TYPE TK UNIVERSAL TIMING RELAY AND D-C. TO A-C. INVERTER

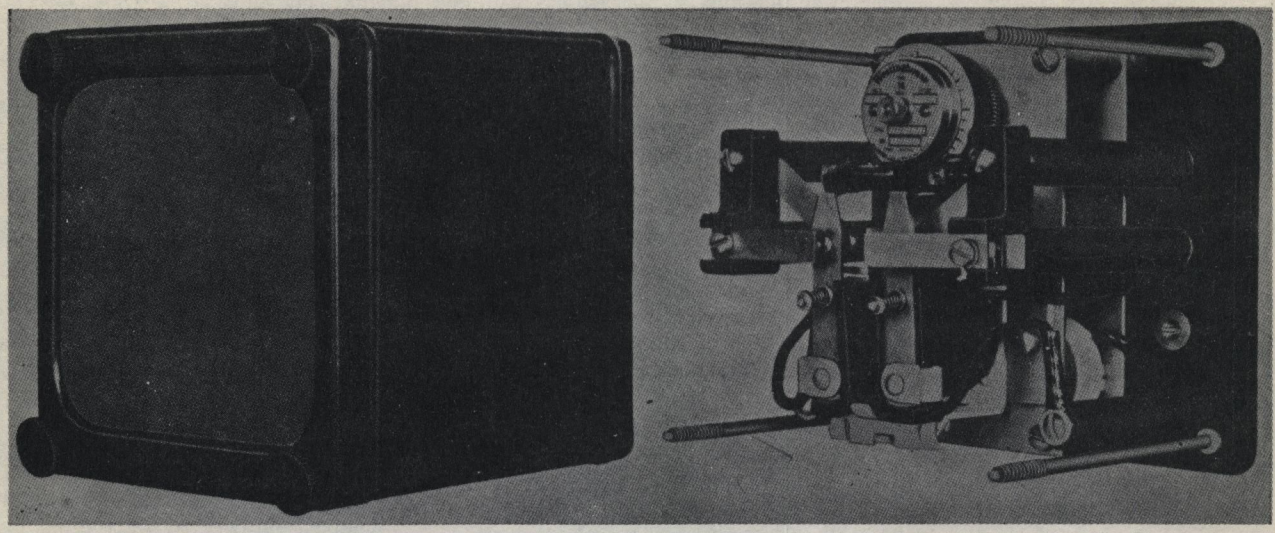


FIG. 1—TYPE TK RELAY WITH COVER REMOVED

Application

The TK relay can be used on a-c. circuits which require a definite time delay between the closing of an a-c. circuit and the closing or opening of other circuits (either a-c. or d-c.) through the relay contacts. Accurate time settings from a few seconds to fifty minutes can be obtained in a single relay. The relay will reset practically instantaneously even with the longest time setting. Two sets of main contacts, one single pole double throw and the other single pole single throw are provided, and these contacts can be adjusted to operate either simultaneously or sequentially.

An unusually wide variation of applications can be handled with the TK relay. The wide time range, quick reset and number of contacts provided will allow a single relay to be applied without modification. Some typical applications are found in automatic control circuits for generators and motors, in connection with the operation of large rectifiers and other thermionic tubes, as a part of the control for voltage regulators, tap-changing transformers, and various forms of industrial control.

Distinctive Features

1. Synchronous motor that will stay "in step" over a very wide fluctuation of voltage. (20% plus or minus motor rating).
2. Quick reset (less than 1 second at the maximum time setting).
3. Large silver contacts capable of carrying 12 amperes continuously. They will open 20 amperes 115 volts a-c. or 15 amperes at 230 volts a-c. non inductive or a circuit carrying 3 amperes at 125 volts d-c.
4. The motor is energized only during the timing interval and since the bearing has sealed-in lubrication, no attention is required and wear is negligible.
5. A new design relay consisting of standard well-known design parts.
6. Time settings from approximately 2 seconds to 50 minutes.

Construction and Operation

The TK relay consists essentially of (1) a synchronous motor (2) a gear train which provides three different ratios (3) a clutch to permit quick resetting when the relay is de-energized (4) tripping mechanism adjustable for time delay and (5) a contactor which carries the main contacts and operates the clutch.

The motor and gear train are mounted between two plates supported by four posts which are in turn fastened to the relay base.

(1) The motor is the same standard design used in some of our other products (relays, meters, etc). It runs at a speed of 600 rpm. and its coil has a low temperature rise. Sleeve bearings, in which a permanent supply of lubrication is placed, are used. The motor pinion is permanently in mesh with the gear train.

(2) The gear train is mounted between the upper portion of the two plates which act as supports for the motor and gear train. The plates are drilled and reamed for the polished gear shafts. These shafts run at low speeds and require no lubrication. The location of a sliding gear assembly on its shaft can be varied to allow it to mesh with different gears or pinions to obtain any one of three speeds. This sliding gear assembly consists of two gears and hub which are free to slide on a shaft but can be locked in any desired position by a set screw. To assist in determining which speed is to be obtained, arrows are placed on the index plate. The sliding gear assembly can be moved to the position where its larger gear is opposite the index plate arrow corresponding to the desired time scale.

The 30 second scale is graduated in sub-divisions to 1 second, and the smallest sub-division on the 5 minute and 50 minute scales is .1 and 1 minute respectively.

(3) The clutch consists of two aluminum discs with serrated faces (resembling crown gears) which are normally separated. The clutch is mounted on the same shaft as the sliding gear assembly. The rear aluminum disc is mounted on this shaft; the front disc has a loose fit on the shaft and has fastened to it the pinion that drives the tripping mechanism. When the relay is energized, the two discs are pressed together by a spring, the serrations on

TYPE TK UNIVERSAL TIMING RELAY—Continued

their faces mesh, and power is transmitted from the motor through the gear train to the tripping mechanism.

(4) The tripping mechanism is fastened to the front plate of the gear train assembly. The armature and clutch spring move in (that is toward the rear of the relay) when energized, but the two moving contacts that the armature carries are prevented from moving by the micarta latch arms. Therefore, the back contact on the left hand side (from the front of the relay) will remain closed until the arms are tripped and the moving fingers released. This same statement also applies to the side of the motor circuit which uses the back contact on the right-hand side of the relay. The tripping is accomplished by a pin on each of the tripping discs pushing down the latch arm levers.

Each of the tripping discs has an index mark on its edge. These marks are located so as to coincide with the zero on the scale plate when the trip pins have reached a point where they will just trip the micarta latch arms and release the contact fingers. Before setting for a predetermined tripping time the gear on the sliding gear assembly should be shifted to the ratio desired. The tripping discs can be rotated so the index is on the desired scale marking by loosening the thumb nut. If sequential operation of the contact fingers is required the left hand contact must trip first as the motor is in series with the back contacts on the right-hand side. When the latter contact is tripped the motor supply becomes open circuited. The minimum setting obtainable without partially raising the latch arm is approximately one small division on the 30 second scale. When the relay is de-energized the clutch is released at once and therefore the tripping mechanism does not have to operate through the gear train. The tripping discs will reset from the maximum travel position in less than one second.

(5) The contactor is of the clapper type. The spring arm, which presses against the front half of the clutch and pushes it into mesh, is fastened to the top of the armature. The sealing-in contact, when used, is operated by an insulating button attached to the same spring arm. The motor and contactor coil are connected together so that as soon as the clutch is operated the motor is also energized. The armature carries the two moving contacts. The moving and stationary contacts are made of chemically pure silver which will carry 12 amperes continuously and 20 amperes for 1 minute. The contacts will interrupt a non-inductive a-c. circuit carrying 20 amperes at 115 volts or 15 amperes at 230 volts. On 230 volts or higher voltages (60 cycles) the contactor coil has a tap brought out at the proper place to act as an auto-transformer to supply 115 volts to the motor.

The TK Relay can be provided with a sealing-in contact which closes when the relay is energized. By properly connecting this contact the relay can be energized and kept energized by momentary closure of an external contact or switch, such as a push button. The supply circuit must then be opened through some other contact or switch in order to de-energize the relay.

Burden at 125 Volts, 60 Cycles

Contactor Burden = 18 Volt-amperes
Motor Burden = 2.6 Volt-amperes

TK RELAY LIST PRICES

Volts	Frequency	Style No. of Relay Without Sealing Contact	List Price Discount Symbol FC	Style No. of Relay With Sealing Contact	List Price Discount Symbol FC
115	25	1 008 930	$40 00	1 008 933	$40 00
230	25	1 008 931	40 00	1 008 934	40 00
460	25	1 008 932	40 00	1 008 935	40 00
115	50	1 008 924	40 00	1 008 927	40 00
230	50	1 008 925	40 00	1 008 928	40 00
460	50	1 008 926	40 00	1 008 929	40 00
115	60	936 926	40 00	1 008 552	40 00
230	60	1 008 550	40 00	1 008 553	40 00
460	60	1 008 551	40 00	1 008 554	40 00

Order by Style Number

TYPE TK UNIVERSAL TIMING RELAY—Continued

WIRING DIAGRAMS

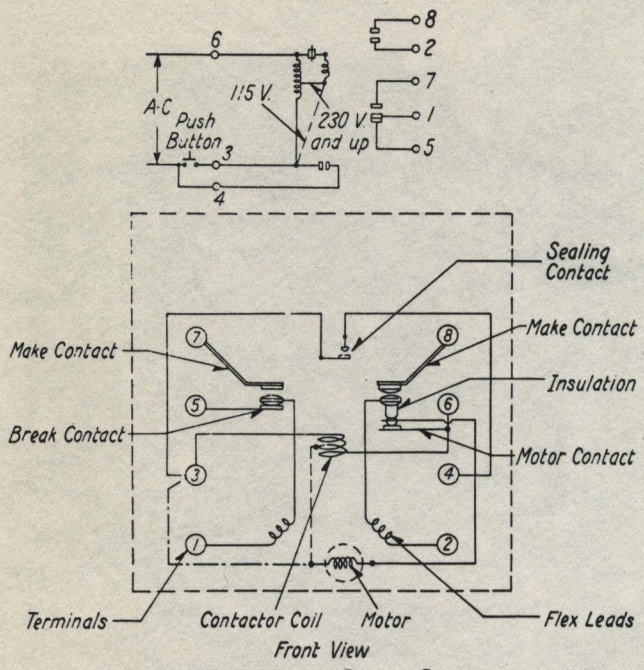


FIG. 2—TK RELAY WITH SEALING CONTACT

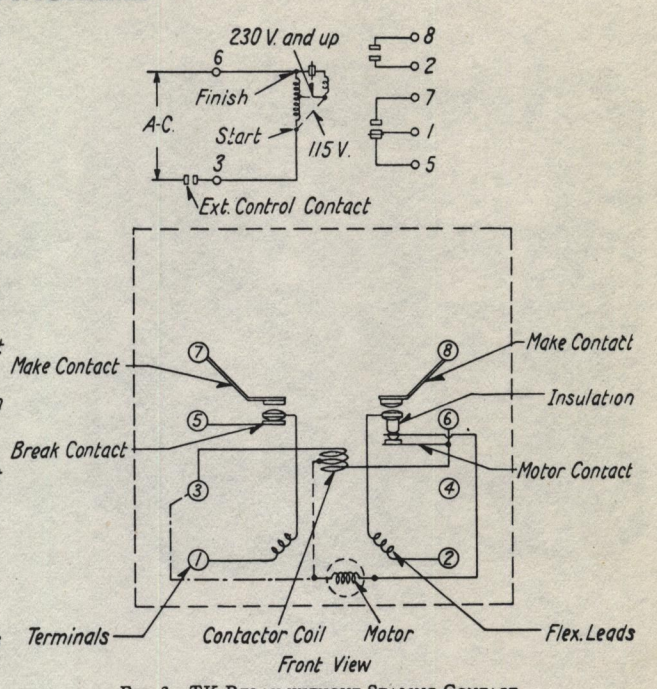
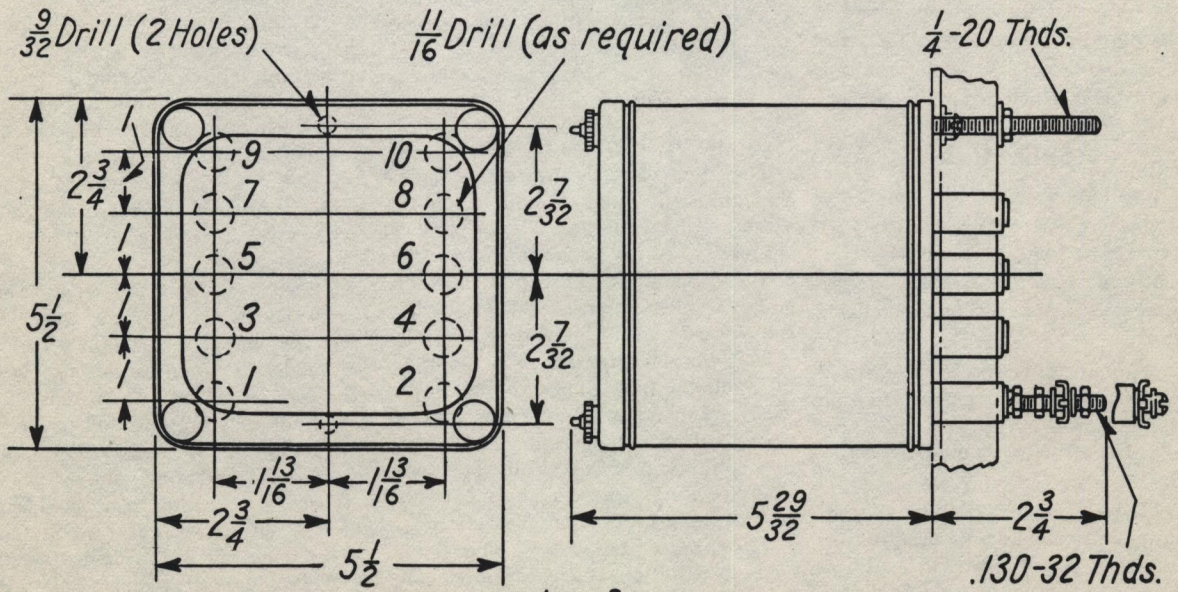


FIG. 3—TK RELAY WITHOUT SEALING CONTACT

OUTLINE DIMENSIONS IN INCHES

Dimensions are for reference only. For official dimensions refer to nearest Westinghouse Sales Office



No. of Terms.	Drill Holes
8 or less	1 to 8
9	1 to 9
10	1 to 10

Note - For 1/8 or 3/16 metal swbds. use screws For mtg. relay and for terminal conns. For 1/4 to 1 IN swbds. use studs for mtg. relay and screws for terminal connections For all other swbds. use studs for both purposes.

FIG. 4—TK RELAY OUTLINE AND DRILLING PLAN

TYPE TK UNIVERSAL TIMING RELAY—Continued

D-C. TO A-C. INVERTER

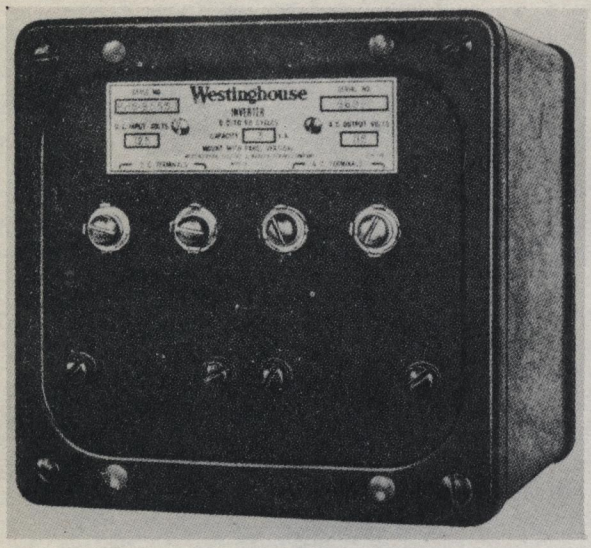


FIG. 5—D-C. TO A-C. INVERTER

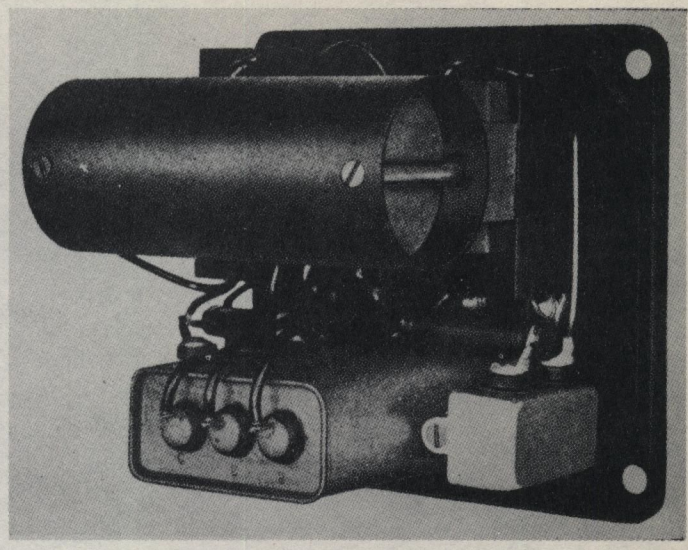


FIG. 6—D-C. TO A-C. INVERTER—COVER REMOVED

D-C.—A-C. INVERTER

To provide a means of converting d-c. power to a-c. for operating 60 cycle devices of low power consumption the inverter was developed; and as there are a number of installations where it will be desirable to operate a TK relay from a d-c. source, the information on the inverter is included in this section.

Application

It is well-known that very small d-c. motors generally are not as satisfactory or accurate as small a-c. motors. Consequently most motor-driven relays are a-c. operated to obtain the most reliable results.

In many installations it is essential to obtain the operating energy from an unfailing source of power. In these installations a battery is used.

The d-c. to a-c. inverter enables both of these advantages to be employed. It is an intermediate device used to convert battery power into 115 volts 60 cycles so that standard a-c. apparatus within its capacity can have a positive source of power at all times. It, therefore, is sometimes desirable to convert available d-c. to a-c. to operate timing relays such as the Westinghouse TK relay and other small synchronous motor-driven devices.

It will not convert a-c. to d-c.

Distinctive Features

1. Simple and reliable.
2. Provides a reliable sinusoidal wave form.
3. No chemical action or thermonic tubes required.
4. Small burden (does not exceed 20 Watts).
5. Contained in 5½" square case for back of switchboard mounting.

Construction and Operation

The d-c. to a-c. inverter includes a magnetically operated double contact vibrator that charges a tank circuit through a series reactor. When the contacts make on either side the tank circuit is given impulses which furnishes the power to keep it oscillating.

The vibrator mechanism is mounted in a sulphur free sponge rubber sleeve with end pads to absorb the contact noise, so that the operation of the d-c. to a-c. inverter is practically noiseless. The mounting serves as a resilient support as well as for sound absorption.

The vibrator has special silver-alloy contact material which has high conductivity, resists oxidation and will give long wear. There is a magnetic weight with a cross-wire on the end of the moving contact spring. The combined weight of these parts together with the spring strength determines the oscillating period of the vibrator.

The tank circuit is composed of a center tap reactor that has a center-tapped capacitor connected to it. The oscillatory circuit is designed to maintain a sinusoidal wave form from no load to full load. The reactor is tapped to obtain the proper operating voltage.

The series reactor is the same size as the tank reactor and has the proper characteristics to reduce the instantaneous tank circuit charging current, reduce the contact duty and aid in obtaining the excellent wave form secured for a device of this kind.

There is a condenser and resistor combination used to absorb the voltage of the series reactor when the vibrator contacts open.

A second resistor and condenser is connected to the vibrator coil. This gives frequency stabilization with varying loads. It reduces the a-c. in the vibrator coil, which in turn reduces the amplitude of vibration, and by permitting the d-c. in the coil to be increased it permits low-starting voltage.

There is a resistor connected across the a-c. output terminals which should be disconnected if the device supplied from the inverter requires more than 3 VA. The maximum output of the inverter is 7.5 VA.

The inverter is intended for intermittent use only, which is the type of service ordinarily required of timing relays and apparatus of that nature.

Burden

20 watts on the d-c. side.

TYPE TK UNIVERSAL TIMING RELAY—Continued

D-C. TO A-C. INVERTER—Continued

INVERTER LIST PRICE

Volts			
D-C. Input	A-C. 60 Cycle	Style No.	List Price Discount Symbol FC
125	115	1 008 561	$25 00

WIRING DIAGRAM

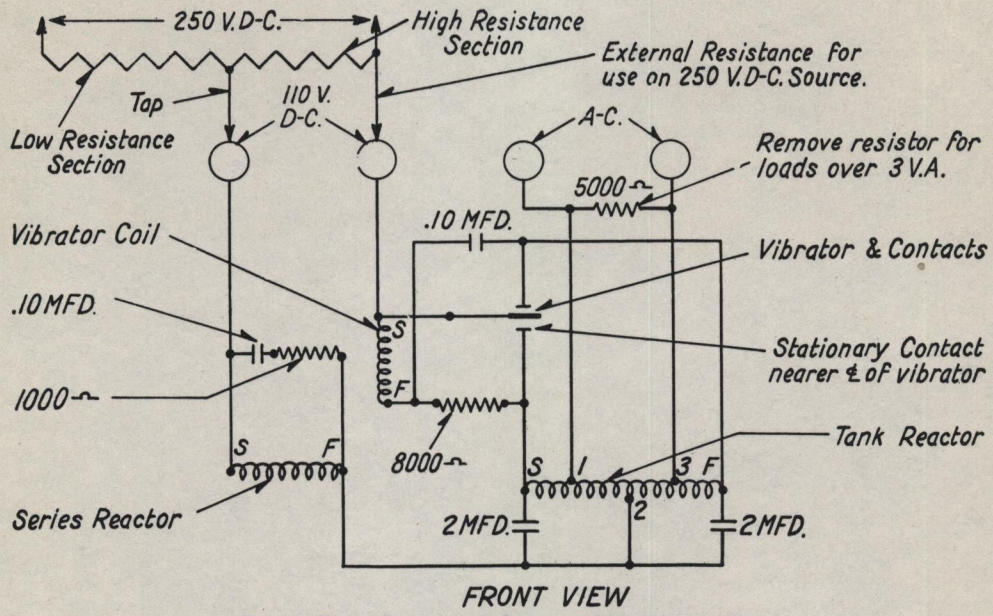


FIG. 7—WIRING DIAGRAM FOR INVERTER STYLE NO. 1008561

OUTLINE DIMENSIONS IN INCHES

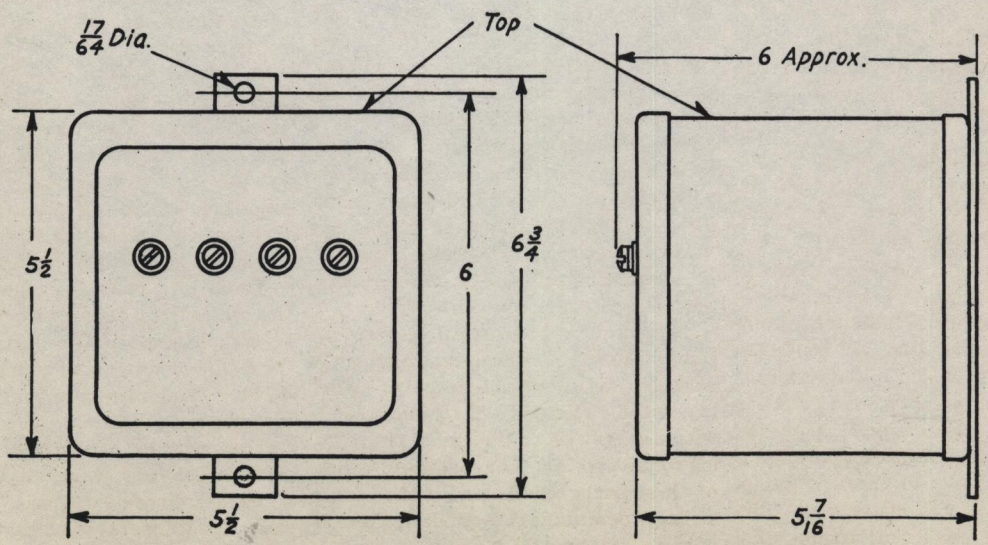
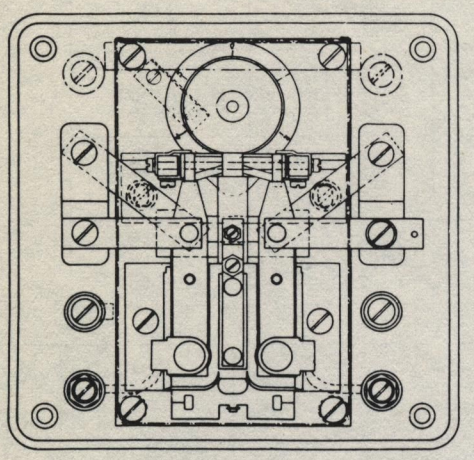
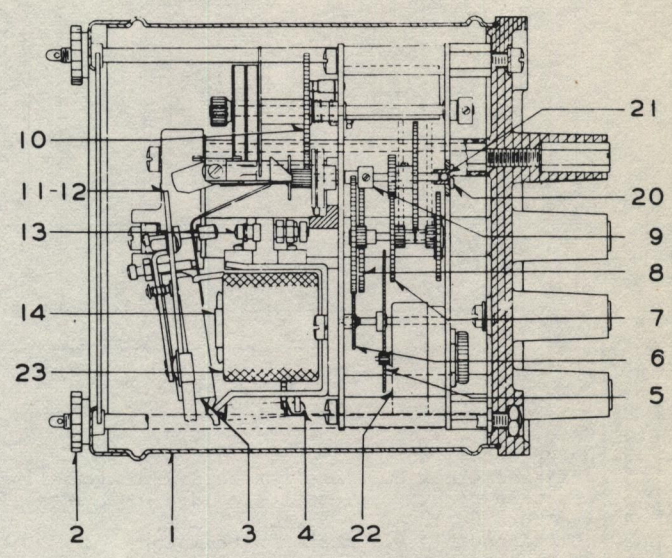
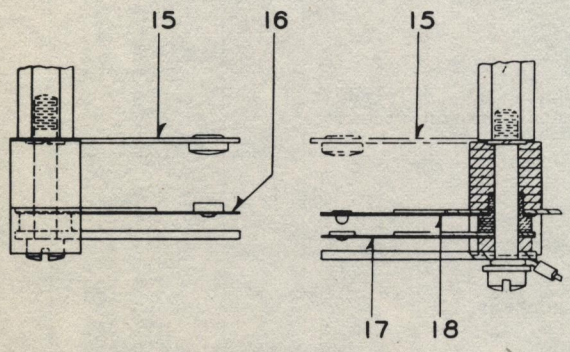


FIG. 8—OUTLINE DIMENSIONS FOR INVERTER STYLE NO. 1008561

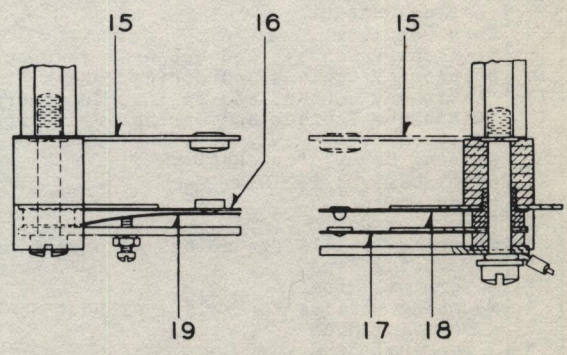
TYPE TK UNIVERSAL TIMING RELAY







STATIONARY CONTACT
ASSEMBLY OLD DESIGN



STATIONARY CONTACT
ASSEMBLY IMPROVED DESIGN

Westinghouse Electric & Manufacturing Company
Newark Works, Newark, N. J.

Printed in U.S.A.

EVERY HOUSE NEEDS WESTINGHOUSE

TYPE TK UNIVERSAL TIMING RELAY

5½" Square Case

Relay Complete		Volts	Cycles	Ref. No. 5	Ref. No. 22	Ref. No. 23
Without Sealing Contact	With Sealing Contact			Shaft Assembly No.1	Synchronous Motor	Operating Coil
Style Number	Style Number			Style Number	Style Number	Style Number
936 926	1 008 552	115	60	1 009 266	1 009 265	937 021
1 008 550	1 008 553	230	60	1 009 266	1 009 265	1 008 563
1 008 551	1 008 554	460	60	1 009 266	1 009 265	1 008 564
1 008 924	1 008 927	115	50	1 059 221	1 059 219	1 002 324
1 008 925	1 008 928	230	50	1 059 221	1 059 219	1 002 325
1 008 926	1 008 929	460	50	1 059 221	1 059 219	1 002 326
1 008 930	1 008 933	115	25	1 059 222	1 059 220	1 002 462
1 008 931	1 008 934	230	25	1 059 222	1 059 220	1 002 463
1 008 932	1 008 935	460	25	1 059 222	1 059 220	1 002 464

Ref No.	DESCRIPTION OF PART	Style Number	No. Req
1	Case.	1 009 305	1
2	Cover Nut	1 001 015	4
3	Armature Block Complete for relays with sealing contact.	1 099 578	1
3	Armature Block Complete for relays without sealing contact.	1 009 564	1
4	Armature Spring	837 967	1
5	Shaft Assembly #1, meshes with motor	Per Table	1
6	Shaft Assembly #2	1 009 267	1
7	Shaft Assembly #3	1 009 268	1
8	Shaft Assembly #4	1 009 269	1
9	Shaft Assembly #5 with clutch	1 009 270	1
10	Shaft Assembly #6 with tripping discs, 50 and 60 cycles.	1 009 456	1
10	Shaft Assembly #6 with tripping discs, 25 cycle	1 059 181	1
11	Lead and Contact Arm Complete, left hand.	1 099 580	1
12	Lead and Contact Arm Complete, right hand	1 099 581	1
13	Sealing Contact , when used	1 055 830	1
14	Core Complete.	1 096 714	1
15	Stationary Contact and Support, make contact	1 096 860	2
16	Stationary Contact and Spring, break contact	1 009 291	1
17	Stationary Contact and Spring, front break contact, motor circuit.	1 009 290	1
18	Stationary Contact and Spring, rear break contact, motor circuit	1 009 289	1
19	Not Used	... ...	.
20	Bearing Screw, for shaft #5	1 009 272	1
21	Steel Ball, 3/32" Dia..	... ...	1
22	Motor	Per Table	1
23	Operating Coil	Per Table	1
*	Mounting Details for relays with sealing contact	839 131	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	8
*	Mounting Details for relays without sealing contact	839 130	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	7

* Not Illustrated
Order Parts by Style Number and Description
Parts indented are included in the Part under which they are indented

TYPE TK UNIVERSAL TIMING RELAY

5½" Square Case—Improved Design

Relay Complete		Volts	Cycles	Ref. No. 5	Ref. No. 22	Ref. No. 23
Without Sealing Contact	With Sealing Contact			Shaft Assembly No.1	Synchronous Motor	Operating Coil
Style Number	Style Number			Style Number	Style Number	Style Number
1 059 953	1 059 962	115	60	1 009 266	1 009 265	937 021
1 059 954	1 059 963	230	60	1 009 266	1 009 265	1 008 563
1 059 955	1 059 964	460	60	1 009 266	1 009 265	1 008 564
1 096 870	1 096 817	575	60	1 009 266	1 009 265	1 008 565
1 059 950	1 059 959	115	50	1 059 221	1 059 219	1 002 324
1 059 951	1 059 960	230	50	1 059 221	1 059 219	1 002 325
1 059 952	1 059 961	460	50	1 059 221	1 059 219	1 002 326
1 096 869	1 096 872	575	50	1 059 221	1 059 219	1 003 383
1 059 947	1 059 956	115	25	1 059 222	1 059 220	1 002 462
1 059 948	1 059 957	230	25	1 059 222	1 059 220	1 002 463
1 059 949	1 059 958	460	25	1 059 222	1 059 220	1 002 464
¢1 096 868	¢1 096 871	575	25	1 059 222	1 059 220	¢1 002 464

¢ For 575 Volt, 25 Cycles only, one external resistor S# 1009014 is required in series with 460 Volt, 25 Cycle Coil S# 1002464.

Ref No.	DESCRIPTION OF PART	Style Number	No. Req
1	Case	1 009 305	1
2	Cover Nut	1 001 015	4
3	Armature Block Complete for relays with sealing contact	1 099 579	1
3	Armature Block Complete for relays without sealing contact	1 096 713	1
4	Armature Spring	1 000 998	1
5	Shaft Assembly #1, meshes with motor	Per Table	1
6	Shaft Assembly #2	1 009 267	1
7	Shaft Assembly #3	1 009 268	1
8	Shaft Assembly #4	1 009 269	1
9	Shaft Assembly #5 with clutch	1 096 695	1
10	Shaft Assembly #6 with tripping discs, 50 and 60 cycles	1 009 456	1
10	Shaft Assembly #6 with tripping discs, 25 cycles	1 059 181	1
11	Lead and Contact Arm Complete, left hand	1 099 580	1
12	Lead and Contact Arm Complete, right hand	1 099 581	1
13	Sealing Contact, when used	1 099 582	1
14	Core Complete	1 096 714	1
15	Stationary Contact and Support, make contact	1 096 860	2
16	Stationary Contact and Spring, break contact	1 096 710	1
17	Stationary Contact and Spring, front break contact, motor circuit	1 096 709	1
18	Stationary Contact and Spring, rear break contact, motor circuit	1 096 708	1
19	Spring	1 094 807	1
20	Bearing Screw for Shaft #5	1 009 272	1
21	Steel Ball 3/32" Dia.	... ...	1
22	Motor	Per Table	1
23	Operating Coil	Per Table	1
*	Mounting Details for relays with sealing contacts	839 131	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	8
*	Mounting Details for relays without sealing contacts	839 130	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	7

* Not Illustrated
Order Parts by Style Number and Description
Parts indented are included in the Part under which they are indented

TYPE TK UNIVERSAL TIMING RELAY

Standard Rectangular Case—Improved Design

Relay Complete				Volts	Cycles	Ref. No. 5	Ref. No. 22	Ref. No. 23
Without Sealing Contacts		With Sealing Contacts						
Projection Mounting	Flush Mounting	Projection Mounting	Flush Mounting			Shaft Assembly No.1	Synchronous Motor	Operating Coil
Style Number	Style Number	Style Number	Style Number			Style Number	Style Number	Style Number
1 056 824-A	1 056 924-A	1 056 833-A	1 056 933-A	115	60	1 009 266	1 009 265	937 021
1 056 825-A	1 056 925-A	1 056 834-A	1 056 934-A	230	60	1 009 266	1 009 265	1 008 563
1 056 826-A	1 056 926-A	1 056 835-A	1 056 935-A	460	60	1 009 266	1 009 265	1 008 564
1 096 875-A	1 096 881-A	1 096 878-A	1 096 884-A	575	60	1 009 266	1 009 265	1 008 565
1 056 821-A	1 056 921-A	1 056 830-A	1 056 930-A	115	50	1 059 221	1 059 219	1 002 324
1 056 822-A	1 056 922-A	1 056 831-A	1 056 931-A	230	50	1 059 221	1 059 219	1 002 325
1 056 823-A	1 056 923-A	1 056 832-A	1 056 932-A	460	50	1 059 221	1 059 219	1 002 326
1 096 874-A	1 096 880-A	1 096 877-A	1 096 883-A	575	50	1 059 221	1 059 219	1 003 383
1 056 818-A	1 056 918-A	1 056 827-A	1 056 927-A	115	25	1 059 222	1 059 220	1 002 462
1 056 819-A	1 056 919-A	1 056 828-A	1 056 928-A	230	25	1 059 222	1 059 220	1 002 463
1 056 820-A	1 056 920-A	1 056 829-A	1 056 929-A	460	25	1 059 222	1 059 220	1 002 464
¢1 096 873-A	¢1 096 879-A	¢1 096 876-A	¢1 096 882-A	575	25	1 059 222	1 059 220	¢1 002 464

¢ For 575 Volt, 25 Cycles only, one external resistor S# 1009014 is required in series with 460 Volt, 25 Cycle Coil S# 1002464.

Ref No.	DESCRIPTION OF PART	Style Number	No. Req
*	Glass Cover, projection type	1 001 582	1
*	Glass Cover, flush type	1 001 581	1
*	Case, flush type	939 034	1
2	Cover Nut	704 110	2
3	Armature Block Complete for relays with sealing contact	1 099 579	1
3	Armature Block Complete for relays without sealing contact	1 096 713	1
4	Armature Spring	1 000 998	1
5	Shaft Assembly #1, meshes with motor	Per Table	1
6	Shaft Assembly #2	1 009 267	1
7	Shaft Assembly #3	1 009 268	1
8	Shaft Assembly #4	1 009 269	1
9	Shaft Assembly #5 with clutch	1 096 695	1
10	Shaft Assembly #6 with tripping discs, 50 and 60 cycles	1 009 456	1
10	Shaft Assembly #6 with tripping discs, 25 cycles	1 059 181	1
11	Lead and Contact Arm Complete, left hand	1 099 580	1
12	Lead and Contact Arm Complete, right hand	1 099 581	1
13	Sealing Contact, when used	1 099 582	1
14	Core Complete	1 096 714	1
15	Stationary Contact and Support, make contact	1 096 860	2
16	Stationary Contact and Spring, break contact	1 096 710	1
17	Stationary Contact and Spring, front break contact, motor circuit	1 096 709	1
18	Stationary Contact and Spring, rear break contact, motor circuit	1 096 708	1
19	Spring	1 094 807	1
20	Bearing Screw for shaft #5	1 009 272	1
21	Steel Ball, 3/32" Dia.	... ...	1
22	Motor	Per Table	1
23	Operating Coil	Per Table	1
*	Mounting Details for relays with sealing contacts	839 131	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	8
*	Mounting Details for relays without sealing contacts	839 130	1
*	Mounting Stud	837 331	2
*	Terminal Stud	839 582	7

* Not Illustrated
Order Parts by Style Number and Description
Parts indented are included in the Part under which they are indented

Westinghouse

TYPE TK TIMING RELAY

INSTRUCTIONS

APPLICATION

The type TK relay is an a-c. relay suitable for applications which require a definite time-delay between closing an a-c. circuit and closing or opening other a-c. or d-c. circuits, through contacts on the relay. Accurate time-settings from a few seconds to fifty minutes can be obtained in the same relay, with a maximum reset time of less than one second for any setting. Two sets of main contacts--one single-pole double-throw and one single-pole single-throw--are provided, and these contacts can be adjusted to operate either simultaneously or sequentially. A seal-in auxiliary contact can also be provided for applications where it is desired to start a timing operation by the monentary closure of an external switch.

INSTALLATION

Inspect relay for any damage that might have occurred in shipment. When removing the blocking from the contactor armature, make sure that the armature has not shifted off its bearings. Rotate the tripping disc mechanism counter-clockwise and allow to reset to make sure that it returns to zero positively. Remove the cover strip at the top of the gear case. This can be readily done by pulling aside one end of the strip which covers the sides and bottom. This strip is held against the top corner posts by a spring. When the bent-over end is clear of the top strip, the strip can be lifted off, exposing the sliding gear assembly and the gear position index plate. With the large gear on clutch shaft set opposite the 30-second mark on index plate, rotate this gear slowly in order to check for apparent friction in gear train.

The tripping disc mechanism is at the top of the relay and the synchronous motor at the bottom. The relay should be mounted in an approximately level position, as viewed from both front and side. Any appreciable variation from a level position will affect the operating characteristics of the relay.

Mounting studs and terminal details are contained in a small cloth bag packed with the relay.

CONSTRUCTION AND OPERATION

The type TK relay consists of a synchronous motor, a gear train to provide three different ratios, a clutch interposed in the gear train to permit quick resetting when the relay is de-energized, a contactor which carries the main contacts and operates the clutch, and a tripping mechanism adjustable for time-delay.

The motor for driving the gear train is located on the back plate of the gear train assembly in the lower right-hand corner. It runs at a synchronous speed of 600, 500 or 250 R.P.M. for 60, 50 or 25 cycle relays respectively, its bearing is self-sealed and self-lubricated and does not require special attention. On relays rated at 230 volts or higher, the contactor coil has a tap brought out at the proper place to act as an auto-transformer to supply 115 volts for the motor.

The gear train is assembled as a separate unit and consists of two brass bearing plates fastened together at the corners by brass posts. The gear shafts run at low speeds and require no lubrication. The three different speeds are obtained by changing the location of a sliding gear assembly. This assembly consists of two gears on a hub that is free to slide on the clutch shaft and can be locked in any desired position with a set screw. The hub is moved to the position where the larger gear is opposite the arrow on the index plate corresponding to the desired time scale. The mesh of the gear teeth should be inspected and the hub shifted slightly if necessary to secure a full mesh, and then the set-screw should be tightened securely.

In 50 and 60 cycle TK relays the maximum time settings available for the three gear positions are: 30 seconds, 5 minutes and 50 minutes. The smallest sub-division is 1 second on the 30 second scale, 0.1 minute on the 5 minute scale and 1 minute on the 50 minute scale. In 25 cycle TK relays the three time scales are 1, 10 and 100 minutes and the smallest sub-divisions are twice the time value for the 50 and 60 cycle relays.

The motor may require one or two seconds to reach synchronous speed after the relay is energized and its average speed during this accelerating period will be something less than synchronous speed. The time scales on the dial make no provision for the effect the accelerating period has upon the total operating time, as this is not noticeable on the intermediate or slow speed settings. When the gears are in the high speed position, it will be more accurate to use a scale setting approximately one second less than the desired time setting.

The clutch is two aluminum discs with serrated faces, arranged so that they are positively engaged and disengaged by a spring on the contactor armature when the latter is in its closed and open positions respectively. The rear disc is fastened on its shaft and the front disc is a running fit on the end of the same shaft. The latter disc has fastened to it the pinion which drives the tripping mechanism. When the relay is energized, the clutch discs engage and power is transmitted from the motor, through the gear train, to the tripping mechanism. When the relay is de-energized, the clutch discs are separated by the opening of the contactor armature, and the reset spring for the tripping mechanism is required to rotate only the trip discs and the front clutch disc. Because of the low inertia and low friction of these parts, the trip discs will reset from the position of maximum travel in much less than one second. The position of the sliding gear assembly has no effect upon the resetting time.

The contactor is of the clapper type. At the top of the armature is fastened a spring arm which presses against the front half of the clutch when the relay is energized, causing the clutch to mesh. The position of the clutch-operating spring can be controlled by an adjusting screw on a bracket fastened to the front of the armature. The seal-in contact is operated by an insulating button on the end of an adjusting screw on the upper end of the same bracket. The motor and contactor coil are connected together so that as soon as the clutch is operated the motor also is energized. The armature carries the two moving contacts, which, as well as the stationary contacts, are silver. The "make" contacts will carry 12 amperes continuously and 20 amperes for 1 minute. The "break" contact has somewhat less pressure and will carry about two-thirds of this rating. The contacts will interrupt a non-inductive a-c. circuit carrying 20 amperes at 115 volts or 15 amperes at 230 volts.

The trip mechanism is fastened to the front plate of the gear train assembly. Although the armature and clutch-operating spring move in when energized, the two moving contact fingers on the armature are prevented from operating by the two Micarta latch arms. Consequently, the back contact on the left-hand side, and the motor circuit which is the back contact on the right-hand side, will remain closed until the Micarta arms are tripped up and the moving fingers released. This is accomplished by the heads of the trip screws on the two discs, which push down the latch arm levers. Repeated tests have shown that the relay will make more than one million operations before the striking and rubbing action of the contact fingers on the ends of the latch arms wears them sufficiently to require replacement.

Each disc has a small bronze index pin projecting approximately 1/32" from its edge. The relay is adjusted so that these pins are opposite the zero on the scale plate when the trip screws in the discs have reached a point where they will just trip the Micarta latch arms and release the contact fingers. To set for a predetermined trip time, first shift gears to the scale wanted. Then loosen the thumb nut locking the trip discs and rotate them so each index is on the desired scale marking, and tighten the thumb nut. The disc nearest the scale plate will trip the left finger only; the disc that is nearest the front will trip both contact fingers. To set the contact fingers for sequential operation the left finger must trip first, as the motor is in series with the back contacts on the right-hand side. When this finger is tripped, it opens the motor circuit.

In making these settings the trip disc should not be rotated so that the trip pins are holding the Micarta arms part way up. Under this condition it is possible for the moving contacts to bounce under these arms and close the front contacts instantaneously when the relay is energized. The minimum settings obtainable without partially raising the latch arm are approximately 1-1/2 division on the 30 second scale, and corresponding points on the other scales.

In some applications it may be desired to have the left-hand contact operate instantaneously, as soon as the relay is energized, and have the time-delay on the right-hand contact only. This can be done by setting the disc nearest the scale plate so that the left-hand latch arm is raised above the end of the contact finger when the trip discs are reset. If any time-delay is desired, however, the minimum setting obtainable without the possibility of erratic operation is the point at which the trip disc begins to raise the latch arm.

Some styles of the TK relay are provided with a seal-in contact, which closes the moment the relay is energized. When connected according to the wiring diagram, this contact energizes the relay, and keeps it energized, when an external contact or switch (such as a push button) is momentarily closed. The relay can be de-energized then only by interrupting the supply circuit by means of some other contact or switch.

ADJUSTMENTS AND MAINTENANCE

The adjustments described in the following paragraphs ordinarily need be made only when reassembling the relay after it has been dismantled for repairs. However, it will be advisable to check the adjustment at the regular maintenance periods and correct them, if necessary.

The die-cast bracket which supports the latch arm assembly is secured to the front gear plate by means of screws passing through slotted holes. To adjust the position of this bracket, loosen both the mounting screws and the screw which holds the stop bracket for the right hand latch arm. Move the sliding gear assembly out of mesh, so that the trip discs will not rotate, and energize the relay. The latch arms should be down so that the contact fingers are held out. Shift the die-cast bracket so that with the latch arms touching the aluminum trip discs (not the trip screws), the projection of the end of the latch arm above the top of its adjacent contact finger will be .075" for the left-hand finger and .070" for the right-hand finger. The dimensions given apply to relays in which the trip discs are 1-1/8" in diameter Earlier relays used discs with a diameter of 1-3/16", and on these the dimension should be .110" for the left-hand finger and .120" for the right-hand finger. A small strip of metal with the ends filed to these dimensions will be convenient to use as a gauge. It can be rested on the ends of the contact fingers and the bracket shifted until the upper front corners of the fingers are even with the ends of the gauge. The mounting screws for the bracket should then be tightened securely. The screw for the right-hand latch arm stop bracket should also be tightened, and the end of the bracket should be bent up or down until the latch arms just clear the small bronze index pins projecting from the trip discs.

Raise the right-hand latch with the fingers and move the armature in by hand until the tips of the contact fingers are opposite the lowest portions of the latch arms. When the left-hand latch arm is just touching its contact finger, there should be a gap of about .010" to .015" between the right-hand arm and its contact finger. (This relation between the latches and the contact fingers prevents any possibility of the left-hand finger tripping first when the trip discs are set for simultaneous tripping.)

Loosen the thumb nut locking the two trip discs and energize the relay with the gears still out of mesh. Hold the final gear firmly against its back stop, and rotate each trip disc by hand until it depresses its latch arm far

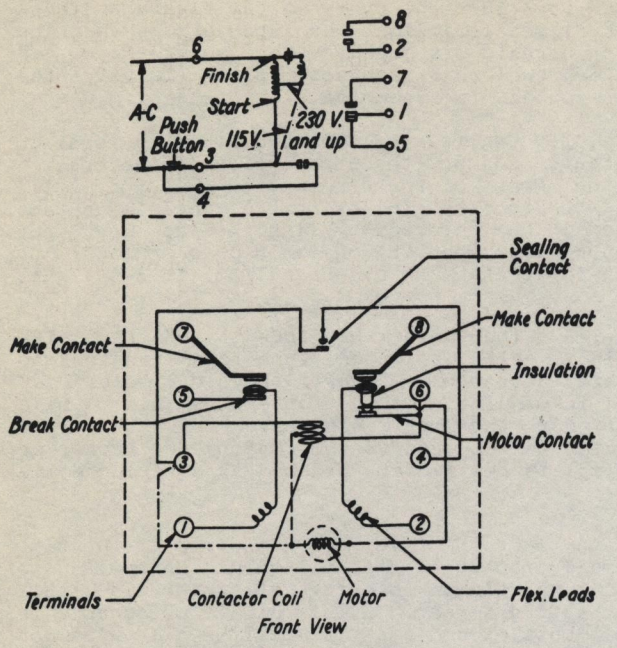


Figure 1
Internal wiring diagram of the Type TK relay with Seal-in cont acts. (Outline & drilling see Fig. 5)

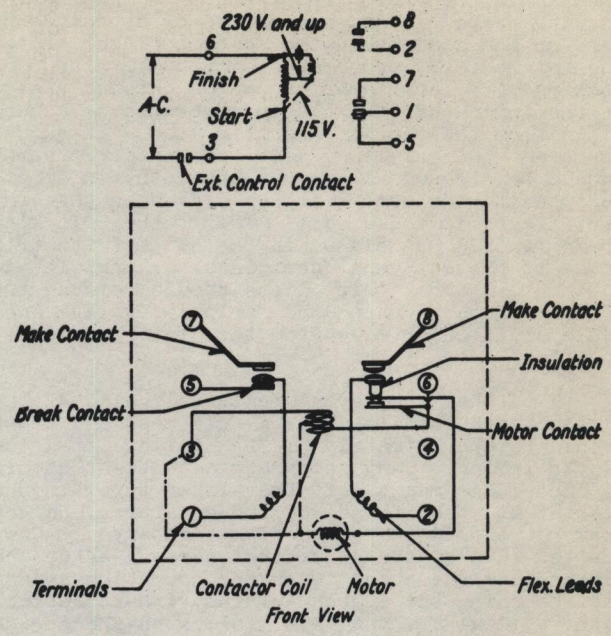


Figure 2
Internal wiring diagram of the Type TK relay without seal-in cont acts. (Outline & drilling see Fig. 5)

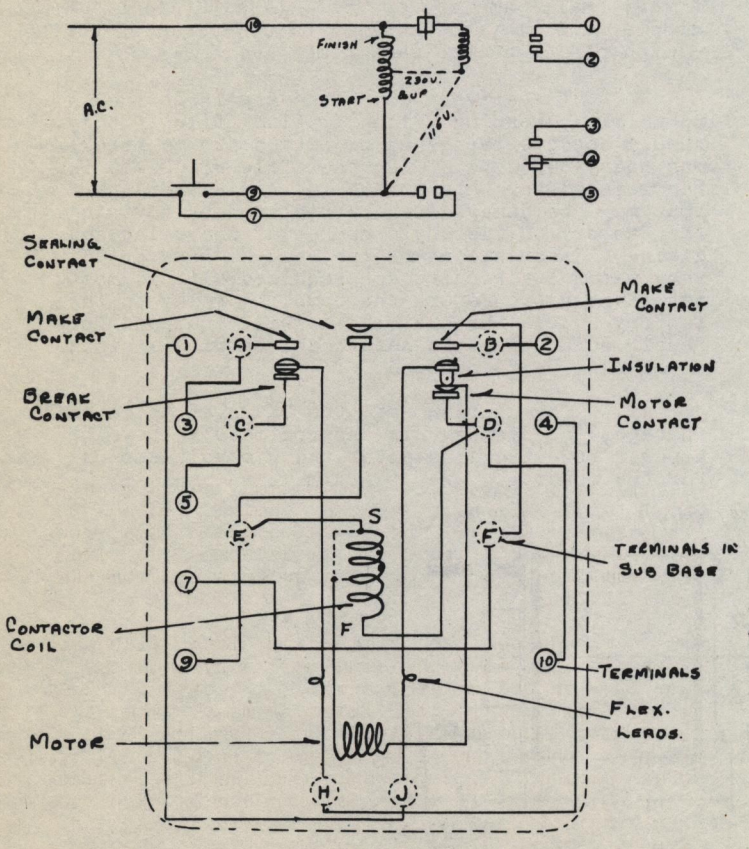


Figure 3
Internal wiring diagrams of the Type TK relay with Seal-in cont acts. (Outline & drilling see Fig. 6 & 7)

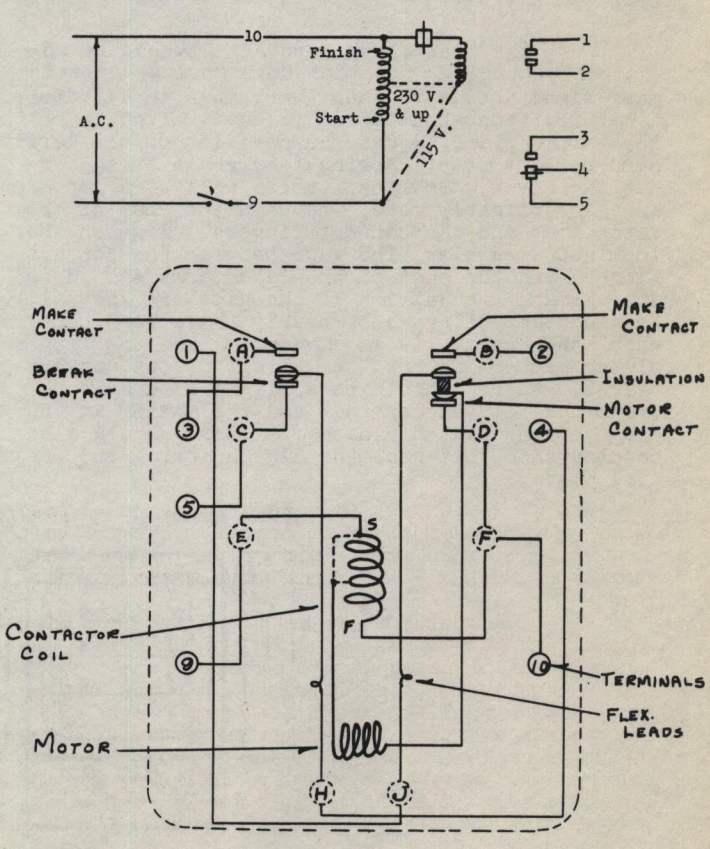


Figure 4
Internal wiring diagram of the Type TK relay without Seal-in cont acts. (Outline & drilling see Fig. 6 & 7)

enough to just trip the contact finger. The bronze pin projecting from each trip disc serves as its zero index, and should be opposite the zero on the dial when the contact finger trips. The trip screws are prevented from turning by a locking wire spring which passes through a slot in the inner end of the trip screw and is accessible from the rear of the trip disc. It should be moved out of the slot and the trip screw should be screwed in or out until the index pin is opposite the zero on the dial when the contact finger is released. Then the locking spring should be placed in the slot of its trip screw to prevent any accidental change in adjustment. The trip discs should release the contact fingers when the trip screws are one-scale division or more from the center or lowest position.

When the armature is held closed, the clutch teeth should have a full mesh and there should be approximately 1/32" follow on the clutch spring. Any necessary adjustment should be made by means of the lower screw in the bracket at the front of the armature, and the lock nut should be securely tightened. One-quarter turn of the adjusting screw, after the clutch is closed and with the operating spring just touching the clutch pinion without deflection, will give about 1/32" follow on the spring. When the armature is released, the clutch teeth should have sufficient separation to prevent any interference with resetting of the trip discs. Too much follow on the clutch spring will prevent the clutch from being held open positively when the relay is de-energized.

The stationary contacts should be adjusted by bending so that both moving contacts make simultaneously when they move in with the armature with about 1/16" follow. With the relay de-energized, adjust the position of the left hand back contact spring, by means of the adjusting screw, so that there will be a gap of 1/64" or slightly more, between the ends of the latch arms and the contact fingers. Tighten the lock nut securely. The gaps between the contact fingers and the ends of the latch arms should be approximately equal. If the gaps are unequal, the contact fingers probably have been bent. When the relay is de-energized and the front clutch member is at the limit of its outward travel, there should be a slight clearance between the clutch spring and the washer at the front of the clutch pinion. There should also be clearance between the clutch spring and the dial plate.

The motor circuit contact should have 1/16" to 3/32" follow when the right-hand contact finger is against the latch arm. When the motor circuit is open, there should be no gap between the rear contact spring (in which the flat contact is assembled) and its stop plate.

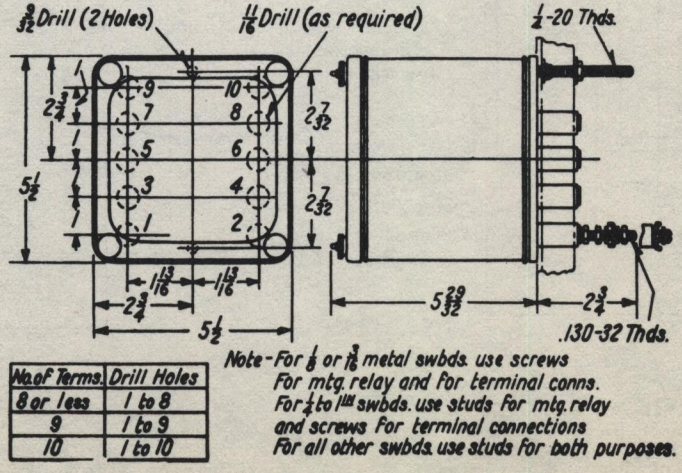
On relays provided with a seal-in contact, adjust the upper screw in the bracket at the front of the armature so that there will be 1/32" to 3/64" follow on the seal-in contact after it has closed. Tighten the lock nut securely. When the relay is de-energized, the seal-in contact should have 1/32" to 3/64" gap.

The motor bearing is of the self-sealed, self-lubricated type and requires no special attention. Due to the close tolerances held in manufacture, no attempt should be made to repair the motor in case of damage. It should be returned to the factory for repair or a complete new motor ordered as a replacement.

If the relay operates very frequently, a small drop of special oil should be applied to the clutch pinion bearing at intervals of six months to one year. This oil is obtainable in small bottles under style #1101752. It will not congeal at low temperatures, and it contains an anti-oxident to retard the formation of gum at high temperatures. It can be applied by dipping a small wire into the oil and touching this to the clutch shaft between the two clutch discs. A very small amount of oil is sufficient. A drop of oil may be applied to the teeth of the clutch pinion at the same time.

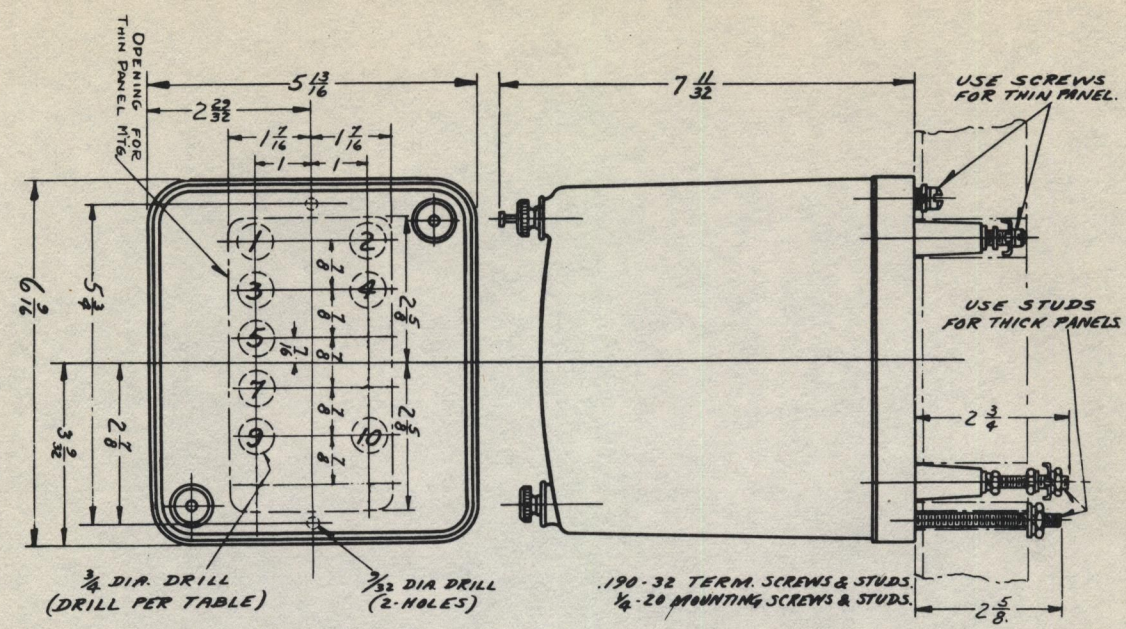
The silver contacts are large enough to permit dressing with a fine file if they should become tarnished or pitted due to breaking heavy currents. Contact file S#1002110 is recommended for this purpose. Any other part that may be damaged can be replaced by advising the factory of the style number of the relay and giving a description of the part. However, if very extensive repairs are required, it is most satisfactory to return the complete relay to the factory unless the customer is well equipped for repair work of this nature and carries a stock of renewal parts on hand.

The burden of the TK relay at rated voltage, 60 cycles, is approximately 18 volt-amperes for the contactor and 2.6 volt-amperes for the motor.



No. of Terms.	Drill Holes
8 or less	1 to 8
9	1 to 9
10	1 to 10

Figure 5
Outline and drilling plan for the metal case with a glass front. (Figures 1 and 2)



Omit Term. No. 7 for Fig. 4.

Figure 6
Outline and drilling plan for the glass cover case - projection type mounting (Figures 3 and 4)

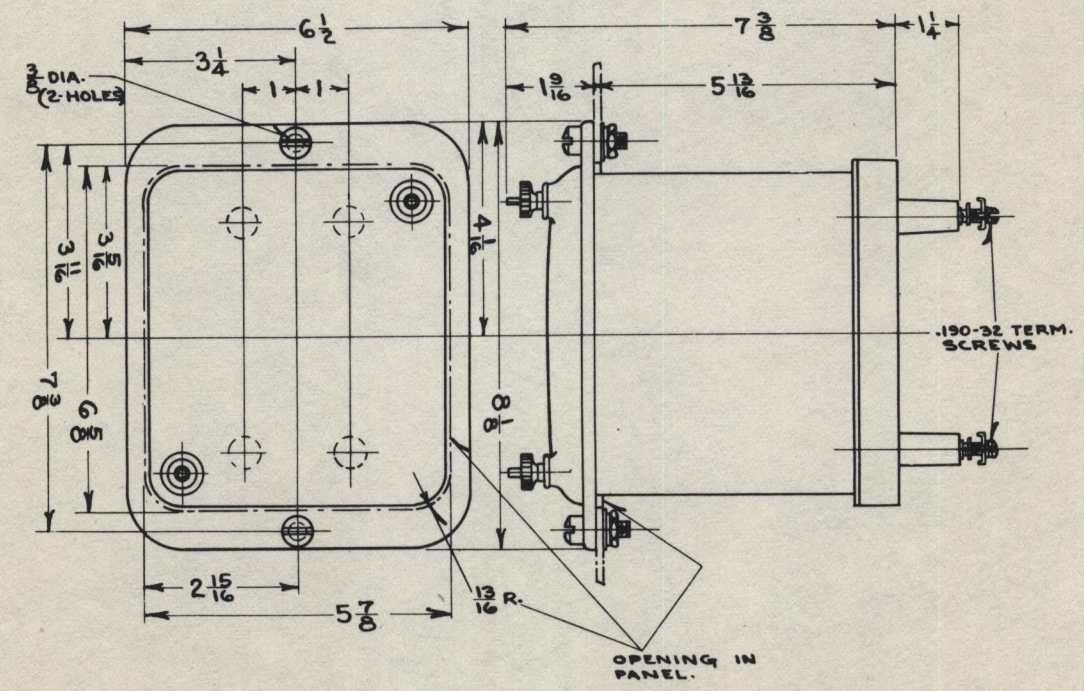


Figure 7
Outline and drilling plan for the glass cover case - flush type mounting (Figures 3 and 4)