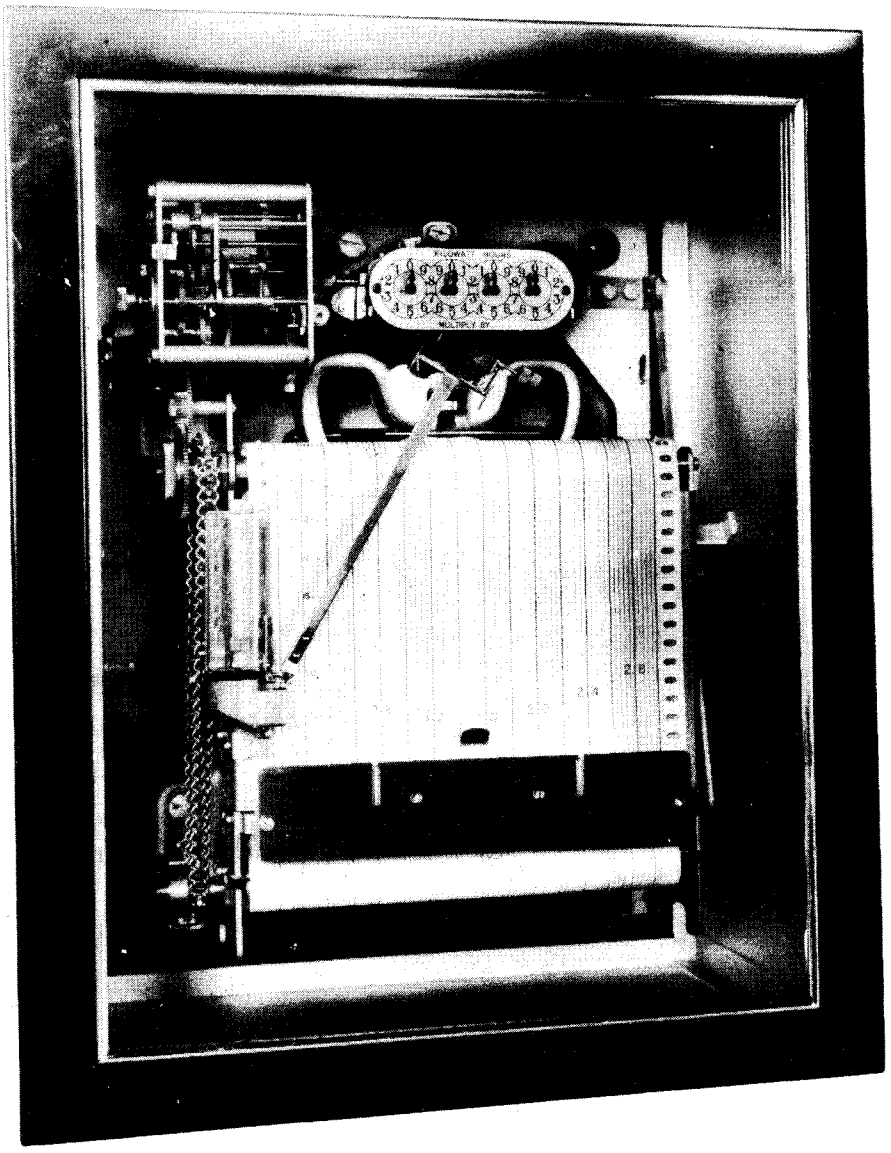
Buffalo Service
Mr. John Atkinson, Mgr.
E-8

I.L. 2485-B
(Filing No. 42-000)

Westinghouse

Recording Demand Meters With Synchronous Clock

INSTRUCTIONS



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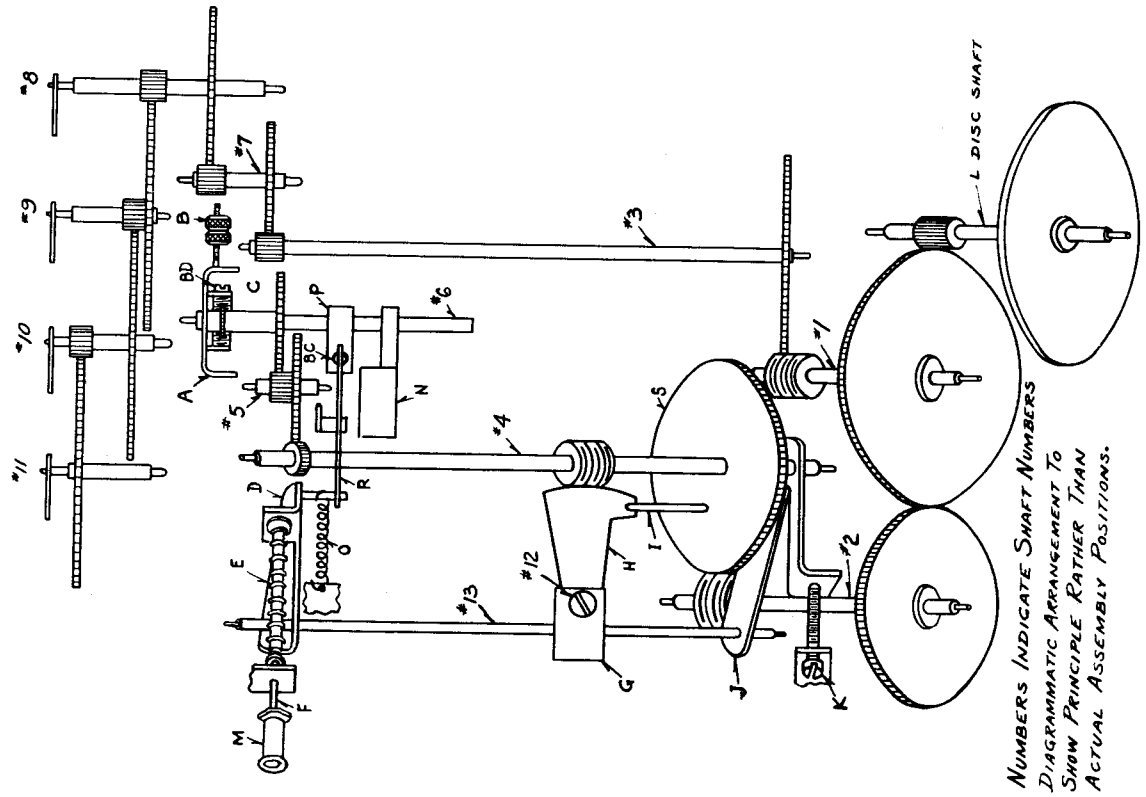


Fig. 5—Schematic Diagram

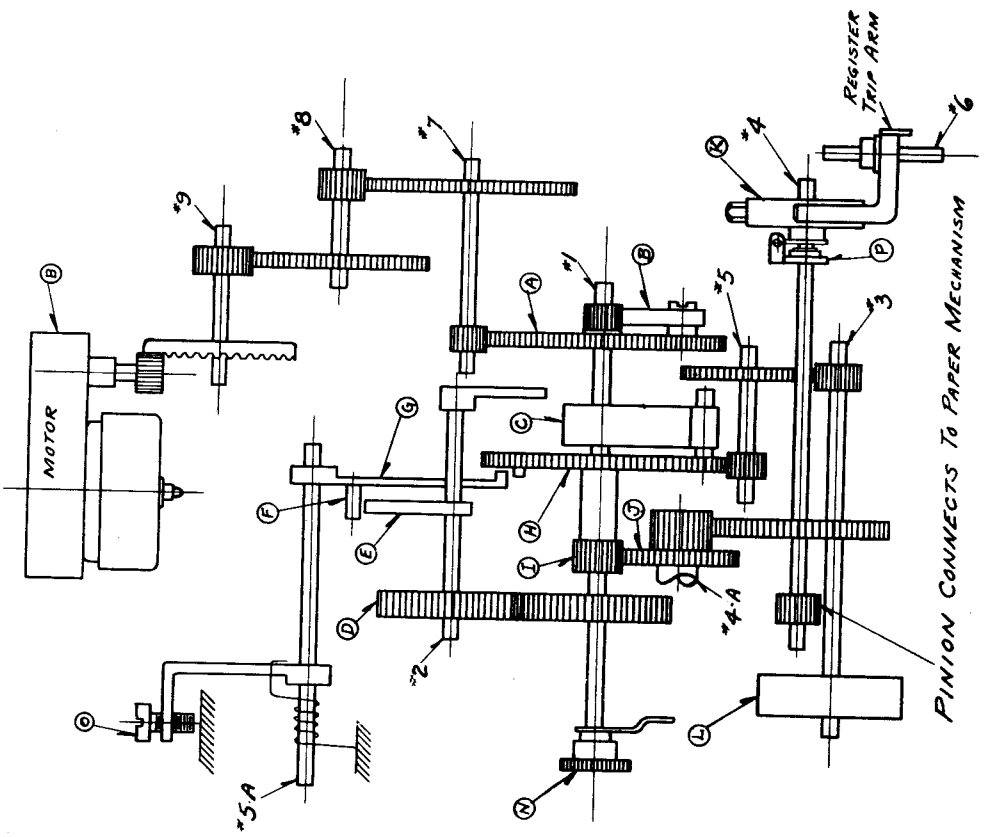


Fig. 4—Tripping Mechanism

TYPE R-2 RECORDING DEMAND METER

GENERAL

The Westinghouse type R-2 recording demand meter is an instrument designed to record both the kilowatt hours consumed and the integrated demand.

The R-2 meter employs the same electromagnets and permanent magnets as used in the C-2, C-3, and similar watthour meters.

The time interval of the instrument, or the period at which the pen is reset to zero, is controlled by a synchronous motor clock mechanism. The small synchronous motor serves both to determine the time interval and to furnish power for advancing the chart. During the time interval, this motor stores energy in a spring which is released at the end of the time interval. It advances the chart and resets the pen to zero.

The paper advance is made at the end of each time interval, and starts just before the resetting of the pen, so that there is a distinct and easily observed record of the maximum pen travel. The pen is reset by the action of a balancing weight, after being tripped out of mesh. Both the amount of integrated demand and the time of its occurrence are recorded.

The paper mechanism is arranged so that the preceding demand record for a number of hours is visible. This complete mechanism may be removed as a unit or swung to one side on a hinge when the meter element is being inspected or adjusted.

PRINCIPLE OF OPERATION

The operation of the meter mechanism may be understood from Fig. 5. Under load the disc-shaft (L) integrates watthours on the register through the gearing of shaft assemblies 1, 3, 7, and 8. At the same time the pen is advanced through shaft assemblies 1, 2, 4, 5 and 6. At the end of the time interval the tripping arm (6), Fig. 4, pushes against rod (F), disengaging the worm wheel on shaft (4) from worm on shaft (2), Fig. 5.

The weight of the pen and the pen arm is counterbalanced by weight (N), and the adjustable weights (B) are so placed as to cause the pen to immediately swing to the zero position when its driving gears are disengaged. When falling to the zero position, the rotation of the worm on shaft (4) moves the swinging section (H) against the stop (I) on worm wheel (S), thus determining the zero position of the pen. When the pressure on rod (F) is relieved, the spring (O) returns the pen gearing into mesh.

When for any reason the pen reaches full scale, arm (P) on shaft (6) pushes against arm (R) on bracket mounted on register frame. This causes worm wheel (S) on #4 shaft to disengage with worm (T) on shaft (2). This throws the pen gearing out of mesh but allows the K.W. H. gearing to go undisturbed.

Adjustment screw (K) is to adjust the mesh between the pen worm and worm wheel (S). This is adjusted at the factory and should require no attention. Screw (BC) adjusts the full scale tripping point, worm (BD) is to adjust the pen to zero position.

The time interval is determined by the synchronous motor (B), Fig. 4, driving shaft (4) through shafts 9, 8, 7, 1 and 4-A. Gear (A) is loose on shaft (1) and drives shaft (1) through ratchet (B). This winds up spring (C) and at the same time turns gear (D) on shaft (2) to operate cam (E). When shaft (2) makes one revolution the cam raises pin (F) on arm (G) and releases gear (H) on shaft (1) to which the other end of spring (C) is attached. Pinion (I) on shaft (1) drives gear (J) on shaft (4-A), causing the reset wheel (K) to force register reset arm against trip rod (M) in Fig. 5, allowing the pen to reset to zero and also advancing the paper and correct amount. The torque of the mechanism is held constant during the reset period by spring governor (L) on #3 shaft. Gear (A) is made to drive shaft (1) through a ratchet (B) so that by turning knob (N) manually one revolution, the mechanism can be made to trip the pen gearing and reset the pen to zero.

CAUTION: The spring (C) on shaft (1) is set at the factory to have one and one-half turns initial tension. If this condition is disturbed in any way, be sure that it is restored in the following manner before putting the meter into operation.

It is necessary that the pin holding the end of spring (C) is back of the tripping trigger on shaft (2) before the one and one-half turns of shaft (1) are made. The pin on gear (H) should be below the reset arm pin and in contact with same.

1. Hold tripping escapement and let the spring run down completely, setting pointer on zero.
2. Release the tripping escapement.
3. Hold shaft (1) gearing and wind the spring one and one-half turns from the zero point.
4. Release shaft (1) gearing. The spring will then have the proper operating torque.

There are only two adjustments on this mechanism. First, the screw (O) which changes the position of arm (G) to make it release spring (C) at the proper time; this is adjusted at the factory and should need no other attention. The other is adjuster (P) used to obtain the proper hook at the end of the line made by the pen which establishes the maximum demand point for that interval.

The paper chart unrolls from spindle (W), Fig. 6 passes upward over roll (N) on the reroll frame and down between plates on reverse side to chain driven spool (X).

INSTRUCTIONS FOR USING

Support the meter in a vertical position, removing all shipping cords and tags. After the meter has been mounted and electrically connected according to one of the diagrams in Figs. 21 to 35, remove the small pieces of paper used to secure the disc shaft during shipment. The small ink reservoir of the inking device should be filled with the special ink provided with the meter. Other inks may evaporate too quickly or clog the pen.

To swing the paper mechanism to one side, loosen the two thumb screws at the bottom of the movement frame until the large gear on the left side of the paper roll drum clears the pinion in the reset mechanism, and until the post on the upper right-hand side of the paper mechanism clears the movement frame.

As the paper is advanced over the paper driving mechanism, it is necessary to compensate for the changes in the size of the paper rolls. This is accomplished by the chain driven spring clutch of the lower left-hand side of the reroll mechanism. This clutch is self-aligning and adjusting, and should require no attention.

It will be noted that the 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 instrument suitable for mounting on a switchboard or any panel where the wiring is from the rear.

To feed on a new paper chart, slide the new roll endwise over the spindle (W), Figs. 3 and 6, and bring the end under the guide and over the roll (N). The locknut (U) should be loosened to allow the roll (N) to turn freely. Slide the end of the paper into the slot in spool (X) and take several turns on this spool. Cutting the end of the paper to a point will facilitate this operation.

Before tightening the locknut (U), pull up all the slack paper between the upper and lower drum at the back of the reroll mechanism.

To synchronize the paper with the time of day, set the paper so that the pen is on the line representing the correct interval of time, tighten the locknut (U). If the time of day falls between two interval marks on the chart, set the pen on the nearest elapsed interval mark. Then to compensate for the difference between the position of the pen and the actual time, turn the manual reset knob (located on the left-hand side of the clock) in a counterclockwise direction until its pointer position corresponds to the number of minutes elapsed in that interval.

The zero of the timing dial represents the end of the time interval.

As an example of the above, a meter with a 15 minute interval is used and the time of day is 9:20 o'clock, set the paper so that the pen is on the 9:15 line and then turn the tripping knob on the timing device forward until its pointer is opposite division 10 on the timing dial, indicating that 5 minutes have elapsed. If it is a 30 or 60 minute interval meter, the paper should be set so that the pen is on the 9:15 o'clock line and the tripping knob set to show that 5 minutes have elapsed. If the above is followed, a time interval will always begin on the hour and one will always end there. This will simplify the keeping of demand records with respect to time.

To check the zero line, press on rod (M), Fig. 5, to trip the pen which should fall to zero. If it does not return to zero, first, see if the worm wheel on shaft (4) is completely demeshed from the worm on shaft (2); if it is not, move collar (M) out on its arm until the worm wheel is demeshed when rod (F) is pressed. Secure head (M) in position by the locknut provided. If the worm wheel demeshes properly without the pen returning to zero, move the weights (B) further out on their arm, locking them together. Do not, however, place these weights so far out as to have the pen return too rapidly. If the pen does not come back exactly to zero, check to see if the stop (I) is in contact with the sector (H). When the stop is in contact with the sector (H) or only slightly out of position, the adjustment of the pen may be made by the micrometer adjustment given by worm (BD).

If the stop (I) is out of contact by a large amount, hold the rod (F) in the tripping position and rotate the worm wheel (S) which carries stop (I) until the stop makes contact with the sector (H). The final adjustment should be made with worm (BD). After adjusting zero, check it by tripping the pen from various positions on the paper.

The head (M) on the tripping arm should be very close to, but not in contact with, the end of the tripping rod, except to the moment of tripping.

With four studs in the reset wheel of the 15 minute interval clock, the pen is reset to zero every 15 minutes. With two studs, set 180 degrees apart, the pen resets every 30 minutes, although the forward movement of the paper which occurs each 15 minutes causes an offset mark at the middle of the 30 minute period, thus enabling the integrated demand to be read for the 15 as well as the 30 minute periods. Similarly, one stud causes a reset of the pen at each 60 minute interval, with an offset mark each 15 minutes. Using the 5 minute interval clock with corresponding arrangements of tripping studs, the pen can be made to reset on 5, 10, or 20 minute intervals. (For each time interval, the corresponding register must be used.)

No part of the meter should be lubricated except the timing mechanism bearings, using Westinghouse Lubricant Style No. 839632, and the cam (E), lubricated with Pure Petrolatum occasionally to prevent wear.

These should be checked approximately every year.

Use only ink Style No. 876426, which is supplied in 2-ounce bottles, ready to use. The inking mechanism consists of a reservoir kept supplied with ink directly from a small bottle. The pen is inked intermittently by a dipper action, as the pen returns to the left.

To replenish the ink supply, remove the entire inking device from the meter. By tipping the ink holder in the upside down position, the remaining ink will flow back into the bottle. When adding new ink, first thoroughly clean the reservoir of any remaining ink, preferably using hot water or alcohol.

When first applying ink, it is well to hold the inking device at an angle to allow some ink to run into the reservoir.

PAPER CHARTS

FOR METERS TYPES R-2, R-22, R-7, R-27 AND R-10--2-1/2 AND 5 AMPERE

Demand Inter. in Min.	Length in Ft.	Capacity in Days*	120 VOLTS CAPACITY in Kw.		240 VOLTS CAPACITY in Kw.		480 VOLTS CAPACITY in Kw.		600 VOLTS CAPACITY in Kw.	
			F.L.	F.S.	F.L.	F.S.	F.L.	F.S.	F.L.	F.S.
5	20	12	1.0	1.0	2.0	2.0	4.0	4.0	5.0	5.0
5	20	12	1.0	1.5	2.0	3.0	4.0	6.0	5.0	7.5
10	27	32	1.0	1.0	2.0	2.0	4.0	4.0	5.0	5.0
10	27	32	1.0	1.5	2.0	3.0	4.0	6.0	5.0	7.5
15-30-60	20	36	1.0	1.0	2.0	2.0	4.0	4.0	5.0	5.0
15-30-60	20	36	1.0	1.5	2.0	3.0	4.0	6.0	5.0	7.5

FOR METERS TYPES R-3, R-23, R-8, R-28, R-9 AND R-29--2-1/2 AND 5 AMPERE

5	20	12	1.5	1.5	3.0	3.0	6.0	6.0	7.5	7.5
5	20	12	1.5	2.25	3.0	4.5	6.0	9.0	7.5	11.25
10	27	32	1.5	1.5	3.0	3.0	6.0	6.0	7.5	7.5
10	27	32	1.5	2.25	3.0	4.5	6.0	9.0	7.5	11.25
15-30-60	20	36	1.5	1.5	3.0	3.0	6.0	6.0	7.5	7.5
15-30-60	20	36	1.5	2.25	3.0	4.5	6.0	9.0	7.5	11.25

* The length of these charts is sufficient to provide a record for the number of days indicated with an additional length of at least two feet for inserting the chart into the meter.

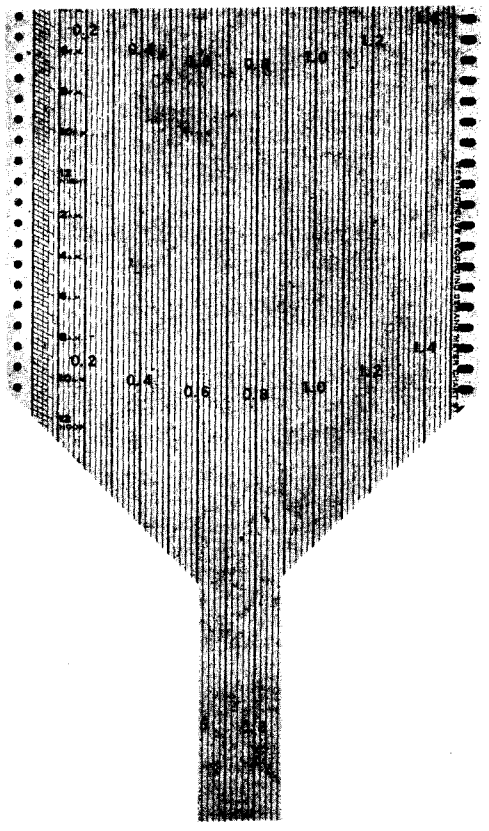


Fig. 2 - Suggested Method for Trimming Leading End of Paper Chart When Starting

WATTHOUR METER ADJUSTMENTS

Full Load - Moving iron discs above permanent magnets to left increases meter speed. Moving discs to right decreases meter speed.

Light Load - Moving screw at bottom of the electromagnet in counterclockwise direction increases meter speed. Clockwise movement decreases meter speed.

Balance Turn screw on right-hand side of meter above disc to move balance plate in or out as required.

Moving balance plate out from electromagnet decreases the torque of the electromagnet. Balance plates should be moved to maximum torque position before balancing elements.

Power Factor - For adjustment change the resistance of the power factor adjusting coil mounted on meter frame. Increasing the resistance makes the element run fast on lagging power factor.

CONSTANTS

By calibration the watthour constant, K_h (watthours per revolution of the disc) is adjusted to be two-thirds per "nominal" kilowatt rating of any type meter.

The register ratio, R_r, is stamped on the frame of the register and equals the revolutions made by the first gear of the register per revolution of the first dial hand. The disc revolutions per revolution of the first dial hand are 100/12 times the R.R. (gear ratio or R_g).

Other two-element meters are:

Type R-7 for 3 phase, 4 wire delta service.
Type R-8 for 3 phase, 4 wire wye service, having three current and two potential coils.
Type R-10 for 2 phase 5 wire service.

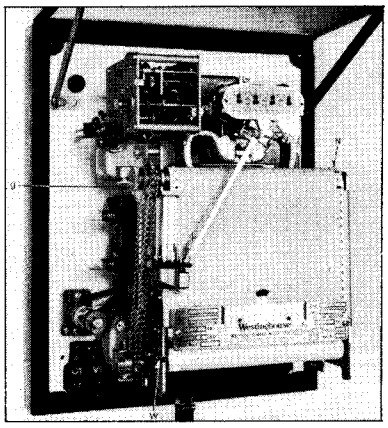


Fig. 3 - Type R-2 Meter With Cover Open

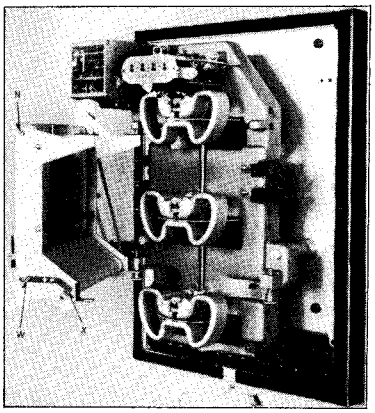


Fig. 6 - Type R-3 Meter with Chart Mechanism Swung to One Side for Inspection of the Meter Element or Insertion of the Demand Chart

TYPE R-3 RECORDING DEMAND METER

The type R-3 meter is similar to the R-2 meter except that it has three elements instead of two. The same type register, clock and paper mechanism are used. The principle of operation and adjustments are the same as for the R-2.

The three element meter for 3 phase, 4 wire delta is type R-9.

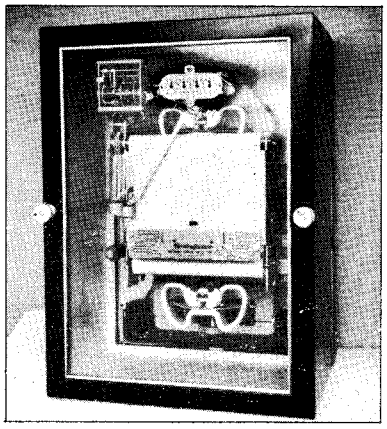


Fig. 7 - R-3 Demand Meter

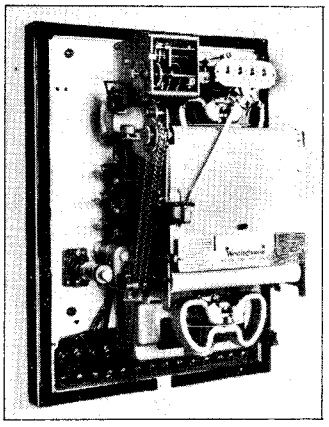


Fig. 8 - R-3 Meter with Cover Removed

TYPE R-22 RECORDING DEMAND METER

The type R-22 meter is a two-element duplex meter for recording and integrating the demand and kilowatt hours of two circuits. This meter consists of two complete R-2 meters assembled on one base and under one cover. The registers are tripped and the paper reroll mechanisms are operated by one clock mechanism. To accomplish this, the tie rod, T in Fig. 9, is assembled to two standard registers and held in position by the rod support on each register. The arms, R, are secured to rod, T, by set screws. These arms should be so adjusted as to allow the same time of disengagement of both registers at the end of the time interval. With this one exception, the operation and adjustment of the registers are the same as those for the type R-2 meter, given on page 3.

The paper reroll mechanisms are operated simultaneously by the addition of the connecting device assembled between the two mechanisms.

By loosening the thumb screw, S in Fig. 9, the connecting device can be disengaged from the left-hand paper mechanism by sliding that section of the device to the right and thereby removing the link, L, from the slot in the left-hand driving drum shaft. When this connecting device is disconnected, adjustments can be made on either paper reroll mechanisms without disturbing the other. To put the device back into operation, the reverse of the above should be applied. To release the driving drum of the right-hand paper reroll mechanism, loosen thumb screw, S, and turn the lock nut, U, in a clockwise direction. All other adjustments are the same as for the type R-2 meter.

Other duplex, 2 element meters are:

Type R-27 for 3-phase, 4 wire delta service.
Type R-28 for 3-phase, 4 wire wye service, having three current and two potential coils.

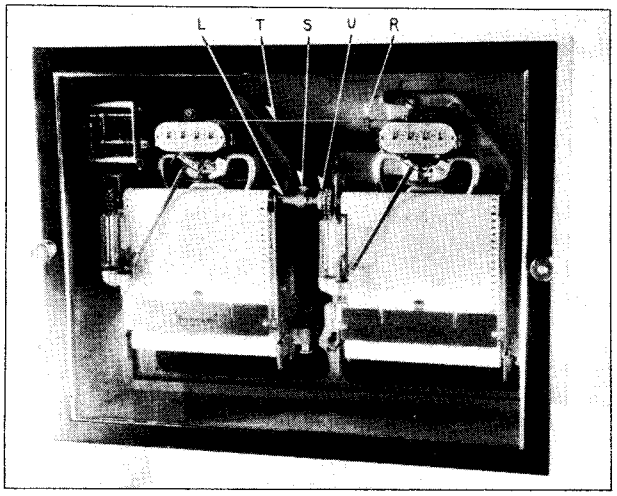


Fig. 9 - Type R-22 Demand Meter with Cover

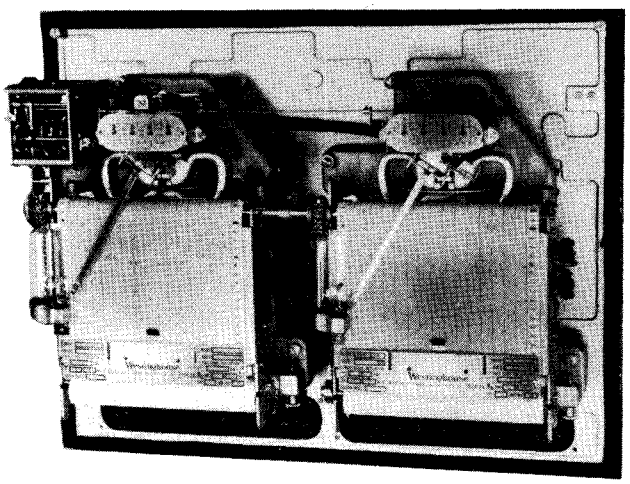


Fig. 10 - Type R-22 Demand Meter With Cover Removed

TYPE R-23 RECORDING DEMAND METER

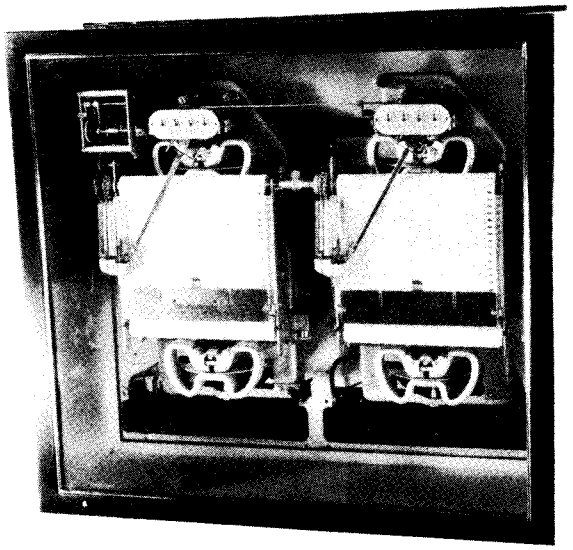


Fig. 11 - Type R-23 Demand Meter

This meter is the same in principle and operation as the type R-22 meter except that two 3-element units are used instead of two 2-element units.

The other duplex 3-element meter for 3 phase, 4 wire delta service is type R-29.

The duplex demand meters may be used to meter two separate circuits in which the combined demand is desired or one element may be connected through phasing transformers and the reactive volt-ampere-hour measured. From these two quantities, the Kv-a. demand and power factor can be determined. The charts record the time of occurrence, the amount, and variation of the demand in steps of the time intervals of the meter. In addition to this, the dials indicate the total kilowatt-hours and total reactive Kv-a.-hours consumed.

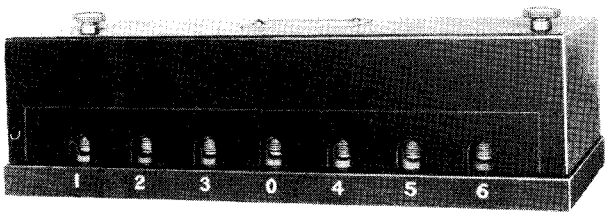


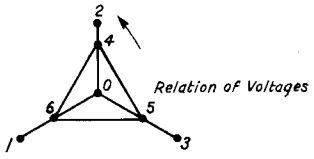
Fig. 12 - Reactive Component Compensator - Cover On

REACTIVE COMPONENT COMPENSATOR

The reactive component compensator is designed to be used in polyphase circuits with a standard polyphase watthour meter to obtain measurement of the reactive kilovolt-ampere-hours.

This compensator, by displacing the voltages impressed on the voltage coils of the meter 90 degrees from the line voltage, enables the watthour meter, to which it is connected, to register the reactive component of the kilovolt-ampere load. The compensator consists of small auto transformers mounted in the same case. Each transformer has taps brought out at the zero, 57.7, 100 and 115.4% points of the winding on 3 phase, 3 wire type. The zero, 57.7 and 100% points of the winding are brought out on the 3 phase, 4 wire type.

On a 2 phase, 4 wire circuit, a compensator is not needed. It is necessary to interchange the voltage connection from each phase of the meter. The current connections are standard.



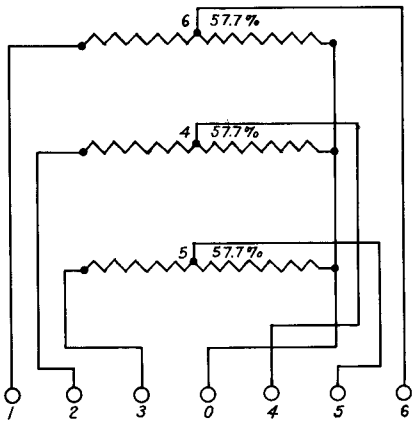
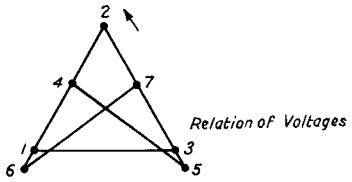


Fig. 13 - Reactive Component Compensator Type K-4, 3 Phase 4 Wire



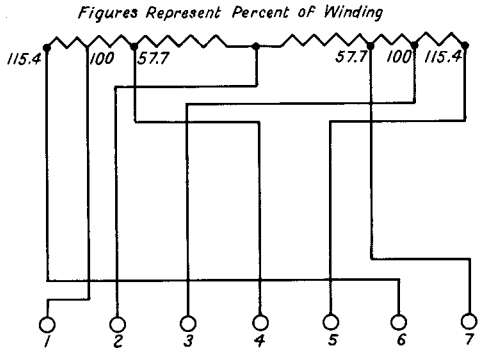


Fig. 14 - Reactive Component Compensator Type K-3, 3 Phase 3 Wire

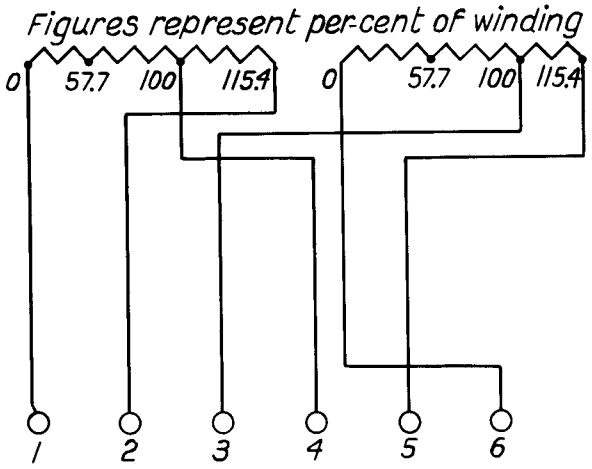


Fig. 15 - Reactive Component Compensator Type K-7, 3 Phase 4 Wire

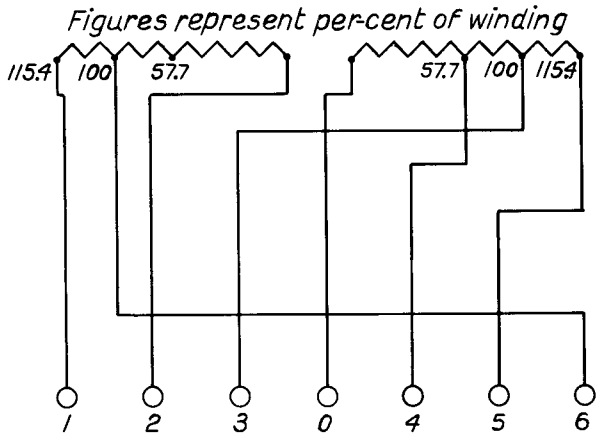


Fig. 16 - Reactive Component Compensator, Type K-9

CONTACT CLOCK AND SOLENOID TRIPPING FOR SIMULTANEOUS DEMAND

When it is desirable to obtain duplicate readings on two meters measuring the same service or to obtain a comparison of the demand of two services, it is essential that both meters be tripped simultaneously.

To do this, one of the meter clocks is equipped with contacts on the tripping mechanism, which will operate at the instant of tripping. This energizes the solenoid that is assembled to the tripping mechanism of the other meter clock. A 120 volt, 60 cycle source is used in operating circuit.

Adjustment - Before putting clocks into service, allow tripping mechanism spring to completely unwind. Turning timing pointer knob, P, Fig. 17 one complete revolution to put 1-1/2 initial turns in spring. The synchronous motor in clock will then keep spring wound up to proper tension for operating paper mechanism.

Connections - Connect synchronous motors of both clocks to same control circuit so that they are started simultaneously. If the distance between the meters does not allow the same control circuit to be used, the motor of the clock having the contacts for operating the solenoid should be energized first.

When the same control circuit is NOT used, the motor circuit of the solenoid operated clock should be opened immediately if the motor circuit of the clock with contacts is interrupted.

Lubrication - Lubricate points marked (x), Fig. 17, occasionally with Westinghouse Lubricant S#839632.

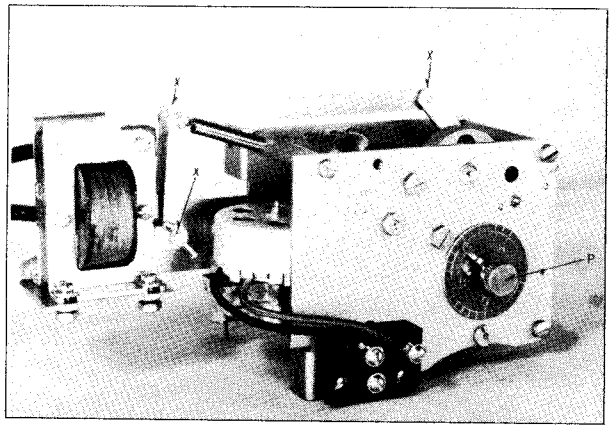


Fig. 17 - Recording Demand Meter Clock With Solenoid Trip

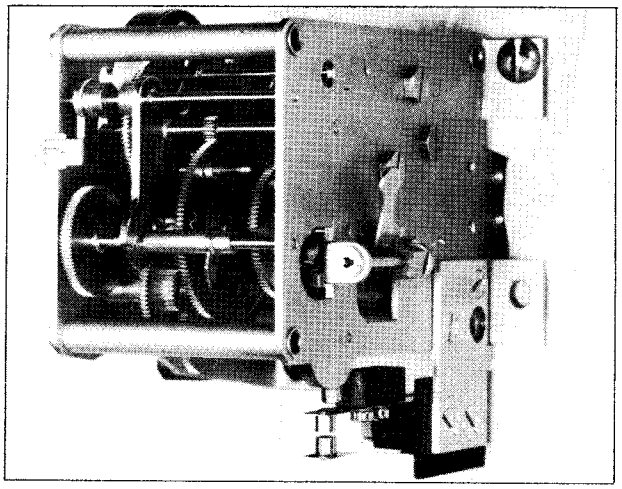


Fig. 18 - Recording Demand Meter Clock with Contacts

HEATERS

When demand meters are mounted in outdoor meter houses in cold climates or in other locations of low temperature it is desirable to install a small heater inside the meter case.

The heaters consist of a small resistance unit of approximately 30-watt consumption. The candelabra base consists of a moulded base to which is attached a socket for the heater unit. The bases of all meters are drilled and tapped for mounting the heater receptacle below the clock.

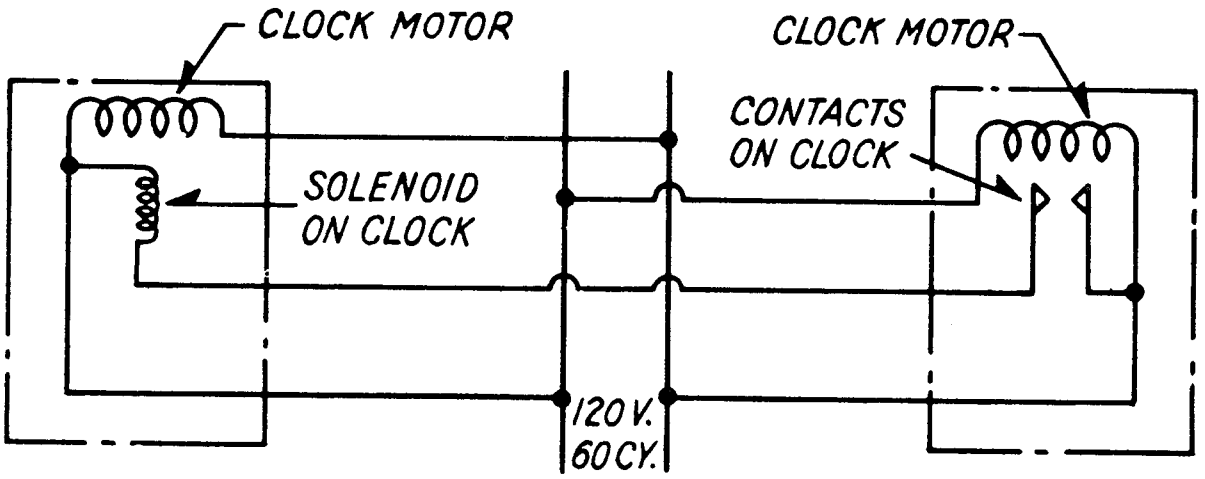


Fig. 19 - Timing Motor and Tripping Circuit Connections

ALARM ACTIVE DEVICE

The adjustable alarm contacts are used to signal the operator of an installation utilizing power purchases on a demand basis, whenever a predetermined value of the demand has been reached.

The contact mechanism is adjustable to agree with the position of the pen point on the chart.

Referring to the diagram, the micrometer screw adjustment, shown at "A", changes the position of a spiral spring, which is carried on the movable bracket and which supports the pen. The outer end of this spring then engages and depresses the contact spring, closing the circuit. With the pen at the required position on the chart, adjust the screw "A" until the contact just closes.

It will be noted that the flexible spiral spring will allow the pen arm to move farther up the scale as the demand record increases, thus avoiding interruption of the record. Due to the gear reduction, the torque of the spring will have no perceptible effect upon the meter accuracy.

The contacts are designed to carry approximately 0.25 ampere inductive load without appreciable burning of the surfaces.

It may be found necessary to adjust the position of the contacts as well. To do this, loosen the set screws holding the contact springs in the posts, sliding the springs to the new position desired.

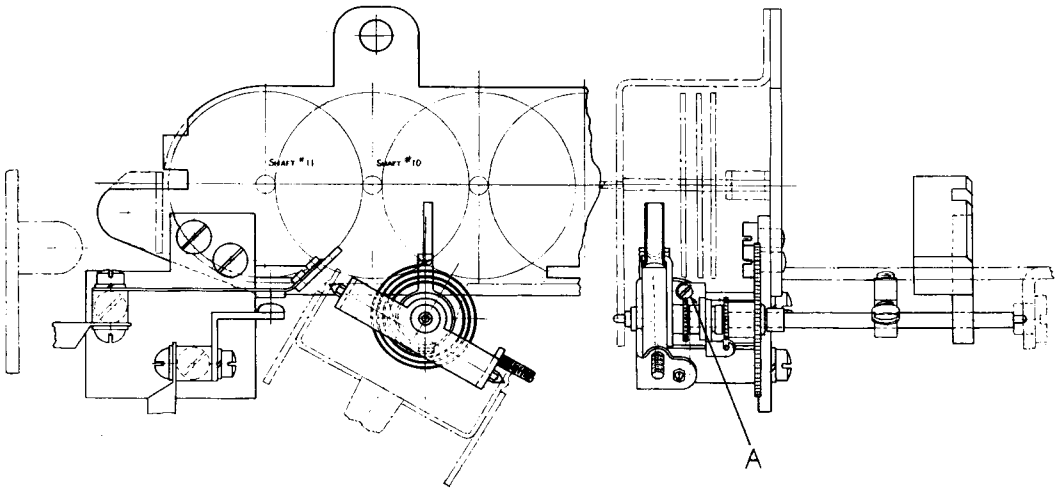


Fig. 20 - Recording Demand Meter Register With Alarm Contacts

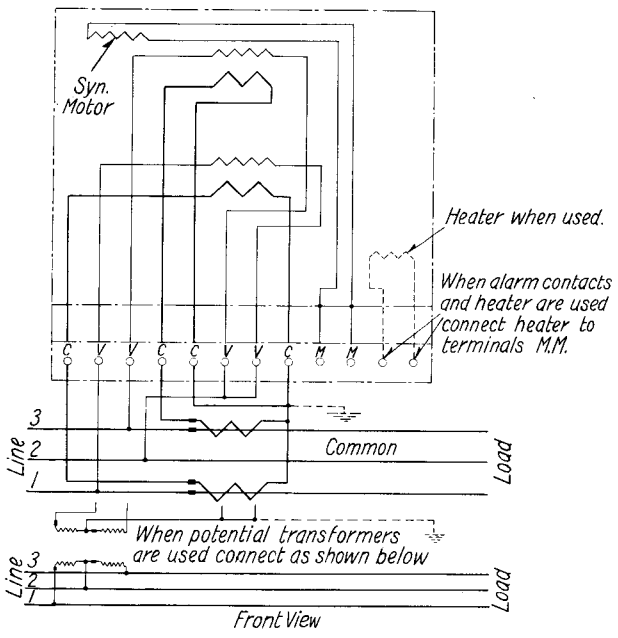


Fig. 21 - Type R-2 Two or Three Phase Three-Wire With Transformers

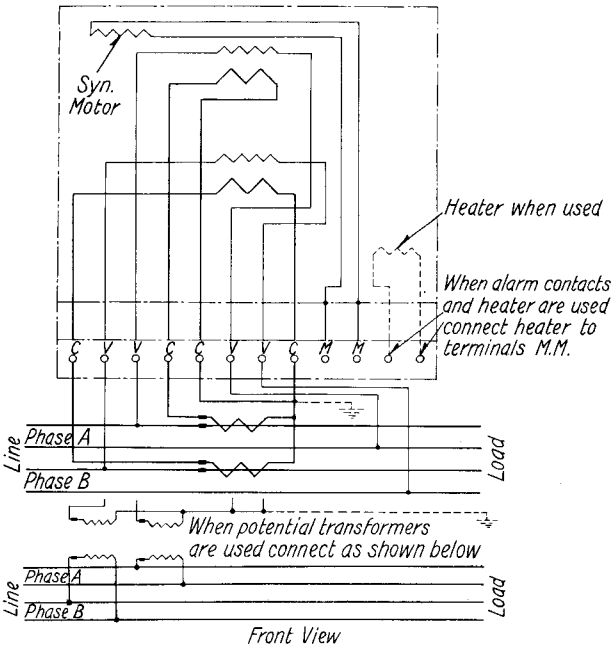


Fig. 22 - Type R-2 Two Phase Four-Wire With Transformers

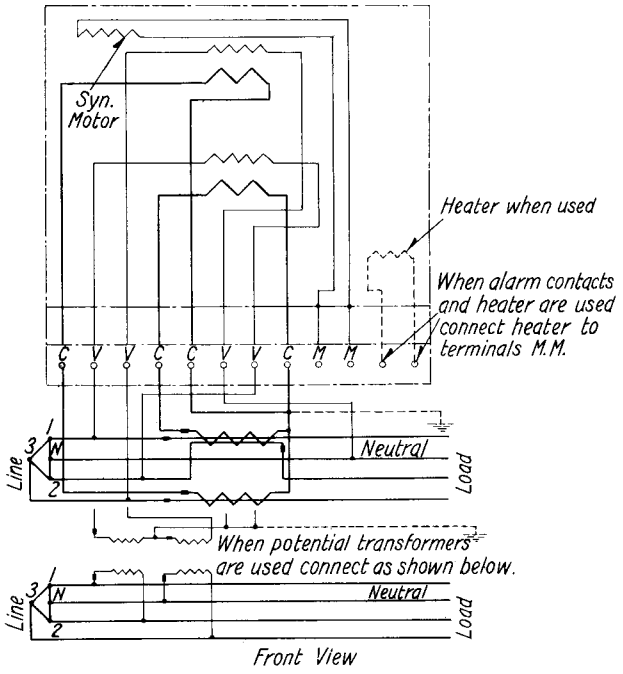


Fig. 23 - Type R-2 Three Phase Four-Wire Delta Using One Two-Wire and One Three-Wire Current Transformer of Equal Ratio

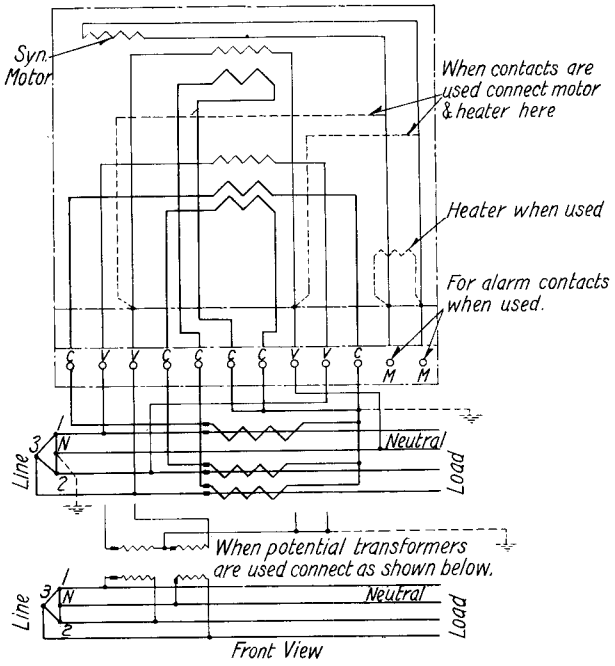


Fig. 24 - Type R-7 Three Phase Four-Wire Delta Using Three Two-Wire Current Transformers of Equal Ratio

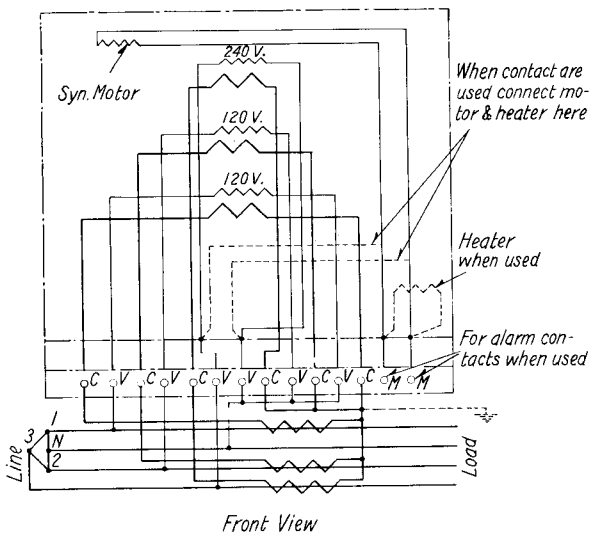


Fig. 25 - Type R-9 Three Phase Four-Wire Delta Using Three Two-Wire Current Transformers of Equal Ratio

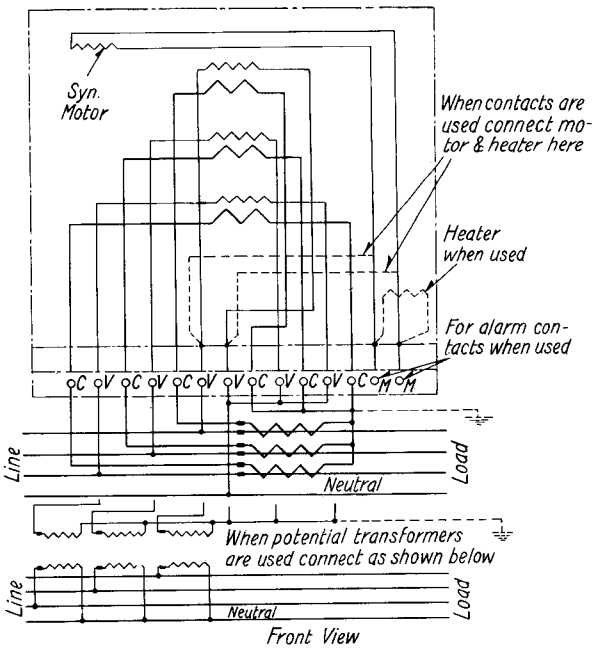


Fig. 26 - Type R-3 Three Phase Four-Wire "Y" With Transformers

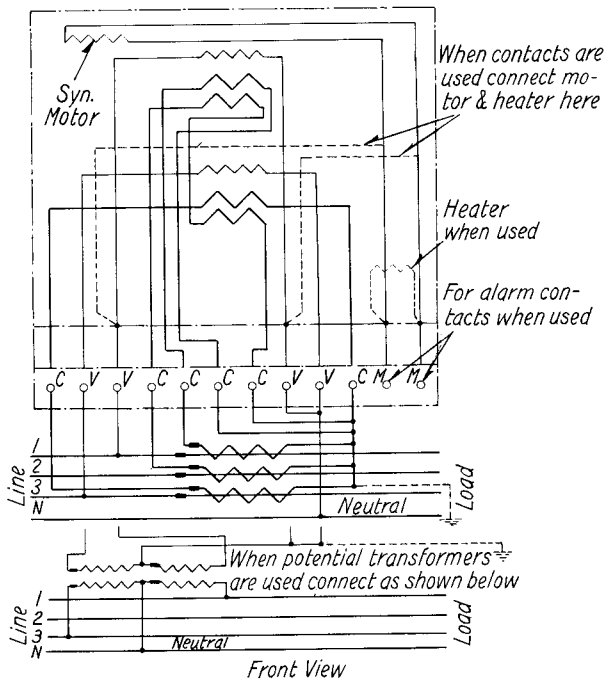


Fig. 27 - Type R-8 Three Phase Four-Wire "Y" With Transformers

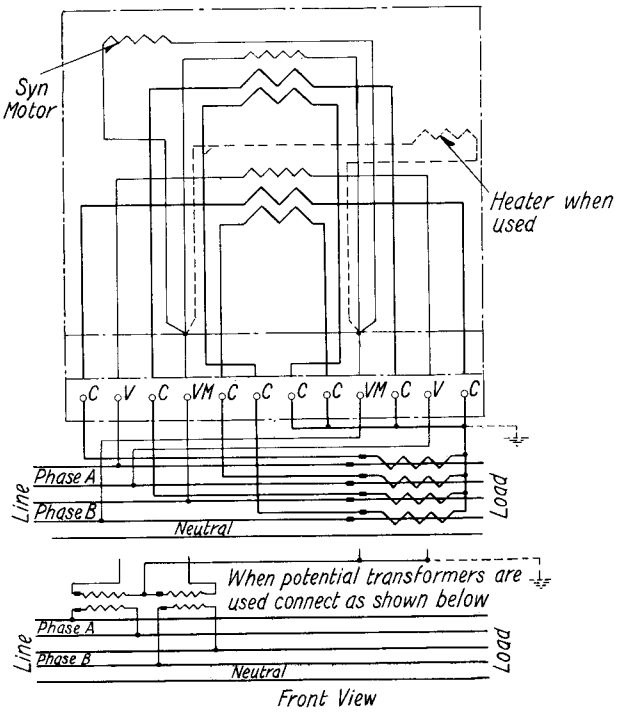


Fig. 28 - Type R-10 Two Phase Five-Wire With Transformers

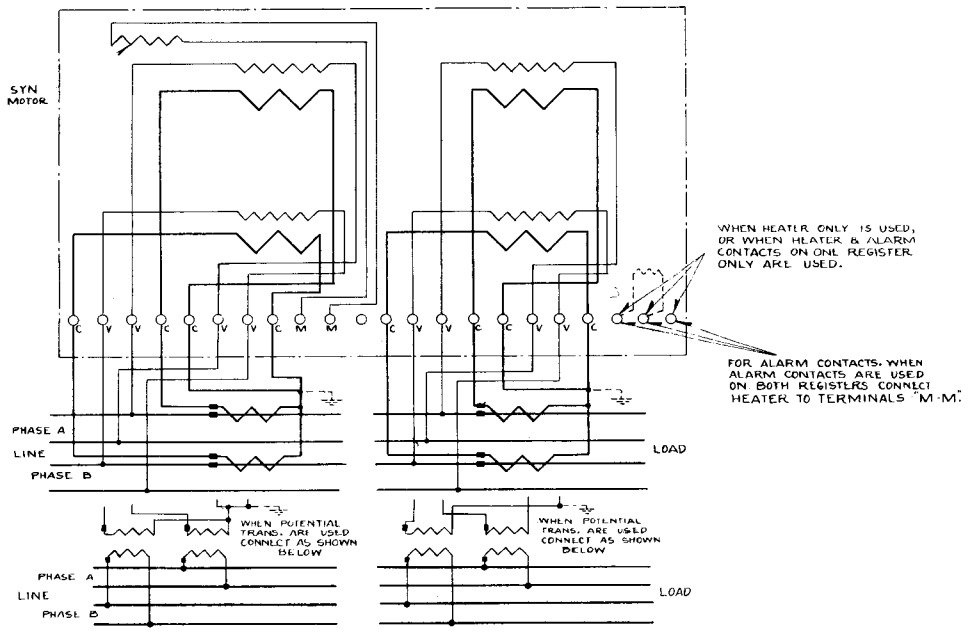
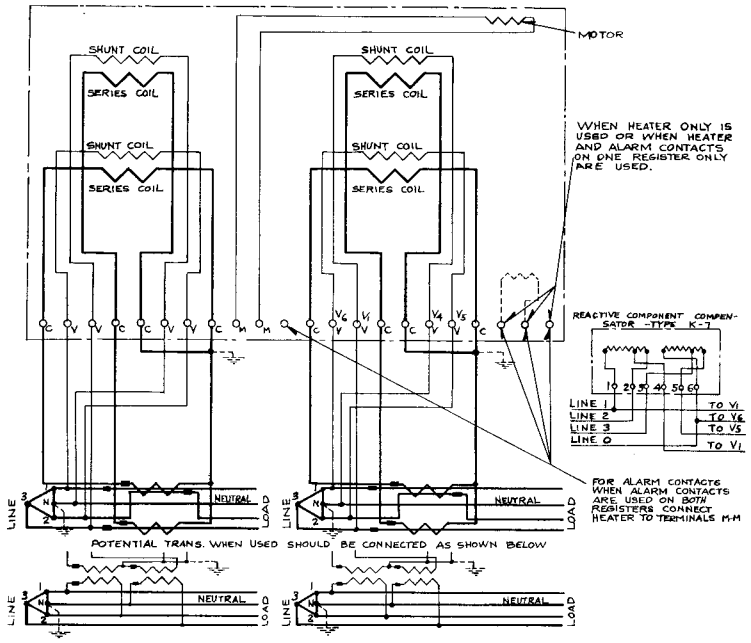


Fig. 29 - Type R-22 Duplex Two Phase Four-Wire With Transformers

NOTE: A Reactive Component Compensator is Not Required for Measuring Reactive Kv-a. on 2-Phase Circuits. Potential Coils of "A" Phase and the Current Coils of "B" Phase are Connected to the Same Reactive Element. Similarly the Potential Coils of "B" and the Current Coils of "A" are Connected to the Other Reactive Element.

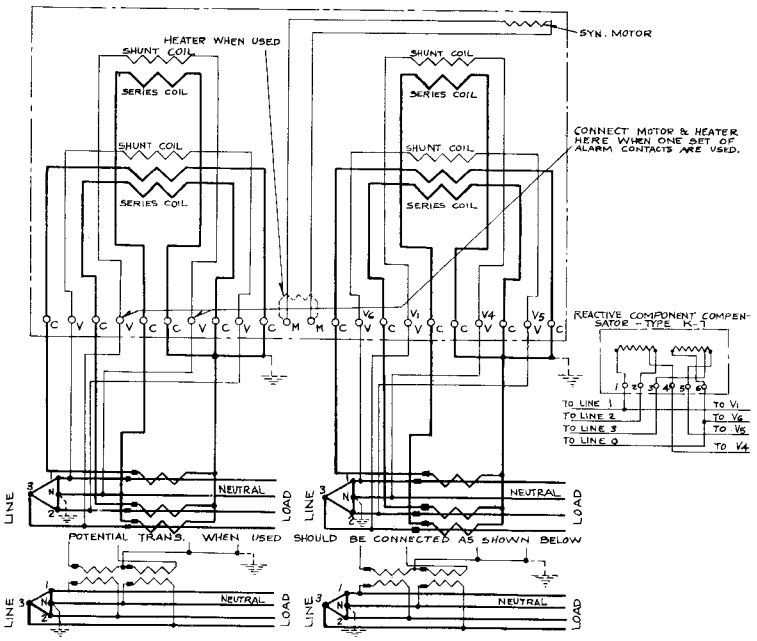
FRONT VIEWS



NOTE: Connections are shown for forward rotation of Reactive Meter on lagging power factor with phase sequence 1-2, 2-3, 3-1.

For forward rotation on opposite phase sequence or on leading power factor, reverse leads to V6 and V5 and reverse leads to V1 and V4.

Fig. 30 - R-22 Duplex Three Phase Four-Wire Delta With Transformers



NOTE: Connections are shown for forward rotation of reactive meter on lagging power factor with phase sequence 1-2, 2-3, 3-1.

For forward rotation on opposite phase sequence or on leading power factor, reverse leads to V6 and V5 and reverse leads to V1 and V4.

Fig. 31 - R-27 Duplex Three Phase Four-Wire Delta With Transformer

FRONT VIEWS

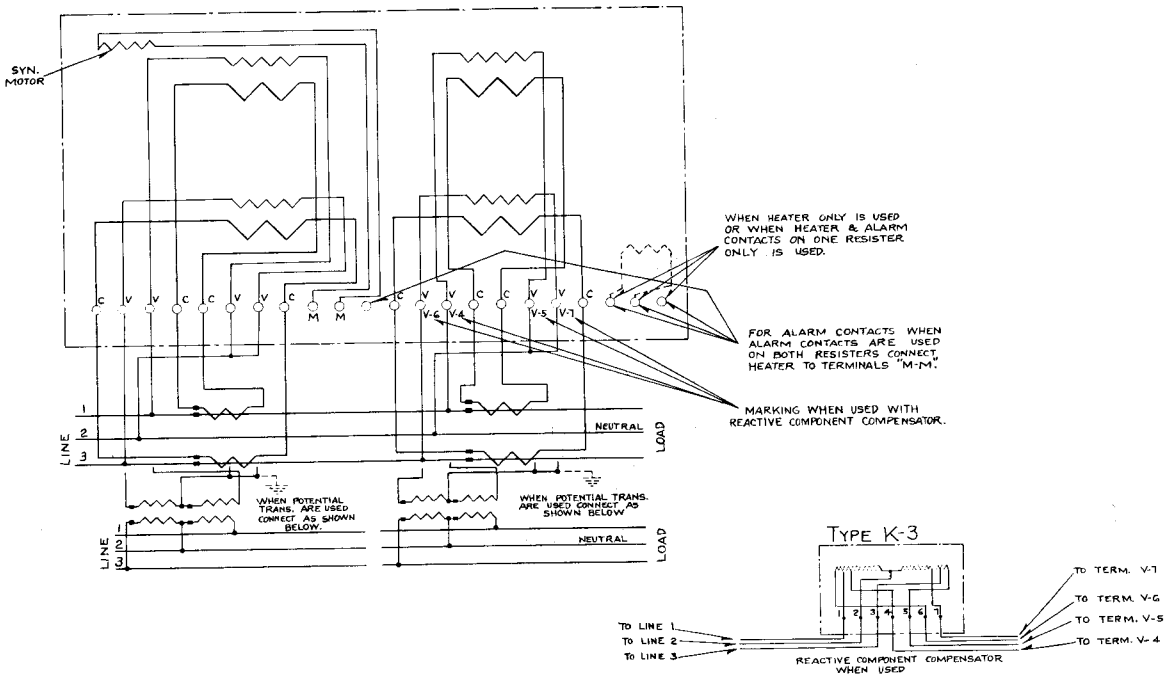


Fig. 32 - Type R-22 Duplex Two or Three Phase Three-Wire With Transformers

NOTE: When the Reactive Component Compensator is Connected as Shown Above for Measuring Reactive Kv-a. 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 Reactive Component Meter When Power Factor is Lagging and Phase Rotation is 1-2, 2-3 and 3-1.

If Phase Rotation is Reversed Leads 4-5 Must be Reversed at Reactive Component Meter or at the Compensator, Also Leads 6-7 Must be Reversed.

If it is Desired to Use Meter on Leading Power Factors Leads 4-5 Must be Reversed; Also Leads 6-7.

If it is Desired to Prevent Reversal of Rotation Whe Power Factor Changes from Lag to Lead or Vice Versa, the Reactive Component Meter Must be Equipped With Ratchet.

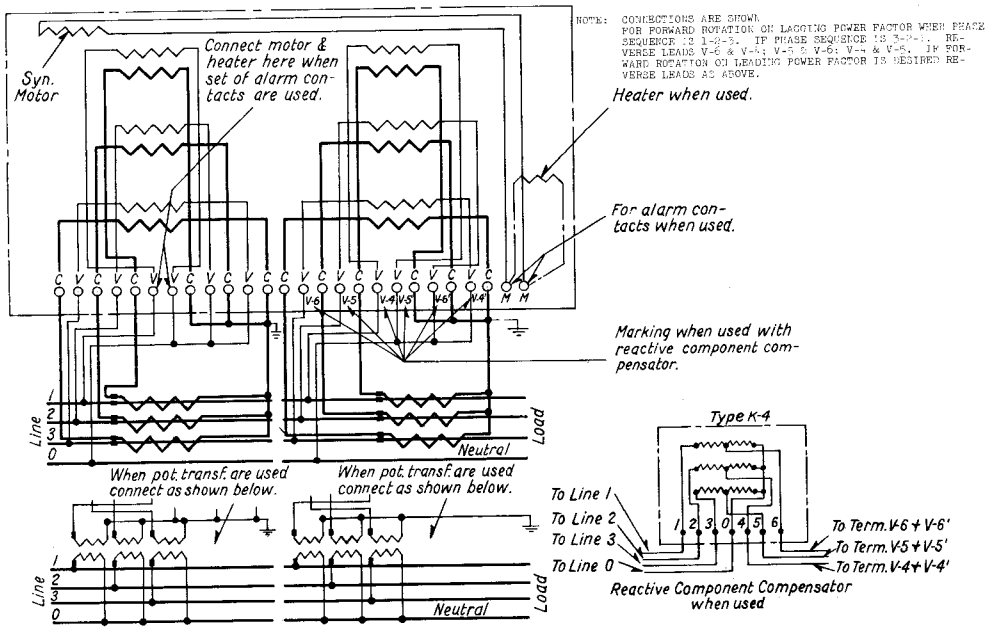


Fig. 33 - Type R-23 Three Phase Four-Wire "Y" With Transformers

FRONT VIEWS

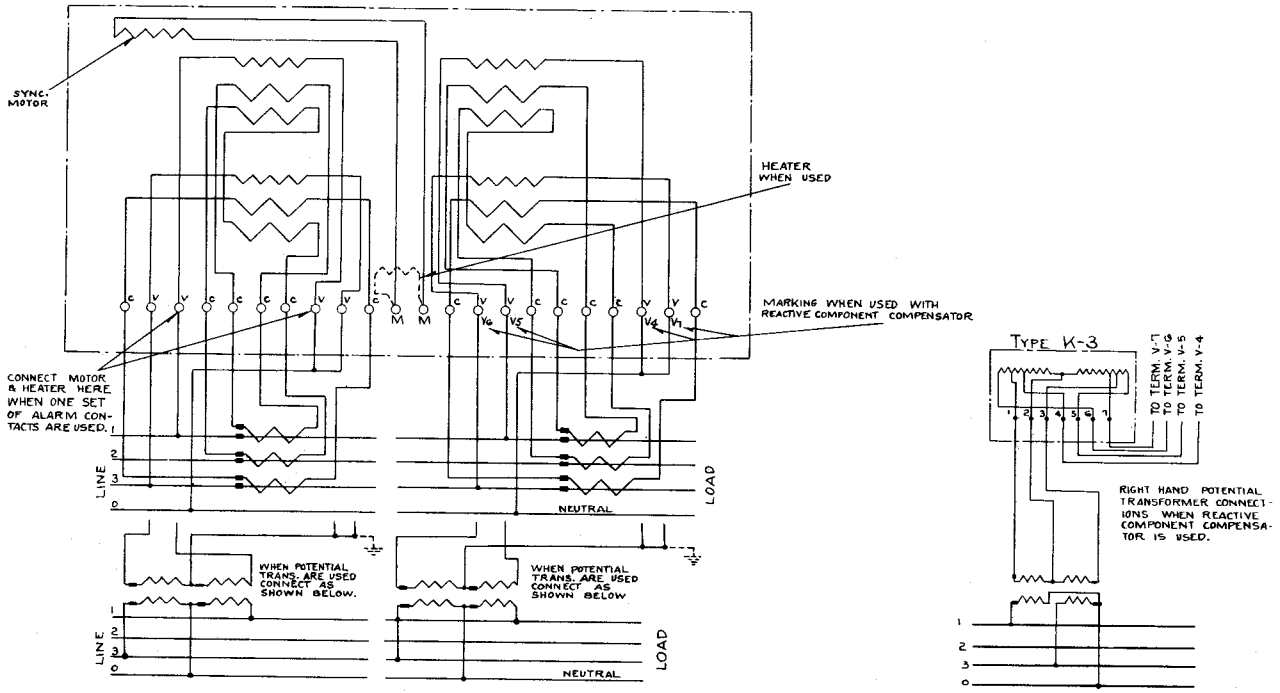


Fig. 34 - Type R-28 Three Phase, Four-Wire "Y" With Transformers

NOTE: When the Reactive Component Compensator is Connected as Shown Above for Measuring Reactive Kv-a., 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 Reactive Component Meter whe Power Factor is Lagging and Phase Rotation 1-2, 2-3 and 3-1.

If Phase Rotation is Reversed Leads 4-5 Must be Reversed at Reactive Component Meter or at the Compensator, Also Leads 6-7 Must be Reversed.

If it is Desired to Use Meter on Leading Power Factors Leads 4-5 Must be Reversed; Also Leads 6-7

If it is Desired to Prevent Reversal of Rotation when Power Factor Changes From Lag to Lead or Vice Versa, the Reactive Component Meter Must be Equipped with Ratchet.

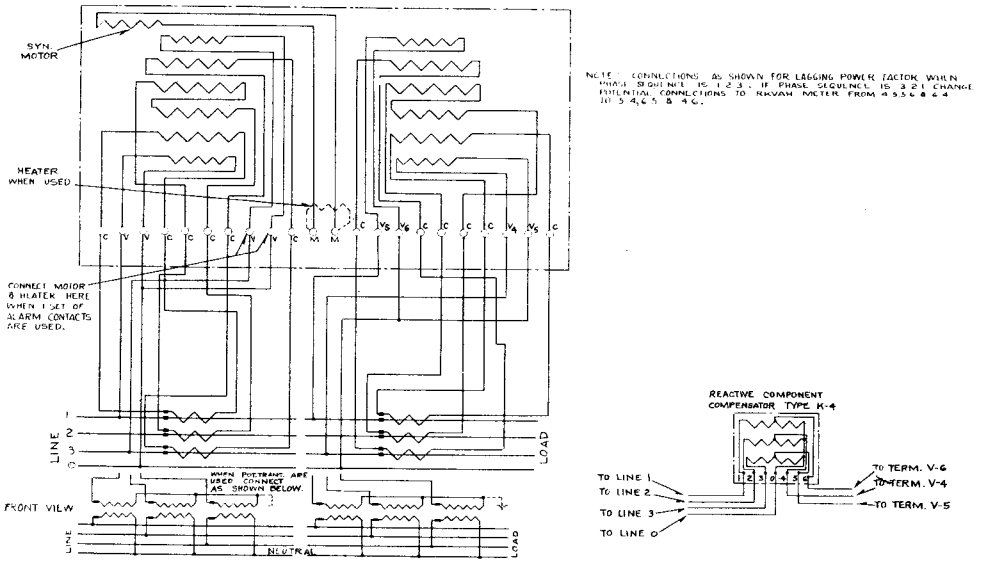


Fig. 35 - Type R-28 Three Phase Four Wire "Y" without Potential Transformers

FRONT VIEWS

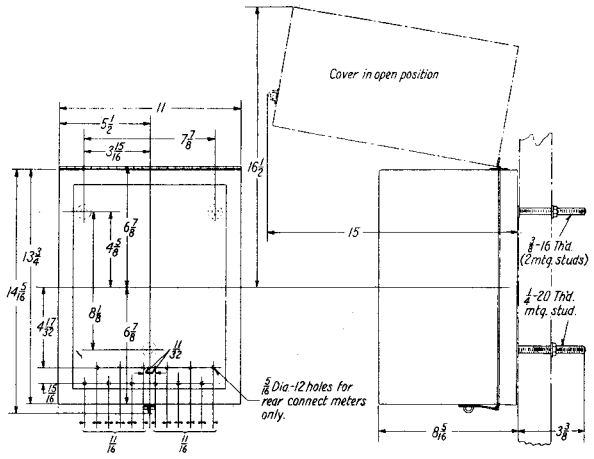


Fig. 36 - Types R-2, R-7, R-8 and R-10 - Hinged Cover

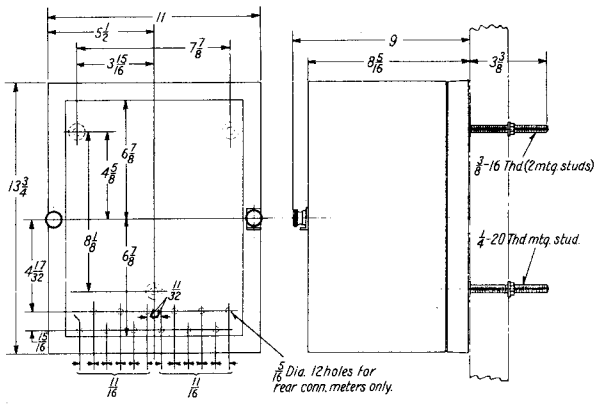


Fig. 37 - Types R-2, R-7, R-8 and R-10 - Stud Cover

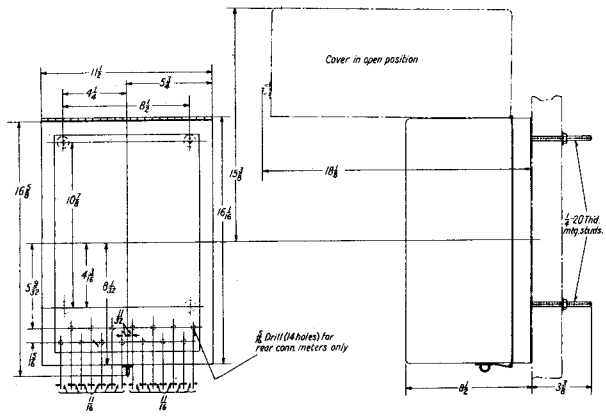


Fig. 38 - Types R-3 and R-9 - Hinged Cover

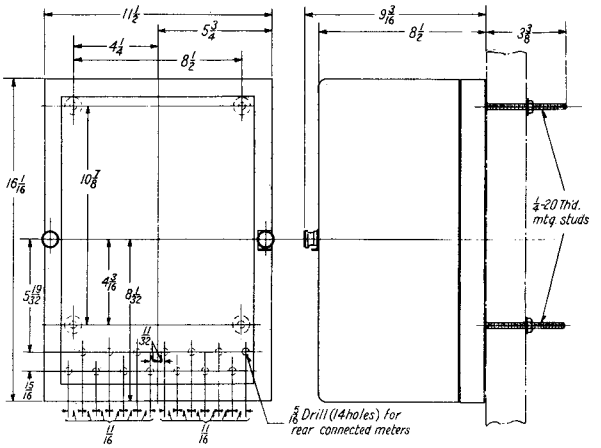


Fig. 39 - Types R-3 and R-9 - Stud Cover

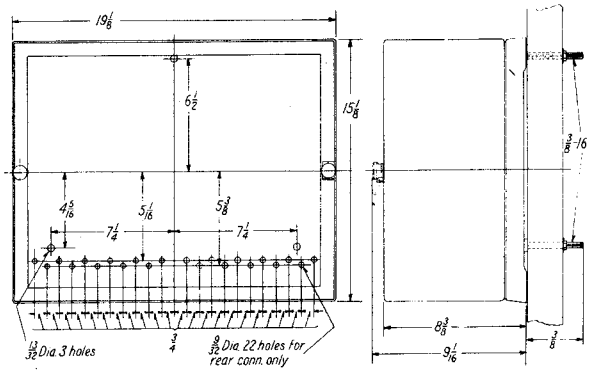


Fig. 40 - Types R-22, R-27 and R-28 - Stud Cover

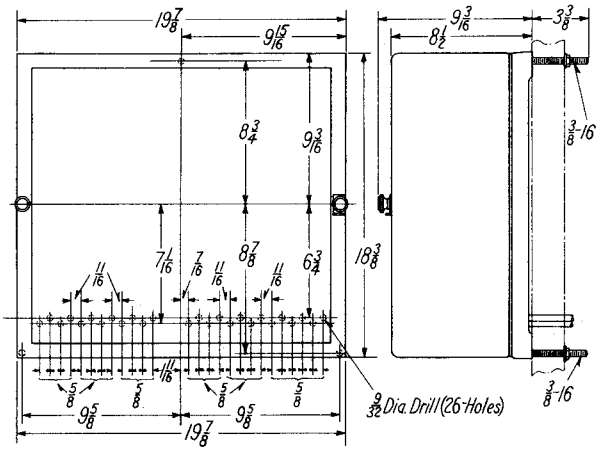


Fig. 41 - Types R-23 and R-29 - Stud Cover

FRONT VIEWS

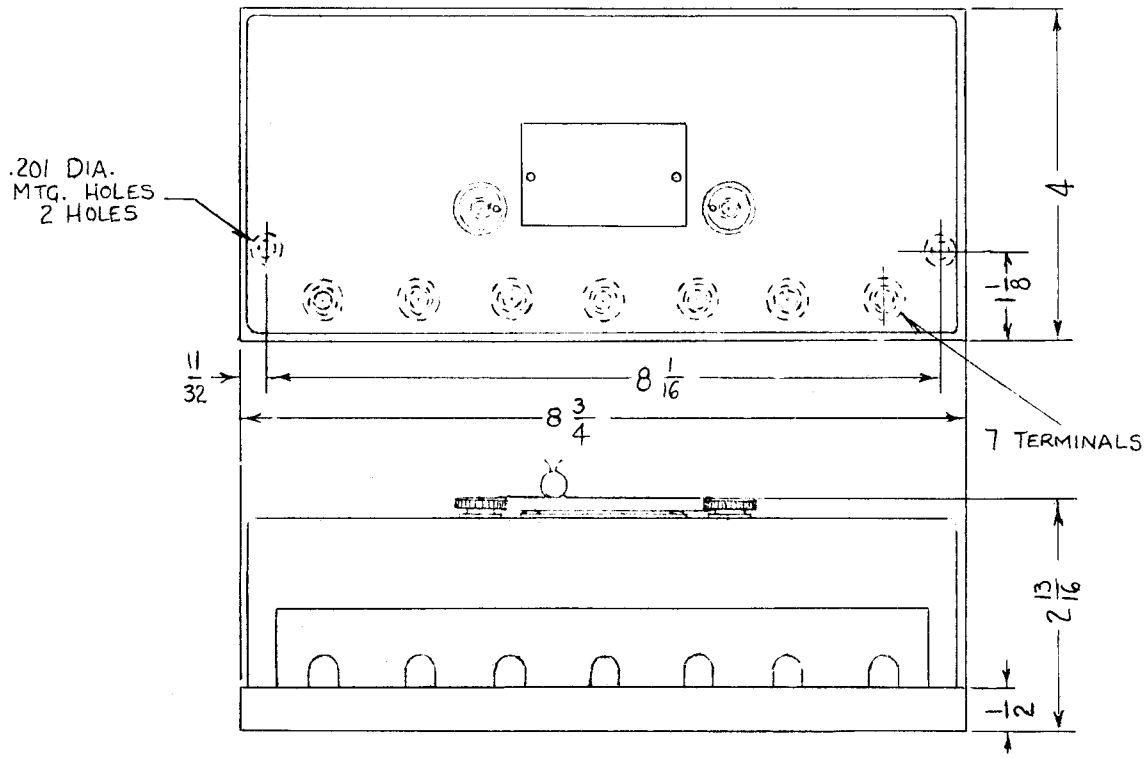


Fig. 42 - Outline and Dimensions For Types K-3, K-4, K-7 and K-9 Reactive Component Compensator