DIRECTIONAL EARTH FAULT RELAY

RBVA

Microelettrica Scientifica

CAT. E2-90

12-01-99

GENERAL CHARACTERISTICS

Two basic versions are available:

- **RBVA/D** function 67N definite time
- **RBVA/I** function 67N inverse time (see time/current curves page 78-79).

The characteristic angle "α" of the measuring direction can be changed over to 0° or 90° (different values on request).
Both versions are fitted, on request, with blocking input and output or with time start output.

SETTINGS

Settings are made on front face by means of two 8 poles DIP-SWITCHES that allow to obtain a wide and accurate setting range of the trip current level as well as of the voltage level and of the trip time delay.

SIGNALIZATIONS

- 1 Green led for signalization of auxiliary supply presence and relay regular operation.
- 1 Red led for trip signalization.
- 1 Yellow led for trip memory.

COMMANDS

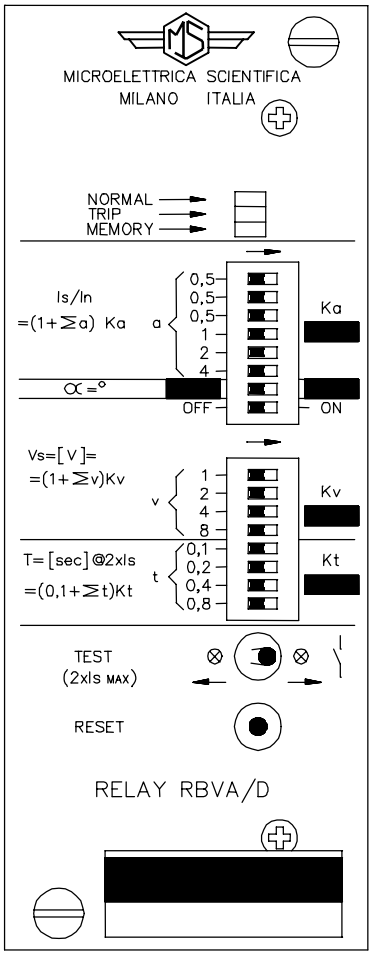
- Test spring lever switch: when pressed it simulates a current flow of 2 times the rated input current and allows the complete functional check of the relay and of the trip time delay. In one position test function does not operate the output relays; in the other it also operates the output relays.
- ON-OFF switch for blocking of the timed output relay.
- Output relays reset after trip can be:
  - manual by reset push button on front face
  - manual by remote push button connected to the relevant terminals provided on the relay
  - automatic by connecting a bridge on remote reset terminals.

The trip memory led can be reset only by the front face reset push button.

OUTPUT RELAYS

- 1 trip signal relay with two Change-over contacts rating 5A.
- 1 time start signal relay with one Change-over contact rating 5A. (Provided on request).

The output relays are normally deenergized (energized on trip).
On request R1 relay can be normally energized (deenergized on trip).



ORDERING DATA

- Relay Type
- Rated Input Voltage
- Rated Input Current
- Auxiliary Power Supply
- Setting Ranges
- Output Relays Configuration
- Execution
- Options on Request

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OPERATION

It is assumed:

- I_s = Set minimum trip current level;
- V_s = Set minimum voltage level to enable directional current tripping;
- I_0 = Fault zero-sequence current;
- α = Set characteristic angle;
- φ_0 = $I_0 \wedge V_0$ phase displacement;
- V_0 = Fault zero-sequence voltage;
- I_t = Trip current at φ_0

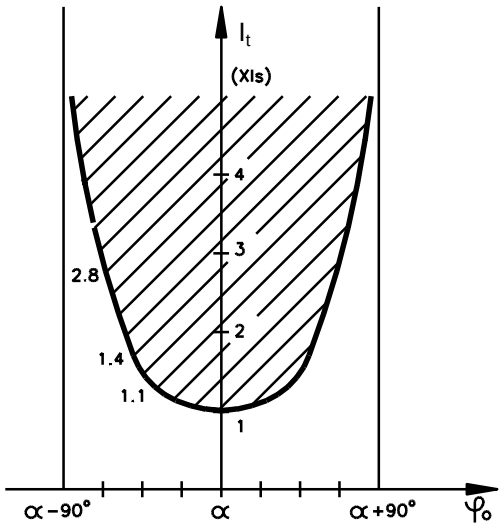


Fig. 2

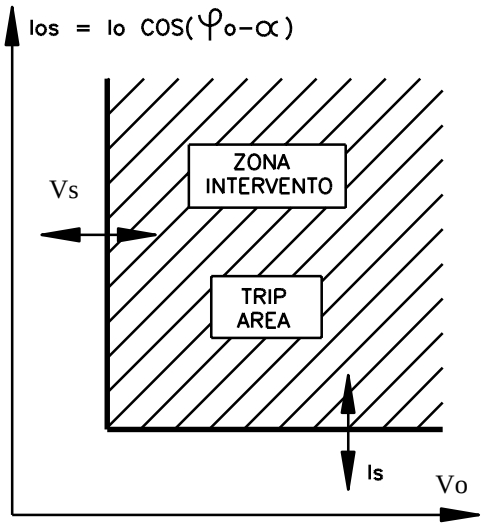


Fig. 1

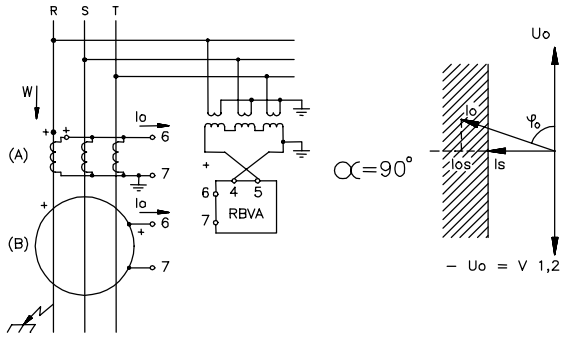
Inside the relay, current and voltage are supplied via special transformers, filters, displacing circuits and amplifiers, to a static demodulator the output voltage of which is proportional to the product:
$I_0 \times \cos(\varphi_0-\alpha) = I_{os}$
the relay trips (if $V_0>V_s$) when $I_{os}>I_s$ (Fig. 1), i.e. when the component of the input current in the measuring direction of the relay exceeds the set trip level I_s.
The sensitivity of the relay is then proportional to $\cos(\varphi_0-\alpha)$, it is maximum when $\varphi_0=\alpha$ and its operation field is limited within the range: $\alpha-90° < \varphi_0 < \alpha+90°$ (Fig. 2).
The characteristic angle of the relay must be selected according to earthing system of the installation which has to be protected against earth fault:

UNEARTHED NEUTRAL:	$\alpha = 90°$
NEUTRAL EARTHED VIA RESISTOR OR REACTANCE:	$\alpha = 0°$
SOLIDLY EARTHED NEUTRAL:	$\alpha = 60°$

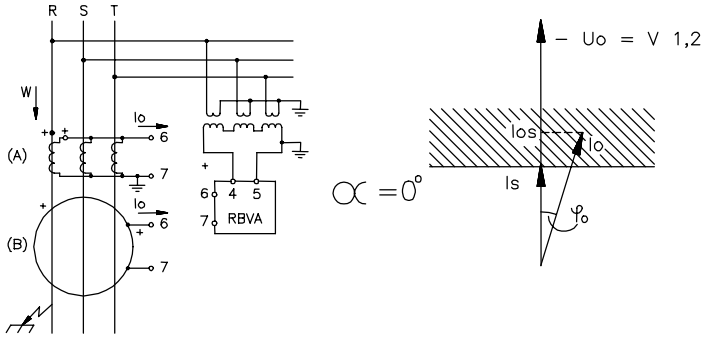
CONNECTIONS

DIRECTIONAL EARTH FAULT PROTECTION

UNEARTHED NEUTRAL SYSTEMS



RESISTORS EARTHED NEUTRAL SYSTEMS



(A) connection to residual output of 3 C.Ts.
(B) connection to core balance CT

OPTIONS

On request are provided:

- Blocking input **(BI)**.
- Blocking output **(BO)** relay R2.
- Start time output **(TO)** relay R2.

OVERALL DIMENSIONS

See Overall Dimensions - **1 Module Relay**.

ELECTRICAL CHARACTERISTICS

Rated input current	:	1A or 5A	Burden on current input	:	0.05VA@1A 0.25VA@5A
Rated input voltage	:	Vn = 100 ÷ 380V, 50/60Hz	Burden on voltage input		2 VA a Vn
			Burden on power supply	:	3W(d.c.); 6VA(a.c.)
Auxiliary power supply	:	Type 1 : 24-110 V d.c./a.c. ± 20% permanent Type 2 : 90-220 V d.c./a.c. ± 20% permanent			

STANDARD SETTING RANGES (Different on request) - **time current curves** (page 78-79)

Trip Current : $I_s = [1 + (0 \div 8.5)] \times Ka \times In$

❑ K_a =0.01	:	$I_s = (0.01 \div 0.095) \times I_n$	step 0.005 x I_n (1)
❑ K_a =0.1	:	$I_s = (0.1 \div 0.95) \times I_n$	step 0.05 x I_n
❑ K_a =1	:	$I_s = (1 \div 9.5) \times I_n$	step 0.5 x I_n (2)

Trip time delay-definite time : $T = [0.1+(0 \div 1.6)] K_t$ sec.

❑ K_t = 0.5	:	T = (0.05 ÷ 0,8) s	step 0.05 s
❑ K_t = 1	:	T = (0.1 ÷ 1,6) s	step 0.1 s (3)
❑ K_t = 5	:	T = (0.5 ÷ 8) s	step 0.5 s

Trip time delay-inverse time

❑ K_t = 0.5	:	T = (0.05 ÷ 0.8) s@2xIs	step 0.05 s
❑ K_t = 1	:	T = (0.1 ÷ 1.6) s@2xIs	step 0.1 s
❑ K_t = 5	:	T = (0.5 ÷ 8) s@2xIs	step 0.5 s

Trip Voltage : Vs = (1 ÷ 16)Kv V

❑ Kv = 1	Vs = (1 ÷ 16) V (3)
❑ Kv = 2	Vs = (2 ÷ 32) V

(1) Standard for CT connection - (2) Standard for Core balance CT connection (100/1A) - (3) Standard version

WIRING DIAGRAM