

> Datasheet

Transformator switching relay | Type TSRDF



intelligent electronics

FSM[®]

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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. Applying a patented smooth switching procedure the TSRDF module controls the connected solid state control element so that either three-phase transformers and/or three single phase transformers together can be operated with 'pulse groups' either in an idle state or loaded condition without inrush current. Using the smooth switching procedure results in the elimination and not only the reduction of inrush current. Two classes of three-phase transformers are distinguished: primary side delta or star without M_p (application D) or star configuration with M_p (application S). Applications using three single-phase transformers distinguish as to whether the transformer is operated between each phase and N (application N) or whether the transformer is operated between two phases respectively (application L), see operating instructions. The TSRDF monitors the voltages of the three phases as well as the phase-sequence of the connected three-phase current supply. The TSRDF can be supplied both to control external thyristors as well as for the control of various forms of instantaneous switching of semiconductor relays. The TSRDF including the control elements (semiconductor relay or thyristor module, or individually connected thyristors) is connected between the power supply and transformer. The TSRDF can be used to control a bypass-contactor, in which the controlling elements are bridged to reduce the power loss.

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, (see application instructions for details).

> OK message display

The LED OK (green) is illuminated continuously when the TSRDF is in working order, and flashes at different rates for faults (see operating instructions).

> Smooth switching procedure

The TSRDF premagnetises the transformer using unipolar voltage impulses before complete switching-on.

Three phase transformer:

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 transformer:

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 TSRDF is used for this purpose (see adjusting instructions). Settings for packet core transformers will be set in the factory.

➤ Message display 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 (see operating instructions).

The function “Error Display” causes the relay point to close in the event of a malfunction (see operating instructions)

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 display 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 operating instructions). 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 after control input 1 has been remotely 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:	400 V: 320 VAC - 440 VAC; peak voltage max. 1200 V										
Standard	200 V: 160 VAC - 230 VAC; peak voltage max. 800 V										
Option	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 $R_{HiLo} = 120 \text{ Ohm}$ 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 $t_{aus} = 0,25 \text{ ms}$										
Thyristors (option)	Triggering through Opto-Triacs across protection resistor RVG im TSRDF <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>V_{rat}</td> <td>200 V</td> <td>400 V</td> <td>500 V</td> </tr> <tr> <td>R_{VG}</td> <td>68 Ohm</td> <td>121 Ohm</td> <td>150 Ohm</td> </tr> </table> Characteristics of the thyristors: Max. available gate current: $I_{Gt} = 220 \text{ mA}$ Max. permissible triggering delay: $t_{gd} = 0,2 \text{ ms}$ Max. permissible release time: $t_q = 0,25 \text{ ms}$ Gate cathode resistance: $R_{GK} = 120 \text{ Ohm} / 0,25 \text{ W}$ Gate cathode diode: $D_{GK} = \text{z.B.: } 1N4004$			V _{rat}	200 V	400 V	500 V	R _{VG}	68 Ohm	121 Ohm	150 Ohm
V _{rat}	200 V	400 V	500 V								
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Power line failure	After a power line failure $\geq 80\text{ms}$ smooth switching on take place when power is returned										
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								
	Application S	Mains on with activated control input 1 Switching on across control input 1	ca. 0.46s ca. 0.29s								
	Application N	SettingTP1 Mains on with activated control input 1 Switching on across control input 1	On R ca. 0.96s ca. 0.23s	On P ca. 0.36s ca. 0.09s							
	Application L	Mains on with activated control input 1 Switching on across control input 1	ca. 0.89s ca. 0.22s	ca. 0.39s ca. 0.1s							
Switching-off delay	On switching off across control input:	Without Bypass contactor: With Bypass contactor	ca. 0.04-0.06s ca. 0.33-0.35s								
Switching frequency	Unlimited										

Control input 1 and 2	Across an opto coupler in TSRDF, separate potential Driver A1-A2 or A4-A5 resp. U= 16 - 121VAC I= 1-8.3mA Driver A1-A3 or A4-A6 resp. U= 16 - 121VAC/DC I= 1.3 -8.1mA
Control output 1 and 2	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 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
EMC (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	Screw terminals, connection cross-section 0.2-2.5 mm ² , 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)	180x125x98mm
Housing	Material PVC and Polyamide, Flammability classUL94 V0
Weight	0,5kg
Shock resistance	10g
Humidity max.	95%, no condensation
Operating temperature	0°C to +60°C, special version: -20°C to +80°C
Storage temperature	-10°C to +70°C

Housing and order code

