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

September, 1990
Supersedes DB 41-200, pages 1-8,
dated November, 1987
Mailed to: E, D, C/41-200A

For Under and/or
Overvoltage Protection
Device Numbers: 27, 59 and 59N

Types CV, CVD, CV-8 Voltage Relays

Application

Low Voltage Protection

A low voltage condition will prevent motors from reaching their rated speed on starting or cause them to lose speed and draw heavy overload current. While overload relays will eventually detect this condition, the motor should be quickly disconnected when severe low voltage conditions exist. Where continuous operation is essential, such as station auxiliary service or continuous manufacturing processes, the CV relay is used for alarm purposes only.

Voltage Transfer Schemes

When alternate sources of power exist, such as double-ended transformer units, the CV relay can be applied to initiate switching of the station bus to the alternate source.

The CVD relay is used in control circuits to initiate switching when the line voltage increases or decreases beyond a predetermined value.

CV-21 to CV-27 relays are frequency compensated, and maintain a fixed pickup voltage over a wide range of frequency. They are used in hydro machines.

Timing Applications

The CV relay has an accurate operating time characteristic over a wide range of time dial positions and minimum operating voltages. It is frequently used where specific time intervals are required after application of normal voltage or the increase or decrease from normal voltage.

Induction Motor Undervoltage Protection

During transistory faults, such as lightning strokes, an overhead line may be momentarily de-energized while the fault arc is being extinguished. During this period it is desirable to prevent disconnection of the motor load, and realize maximum benefit from fast reclosing schemes. Time delay CV relays are used to keep the motor load in service.

Ground Fault Protection of Ac Generator Windings

The single unit CV-8 relay provides effective ground fault protection for generator stator windings. It is relatively insensitive to third harmonic (180 hertz) voltage, and will not operate for third harmonic load unbalance which normally flows in the generator neutral. The CV-8 has a 60-hertz pickup voltage of 8% of rating, and provides good sensitivity for light ground faults in the machine.

Features

Low burden due to high efficiency of "E" type electromagnet.

Small size FT-11 case permits optimum use of panel space.

Frequency compensated designs having a variation in pickup of less than 5% over the frequency range of 30 to 90 hertz, applied on hydro operation.

Variety of designs available including units with single, double, or single-pole double-throw contacts with dc or ac seal-in units or instantaneous voltage units.

Harmonically restrained CV-8 relay provides excellent ground fault detection of generator stator windings.

Contact Arrangements Available

Relay	Device Number	Contacts	De-Energized Position①	Energized Position①
Undervoltage CV-1, CV-2, CV-21, CV-22	27	Spst, dpst	Left contact closed	Left contact open at tap value or above
Overvoltage CV-4, CV-5, CV-24, CV-25	59	Spst, dpst	Left contact open	Left contact closed at tap value or above
Under or Overvoltage CV-6, CV-7, CV-26, CV-27	27 or 59	Spdt	Left contact open Right contact closed	Left contact closes at tap value or above Right contact closes below tap value
Low Pickup Overvoltage CV-8	59N	Spst, dpst	Left contact open	Left contact closed at minimum pickup or above
Harmonic Filter CV-8	59N	Spdt	Left contact open Right contact closed	Left contact closed at minimum pickup or above Right contact open
Over and Undervoltage CVD	27 or 59	Spdt	Left contact closed Right contact open	Left contact opens at low voltage setting Right contact closes at high voltage setting

① Front view.

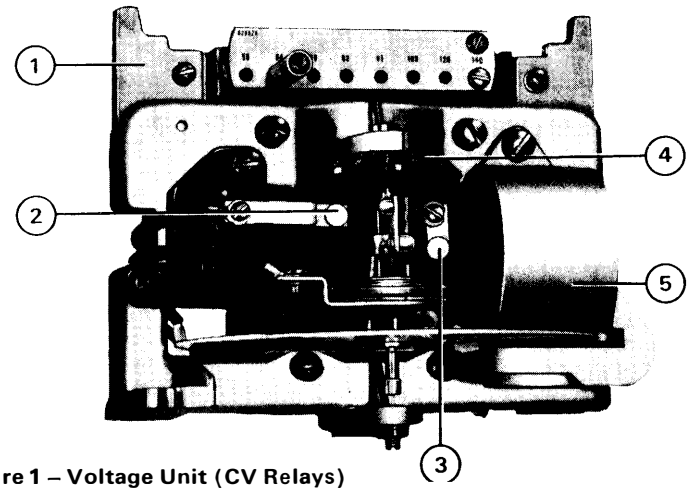


Figure 1 – Voltage Unit (CV Relays)

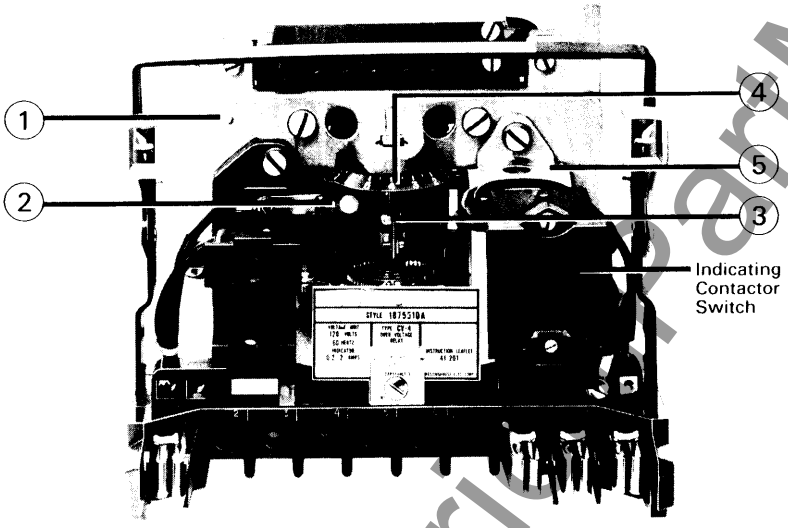


Figure 2 – Type CV-4 Relay – Front View, Chassis

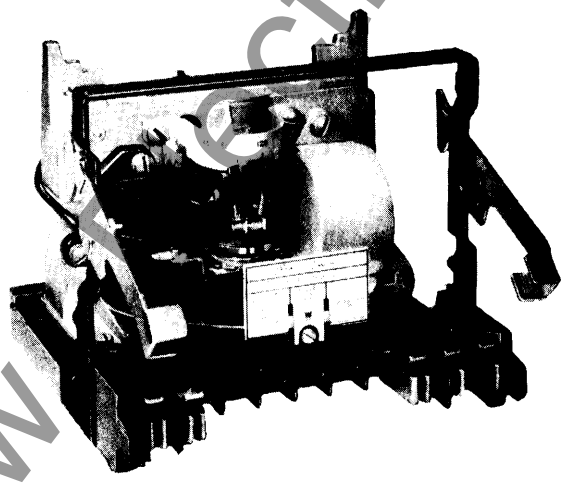


Figure 3 – Type CVD, Chassis View

Operation and Construction

1 Mounting Frame

Solid one-piece die-cast aluminum. Assures accurate and permanent alignment of all components.

2 Left Stationary Contact

Has supporting plate which is reversible to eliminate wipe when used in quick-opening applications with high speed reclosers.

3 Right Stationary Contact

On CV-6, 7, 26, and 27 relays, the left (front) stationary contact is closed at tap value voltage, and the right (back) contact will close at a lower voltage which is within 5% of this value.

4 Time Dial

Indicates initial position of the moving contact. It is indexed from position ½ (minimum time) to 11 (maximum time).

5 Damping Magnet

High strength Alnico. Used for damping the induction disc.

CV-1, 2, 4, 5, 6, 7

These relays consist of a voltage unit employing the electromagnetic induction disc construction (as shown in figure 1), and an Indicating Contactor Switch unit (ICS).

The voltage unit consists of an "E" shaped laminated core which has a main tapped coil and a shading coil on one of the outer legs to shift the flux out of phase.

In operation, the out-of-phase flux interacts with the main coil flux to create a torque on the disc. Rotation of the disc is opposed by a spiral spring which resets the contacts and disc to their normal position when the applied voltage falls below the tap setting value. The voltage values indicated by the tap plate are the minimum voltages required to close the relay contacts.

On overvoltage relays types CV-4 and CV-5, the contacts close at tap value or above. On undervoltage types CV-1 and CV-2, the contacts open at tap value or above. On the over and undervoltage types CV-6 and CV-7, the tap value is the voltage at which the relay's front contact closes. The back contact will close within 5% of this value.

CV-8
The CV-8 uses the same basic induction disc voltage unit and Indicating Contactor Switch as types CV-1 to CV-7, but in addition includes a built-in capacitor connected in series with the electromagnet coil to filter out third harmonic voltage.

It is designed for low pickup value (8% of continuous voltage rating) in generator ground fault detection schemes.

CV-21, 22, 24, 25, 26, 27
These relays employ the same basic induction disc voltage unit and Indicating Contactor Switch and operate similar to types CV-1 to CV-7, except that they include a frequency compensating resistor connected in the outer leg coil circuit of the "E" type electromagnet. The compensating resistor enables them to maintain their 60 cycle pickup voltage and/or dropout values within 5% over a variable input frequency of from 30 to 90 hertz.

Their contact arrangements and characteristic curves are the same as those for the comparable CV-1 to CV-7 types.

CVD (Fig. 3)
Type CVD incorporates the same basic electromagnetic induction disc voltage unit used in the CV-1 to CV-7 types, but is constructed to operate essentially as a contact making voltmeter, with high and low voltage contacts, which are independently adjustable over a calibrated scale.

Upon application of voltage to the relay, the disc moves to a position in its travel that corresponds to the applied voltage, and remains in this position until the applied voltage changes. It then moves to a position corresponding to the new voltage value. Since the movement of the disc from one position to another is under the control of the restraining spring and the damping magnet, the relay has inverse timing characteristics. The greater the change in applied voltage, the faster the relay disc and moving contact will travel.

ICS, ACS, and IIV Units
ICS: The Indicating Contactor Switch is a dc current operated device having a magnetic armature to which leaf-spring contacts are attached. When energized at pickup value, the moving contacts bridge the stationary contacts and seal in around the main relay contacts, relieving them of carrying heavy trip currents. The switch has a target which indicates completion of the trip circuit.

ACS: Similar to the ICS unit, except that it is ac current operated.

IIV: Also similar to the ICS unit, except that it is ac voltage operated

Thermal Capacities and Burden Data (60 Hertz)

Tap Value: Volts			Volt-Amperes ②	Power Factor Angle③	Watts
120 Volts Nominal	240 Volts Nominal	480 Volts Nominal			
CV-1, 2, 4, 5, 6, 7④					
55	110	220	10.0	67°	3.8
64	128	256	7.0	69°	2.5
70	140	280	5.8	70°	2.0
82	164	328	4.0	71°	1.3
93	186	372	3.1	72°	1.0
105	210	420	2.4	73°	.7
120	240	480	1.8	74°	.5
140	280	560	1.3	75°	.3
CV-21, 22, 24, 25, 26, 27④					
55	110	...	14.4	64°	6.3
64	128	...	10.4	66°	4.2
70	140	...	8.3	67°	3.3
82	164	...	6.0	68°	2.2
93	186	...	4.7	69°	1.6
105	210	...	3.6	70°	1.3
120	240	...	2.8	71°	.9
140	280	...	2.0	72°	.6

Voltage Rating	Maximum Continuous Voltage	Volt-Amperes ⑤	Power Factor Angle	Watts
CV-8⑦				
67	67	30.0	70°⑥	10.0
199	199	30.0	70°⑥	10.0
CVD				
30-120	132	7.85	70°③	2.67
40-160	176	7.85	70°③	2.67
80-320	352	7.85	70°③	2.67
105-135	148	16.5	78°③	3.52
210-270	296	16.5	78°③	3.52

② At nominal rating.
③ Degrees current lags voltage.
④ Maximum continuous voltage is 110% of nominal or tap voltage, whichever is higher.
⑤ At maximum continuous voltage.
⑥ Degrees current leads voltage.
⑦ Minimum pickup is 8% of continuous rating

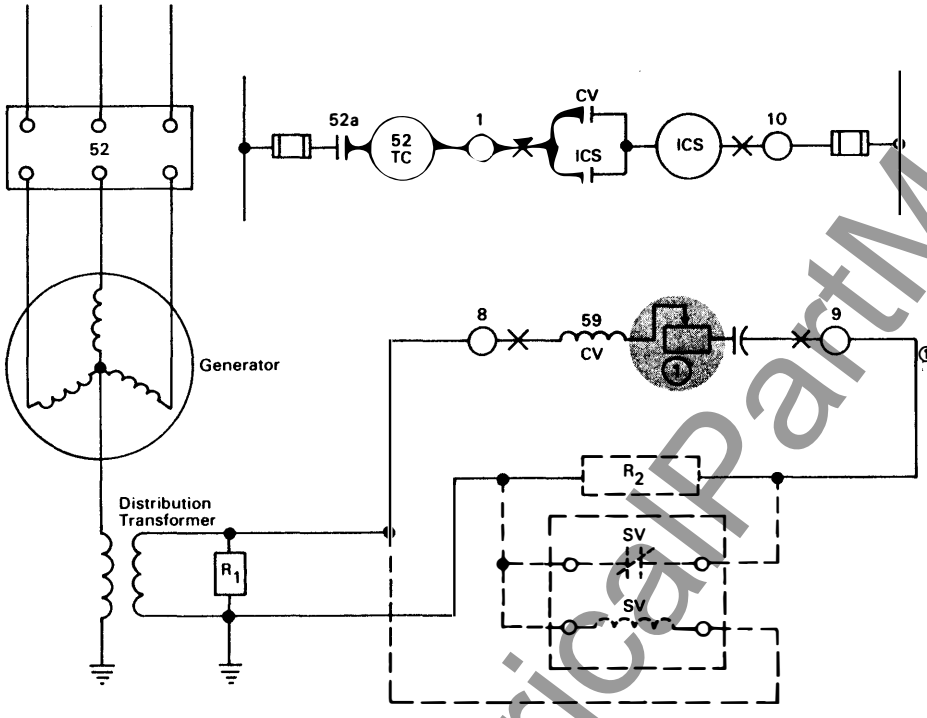
Generator Ground Protection (Type CV-8)

Typical Application of Low Pickup Overvoltage Relay (Ground Fault Protection of Ac Generator Windings)

The generator neutral is grounded through a distribution transformer. The primary of the transformer is rated for generator line-to-line voltage, secondary for 120 or 240 volts. A CV-8 low pickup relay is used to detect ground fault in the generator winding. The relay contains a tuned filter circuit which offers high impedance to 180 hertz voltage (third harmonic) and low impedance to 60 hertz voltage.

The 67 volt CV-8 relay can withstand 67 volts continuously and 140 volts for 2 minutes. If the relay is to be used for an alarm or a timing function where the above values are exceeded, it is advisable to use the 199 volt CV relay. If however, a more sensitive pickup is required, a 67 volt relay may be used in conjunction with one SV relay and an external resistor. Using a 70-160 volt SV relay and a 375 ohm, 8½-inch external resistor, the combination is rated at 160 volts continuous. R_2 resistor assembly is style number 1956 449. At 70 volts, the SV relay picks up, opening its contact, and inserting the resistor in series with the type CV-8 relay, thus reducing the voltage impressed across the CV-8 coil.

Due to the high impedance of the CV-8 during generator warm-up or reduced frequency operation, an additional adjustable SV relay rated 7-16 volts, 60 hertz is used to back up the CV-8. The SV is set to initiate tripping. With a 7 volt, 60 hertz setting, it will operate at 2 volts, 15 hertz or 3.5 volts at 30 hertz. During 60 hertz operation, the SV relay is disconnected by a 52b contact. A third harmonic filter circuit is not required with the SV because of the low values of third harmonic present during reduced frequency operation.



① Also available in adjustable range:
5.4 to 20.0 volts (67 volts continuous)
16.0 to 40.0 volts (199 volts continuous)

Device Number Chart

52 – Power Circuit Breaker
52a – Breaker Auxiliary Contact
52TC – Breaker Trip Coil
59 – Non-Directional Voltage Relay Type CV-8
ICS – Indicating Contactor Switch
R_1 – Resistor Supplied by Customer
R_2 – Voltage Drop Resistor
SV – Voltage Relay (see DB 41-765)

Figure 4

Shipping Weights and Carton Dimensions

Case Size	Weight: Lbs. (kg) Net	Shipping	Domestic Shipping Carton Dimensions: Inches (mm)
FT-11	8 (3.6)	11 (5)	9 x 9 x 12 (23 x 23 x 31)
FT-21	10 (4.5)	13 (5.9)	9 x 12 x 13 (23 x 31 x 33)

Further Information

List Prices: PL 41-020
Technical Data: TD 41-025
Instructions:
CV-1 thru -8, IL 41-201
CVD, IL L-385794
CV-21 thru -27, IL 41-201.2
Renewal Parts:
Type CV, RPD 41-923
Type CVD, RPD 41-924
Flexitest Case Dimensions: DB 41-076
Contactor Switches: DB 41-081
Other Protective Relays:
Application Selector Guide, TD 41-016

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For Under and/or Overvoltage Protection

Types CV, CVD, CV-8 Voltage Relays

Over or Undervoltage, Non-Directional, Single Phase

Type and Time Curve	Contacts	Frequency Hertz	Indicating Contactor Switch ③	Volts: Ac Nominal	Volts: Ac Adjustable Range	Relay Data Internal Schematic	Relay Data Style Number	Case Size
Undervoltage (Device Number: 27)								
CV-1① Long	Spst-cc	60	0.2/2.0 amps dc	120 240 480	55-140 110-280 220-560	182A724	1875 506Ⓢ 1875 507 288B549A13	FT-11
	Dpst-cc			120 240 480	55-140 110-280 220-560	182A725	1875 514 1875 515 289B053A13	
CV-2① Short	Spst-cc			120 240 480	55-140 110-280 220-560	182A724	1875 508Ⓢ 1875 509 288B549A21	
	Dpst-cc			120 240 480	55-140 110-280 220-560	182A725	1875 516 1875 517 289B053A25	
Overvoltage (Device Number: 59)								
CV-4① Long	Spst-cc	60	0.2/2.0 amps dc	120 240 480	55-140 110-280 220-560	182A724	1875 510 1875 511 288B584A13	FT-11
	Dpst-cc			120 240 480	55-140 110-280 220-560	182A725	1875 518 1875 519 288B975A13	
CV-5① Short	Spst-cc			120 240 480	55-140 110-280 220-560	182A724	1875 512Ⓢ 1875 513 288B584A21	
	Dpst-cc			120 240 480	55-140 110-280 220-560	182A725	1875 520 1875 521 288B975A25	
			IIV 120-200 Vac	120	55-140	183A490	1956 061	
Over or Undervoltage (Device Number: 27 or 59)								
CV-6① Long	Spdt-cc and co②	60 Overvoltage Circuit	0.2/2.0 amps dc in overvoltage circuit	120 240 480	55-140 110-280 220-560	182A727	1875 522 1875 523 288B585A13	FT-11
CV-7① Short				120 240 480	55-140 110-280 220-560	182A727	1875 524④ 1875 525 288B585A22	
CV-6 Long	Spdt cc & co	60	0.2/2.0 amps dc in undervoltage circuit	120 240	55-140 110-280	183A283	1962 090 1961 007	FT-11
CV-7① Short				120 240	55-140 110-280	183A283	1955 332 718B850A30	

Ⓢ 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".

② Electrically common moving contact.

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.

④ Continuous rating.

Over or Undervoltage, Non-Directional, Single Phase Continued

Type and Time Curve	Contacts	Frequency Hertz	Indicating Contactor Switch ③	IIV ⑤	Volts: Ac Nominal	Volts: Ac Adjustable Range	Relay Data Internal Schematic	Relay Data Style Number	Case Size
Overvoltage, 8% Pickup (Device Number: 59)									
CV-8①	Spst-cc	60	0.2/2.0 amps dc	None	67⑤	5.4⑦	182A743	1875 526	**FT-21**
					199	16.0⑦	182A726	1875 527⑤	**FT-11**
Short					67⑤	5.4-20	185A038	183A205A15⑤	**FT-21**
					199	16-40	188A307	288B618A12⑤	**FT-11**
					290	22.5⑦	185A129	1963 590	**FT-21**
	Dpst-cc				67	5.4⑦	183A499	1956 201	**FT-21**
					199	16⑦	184A192	1961 422	**FT-11**
	Spdt-cc and co				199	16⑦	629A001	288B618A22	**FT-11**
			None		199	16.0⑦	184A563	288B618A21	
Undervoltage, Frequency Compensated (Device Number: 27)									
CV-21	Spst-cc	30-90	0.2/2.0 amps dc	None	120	55-140	185A133	290B568A09	**FT-11**
					240	110-280		290B568A10	
Long	Dpst-cc	30-90			120	55-140	185A134	290B571A09	
CV-22	Spst-cc	30-90			120	55-140	185A133	290B568A21	
					240	110-280		290B568A22	
Short	Dpst-cc	30-90			120	55-140	185A134	290B571A21	
Overvoltage, Frequency Compensated (Device Number: 59)									
CV-24	Spst-cc	30-90	0.2/2.0 amps dc	None	120	55-140	185A133	290B569A09	**FT-11**
				120-200	120	55-140	187A998	290B569A10	
Long	Dpst-cc	30-90		None	120	55-140	185A134	290B572A09	
				120-200	120	55-140	187A994	290B572A10	
CV-25	Spst-cc	30-90		None	120	55-140	185A133	290B569A21	
					240	110-280		290B569A22	
Short		30-90		120-200	120	55-140	187A998	290B569A24	
					240	110-280		290B569A23	
	Dpst-cc	30-90		None	120	55-140	185A134	290B572A21	
				120-200	120	55-140	187A994	290B572A22	
Over or Undervoltage, Frequency Compensated (Device Number: 27/59)									
CV-26 Long	Spdt-cc and co②	30-90	0.2/2.0 amps dc	None	120	55-140	185A135	290B570A09	**FT-11**
					240	110-280		290B570A10	
CV-27 Short	Spdt-cc and co②	30-90		None	120	55-140	185A135	290B570A21④	
					240	110-280		290B570A22	

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".

② Electrically common moving contact.

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.

④ Continuous rating.

⑤ IIV: Instantaneous Indicating Voltage unit which is ac voltage operated. The unit has an adjustable range of 120-200 volts. When energized at or above pickup setting contacts of the unit close and a target indicates completion of the trip circuit.

⑤ Use one style number 1956 449 resistor assembly (8½", 375 ohms) with CV-8 relay for sensitive detection and 160 volts continuous, See DB 41-200.

⑦ Not adjustable.

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Supersedes TD 41-020, Type CVD on page 56, dated November, 1987
Mailed to: E, D, C/41-200A

For Under and/or Overvoltage Protection

Types CV, CVD, CV-8 Voltage Relays

Over and Undervoltage, Non-Directional (Device Number: 27/59, DB 41-200)

Type and Time Curve	Contacts	Indicating Contactor Switch ③	Time Curve: Seconds④	Volts: Ac Maximum Continuous	Relay Data: Adjustable Range	Internal Schematic	Style Number	Case Size
Adjustable, Under and Overvoltage								
CVD 60 Hertz① Inverse	Spdt-cc and co②	None	....	148	105-135	184A176	1961 156	**FT-11**
			1.9	176	40-160		289B970A09	
			....	296	210-270		289B970A13	
			1.9	352	80-320		289B970A10	
			2.0	132	30-120	184A176	289B970A20	
			1.5	132	30-120		289B970A21	
			....	253	180-230		289B970A16	
		0.2/2.0 amps dc	1.5	132	30-120	184A793	289B970A12	
			1.9	176	40-160	184A793	289B970A15	
			....	148	105-135	184A793	1962 734	
		.25 amp ac (ACS)	....	148	105-135	184A538	1961 943	
		2 operation indicators 0.2/2.0 amps dc	2.0	132	30-120	629A184	289B970A28	

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

② Electrically common moving contact.

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.

④ The time it takes relay to close contacts from mid scale to end scale with "Test Point" settings. (Refer to M scale.)