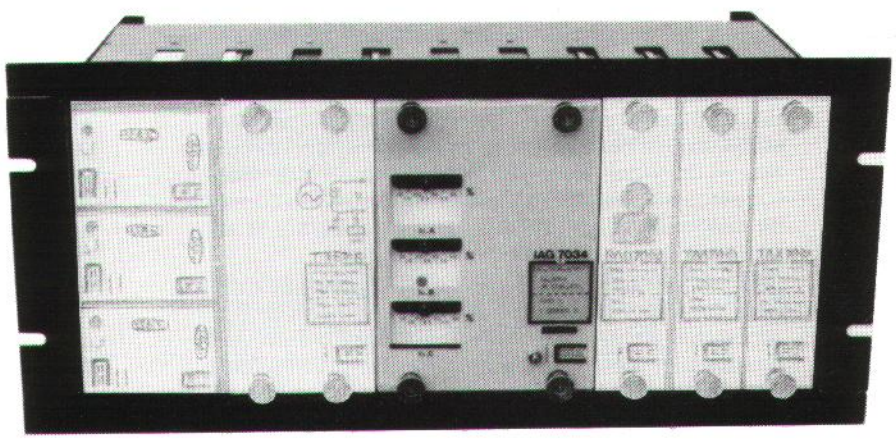
high impedance differential protection

IAG 7014 7034



THE ULTIMATE IN POWER NETWORK SUPERVISION

high impedance differential protection in modular case IAG 7014 and IAG 7034

For differential protection, one of the most important problems is to provide stability for through faults, which, of course, must not cause the tripping of the protected zone. The magnetizing characteristics of two similar current transformers are never absolutely identical, and the first 5 or 6 cycles of a fully offset external fault current (more especially if this current is of higher amplitude), may cause different saturation phenomena, giving rise to a difference of secondary currents, which could have the same effect as those produced by a fault within the protected zone.

In order to avoid unwanted tripping under these conditions, a high impedance overcurrent relay may be used, choosing an operating level above that calculated from the maximum voltage at the C.T. terminals for the heaviest external fault current. The calculations include the fact that one of the C.T.s may be completely saturated, and the other not at all, and can thus be based on the maximum fault current, the secondary resistance of the C.T.s involved, and the wiring resistance. It is thus possible to fix the operating level at a value which cannot allow tripping for an external fault.

The IAG 7014 and IAG 7034 relays are constructed especially for this type of service. The desired result is achieved by using external stabilising resistors, and an internal 50 cycles filter which de-sensitises the relay to third harmonic currents, i.e. those usually associated with saturating current transformers and external faults.

Because of these characteristics, the IAG 7014 and IAG 7034 relays provide high speed protection which is stable, and at the same time sensitive, at a cost considerably lower than biased differential protections.

APPLICATIONS

IAG 7014 and 7034 relays may be used in the following circumstances :

— Instantaneous longitudinal differential protection of bus-bars and eventually alternators, synchronous or induction machines, (IAG 7034, see fig. 1 and 4).

— Instantaneous restricted earth fault protection of bus-bars or transformers (IAG 7014, see fig. 2 and 3).

— Instantaneous transverse protection of machines with two windings in parallel.

DESCRIPTION

One attracted armature unit forms the base of the IAG 7014 relay. To this are added a capacitor and a small cored choke, which together form the 50 Hz tuned circuit in series with the operating coil.

A small tapped autotransformer and plug-bridge provide the required adjustments.

The IAG 7014 relay is equipped with 2 normally open contacts, and a flag indicator which may be reset by an external hand operated button.

The IAG 7034 is the three phase version of the above, containing three similar units in one case.

Their modular draw-out case, type R, may be mounted as follows :

— either as a separate relay : projecting or flush,
— or by insertion into a standard 19" rack cradle.

C.Ts CHARACTERISTICS

The current transformer requirements may be simply calculated as follows - Suppose :

Rs - resistance of the C.T. secondary winding
Rp - loop resistance of the pilot wires
If - secondary current corresponding to the maximum possible external fault.
Is - secondary equivalent of actual operating current.
Ir - relay current setting.
n - total number of Cts in parallel in the protected zone.

(i) Minimum kneepoint voltage of the secondary magnetising characteristic :

$$VK = 2\,If\,(Rs + Rp)$$

The knee point is defined as the point at which a further increase of 10% in the voltage gives rise to a 50% increase in magnetising current.

(ii) Magnetising current at $\frac{VK}{2}$

a) Restricted earth fault protection with 3 or 4 Cts

$\frac{Is - Ir}{3}$ or $\frac{Is - Ir}{4}$ respectively

b) Differential bus-bar protection : $\frac{Is - Ir}{n}$

c) Longitudinal differential, or transverse, protection of machines : $\frac{Is - Ir}{2}$

Stabilising resistors provided with the relays

Nominal C.T. secondary current	Variable resistor
0,5 A	0 - 400 Ohms
1.0 A	0 - 200 Ohms
5.0 A	0 - 50 Ohms

The setting value of this resistor may be calculated from the following :

$$Rst = \frac{VK}{2Ir} - \frac{VA}{Ir^2}$$

Where :
VA = relay burden
Rst = value of stabilising resistor.

GENERAL CHARACTERISTICS

1	*Nominal C.T. secondary current*	*1 or 5 A - 50 Hz or 60 Hz*
2	*Setting : 7 values*	*10 - 15 - 20 - 25 - 30 - 35 - 40 % In* *or 20 - 30 - 40 - 50 - 60 - 70 - 80 % In* *or 5-7, 5-10-12, 5-15-17, 5-20 %*
3	*Operating time* ..... *The tapped autotransformer is designed to saturate partially just above the setting current, which gives approximately constant operating energy and hence a remarkably constant operating time*	*0,030 sec. at 5 times operating current.*
4	*Burdens*	*0,9 VA at minimum setting* *1,0 VA at maximum setting.*
5	*Auxiliary voltage*	*24 V DC ± 10 %* *48 or 60 or 110 or 125 or 220 V DC* *+ 10 % — 20 %*
6	*Output contacts*	*2 NO or 2 NC or 1 NO + 1 NC*

	Alternating current	**Direct current**
• *Making capacity*	*2500 VA with max of 10 A or 500 V*	*2500 W with max of 10 A or 500 V*
• *Rupturing capacity*	*1250 VA with max of 5 A or 500 V*	*1000 W (resistive) - 50 W (inductive) with max of 3 A or 500 V*
• *Continuous carrying capacity*	*5 A*	*5 A*

7	*Mechanical operation indicator*	*with hand reset.*
8	*Insulation*	*2 kV AC for 1 minute applied between contacts, coil and case.*
9	*Case :*	
	IAG 7014	*R 2*
	IAG 7034	*R 3*
10	*Identifying drawing to be used when ordering :*	
	IAG 7014	*9689*
	IAG 7034	*9671*
11	*Weight :*	
	IAG 7014	*3.5 kg*
	IAG 7034	*5 kg*

APPLICATION DIAGRAMS

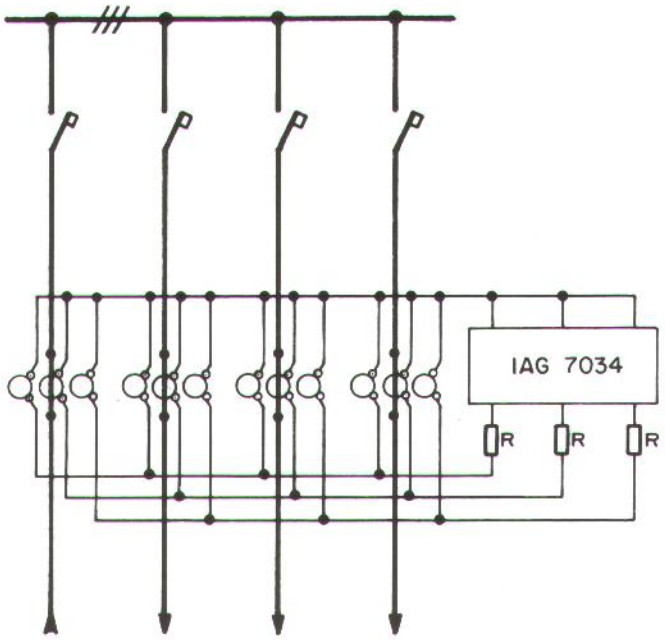


Figure 1

Bus-bar three-phase differential protection using IAG 7034

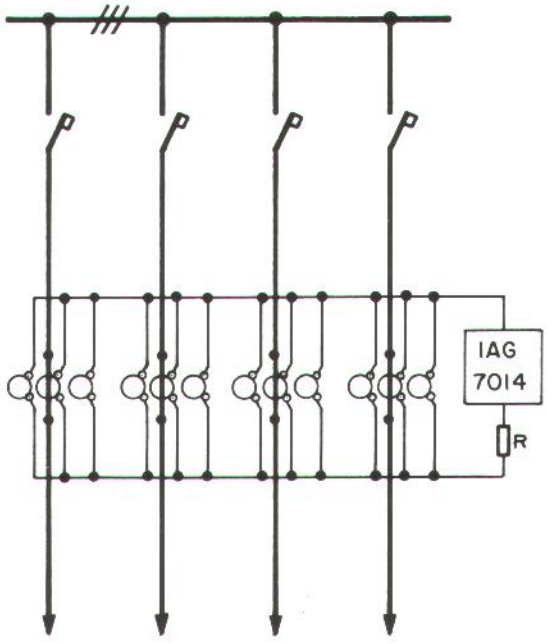


Figure 2

Bus-bar earth-fault differential protection using IAG 7014

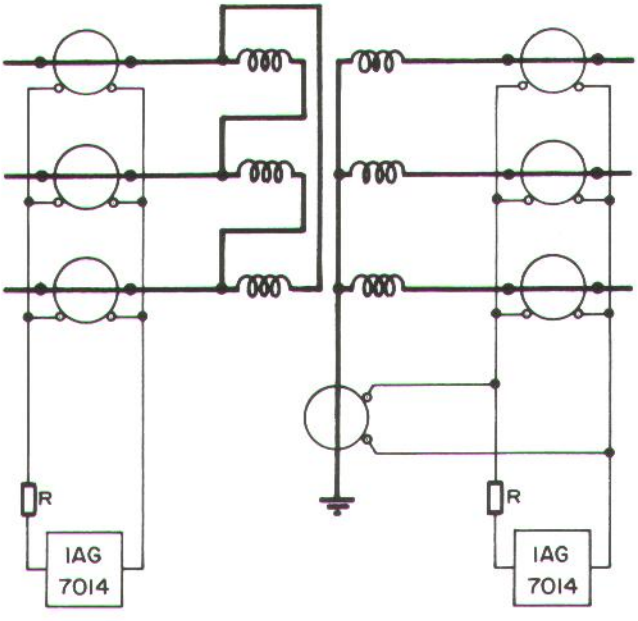


Figure 3

Transformer restricted earth fault protection using IAG 7014

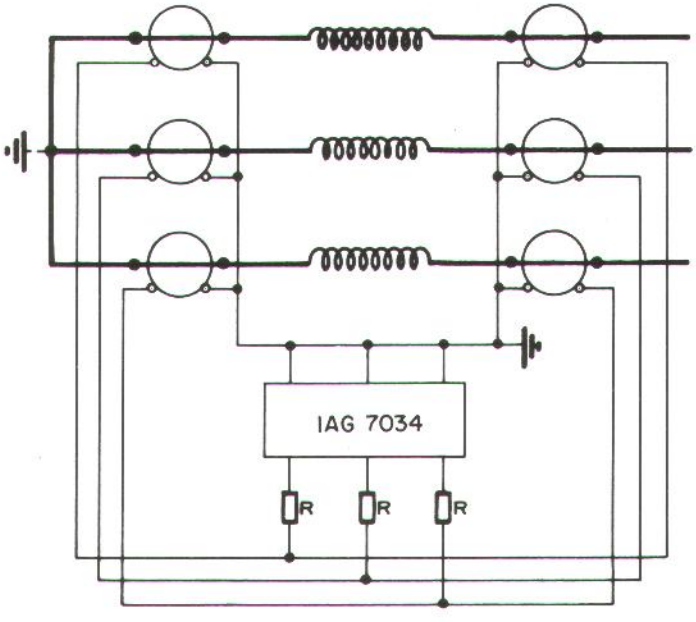


Figure 4

Machine differential protection using IAG 7034

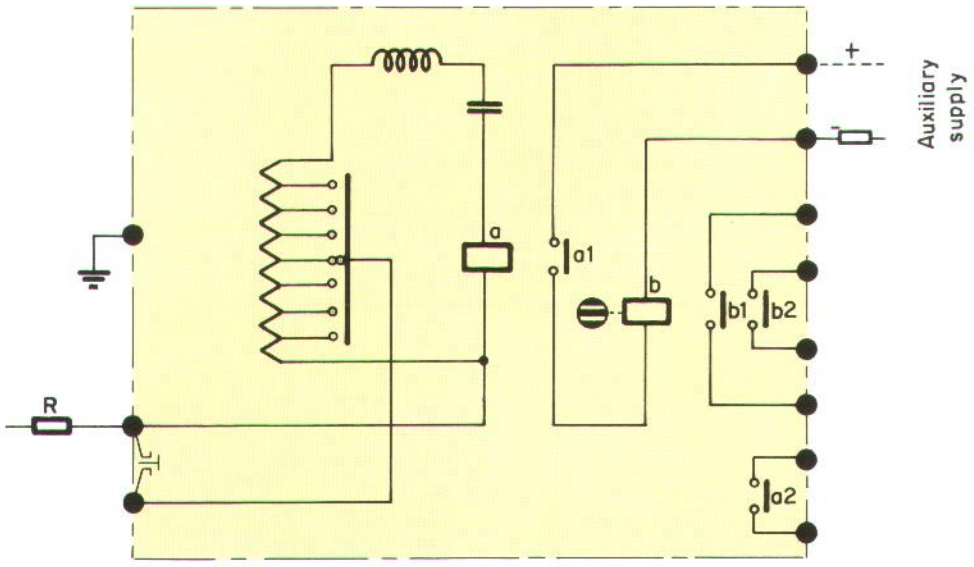


Figure 5 - IAG 7014
Simplified operation and connection diagram

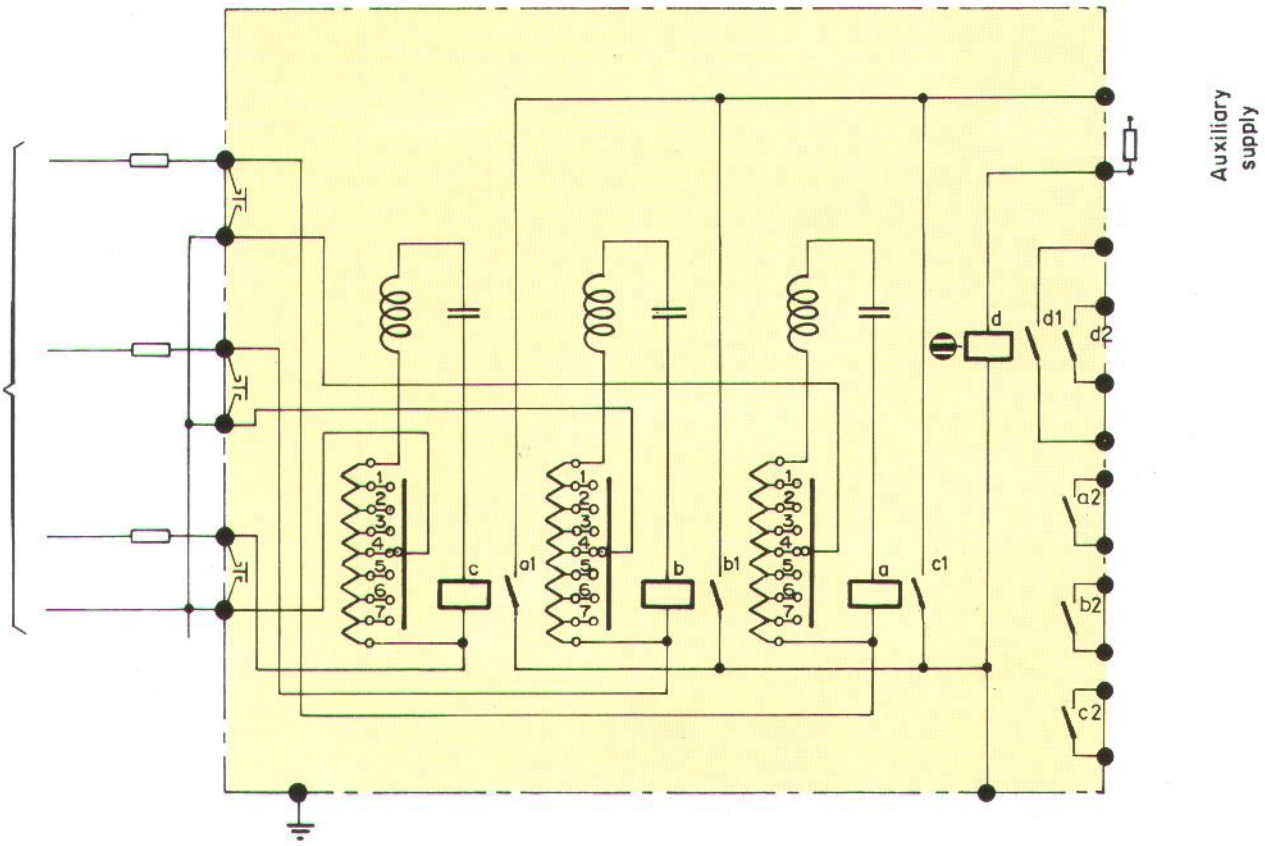
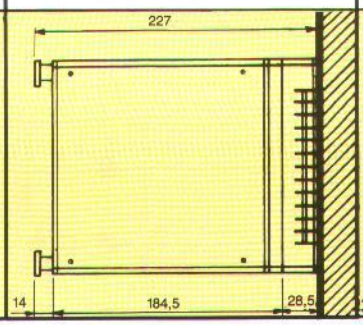
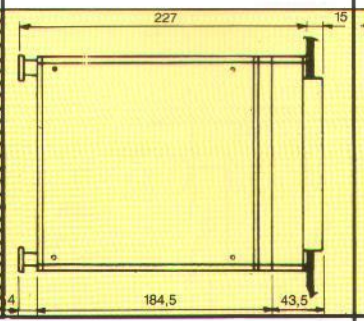
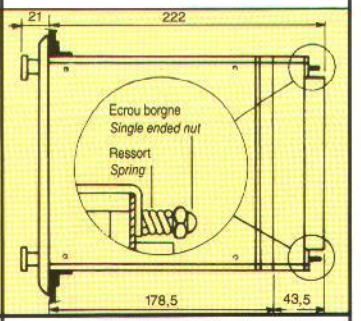
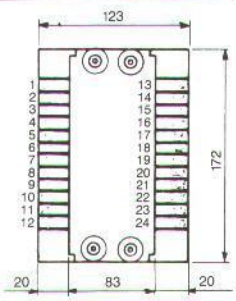
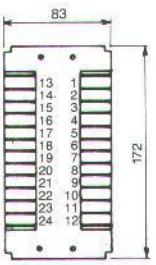
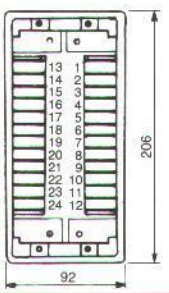
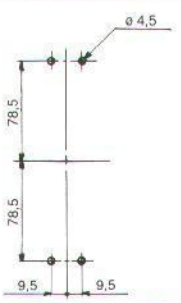
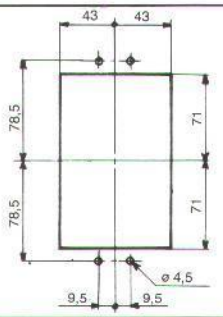
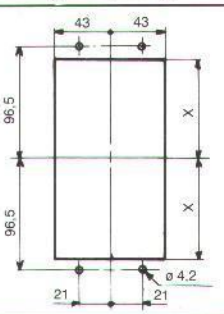
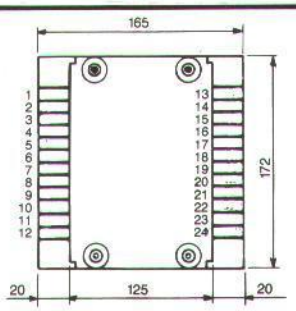
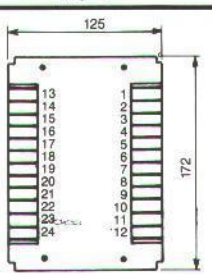
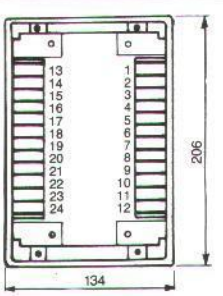
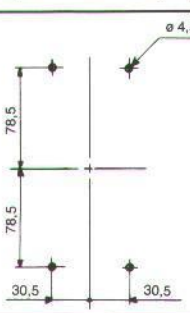
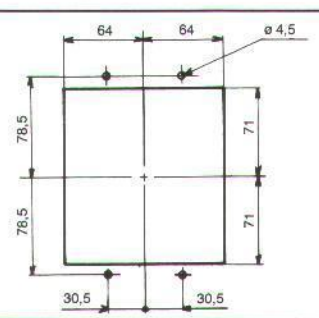
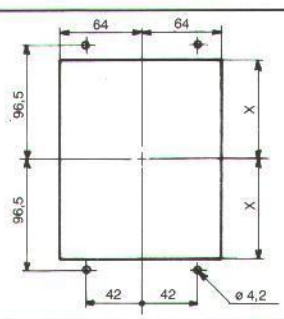


Figure 6 - IAG 7034
Simplified operation and connection diagram

CASE

TYPE R2 and R3

		projecting front connection	projecting rear connection	flush rear connection
CASE DIMENSIONS / CONNECTING SCREWS ø M4				
				x = 89 for panel th. < 2 x = 90,5 for panel th. > 2
R2	CASE DIMENSIONS			
	DRILLING AND CUT OUT			
R3	CASE DIMENSIONS			
	DRILLING AND CUT OUT			

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