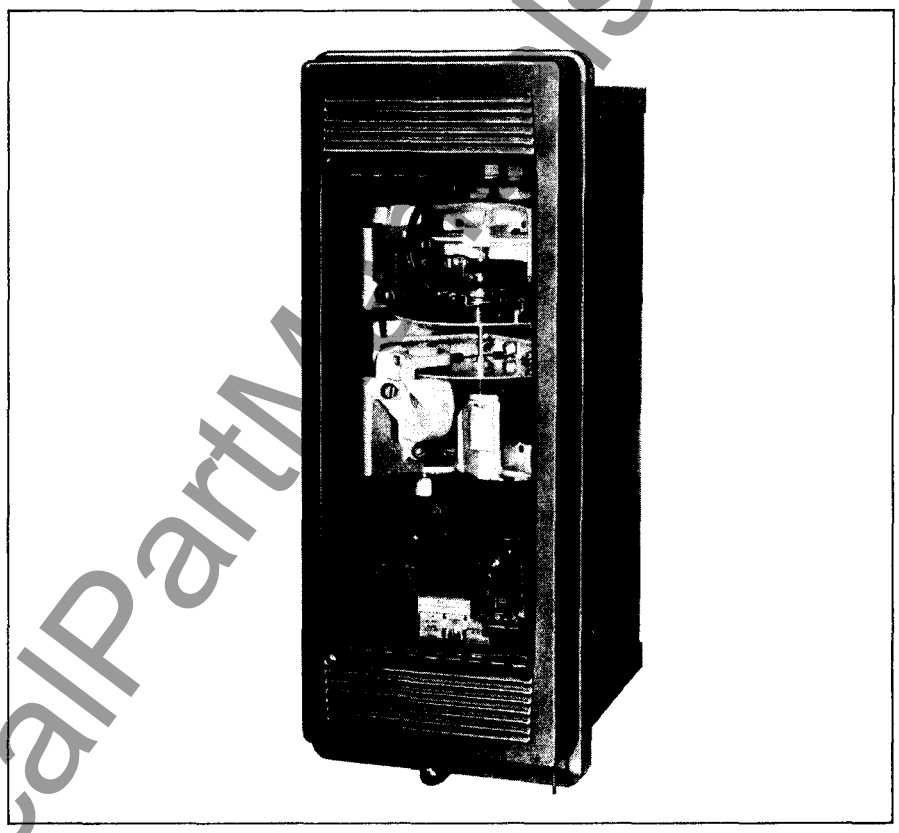
ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

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:

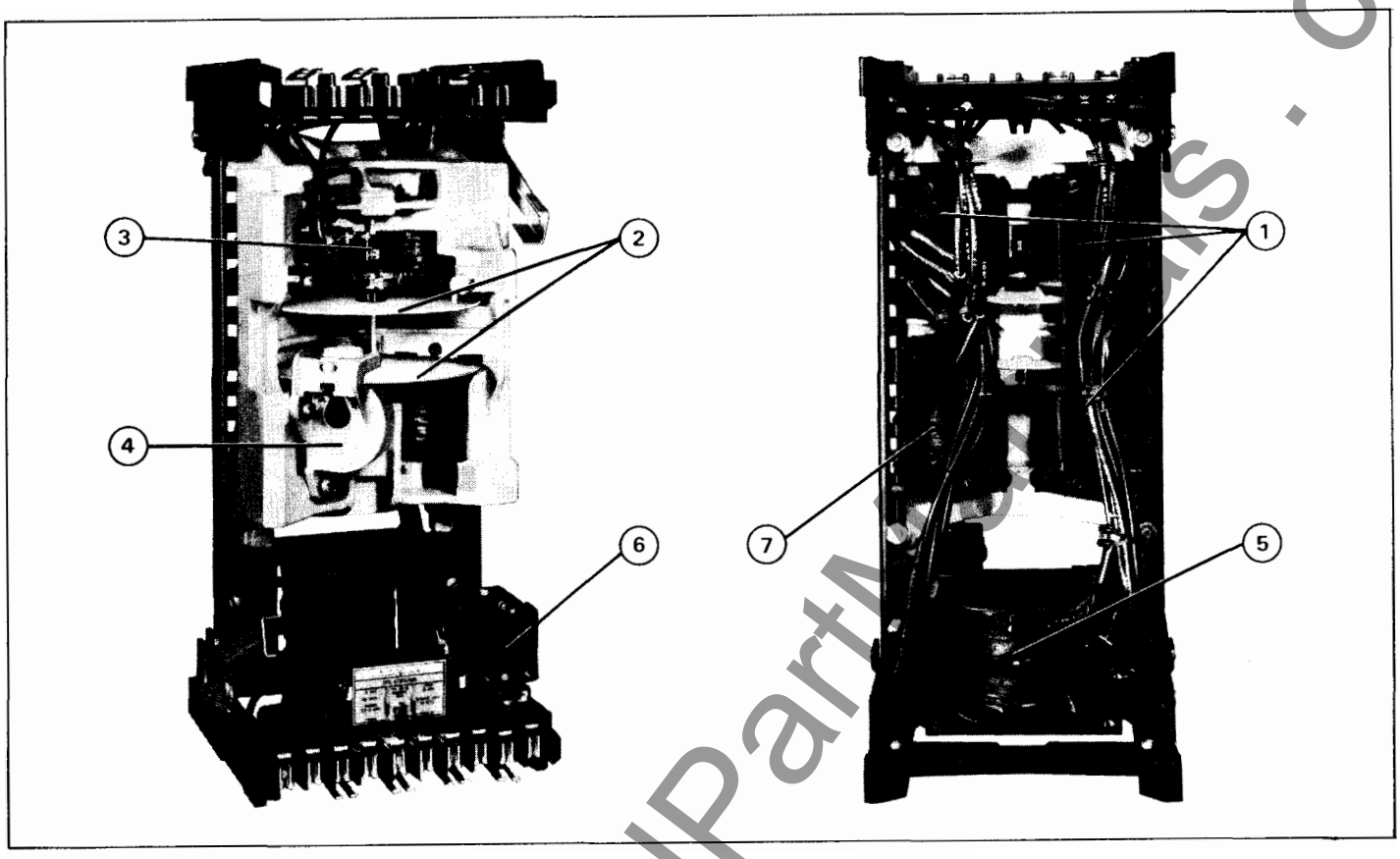
Case 1: Fault current maximum of 100A rms in CT secondary – drop across 2-way lead burden and relays (CA-16 and CA-26 restraint-coil burden is negligible).

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 $I_{EXT} = 100$A, 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 Trip①

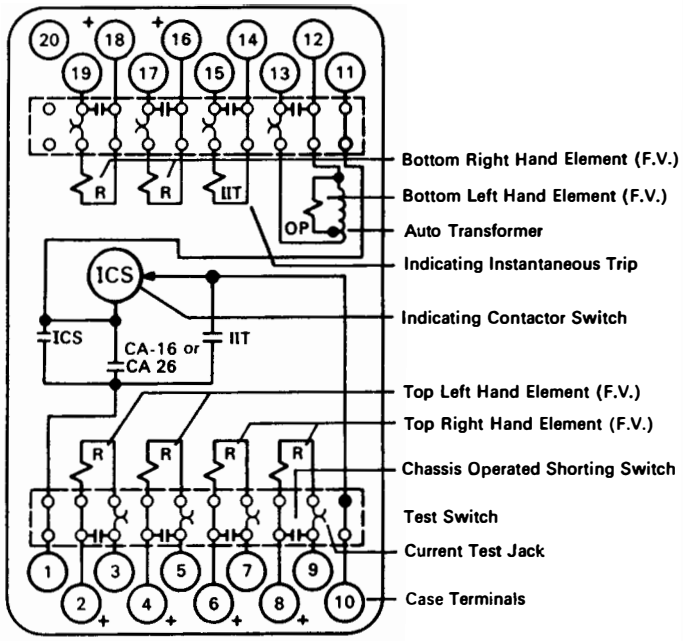


Fig. 1 185A443

Without Indicating Instantaneous Trip①

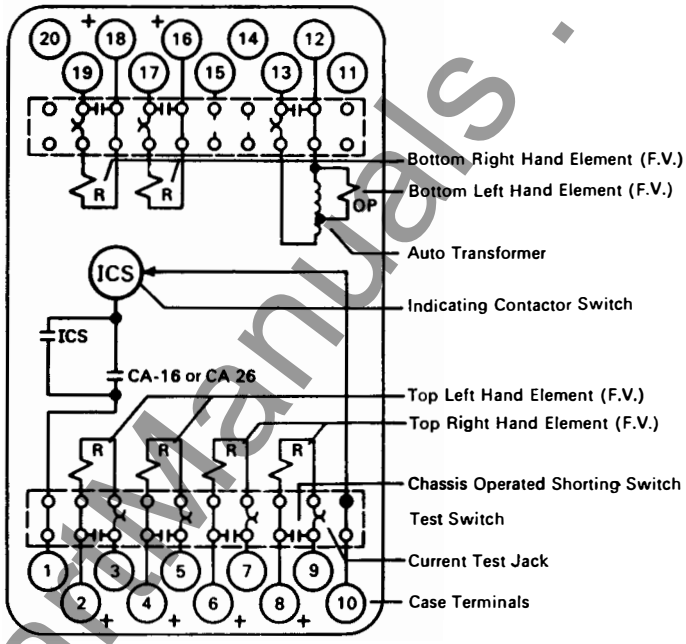


Fig. 2 185A419

With Sensitive Fault Detector①

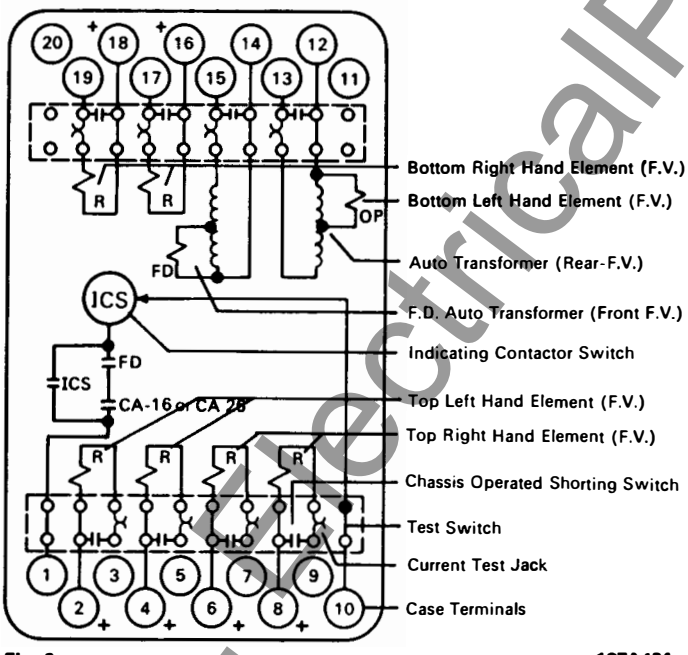
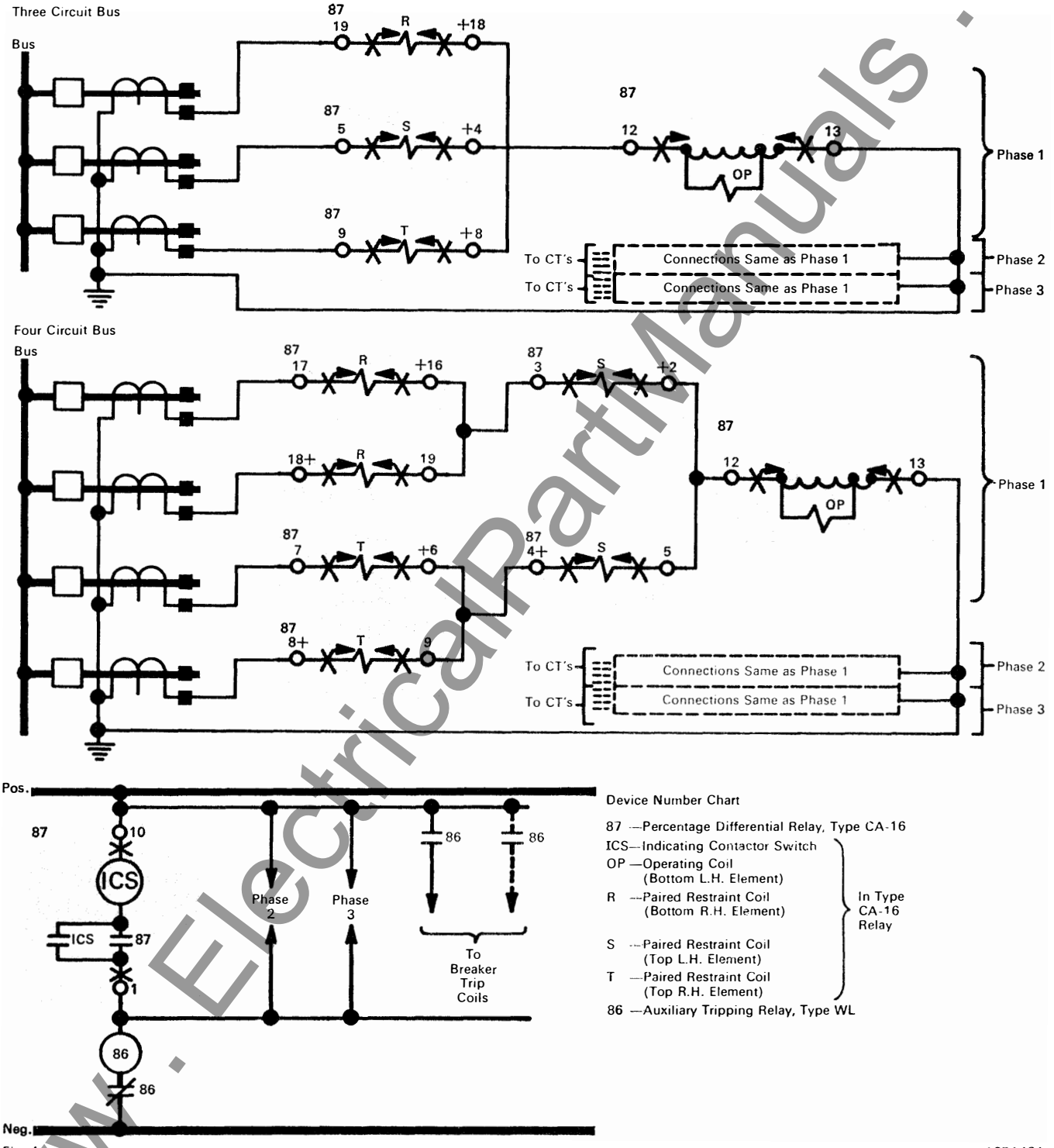


Fig. 3 187A434

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

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)

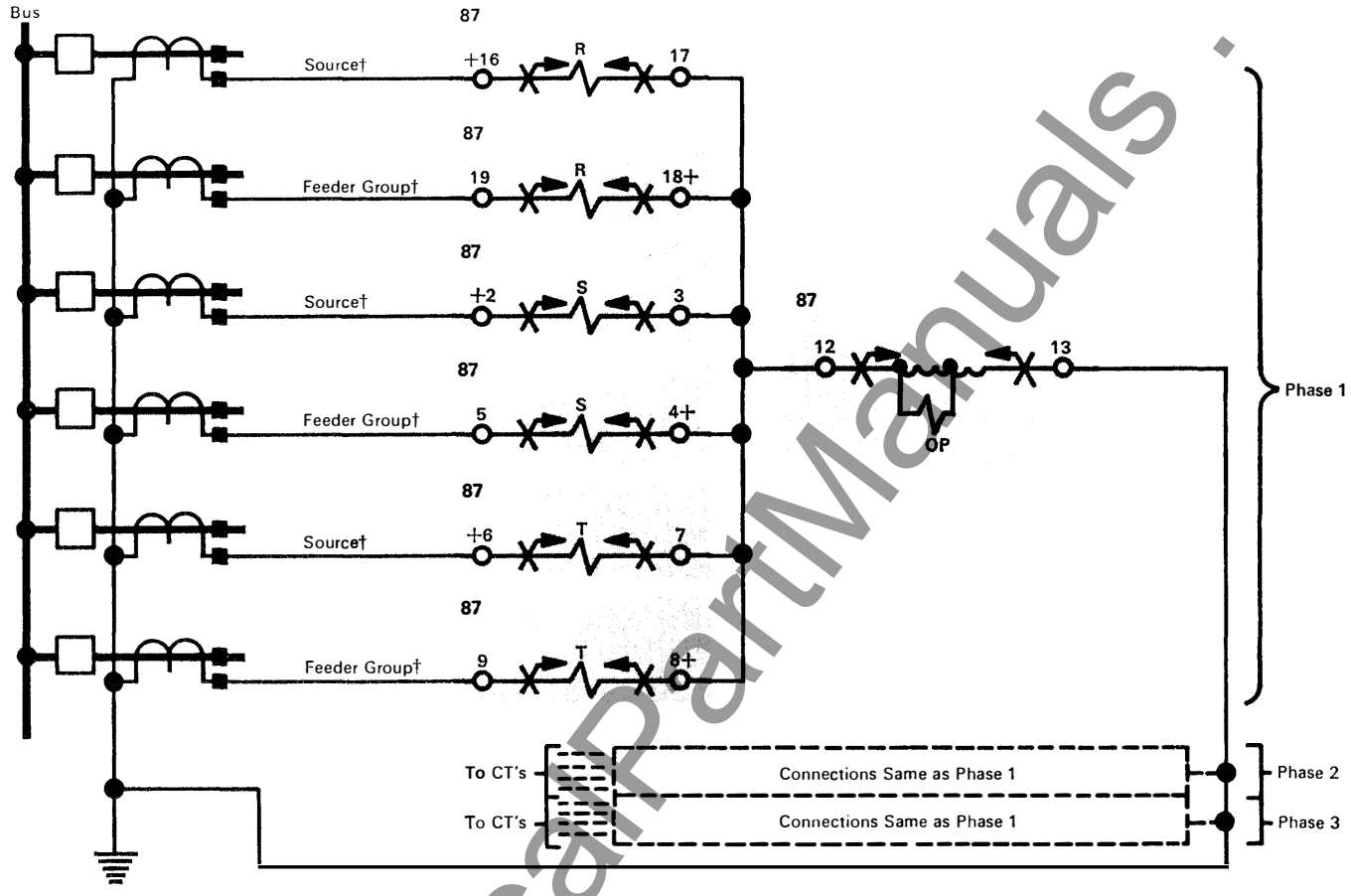
} In Type CA-16 Relay

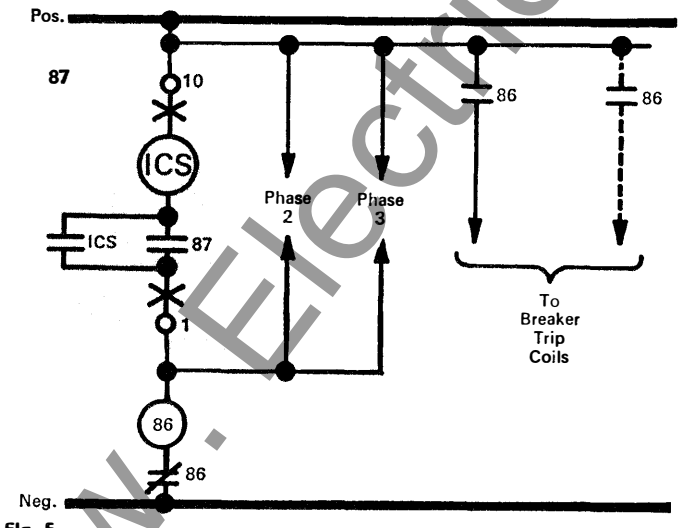
86 —Auxiliary Tripping Relay, Type WL

Fig. 4

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)

(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

187A425

ABB

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
Contactor Switches: DB 41-081
Other Protective Relays:
Application Selector Guide, TD 41-016

Typical Time Curves

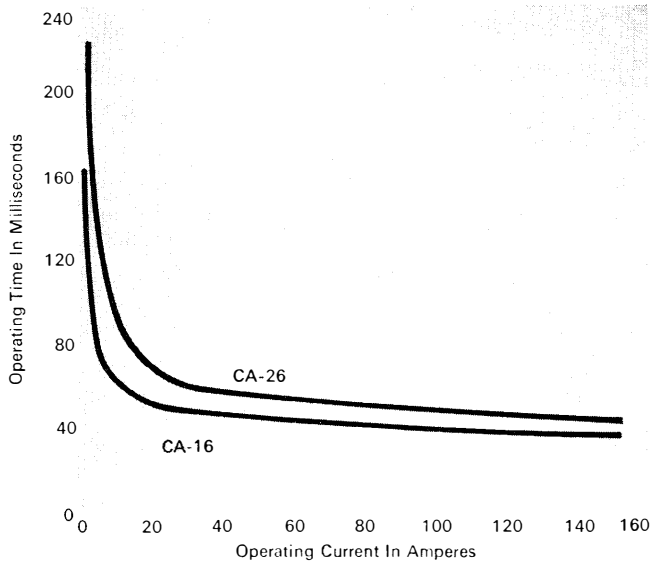


Fig. 7 537956

Typical Burden Characteristics

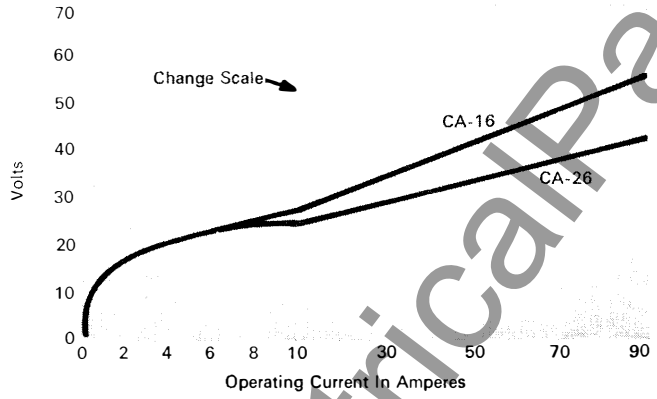


Fig. 8 537957

Percentage Differential Characteristics
(One Restraint Winding)

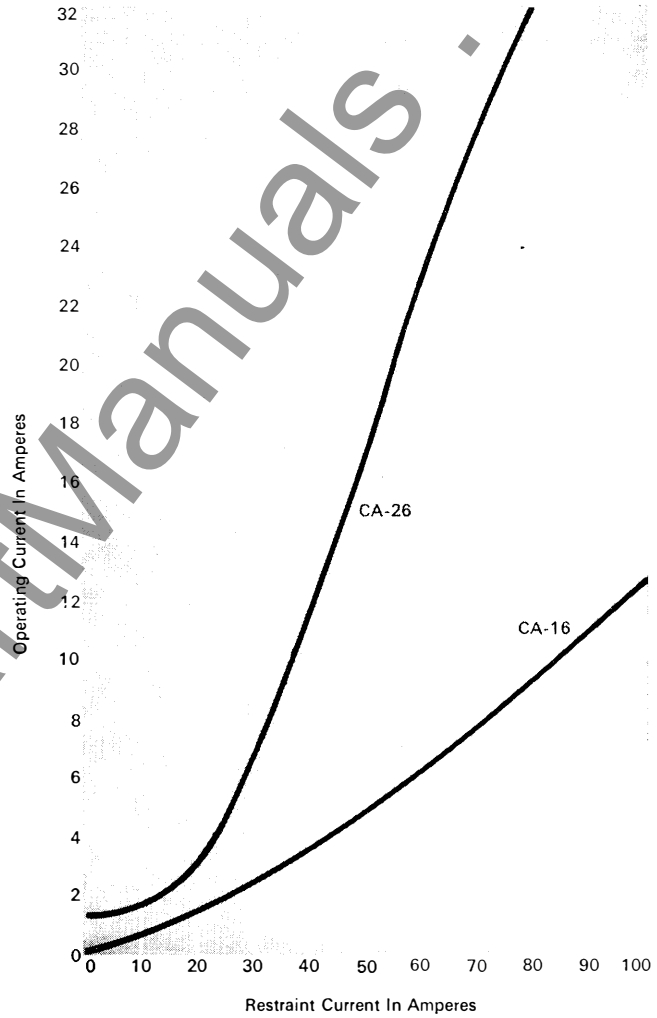


Fig. 9 849A450

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 Net	Weight: Pounds Shipping	Domestic Shipping Carton Dimensions: Inches
CA-16 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

ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
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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 Switch③

Type	Application	Contacts	Frequency, Hertz	Amperes, Ac			Sensitivity	Relay Data		
				Minimum Trip	Instantaneous Trip (IIT)	Fault Detector		Internal Schematic	Style Number	Case Size
CA-16 ①	Bus	Spst-cc	60	0.15	None	None	Variable	185A419	671B157A09⑤	**FT-32**
					10-40			185A443	671B157A11	
					20-80			185A443	671B157A18	
					None	0.15		187A434	671B157A20⑤	
						4-16		185A442	671B157A10	
		Dpst-cc			None	4-16		188A684	671B157A15	
						None		629A286	671B157A22	
		Spst-cc		0.9	none	None		185A419	671B157A19	
				1.0	40-160			185A443	671B157A14	
				2.0	40-160			185A443	671B157A16	
CA-26 ①	2 & 3 winding transformer	Spst-cc	60	1.25	None	None	Variable	185A419	671B158A09	**FT-32**
					10-40	None		185A443	671B158A16	
					40-160			185A443	671B158A10	
					None	4-16		185A442	671B158A11	
					40-160	4-16		629A041	671B158A14	
		Dpst-cc			None	None		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, Hertz	Ratio Range	Phase	Style Number	List Price
50	25 to 60	10.8/5 to 5/5	1	7881A16G01⑤	Refer to ABB Power T&D Company, Inc. Low Voltage Instrument Transformers Pinetops, NC 27864
100				7881A16G02	

⑤ Denotes item available from stock.

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

③ **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.