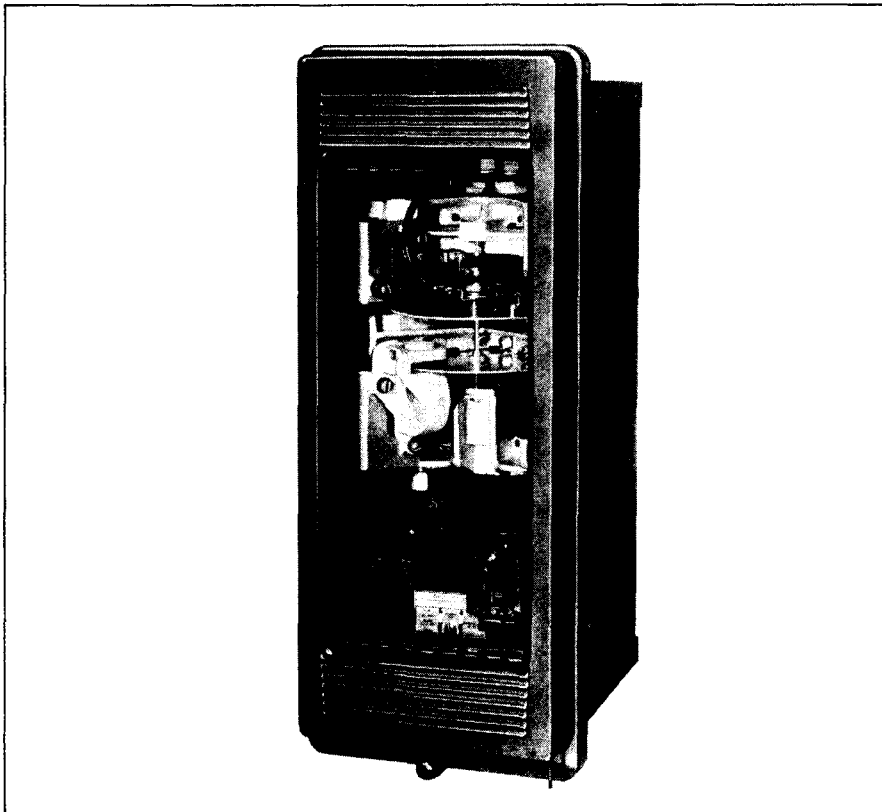


July, 1991  
Supersedes DB 41-337, pages 1-8,  
dated July, 1971  
Mailed to: E, D, C/41-300A

Single Phase  
For Bus and Transformer Protection  
**Device Number:** 87B, CA-16  
87T, CA-26

## Types CA-16, CA-26 Percentage Differential Relays



### 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

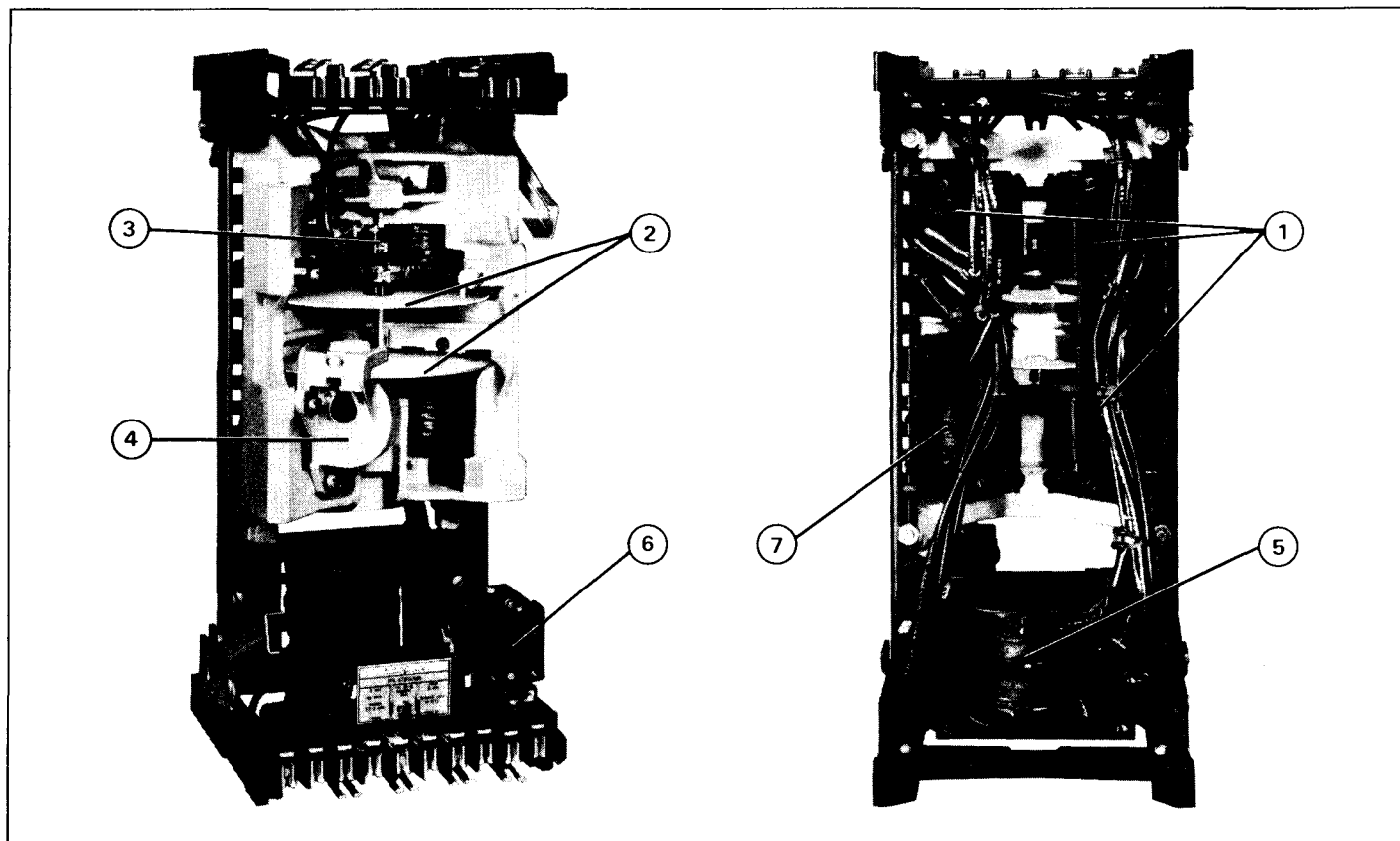
The burden voltage is described as:

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  $I_{EXT} = 100A$ , the burden (excluding CT resistance) should not exceed:  
 $N_P V_{CL}/133 = (0.67 \times 200)/133 = 1.0$  ohms.



### Construction

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

#### ① 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.

#### ② Induction Discs

Mounted on a common rotatable shaft.

#### ③ Moving Contact

Also mounted on the common rotatable shaft.

#### ④ Damping Magnet

#### ⑤ Auto-Transformer

#### ⑥ Indicating Contactor Switch

#### ⑦ 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.

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

### With Indicating Instantaneous Trip<sup>①</sup>

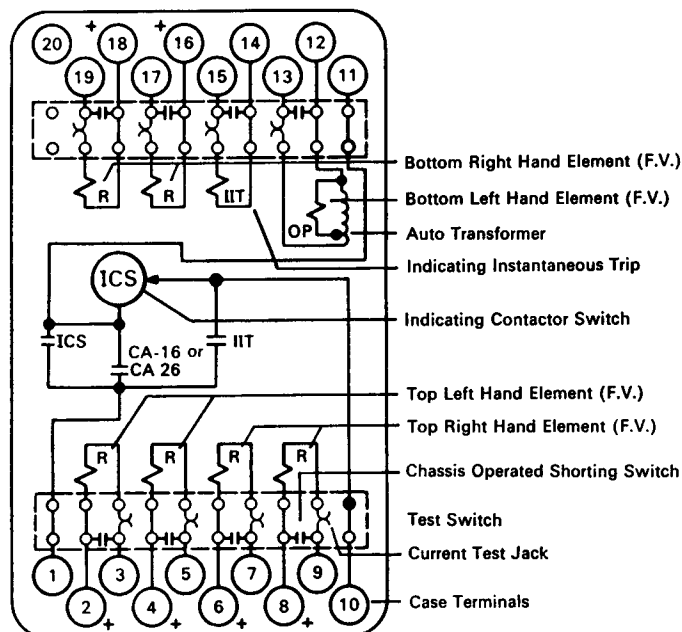


Fig. 1

185A443

### Without Indicating Instantaneous Trip<sup>①</sup>

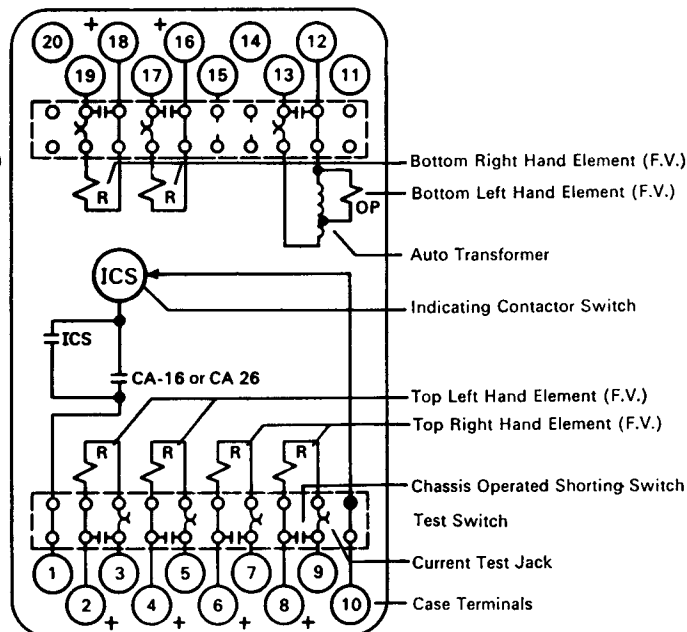


Fig. 2

185A419

### With Sensitive Fault Detector<sup>①</sup>

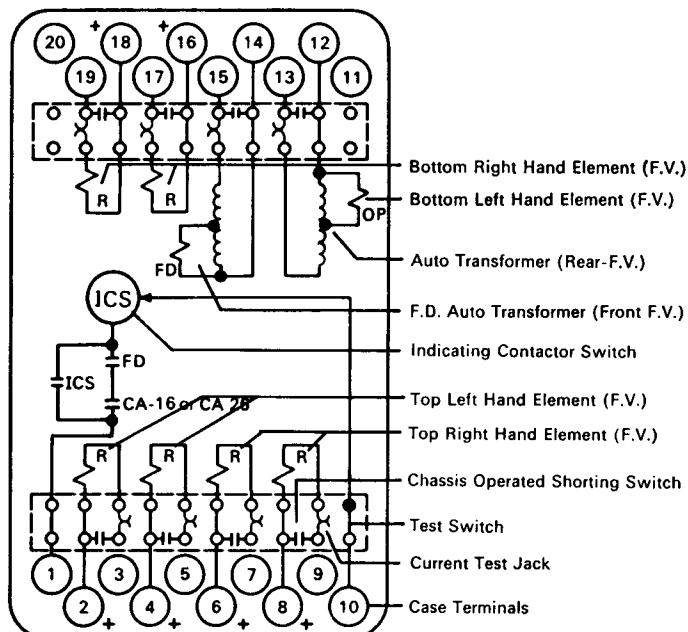


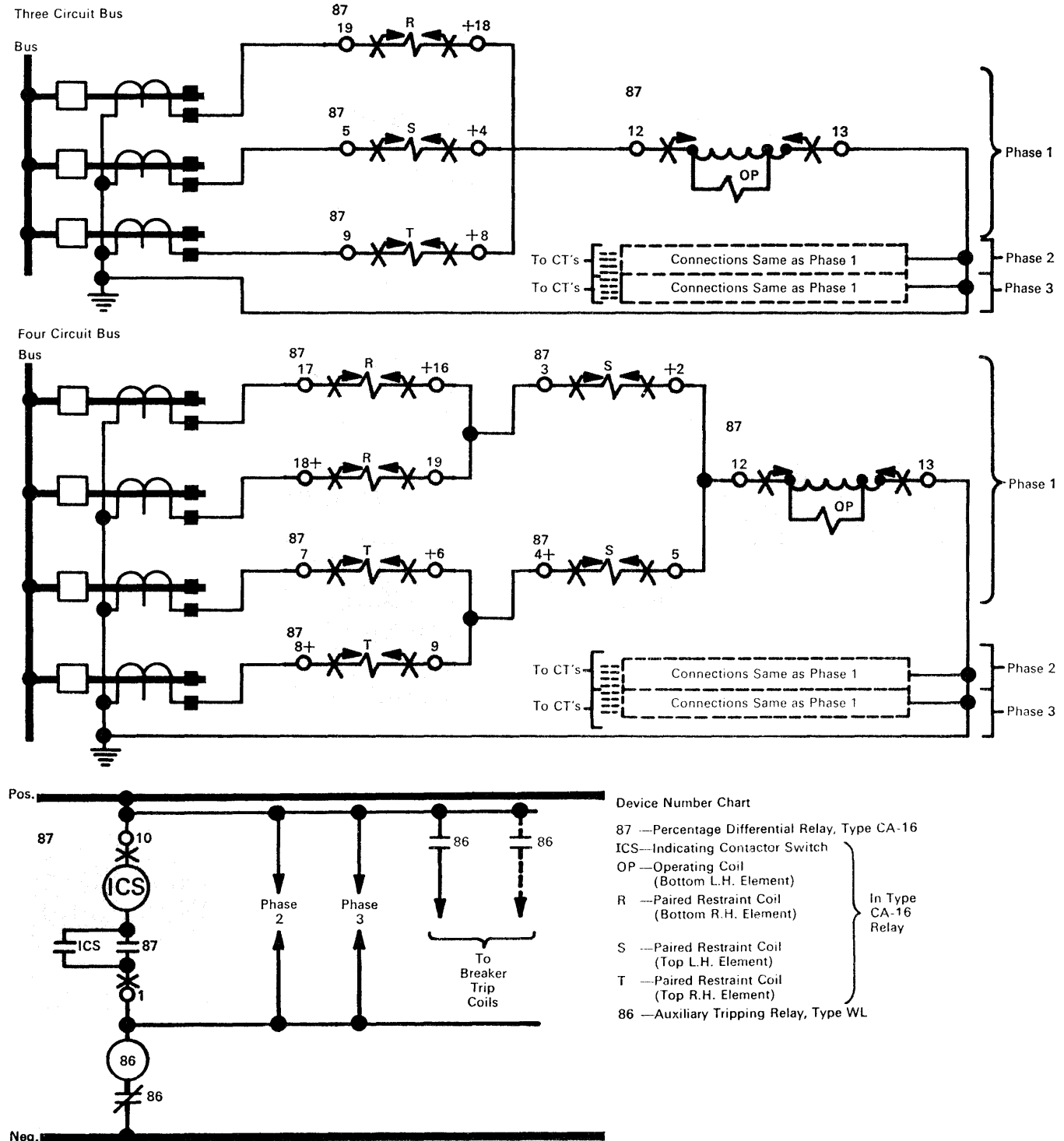
Fig. 3

187A434

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

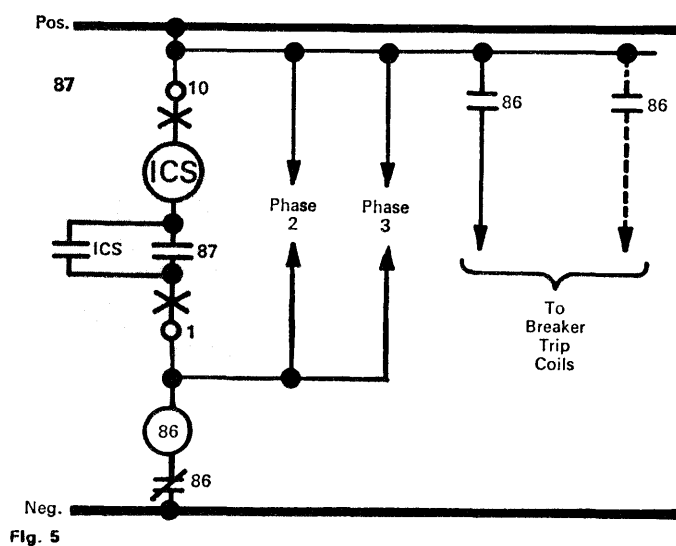
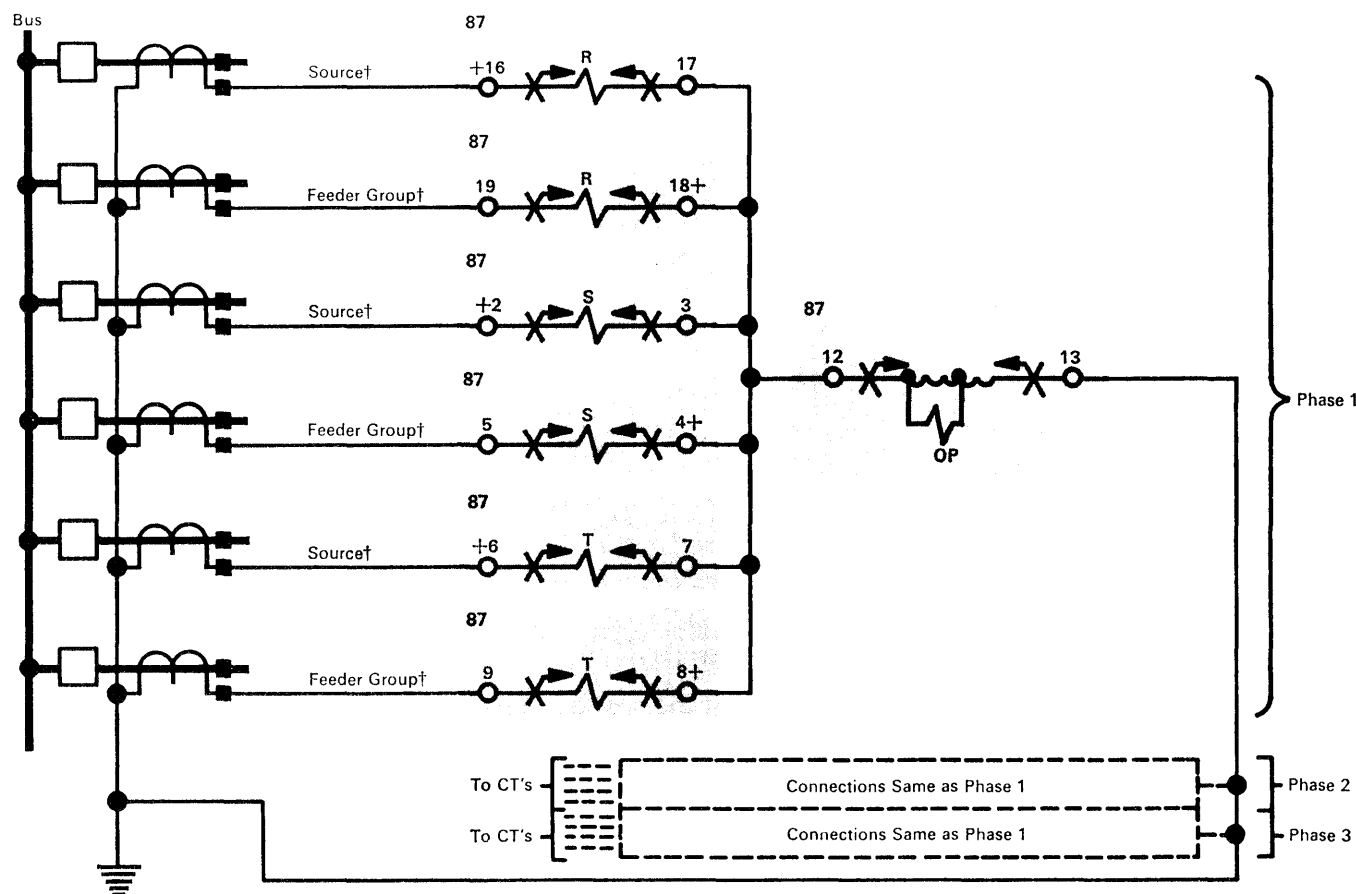
## External Wiring

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



187A424

## 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)

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

In Type  
CA-16  
Relay



**Further Information**

List Prices: PL 41-020

Technical Data: TD 41-025

Application Data: AD 41-301E

Instructions: IL 41-347.1

Renewal Parts: RPD 41-938

Flexitest Case Dimensions: DB 41-076

Contactors Switches: DB 41-081

Other Protective Relays:

Application Selector Guide, TD 41-016

## Typical Time Curves

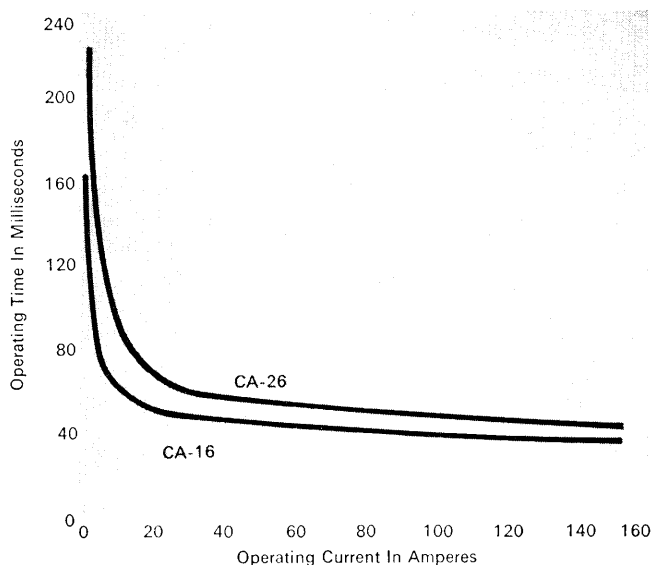


Fig. 7

537956

## Typical Burden Characteristics

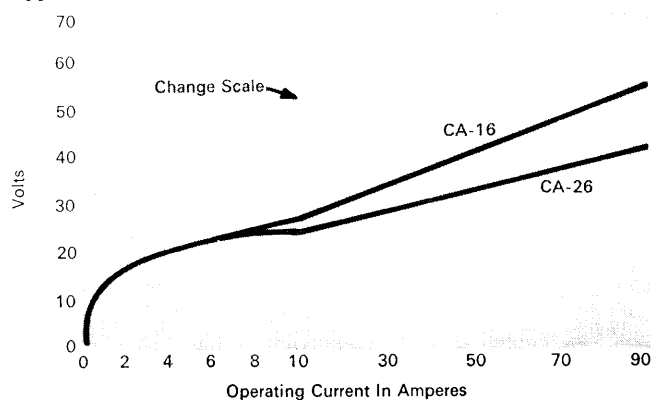


Fig. 8

537957

## Percentage Differential Characteristics (One Restraint Winding)

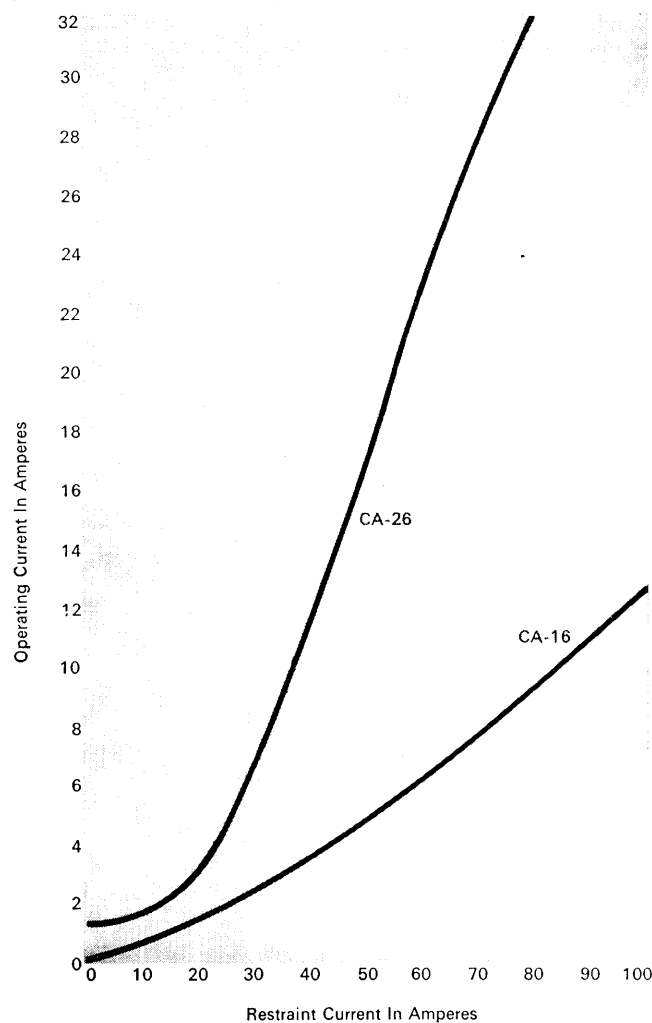


Fig. 9

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.



### **Weights and Carton Dimensions**

| Type             | Case Type | Weight: Pounds |          | Domestic Shipping Carton Dimensions: Inches |
|------------------|-----------|----------------|----------|---------------------------------------------|
|                  |           | Net            | Shipping |                                             |
| CA-16}<br>CA-26} | FT-32     | 24             | 28       | 13 x 13 x 21                                |

### **Further Information**

List Prices: PL 41-020

Technical Data: TD 41-025

Application Data: AD 41-301E

Instructions: IL 41-337.3

Flexitest Case Dimensions: DB 41-076

(FT-32 Case)

Other Protective Relays:

Application Selector Guide, TD 41-016



July, 1991  
Supersedes TD 41-020, Types CA16, CA-26  
on page 67, dated November, 1987  
Mailed to: E, D, C/41-300A

Single Phase  
For Bus and Transformer Protection

## Types CA-16, CA-26 Percentage Differential Relays

### Percentage Differential, Inverse Time, Single Phase (Device Number: 87) With 0.2/2.0 Amps Dc Indicating Contact or Switch<sup>①</sup>

| Type       | Application                  | Contacts | Frequency,<br>Hertz | Amperes, Ac     |                             |                   | Sensitivity | Relay Data            |                 |              |       |
|------------|------------------------------|----------|---------------------|-----------------|-----------------------------|-------------------|-------------|-----------------------|-----------------|--------------|-------|
|            |                              |          |                     | Minimum<br>Trip | Instantaneous<br>Trip (IIT) | Fault<br>Detector |             | Internal<br>Schematic | Style<br>Number | Case<br>Size |       |
| CA-16<br>① | Bus                          | Spst-cc  | 60                  | 0.15            | None                        | None              | Variable    | 185A419               | 671B157A09®     | FT-32        |       |
|            |                              |          |                     |                 | 10-40                       |                   |             | 185A443               | 671B157A11      |              |       |
|            |                              |          |                     |                 | 20-80                       |                   |             | 185A443               | 671B157A18      |              |       |
|            |                              | Dpst-cc  |                     |                 | None                        | 0.15              |             | 187A434               | 671B157A20®     |              |       |
|            |                              |          |                     |                 | None                        | 4-16              |             | 185A442               | 671B157A10      |              |       |
|            |                              |          |                     |                 |                             | 4-16              |             | 188A684               | 671B157A15      |              |       |
| Spst-cc    | 0.9                          | none     |                     | None            | 629A286                     | 671B157A22        |             |                       |                 |              |       |
|            |                              |          |                     |                 | 1.0                         | 185A419           | 671B157A19  |                       |                 |              |       |
|            |                              |          |                     |                 | 2.0                         | 185A443           | 671B157A14  |                       |                 |              |       |
| CA-26<br>① | 2 & 3 winding<br>transformer | Spst-cc  |                     | 60              | 1.25                        | 40-160            | None        | Variable              | 185A419         | 671B158A09   | FT-32 |
|            |                              |          |                     |                 |                             | 40-160            |             |                       | 185A443         | 671B158A16   |       |
|            |                              |          |                     |                 |                             | 40-160            |             |                       | 185A443         | 671B158A10   |       |
|            |                              | Dpst-cc  |                     |                 | None                        | 4-16              | 185A442     |                       | 671B158A11      |              |       |
|            |                              |          |                     |                 | None                        | 4-16              | 629A041     |                       | 671B158A14      |              |       |
|            |                              |          |                     |                 |                             | 40-160            | 629A286     |                       | 671B158A15      |              |       |

### Type A Auto-Balance Transformer

For use with CA-26 relays. See Catalog Section 42-000 (P.B. 42-852).

| Volt-amperes | Frequency,<br>Hertz | Ratio<br>Range | Phase | Style<br>Number         | List Price                                                                                        |
|--------------|---------------------|----------------|-------|-------------------------|---------------------------------------------------------------------------------------------------|
| 50           | 25 to 60            | 10.8/5 to 5/5  | 1     | 7881A16G01 <sup>③</sup> | Refer to ABB Power T&D Company, Inc.<br>Low Voltage Instrument Transformers<br>Pinetops, NC 27864 |
| 100          |                     |                |       | 7881A16G02              |                                                                                                   |

<sup>③</sup> Denotes item available from stock.

<sup>①</sup> 50 Hertz relays and auxiliaries can be supplied at same price. Order "Similar to Style Number ..... except 50 Hertz".

<sup>③</sup> ICS: Indicating Contactor Switch (dc current operated) having seal in contacts and indicating target which are actuated when the ICS coil is energized at or above pickup current setting. Suitable for dc control voltages up to and including 250 volts dc. Two current ranges available:

- (1) 0.2/2.0 amps dc, with tapped coil.
- (2) 1.0 amp dc, without taps.

Rating of ICS unit used in specific types of relays is shown in price tables. All other ratings must be negotiated.

When ac current is necessary in a control trip circuit, the ICS unit can be replaced by an ACS unit.

The ACS unit may be supplied in place of an ICS unit at no additional cost. Specify system voltage rating on order.