DEALING WITH PROBLEMS IN OUTPUT RELAYS USED IN MICROPROCESSOR-BASED PROTECTION DEVICES – PART II

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There are in the market completely assembled modules (solid-state relays on basis of IGBT technology) ready to use at 250 VDC.

These modules are larger (58.4 x 45.7 x 22.9 mm) compared to a single IGBT with a driver, but can be used in MPDs of any design as they don't require a printed circuit board or any addition elements for installation (see fig. 9).

Both modules have a high current and overvoltage capability (75A, 1500 V – for 1, and 25A, 1200 V – for 2), that makes them suitable for usage in an MPD.

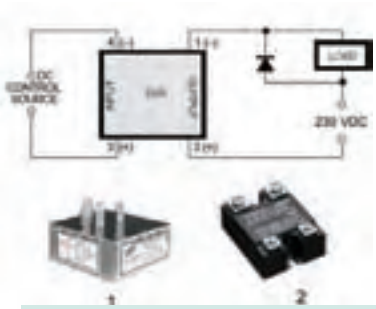

Fig. 9. Solid-state modules for switching of inductive load at 250 VDC
1 – APSW-DC75 type (Applied Power Systems);
2 – SSC1000-25 type (Crydom).

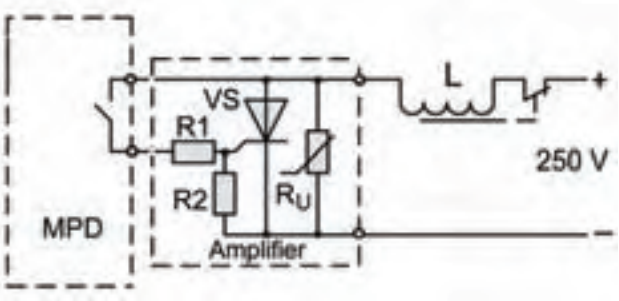

Fig. 10. Simple switching amplifier on single thyristor for trip coil energizing.

IMPROVEMENT OF MDP BY THE OPERATIONAL STAFF OF POWER SYSTEM

One simple solution for the problem of MPD output contacts, including switching-on the CB trip coil, would be to use an external power amplifier of an elementary type and insert it between the output contact of the MPD and the trip coil (fig. 10).

When the single output MPD contact switches on a group

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IGBT		IXSK35N120AU1	APT35GN120B	FGA25N120ANTD
Collector-emitter voltage, V	V_{CES}	1200	1200	1200
Collector current, A - continuous - peak	I_{-}	35 140	94 105	25 90
Collector-emitter saturation voltage, V	V_{CE} (SAT)	4 - 8	2.5 – 4.7	3. 5 – 7.5
Total power dissipation, W	P_{tot}	300	379	312
Case type	-	TO-264A	TO-247	TO-3P
Max. operating junction temperature, °	T_J	150	150	150

Table 4. Parameters of some modern IGBT transistors, suitable for using as output elements of MPD.

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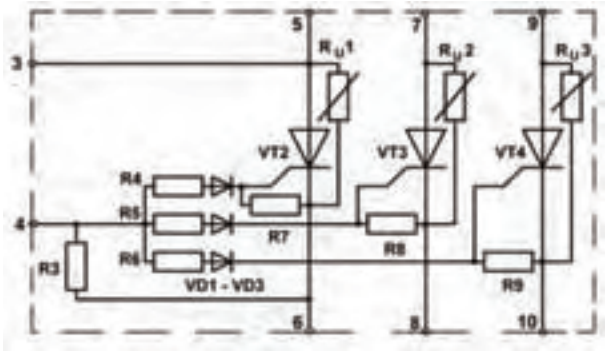

Fig. 11a. Power demultiplexer on thyristors for switch-on the group of trip coil.

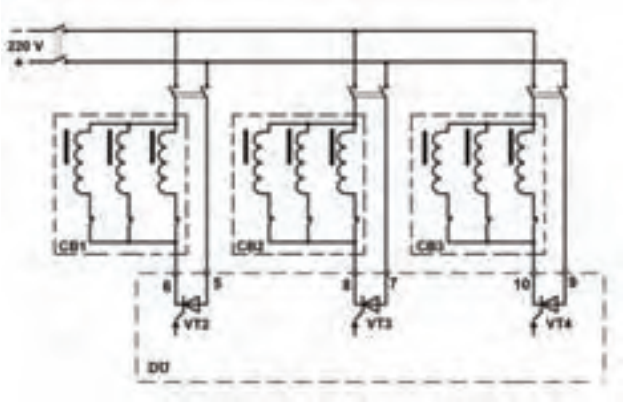

Fig. 11b. Circuit diagram for external connection of power demultiplexer (DU). CB1, CB2, CB3 – three phase circuit breakers.

of trip coils belonging to different circuit breakers, it is possible to use a power de-multiplexer on thyristors (fig. 11) connected to the output of the above mentioned amplifier.

For contacts of auxiliary relays (which require not only switching-on, but also switching-off the inductive load) arc-protective modules of the passive type connected in parallel to

Fig. 12. Passive arc-protective module contains series connected R and C elements (produced by RIFA).

contacts of the relay can be used, for example, a self-made or industrial type RC-circuit (fig.12) manufactured by many companies.

More effective protection of relay contacts against an electric arc is provided by protective modules of the active type, containing semiconductor elements such as transistors (fig. 13).

Fig. 13. Smart (active type) arc-protective modules SEL-9501 and SEL-9502 types (produced by SEL).

Naturally, modules of this type are much more complex and expensive than modules of the passive type. Even a more simplified version of such a module (USA Pat. 5703743) contains two transistors (IGBT and FET types), one triac, three diodes, and three Zeners.

A more sophisticated updating (USA Pat. 6956725) consists of the current transformer, a rectifier bridge, and some capacitors and resistors in addition to the above-listed elements.

Such modules are sold in the open market by Schweitzer Engineering Laboratories and can be successfully used by any MPD operator. The choice of type of protective module depends on the concrete parameters of the switching load. At "light" loads, with the time constant not exceeding 7-10 ms, elementary RC-modules can be used, and for heavy loads with R/L = 30 – 50 ms, active type modules are more suitable.