



Reyrolle  
Protection  
Devices

## 7PG23 - 5B3

Restricted Earth Fault

Energy Management

**SIEMENS**



# 7PG23 - 5B3

Restricted Earth Fault



## 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 minimum 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 CTs, these resistors protect the CT insulation and secondary wiring.

## Functional Overview

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

## Application

The 5B3 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 transformers. 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 currents which may be produced during switching.

## CT Requirements

Experience has shown that most protection CTs are suitable for use with the high impedance relays and that where the CTs are specifically 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 CTs should, if possible, have identical turns ratios.
- b) The knee point voltage of each CT should be at least  $2x V_s$ . 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) CTs should be of the low leakage reactance type. Most modern CTs are of this type and there is no difficulty in meeting this requirement. A low leakage reactance CT 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.

## Technical Information

Frequency fn:	50 or 60 Hz
Current Is:	Fixed at 20mA
Voltage Vs:	15V to 270V in 5V steps
Thermal withstand:	Continuous $1.25 \times V_s$
Accuracy:	$V_s \pm 5\%$
Burden:	$V_s \times 20\text{mA}$
Operating time:	45ms maximum at $3 \times V$

Indication: Hand reset flag  
Contact arrangement: 3 normally open self reset  
Contact rating:  
Contacts are capable of making and carrying 6.6kVA 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  
56 days at 95% RH and +40°C  
Vibration: IEC 255-21-2

The relay complies with the requirements of BS142, 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.

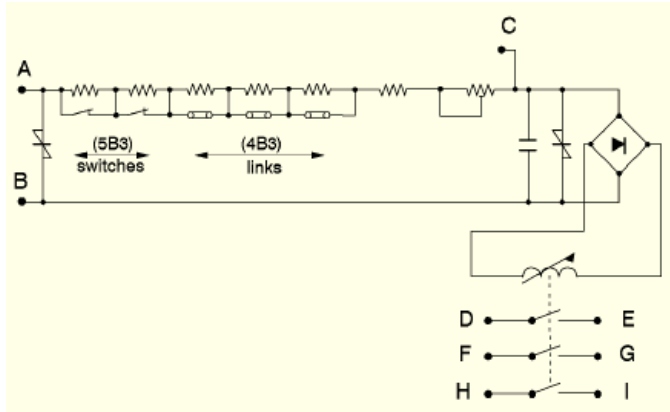
## Insulation IEC 255-5

Relay will withstand:

5kV 1.2/50,  $\mu\text{s}$  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.

## Case

Single element Epsilon E3 case.



	A	B	C	D	E	F	G	H	I
5B3 (size 3 case)	28	27	22	1	3	2	4	5	7

Fig 1. Modular relay case terminal numbers

## Stability

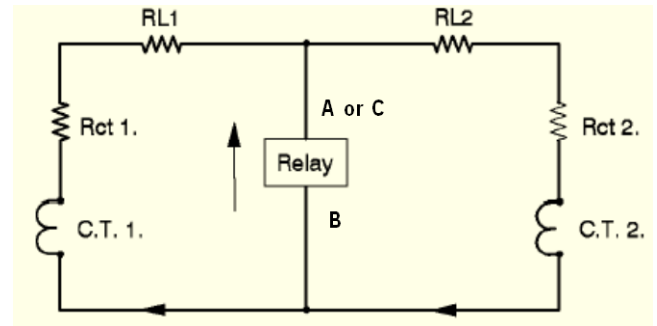


Fig 2. High Impedance Scheme

For stability the voltage setting of the relay must be made equal to or exceed the highest value of  $V$  calculated below:

$$V = I(R_{ct} + R_l)$$

Where:

$R_l$  = The largest value of pilot-loop resistance between the CTs and the relay.

$R_{ct}$  = The secondary winding resistance of the CT.

$I$  = The CT 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 CT'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 CT. at the relay setting voltage.

$N$  = C.T. turns ratio

# Ordering Information – 7PG23 – 5B3

Product description	Variants	Order No.
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**5B3**

Single element high impedance relay, ideal for REF applications.

Relay type  
 5B3 - High impedance, 50Hz  
 5B3 - High impedance, 60Hz

Type of flag  
 Hand reset flag

Contact operation  
 Self reset contacts

Contact arrangement – NO  
 3 NO

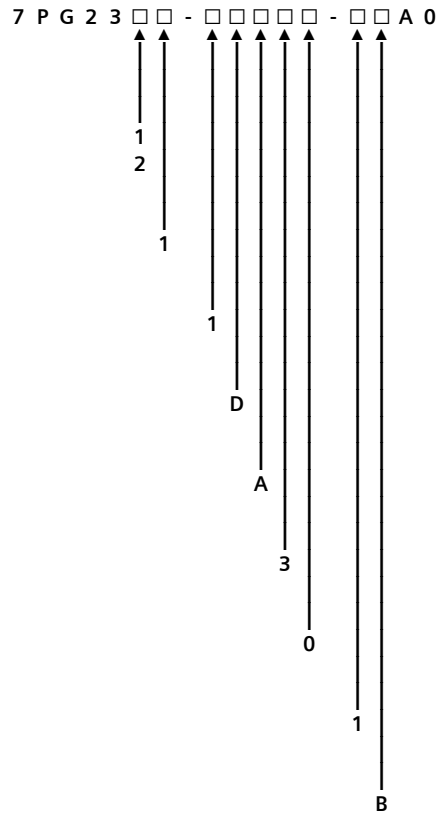
Contact arrangement NC  
 0 NC

Number of contacts  
 Three

Contact type  
 NO (Standard) / NC (Standard)

Setting range <sup>1)</sup>  
 15V AC to 270V AC

Housing size  
 Case size E3 (4U high)



1) Relay is pre-set to 15VAC, customer adjustable settings up to 270VAC in increments of 5V provided by heavy duty DIL switches



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EMDG-C10082-00-76GB

December 2012

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