



frequency relays

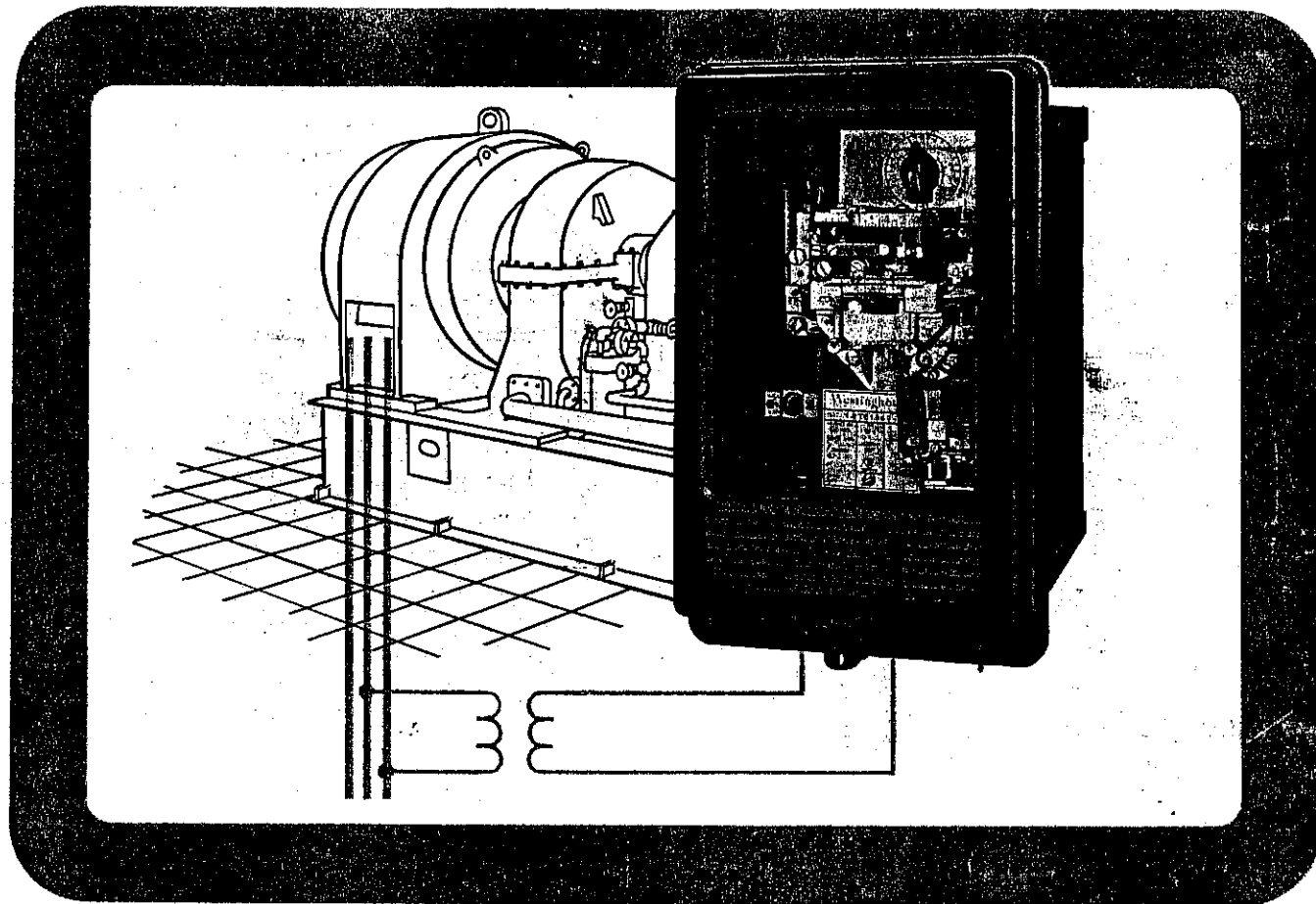
type OF-1

for under- and over-frequency protection
of synchronous machines

descriptive
bulletin

41-500

page 1



application

for the protection or control of equipment
on systems where frequency may vary

- protection of local generators in industrial plants from severe overload when the power company system tie is disconnected
- for sounding alarm upon critical change in frequency
- load-shedding: Selective dropping of load when it becomes necessary to automatically disconnect definite blocks of load or sectionalize the transmission system after frequency drops below a predetermined value. Several relays can be used with different underfrequency settings, on different time settings, to shed blocks of load progressively, with continued frequency drop.

May, 1957

supersedes descriptive bulletin 41-292, dated March, 1950
mailed to: E/324/DB; D65-8A; C29-5B



construction and operation

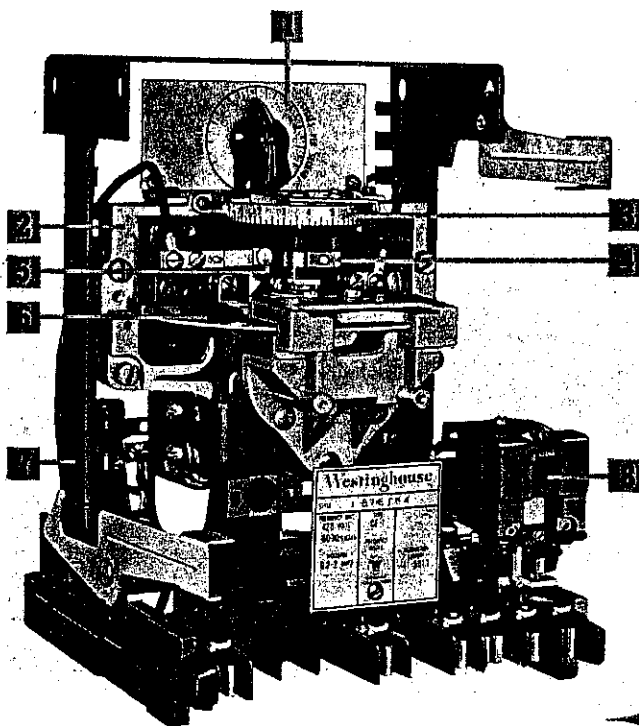


fig. 1

external impedance box

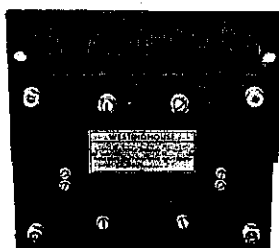


fig. 2

construction

1 frequency setting rheostat (adjustable)

60-50 or 50-42 cycles for under-frequency relays.
60-70 cycles for over-frequency relay.

CF-1 relays can readily be set within $\frac{1}{2}$ cycle intervals which are marked on the calibrated scale of the rheostat.

2 mounting frame

Solid aluminum die-cast frame assures accurate and permanent alignment of all components.

3 time setting dial

Inverse time delay. Continuously adjustable from number 1 to number 10 lever position (see curves pages 4 to 6).

4 moving contact

Made of silver and clamped to the insulated section of the disc shaft. Electrical connection is made through the spiral control spring from the moving contact to the spring adjuster frame, then to the relay terminal.

5 stationary contact

Also of silver, with sufficient spring wipe to assure positive contact. Vernier set screw controls contact follow.

internal wiring • front view

standard relay

over or under frequency
with variable time delay: spst contacts

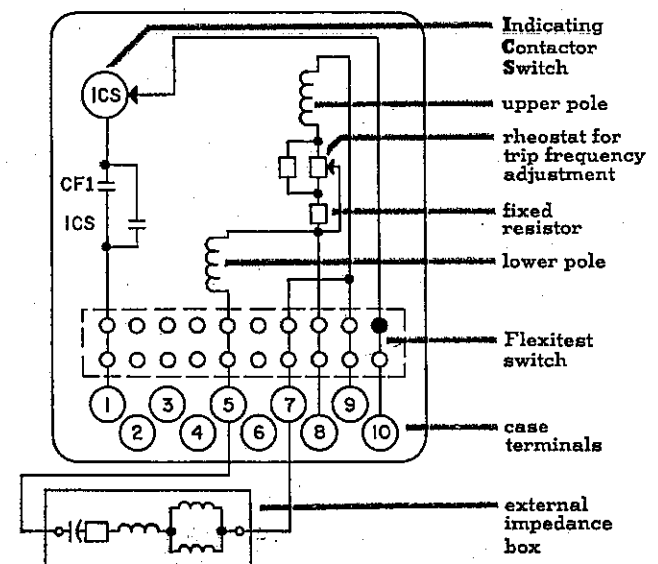


fig. 4

induction disc element

Has potential windings on upper and lower poles. Lower pole has capacitor in series with winding, upper pole does not. See "operation."

chassis

Single-bar chassis construction permits maximum accessibility to relay operating unit for maintenance and setting.

Indicating Contactor Switch (ICS)

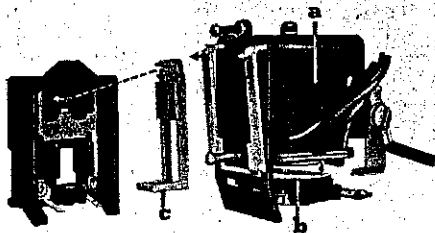


fig. 3

ICS coil (a): Two taps on front of relay below ICS unit permit connection for either 0.2 (left) or 2.0 (right) amp d-c minimum pickup.

armature (b): When coil is energized above pickup setting, contacts close to relieve main relay contact from carrying heavy trip current. During operation, two fingers on the armature deflect a spring located on front of switch allowing the operation indicator target (c) to drop. Drop-out is 65% of pickup setting. See page 7, "trip circuit data."

operation

under-frequency relay: So designed that at normal frequency (60 cycles) the upper pole current leads the lower pole current and the two out-of-phase fluxes thus produced act to produce contact opening torque on the disc.

When the frequency drops, the phase angle of the lower pole circuit becomes more leading, until at the frequency setting of the relay the lower pole current begins to lead the upper pole current and the relay torque is reversed to the tripping direction.

The lower the frequency, the greater the phase angle displacement and hence the faster the relay trips.

An adjustable resistor in the upper pole circuit is provided to set the tripping frequency.

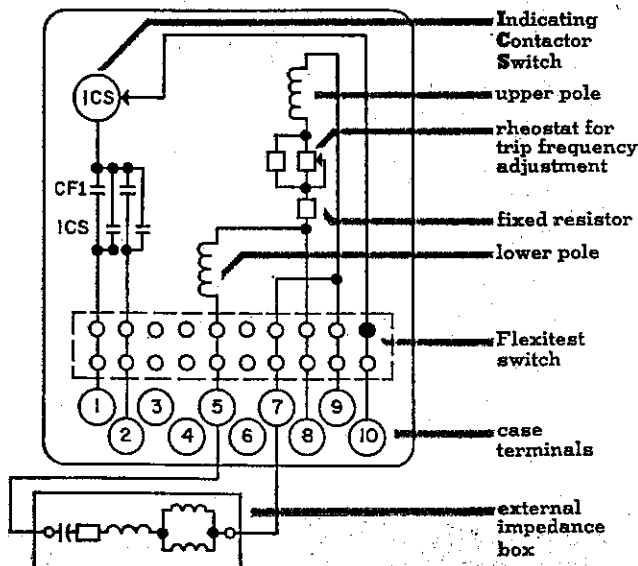
The frequency at which the relay contacts close and open is essentially constant. For example, suppose the 60-cycle under-frequency relay is set to close its contacts at 59 cycles. The CF-1 moving contact will start to move away from the back stop, or back contact at 59.1 to 59.2 cycles but will not close until the frequency drops to 59 cycles or below. Also, when the frequency rises above the 59 cycle setting, the front contact opens but the moving contact will not reach the back stop (or close the back contact circuit) until the frequency rises to 59.1 or 59.2 cycles. The above frequency difference of 0.1 to 0.2 cycles is based on a #10 or maximum time setting. If a lower time delay setting is used, the frequency difference required between opening of the back contact and closing of the front contact is less and decreases as the magnitude of the time delay decreases.

over-frequency relay: Operates similarly, i.e., upon increase of frequency to within 0.1 or 0.2 cycles of the relay setting, the moving contact moves toward the front closing contact but will not close until the frequency setting is reached.

The disc rotation of under-frequency and over-frequency relays is in the same direction. Where operation on both under-frequency and over-frequency is desired, two relays are required, one for each.

special relays

over or under frequency
with variable time delay: dpst contacts



over or under frequency
with variable time delay: spdt contacts

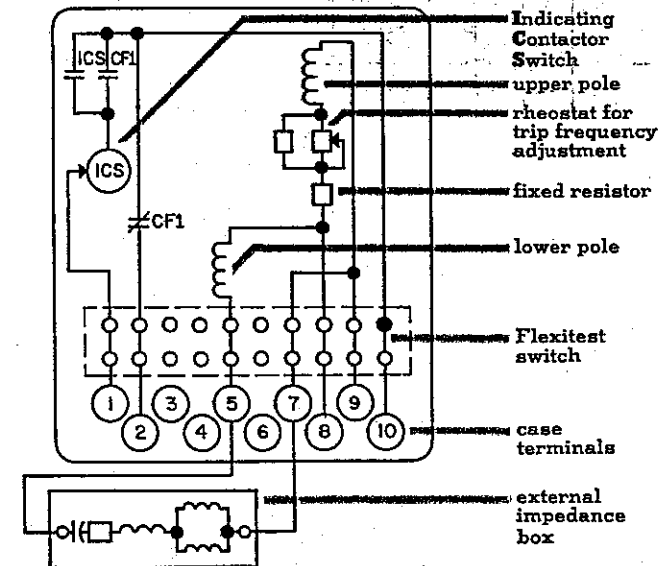


fig. 6



time curves of typical settings

under frequency relays

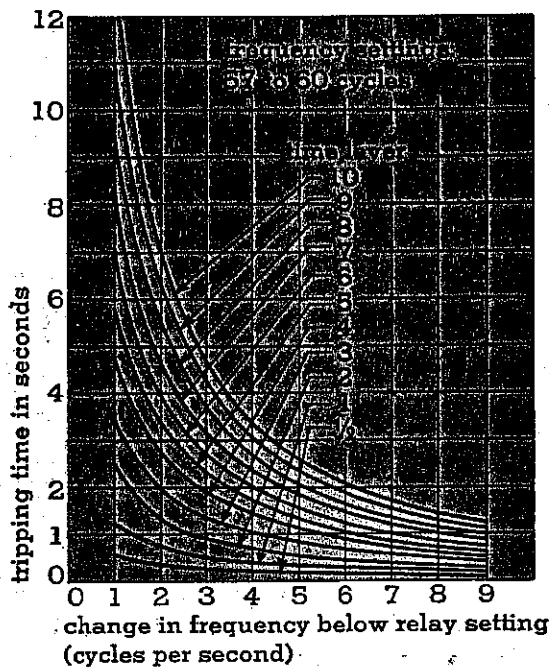


fig. 7

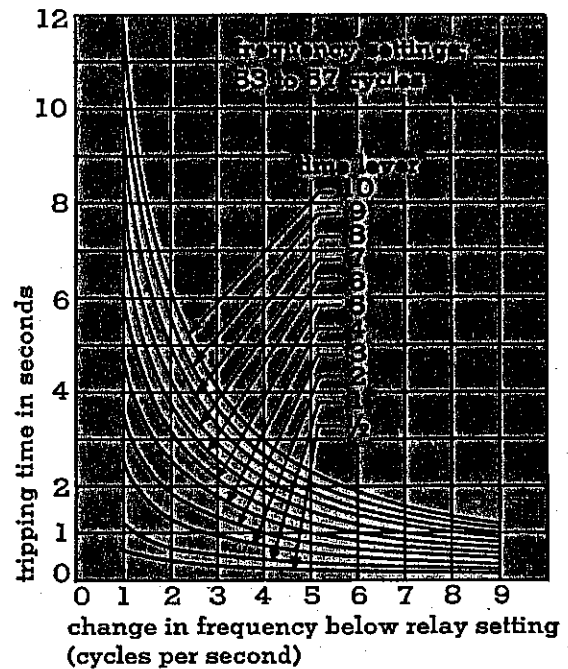


fig. 8

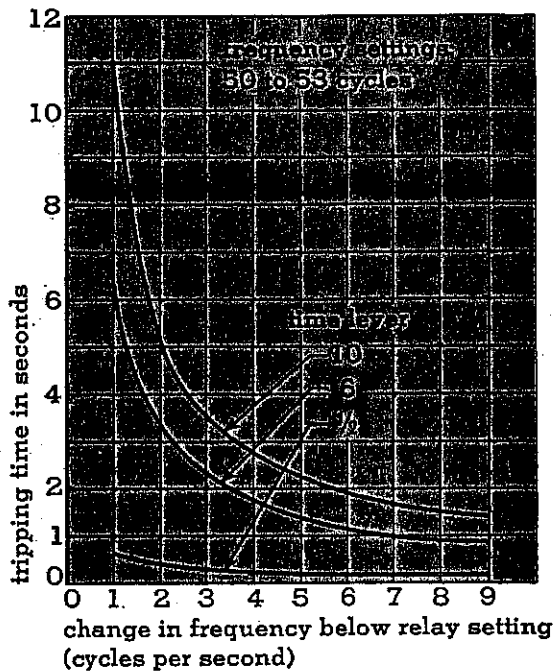


fig. 9

Curves on page 6 show the insensitivity of CF-1 relays to wide voltage variations from standard voltage ratings.

This feature permits close coordination between steps in dropping blocks of load during "load shedding."

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over frequency relays

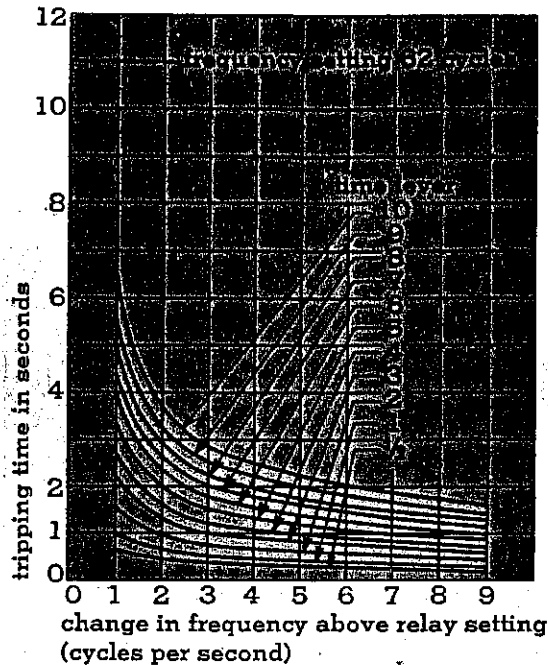


fig. 10

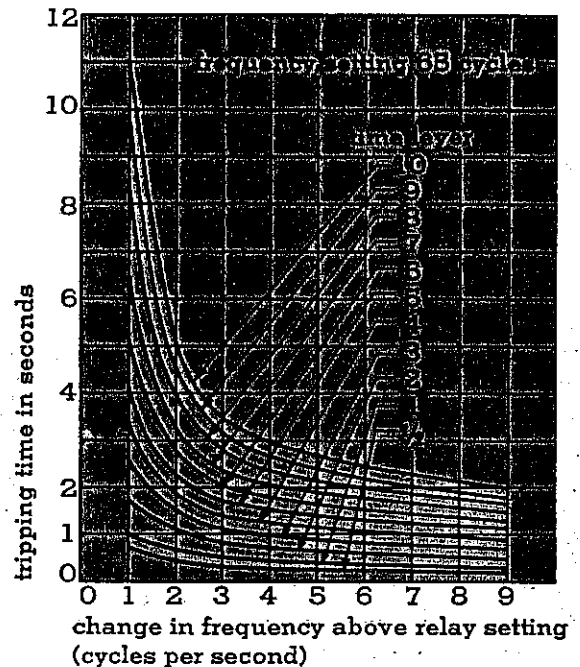


fig. 11

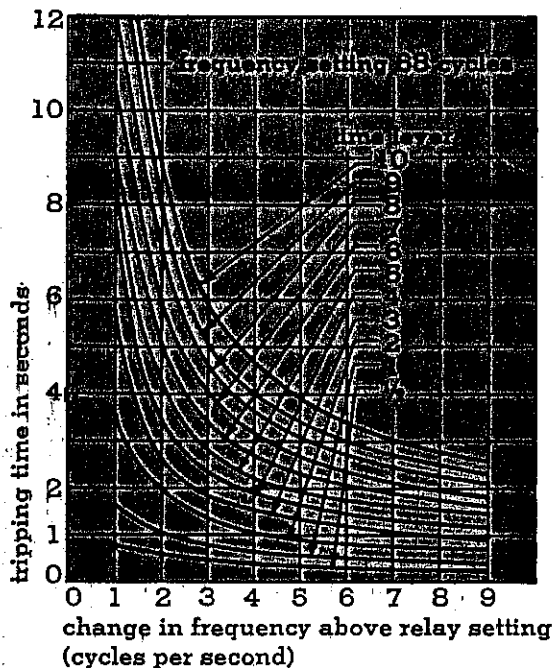


fig. 12

Factory adjustment of the CF-1 main contact provides contact follow on the stationary contact.

Where quick opening contact operation is desired, this contact follow can be eliminated by tightening the small set screw on the stationary contact assembly until the contact rivet rests solidly against the insulated backstop.

Contact opening time with no follow is 3 to 6 cycles on a 60 cycle base.



Voltage and Temperature Curves

under frequency relays

trip frequency vs voltage variation
(nominal rating, 120 volts)

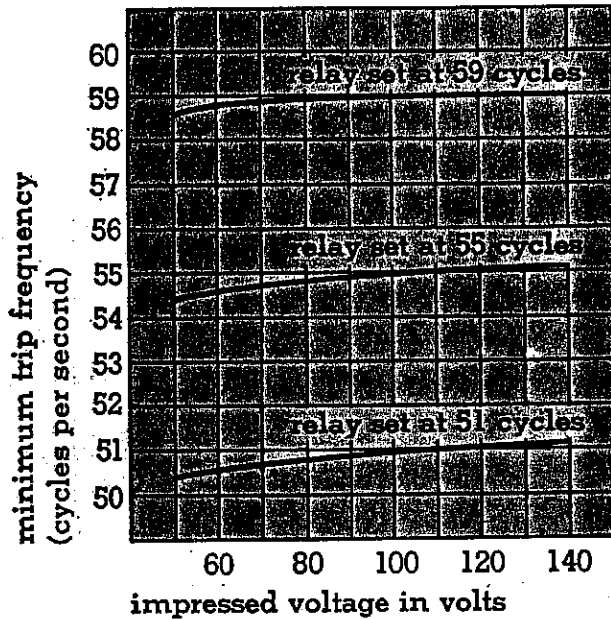


fig. 13

trip frequency vs temperature
(nominal rating, 25°C)

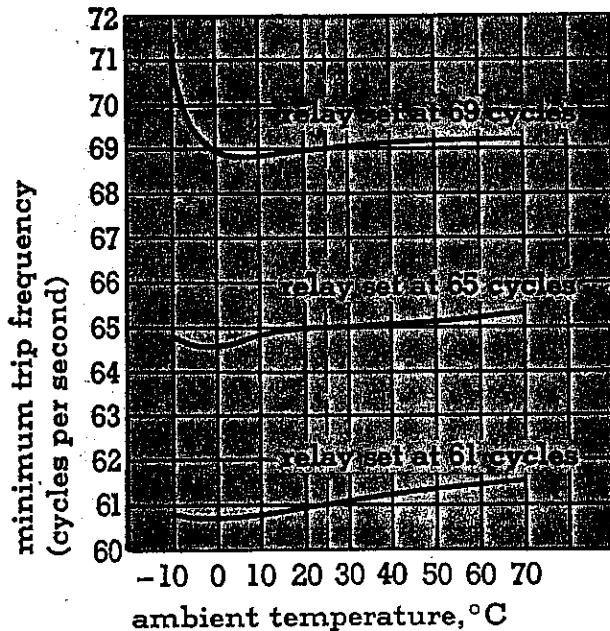


fig. 14

over frequency relays

trip frequency vs voltage variation
(nominal rating, 120 volts)

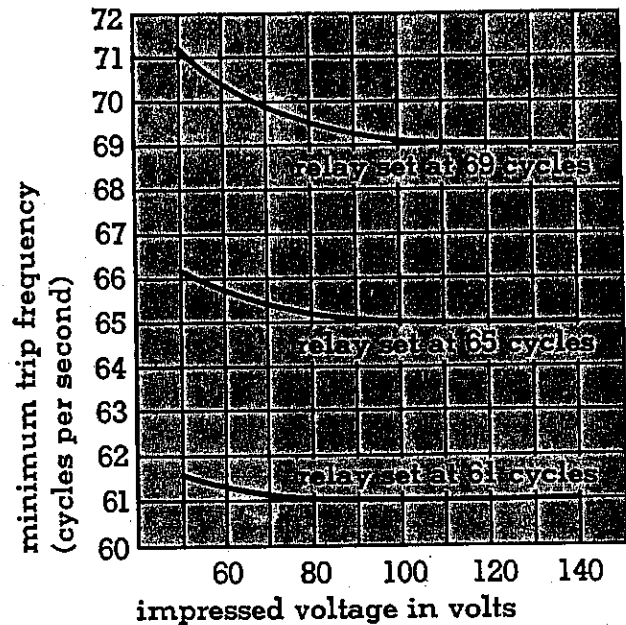


fig. 15

trip frequency vs temperature
(nominal rating, 25°C)

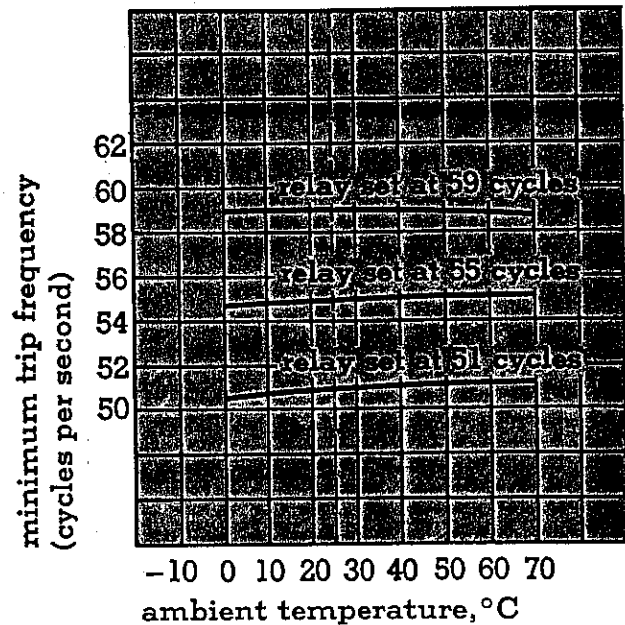


fig. 16

frequency relays

type CF-1

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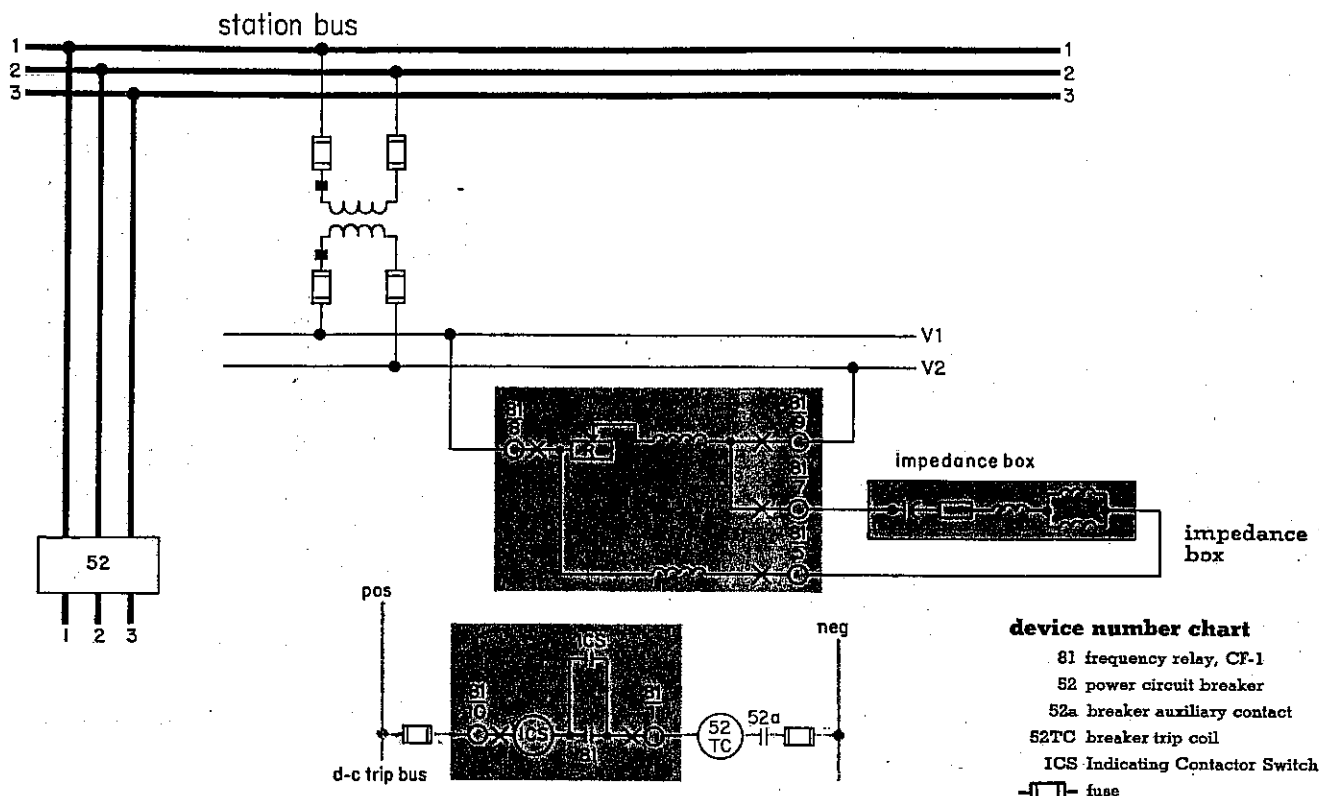
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external wiring

CF-1 relay for under or over frequency protection



device number chart

- 81 frequency relay, CF-1
- 52 power circuit breaker
- 52a breaker auxiliary contact
- 52TC breaker trip coil
- ICS Indicating Contactor Switch
- fuse

ordering information

order by style number

type	contacts	Indicating Contactor Switch "ICS unit"	volts, a-c	range, cycles	Flexitest universal case		wired as per:
					relay style no. ■	case size +	
CF-1	spst-cc	0.2/2.0	120	under-frequency, 50-42	1878 782	FT-21	fig. 4
				under-frequency, 60-50	1876 165		
				over-frequency, 60-70	1876 164		

Above styles for standard CF-1 relays only. Special relays (see fig. 5 and 6, page 3) available. Negotiate with Westinghouse.

■ Style number includes external impedance box.

+ For mounting on panels thicker than 3/16" enter two items on order for:

- (1) Standard style relay;
- (2) Hardware necessary to mount on inch thick panel.

burden data at 120 volts, 60 cycles

setting	volt amperes	watts	lagging, vars
51 cycles	13.4	11.2	7.4
55 cycles	15.7	12.5	9.7
59 cycles	17.2	12.8	11.4
61 cycles	20.0	17.9	9.1
65 cycles	21.7	18.6	11.2
69 cycles	23.0	19.0	12.9

continuous rating of relay coil: 132 volts, 50-60 cycles

trip circuit data

ICS tap: amps	rating in amps, d-c		resistance in ohms	drop-out 65% of pick-up
	continuous	one second		
0.2	0.4	11.5	6.5	65% of pick-up
2.0	3.2	88.0	0.15	

contact ratings

d-c voltage control	amperes main contacts will:		
	open	close	carry for one second
125	0.2	30.0	2.25
250	0.1	30.0	2.25

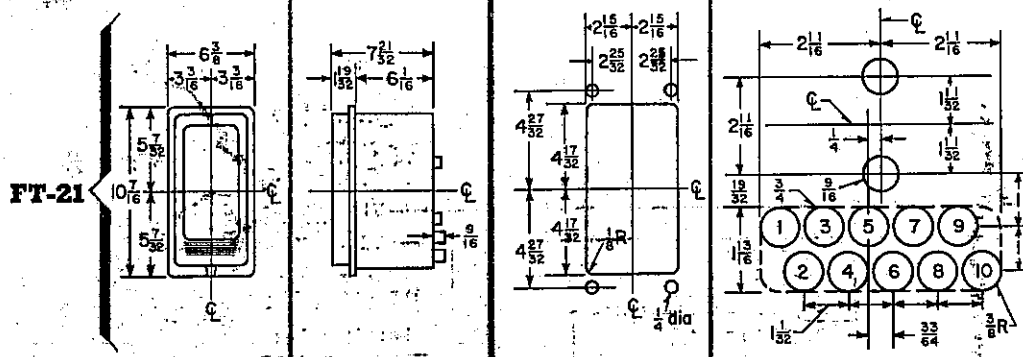


frequency relays
type CF-1

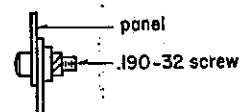
for reference only

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

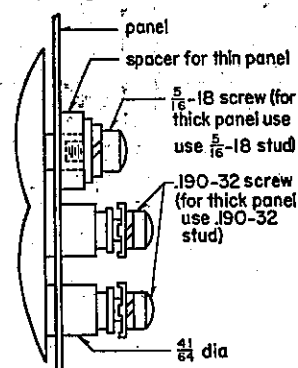
Flexitest universal cases



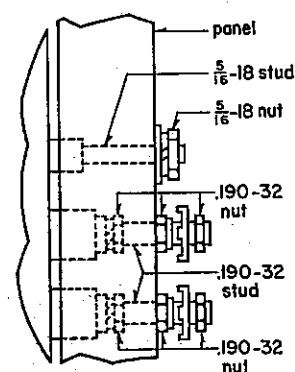
semi-flush mounting
3/16" panels



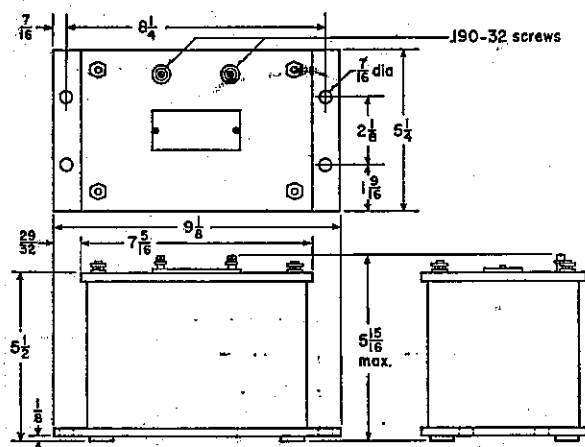
projection mounting
3/16" panels



3/16" to 2-1/2" panels



external impedance box



weights and domestic shipping carton dimensions

	weight, lbs		domestic shipping carton dimensions, inches
	net	shipping	
relay	12	24	12 x 12½ x 20½
external reactor	5		

further information:

prices	price list 41-020
Flexitest case	descriptive bulletin 41-075
instructions	instruction leaflet 41-501.1
renewal parts	renewal parts data 41-292
inquiries	nearest Westinghouse sales office