



## Restricted Earth Fault Relay

# 5B3

### Description

The relay uses a type B61 attracted armature element energized via a low pass filter circuit and a full wave rectifier. The relay has a pre-set setting of 15V. Other resistors are introduced into the circuit to provide the voltage setting range up to 270V in increments of 5V using heavy duty DIL switches.

Included within the relays, are the essential non-linear resistors to limit the peak voltage output from saturated C.T.s, these resistors protect the C.T. insulation and secondary wiring.

### Current Transformer Requirements

Experience has shown that most positive C.T.s are suitable for use with the high impedance relays and where the C.T.s are specially designed for this protection, their overall size may be smaller than that required for an alternative current balance protection. The basic requirements are:

- a) All C.T.s should have identical turns ratios, if possible.
- b) The knee point voltage of each C.T.s should be at least 2xVs. The knee point voltage is expressed as the voltage applied to the secondary circuit with the primary open circuit which when increased by 10% causes the magnetizing current to increase by 50%.
- c) C.T.s should be of the low leakage reactance type. Most modern C.T.s are of this type and there is no difficulty in meeting this requirement. A low leakage reactance C.T.s has a jointless ring type core, the secondary winding evenly distributed along the whole length of the magnetic circuit and the primary conductor passes through the approximate centre of the core.

### Applications

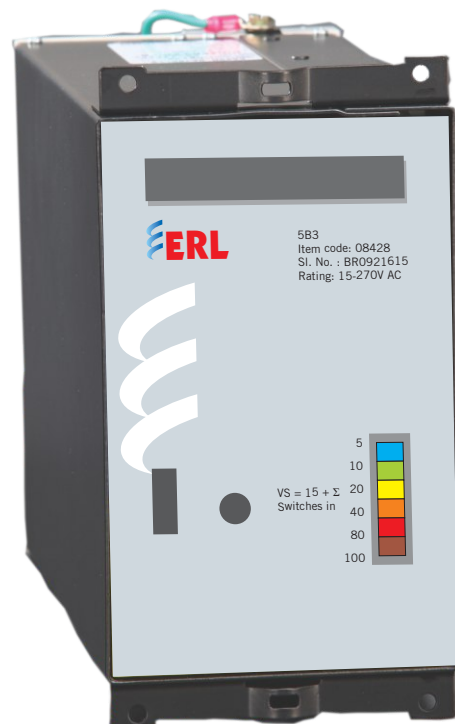
Type 5B3 electromagnetic relay is ideal for restricted earth fault protection of transformer windings or phase and earth fault protection of reactors and the stator windings of large machines. This relay may also be used for high impedance busbar protection.

High impedance schemes have the advantages over low impedance schemes that, a more sensitive setting can be obtained without any loss of stability and the primary fault setting calculation is simpler. Current operated schemes are more susceptible to mal-operations from through faults, unless greater care is taken with the selection of the current transformer.

For some restricted earth fault applications the primary fault setting needs to be greater at harmonic frequencies than the setting at the fundamental frequency. The 5B3 relay uses a low pass filter circuit to achieve this. No adverse reduction in fault setting can occur with the high frequency current, which may be produced during switching.

### Features

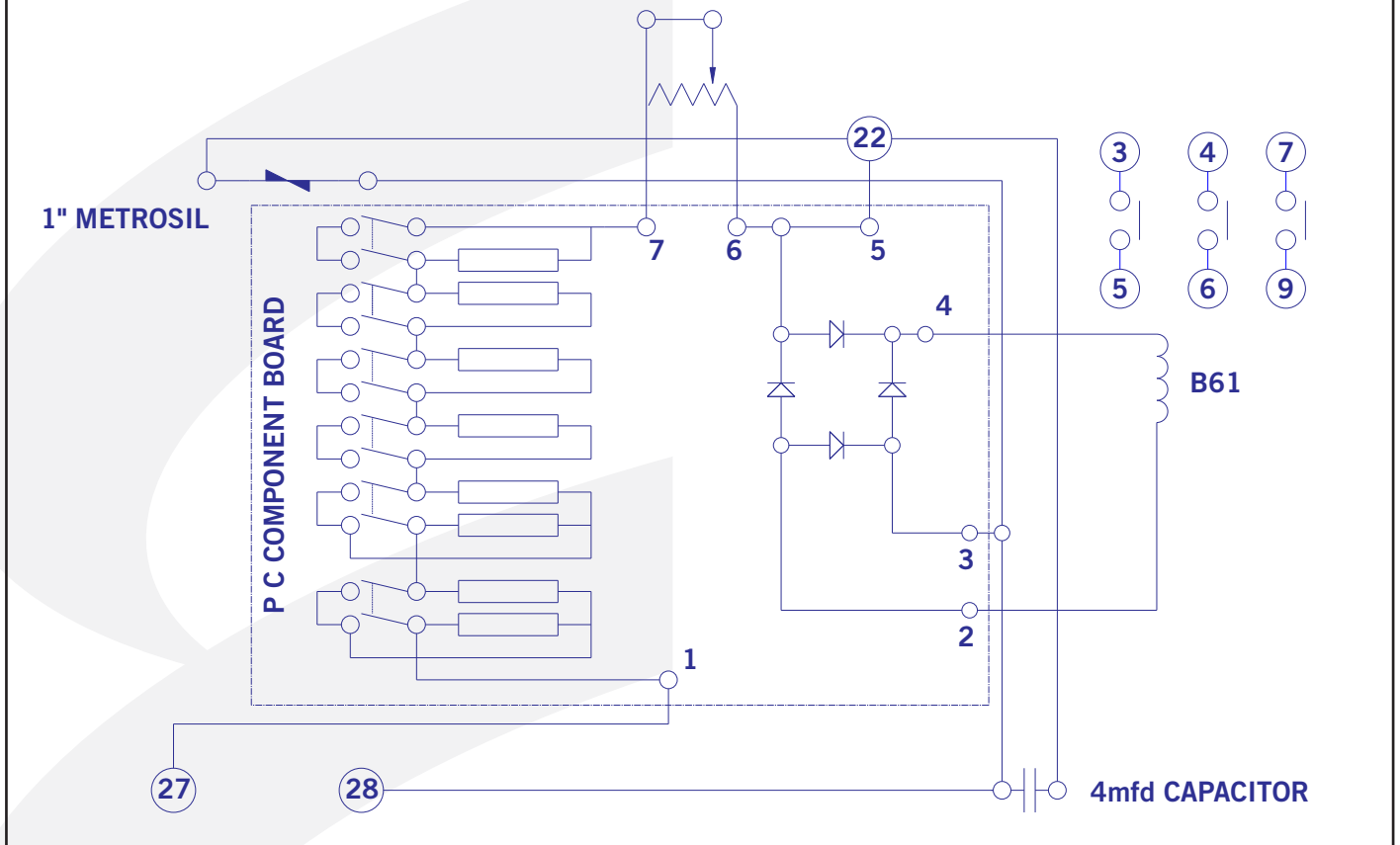
- Low settings can be achieved
- Stability based upon plant capacity



Restricted Earth Fault Relay - 5B3

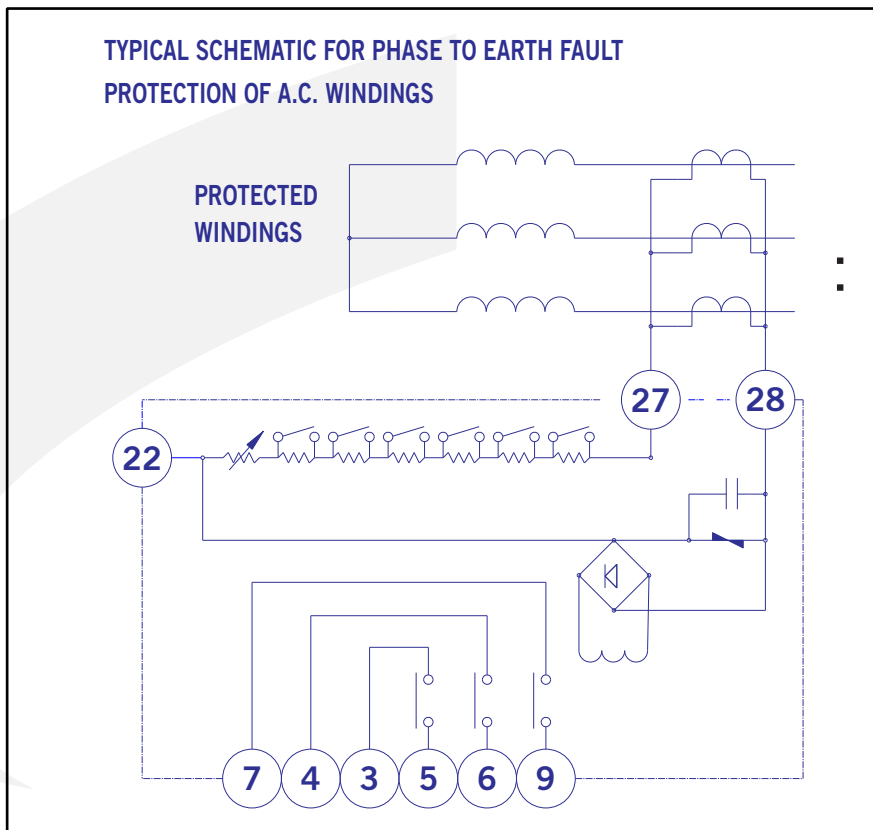


### LOOKING ON FRONT OF RELAY



Wiring Diagram

### TYPICAL SCHEMATIC FOR PHASE TO EARTH FAULT PROTECTION OF A.C. WINDINGS



Typical Wiring Diagram for 5B3 Relay

## Technical Information

Frequency fn.	50Hz.
Settings	
Current Is	: Fixed at 20mA.
Voltage Vs	: 15V to 270V in steps of 5V
Thermal withstand	: Continuous 1.25 x Vs
Burden	Vs x 20 mA. (approx)
Operating Time	45ms maximum at 3 x Vs
Indication	Hand reset flag.
Contact Arrangement	3 normally open self reset.

## Contact Rating:

Contacts are capable of making and carrying 6.6 KVA for 0.2 seconds with a maximum of 30A. Contacts are intended for use in circuits where a circuit breaker auxiliary switch breaks the trip coil current.

## Environmental

Temperature	IEC 68-2-1 & 2
Operating	-10°C to + 55°C
Storage	-25°C to + 70°C
Humidity	IEC 68-2-3
	56days at 95% RH and + 40°C
Vibration	IEC 255-21-2

The relay complies with the requirement of BS 142, section 2.2, category S2 over the frequency range 10 to 800Hz impact. The relay will withstand panel impact shocks of 20g. Operational / Mechanical life in excess of 10,000 operations.

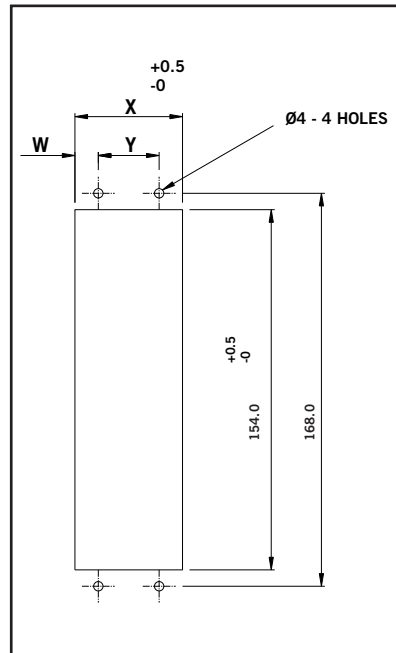
## Impulse Test

IEC 255-5

### Relay will withstand:

5KV 1.2/50,  $\mu$ s 0.5J between all terminals and case earth and between adjacent terminals.  
 2KV rms 50Hz for 1 minute between all case terminals connected together and the case earth and between independent circuits.  
 1KV rms 50Hz for 1 minute across normally open contacts.

## Cutout Details



CASE SIZE	DIMENSION		
	W	X	Y
E4	9.50	97.00	78.00

### Note:

1. All dimensions are in mm
2. All dimensions are measured equidistant from center line
3. Maximum depth of equipment inside panel : 225mm

### Stability

For stability the voltage setting of the relay must be made equal to or exceed the highest value of  $V = I (R_{ct} + RL)$

### Where:

- RL = The largest value of pilot-loop resistance between the C.T.s and the relay  
 Rct = The secondary winding resistance of the C.T  
 I = The C.T. secondary current corresponding to the maximum steady state through fault current of the protected equipment.



## Fault Setting

It should, however, be noted that because the operating voltage of the relay circuit is relatively high, the excitation currents of the C.T.'s in parallel with the relay may comprise a large proportion of the fault setting.

$$\text{Primary fault setting} = N (I_0 + I_1 + I_2 + I_3)$$

Where :

$I_0$	=	Relay operating current
$I_1$ etc	=	Excitation current of each C.T at the relay setting voltage
N	=	C.T turns ratio

## Qualification

ISO 9001 – 2008

*The policy of EASUN REYROLLE is one of continuous improvement and development. The company therefore reserves the right to supply equipment which may differ slightly from that described and illustrated in the publication.*

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