Westinghouse Electric Corporation
Relay and Telecommunications Division
Coral Springs, FL 33065

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With Solid State Timing

High-Speed Underfrequency Relay
Type KF

Application

The KF relay provides high-speed sensing of underfrequency conditions during system disturbances.

Usual applications of the relay involve selective dropping of the system load based on the frequency decrement.

It is particularly applicable for relatively isolated areas where a severe overload (i.e., greater than 50%) could occur due to a tie-line trip.

The relay can be applied to control voltage regulator tap changing mechanisms during low frequency operation.

Speed of operation of the relay is inversely proportional to the decrease of system frequency.

A minimum delay of 6 cycles is required since a sudden shift in the voltage phase angle during a fault will appear as a rapid change in frequency to underfrequency relays.

Features

Solid state timing is available to provide a wider range of time delay adjustment (6-30 cycles on a 60 hertz base). A 100 ms time delay on trip prevents undesirable conditions or voltage dips.

Individual settings for frequency, time delay, and Indicating Contactor Switch pickup make the relay suitable over a variety of applications.

Operable over a temperature range of −20°C to +60°C.

Operable over a voltage range of 70 to 110% of rated voltage.

Will not false trip on energization or de-energization.

A high-speed cylinder unit in conjunction with a time-delay-on-pickup telephone-type relay provides secure system frequency detection.

Device Number: 81

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Construction

1 Induction Cylinder Unit

Has positive contact opening torque at normal frequency.

2 Indicating Contactor Switch (ICS)

Taps provided for 0.2 or 2.0 amps dc pickup operation. For breaker trip circuits or for operation of a type WL lockout relay, the 2.0 amp tap is used. When the current is low, as when using an SG or MG-6 multi-contact auxiliary relay, the 0.2 amp tap is recommended.

The ICS has 6.5 ohms resistance on the 0.2 amp tap, and 0.15 ohms on the 2.0 amp tap.

3 Frequency Adjusting Reactor

Has adjustments for setting the relay to trip at the desired frequency. The minimum trip frequency can be varied over the operating range of 55-59.5 hertz. The standard 60 hertz KF relay is shipped adjusted for contact closing at 59.5 hertz, unless otherwise specified.

A locking feature is provided to prevent an accidental change in the setting.

4 Solid State Timing Circuit

5 Timer Adjustment

Also provided with a locking feature for prevention of accidental setting change.

6 Telephone Relay (T)

Provides 6 cycle delay **only** on non-adjustable KF. 6-30 cycle adjustable delay is accomplished with a rheostat connected to static timing circuit. See no. 5 above.

Contacts work against gravity.

The telephone relay and the cylinder unit have mechanical spring restraint. This combined with the solid state timing circuit make the relay virtually immune to accidental panel shock.

Figure 1 Upper View

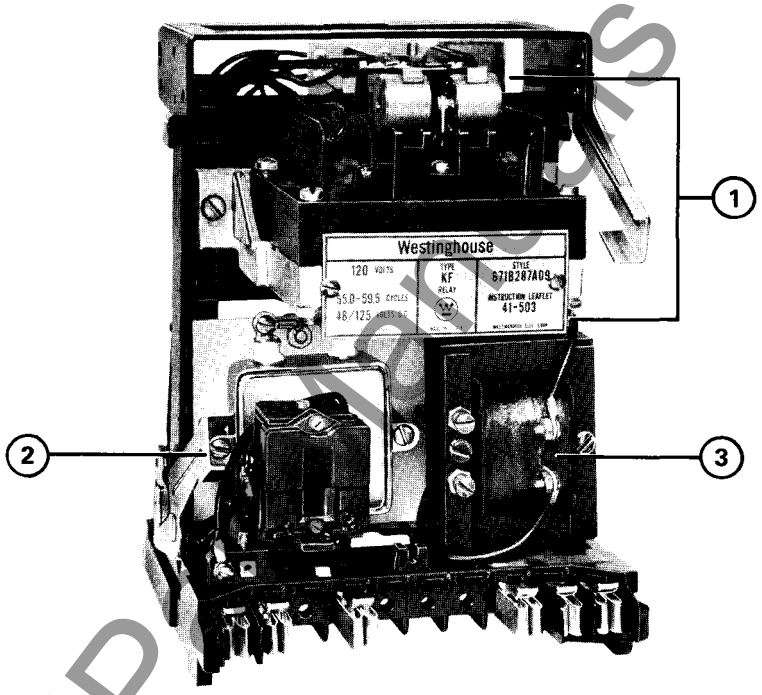
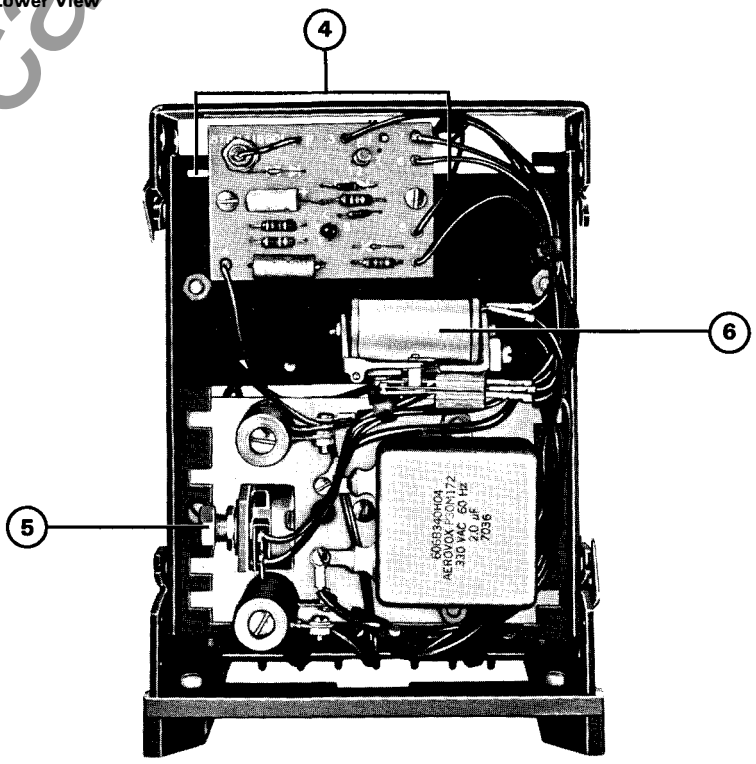


Figure 2 Lower View



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Operation

When the applied source frequency drops below the setting of the relay, the cylinder unit will close, energizing the solid-state timing circuit. At this point, the telephone relay is picked up and sets up tripping. The Indicating Contactor Switch (ICS) is also picked up, and will provide trip indications.

The timer will reset when the cylinder unit resets; de-energizing the telephone relay.

The time-delay unit's operation can be selected from one of three types available:

1. Ac operation, non-adjustable (6 cycles)

2. Ac operation, adjustable (6-30 cycles)

3. Dc operation, adjustable (6-30 cycles)

Characteristics

Ratings
The KF relay is rated 120 volts at 60 hertz, or 120 volts at 50 hertz.

Adjustable range of frequency is 55-59.5 hertz for the 60 hertz relay, and 44-49.5 hertz for the 50 hertz relay.

Continuous rating – 110% of rated voltage.

Trip Circuit
The main contacts will close 30 amperes at 250 volts dc, and the seal-in contacts of the ICS will safely carry this long enough to trip a circuit breaker.

Trip Circuit Constants
Indicating Contactor Switch (ICS)
6.5 ohms resistance on the 0.2 amp tap.
0.15 ohms resistance on the 2.0 amp tap.

Burden
12.6 volt-amperes at 120 volts, 60 hertz.
13.4 volt-amperes at 120 volts, 50 hertz.

Timing Circuit Selection

A choice of ac or dc time delay is available. For example, where adjustable time delay is required, a KF relay with the auxiliary time delay relay energized from the tripping battery is available. The ac time delay type utilizes a full-wave bridge rectifier.

By using ac for timing circuit, the following advantage is obtained:

A single style relay is applicable for all tripping battery ratings.

A minimum delay of 6-cycles is required unless the trip circuit is supervised by another device which will be open during faults. Unbalanced faults can cause a sudden shift in the voltage phase angle, producing an apparent rapid change in frequency. The cylinder unit closes momentarily, but will not produce tripping when used with a 6-cycle telephone unit delay.

Where the relay and motor load can be readily isolated, such as a station tapped off a tie line, use a type KO-1 current detector relay, 0.5-2 amperes to supervise the KF trip circuit. Energize the KO-1 relay with one phase of the station supply current so it will reset when the station is de-energized, otherwise the motor inertia may maintain sufficient voltage to operate the KF relay and lock out the expendable feeders. KF relays with time delays as long as 30 cycles have operated for this cause. During actual under-frequency conditions, if the station load is too low to operate the KO-1 relay, no purpose is served in tripping any of its feeders.

While long delays are desirable for security, care must be exercised in load-saving applications to insure that load shedding has been completed before the frequency drops more than 3 cycles (i.e., 57 hertz on 60 hertz system). Otherwise, generation may be curtailed due to plant auxiliary motor trouble. Figure 3 shows the KF rate-of-change of frequency. With a 6-cycle delay relay set for 59.5 hertz, for example, breaker trip coil energization occurs at 0.6 cycle below "trip" frequency (59.5 – 0.6 = 58.9 hertz) for a decay rate of 2.5 Hertz per second. This rate corresponds to about 30% overload, assuming an inertia constant of H = 3.

After the first priority load has been shed the decay rate will diminish. Even so, unless the overload is quite small, a 30-cycle delay is excessive if three graded frequency priorities are to be accommodated without allowing the system frequency to dip below 57 hertz on a 60-hertz system.

Rate Of Change

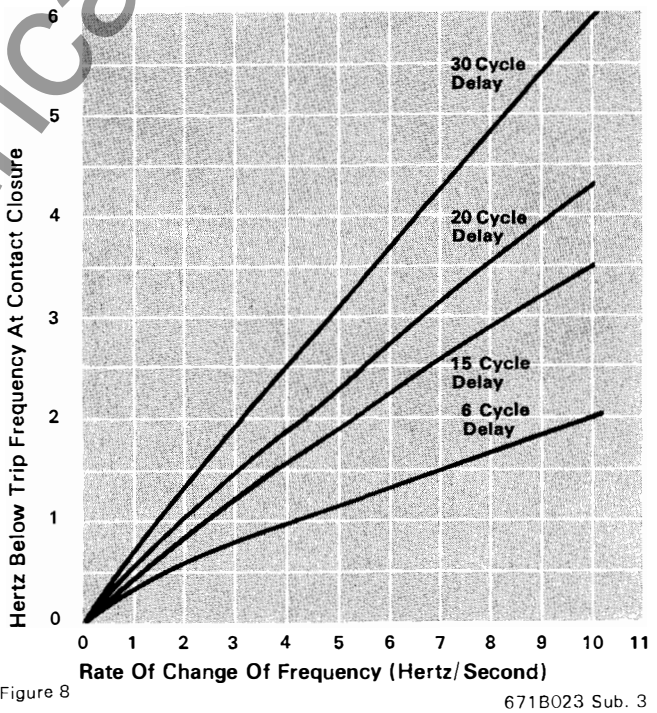

Figure 8

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Shipping Weights and Carton Dimensions

Type	Flexitest Case Size	Weight: Lbs.		Domestic Shipping Carton Dimensions: Inches
		Net	Shipping	
KF	FT-21	12	16	9 x 12 x 13

Further Information
Prices, Style Numbers, Ordering Information: PL 41-020
Instructions: IL 41-503
FT-21 Case Dimensions: DB 41-075
Other Protective Relays: Selector Guide 41-000

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