

September, 1990
Supersedes DB 41-503,
pages 1-4, dated July, 1988
Mailed to: E, D, C/41-500A

With Solid State Timing
Device Number: 81

Type KF High-Speed Underfrequency Relay



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 $+60^{\circ}\text{C}$.

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.

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

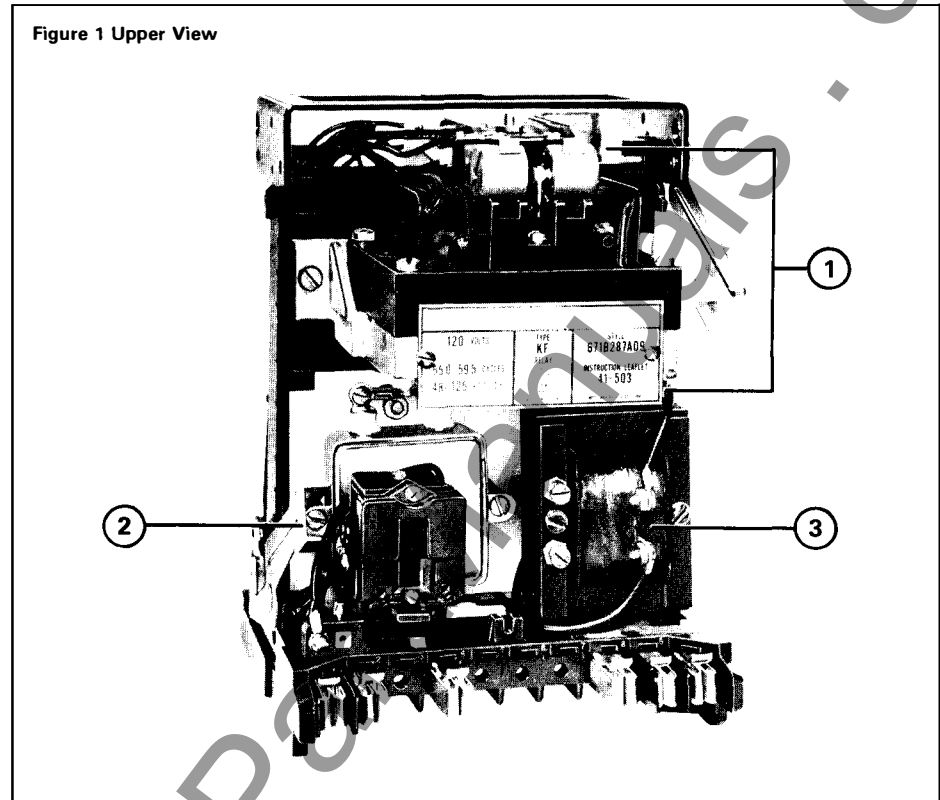
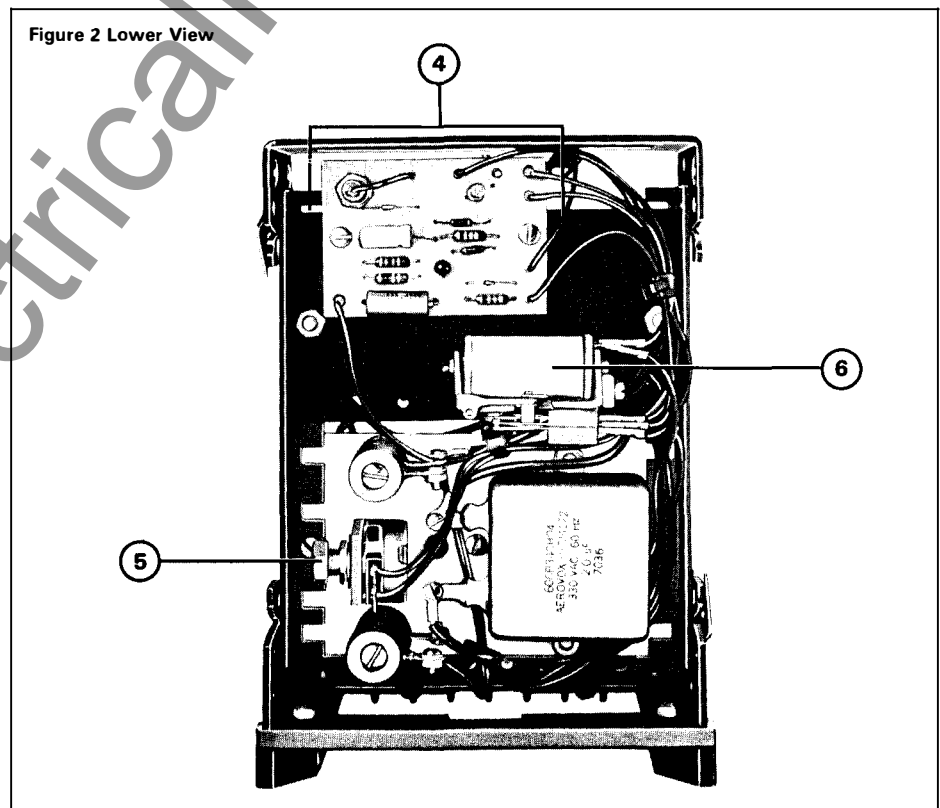


Figure 2 Lower View



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 trip-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

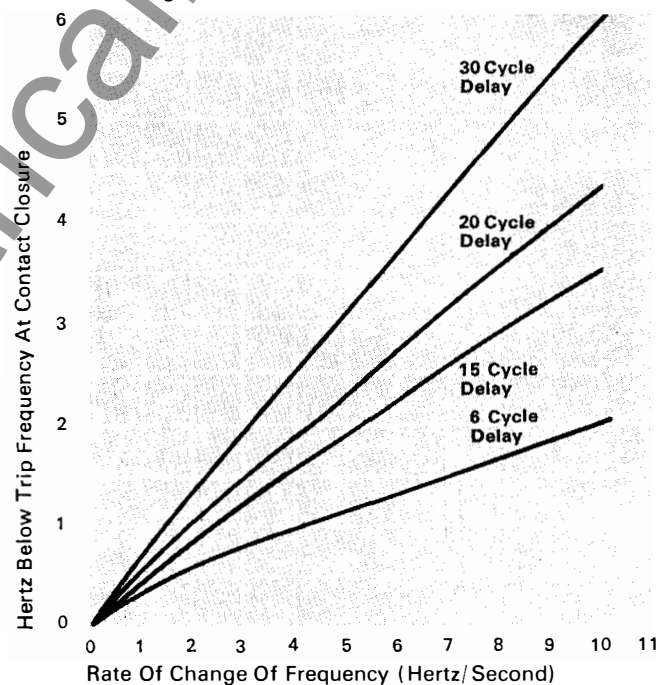


Figure 3

671B023 Sub 3



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

List Prices: PL 41-020

Technical Data: TD 41-025

Instructions: IL 41-503

Renewal Parts: RPD 41-959

Flexitest Case Dimensions: DB 41-076

Contactors Switches: DB 41-081

Other Protective Relays:

Application Selector Guide, TD 41-016

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December, 1990
Supersedes

With Solid State Timing

Type KF High Speed Underfrequency Relay

Frequency

Underfrequency, Instantaneous, 120 Volts, 60 Hertz (Device Number: 81)

Type	Contacts	Adjustable		Indicating Contactor Switch ^③	Timing Circuit Voltage Rating ^②	Relay Data		
		Range Hertz	Time Delay Cycles			Internal Schematic	Style Number	Case Size
KF ^①	Spdt-cc and co	55.0-59.5	6-30 (adj.)	0.2/2.0 amp dc	48/125 volts dc	849A318	671B287A09 ^④	FT-21
					120 volts ac adj.	862A525	671B287A15	
					125/250 volts dc	862A596	671B287A16	
			6 (non. adj.)		120 volts ac	861A659	671B287A13	

④ 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 50 hertz relays are available with dc timing circuits only.

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.