INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

RECORDING KVA DEMAND METERS
(TYPES RI-2, RI-3, RI-4, RI-6, RI-7, RI-8, RI-9, RI-10, RI-32, RI-38)

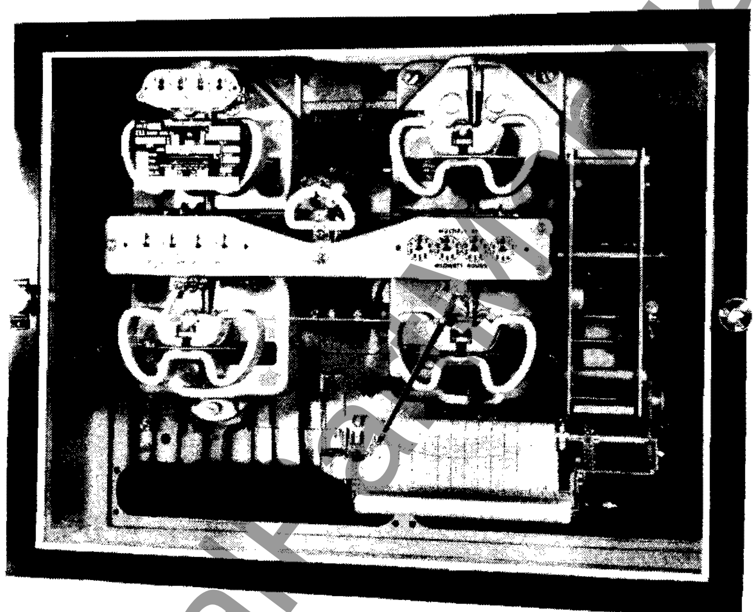


Fig. 1—Type RI-2 Recording KVA Demand Meter.

INTRODUCTION

Type RI recording Kva meters provide readings of Kwh, Kvarh, and Kvah, a record on one chart of Kw and Kva demand, and an indication of power factor. Power factor for any time interval such as the time of maximum demand and average monthly power factor may be computed from the chart.

RI meters have two sets of identical standard watthour meter elements. One measures true watts, the other is connected through an external phase shifting transformer to measure vars (reactive component). The meter contains a ball-type differential mechanism arranged to add the motions of the two meter elements vectorially and thereby drive a demand register in proportion to the vector sum of the kilowatts and kilovars. When used on 2-phase circuits, no phase-shifting transformers are necessary.

The Kva demand record is made graphically upon a strip chart by a pen driven from the ball. Its rate of movement across the paper is proportional to the total Kva in the metered circuit. The Kw demand is obtained by means of a "stop" driven by the Kw gears train. At the end of the time interval, the pen is disengaged from the Kva gears and falls back until arrested by this "stop". It pauses momentarily and then is reset to zero. As the paper chart is moving during this "resetting period", distinct vertical marks are made at both the Kva and Kw demand points.

The clock mechanism which trips the pen and advances the paper may be any one of three types as follows: (1) all-electric operation in which a synchronous motor determines the time interval and winds up a spring which when tripped by the interval mechanism trips the pen and advances the chart; (2) a clock in which a synchronous motor determines the time interval and a separate hand-wound spring mechanism trips the pen and advances the chart; (3) a mechanical unit in which a 35-day hand-wound clock determines the time interval and a separate hand-wound mechanism trips the pen and advances the chart. All of these clocks are interchangeable.

APPLICATION CHART

TYPE	NUMBER OF ELEMENTS	CIRCUIT APPLICATION
RI-2	2	3-phase, 3 wire or 2-phase, 3 or 4 wire
RI-3	3	3-phase, 4 wire wye
RI-4	3	Totalizing 1-phase, 2-wire and 3-phase, 3-wire
RI-6	3	Totalizing 1-phase, 3-wire and 3-phase, 3-wire
RI-7	2	3-phase, 4-wire delta
RI-8	2-1/2	3-phase, 4-wire wye
RI-9	3	3-phase, 4-wire delta
RI-10	2	2-phase, 5 wire
RI-32	4	Totalizing two 3-phase, 3-wire circuits.
RI-38	4	Totalizing two 3-phase, 4-wire wye circuits.

INSTALLATION AND OPERATING INSTRUCTIONS

The RI meter is designed to be either front or rear connected. As received, it is adapted for front connection. However, brass studs are included, which, when screwed into the terminals on the back of the meter, convert it into a rear connected meter suitable for mounting on a switchboard or any panel where the wiring is from the rear. Outline and drilling plans are shown in figs. 9 to 15.

The meters are furnished with 15, 30, and 60 minute intervals. Current capacities of 2.5, 5, 15 and 50 amperes and voltage ratings of 120, 240 and 480 volts are supplied. The meter may be supplied to have chart full scale equal to either 150% or 100% nominal full load. The 2.5 and 5 ampere meters have direct reading charts and registers but a multiplier must be used for all indications on higher rating meters.

The meter is manufactured in the types described in the table below.

Mount the meter taking care to have it level. It is best to place the level on the top edges of the register. Connect according to the appropriate diagram of Figs. 16 to 31.

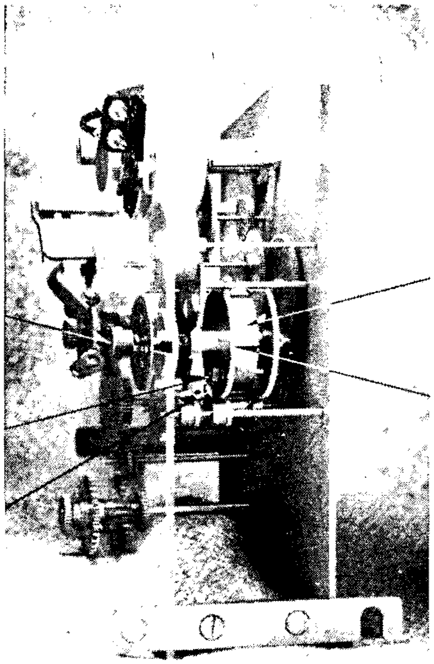


Fig. 2—All Electric Clock-View of Mechanism.

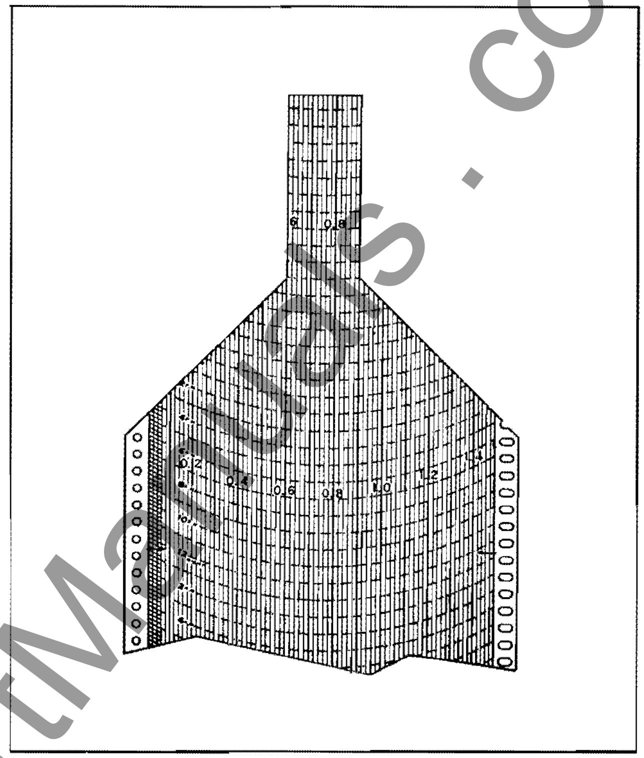


Fig. 3—Suggested Method for Trimming Leading End of Paper Chart when Starting.

Remove the cord and paper used to secure the inkwell, chart and pen, ball carriage and discs. Place the Kva ball carefully on carriage. Handle with care. If ball is accidentally dropped or otherwise damaged, replace with a new one.

If the meter has an all-electric clock; check the operation as follows: The spring (Fig. 2) should have one and one-half turns tension just after tripping. If this condition has been disturbed, restore it as follows before putting the meter in operation. Pull the latch arm down and allow the spring to run down. Turn the knob "DD" slowly until the stop pin on the gear is in a neutral position just behind the trip latch. Then hold the spring gear and turn knob "DD" 1-1/2 turns. Release the spring gear so that the stop pin is held by the latch arm. Reset pointer on zero and turn the knob "DD" one revolution to check operation.

If the meter has a hand-wound clock wind the springs and start the clock. The main spring used to determine the time interval should be wound every month. The main spring which advances the chart should be wound according to the following schedule. This also applies to those clocks which have a synchronous motor interval mechanism but a spring driven tripping and chart advancing mechanism.

Interval of Meter

15 minutes - every 15 days
30 minutes - every 15 days
60 minutes - every 60 days

The regulation of the spring driven clock is accomplished in the usual manner, by moving the small arm of the escapement mechanism toward "F" or "S" as marked.

Before inserting a new roll of chart paper cut the end as per Fig. 3. Slide the roll endwise over the spindle "W" (Fig. 7) and bring the ends under the guides and over the roll "N". Loosen lock-nut "U" to allow roll "N" to turn freely. Slide the end of the paper into the slot in spool "X" and take several turns on this spool. See that the edges of the paper do not bind under the guides nor rub against the sides of the metal frame holding the spool and that the pins of the roll "N" fit into perforations along the edge of the paper without tearing. The paper must lie tight against the roll.

Remove small ink bottle and well. Fill bottle with ink supplied. Other inks may evaporate too quickly and clog the pen.

Fill the pen and start the ink flowing by moving the fine wire back and forth through the pen tip until ink appears on it. The wire must be removed during normal operations. Flow is best started in a "V" type pen by inserting a razor blade in the "V" and drawing it back and forth until flow is started.

Adjust zero as follows: Press the bell crank "H" (Fig. 7), allowing the pen to trip. If it does not reach zero, first determine whether it has been stopped by the kw stop "19" under the right side of the cross arm holding the pen. If it has, turn the kw worm, "A" to move the stop away from this arm. Then turn the corresponding worm "Aa" on the kva (left) side so that the pen rests on zero with the bell crank "H" held in the tripping position and turn worm "A" so that pin "G" is just in contact with sector "V". If the pen does not return to zero, but can be moved there by hand, move weight "C" further out on the cross arm. This weight should be set to make the pen return to zero even if the deflection was small. On the other hand, it should not be set in such a way that the pen returns with excessive speed from large deflections. The worms "A" and "Aa" actually move the gears with pins "G" and "Ga" which are stopped by sectors "V" and "Va".

Check the zero setting as follows: Run the kvar disc alone enough revolutions to bring the pen up to the first fine line on the chart. This is equal to 1/5 of the revolutions as determined in "Checking Correct Demand Registration" Section on page 5. Loosen the thumb nut "U" and move the chart slightly to draw a line. If the pen is not exactly on the chart line turn worm "Aa" until this is accomplished. Recheck by tripping the pen and running the required number of revolutions again.

It may be observed that there is a slight variation in the zero setting on successive resets. The amount of the variation depends on the capacity and interval of the meter and is unavoidable since on re-engagement, the worm wheel does not mesh in exactly the same way with the worm on each reset. By making several checks the best compromise can be established.

Check the kw setting in the same manner as follows: First demesh the kva gearing by loosening the thumb screw "Z" (this screw has a left hand thread) and moving the interval wheel "Y" so that the trip arm "H" is on top of one of the small wheels. Then run the kw disc the same number of revolutions as above. Move the chart and if the pen is not exactly on the chart line readjust worm "A".

Check that the pen makes distinct vertical marks at the end of the pen stroke and at the Kw demand point. Hold the bell crank in and then move the pen to a point near full scale and move the "Kw stop" to some point below. Then trip the clock and observe the action. If unsatisfactory loosen the thumb screw "Z". (This screw has a left hand thread). Turn the interval wheel "Y" so that the trip lever is about half-way between the large and small rollers. Tighten thumb screw "Z" and recheck the operation.

With the meter elements being driven, check for correct operation as follows:

a. With both elements rotating at the same speed forward to the right, the P.F. pointer should indicate 70.7% lag.

b. With the reactive meter at rest, the P.F. Pointer should indicate 100%.

c. With the watthour meter at rest and the reactive meter rotating forward the indication should be 0% lag.

d. With both meters rotating at the same rate but with the reactive meter reversed, the indication should be 70.7% lead.

Calibration Adjustments

There are four basic adjustments which may be made. On two and three-disc meters the adjustments are as follows:

Full load- moving iron discs above disc gap to the left increases meter speed and vice versa.

Light Load- Moving the screw at the left of the frame and below the disc in the clockwise direction increases meter speed and vice versa. (F in label indicates fast).

Phase Balance- Turning the screw at the left of the frame and above the disc, moves the balance plate in or out of the electromagnet. Moving the plate out decreases torque.

Power Factor- Increasing the resistance of the loop mounted beside each electromagnet increases speed and vice versa. The loop is closed with a soldered joint and resistance is increased by closing the loop closer to the end of the wire.

On four disc meters, the adjustments are the same except for the following:

Full Load The keeper is located below the disc gap and must be turned to the right to increase speed.

Light Load The adjustment screws are similar to those of the two and three element meters but are located alternately to the right and left of the frame. Those on the right are turned counterclockwise and those on the left are turned clockwise to increase speed.

Phase Balance - The phase balance adjusters are accessible from the front of the meters. Turning them counterclockwise increases speed.

Checking Correct Demand Registration of All Scale Points.

The demand indication may be checked by noting the advancement of the pen for a definite number of disc revolutions. It is recommended that only the Kw side of the meter be operated first and that the Kva gearing be demeshed. By means of the following formula the number of disc revolutions between main chart division lines (.1, .2 etc.) can be computed.

$$\text{KW Disc Revolutions Between Main Chart Lines} = \frac{25 \times (\text{Interval in Minutes - 15, 30 etc.})}{\text{Number of Main Division Lines to Full Load.}}$$

For example the RI-2, 120 volt, 5 ampere, 15 minute interval, full scale equal to 150% of full load meter, has a chart with full scale equal to 1.5 Kw and 15 main division lines (at .1, .2, .3, etc. to 1.5). The number of main division lines to full load (1.0 Kw) is 10.

Using the above formula,

$$\text{KW Disc Revolutions Between Main Chart Lines} = \frac{25 \times 15}{10} = 37.5$$

37.5 would also be the correct number for a similar meter in which full scale equals full load since there would still be 10 main division lines to full load. For easy reference full load is always marked on the name plate. This formula is applicable to all meters.

To check the Kva-gearing it is best to operate the Kw and Kvar elements at the same speed by connecting them directly in parallel. When this is done the formula becomes:

$$\text{Disc Revolutions Between Main Chart Lines} = \frac{.707 \times 25 \times (\text{Interval in Minutes})}{\text{Number of Main Division Lines to Full Load}}$$

If there is a constant relation between the speed of the Kw and Kvar discs even though they are not the same, the deflection for a given number of revolutions may be computed.

Placing Chart in Synchronism

To set the chart in synchronism with actual time, turn the pointer on the calibrated dial (See item "CC" - Fig. 7) on the side of the clock until the escapement is released, allowing the chart to advance and the pen to trip. Then stop the discs of the meter and the motor (or mechanical clock by blocking the gear driving the escapement with a piece of paper). Loosen thumb screw "U" on the clock shaft which drives the chart, allowing the chart to be advanced freely. Rotate the chart until the pen is at the point where the present interval should have started and tighten the thumb screw. Set the pointer on dial "CC" to the number of minutes which have elapsed since the time indicated on the chart. Then allow the clock (or timing motor) and meter discs to operate.

An example may make this clearer. Suppose the meter had a 15 minute interval and that it is 10:20 A.M. It is desired to start the next time interval at 10:30 A.M. First, the pen is tripped as described. Then the timing motor and meter discs are stopped. Next, the chart is advanced as described, so that the pen rests on the 10:15 A.M. point. The pointer is then set to indicate 6 minutes if the time is 10:21 (10:21 - 10:15), 7 minutes if it is 10:22 etc...... and the meter discs and the motor are allowed to start.

MAINTENANCE

General

All RI registers should be given a periodic cleaning. The frequency of the servicing varies according to the conditions to which the device is subjected.

It is not possible to specify in a general instruction leaflet any rigid rules to govern time intervals between servicing or inspections. The conditions in application are so variable that dependence must be placed upon the expereince and judgement of the local operators.

The register should be removed from the meter and the gearing cleaned with a good grade of clock cleaning fluid. It should be dried thoroughly after cleaning. The register requires no lubrication.

The meter elements are serviced in the usual manner for watthour meters.

With the exception of the motor and clock gear train all of the moving parts on these meters operate at low speeds and with practically no mechanical load. They, therefore, require very little lubrication. The motor bearings are lubricated at the factory. Motor maintenance is described in a separate publication "Demand Motor Maintenance Manual" which is available upon request. Also, complete repairing and overhauling service is available at the factory.

Add a trace of oil S#935736 to the shaft bearings in the clock.

Changing Interval or Meter

Both the clock and the register must be changed in changing the interval of a meter. 15 min. clocks may be converted to 30 minute clocks and vice versa, by the removal or addition of one large and one small roller on the wheel "Y". To convert to or from 60 minute

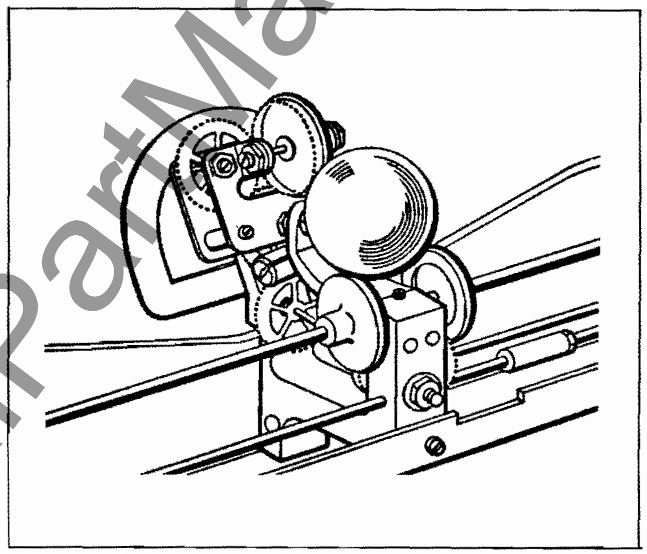


Fig. 4—Ball Type Differential Mechanism.

interval clocks requires in addition a gearing change. A change in register gearing is involved in all interval changes.

PRINCIPLE OF OPERATION

Ball Mechanism

The ball mechanism is shown in detail in Fig. 4. Two horizontal shafts are driven by the meter elements. As shown in Fig. 5, these shafts terminate in driving discs which are located so that the lines from the center of the ball to the two points of contact are at

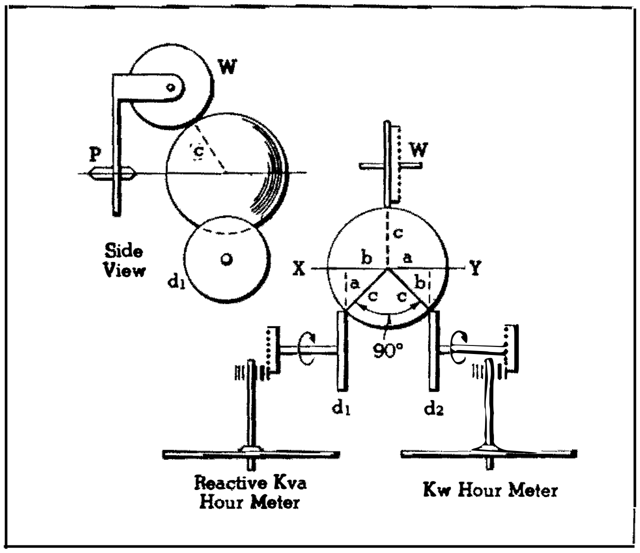


Fig. 5—Action of Ball Mechanism at 70.7% Lagging Power Factor.

90 degrees from each other. This gives the ball a resultant motion which it in turn transmits to the driven disc shown at the top. This driven disc is swiveled in jewel bearings to follow the vectorial direction of the surface of the ball. It, in turn, drives the Kva demand mechanism of the register. Figs. 5 and 6 define this action.

The driving discs "d_1" and "d_2" cause the ball to rotate about the axis, "X-Y", the position of this axis being determined by the relative speeds of the driving discs. The speed of the ball is equal to the vector sum of the disc speeds. The driven disc (being pivoted) shifts its angular position according to the power factor. Thus, by the addition of a pointer and a stationary dial marked according to the cosines of the angles, power factor indication is obtained.

It is evident that if the watthour and reactive meters are rotating forward at equal speeds... the condition at 70.7% lagging power factor... the two discs, "d_1" and "d_2" run at equal speeds and the ball will rotate about a horizontal axis, "X-Y", in the plane of the paper. If we draw a radius, "a", from the disc "d_1" perpendicular to the axis, "X-Y", and a radius "b", from the point of contact of "d_2", radii "a" and "b" will then be proportional to the speed of the watthour and reactive meters. The wheel "W", rotates at a speed proportional to the radius, "c", which is somewhat greater than "a" or "b". It is evident that the two triangles, "a-b-c", are equal, and it can be proved that they are equal at all power factors. Since "a-b-c" is a right triangle, $c = \sqrt{a^2 + b^2}$...the vector sum of "a" and "b", the integrated motion of "W" is then the vector sum of the motions of the watthour and reactive meters, and is equivalent to Kva-hours. The wheel, "W" is mounted in a frame which moves about the axis perpendicular to the frame in which "X-Y" moves, and the axis would, if extended, pass through the center of the ball. As the axis, "X-Y" shifts, the wheel, "W" takes a position so that it always rolls on a great circle with a speed proportional to the radius "c".

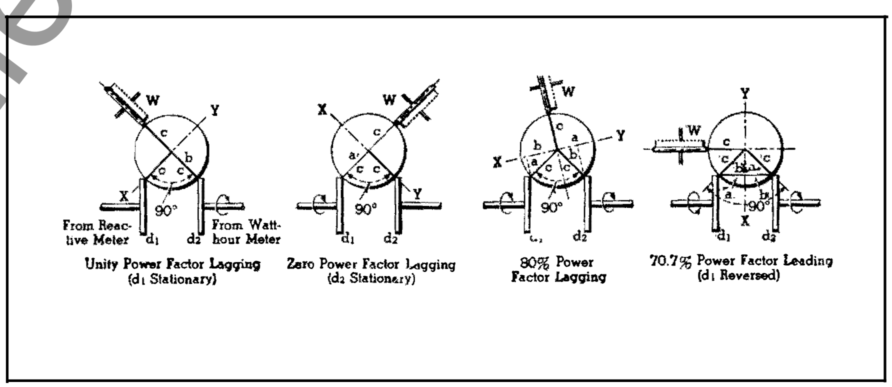


Fig. 6—Action of Ball Mechanism at Various Power Factor Values.

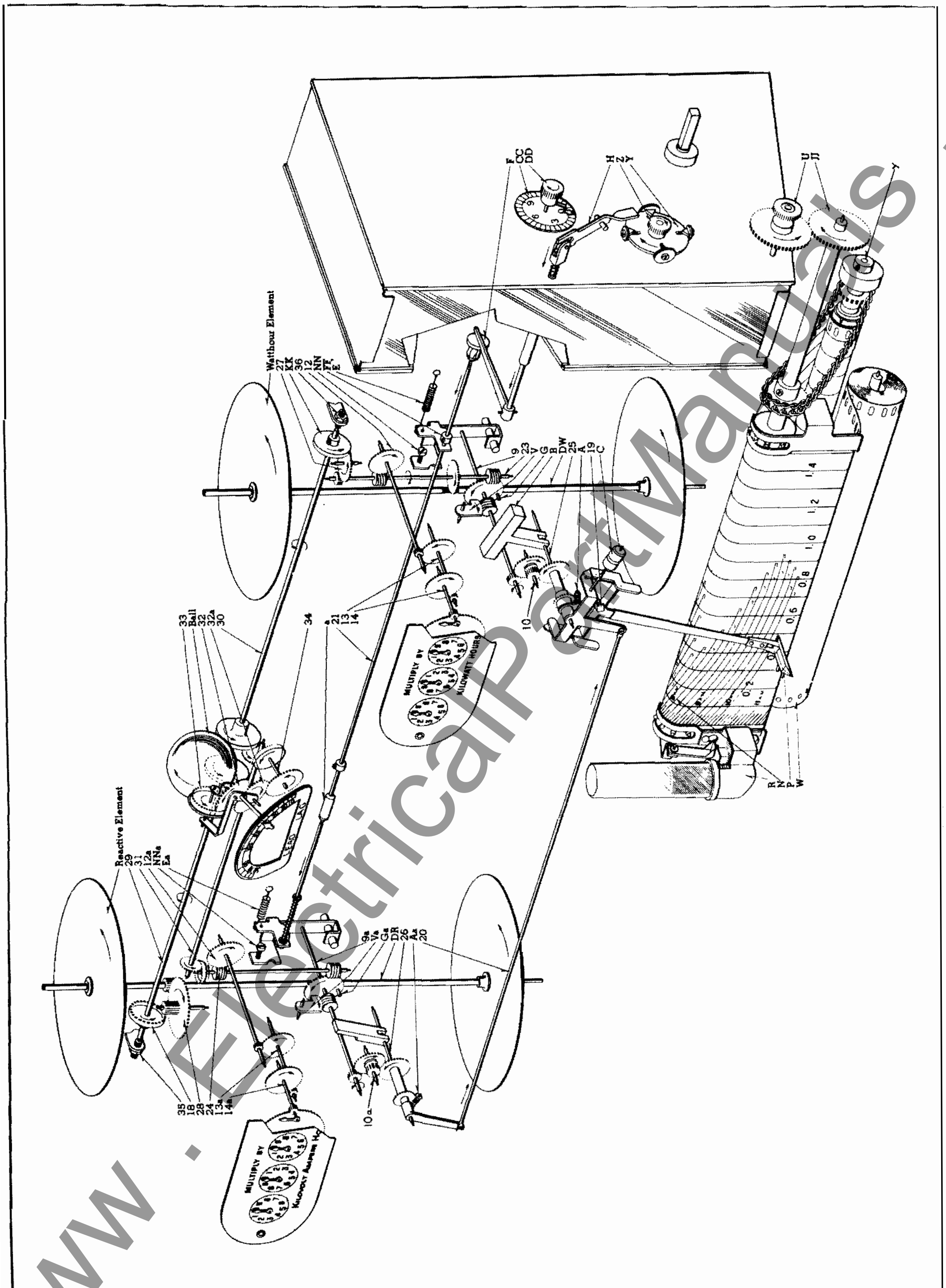


Fig. 7—Type RI-2 Meter — Perspective View of Mechanism (KVARH Register not Shown).

Details of Operation

Fig. 7 shows the actions of the various parts of the meter mechanism. Under load the disc shaft DW (right hand side) drives:

a. The watthour register through shaft assemblies 23, 12, 13 and 14.

b. One side of the ball through shaft assemblies 23, 27, and 30.

c. The stop 19, which determines the Kw demand record on the paper, through shaft assemblies 23, 9, 10 and 25.

At any other than unity power factor, the disc shaft DR (left hand side) also rotates and drives:

a. The Kvarh register (not shown).

b. The other side of the ball through shaft assemblies 28 and 29.

Wheel 33 supports the ball at a third point, is driven by it and through gearings 32, 32a, 34, 31, 24, 12a, 13a and 14a records the total kilovolt-ampere hours on the Kva register. The pen is driven through the additional shaft assemblies 9a, 10a, and 26 and connecting rod 20.

At the end of the time interval the tripping latch "H", pushing against the tripping rod "F", first moves the cradle which carries one end of the shaft 9a and disengages the wormwheel of shaft 9a from the worm on shaft 24 and allows the pen to fall back until arrested by the kilowatt stop 19, which has not, as yet been disengaged; the pen is held here momentarily until the rod "F" moves far enough to disengage the wormwheel on shaft 9 from the worm on shaft 23 allowing the pen to reset to zero.

The weight of the pen and pen-arm is counterbalanced by weight "B" and the adjustable weights "C" which return it to the zero position when its driving gears are disengaged.

When falling to the zero position, the rotation of the worms on shaft 9 and 9a moves the swinging sectors "V" and "Va" against which the pins "G" and "G_a" eventually strike and thus limits the backward movement of the pen. When the pressure on the rod "F" is relieved springs "E" and "Ea" remesh the pen mechanism.

At the proper time interval the reset wheel "Y" is rotated one-half turn, causing a movement of bell-crank "H" and a consequent tripping of the pen. Two rollers on wheel "Y" set at 90° to each other actuate the bell crank. The first always actuates the Kva mesh and the second (larger then the first) releases the Kw mesh on shaft 9. Just before the pen begins to fall back, however, the gear "JJ" rotates and advances the paper.

The paper chart unrolls from spindle "W" passes upward over the face of the roll "N" and rerolls on the belt driven spool "X".

ACCESSORIES

Ratchets

Ratchets are supplied to prevent reverse rotation of either Kw or Kvar shafts individually in case of reversal of power flow or change from lagging to leading power factor. A double ratchet is also supplied to prevent reverse rotation of both shafts in case of reversal of power.

The single ratchet gears are applied on the 23 and 29 shafts for the Kw and Kvar sides respectively. It is necessary to remove these shafts and slip and gear on the ends. The pawl assembly is clamped on the register frame.

The double ratchet assembly (Fig. 8) is fastened by two screws to the back of the ball mechanism support. The 29 and 30 shafts must be removed from the register and the crown gears removed from the shaft so that the two loose gears supplied can be slipped on these shafts. Align these gears with those on the ratchet assembly and tighten them.

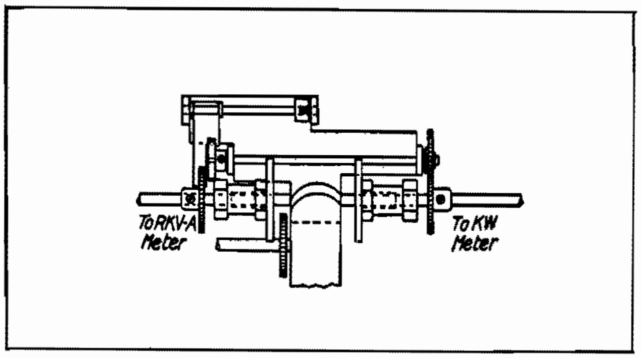


Fig. 8—Double Ratchet (Rear View).

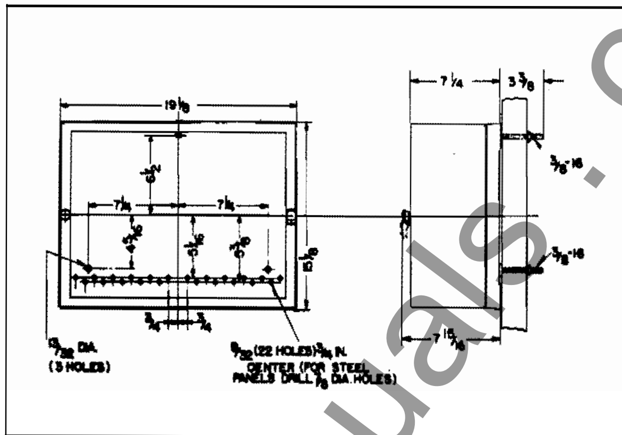


Fig. 9—Outline Dimensions. Types RI-2, -7, -8, -10 Meters with Stud Covers.

Alarm Contacts.

Alarm contacts are provided for the Kw side only. The assembly is mounted onto the rear of the register and the sector meshes with the gear on the 25 shaft.

Heaters

Heaters are provided for operation under low temperature conditions. Bases are drilled for the mounting of these units and they are wired as shown in the connection diagrams.

Phase-Shifting Transformers

Internal connections of the phase-shifting transformers are shown in detail in the wiring diagrams.

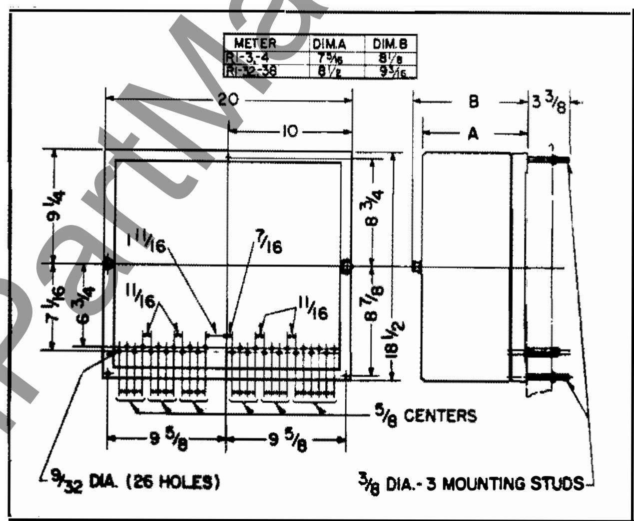


Fig. 10—Outline Dimensions, Types RI-3, -4, -6, -9, -32, -38 Meters with Stud Covers.

REPAIRS AND RENEWAL PARTS

Where facilities are limited or where only a small number of meters are used, it is recommended that the meters be returned to the factory for repairs. When returning a meter for repairs obtain a Returned Material Tag from the District Office so as to avoid delay in identifying the shipment.

When ordering renewal parts, give the entire nameplate reading. Always give the name of the part wanted. Check Renewal Parts Data 42-414 for aid in identifying parts.

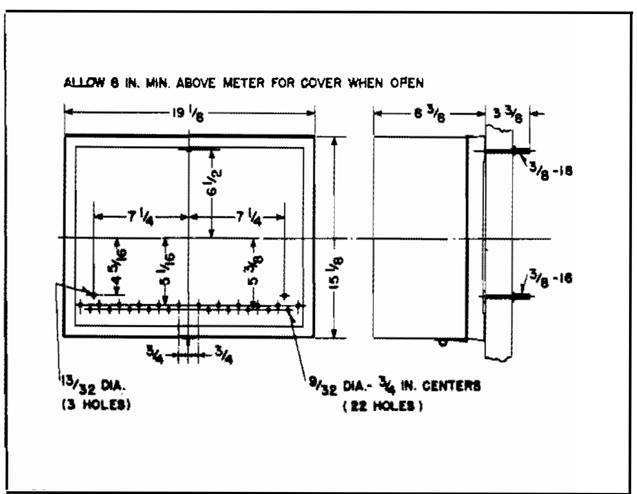


Fig. 11—Outline Dimensions, Types RI-2, -7, -8, 10 Meters with Hinge Covers.

GENERAL NOTES

The data on this page is typical and is based on Type RI-2, 5-ampere, 120-volt, 60-cycle meters.

REGISTER AND CHART DATA

Register ratio (R_r) = 3,000.
Gear ratio (R_g) = 15,000.
Test constant (K_t) = 2,400.
Pinion on disc shaft, right-hand—12 teeth.
Pinion on disc shaft, left-hand—24 teeth.
Gear on first shaft in register, right-hand or kw-side—60 teeth.
Gear on first shaft in register, left-hand or reactive-side—120 teeth.
Full-load of demand chart—1 kw.
Full-scale of demand chart—1.5 kw. (or 1 kw).

METER DATA

RPM at 500 watts per element—25.
Watthour constant (K_h) = 2/3.

BURDENS
Values given are for a single element at rated current and voltage (120-volt basis)

	Volt-Amperes	Watts	Vars	% P. F.
RI-2, RI-3, RI-4, RI-6, RI-7, RI-8				
Current Coil	.59	.26	.53	44
Potential Coil (KW side)	13.8	2.5	13.8	18
Potential Coil (KVAR side of RI-2 meter, including K-3 phase-shifting transformer)**				
Lagging phase†	23.7	−11.8‡	20.3	−50‡
Leading phase†	23.7	19.4	14.8	82
Potential Coil (KVAR side of RI-8 meter, including K-5 phase-shifting transformer)**				
Lagging phase Ø	29.8	20.9	21.2	77
Leading phase Ø	28.9	−10.3‡	27.0	−38‡
RI-32, RI-38 Meters				
Current Coil	.59	.26	.53	44
Potential Coil	9.2	1.9	9.0	20
Potential Coil (KVAR side of RI-32 meter, including K-3 phase shifting transformer)**				
Lagging phase†	16.7	− 7.2‡	15.1	−43‡
Leading phase†	17.3	13.6	10.7	79
Potential Coil (KVAR side of RI-38 meter, including K-5 phase-shifting transformer)**				
Lagging phase Ø	23.0	15.1	17.4	66
Leading phase Ø	22.5	− 5.7‡	21.8	−25‡
RI Meters (OA Electromagnets)				
Current Coil	1.25	.88	.89	70
Potential Coil (KW side)	12.0	1.7	11.8	18
Potential Coil (KVAR side of 3-phase, 3-wire meter, including K-3 phase shifting transformer)**				
Lagging phase†	20.8	−10.6‡	17.7	−51‡
Leading phase†	21.8	16.7	13.7	77
Potential Coil (KVAR side of 3-phase, 4-wire (2½ element) meter, including K-6 phase shifting transformer)**				
Lagging phase Ø	27.3	18.1	20.4	66
Leading phase Ø	26	− 9.1‡	24.4	−35‡
Phase Shifting Transformers				
K-3, K-4, K-7, K-9 Phase Shifting Transformer (each coil*)	4.1	1.3	3.9	31
K-5 Phase Shifting Transformer (each coil*)	11.0	2.8	10.6	25

**For potential coils on the KVAR side of other meters, except those listed above.
W, total watts = potential coil watts + transformer coil watts
V, total vars = potential coil vars + transformer coil vars
Volt-amperes = $\sqrt{W^2+V^2}$

* K-3, K-5, K-7, K-9 transformers use two coils, the K-4 uses three coils.

† If phase rotation is 1-2-3 then phase 1-2 lags phase 3-2 by 60° and is therefore called the lagging phase and conversely phase 3-2 is called the leading phase.

‡ The — sign indicates that power is being fed back to the potential transformer.

Ø If phase rotation is 1-2-3 then phase 1-0 lags phase 3-0 by 120° and is therefore called the lagging phase. Conversely phase 3-0 is called the leading phase.

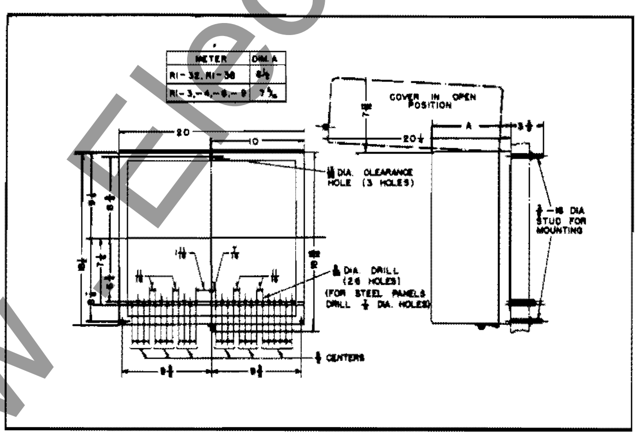


Fig. 12—Outline Dimensions, Types RI-3, -4, -6, -9, -32, -38 Meters with Hinge Covers.

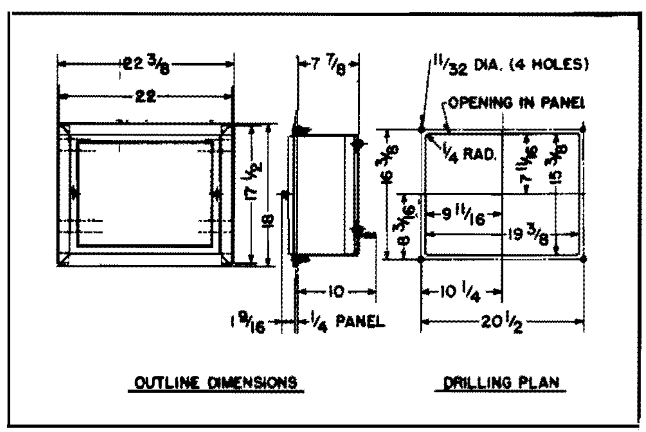


Fig. 13—Outline Dimensions, Types RI-2, -7, -8, -10 Meters Flush Type.

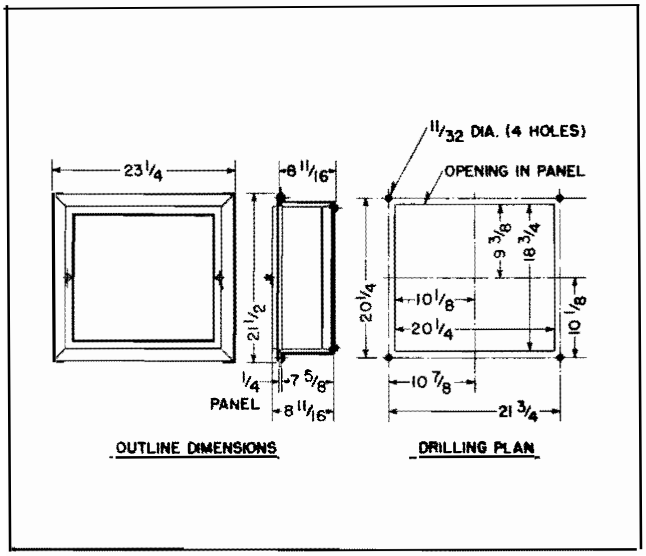


Fig. 14—Outline Dimensions, Types RI-3, -4, -6, -9, 32, -38 Meters, Flush Type.

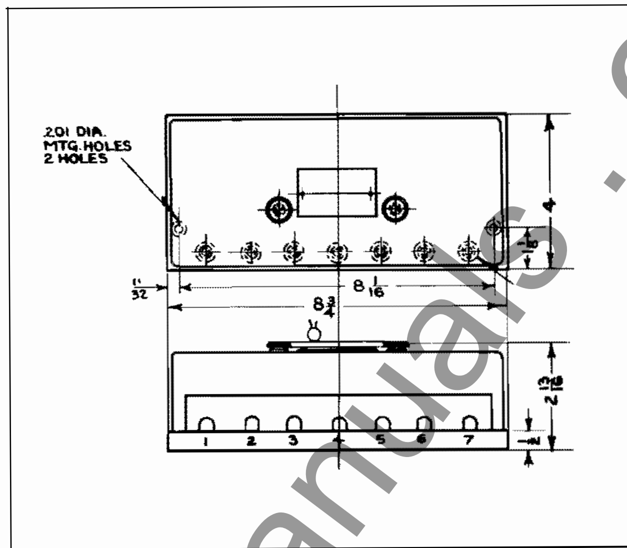


Fig. 15—Outline Dimensions, Types K-1, -3, -4, -5, -7, -9 Phase Shifting Transformers.

WIRING DIAGRAMS – FRONT VIEW

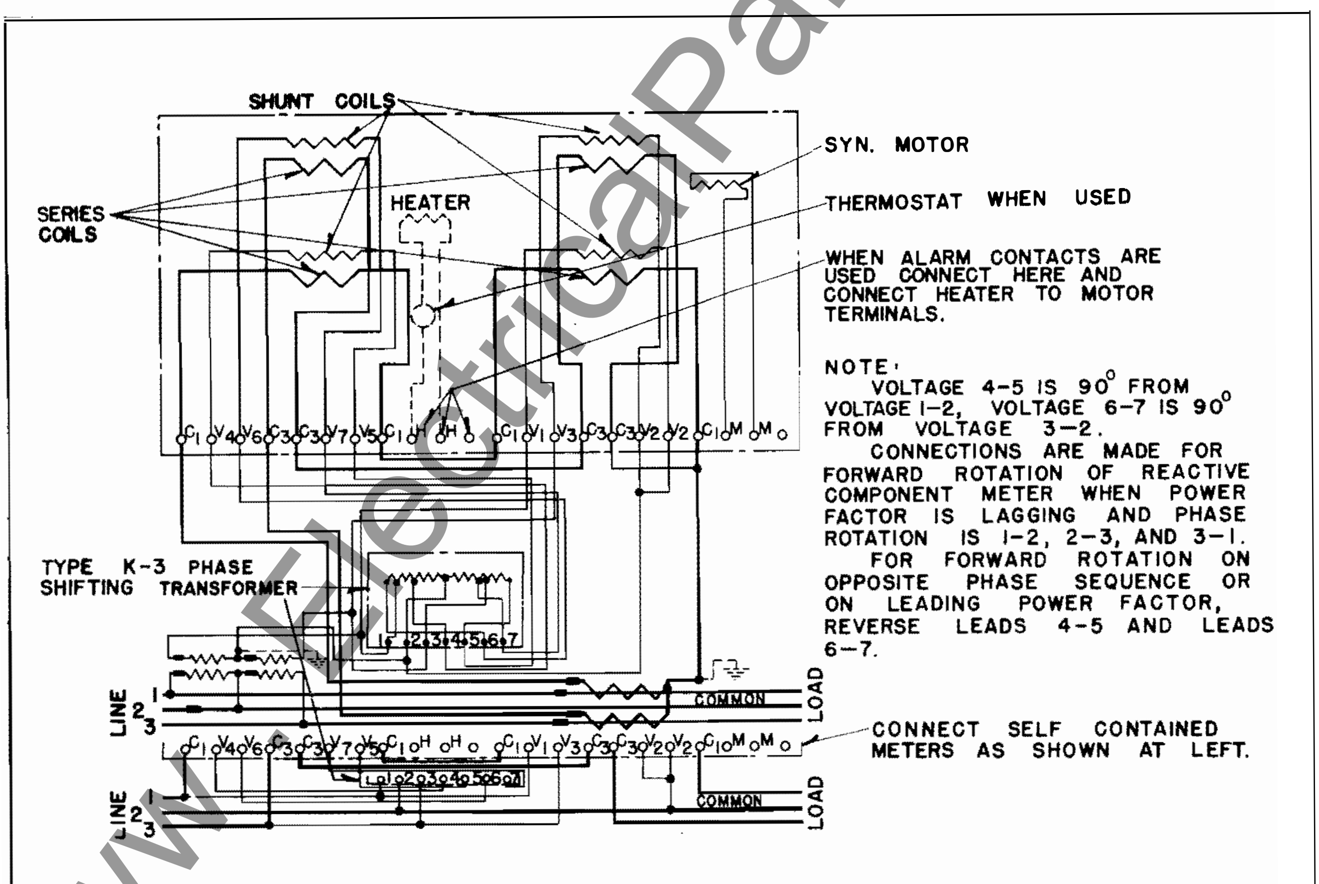


Fig. 16—Type RI-2, 3-Phase, 3-Wire, Using K-3 Phase Shifting Transformer.

WIRING DIAGRAMS — FRONT VIEW

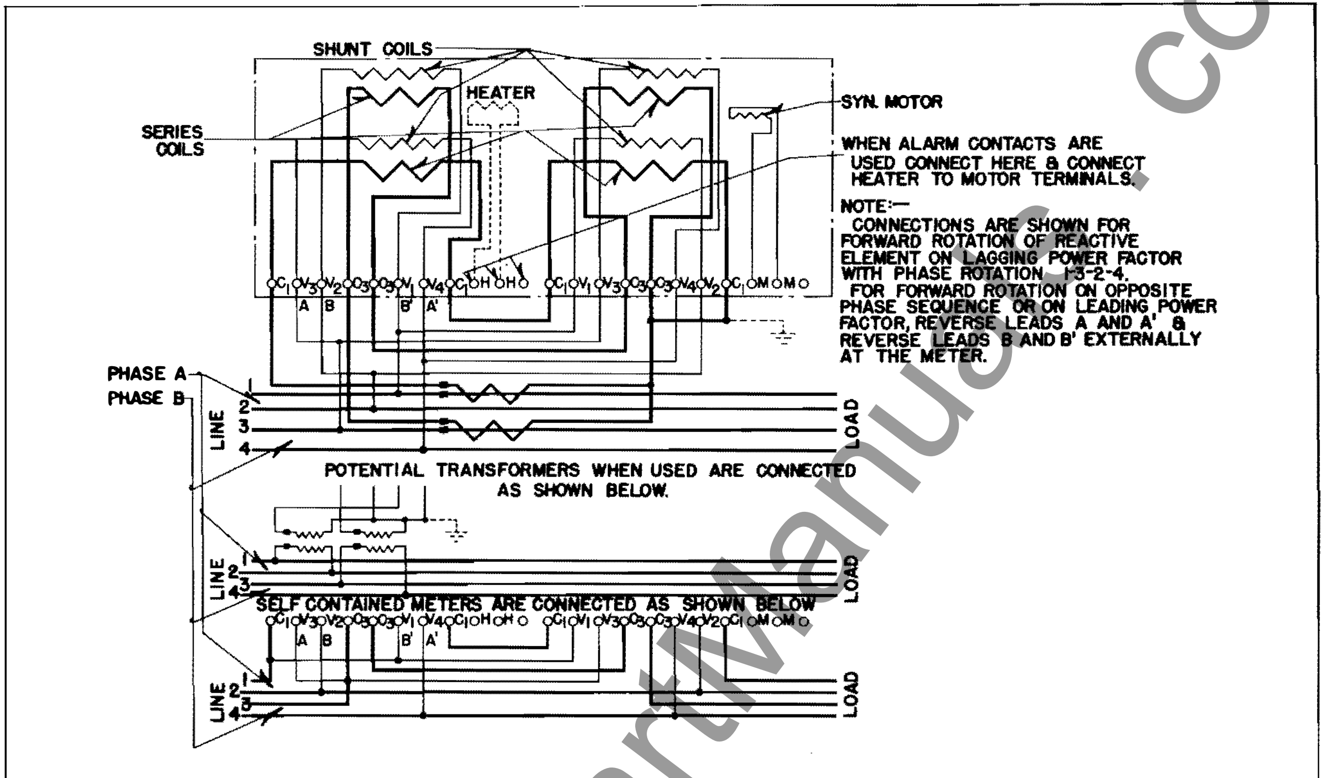


Fig. 17—Type RI-2, 2-Phase, 4-Wire.

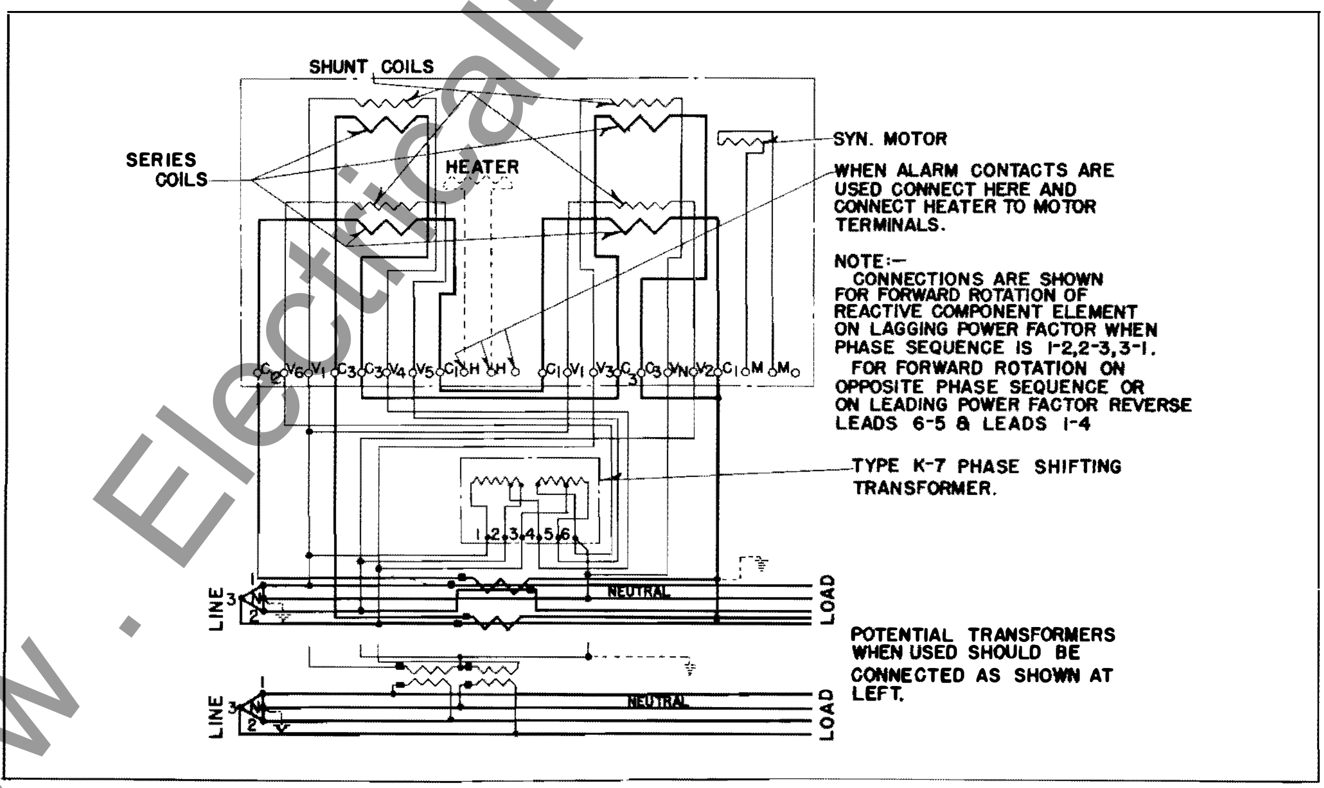


Fig. 18—Type RI-2, 3-Phase, 4-Wire, Delta, Using One 2-Wire and One 3-Wire Current Transformer and K-7 Phase Shifting Transformer.

WIRING DIAGRAMS – FRONT VIEW

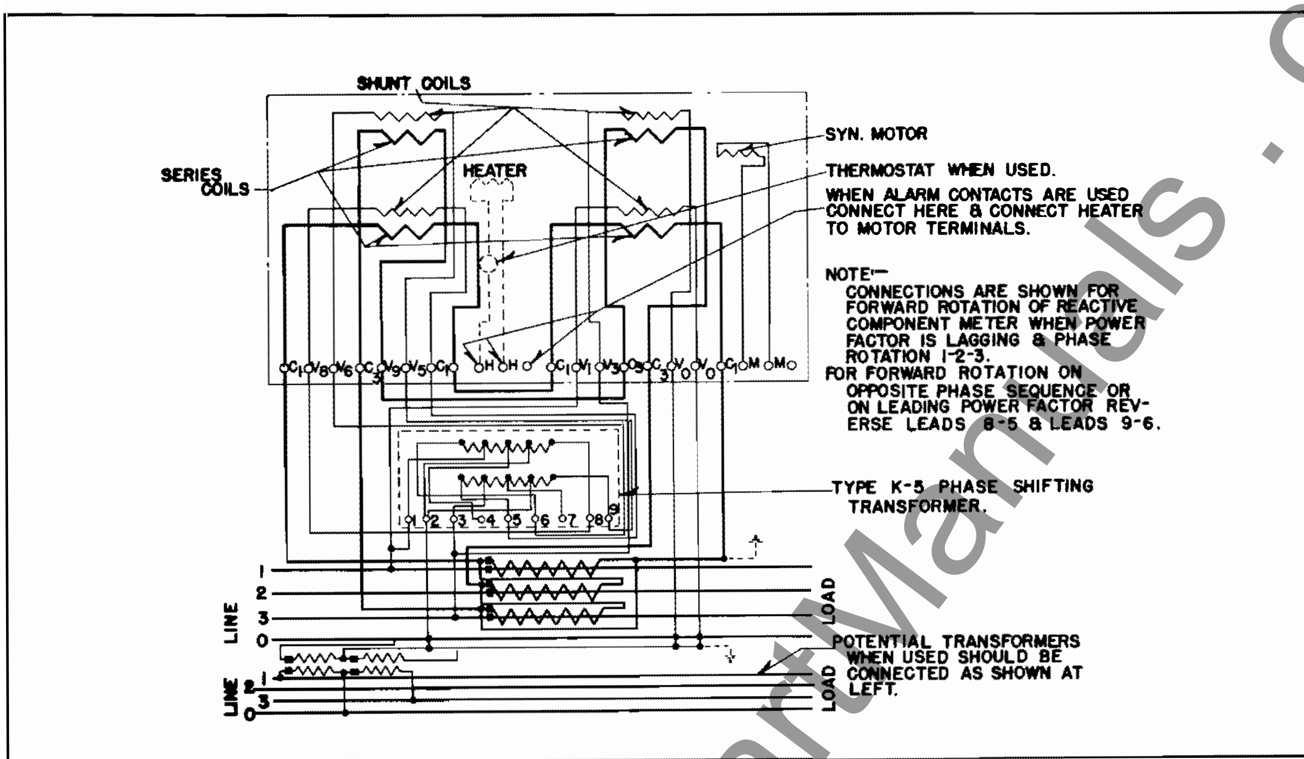


Fig. 19—Type RI-2, 3-Phase, 4-Wire "Y" Using Three 2-Wire Current Transformers and K-5 Phase Shifting Transformer.

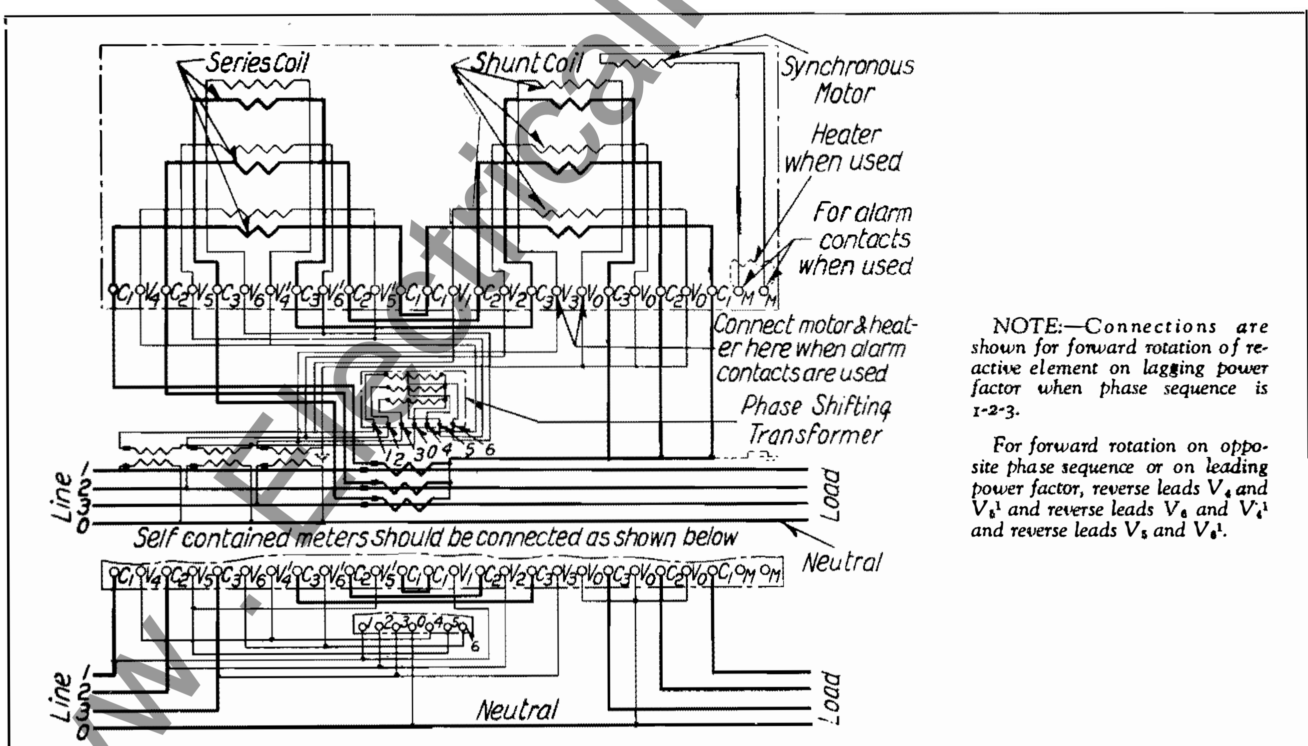
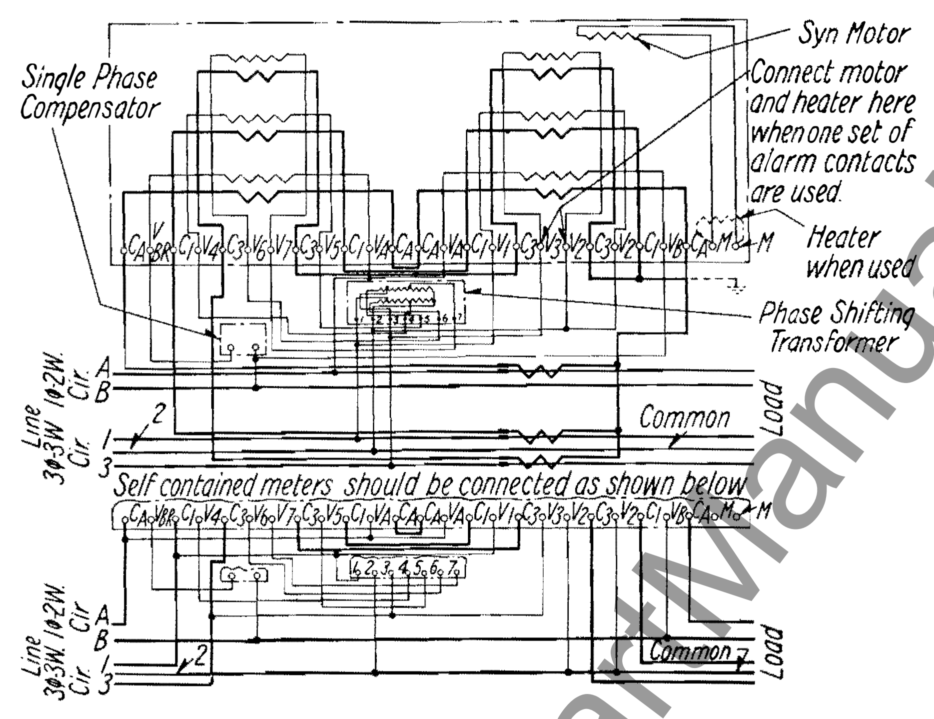


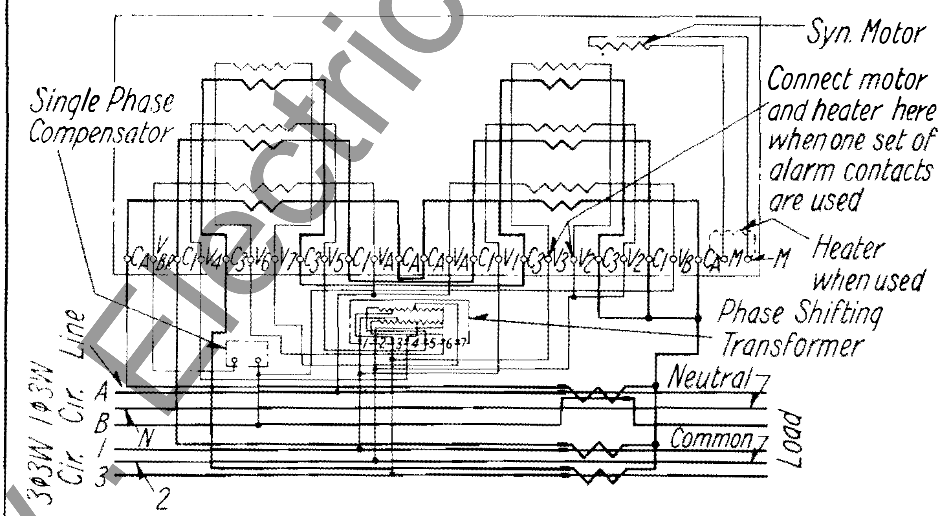
Fig. 20—Type RI-3, 3-Phase, 4-Wire "Y" Using K-4 Phase Shifting Transformer.

WIRING DIAGRAMS — FRONT VIEW



NOTE:—Connections are shown for forward rotation of reactive element on lagging power factor when phase sequence is 1-2, 2-3, 3-1. For forward rotation on opposite phase sequence, or on leading power factor, reverse leads V_4 and V_5 and reverse leads V_6 and V_7.

Fig. 21—Type RI-4 Totalizing 3-Phase, 3-Wire and Singlephase 2-Wire, Using K-3 Phase Shifting Transformer.



NOTE:—Connections are shown for forward rotation of reactive element on lagging power factor when phase sequence is 1-2, 2-3, 3-1. For forward rotation on opposite phase sequence, or on leading power factor, reverse leads V_4 and V_5 and reverse leads V_6 and V_7.

Fig. 22—Type RI-4, Totalizing Three Phase, 3-Wire, and Singlephase 3-Wire, Using One 3-Wire Current Transformer (Singlephase Circuit) and K-3 Phase Shifting Transformer.

WIRING DIAGRAMS — FRONT VIEW

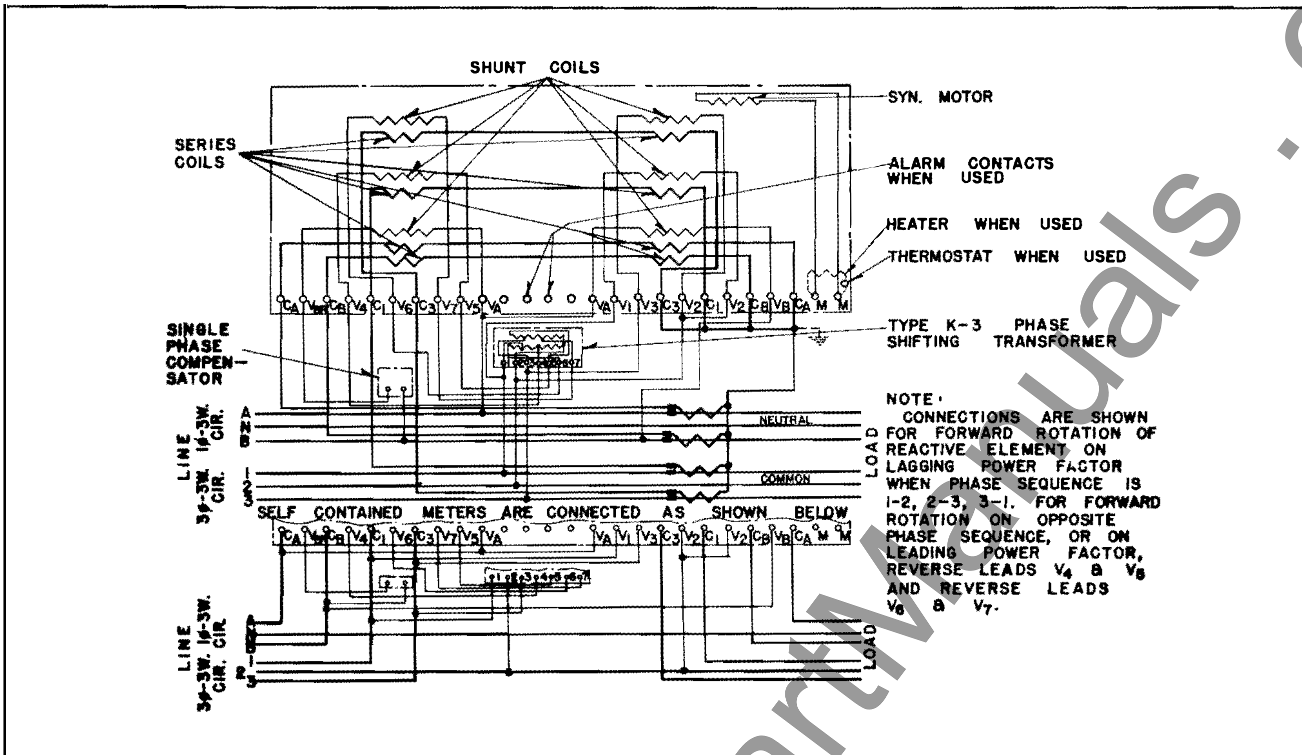
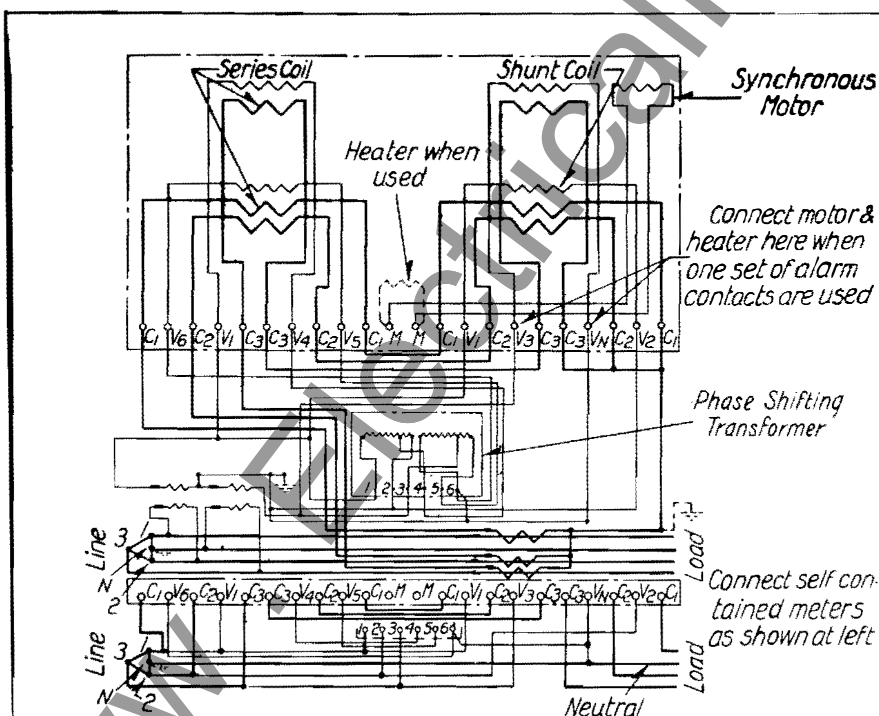


Fig. 23—Type RI-6, Totalizing 3-Phase, 3-Wire and Singlephase 3-Wire using K-3 Phase Shifting Transformer.

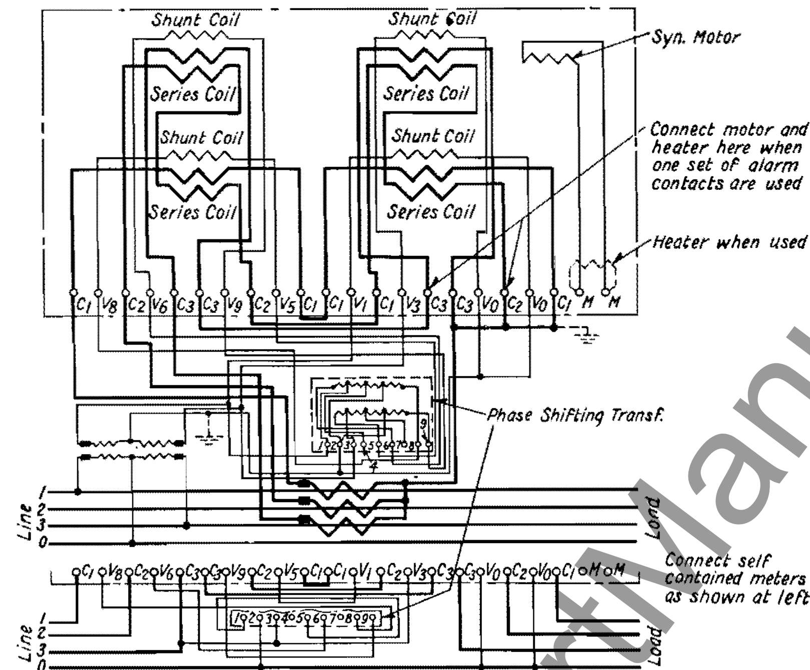


NOTE:—Connections are shown for forward rotation of reactive component element on lagging power factor when phase sequence is 1-2, 2-3, 3-1.

For opposite phase sequence, change potential connection to reactive component meter from 6-5 and 1-4 to 5-6 and 4-1.

Fig. 24—Type RI-7, 3-Phase, 4-Wire Delta Using K-7 Phase Shifting Transformer.

WIRING DIAGRAMS — FRONT VIEW



NOTE:—Voltage 8-5 is 90° from 1-2, voltage 6-9 is 90° from voltage 2-3. (numerals refer to compensator).

Connections as shown for lagging Power Factor when phase sequence is 1-2-3. If phase sequence is 3-2-1 change potential connections to RKVAH Meter from 8-5 and 6-9 to 5-8 and 9-6.

Earlier models of the RI-8 meters used the Type K-3 compensator requiring different connections.

For forward rotation on leading power factors, leads 8-5 and 6-9 must be reversed.

Fig. 25—Type RI-8, 3-Phase, 4-Wire "Y" Using Two Potential Transformers and K-5 Phase Shifting Transformer.

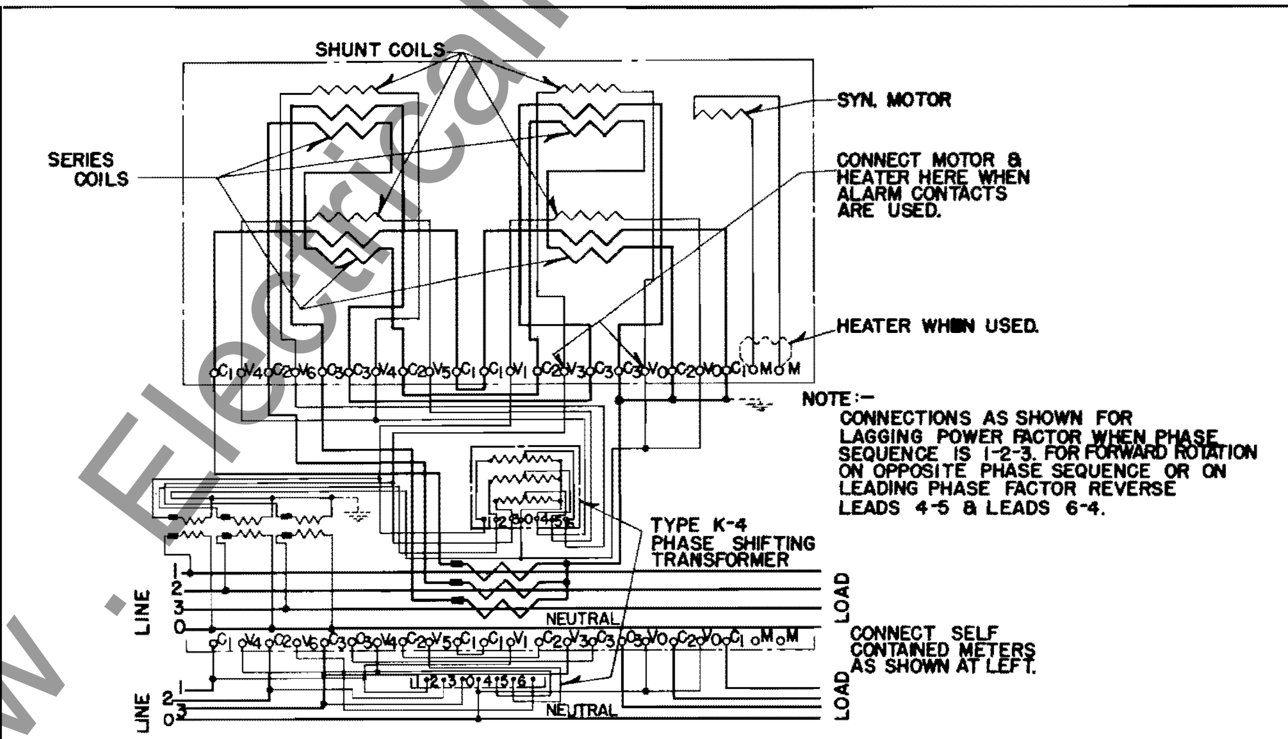
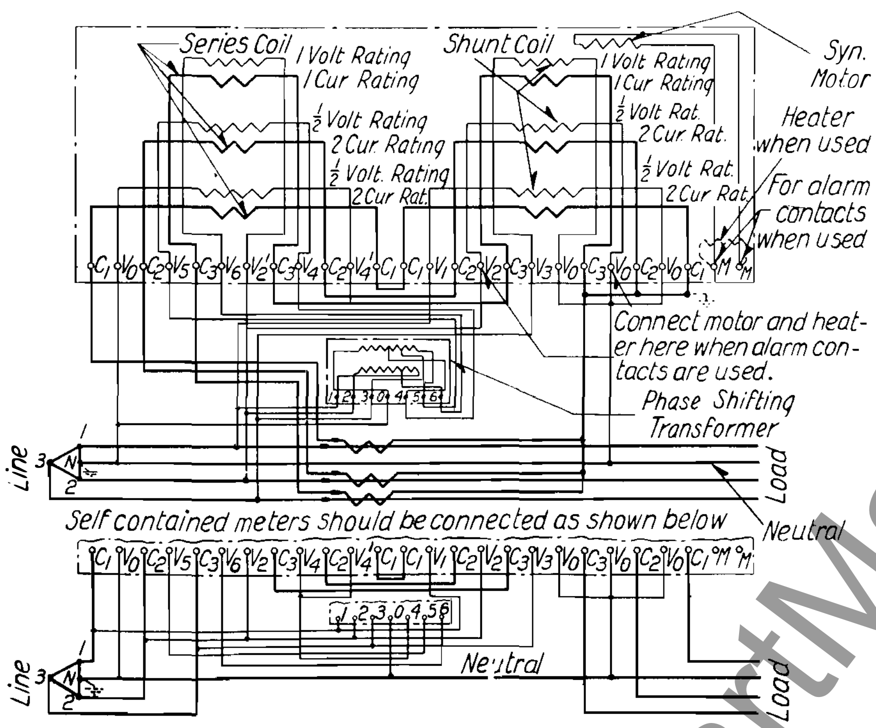


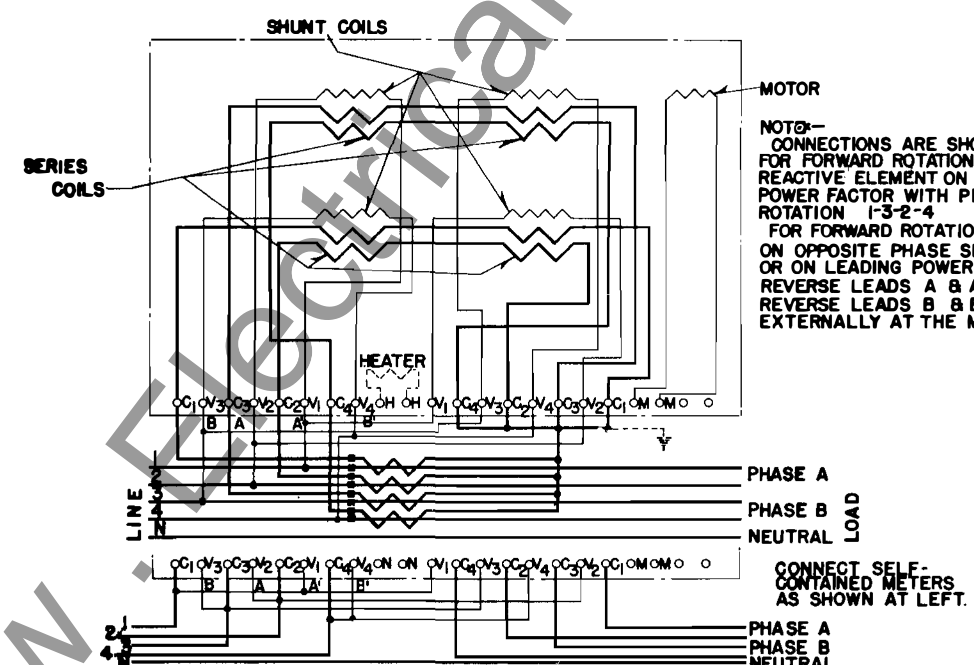
Fig. 26—Type RI-8, 3-Phase, 4-Wire "Y" Using Three Potential Transformers and K-4 Phase Shifting Transformer.

WIRING DIAGRAMS — FRONT VIEW



NOTE:—Connections are shown for forward rotation of reactive element on lagging power factor when phase sequence is 1-2, 2-3, 3-1. For forward rotation on opposite phase sequence, or on leading power factor, reverse leads V_0 and $V_4{}^1$, reverse leads V_5 and V_4, and reverse leads V_6 and $V_2{}^1$.

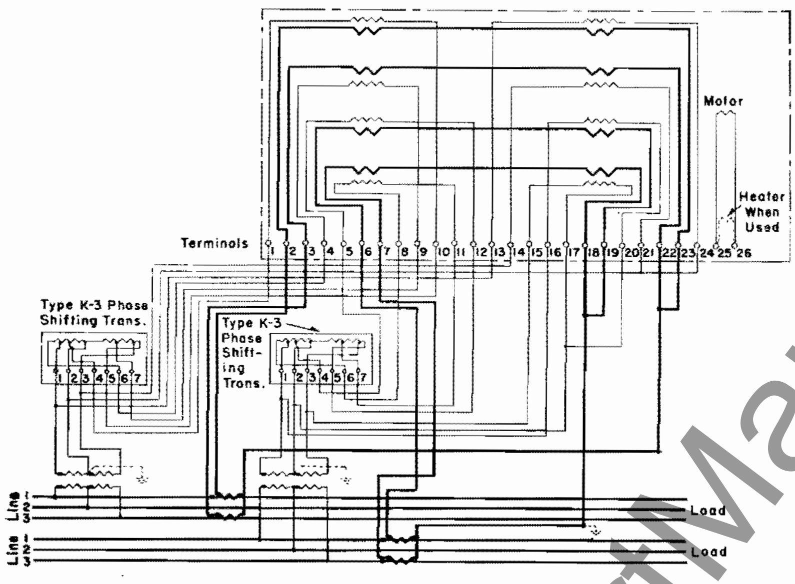
Fig. 27—Type RI-9 3-Phase, 4-Wire Delta Using K-9 Phase Shifting Transformer.



NOTE:—
CONNECTIONS ARE SHOWN FOR FORWARD ROTATION OF REACTIVE ELEMENT ON LAGGING POWER FACTOR WITH PHASE ROTATION 1-3-2-4
FOR FORWARD ROTATION ON OPPOSITE PHASE SEQUENCE OR ON LEADING POWER FACTOR, REVERSE LEADS A & A' AND REVERSE LEADS B & B' EXTERNALLY AT THE METER.

Fig. 28—Type RI-10, 2-Phase, 5-Wire.

WIRING DIAGRAMS — FRONT VIEW



NOTE—Voltage 4-5 is 90° from voltage 1-2. Voltage 6-7 is 90° from voltage 3-2. Connections are made for forward rotation of Kilovar elements when power factor is lagging and phase rotation is 1-2, 2-3 and 3-1.

If phase rotation is reversed, leads 4 and 5 must be reversed at reactive component meter or at the phase shifting transformer; also leads 6 and 7 must be reversed.

If it is desired to use meter on leading power factors, leads 4 and 5 must be reversed, also leads 6 and 7.

Fig. 29—RI-32, Totalizing, Two 3-Phase, 3-Wire Circuits Using K-3 Phase Shifting Transformers.

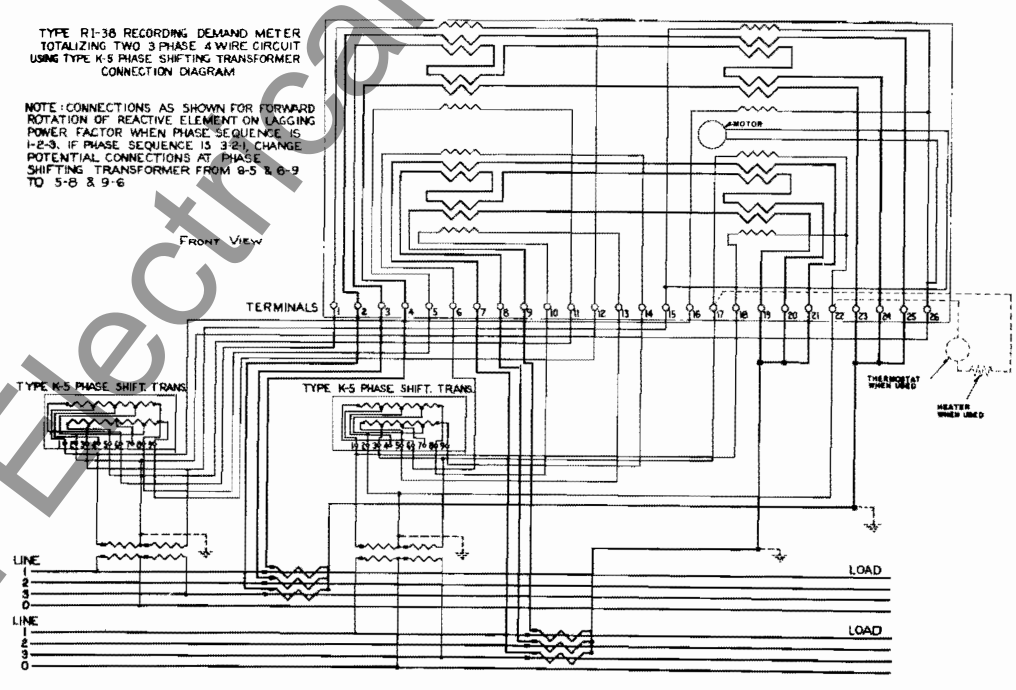
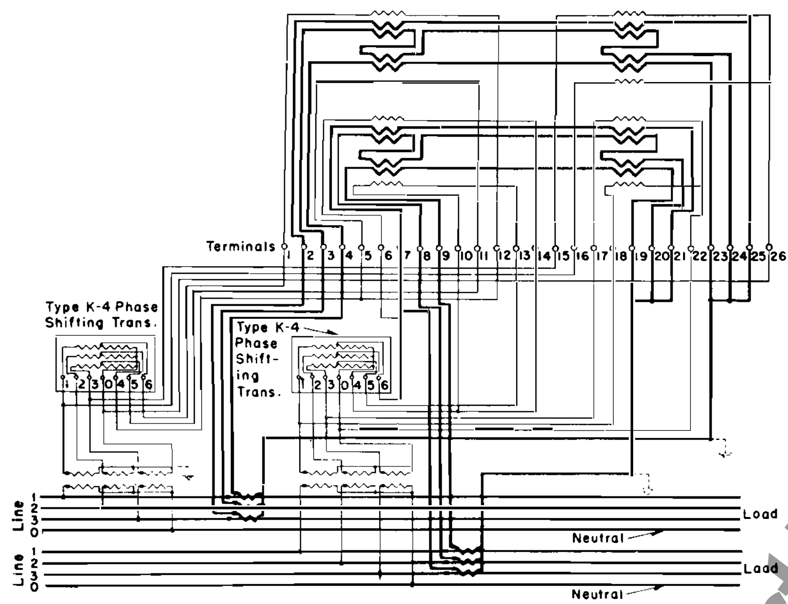


Fig. 30—RI-38, Totalizing Two 3-Phase, 4-Wire "Y" Circuits Using Two Potential Transformers per Circuit and K-5 Phase Shifting Transformers.



NOTE—Connections as shown for forward rotation of reactive element on lagging power factor when phase sequence is 1-2-3.

If phase sequence is 3-2-1 change potential connections to Kilovar elements from 4-5 and 6-4 to 5-4 ane 4-6.

Fig. 31—RI-38. Totalizing, Two 3-Phase, 4-Wire, "Y" Circuits Using Three Potential Transformers per Circuit and K-4 Phase Shifting Transformers.