2B-UT

Contactors





#### **RH1B-UT**



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#### RH3B-UT



Switches & Pilot Lights

Signaling Lights

**Relays & Sockets** 

Timers



#### **Dimensions con't (mm)**

#### RH1V2-U/RH1V2-UD





#### RH3V2-U/RH3V2-UL/RH3V2-D





## **Standard DIN Rail Mount Sockets**

SH1B-05

SH3B-05







#### RH4V2-U/RH4V2-UL/RH4V2-UD

RH2V2-U/RH2V2-UL/RH2V2-UD



SH2B-05



#### SH4B-05



Timers

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Terminal Blocks

#### **Dimensions con't (mm)**

#### **Finger-safe DIN Rail Mount Sockets** SH1B-05C



#### SH3B-05C





(Top View)

#### **Through Panel Mount Socket**

#### SH1B-51 Panel Thickness: [18 (N-1) + 12.4] <sup>+0.5</sup> to 2 Terminal Arrangement 159 25.4 25.6+ 1314 (Bottom View 18 N: No. of sockets mounted min.\* 5.4 18 3.5 \* 10.4 min. when using hold-down springs 1 2.4 12.2 SH3B-51



#### [36 (N-1) + 30.4] <sup>+0.6</sup> 25.6 N: No. of sockets mounted min \* 5.4 \* 10.4 min. when using hold-down springs



SH4B-51



Timers

**Relays & Sockets** 

Switches & Pilot Lights

Signaling Lights

## **Dimensions con't (mm)**

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## **PCB Mount Sockets**

SH2B-62







21.5 min.

8-ø2.4 holes

(Tolerance 0.1)

+ + + + +

\$ \$ \$

#### SH3B-62





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Switches & Pilot Lights

Signaling Lights

## **Operating Instructions**

#### **Driving Circuit for Relays**

- 1. To ensure correct relay operation, apply rated voltage to the relay coil.
- 2. Input voltage for the DC coil:

A complete DC voltage is best for the coil power to make sure of stable relay operation. When using a power supply containing a ripple voltage, suppress the ripple factor within 5%. When power is supplied through a rectification circuit, the relay operating characteristics, such as pickup voltage and dropout voltage, depend on the ripple factor. Connect a smoothing capacitor for better operating characteristics as shown below.



#### 3. Leakage current while relay is off:

When driving an element at the same time as the relay operation, special consideration is needed for the circuit design. As shown in the incorrect circuit below, leakage current (lo) flows through the relay coil while the relay is off. Leakage current causes coil release failure or adversely affects the vibration resistance and shock resistance. Design a circuit as shown in the correct example.



4. Surge suppression for transistor driving circuits:

When the relay coil is turned off, a high-voltage pulse is generated, causing a transistor to deteriorate and sometimes to break. Be sure to connect a diode to suppress the back electromotive force. Then, the coil release time becomes slightly longer. To shorten the coil release time, connect a Zener diode between the collector and emitter of the transistor. Select a Zener diode with a Zener voltage slightly higher than the power voltage.



#### **Protection for Relay Contacts**

1. The contact ratings show maximum values. Make sure that these values are not exceeded. When an inrush current flows through the load, the contact may become welded. If this is the case, connect a contact protection circuit, such as a current limiting resistor.

#### 2. Contact protection circuit:

When switching an inductive load, arcing causes carbides to form on the contacts, resulting in increased contact resistance. In consideration of contact reliability, contact life, and noise suppression, use of a surge absorbing circuit is recommended. Note that the release time of the load becomes slightly longer. Check the operation using the actual load. Incorrect use of a contact protection circuit will adversely affect switching characteristics. Four typical examples of contact protection circuits are shown in the following table:



3. Do not use a contact protection circuit as shown below:

Power	This protection circuit is very effective in arc suppression when opening the contacts. But, the capacitor is charged while the contacts are opened. When the contacts are closed, the capacitor is discharged through the contacts, increasing the possibility of contact welding.
	This protection circuit is very effective in arc suppression when opening the contacts. But, when the contacts are closed, a current

pression when closed, a current flows to charge the capacitor, causing contact welding.

Generally, switching a DC inductive load is more difficult than switching a DC resistive load. Using an appropriate arc suppressor, however, will improve the switching characteristics of a DC inductive load.

#### Soldering

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- 1. When soldering the relay terminals, use a soldering iron of 30 to 60W, and quickly complete soldering (within approximately 3 seconds).
- 2. Use a non-corrosive rosin flux.

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#### **Operating Instructions con't**

# Switches & Pilot Lights

**Relays & Sockets** 

# Other Precautions 1. General notice:

To maintain the initial characteristics, do not drop or shock the relay.

The relay cover cannot be removed from the base during normal operation. To maintain the initial characteristics, do not remove the relay cover.

Use the relay in environments free from condensation, dust, sulfur dioxide (SO\_2), and hydrogen sulfide (H\_2S).

Make sure that the coil voltage does not exceed applicable coil voltage range.

- 2. UL and CSA ratings may differ from product rated values determined by IDEC.
- 3. Do not use relays in the vicinity of strong magnetic field, as this may affect relay operation.

## Safety Precautions

- Turn off the power to the relay before starting installation, removal, wiring, maintenance, and inspection of the relays. Failure to turn power off may cause electrical shock or fire hazard.
- Observe specifications and rated values, otherwise electrical shock or fire hazard may be caused.
- Use wires of the proper size to meet voltage and current requirements. Tighten the terminal screws on the relay socket to the proper tightening torque.
- Surge absorbing elements on AC relays with RC or DC relays with diode are
  provided to absorb the back electromotive force generated by the coil. When
  the relay is subject to an excessive external surge voltage, the surge absorbing element may be damaged. Add another surge absorbing provision to the
  relay to prevent damage.

#### Precautions for the RU Relays

- Before operating the latching lever of the RU relay, turn off the power to the RU relay. After checking the circuit, return the latching lever to the original position.
- Do not use the latching lever as a switch. The durability of the latching lever is a minimum of 100 operations.
- When using DC loads on 4PDT relays, apply a positive voltage to terminals of neighboring poles and a negative voltage to the other terminals of neighboring poles to prevent the possibility of short circuits.
- DC relays with a diode have a polarity in the coil terminals. Apply the DC voltage to the correct terminals.



