

Data sheet

Transformer switching relay | Type TSRDF



The TSRDF is a control module, which can be used as a control element of a transformer switching relay when used in combination with external thyristors or semiconductor relays in a three-phase current supply. Using this module transformers can be frequently switched, without inrush current peaks.

Fields of application

The TSRDF can be used in frequently switching welding or heating transformers as well as heavy duty transformers for industrial applications, plant construction and research.

Functions

- ▶ **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)
- ▶ **OK-LED**
The LED OK (green) is illuminated when the TSRDF is in working order, and flashes at different rates for occurring faults.
- ▶ **Smooth switching procedure**
The TSRDF premagnetises the transformer using unipolar voltage impulses before complete switching-on.
- ▶ **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 TSRDF.

➤ 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 hysteresis curve during the premagnetisation. The value of the premagnetisation required to reach the inflexion point of the hysteresis 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.

➤ 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 Display“ is activated for the Message Output 1 function (factory setting), the relay contact is closed as soon as the TSRDF has completed switching-on of the connected transformer after completion of the premagnetisation (remnance-setting). With the function „OK Display“ the relay contact is closed after the mains voltage has been switched on and successful initialisation of the TSRDF has been completed. This contact remains closed until an error occurs. The function “Error Display” causes the relay point to close in the event of a malfunction. The function “Bypass Contactor Selection” causes the TSRDF to switch-off the controlling elements as soon as the bypass contactor is bridged after switching-on is completed. The TSRDF switches-on the controlling element again during disconnection before the bypass contactor is switched-off. In this manner wearing of the contactor connections is avoided.

➤ 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.

➤ Rotation direction recognition

The TSRDF 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 TSRDF switches the connected transformer on for a clockwise phase sequence or also for an anticlockwise phase sequence.

➤ Error handling

The TSRDF recognises different errors which, on occurring, independently switches the transformer off (see also 2). The DIP switch 1 on the TSRDF 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.

Technical Data

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

Description	
Rated voltage 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
Control element Standard	Semiconductor relays quick action switching, 2.5 kV Test voltage between the control and load circuit. Characteristic values for the semiconductor relay: Open circuit control voltage DC: $U_{HiLo} = 5 \text{ V}$ DC internal resistance $R_{HiLo} = 120 \text{ } \Omega$ Maximum available control current: $I_{HiLo} = 10 \text{ mA}$ Maximum permissible switching-on delay: $t_{ein} = 0.2 \text{ ms}$ Maximum permissible switching-off delay $t_{aus} = 0.25 \text{ ms}$

Description					
Option Thyristors	Triggering through Opto-Triacs across protection resistor R_{VG} im TSRDF V_{rat} 200 V 400 V 500 V R_{VG} 68 Ω 121 Ω 150 Ω Characteristics of the thyristors: Max. available gate current: $I_{Gt} = 220$ mA Max. permissible triggering delay: $t_{gd} = 0.2$ ms Max. permissible release time: $t_q = 0.25$ ms Gate cathode resistance: $R_{GK} = 120$ Ohm/ 0,25 W Gate cathode diode: $D_{GK} =$ z.B.: 1N4004				
Power line failure	After a power line failure ≥ 80 ms smooth switching on take place when power is returned				
Turn-on delay (50 Hz)	Application D	Mains on with activated control input 1	approx. 0.42 s		
		Switching on across control input	approx. 0.25 s		
	Application S	Mains on with activated control input 1	approx. 0.46 s		
		Switching on across control input	approx. 0.29 s		
	Application N	Setting TP1	on R		on P
		Mains on with activated control input 1	approx. 0.96 s		approx. 0.36 s
		Switching on across control input	approx. 0.23 s		approx. 0.09 s
		Switching on across control input with Bypass-contactor control	approx. 0.96 s		approx. 0.36 s
	Application L	Mains on with activated control input 1	approx. 0.89 s		approx. 0.39 s
		Switching on across control input	approx. 0.22 s		approx. 0.1 s
		Switching on across control input with Bypass-contactor control	approx. 0.89 s		approx. 0.39 s
	Switching-off delay	On switching off across control input: Without Bypass contactor: ca. 0.04-0.06s With Bypass contactor ca. 0.33-0.35s			
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 TSRDF, separate 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				
	Relay make contact Max. switching power (Ohmic load): 2000VA Max. switching voltage: 380VAC Max. switching current: 10A Rated load (Ohmic load): 8A/250VAC, 5A/380VAC, 8A/24VDC Lifetime Mechanical 20×10^6 Electrical 100×10^3 at the rated loading				

Description		
Lifetime	Mechanical 20x10 ⁶ Electrical 100x10 ³ at the rated loading	
Bypass-Contactor	Max. permissible response delay	0.3s at 50Hz, 0.23s at 60Hz
	Max. permissible release delay	0.3s at 50Hz, 0.23s 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	
EMC (CE)	Interference immunity: EN 50082-2 Interference emission: EN 50081-1 To comply to the limits of the interference emission (crackle interference) the TSRDF may be switched on and off maximum five times per minute without external mains filtering.	
Connections	Screw terminals, connection cross-section 0.2-2.5 mm ² , tightening torque 0.5-0.6 Nm	
Fixture	Quick connection to 35 mm 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	II	
Dimensions (LxWxH)	180 x 125 x 98 mm	
Housing	Material PVC and Polyamide, Flammability classUL94 V0	
Weight	0.5 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	

Dimensions and order code

