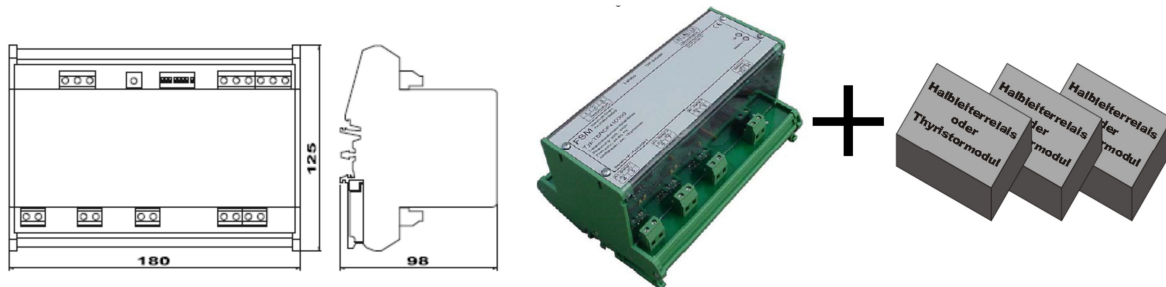


Transformer switch relays

13.3 Type TSRDF Transformer switch relay



The TSRDF is a control module which realises a transformer switch relay with its external thyristors or solid-state relays as an actuator for the three-phase current. Transformers may often be switched with its help. Using a patented soft start-up operation the TSRDF switches three-phase transformers as well as three single-phase transformers together open-circuited or on-load without inrush. The inrush is not only bordered but avoided by the soft start-up operation. Three-phase transformers are classified in primary connection symbols triangle or star without Mp (Application D) and connection symbol star with Mp (Application S). Applications with three single-phase transformers are distinguished between transformers that are operated between every phase and N (Application N) and those that are operated between every two phases (Application L) (see operating instructions). The TSRDF monitors the stress level of the three phases as well as the phase sequence of the attached three-phase current. The TSRDF may be delivered for switching external thyristors or in another version for instantaneous switching solid-state relay. It is operated by the actuating elements (solid-state relays or thyristor modules or single thyristors with snubber circuit) between network and transformer.

The TSRDF is able to switch a bypass contactor which bypasses the actuating elements and minimizes the power loss.

The TSRDF applies with often switched welding transformers filament transformers or transformers with high power in industry plant construction and research.

Functions:

1. DIP switch:

The following adjustments may be conducted via the DIP switches:

Error correction – Rotation direction detection – Control inputs - Message 1 – Application

2. OK - LED:

The illuminating diode OK (green) illuminates when TSRDF is in OK status and blinks with different velocities if there are annoyances. (see operating instructions).

3. Soft start-up operation:

The TSRDF biases the transformer before the full plug with unipolar voltage pulses.

3a. Three – phase transformers:

In three-phase transformers (Applications D and S) the magnetic flux inside the iron core is balanced during the bias. To this end the voltage pulse's amplitude is increased from an initial value up to a terminal value of a quarter mains period (5 ms at 50 Hz). The terminal value is the same for all three-phase transformers and needn't be adjusted. To assure the soft start-up operation works right the three-phase transformers have to be connected winding correctly to the TSRDF.

3b. Single – phase transformers:

In single-phase transformers (Application N and L) the magnetic flux inside the iron core is drifted into the inflexion point of the hysteresis curve during the bias. The power of the bias that is necessary to

reach the reflexion point of the hysteresis curve is the same for all transformers. The amplitude of the therefore necessary voltage pulses needs to be aligned to the different types of transformers like package core or toroidal transformers. The potentiometer (TP1) inside the TSRDF serves for that factory-provided adjustment for package core transformers (see operating instructions).

4. Message output 1:

The illuminating diode "Meldung 1" (yellow) illuminates when the relay contact at the clamps 23 and 24 is closed. If for message output 1 the function "Voll-Ein-Meldung" (factory-provided adjustment) is chosen the relay contact gets closed when the TSRDF completely switched on the connected transformer after the end of bias (magnetic residual setting).

Using the function "Ok-Meldung" the relay contact gets closed after spreading the mains voltage and successful initialisation of the TSRDF. The contact stays closed until an annoyance arises (see operating instructions). At the function "Fehler-Meldung" the relay contact is closed as soon as an annoyance arises (see operating instructions). At the function "Bypass-Schütz-Ansteuerung" the TSRDF switches off the actuating elements after full plug as soon as the bypass contactor bypassed it. The TSRDF does not switch on the actuating elements again until the bypass contactor is switched off. So the used contact of the contactor may be switched without abrasion.

5. Message output 2: (Option)

The message output 2 is an optional relay message output whose function will be determined corresponding to the client's requirements. The illuminating diode "Meldung 2" (yellow) illuminates when the relay contact at the clamps 33 and 34 is closed.

6. Rotation direction detection:

The TSRDF detects the phase sequence of the three-phase current after spreading the mains voltage. By using the DIP switch 2 it may be chosen if the TSRDF switches on the connected transformer only at right-handed or also at left-hand phase sequence.

7. Failure management:

The TSRDF recognises diverse annoyances which activate a cut-out of the connected transformer (see operating instructions). At the TSRDF may be chosen via the DIP switch if it switches on the transformer autonomously when the mentioned annoyance is eliminated or not until the remote on signal at control input is applied recently.

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Technical data

(Start-up operation corresponding to patent No.: DE 42 17 866 EP 05 75 715 B1 US 005 517 380A)

Nominal voltages:

Standard: 400 V: 320 VAC – 440 VAC; peak voltage max. 1200 V

Option: 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

Overvoltage category: III

Actuating element:

Standard: Solid-state relay instantaneous switching 2.5 KV proof voltage between control and load circuit. Characteristics for the solid-state relay:

Idling 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 allowable input delay: $t_{ein} = 0.2 \text{ ms}$

Maximum allowable output delay: $t_{aus} = 0.25 \text{ ms}$

Option thyristors:

Combustion with opto-triacs via multiplier R_{VG} in TSRDF

Unenn 200 V 400 V 500 V

R_{VG} 68 ohm 121 ohm 150 ohm

Characteristics for the thyristors:

Max. available gate current: $I_{Gt} = 220 \text{ mA}$

Max. allowable ignition delay: $t_{gd} = 0.2 \text{ ms}$

Max. allowable recovery time: $t_q = 0.25 \text{ ms}$

Gate cathode resistance: $R_{GK} = 120 \text{ Ohm} / 0.25 \text{ W}$

Gate cathode diode: $D_{GK} = \text{e.g.: } 1N4004$

Power failure:

In case of power failure > 80 ms soft start-up at power recurrence

Input delay: (50 Hz)

Application	Control Input	at R	at P
Application D	Mains on with operated control input 1	ca. 0.42 s	
	Switch-on via control input 1	ca. 0.25 s	
Application S	Mains on with operated control input 1	ca. 0.46 s	
	Switch-on via control input 1	ca. 0.29 s	
Application N	Adjustment TP1		
	Mains on with operated control input 1	ca. 0.96 s	ca. 0.36 s
Application L	Switch-on via control input 1	ca. 0.23 s	ca. 0.09 s
	Mains on with operated control input 1	ca. 0.89 s	ca. 0.39 s
	Switch-on via control input 1	ca. 0.22 s	ca. 0.1 s

Output delay:

At switch-off via control input: without bypass contactor: ca. 0.04-0.06 s
With bypass contactor: ca. 0.33-0.35 s

Ferquency of operation:

Optional

Control input 1 and 2:

Via optocoupler inside the TSRDF isolated

Activation A1-A2 or A4-A5: $U = 16 - 121 \text{ VAC/DC}$ $I = 1.8 - 3 \text{ mA}$

Activation A1-A3 or A4-A6: $U = 93 - 550 \text{ VAC}$ $I = 1.3 - 8.1 \text{ mA}$

Control output 1 and 2:

Relay closing contact

Max. breaking capacity (Ohm resistive load): 2000 VA

Max. switching voltage : 380 VAC

Max. switching current: 10 A

Nominal load (Ohm resistive load): 8 A / 250 VAC 5 A / 380 VAC 8 A / 24 VDC

Durability: mechanical 20×10^6 electrical 100×10^3 at nominal load

Bypass contactor:

Max. allowable on-delay: 0.3 s at 50 Hz 0.23 s at 60 Hz

Max. allowable dropout delay: 0.3 s at 50 Hz 0.23 s at 60 Hz

To dejam the contactor coil it is advisable to connect the coil in parallel to an RC-circuit.

EMV (CE):

Fault-free operation: EN 50082-2 transient emissions: EN 50081-1

To follow the safety values for the transient emission (clicks) the TSRDF without extra power supply filtering may only be switched on or off five times per minute.

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Connections:	Screw-type terminals clamping range 0.2 – 2.5 mm ² locked torque 0.5 – 0.6 Nm
Anchorage:	Quick fastening on 35 mm bearing rail corresponding to DIN EN50022 / DIN EN50035
Building type:	capsuled in moulding case
Degree of pollution:	3
Type protection:	IP 20
Protection class:	Attachment of protection class II
Dimensions (LxBxH):	180 x 125 x 98 mm
Case:	Material PVC and polyamide flammability class UL94 V0
Weight:	0.5 kg
Shock strength:	10 g
Humidity:	95 % non-condensing
Operating temperature:	0°C up to + 60°C Extra version: - 20°C up to + 80°C
Storage temperature:	- 10°C up to + 70°C

