› Datasheet

Transformator Switching Relay | Type TSRD

intelligent electronics | FSM®

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The TSRD is an electronic load contactor used for switching transformers in a three-phase network. Applying a patented smooth switching procedure three-phase transformers, as well as single-phase transformers running in parallel can be operated from an idle state or loaded state without inrush current. Smooth switching procedure eliminates inrush current and not only reduces it. In the application of three-phase transformers it is distinguished between the primary vector group delta or star connection without Mp (application D) and the vector group star with Mp (application S). Applications with three single-phase transformers distinguise whether the transformers are operated between phase and N (application N) or whether the transformers are operated between two phases (application L).
The TSRD monitors both the voltage values of the three phases, as well as the phase sequences of the connected three-phase network.
The TSRD is simply connected between the mains switch and the transformer. It can, however, also be used as a mains switch without potential separation in which case it is activated using control input 1. Smooth switching of the transformer is done using thyrsistors which are bridged using an external bypass contactor as soon as the fully-on state is achieved so as to minimise the losses in the TRSD. This contactor is only required for the AC1 class and is not delivered with the TSRD. The TSRD carries out an internal contactor response control so as to assure that the thyrsistors are bridged. Switching-off is also carried out using thrysistors because the bypass contactor is deactivated and then the thrysistors can be switched off.
The TSRD can also be used to switch unloaded or partially loaded transformers with rated currents greater than 50A.

Fields of application

The TSRD can be used in isolating, control, filament and automotive transformers for industrial applications, plant construction or research. Using the TSRD, transformers can be quick-action fuse-protected on the primary side to the rated current, therefore ensuring optimum protection.

Principles

1. DIP-Switch
Using the DIP-switch, the following settings can be applied: Error handling, rotation direction recognition, control inputs, message output 1, transformer type (see application instructions for details)

2. OK-LED
The LED OK (green) is illuminated when the TSRD is in working order, and flashes at different rates for occuring faults.

3. Smooth switching procedure
The TSRD premagnetises the transformer using unipolar voltage impulses before complete switching-on..

3a. Three-phase transformers
For three-phase transformers (application D and S) the magnetic flux in the iron core of the three-phase transformer is balanced during the premagnetisation. To achieve this the width of the voltage impulse is continuously increased from an initial value to a final value of a quarter of the mains period (5ms at 50Hz). The final value is the same for all three-phase transformers and need not be set. In order that the smooth switching procedure functions correctly, the coil connection group of the three-phase transformers must match that of the connected TSRD. (you can get more information from our technical person Mr. Konstanzer).

3b. Single-phase transformers
For single-phase transformers (application N and L), the magnetic flux in the iron core is equal to the inflexion point of the hysterysis curve during the premagnetisation. The value of the premagnetisation required to reach the inflexion point of the hysterysis curve is the same for all transformers. 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 TSRD is used for this purpose (see adjusting instructions). Settings for packet core transformers will be set in the factory.

4. Message output 1
The LED display 'Message 1' (green) is illuminated when the relay contact between connectors 23 and 24 is closed. If the function „Fully-on" is activated for the Message Output 1 function (factory setting), the relay contact is closed as soon as the TSRD has completed switching on of the connected transformer after completion of the premagnetisation (remnance-setting). With the function „OK Message" the relay contact is closed the mains voltage is switched on and successful initialisation of the TSRD has been completed. This contact remains closed until an error occurs (see 2 also). If the message function is deactivated, the relay contact is not addressable, i.e the relay contact is used according to the function chosen by the customer.

5. Message output 2
The LED display 'Message 2' is an optional relay output whose function can be chosen by the customer. The LED display 'Message 2' (yellow) is illuminated when the relay contact between connectors 33 and 34 is closed.

6. Rotation direction recognition
The TSRD detects the phase sequence of the three-phase network as soon as the power is switched on. DIP switch 2 can be used to determine whether the TSRD switches the connected transformer on for a clockwise phase sequence or also for an anticlockwise phase sequence.

7. Error handling
The TSRD recognises different errors which, on occurring, independently switches the transformer off (see also 2). The DIP switch 1 on the TSRD can be used to decide whether the transformer is independently switched on again as soon as the interference is eliminated, or first after control input 1 has been remotely activated.

8. Contactor response control
Using the protection response control the TSRD monitors whether the bypass contactor is activated after complete switching on or not. To do this the voltage in the control element L3-T3 is measured after complete switching on. If this voltage does not drop to zero after the bypass contactor should have bridged the control elements, the TSRD goes into alarm and switches the transformer off again. Once the bypass contactor is on the thyristors in the control elements L1-T1 and L2-T2 area switched off and will only be switched on again once the connected transformer is switched off. If the current flowing through the control element L3-T3 is less than 20mA, the TSRD can no longer determine whether the bypass contactor is activated.

Technical details

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

Rated voltage: Standard Option Option	400 V: 320 VAC – 440 VAC; peak voltage max. 1200 V 200 V: 160 VAC – 230 VAC; peak voltage max. 800 V 500 V: 400 VAC – 550 VAC; peak voltage max. 1600 V		
Frequency	45 - 65 Hz		
Over voltage category	III		
Rated current: Standard Option	32 A Maximum peak current: 400A (t_{peak} =10ms), leakage current in blocked condition:12mA at 400V Load integral limit: 800A²s (t=10ms) 50A Maximum peak current: 600A (t_{peak} =10ms), leakage current in blocked condition:12mA at 400V Load integral limit: 1800A²s (t=10ms)		
Power line failure	After a power line failure >= 80ms smooth switching on take place when power is returned		
Protection	Maximum protection to the rated current of theTSRD i.e.: for circuit breakers with B characteristics, or melting fuses with g/R characteristics the TSRL is short circuit protected.		
Turn-on delay (50 Hz)	Application D:	Mains on with activated control input 1 Switching on across control input 1	ca. 0,42s ca. 0,25s

Turn-on delay (50 Hz)	Application S:	Mains on with activated control input 1	ca. 0,46s	
		Switching on across control input 1	ca. 0,29s	
	Application N	SettingTP1	On R	On P
		Mains on with activated control input 1	ca. 0.96s	ca. 0.36s
		Switching on across control input 1	ca. 0.23s	ca. 0.09s
	Application L	Mains on with activated control input 1	ca. 0.89s	ca. 0.39s
		Switching on across control input 1	ca. 0.22s	ca. 0.1s

Switching-off delay (50Hz)	On switching off across control input 1:	Application D:	ca. 0,07-0,09s
		Application S:	ca. 0,08-0,10s
		Application N:	ca. 0,08-0,10s
		Application L:	ca. 0,08-0,10s

Switching frequency	Unlimited
Lifetime	Dependent on the loading of the control relay contact of the bypass contactor (connection 13/14)
Control input 1 and 2	Across an opto coupler in TSRD, seperate potential Driver A1-A2 bzw. A4-A5 U= 16 – 121 VAC/DC I= 1 - 8,3 mA Driver A1-A3 bzw. A4-A6 U= 93 – 550 VAC I= 1,3 - 8,1 mA
Option control ouput 1 and 2	Relay make contact

Bypass-Contactor-Driver	Max. switching power (ohmic load):		2000 VA
	Max. switching voltage:		380 VAC
	Max. switching current:		10 A
	Rated load (ohmic load):		8 A/250 VAC, 5 A/380 VAC, 8 A/24 VDC
	Lifetime	Mechanical	$20x10^6$
		Electrical	$100x10^3$

Bypass-Contactor	Max. permissible response delay: 0,29s at 50Hz, 0,24s at 60Hz Max. permissible release delay: 0,36s at 50Hz, 0,28s at 60Hz To suppress interference in the contactor coil it is recommended to connect an RC element parallel to the coil
Intrinsic Consumption	1,7 W
EMV (CE)	Interference immunity: EN 50082-2 Interference emission: EN 50081-1 To comply to the limits of the interference emission (crackle interference) the TSRD may be switched on and off maximum five times per minute without external mains filtering.
Connections 32A Mains/load connections: 50A Mains/load connections Control inputs/outputs	 Screw terminals, connection cross-section 0,2- 4 mm2, tightening torque 0,5-0,6 Nm Screw terminals, connection cross-section 0,5-10 mm2, tightening torque 1,2-1,5 Nm Screw terminals, connection cross-section 0,2-2,5 mm2, tightening torque 0,5-0,6 Nm
Fixture	- Quick connection to 35mm connection rails according to DIN EN 50 022 or DIN EN50035
Type	Encapsulated, housing made from insulating material
Cleanliness class	3
Degree of protection	IP 20
Protection class	Protection class II
Dimensions (LxWxH)	180x125x98 mm
Housing	Material PVC and Polyamide, Flammability classUL94 V0
Weight	0,8 kg
Shock resistance	10 g
Humidity max	95 % , no condensation
Operating temperature	-15 °C up to 50 °C
Storage temperature	-15 °C up to 50 °C