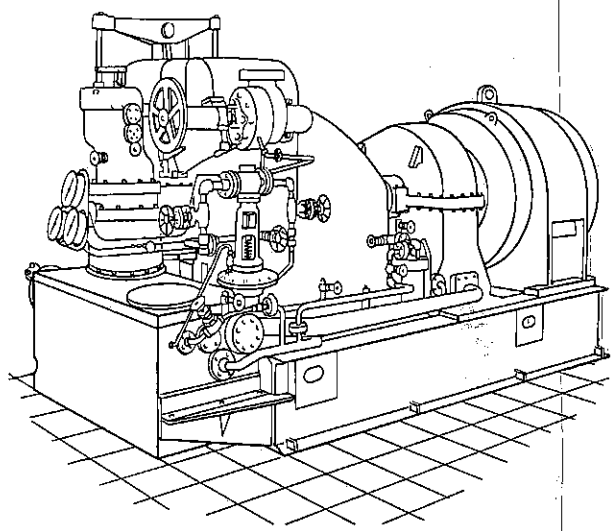
reverse power relay
type CRN-1

for anti-motoring protection of generators and prime movers

descriptive bulletin

41-250

page 1



application

The CRN-1 relay is designed to detect reverse power flow into generators. Its use is recommended in cases where the connected system has sufficient capacity to "motor" the generator upon loss of input to the prime mover (steam turbine, hydraulic turbine, or diesel engine). The protection afforded is primarily for the prime mover, rather than for the generator.

With the type CRN-1 relay on the system, steam turbines are protected against overheating should low steam flow occur, and hydraulic turbines are protected against blade-cavitation in case of low water flow. It can also be used to initiate an alarm or tripping function.

The relay affords three-phase protection. It is energized by a single-phase line current and a line-to-line voltage using either wye or delta potential transformers.

ratings available:
120 or 208 volts, line-to-line

device number: 32

minimum reverse power required to drive prime mover at synchronous speed upon loss of input energy

machine	percent of nameplate kw rating
steam turbine	3
hydraulic turbine	25
diesel engine	.2—2

May, 1960
new information
mailed to: E/321/DB; D65-5A, C/3I2/DB

construction and operation

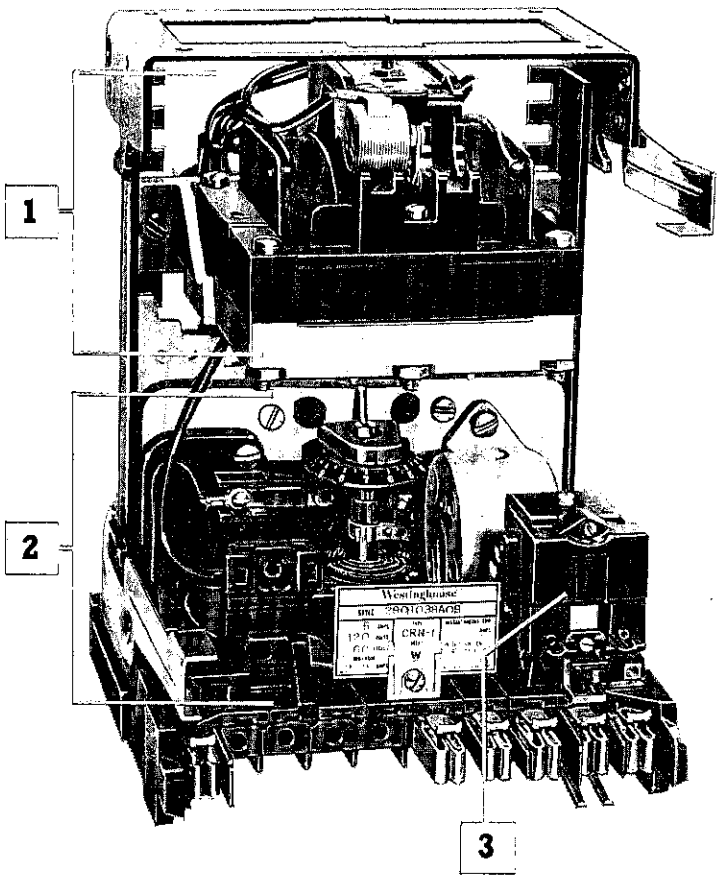


fig. 1

The CRN-1 relay is housed in the FT-21 universal Flexitest case, and consists basically of a sensitive directional unit which directionally controls a voltage-operated timing unit.

The directional unit has a sensitivity of .02 amperes at rated voltage. The timing unit can be adjusted over a range of 2 to 40 seconds.

torque The directional unit has maximum torque when the operating current leads the polarizing voltage by 30°. Using the 30° connection (fig. 8, page 5) maximum torque occurs at 100% power factor on the system.

1 directional unit (D)

Product type induction cylinder unit which operates due to the interaction of the flux created by the operating circuit current and polarizing circuit voltage. Consists basically of an electromagnet, supporting bridge, stationary contact, moving contact assembly, and a die-cast aluminum frame.

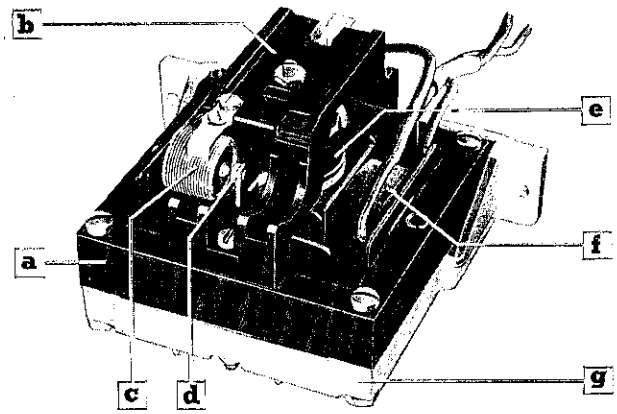


fig 2

a laminated electromagnet

Has two series-connected polarizing coils mounted on alternate sides, with two series-connected operating coils diametrically mounted on remaining opposite sides.

b molded supporting bridge

Houses upper guide bearing of moving element, and supports the stationary contact assembly.

c stationary contact assembly

The stationary contact is attached to the supporting bridge by means of a spring-type clamp. The contact itself is made of silver cadmium oxide, and electrical connection is via the spring-type clamp to the moving-contact spiral spring and spring adjuster clamp.

d moving contact assembly

Consists of a silver cadmium oxide contact, a contact carrying arm, spiral spring, and a rotatable shaft and aluminum cylinder assembly. The shaft is supported by upper and lower jewel bearings, and the cylinder rotates in the air gap formed by the electromagnet and the magnetic core.

e moving element induction cylinder

f polarizing and operating coils (mounted on the electromagnet)

g die-cast aluminum frame

Assures proper alignment of component parts, and supports lower jewel bearing of the moving element.

2 timer unit (T)

Induction disc design, with laminated electromagnet of the "E" type structure. A main coil on the electromagnet's center leg produces a flux which divides and returns through the outer legs. A shading coil on the left leg produces an out-of-phase flux which reacts with the flux in the other leg to produce a contact-closing torque in the air gap of the electromagnet.

The "E" units high efficiency, low burden design produces high torque, which results in positive contact action.

Main coil of the timing unit is connected in series with the directional unit (fig. 7) contact. Thus, it can only operate when power flow is in the "trip" direction, and above the pick-up ratings of both the timer and directional units.

The timer picks up at 54% of rated voltage, will withstand 110% of rating continuously, and is adjustable over a 2 to 40 second timing range.

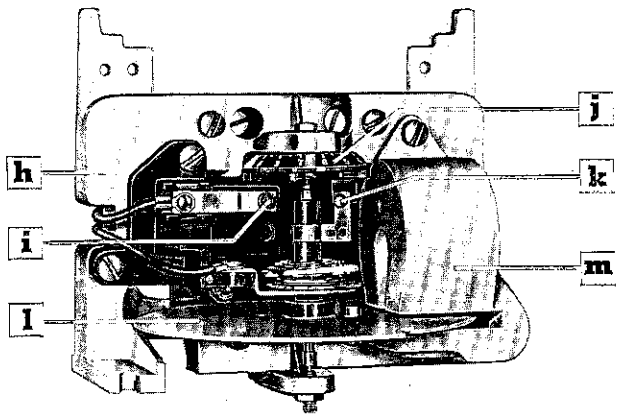


fig. 3

h one-piece die-cast aluminum frame

Assures permanent, accurate alignment of all components.

i stationary contact

Made of silver, with adequate "wipe" to assure positive contact action. Double-trip relays have vernier screw on stationary contact plate to provide simultaneous contact action and adjustable "wipe".

j time dial

Indicates initial position of moving contact timer unit. Dial is indexed from position ½ (minimum time) to position 11 (maximum time). See time curves, fig. 6, page 4.

k moving contact

Made of pure silver and connected via spiral spring to spring adjuster assembly.

l induction disc

Spiral shaped to compensate for spring wind-up throughout moving contact travel. Provides accurate pickup at any disc position.

m damping magnet

A high strength alnico magnet is used for damping the induction disc.

inverted view of damping magnet

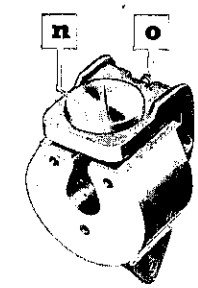


fig. 4

n keeper screw

For micrometer adjustment of the damping magnet air gap flux, without need for shifting magnet location.

o set screw

Locks damping magnet keeper screw securely in position.

3 Indicating Contactor Switch (ICS unit)

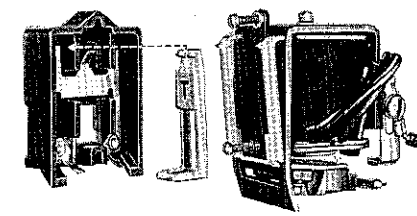


fig. 5

The d-c Indicating Contactor Switch unit is a small clapper type device having a magnetic armature to which leaf-spring mounted contacts are attached. The armature is attracted to the core when the coil is energized at or above pick-up value, causing the moving contacts to bridge two stationary contacts, completing the trip circuit. The ICS contacts are connected in parallel with the main relay contacts, and relieve them of carrying heavy trip currents. The main relay contacts will close 30 amperes at 250 volts d-c, and the ICS contacts will safely carry this current long enough to trip a circuit breaker.

When the ICS is energized, two fingers on the armature yoke deflect a leaf-spring located on the front of the switch, allowing the operation indicator target to drop. The target is reset external to the case by a push rod located at the bottom of the relay case cover.

Taps on the front of the relay provide connection for either 0.2 (left) or 2.0 (right) ampere d-c minimum pick-up setting.

When protective relay energizes a WL relay rated 125 or 250 volts d-c, the 0.2 ampere tap is recommended. The 2.0 ampere tap is used on 24 or 48 volt d-c circuits.

characteristics

contact closing time

Contact closing time is approximately proportional to time-dial settings, and inversely proportional to the applied timer voltage.

burden data (60 cycles)

unit	coil	burden at:	volt-amperes	power factor↓
directional	voltage	rated voltage	3.5	60°
	current	5 amps	5.5	47°
timer	voltage	rated voltage	6.5	73°

↓ current lags voltage

directional unit sensitivity

rating: volts	minimum pickup values◆		phase angle relationship
	volts	amperes	
120 or	rated	.020	I leading V by 30°ɤ
208	rated	.023	I in phase with V

◆ Energization quantities are input quantities at the relay terminals
ɤ Maximum torque angle.

ICS unit

unit	tap in amps	ohms: d-c	ampere rating	
			continuous	1-second
d-c Indicating	0.2	6.4	0.4	11.5
Contactor Switch	2.0	0.15	3.2	88.0

settings

Internal connection of the CRN-1 relay is per figure 7, and the only setting required is the time-delay setting of the timer or induction-disc unit.

For correct operation, the CRN-1 relay should be connected so that maximum torque occurs with unity power factor on the power system.

Since the directional unit has a 30° maximum torque characteristic, external connections should be made as shown in figure 8.

operating time values

Figure 6 illustrates operating time values for various values of applied voltage at selected time-dial settings.

time curves

CRN-1 120 volt relay

(proportional values apply for 208 volt type)

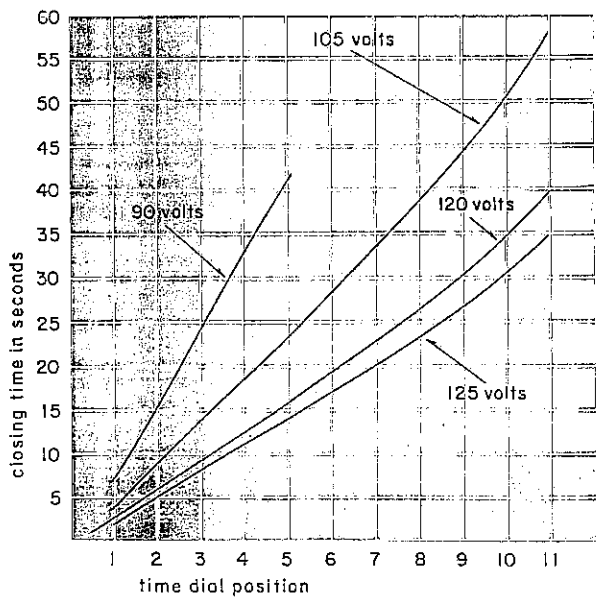


fig. 6

wiring diagrams

internal (spst-cc • FT-21 case)

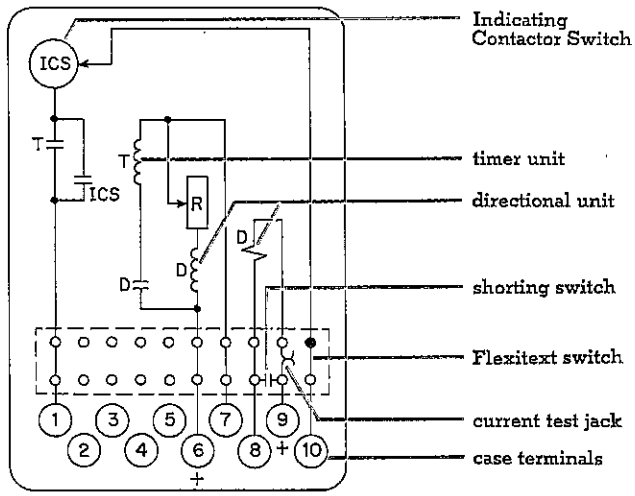
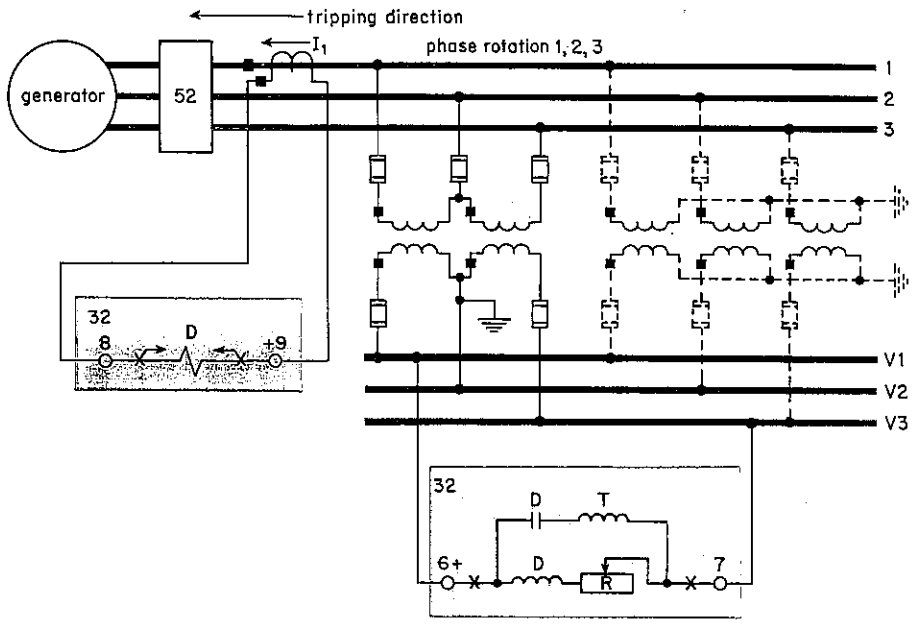
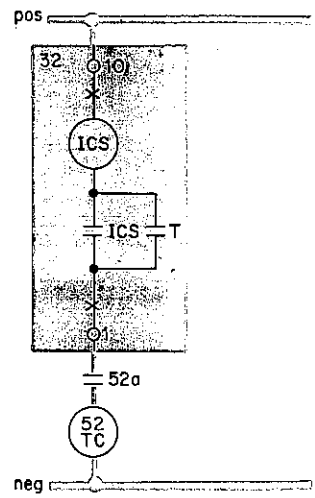
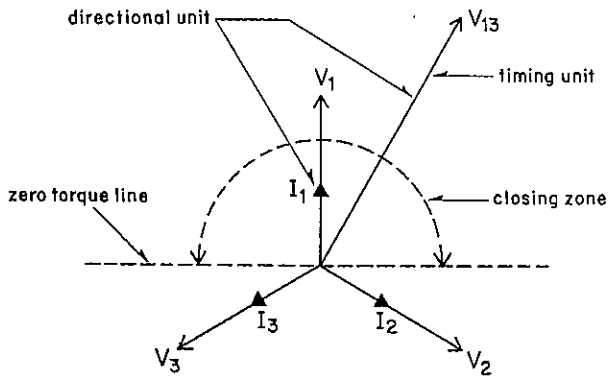


fig. 7

external







device chart number

32—reverse power relay, type CRN-1
32D—CRN-1 relay directional unit
32T—CRN-1 timer unit
52—power circuit breaker
ICS—Indicating Contactor Switch
TC—breaker trip coil
a—breaker auxiliary contact

fig. 8

ordering information order by style number

60 cycle↓ • for three phase application

type	time curve	appli-cation	contacts	Indicating Contactor Switch	volts line to line	Flexitest universal case		
						relay style no.	case size	wired per fig.
CRN-1	inverse	three phase	spst—cc +	0.2/2.0 amp-dc	120 208	290B038A09 290B038A11	FT-21	7

↓ 50 cycle relays can be supplied. Order "similar to style number ....., except for 50 cycles".

+ single pole single throw—circuit closing

dimensions in inches

for reference only; do not use for construction purposes

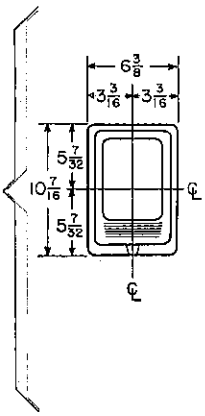
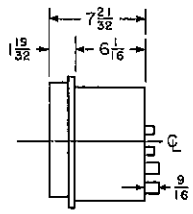
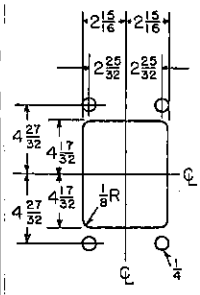
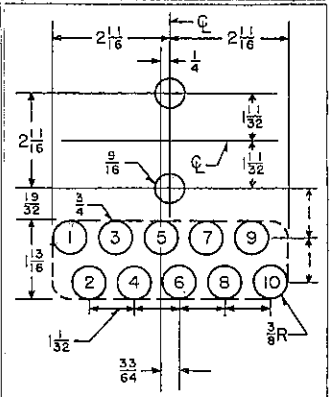
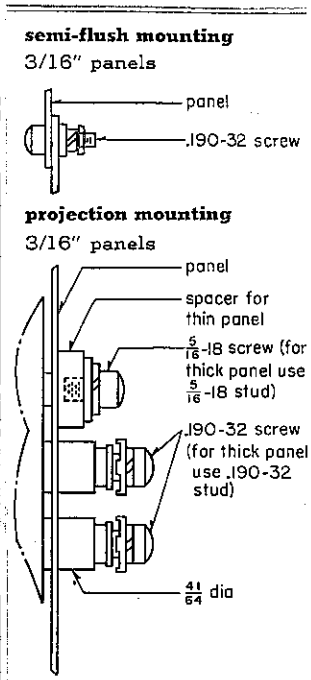
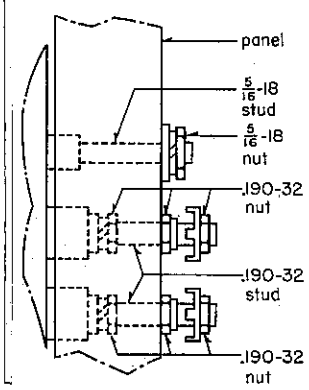
case type	case dimensions (inches) front view	case dimensions (inches) side view	panel cutout dimensions (inches) front view semi-flush	panel cutout dimensions (inches) front view projection	terminal and mounting hardware
FT-21					 

fig. 9

shipping weights and carton dimensions

relay type	Flexitest case type	weight: lbs		domestic shipping carton dimensions: inches
		net	shipping	
CRN-1	FT-21	12	16	9 x 12 x 13

further information:

prices	price list 41-020
instructions	instruction leaflet 41-251.2
Flexitest case	descriptive bulletin 41-075
other protective relays	index 41-000
inquiries	nearest Westinghouse sales office

Westinghouse Electric Corporation
relay dept: meter division • Newark plant • Newark, N. J.
printed in U.S.A.