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GEI-31037

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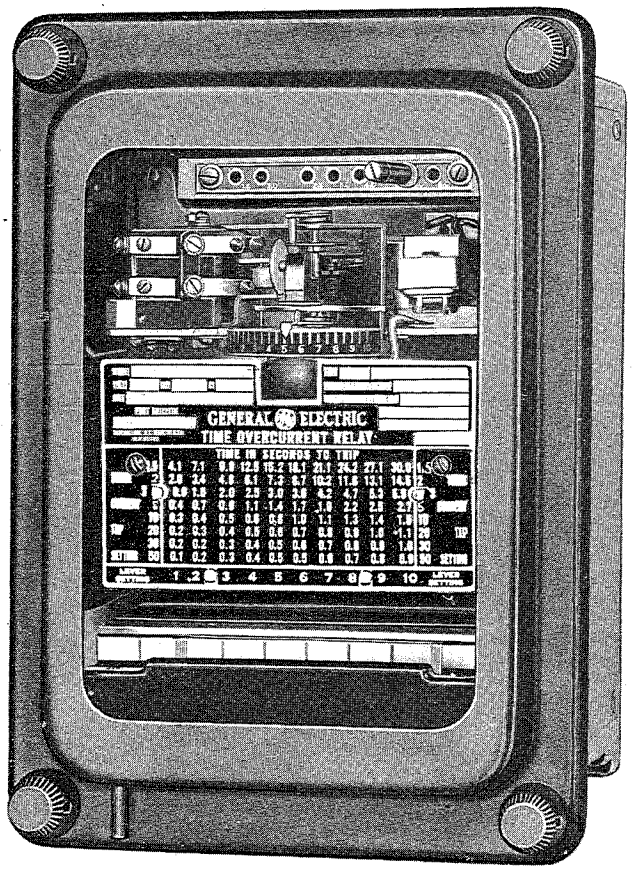
INSTRUCTIONS

Switchgear

TIME OVERCURRENT RELAYS



Types

ICC21A **ICC21C** **ICC29A**
ICC21B **ICC26B** **ICC29B**
ICC28A

GENERAL ELECTRIC

A

CONTENTS

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

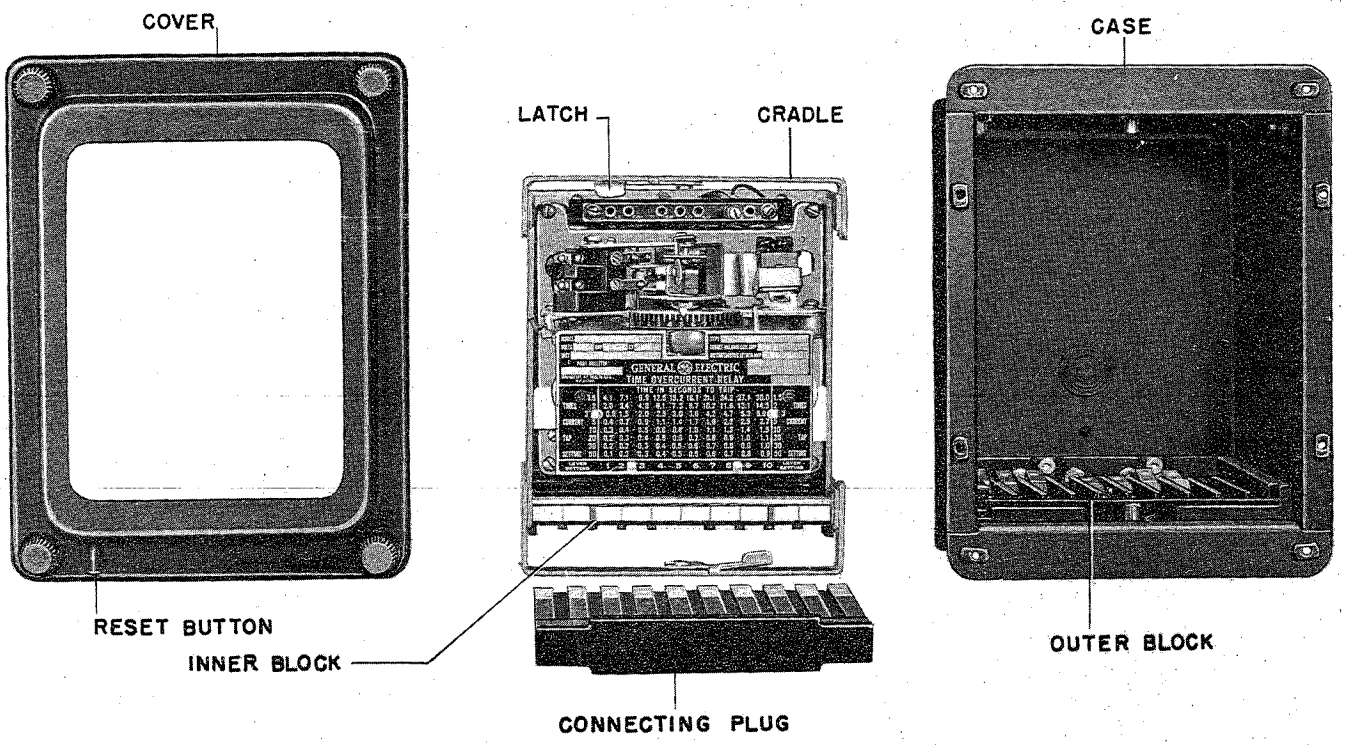


Fig. 1 The Type ICC26B Relay Removed From Case

Fig. 1 (8007566)

TIME OVERCURRENT RELAYS
TYPE ICC

INTRODUCTION

The Type ICC21A, ICC21B, ICC21C, ICC26A, ICC28A, ICC29A and ICC29B relays are time-overcurrent units provided with the watthour meter form of driving element. The Type ICC21A, ICC21B, ICC21C, ICC26B and ICC28A relays have the very-inverse time characteristics shown in Fig. 2, and it is necessary to close the secondary circuit of the so called "transformer coil" to produce torque. The leads of this coil are connected to terminals so that connections may be made to the contacts of some controlling device, such as, a power directional relay.

The Type ICC29A and ICC29B relays have the time characteristics shown in Fig. 3 and do not depend upon any other relay for their operation since the secondary circuit of the "transformer coil" is closed within the relay.

APPLICATION

The Type ICC21A, ICC21B, ICC21C, ICC26A and ICC28A relays are used where it is desired to have overcurrent action dependent upon the operation of another relay or device, such as the power directional device previously mentioned. Fig. 5 shows an application of three Type ICC21A relays in conjunction with a Type CAP relay and two Type HGA relays used for directional-overcurrent protection of a line. When connected this way, the Type CAP relay contacts close on a reversal of power and thus place the Type ICC relays in an operative condition. If the current is excessive, the Type ICC relay contacts close after a predetermined time and trips the breaker. The Type HGA relays in this circuit are used to multiply the contacts of the Type CAP relay.

The Type ICC29A and ICC29B relays find their application in the protection of heavily loaded feeders and transmission lines. The shape of the time-current curve (Fig. 3) prevents the breaker from tripping after it is closed on a loaded line. At this time, the current will be exceedingly high due to the starting current of motors and other such apparatus.

Fig. 6 shows a circuit that will protect a line against phase-to-phase as well as ground faults.

OPERATING CHARACTERISTICS

The Type ICC21A relay is dependent upon some other relay or device for its operation. This relay has the very-inverse characteristics shown in Fig. 2, and is equipped with single circuit-closing contacts.

The Type ICC21B relay differs from the Type ICC21A relay in that it is provided with an instantaneous unit with single circuit-closing contacts. The instantaneous unit operates over a 4 to 1 range and has its calibration stamped on the tube surrounding the plunger. Time-current curves for the instantaneous unit are shown in Fig. 4.

The Type ICC21C relay is composed of three Type ICC21A units mounted in one case. The target-holding coil and contact circuits of all three units are paralleled.

The Type ICC26B relay differs from the Type ICC21B relay in that it has two circuit-closing contacts in the instantaneous unit and induction element circuits.

The Type ICC28A relay is similar to the Type ICC21B relay except that it contains three identical units in a three-unit, double-end case.

The Type ICC29A relay is a time-overcurrent relay with the characteristics shown in Fig. 3. This relay has single circuit-closing contacts and does not depend upon any other relay or device for its operation.

The Type ICC29B relay differs from the Type ICC29A relay in that it contains an instantaneous element similar to that used in the Type ICC21B relay.

RATINGS

Present models of ICC overcurrent relays are all 60 cycles with either 1.0 or 0.2 amp target and holding coils. Tap ranges are 0.5-2.0, 1.5-6, or 4.-15 amps, depending upon the relay type. The Type ICC29A and ICC29B relays have 4-16 amp. tap ranges instead of the 4-15 amp ranges. On those relays with an instantaneous unit, ranges for these units are 7-28, 10-40, or 20-80 amps, depending upon the type of relay.

CONTACTS

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying rating is limited by the two forms of target and holding coils. Relays with 1.0-ampere target and holding coils have a rating of 30 amperes for tripping duty and hence will trip any circuit breaker with trip-coil current within this rating. After tripping occurs, the tripping circuit must be opened by an auxiliary switch on the circuit breaker or by other automatic means as the relay contacts are sealed closed when tripping current is flowing.

TARGET AND HOLDING COILS

There are two ratings of these coils available. The choice between them depends on the current taken by the tripping circuit.

The 0.2-ampere coil is for use with trip coils

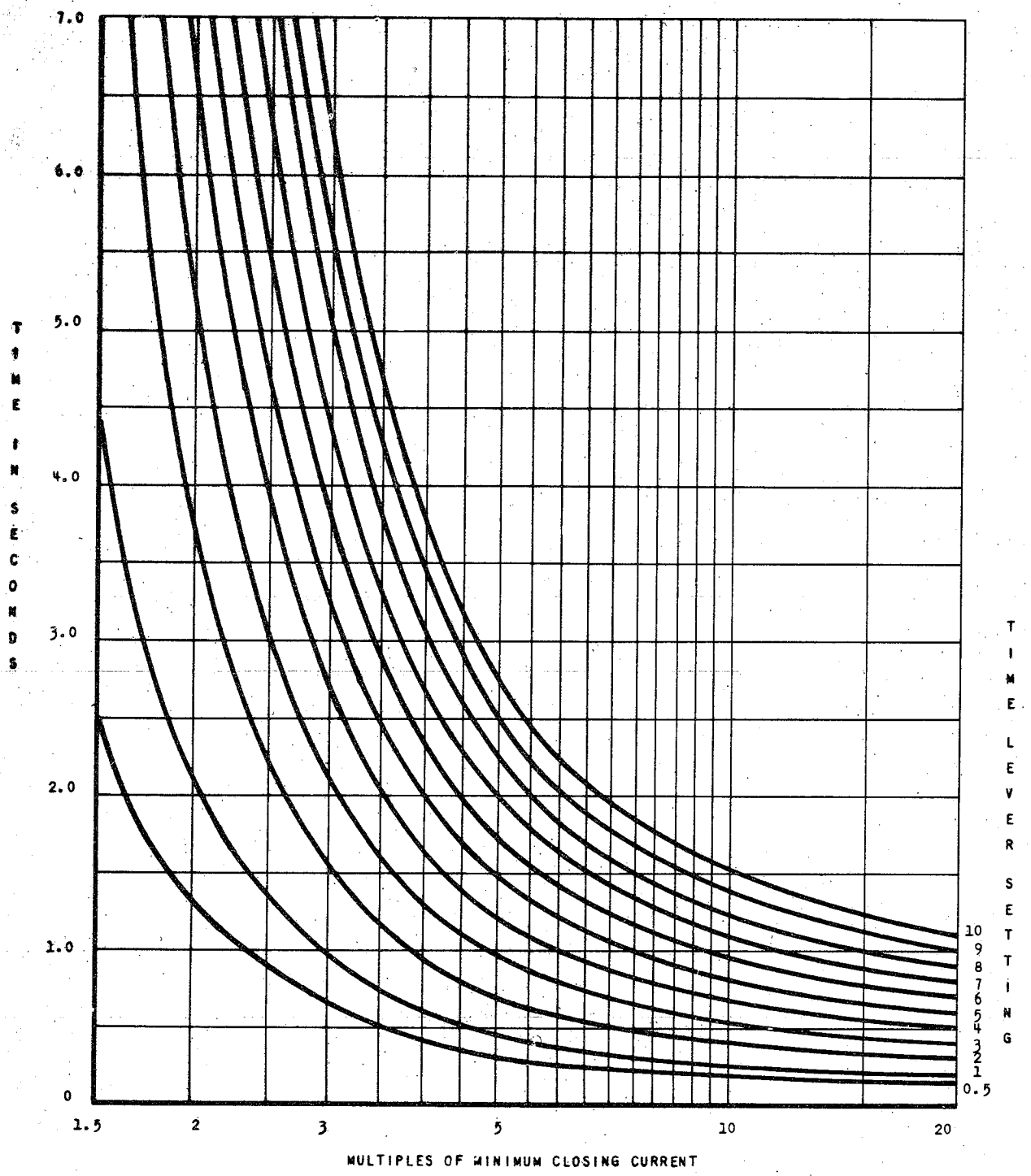


Fig. 2 (K-6209200-B)

Fig. 2 Very-Inverse Time-Current Characteristics of Relay Types ICC21A, ICC21B, ICC21C, ICC26B, and ICC28A

that operate on currents ranging from 0.2 to 1.0 ampere at the minimum control voltage. If this coil is used with trip coils that take 1.0 ampere, or more, there is a possibility that the 7-ohm resistance will reduce the tripping current to so low a value that the breakers will not be tripped.

The 1.0-ampere coil should be used with trip coils that take 1.0 ampere or more at the minimum control voltage provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes an auxiliary relay must be used to control the trip coil circuit, the connections being such that the tripping current does not pass through the contacts of the target and holding coil of the Type ICC relays.

When it is desirable to adopt one type of relay as standard to be used anywhere on a system, relays with the 1.0-ampere target and holding coil should be chosen. These relays should also be used where it is impossible to obtain trip-coil data, but attention is called to the fact that the target may not operate if used in connection with trip coils taking less than 1.0 ampere.

The ratings of the two forms of target and holding coils are as follows:

Function	Amperes, AC or DC	
	1 Amp (0.25 Ohm) Coil	0.2 Amp (7 Ohm) Coil
Carry for Tripping Duty	30	5
Carry Continuously	4	0.8

BURDENS

The burdens at 5 amperes, 60 cycles are as follows for each relay unit:

RELAY TYPES ICC21A, ICC21B*, ICC21C, ICC26B* AND ICC28A*

RATING	TAP	VA	WATTS	P.F.
0.5 - 2	0.5	151	78	.52
1.5 - 6	1.5	17	10.3	.61
4 - 15	4	9	2	.23

RELAY TYPES ICC29A AND ICC29B*

RATING	TAP	VA	WATTS	P.F.
0.5 - 2	0.5	93	81	.87
1.5 - 6	1.5	17	15.7	.93
4 - 16	4	21	1.3	.60

(*) There is an additional burden due to the instantaneous unit, taken at 5 amperes, 60 cycles as follows:

Instantaneous Unit Rating	V.A.	Watts	P.F.
7-28	9.5	5.7	.60
10-40	.8	.5	.62
20-80	.2	.1	.50

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust, and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

DESCRIPTION

The case is suitable for either surface or semi-flush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case and also carries the reset mechanism when one is required. Each cover screw has provision for a sealing wire.

The case has studs or screw connections at both ends or at the bottom only for the external connections. The electrical connections between the relay units and the case studs are made through spring backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer blocks, attached to the case, have the studs for the external connections, and the inner blocks have the terminals for the internal connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads being terminated at the inner block.

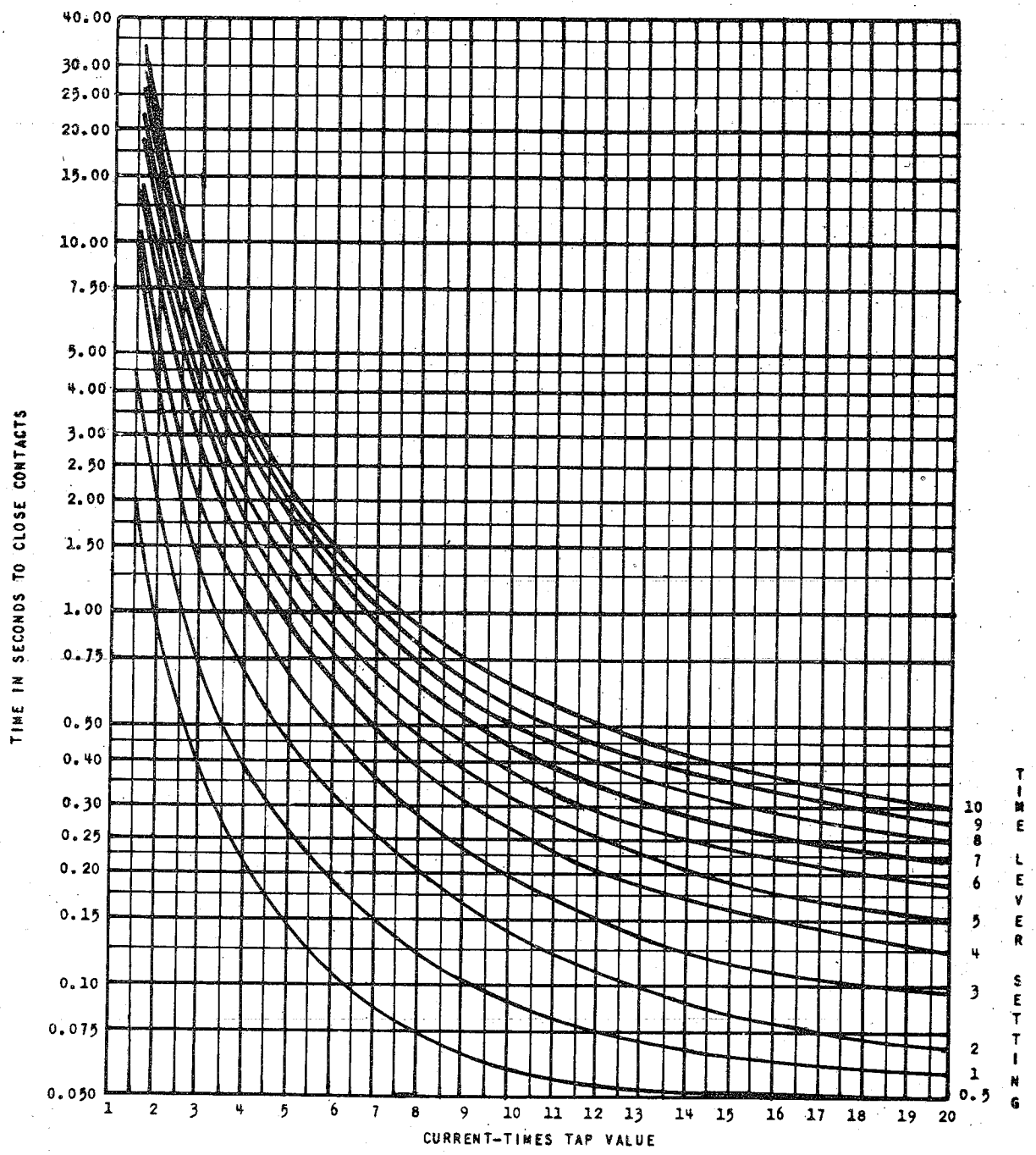


Fig. 3 (K-6375713)

Fig. 3 Time-Current Characteristics of Relay Types ICC29A and ICC29B

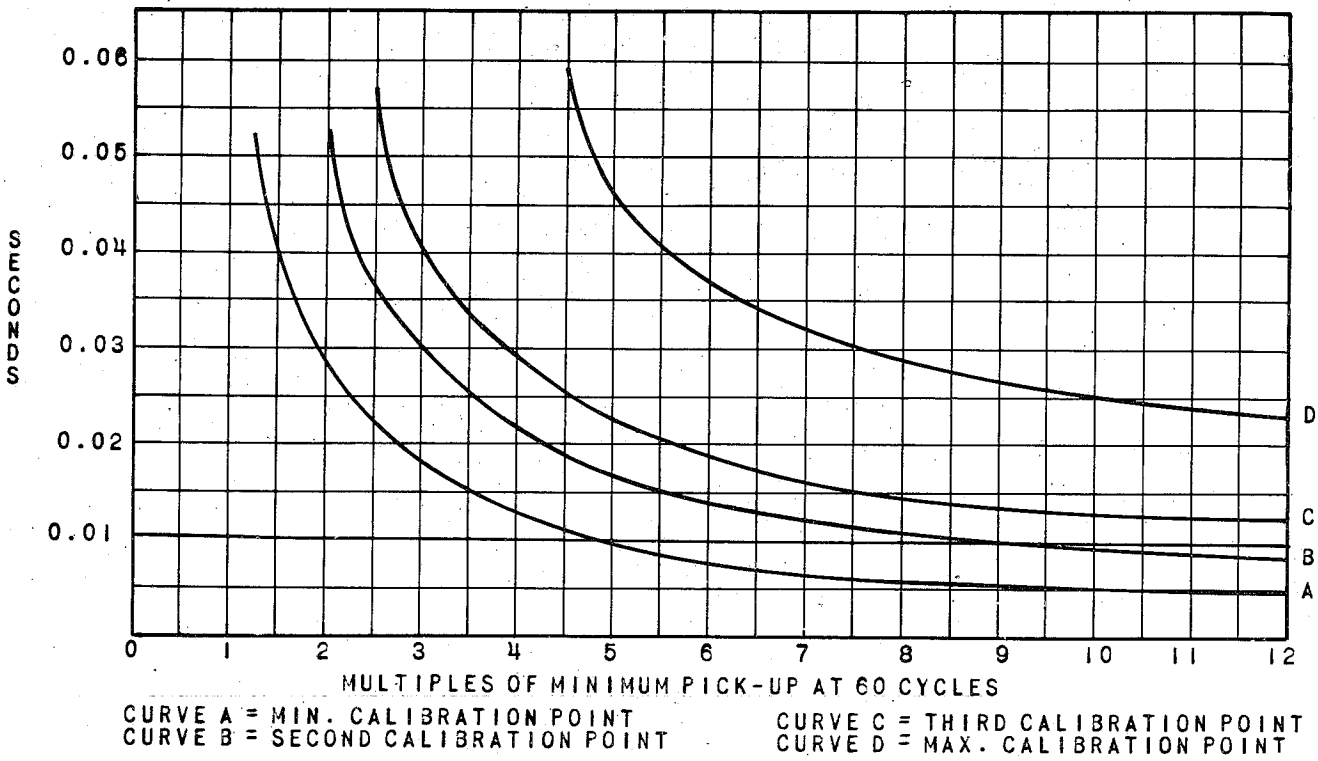


Fig. 4 Time-Current Characteristics For The Instantaneous Unit

This cradle is held firmly in the case with a latch at the top and the bottom and by a guide pin at the back of the case. The cases and cradles are so constructed that the relay cannot be inserted in the case upside down. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews, holds the connecting plug in place.

To draw out the relay unit the cover is first removed, and the plug drawn out. Shorting bars are provided in the case to short the current transformer circuits. The latches are then released, and the relay unit can be easily drawn out. To replace the relay unit, the reverse order is followed.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current and voltage, or from other sources. Or, the relay unit can be drawn out and replaced by another which has been tested in the laboratory.

INSTALLATION

LOCATION

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel diagrams are shown in Fig. 18 and Fig. 19.

CONNECTIONS

Internal connection diagrams for the various relay types are shown in Fig. 7 to 13 inclusive. Typical wiring diagrams are given in Fig. 5 and 6.

One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gage copper wire or its equivalent.

INSPECTION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under "Maintenance".

DEVICE FUNCTION NUMBERS FOR USE WITH EXTERNAL DIAGRAMS

51 - Power Directional Relay, Type Cap

52 - Circuit Breaker

67 - Directional Ground Relay, Type ICC

67X - Auxiliary Relay, Type HGA

a - Auxiliary Contact, Closed When Breaker, is closed.

CC - Current Coil

HC - Target-Holding Coil

PC - Potential Coil

TC - Trip Coil

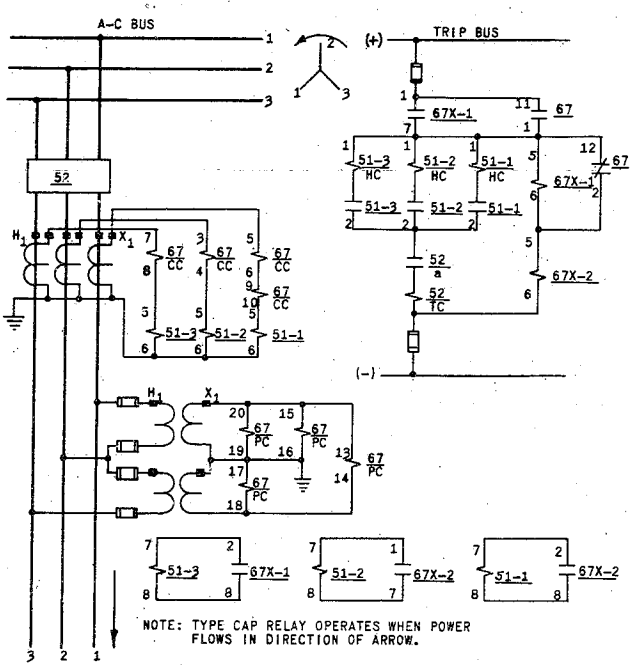


Fig. 5 Directional Overcurrent Protection of a Line Using Three Type ICC21A Relays in Conjunction With One Type CAP Relay and Two Type HGA Relays

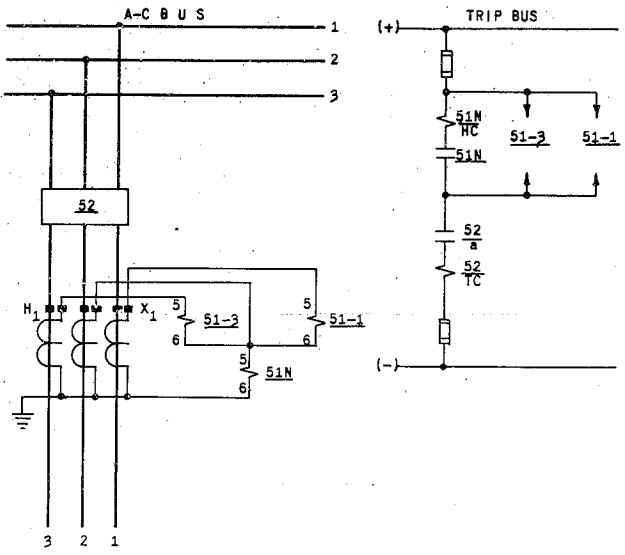


Fig. 6 Protection of a Line Using Three Type ICC29A Relays

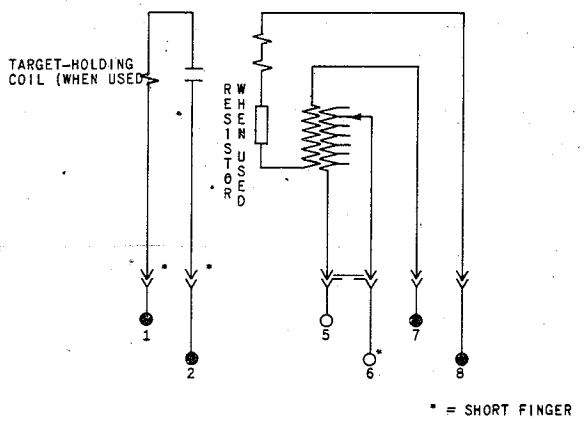


Fig. 7 Internal Connections For Type ICC21A Relay (Front View)

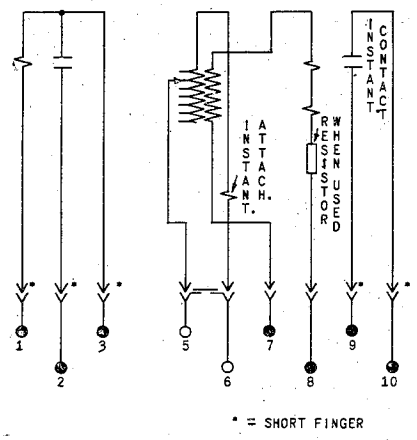


Fig. 8 Internal Connections For Type ICC21B Relay (Front View)

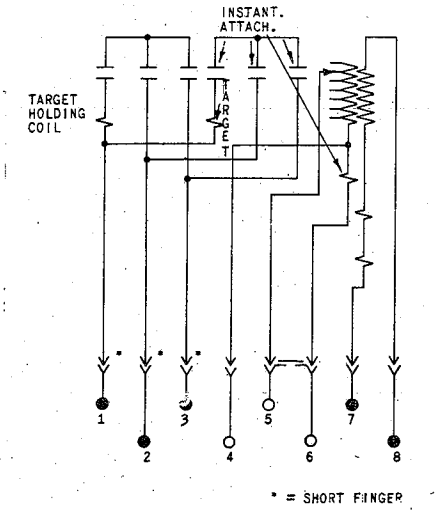


Fig. 9 Internal Connections For Type ICC26B Relay (Front View)

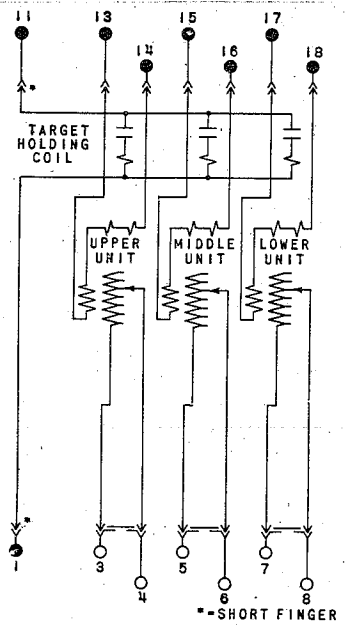


Fig. 10 Internal Connections For Type ICC21C Relay (Front View)

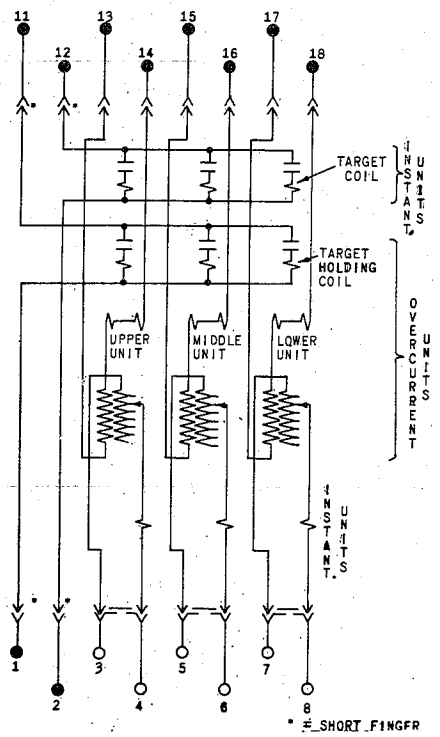


Fig. 11 Internal Connections For Type ICC28A Relay (Front View)

ADJUSTMENTS

CURRENT SETTINGS

The minimum current at which the contacts will just close is determined by the position of the tap plug (or plugs in the case of the Type ICC29A and ICC29B relays) at the top of the relay.

When changing taps with the relay in service, first remove the connecting plug at the bottom of the relay to short the current transformer secondary circuit. Next screw the tap plug (or plugs) into the tap (or taps) marked for the desired current and then replace the connecting plug.

The Type ICC21A, ICC21B, ICC21C, ICC26B, and ICC28A relays have only one tap plate and the minimum operating current corresponds to the setting of the plug in the tap block.

There are two separate tap blocks at the top of the Type ICC29A and ICC29B relays. The right-hand block has two receptacles marked "Multiply by 1" and "Multiply by 2". With the plug inserted in the "Multiply by 1" receptacle, the minimum operating current corresponds to the setting of the plug in the left-hand plate; when inserted in the "Multiply by 2" receptacle, this value is doubled.

TIME SETTING

The setting of the time lever determines the length of time the unit requires to close its contacts when the current reaches the predetermined value. The contacts are just closed when the dial is set on 0. When the dial is set on 10, the disk must travel the maximum amount to close the contacts and therefore this setting gives the maximum time setting.

The primary adjustment for the time of operation of the unit is made by means of the time lever. However, further adjustment is obtained by moving the permanent magnet along its supporting shelf; moving the magnet in toward the back of the unit decreases the time, while moving it out increases the time.

If selective action of two or more relays is required, determine the maximum possible short-circuit current of the line and then choose a time value for each relay that differs sufficiently to insure the proper sequence in the operation of the several circuit breakers. Allowance must be made for the time involved in opening each breaker after the relay contacts close. For this reason, unless the circuit time of operation is known with accuracy, there should be a difference of about 0.5 second (at the maximum current) between relays whose operation is to be selective.

CONTACT ADJUSTMENT

With the contacts just closed, there should be enough space between the contact-holding armature and the poles of the target magnet to permit the fixed contact tips to be deflected about 1/32 inch when the armature is finally pushed against its poles. The tips should lie in the same vertical plane. These adjustments are readily secured by moving each contact brush by means of the screws in the front of the brush block which pushes against it near its center.

When the time lever is moved to the position where it holds the contacts just closed, it should indicate zero on the time-lever scale. If it does not, and the brushes are correctly adjusted, shift the scale slightly after loosening the two small screws holding it to the under side of the contact plate.

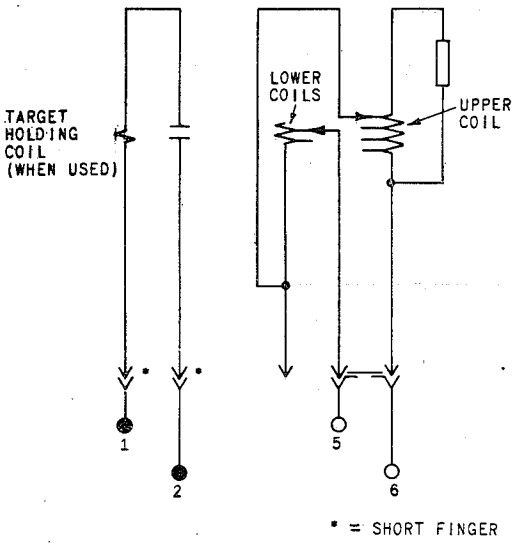


Fig. 12 Internal Connections For Type ICC29A Relay (Front View)

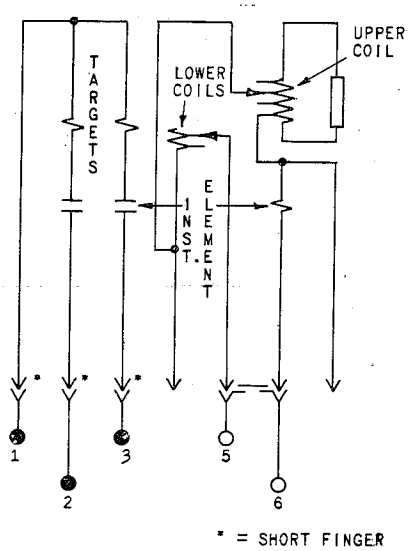


Fig. 13 Internal Connections For Type ICC29B Relay (Front View)

Fig. 13 (K-6375664)

Fig. 12 (K-6375663)

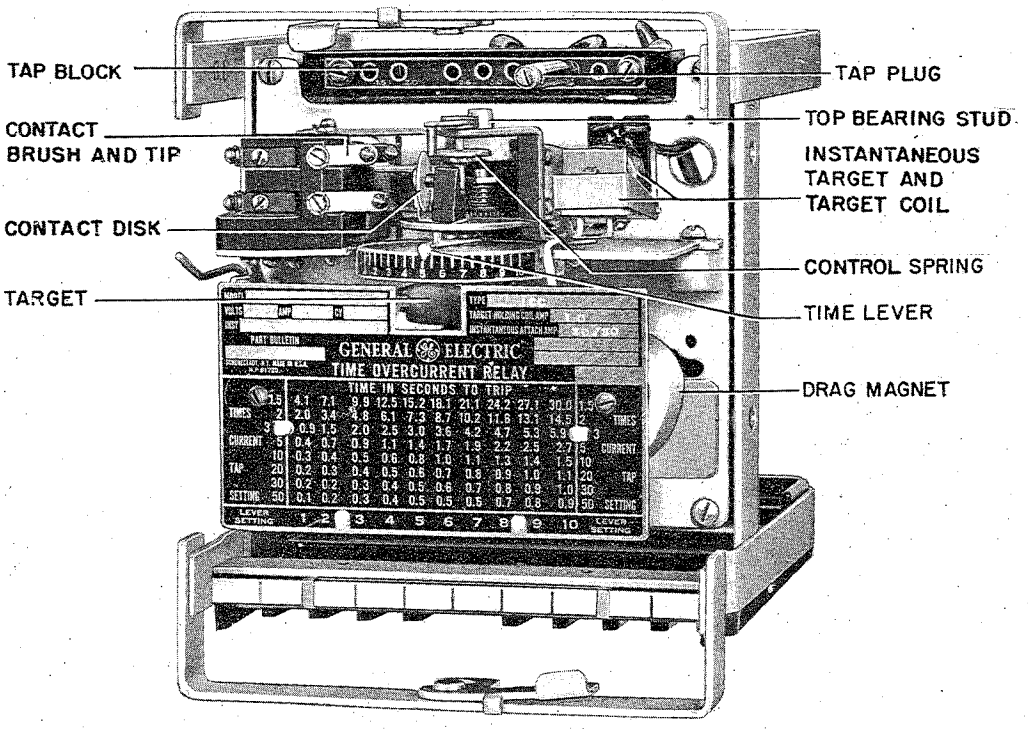


Fig. 14 Type ICC26B Relay in Cradle (Front View)

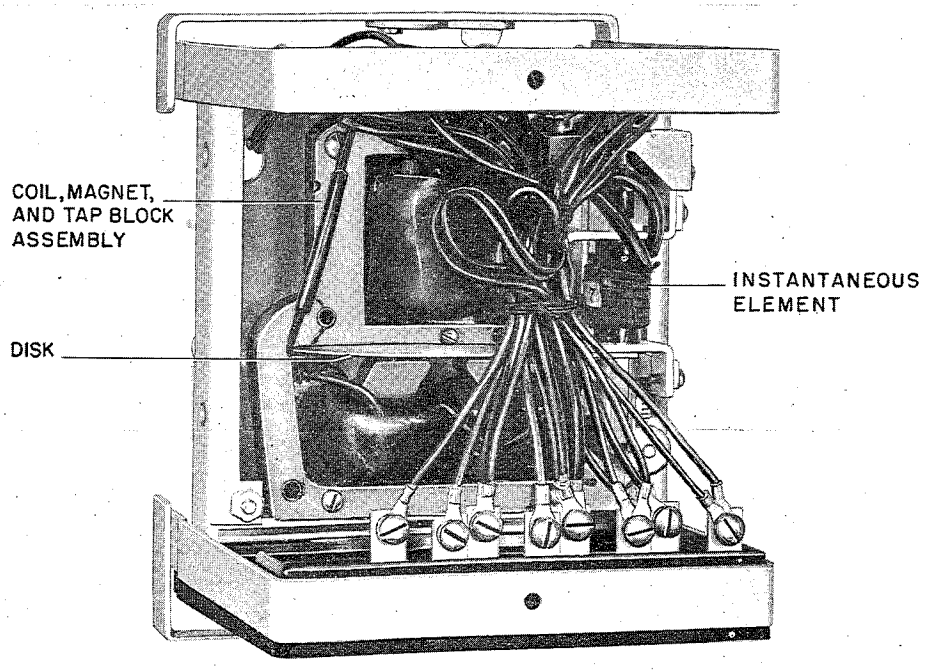


Fig. 15 Type ICC26B Relay in Cradle (Rear View)

OPERATION

The connections to the relay should be checked before it is put into service. Suitable current tap and time lever settings are to be made as described above. The current setting is below that amount necessary to operate the relay and hence, the contacts are held open by the control spring under normal load conditions. No torque can be developed in the relays with very-inverse time characteristics when the contacts of the controlling device are open, regardless of the current magnitude.

MAINTENANCE

The relays are adjusted at the factory and it is advisable not to disturb the adjustments. If, for any reason, they have been disturbed, the following points should be observed in restoring them:

DISK AND BEARINGS

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle. If it is necessary to replace the jewel a new pivot should be screwed into the bottom of the shaft at the same time. A very small drop of General Electric meter-jewel oil, or fine watch oil, should be placed on the new jewel before it is inserted. The jewel should be turned up until the disk is centered in the air gaps, after which it should be locked in this position by the set screw provided for this purpose. The upper bearing pin should next be adjusted until very little end play can be felt between the pin and the steel ball in the recess at the top of the shaft; about .015 inch is correct.

GEAR MESH

The gear and pinion should be meshed as deeply as possible without binding in any position when the disk is rotated. This adjustment is correct when a slight backlash can be felt in all disk positions. The two screws holding the contact mechanism assembly to the relay frame should be tightened securely after this adjustment is made.

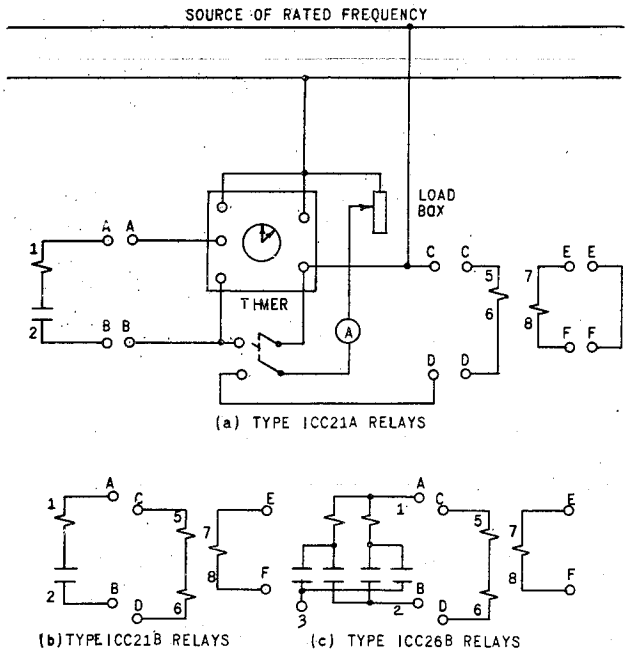


Fig. 16 (K-6154973)

Fig. 16 Testing Connections For Type ICC Relays

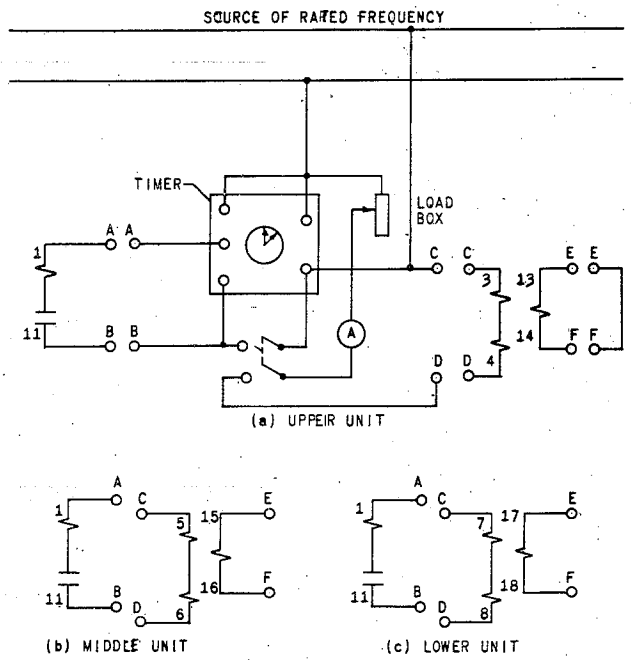


Fig. 17 (K-6375704)

Fig. 17 Testing Connections For Type ICC21C and ICC28A Relay

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact.

Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described above can be obtained from the factory.

TESTS

The tests recommended are those that will determine the pickup and time current values. The minimum operating current required to close the contacts should be within 5 per cent of the values marked on the tap plate. The time values should be within plus or minus 7 per cent of the values shown on the time curves. In making these tests on relays with very-inverse time characteristics, it is necessary to make sure that the secondary of the "transformer coil" (leads 7-8) is short circuited. Test connections for Type ICC21A, ICC21B, and ICC26B are shown in Fig. 16. Test connections for the Type ICC28A relay are shown in Fig. 17. Test connections for the Type ICC29A relay will correspond to those of the Type ICC21A except that the short circuit across terminals 7 and 8 is not necessary. Test connections for the Type ICC29B relay correspond to those for the Type ICC21B except that as in the case of the Type ICC29A, no short circuit across terminals 7 and 8 is necessary.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company requisition number on which the relay was furnished.

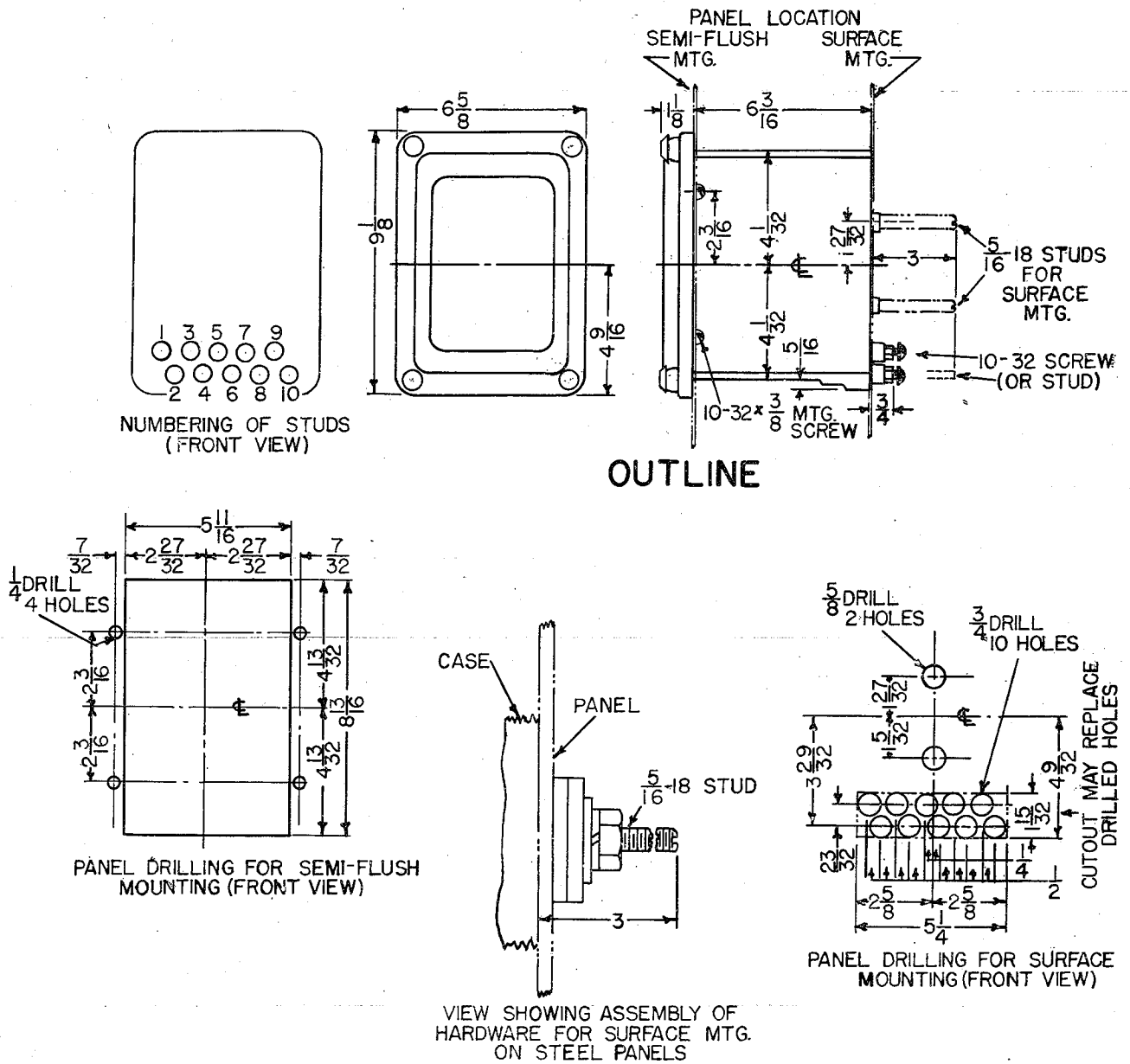


Fig. 18 (K-6209271)

Fig. 18 Outline and Panel Drilling Dimensions for Type ICC21A, ICC21B, ICC26B, ICC29A, and ICC29B Relays

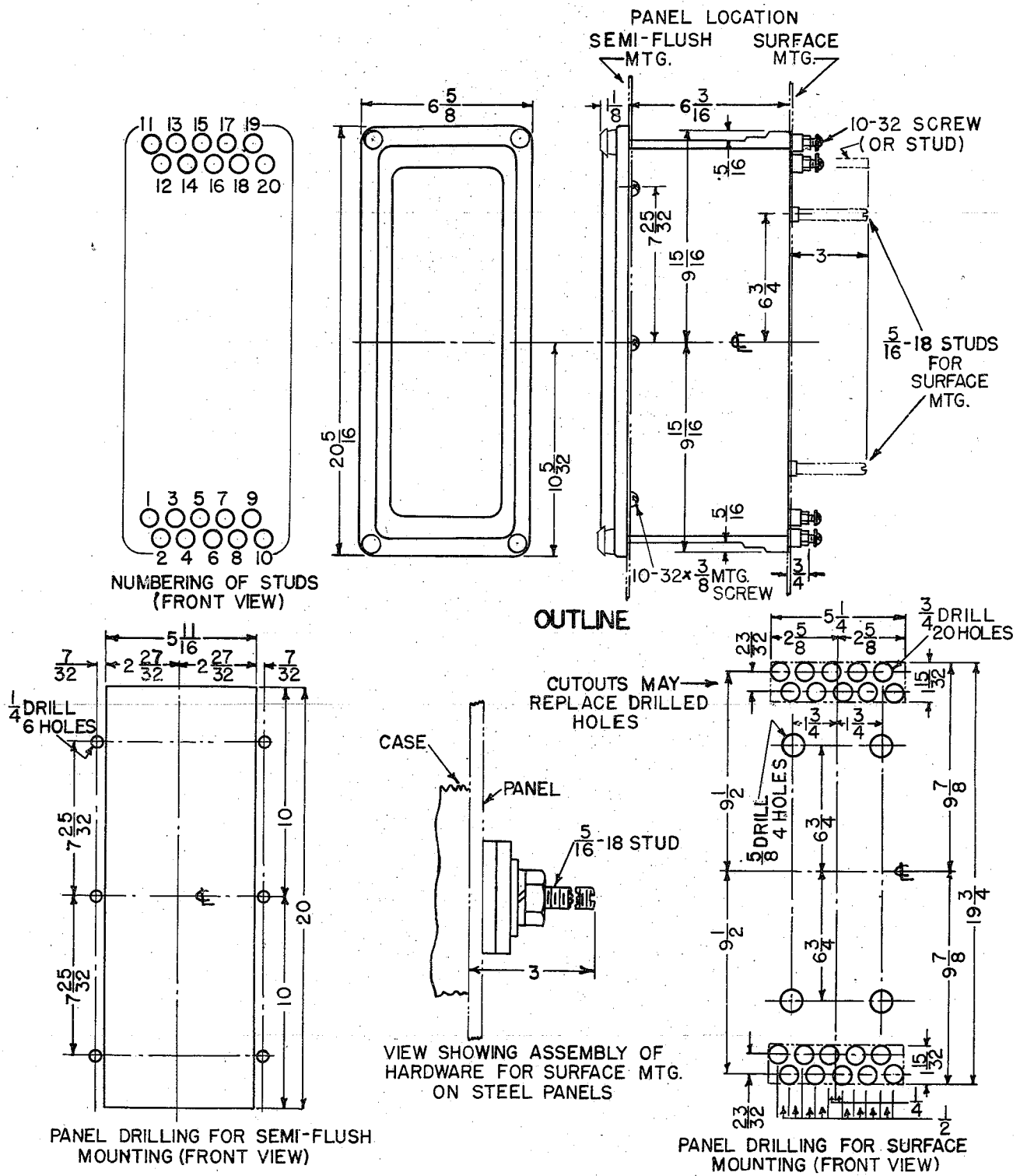


Fig. 19 (K-6209276)

Fig. 19 Outline and Panel Drilling Dimensions for Type ICC21C and ICC28A Relays

IF YOU REQUIRE SERVICE

IF AT ANY TIME you find it necessary to repair, recondition, or rebuild your G-E apparatus, there are 30 G-E service shops whose facilities are available day and night for work in the shops or on your premises. Factory methods and genuine G-E renewal parts are used to maintain the original performance of your G-E apparatus. If you need parts only, immediate shipment of many items can be made from warehouse stock.

The services of our factories, engineering divisions, and sales offices are also available to assist you with engineering problems. For full information about these services, contact the nearest service shop or sales office listed below:

APPARATUS SERVICE SHOPS

Atlanta—Chamblee, Ga. . . . . 4639 Peachtree Indus. Blvd.
*Baltimore 30, Md. . . . . 920 E. Fort Ave.
Boston—Medford 55, Mass. . . . . Mystic Valley Pkwy.
Buffalo 11, N. Y. . . . . 318 Urban St.
Charleston 28, W. Va. . 306 MacCorkle Ave., S.E.
Chicago 80, Ill. . . . . 849 S. Clinton St.
Cincinnati 2, Ohio . . . . . 444 W. Third St.
Cleveland 4, Ohio . . . . . 4966 Woodland Ave.
Columbus 15, Ohio . . . . . 213 Cozzens St.
Dallas 9, Texas . . . . . 3202 Manor Way
Denver 5, Colo. . . . . 3353 Larimer St.
Detroit 2, Mich. . . . . 5950 Third Ave.
Houston 20, Texas . . 5534 Harvey Wilson Drive
Johnstown, Pa. . . . . 841 Oak St.
Kansas City 8, Mo. . . . . 819 E. 19th St.
Los Angeles 1, Calif. . . . . 6900 Stanford Ave.
Milwaukee 3, Wisc. . . . . 940 W. St. Paul Ave.
Minneapolis 1, Minn. . . . . 410 Third Ave., N.
New York 14, N. Y. . . . . 416 W. 13th St.
Philadelphia 23, Pa. . . . . 429 N. Seventh St.
Pittsburgh 6, Pa. . . . . 6519 Penn Ave.
Portland 18, Oregon. . . . . Swan Island
Richmond 24, Va. . . . . 1403 Ingraham Ave.
St. Louis 1, Mo. . . . . 1110 Delmar Blvd.
Salt Lake City 9, Utah . . . 141 S. Third West St.
San Francisco 3, Calif. . . . . 1098 Harrison St.

Seattle 4, Wash. . . . . 3422 First Ave., S.
Toledo 4, Ohio . . . . . 1 So. St. Clair St.
York, Pa. . . . . 54 N. Harrison St.
Youngstown 5, Ohio . . . . . 272 E. Indianola Ave.

*Convenient G-E Renewal Parts Center for-over-the-counter purchases of industrial parts, located at same address.

APPARATUS SALES OFFICES

Akron 8, Ohio . . . . . 335 S. Main St.
Albany 7, N. Y. . . . . 90 State St.
Albuquerque, N. Mex. . . . . 323 S. 3rd St.
Allentown, Pa. . . . . 1014 Hamilton St.
Amarillo, Texas . . . . . 300 Polk St.
Atlanta 3, Ga. . . . . 187 Spring St., N.W.
Bakersfield, Calif. . . . . 211 E. 18th St.
Baltimore 1, Md. . . . . 111 Park Avenue
Bangor, Maine . . . . . 77 Central St.
Beaumont, Texas . . . . . 398 Pearl St.
Binghamton, N. Y. . . . . 19 Chenango St.
Birmingham 3, Ala. . . . . 1804 Seventh Ave. N.
Bluefield, W. Va. P.O. Box 447, Appalachian Bldg.
Boston 1, Mass. . . . . 140 Federal St.
Buffalo 3, N. Y. . . . . 535 Washington St.
Butte, Mont. . P.O. Box 836 103 N. Wyoming St.
Canton 1, Ohio . . . . . 700 Tuscarawas St., W.
Cedar Rapids, Iowa . . . . . 203 Second St., S.E.
Charleston 28, W. Va. . 306 MacCorkle Ave., S.E.
Charlotte 1, N. C. . . . . 200 S. Tryon St.
Charlottesville, Va. . . . . 123 E. Main St.
Chattanooga 2, Tenn. . . . . 832 Georgia Ave.
Chicago 80, Ill. . P.O. Box 5970A, 840 S. Canal St.
Cincinnati 2, Ohio . . . . . 215 W. Third St.
Cleveland 4, Ohio . . . . . 4966 Woodland Ave.
Columbia 1, S. C. . P.O. Box 324 1420 Lady St.
Columbus 15, Ohio . . . . . 40 S. Third St.
Corpus Christie, Texas . . 108½ N. Chaparral St.
Dallas 2, Texas . . . . . 1801 N. Lamar St.
Davenport, Iowa . . . . . 511 Pershing Ave.
Dayton 2, Ohio . . . . . 118 W. First St.
Denver 2, Colo. . . . . 650 Seventeenth St.
Des Moines, Iowa . . . . . 418 W. Sixth Ave.
Detroit 2, Mich. . . . . 700 Antoinette St.
Duluth 3, Minn. . . . . 14 W. Superior St.
Elmira, N. Y. . . . . Main and Woodlawn Aves.
El Paso, Texas . . . . . 109 N. Oregon St.
Erie 2, Pa. . . . . 10 E. Twelfth St.
Eugene, Ore. . . . . 29 W. Eleventh St.
Evansville 19, Ind. . . . . 123 N.W. Fourth St.
Fairmont, W. Va. . . . . 511 Jacobs Bldg.
Fergus Falls, Minn. . . . . 102 W. Lincoln St., P.O. Box 197
Fort Wayne 2, Ind. . . . . 127 W. Berry St.
Fort Worth 2, Texas . . . . . 408 W. Seventh St.
Fresno 1, Calif. . . . . Tulare and Fulton St.
Grand Rapids 2, Mich. . 148 Monroe Ave., N.W.
Greensboro, N. C. . . . . 301-3 S. Elm St.
Greenville, S. C. . . . . 106 W. Washington St.
Hagerstown, Md. . . . . Professional Arts Bldg.
Harrisburg, Pa. . . . . 229 N. Second St.
Hartford 3, Conn. . . . . 410 Asylum St.
Houston 1, Texas . . . . . 1312 Live Oak St.
Indianapolis 4, Ind. . . . . 110 N. Illinois St.
Jackson, Mich. . . . . 120 W. Michigan Ave.
Jackson 1, Miss. . . . . 203 W. Capitol St.
Jacksonville 2, Fla. . . . . 700 E. Union St.
Jamestown, N. Y. . . . . 2 Second St.
Johnson City, Tenn. . . . . 334 E. Main St.
Johnstown, Pa. . . . . 841 Oak St.
Kansas City 6, Mo. . . . . 106 W. Fourteenth St.
Knoxville 08, Tenn. . . . . 602 S. Gay St.
Lansing 68, Mich. . . . . 215 So. Grand Ave.
Lincoln 8, Neb. . . . . 1001 "O" St.
Little Rock, Ark. . . . . 103 W. Capitol Ave.
Los Angeles 54, Calif. . . . . 212 N. Vignes St.
Louisville 2, Ky. . . . . 455 S. Fourth St.
Madison 3, Wisc. . . . . 16 N. Carroll St.
Manchester, N. H. . . . . 875 Elm St.
Medford, Ore. 205 W. Main St., P.O. Box 1349
Memphis 3, Tenn. . . . . 8 N. Third St.
Miami 32, Fla. . . . . 25 S.E. Second Ave.
Milwaukee 3, Wisc. . . . . 940 W. St. Paul Ave.
Minneapolis 3, Minn. . . . . 12 S. Sixth St.
Mobile 13, Ala. . . . . 54 St. Joseph St.
Nashville 3, Tenn. . . . . 234 Third Ave., N.
Newark 2, N. J. . . . . 744 Broad St.
New Haven 6, Conn. . . . . 129 Church St.
New Orleans 12, La. . . . . 837 Gravier St.
New York 22, N. Y. . . . . 570 Lexington Ave.
Niagara Falls, N. Y. . . . . 253 Second St.
Norfolk 10, Va. . . . . 229 W. Bute St.
Oakland 12, Calif. . . . . 409 Thirteenth St.
Oklahoma City 2, Okla. . . 119 N. Robinson St.
Omaha 2, Nebr. . . . . 409 S. Seventeenth St.
Pasco, Wash. . . . . 421 W. Clark St.
Peoria 2, Ill. . . . . 410 Main St.
Philadelphia 2, Pa. . . . . 1405 Locust St.
Phoenix, Ariz. . . . . 303 Luhrs Tower
Pittsburgh 22, Pa. . . . . 535 Smithfield St.
Portland 3, Maine . . . . . 477 Congress St.
Portland 7, Ore. . . . . 920 S.W. Sixth Ave.
Providence 3, R. I. . . . . Industrial Trust Bldg.
Raleigh, N. C. . . . . 336 Fayetteville St.
Reading, Pa. . . . . 31 N. Sixth St.
Richmond 17, Va. . . . . 700 E. Franklin St.
Riverside, Calif. . . . . 3808 Main St.
Roanoke 11, Va. . . . . 202 S. Jefferson St.
Rochester 4, N. Y. . . . . 89 E. Ave.
Rockford, Ill. . . . . 110 S. First St.
Rutland, Vt. . . . . 38½ Center St.
Sacramento 14, Calif. . . . . 626 Forum Building
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San Diego 1, Calif. . . . . 861 Sixth Ave.
San Francisco 6, Calif. . . . 235 Montgomery St.
San Jose, Calif. . . . 409 Bank of America Bldg.
Savannah, Ga. . . . . 4 E. Bryan St.
Seattle 4, Wash. . . . . 710 Second Ave.
Shreveport 90, La. . . . . 803 Jordan St.
Sioux City 13, Iowa . . . . . 507 Sixth St.
Sioux Falls, S. D. . . . . 321½ S. Phillips Ave.
South Bend 11, Ind. . . . 112 W. Jefferson Blvd.
Spokane 8, Wash. . . . . S. 162 Post St.
Springfield, Ill. . . . . 607 E. Adams St.
Springfield 3, Mass. . . . . 1387 Main St.
Stockton, Calif . . . . . 11 So. San Joaquin St.
Syracuse 2, N. Y. . . . . 113 S. Salina St.
Tacoma 1, Wash. . . . . 1019 Pacific Ave.
Tampa 6, Fla. . . . . 1206 North A St.
Toledo 4, Ohio . . . . . 420 Madison Ave.
Trenton 8, N. J. . . . . 214 E. Hanover St.
Tulsa 3, Okla. . . . . 320 S. Boston Ave.
Utica 2, N. Y. . . . . 258 Genesee St.
Washington 5, D.C. . . . 806 Fifteenth St., N.W.
Waterbury 89, Conn. . . . . 111 W. Main St.
Waterloo, Iowa . . . . . 206 W. 4th St.
Wheeling, W. Va. . . . . 40 Fourteenth St.
Wichita 2, Kan. . . . . 200 E. First St.
Williamston, N. C. . . . . City Hall
Wilmington, Del. . . . . 1326 N. Market St.
Worcester 8, Mass. . . . . 507 Main St.
York, Pa. . . . . 56 N. Harrison St.
Youngstown 5, Ohio . . . . . 272 E. Indianola Ave.

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APPARATUS DEPARTMENT, GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

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