

current inrush avoider for toroidal-transformers

Data Sheet: Transformer Switching Relay TSRL

The TSRL is an electronic relay used in the switching of transformers. Using a patent smooth switching procedure, one or more single phase transformers can be switched, either from an idle state or loaded state without inrush current.

Smooth switching procedure eliminates inrush and not only reduces it.

Using TSRL transformers can be limited to their rated current at the primary side, and therefore are optimally safeguarded. Transformers which are frequently switched can also be optimised using TSRL i.e. transformer design for up to 1.6T induction using low loss plating and small copper losses.

Transformers can therefore be designed for economic and low-loss operation.

The TSRL is simply installed between the main switch and the transformer. It may also be used as the main switch when operated using a control input. There are no long term switching losses.



Application Areas:

The TSRL can be used in isolating, control, filament and automotive transformers for industrial applications, plant construction and research.

Operation Principal:

1. Smooth switching procedure:

The TSRL pre magnetises the transformer before complete switching using unipolar voltage impulses. The strength of the pre magnetisation is the same for all transformers, and its value should amount to the turning point of the hysteresis curve. The width of the required voltage impulses must be matched to the different transformer types, such as packet core transformers or toroidal mains transformers. The potentiometer (TP1) in the TSRL is used for this purpose (see adjusting instructions).

2. Dimming (Special Version):

The TSRL can also be used in the smooth switching of filter capacitor elements such as frequency converters used in network input circuits. Large filter capacitors following a transformer can also be switched smoothly

In this case the voltage impulses are continuously increased up to the potentiometer set values before complete switching (see adjusting instructions).

2. Half-wave failure recognition (Special version):

Line voltage distortions such as half-wave failures can result in saturation currents larger than the inrush current in the transformer. The TSRL reacts to half-wave failures by immediately switching off before saturation currents arise, and then the smooth switching-on operation is again resumed. In this manner triggering of the fuse can be avoided..

Technical Data:

(Switching-on procedure according to Patent No. DE 42 17 866, EP 05 75 715 B1, US 005 517 380A)

Rated voltage:

Standard:	230V: 190VAC - 260VAC; Peak voltage max. 800V
Option:	110V: 90VAC - 135VAC; Peak voltage max. 600V
Option:	400V: 350VAC - 450VAC; Peak voltage max. 1200V
Option:	500V: 410VAC - 560VAC Peak voltage max. 1600V
Option:	90VAC - 260VAC; Peak voltage max. 800V (Half-wave failure recognition not possible)
Frequency:	45-65 Hz
Overvoltage category:	III

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Rated current, Standard:	ambient temperature 30°C 40°C 50°C 60°C 70°C max. load current 16 A 16 A 16 A 14 A 12 A
	Max. peak current: 400A (t _{peak} =10ms), Leakage current 11mA bei 230VAC
	Load integral limit: 800A ² s (t=10ms)
Option:	ambient temperature 30°C 40°C 50°C 60°C 70°C max. load current 32 A 28 A 25 A 22 A 19 A
	Max.: peak current: 500A (t _{peak} =10ms), Leakage current 11mA bei 230VAC
	Load integral limit: 1250A ² s (t=10ms)
Power supply failure:	For power supply failure > 60ms smooth switching-on takes place after power recovery
Option half-wave failure recognition:	For power supply failure > 2ms smooth switching-on takes place after power recovery
Protection:	Protection maximum to the rated current of the TSRL, for example for circuit breakers with B characteristics, or melting fuses with g/R characteristics the TSRL is short circuit protected.
Turn-on delay:	Setting TP1 on R ON P Dimmer R Dimmer P Switching mains (control input on) ca. 0.88s ca. 0.15s Ca. 0.95s ca. 0.45s Switching ON using control input ca. 0.25s ca. 0.06s Ca. 0.35s ca. 0.30s
Turn-off delay:	Switching off using the control input approx. 0.03-0.05s
Switching frequency:	Independent of the transformer type (Packet- or toroidal core transformer) Typically 25 switching cycles in succession, then 60 sec pause required (packet core Transformer), up to unlimited switching cycles without a pause (Toroidal transformer)
Lifetime:	about 5 million switching operations
Control input:	Standard: Over an external normally open contact, or through the transistor of an external optical coupler Contact voltage: 5 V Contact current: 14 mA Terminals S1/ S2 area connected to the mains
Option optical coupler input:	Through control voltage Control voltage: 4- 32 VDC Control current: 1-12 mA
External Potentiometer:	Resistance: 1-2,5 k Ohm, max. cable length 0,5m, U _{cc} =5VDC
For special functions	Potentiometer is connected to the mains (Test voltage 2,5 kV) z.B. Timing function
Electromagnetic compatibility (CE):	Interference immunity: EN 50082-2; Interference emission: EN 50081-1 To comply to the limits of the interference emission (crackle interference) the TSRL may be switched on and off only five times per minute without external mains filtering.
Connections:	16A Mains/Load connectors: Screw terminals, connection cross-section 0.2-2.5mm ² , tightening torque 0.5-0.6Nm 32A Mains/Load connectors: Screw terminals, connection cross-section 0.2-4mm ² , tightening torque 0.5-0.6Nm Control input: Spring terminals, connection cross-section 0.1-2mm ² ext.Potentiometer: Spring terminals, connection cross-section 0.1-0.5mm ²
Fixture:	-Quick connection to 35mm connection rails according to DIN EN 50 022 or DIN EN50035 - Wall mounting using two 4.5mm connection bore holes - Circuit board mounting (without housing) using three 3.2mm connection bore holes
Type: Housing:	Encapsulated, housing made from insulating material
Circuit board:	Open
Cleanliness class:	In the housing: 3, circuit board: 2
Degree of protection:	In the housing: IP20, circuit board: IP00
Protection class:	Protection class II
Dimensions (LxWxH):	With housing: 98x88x35mm; for 500 V: 98x88x45mm; Circuit board 77.5x85x30mm
Housing:	Material ABS, Flammability class UL94 VO
Weight:	0.2kg
Shock resistance:	10g
Humidity max.:	95%, no condensation
Ambient temperature:	0°C to 60°C, special version: -20°C to +70°C
Storage temperature:	-10°C to 70°C

