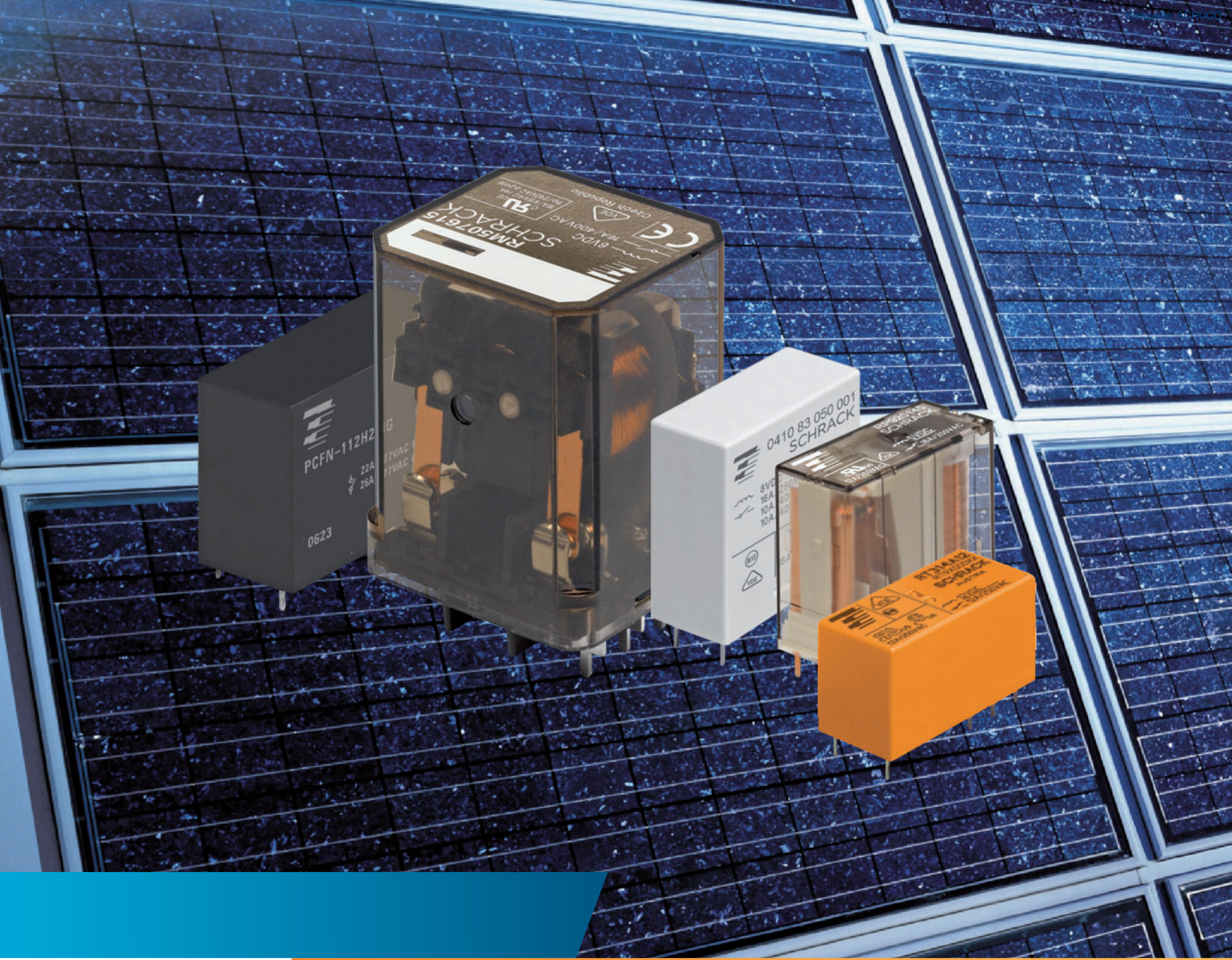


Solar Relays

Tyco Electronics

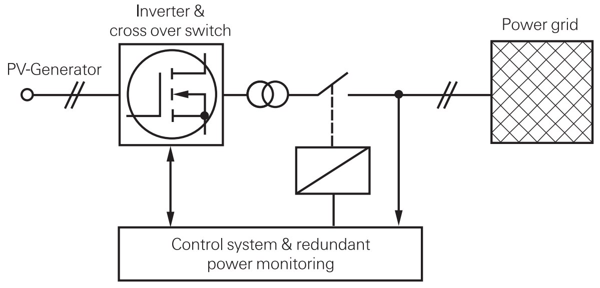
Our commitment. Your advantage.

Solar

Solar energy - Priority No.1
With today's environmental concerns and energy sources becoming scarce, there is growing interest for photovoltaic systems. Approximately 15,000 times of current global electricity consumption could potentially be produced from solar radiation. A possible application for this energy source lies in PV solar modules on private houses and also in large high power installations.

Core components for solar systems
In addition to the popular Solarlok interconnection systems for PV solar modules, Tyco Electronics supplies a number of other core components for solar systems. Relays are an important part, after all "solar electricity only enters the electricity network over relays". Feeding energy into the national electricity network is subject to special rules and standards and special requirements apply to the relays used.

Relays in solar energy systems
Photovoltaic solar energy systems consist of a PV-generator (solar modules) and a power inverter with a connection to the power line. The advantage of these systems is that the solar energy can be fed into the public power grid and energy can be taken out of the network if necessary. It is precisely at the feed-in interface to the power grid that electromechanical relays find their main application area. Safety measures require an automatic switching unit with a circuit break function between the generating equipment and the feed-in point into the power grid.
The relevant switching units must comply with DIN standard V VDE V 0126-1-1 from 02.2006. The most important specification contained in this standard is that a contact gap of ≥ 1.5mm is required at each switched pole.



Block diagram of an automatic switching unit
(example of a Photovoltaic application)

The automatic switching units are usually integrated into the inverters of PV systems. Each pole requires two switches mounted in series. At least one of the two switches must be configured as a relay or as a circuit breaker.
This means that for PV systems with galvanic isolation and single-phase AC feed-in at least two normally open relay contacts are needed, one each for the phase L and neutral line N lines.
For PV systems with no galvanic isolation, both of the switches mounted in series must be electromechanical components. In any case, the circuit separation must be achieved via four electromechanical contacts, two for L and two for N lines. Three-phase systems will need, accordingly, a higher number of contacts. Depending on circuit design and test algorithms, it is also possible to use configurations where the contacts operate simultaneously, e.g. 2 changeover relays with one contact for the separation of the L and one for N line.

Depending on system power and type of feed-in, a continuous current rating of up to 26 A is required, e.g. for 6 KWp and single-phase feed-in. This is the typical upper limit for small systems such as those aimed at single family houses. For large-scale installations, inverters with substantially higher feed-in currents are needed.

Technical requirements
Amongst the specific requirements for inverters is to minimise the dissipation within the device; a struggle for every per cent of efficiency. Also in view of the internal temperature of the device the power dissipation must be kept to a minimum. The relays in the inverter have to operate continuously with as little coil power as possible. Due to their specified switching state, both at energisation and in case of power failure, mono-stable relays are preferred. Relays for this application require special design and dimensioning.
A focus is on the control circuit in order to maximize switching performance up to high ambient temperatures and to reduce the coil dissipation. In the example of the PCFN Solar relay, the optimal control of solar relays is discussed in more detail.

For the use in AC-disconnection Tyco Electronics offers solutions from the product families RM, 041083 and the PCFN. The PCFN Solar is a perfect example: on a printed circuit area of only 490 mm² it has a continuous contact rating of 26 A and a contact gap of 1.5 mm; with 1.5 W pull-in power required for 0.1 s for secure operation after which the power of the coil can be lowered to a hold level of 200 mW.

Relays for the inverter input
While electromechanical relays are mandatory for power grid interconnection, it is not yet the case on the inverter inputs. Using electromechanical relays it is possible to implement special features - e.g. remote on/off switching over a long distance (internet), service disconnection and also reversible emergency shut-down in the event of a failure. For this purpose, Tyco Electronics offers the EV 200, a cost effective solution for voltages up to 900 VDC and most current requirements.

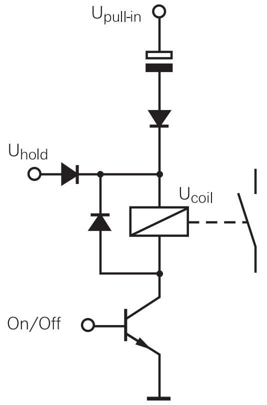
In addition to these main functions, relays are often required for interface functions, for internal test and measurement purposes, e.g. automating test sequences, signalling operating conditions or controlling sequenced actions. For these applications often relays with high contact gaps, for instance the RP920145, are required.

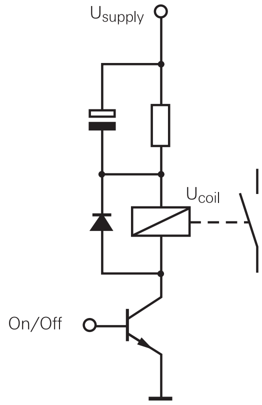
Tyco Electronics relays for all tasks
Tyco Electronics offers an optimal solution for all switching tasks in a solar inverter. For technical information and application advice, please contact our Application Engineers available via phone number +49 30 38638775.

PCFN Solar

Example: Photovoltaic systems incorporating the PCFN-Solar

The PCFN Solar is a mono-stable relay specially developed for the automatic switching units of PV systems with the lowest possible power dissipation. To operate the relay the rated power of 1.5 W has to be applied for 100 ms and can then be reduced to the holding power of approx. 200 mW by reduction of the coil voltage. The magnetic system is designed for this reduced holding power, continuous operation without power reduction is not permitted for ambient temperatures of > 23°C!





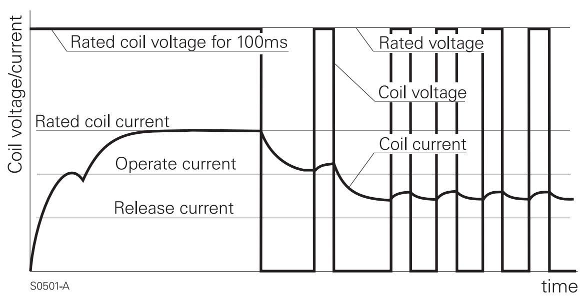
Common methods for the reduction of coil power consumption

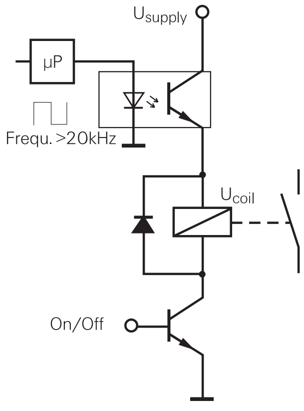
Coil voltage reduction

For mono-stable DC relays (DC coil) and limited acceleration and shock requirements, it is possible to reduce the coil power dissipation, after a pull-in pulse equivalent to at least the coil's rated voltage. After 100 ms the minimum pull-in voltage (75% of the rated coil voltage) must be available at the coil.
After a capacitor has been charged or discharged, the coil voltage for a 12 V relay must remain within a range of 4.4 to 6 V. Under these operating conditions, it is possible for the contacts to conduct a current of up to 22 A at an ambient temperature of 85°C or a continuous current of 26 A at temperatures up to 75°C.

Pulse width modulation (PWM)

After a pull-in pulse for at least 100 ms, it is possible to reduce the power dissipation of mono-stable DC relays by controlling the coil current, e.g. by pulse width modulation (PWM) or without control using a pre-adjusted pulse width. The frequency should be selected so that it lies outside the audible spectrum (> 20 kHz).
The pull-in voltage must be available for 100ms in the range 12 to 15 V (for 12 V relay). With a modulation the mean value of the coil voltage must remain in the range of 4.4 to 6V (for 12 V relay).
When a pulse width modulation design is used, the effects with regard to Electromagnetic Compatibility (EMC) must be checked.





Technical data and notes

For the recommended minimum coil current, minimum holding voltage and all questions relating to the reduction of power consumption of relay coils, please contact our technical support.
Please note that the decision on the suitability of a specific component is the solely responsibility of the user. To ensure the suitability of the product for a specific application the user has to test these products before the use under the most stringent conditions they will be exposed to in the actual application.
Comprehensive technical data as well as application hints please find in the data sheets; the test conditions and processing information is described in the definitions. All information can be found at www.schrackrelays.com/schrack or http://relays.tycoelectronics.com/schrack/

AC Breakers

PCFN Solar

- 1 NO contact, 26 A
- Contact gap: > 1.5 mm
- 6 kWp at 75°C
- RoHS compliant
- Solar version: PCFN-112H2MG,000

0410 83

- 1 NO bridging contact, up to 18 A
- Contact gap: > 3 mm
- Up to 4 kWp at 85°C
- RoHS compliant
- Various versions: e.g. 0410 83 050 001

RM5

- 2 NO contacts, up to 22 A
- Contact gap: > 1.5 mm
- Up to 5 kWp at 50°C
- RoHS compliant
- Various versions: e.g. RM 900271

	PCFN Solar	0410 83	RM5
Contacts			
Configuration	1 NO	1 NO	2 NO
Rated current	26 A	16 A	16 A
Rated voltage	277 VAC	250 VAC	380 VAC
Breaking capacity	7200 VA	4200 VA	6000 VA
Contact gap	> 1.5 mm	> 3 mm	> 1.5 mm
Coil			
Nominal voltage	12 VDC[1)]	12 VDC	115 VAC
Nominal coil power	1.5 W pull-in; 200 mW holding	360 mW	2.8 VA
Coil versions	-	other coil voltages	other coil voltages
Insulation			
Dielectric strength coil-contact	4000 V_{rms}	4000 V_{rms}	2500 V_{rms}
Clearance / creepage coil-cont.	6.1 / 6.1 mm	> 8 / 8 mm	> 3 / 4 mm
General data			
Ambient temperature max.	75°C (85°C at 22A)	85°C	50°C
Standard versions	flux proof	flux proof	dust proof
Terminals	PCB	PCB / Quick connect terminals	PCB
Dimensions l x w x h	30.4 x 16 x 26.5 mm	31.5 x 12.5 x 28.5 mm	38.5 x 35.5 x 51.5 mm
RoHS (Directive 2002/95/EC)	compliant	compliant	compliant

[1)] Ambient temperature > 23°C requires reduction of coil voltage to 4.4...6 V after 100ms

DC Breakers	Interface & Sensing	

EV200

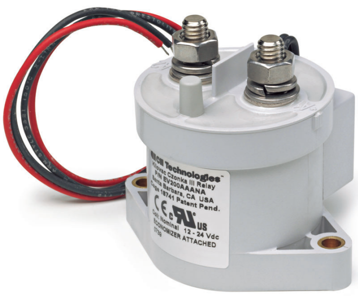
- 1 NO bridging contact, 200 A
- Contact gap: > 1.3 mm
- RoHS compliant versions
- Various versions: e.g. EV200AAANA

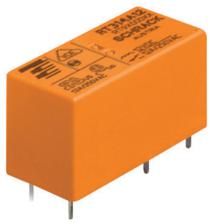
RT1 bistable

- 1 CO contact, 16 A
- Contact gap: > 0.2 mm
- RoHS compliant
- Various versions: e.g. RT314A12

RPII/2

- 2 NO contacts, 8 A
- Contact gap: 1.5 mm
- RoHS compliant
- Various versions: e.g. RP920145





	EV200	RT1 bistable	RPII/2
Contacts			
Configuration	1 NO	1 CO or 1 NO	2 NO
Rated current	200 A	16 A	8A
Rated voltage	320 VDC (max. 900 VDC)	250 VAC	250 VAC
Breaking capacity	2000 A	4000 VA	2000 VA
Contact gap	> 1.3 mm	> 0.2 mm	1.5 mm
Coil			
Nominal voltage	9...36 VDC	12 VDC	5 VDC
Nominal coil power	1.7 W (through economizer)	400 mW	800 mW
Coil versions	other coil voltages	mono-& bistable, other coil volt.	other coil voltages
Insulation			
Dielectric strength coil-contact	2000 V_{rms}	5000 V_{rms}	4000 V_{rms}
Clearance / creepage coil-cont.	-	> 10 / 10 mm	> 8 / 8 mm
General data			
Ambient temperature max.	85°C	85°C	55°C (85°C)
Standard versions	hermetically sealed	-	-
Terminals	M8 threaded terminals	PCB, through hole	PCB, through hole
Dimensions l x w x h	66 x 80 x 72 mm	29 x 12.7 x 15.7 mm	29 x 12.6 x 25.5
RoHS (Directive 2002/95/EC)	compliant versions	compliant	compliant

Dimenstions are in mm and are shown for refererence purpose only.

Specifications subject to change.

Tyco Electronics Austria GmbH
Pilzgasse 33
1210 Vienna
Austria
Phone: +43 1 90560-0
Fax: +43 1 90560-1333

www.tycoelectronics.com

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