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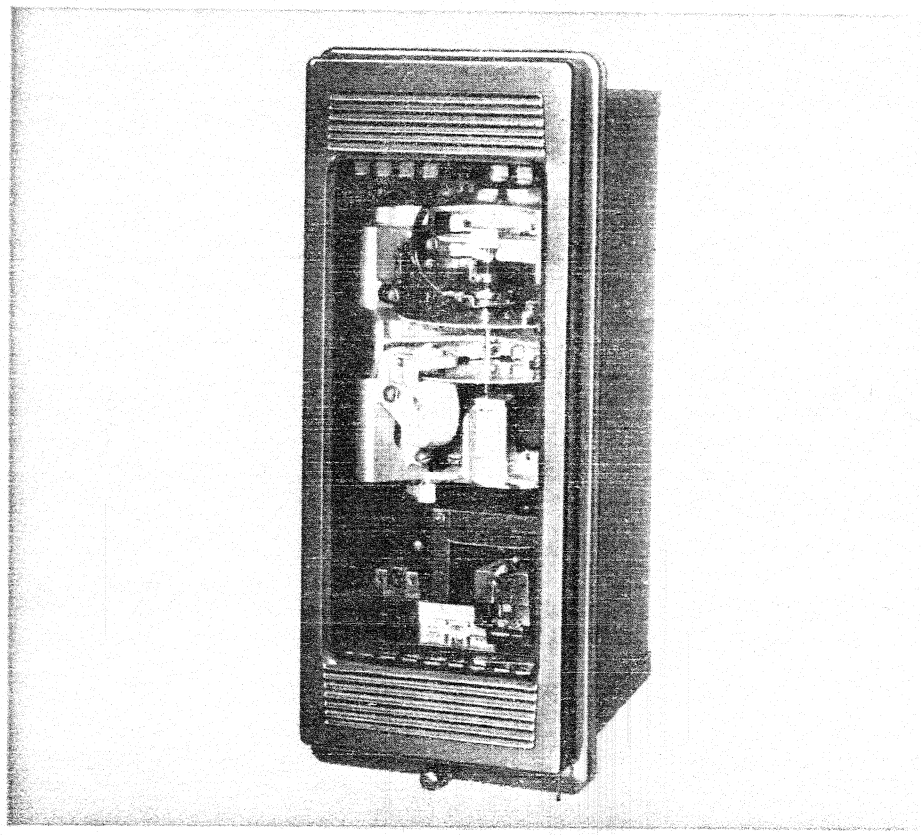
CA-16 and CA-26 Percentage Differential Relays

For Bus and Transformer Protection



Application

The CA-16 Relay is a single-phase differential relay used for the protection of multi-circuit buses up to a total of six circuits.

The CA-26 Relay provides differential protection for both 2- and 3-winding transformers. It is also suitable for combination bus-transformer applications (see Figure 6).

Both types have a variable percentage ratio characteristic which provides high sensitivity at low current magnitudes with an increase in percentage ratio at the higher currents. They will, therefore, detect light internal faults within their areas of protection, and at the same time allow for variation in the true current transformer ratios at high currents, thus preventing false tripping on heavy external faults. This is particularly advantageous when severe saturation of the current transformers is caused by the dc component of symmetrical short circuits.

Both CA-16 and CA-26 relays may be used on circuits where the external fault current through the bus or transformer is 100 rms secondary amperes or less.

The current transformers should not saturate when carrying the maximum external symmetrical fault current (i.e., exciting current should not exceed one secondary ampere, rms). This requirement is met if the burden voltage does not exceed $N_P V_{CL}/133$, where:

N_P = proportion of total CT turns in use

V_{CL} = current transformer 10L accuracy-class voltage

The burden voltage is described as:

Case 1: Fault current maximum of 100A rms in CT secondary – drop across 2-way lead burden and relays (CA-16 and CA-26 restraint-coil burden is negligible).

Case 2: Fault current greater than 100A rms in CT secondary – drop across 2-way lead burden and relays plus: $(I_{EXT} - 100)\ R_{CT}$

where I_{EXT} = max. external symmetrical fault current in secondary rms amperes.

R_{CT} = CT resistance, ohms

For example, if the 400/5 tap of 600/5 10L200 wye-connected CT's are used $N_P = 400/600 = 0.67$; if $I_{EXT} = 100$A, the burden (excluding CT resistance) should not exceed: $N_P V_{CL}/133 = (0.67 \times 200)/133 = 1.0$ ohms.

Device Number: 87

July, 1971
Supersedes DB 41-337 dated October, 1968
E, D, C/2015/DB

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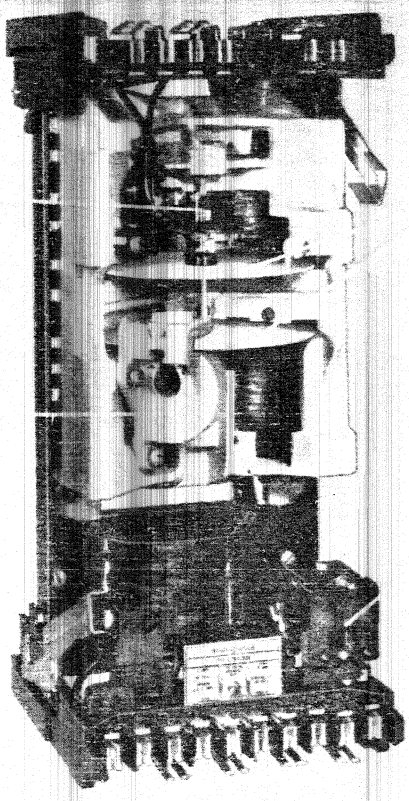

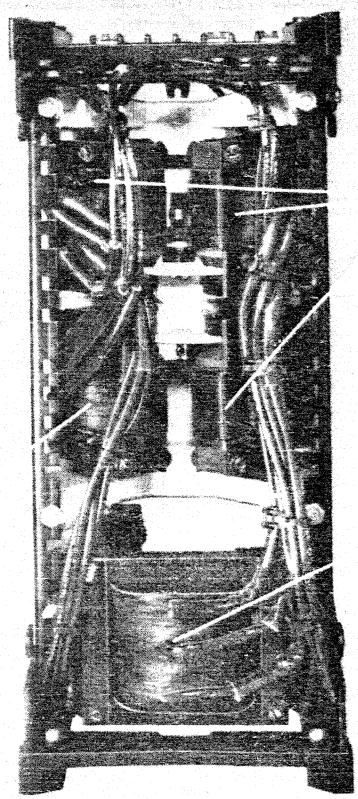

Construction

Types CA-16 and CA-26 relays consist of:

Restraining Elements (Three) and Operating Element

The restraining elements are "E" type laminated electromagnets with a primary coil on each of the outer legs, and a secondary coil on the center leg. The fluxes from the restraining elements produce a contact-opening torque.

Induction Discs

Mounted on a common rotatable shaft.

Moving Contact

Also mounted on the common rotatable shaft.

Damping Magnet

Auto-Transformer

Indicating Contactor Switch

Operating Element

Operating element is similar in construction to the restraining elements. Fluxes from this produce a contact-closing torque.

Relays are available with an Indicating Instantaneous Trip unit which provides extremely fast tripping on heavy internal faults.

On installations where the relay would be subject to mechanical shock (such as on swinging panels), a variation of these types is available. This variation includes a sensitive fault detector contactor switch operated from an auto-transformer.

Operation

The restraining elements of the relays are energized from the secondary of the current transformer in the circuits of the power transformer being protected.

The operating element is energized through the auto-transformer in accordance with the current flowing in the differential connection of the current transformers.

Referring to Figure 2, a current of 5 amperes flowing in at terminal 18 and out at terminal 19 will produce a restraining torque. Similarly, a current of 5 amperes flowing in at terminal 16 and out at terminal 17 will produce an equal amount of torque.

If both of these currents flow simultaneously and with the polarity indicated, their effect will be additive, and will produce the same effect as though 10 amperes were flowing in at terminal 16 and out at terminal 17. Conversely, if these two currents were simultaneous, but one of opposite polarity, their effect would cancel each other and no torque would be produced. Thus, the relays distinguish between internal and external faults.

CA-16 and CA-26 Percentage Differential Relays

For Bus and Transformer Protection

Internal Wiring (Front View) CA-16 or CA-26 Relay in FT-32 Case

With Indicating Instantaneous Trip①

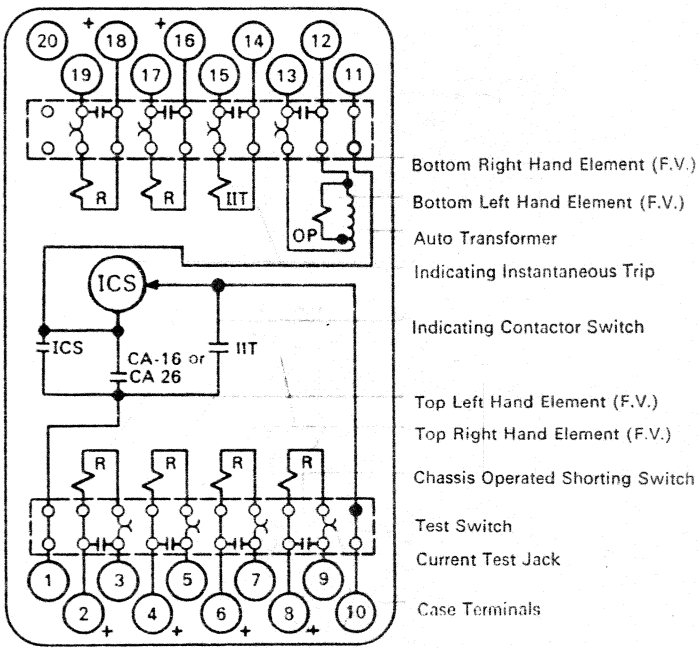

Fig. 1 185A443

Without Indicating Instantaneous Trip①

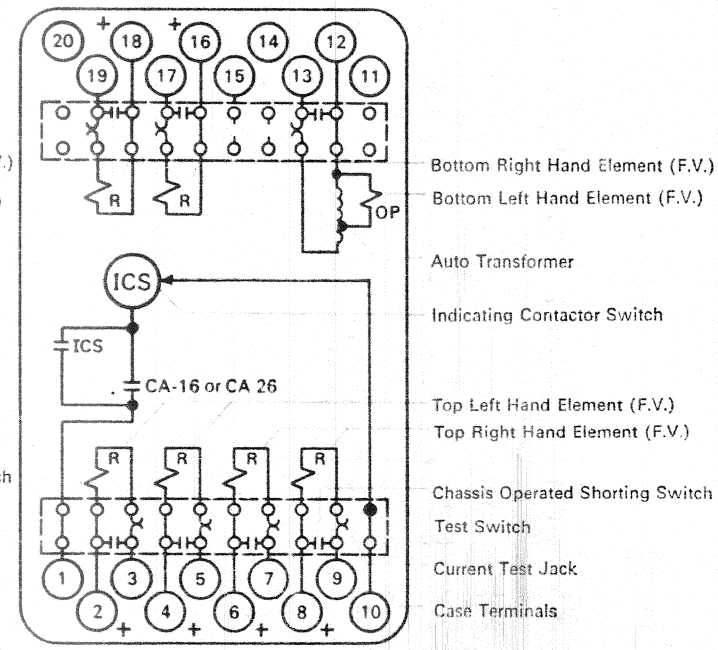

Fig. 2 185A419

With Sensitive Fault Detector①

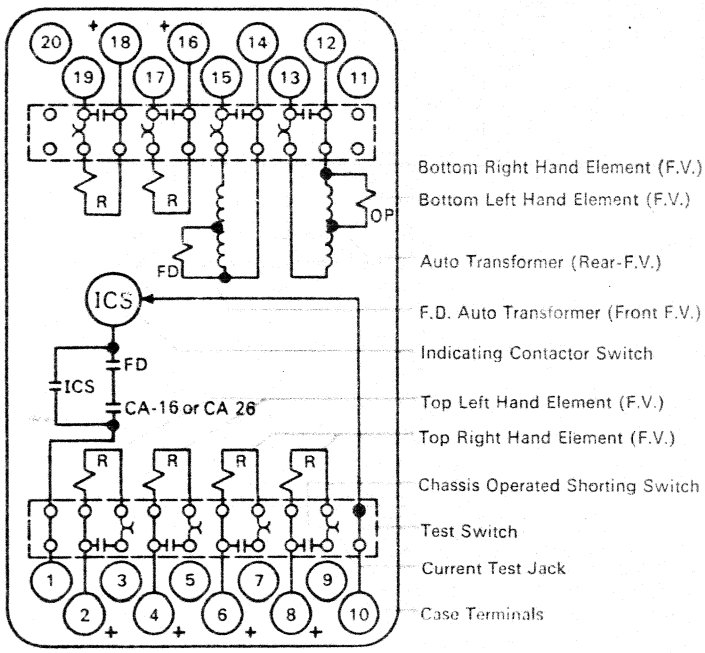

Fig. 3 187A434

① With relative instantaneous polarity as shown, the ampere turns in the paired restraining coils add to produce maximum torque.

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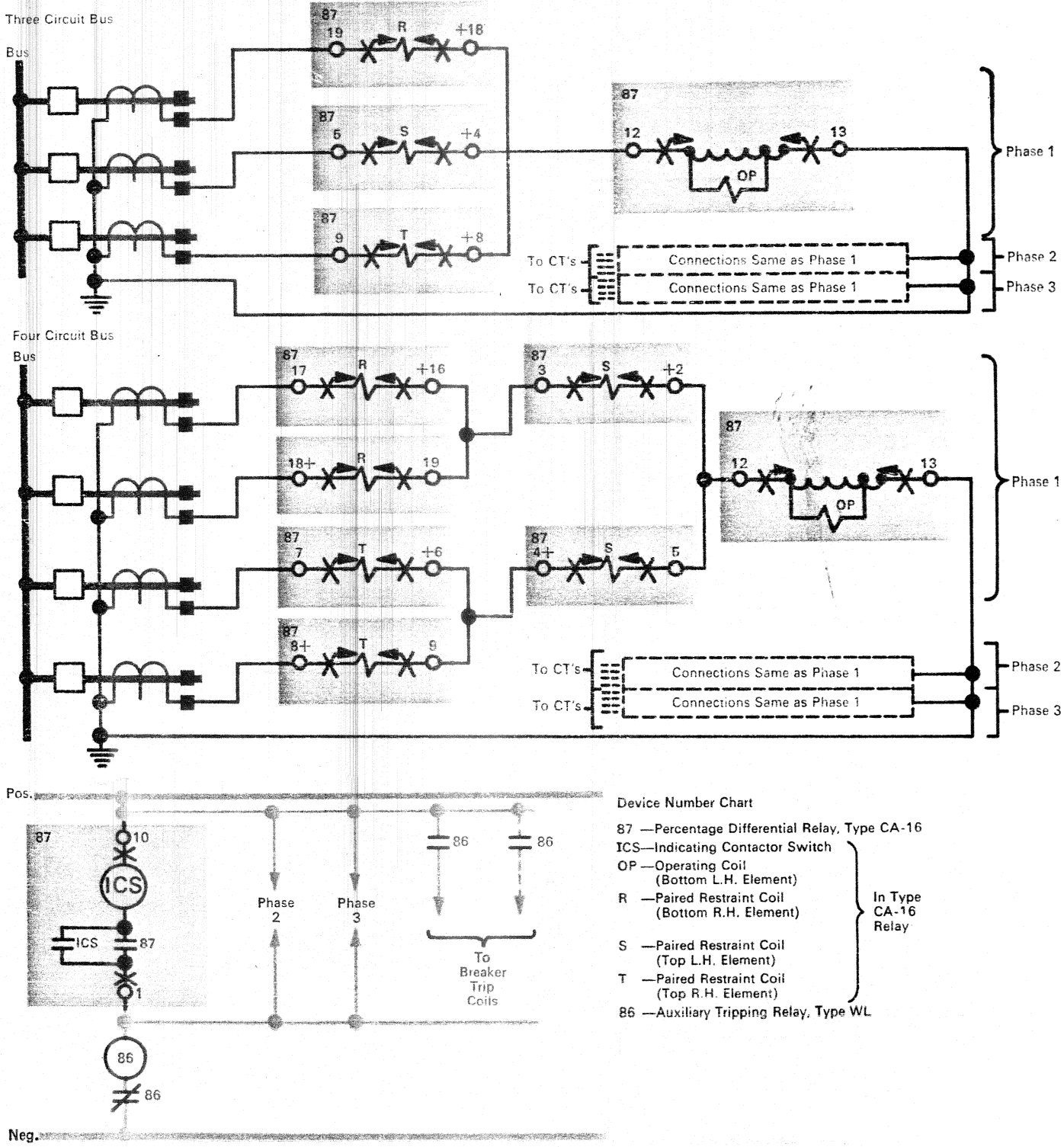
External Wiring

One Set of CA-16 Relays For The Protection of a Three or Four-Circuit Bus



Device Number Chart

87 —Percentage Differential Relay, Type CA-16
ICS—Indicating Contactor Switch
OP —Operating Coil (Bottom L.H. Element)
R —Paired Restraint Coil (Bottom R.H. Element)
S —Paired Restraint Coil (Top L.H. Element)
T —Paired Restraint Coil (Top R.H. Element)

} In Type CA-16 Relay

86 —Auxiliary Tripping Relay, Type WL

Fig. 4

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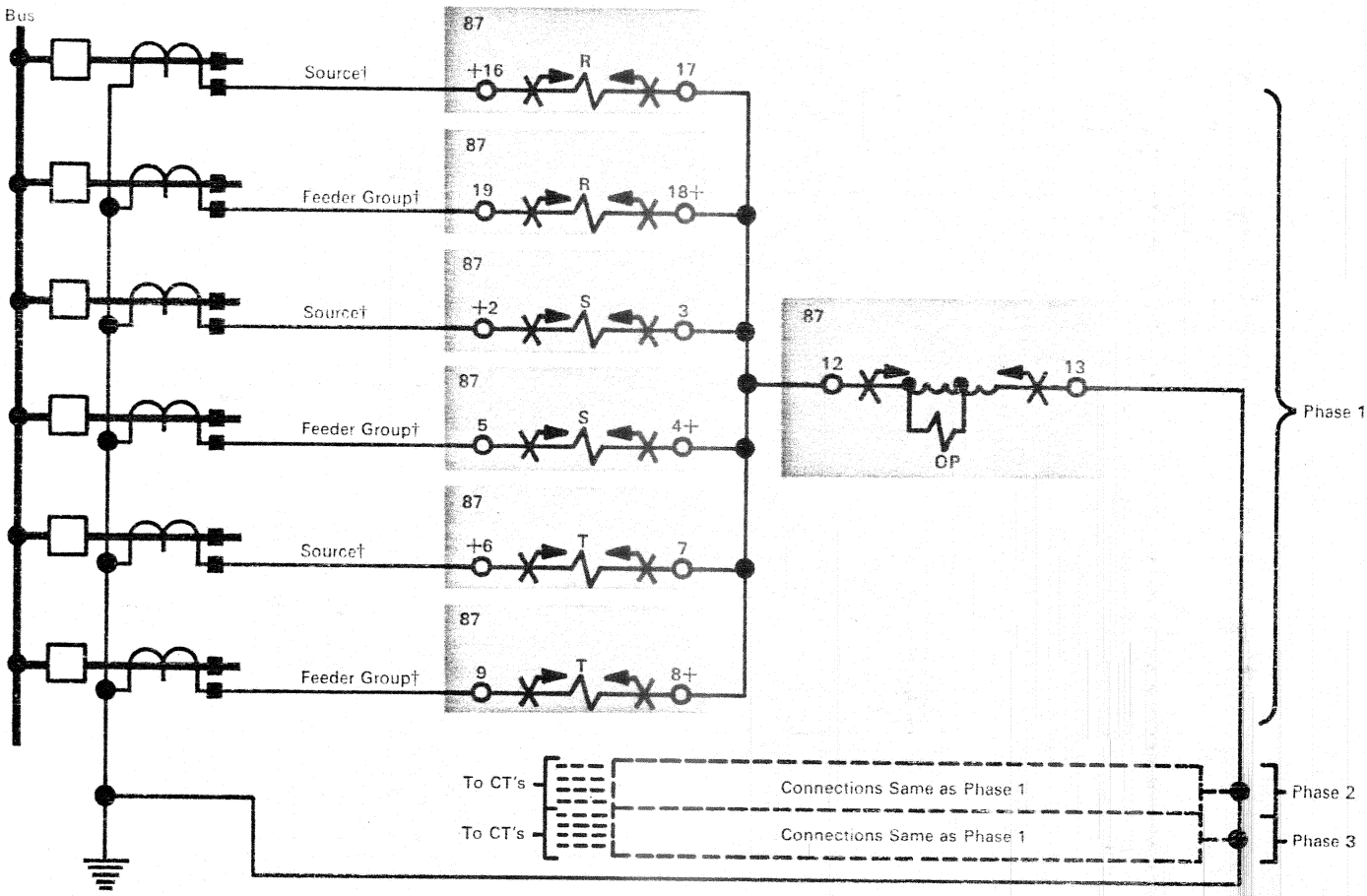
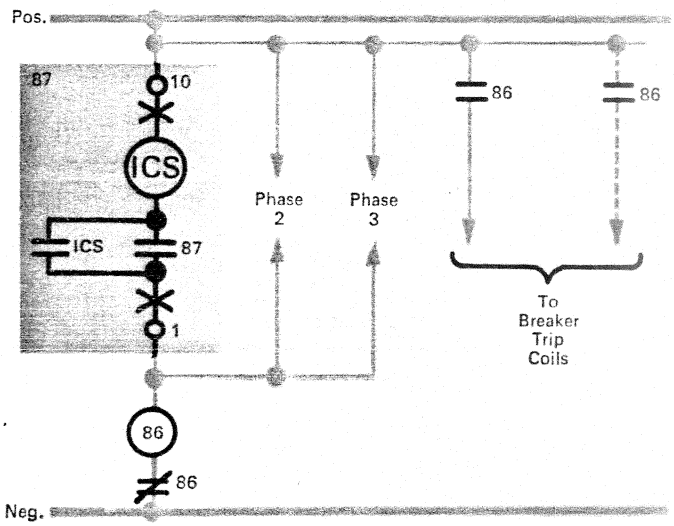
CA-16 and CA-26 Percentage Differential Relays

For Bus and Transformer Protection

One Set of CA-16 Relays for the Protection of a 6-Circuit Bus With Three Feeder Groups





Device Number Chart

87 —Percentage Differential Relay, Type CA-16
ICS—Indicating Contactor Switch
OP —Operating Coil (Bottom L.H. Element)
R —Paired Restraint Coil (Bottom R.H. Element)
S —Paired Restraint Coil (Top L.H. Element)
T —Paired Restraint Coil (Top R.H. Element)

(ICS, OP, R, S, T: In Type CA-16 Relay)

86 —Auxiliary Tripping Relay, Type WL

† —As defined here a feeder contributes only a small portion of the total fault-current contribution for a bus fault. Otherwise the circuit is a source

Fig. 5

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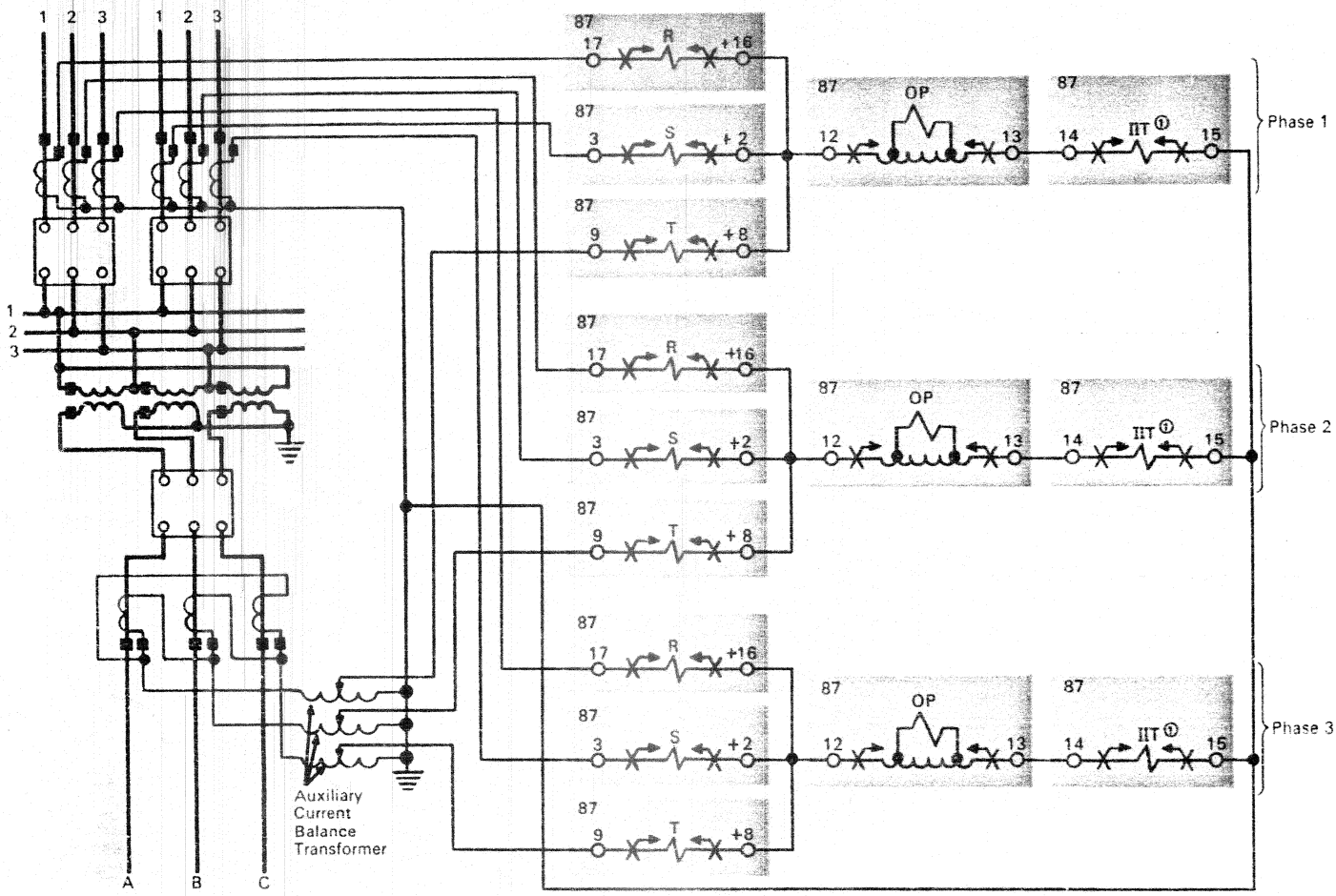
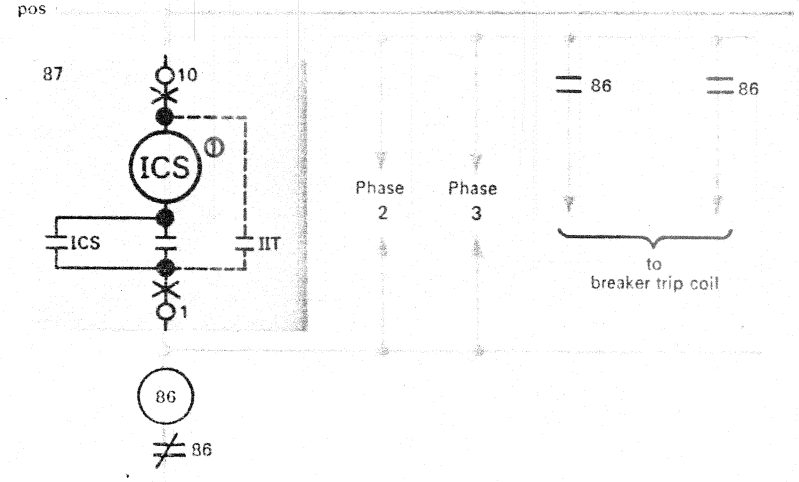
External Wiring
CA-26 Relay for Transformer Protection and Bus Protection





Device Number Chart

87 —Percentage Differential Relay, Type CA-26

In Type CA-26 Relay:
- ICS—Indicating Contact Switch
- OP —Operating Coil
- R —Restraint Coil (Bottom Right Hand Element)
- S —Restraint Coil (Top Left Hand Element)
- T —Restraint Coil (Top Right Hand Element)

86 —Auxiliary Tripping Relay, Type WL

① Use Indicating Instantaneous Trip Unit Where Internal Fault Current Can Exceed Twice the Maximum Total Current Flowing Through the Differential Zone for an External Fault. Set Pickup Equal to Maximum Total Current Flowing Through the Differential Zone.

Fig. 6

606B269

CA-16 and CA-26 Percentage Differential Relays

For Bus and Transformer Protection

Typical Time Curves

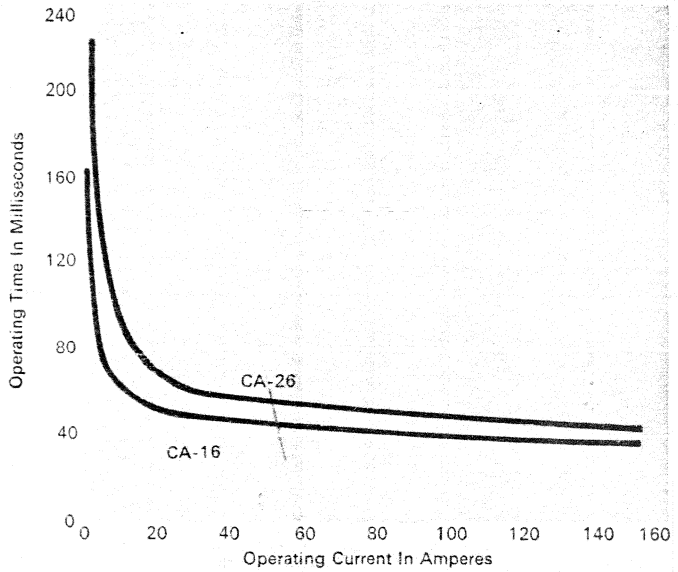


Fig. 7 537956

Typical Burden Characteristics

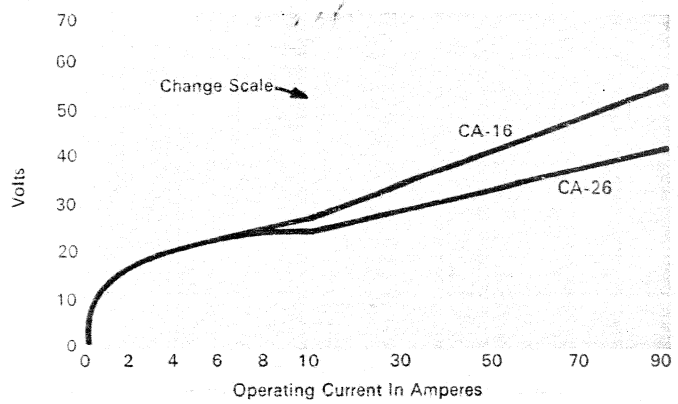


Fig. 8 537957

Percentage Differential Characteristics
(One Restraint Winding)

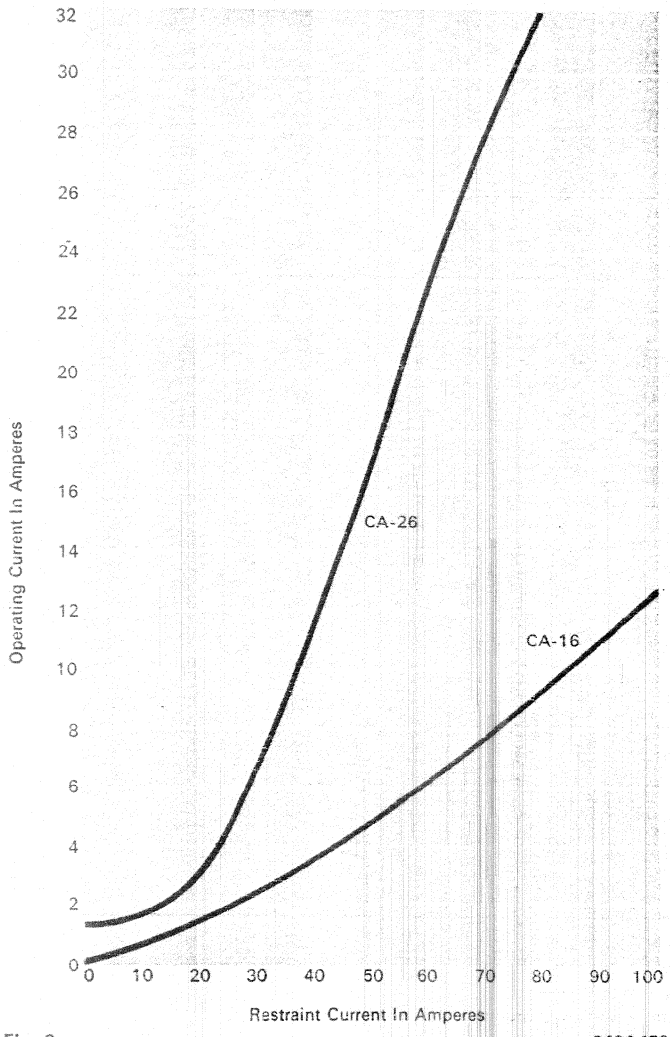


Fig. 9 849A450

Relay Characteristics

Restraint Coils

Burden at 5 Amps: 0.75 volt-amperes each

Continuous Rating: 14 amperes

1-Second Rating: 460 amperes

Operating Circuit

Burden: See Figure 8.

Minimum Trip Current (Between Terminals 12 and 13)

CA-16: 0.15 amperes

CA-26: 1.25 amperes

Continuous Rating: 8 amperes

1-Second Rating: 280 amperes

Sensitive Fault Detector

Minimum Trip Current: 0.15 amperes

Indicating Contactor Switch

0.2 amperes or 2.0 amperes. Will close and carry 30 amperes long enough to trip a circuit breaker.

Operating Time

See Figure 7.

CA-16 and CA-26 Percentage Differential Relays

For Bus and Transformer Protection

Weights and Carton Dimensions

Type	Case Type	Weight: Pounds		Domestic Shipping Carton Dimensions: Inches
		Net	Shipping	
CA-16\ CA-26/	FT-32	24	28	13 x 13 x 21

Further Information

Prices: PL 41-020
Application: AD 41-300
Instructions: IL 41-337.3
Dimensions: DB 41-075 (FT-32 Case)
Other Protective Relays: SG 41-000

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