Westinghouse

—25 LINE—
SWITCHBOARD INSTRUMENTS
SIX-INCH CLASSIFICATION
INSTRUCTIONS

GENERAL

Cases

The first letter in type designates the form of case used.

U = Rect. Proj. Base M't'd 5½" x 5½".
K = Rect. Flush, Flange M't'd 6½" x 6½".
M = Rect. Flush, Base M't'd 5 13/16" x 5 13/16".

Mechanisms

The second letter in type designates the principle of operation.

A = Repulsion Moving Iron.
X = Permanent Magnet Moving Coil.
T = Thermocouple plus x.
C = Rectifier plus x.
Y = Electrodynamic.
I = Rotating Iron Vane.

Insulation Rating

All Ammeters and Voltmeters are insulated for 750 volt maximum service. Wattmeters, power factor meters, frequency meters and synchroscopes are insulated for 250 volt service.

Dial Notes

References to type, style number, use of external shunts, calibration data, etc., are referred to on dial.

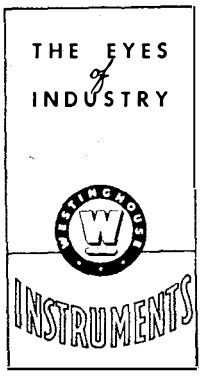
The full scale marking of an indicating instrument is not necessarily the same as the ratings of the current and voltage coils. The coil ratings are based upon temperature requirements. Full scale values are chosen to give clear, simple scale markings of the values of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 7.5, 8, or decimal multiples of these values.

These coil ratings are given in the data lines near the bottom of the dial plate, and are not necessarily part of the calibration data of the instrument. The calibration data are marked on the dial and in the case of Wattmeters and Varmeters comprise the calibration constant K and the ratios of the current and potential transformers when these are used.

The constant K is the product of the ratios of the current and potential transformers. It is equal to the number of Kilowatts (or Kilovars) indicated per Kilowatt (or Kilovar) applied to the coils, on a single phase test circuit.

Installation

Unpack instruments carefully. Terminal and mounting hardware, and any external resistors or reactors may be in separate packages.



Drill panels and connect according to the diagrams in this leaflet, or according to switchboard drawings if instruments are supplied as part of a switchboard.

On any instruments which operate with spring control, such as ammeters, voltmeters or wattmeters, adjust the pointer to zero by means of the zero adjuster before energizing the windings. Power factor meters, position indicators, synchroscopes and frequency meters do not have zero adjusters.

CIRCUIT PRECAUTIONS

The secondary circuits of all instrument transformers should be grounded.

The external connecting diagrams for the A-C. instruments show the proper locations for ground connections for the secondary circuits of the instrument transformers, aud for the instrument cases.

The ground connection of the cases should be omitted when instruments are mounted on "live front" switchboard panels.

CALIBRATION

A-C. Instruments

Types A-25 ammeters and voltmeters operate on the repulsion iron vane principle. Calibration adjustments are made by shifting the outer end of the spring in its holder. After loosening the small clamping screw, the zero adjuster should be left in mid-position, the pointer being set to zero by shifting the small tail piece of the inner spring adjuster located beneath the spring, using a small suitable tool. The outer spring clamping screw must be tightened before shifting the inner spring adjuster.

Type Y-25 wattmeters are the electrodynamic type. Polyphase wattmeters may be checked on single phase circuits by testing each element separately, or the current coils may be connected in series and the potential coils in parallel, and both elements tested at the same time. Calibration adjustments are made by changing the resistance of the potential circuit.

Varmeters are exactly like the wattmeters, except that they indicate the reactive volt-amperes by means of external phase shifting transformers. They are often made with zero center scales. When used on unidirectional circuits the scales are marked "lag" and "lead" as in power factor meters. When intended for tie lines or other duo-directional circuits, the lag and lead notations are generally omitted and directional markings are substituted, to show direction of reactive power flow.

Type Y-25 power factor meters are of the crossed-coil, electrodynamic type. Maximum accuracy is obtained when current in the current coils is from 40 to 125 per cent of coil rating and voltage on the potential circuit from 75 to 125 per cent of normal. Polyphase power factor meters are designed to indicate correctly only on balanced load.

In order to test external 3 phase connections first check in reference to phase sequence (1—2—3).

A trial connection may be checked by shunting part of the current from the stationary coil with a low resistance wire (about 0.1 ohm) across the current terminals. If the pointer movement is toward the lag side of the scale, connections are correct. If the pointer movement is toward the lead side of the scale the connections to the first and third potential terminals should be interchanged on the line side of external resistors if any are used.

Further incorrect action may be due to the current connection being in the wrong phase, or reversed, giving six possible vector directions on three phase, one of which is correct for the power factor meter.

Should the pointer remain at one end of the scale regardless of change in power

factor the current connections should be interchanged. Polyphase power factor meters are adjusted by changing the value of resistance in the potential circuits. Single-phase instruments are adjusted by changing the air gap of the iron in the reactor or changing the value of resistance in the voltage circuit.

Type Y-25 frequency meters are of the crossed-coil electro dynamic type, the coils being connected into a network consisting of a reactor and a capacitor forming a resonant circuit.

If errors are found, the calibration may be corrected by adjusting the external reactor box. For this purpose an iron screw is provided, accessible through a hole in the perforated metal case. Changing the internal resistor which shunts one of the moving coils varies the over-all width of the scale range.

Type I-25 synchroscopes operate on the rotating iron vane principle. Calibration may be checked by connecting both circuits to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position. If the rotation is irregular, the currents in the reactor branch and resistance branch should be equalized.

Type I-25, 360-degree scale power factor meters are similar in mechanical construction to the synchroscope. The inner coils are wound as current coils and the outside stator coils wound as potential coils. Connections may be checked the same as for type Y-25-one hundred degree scale power factor meters.

Type I-25 position indicators are similar in mechanical construction to the synchroscope, the electrical characteristics being different. Leads must be connected in the proper sequence to have the indicator follow the controller properly in the right direction.

Permanent Magnet Moving Coil Types

Type X-25 voltmeter calibration adjustments are made by changing the value of resistance in series with the element. When used with an external resistor on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be kept at ground potential.

Type X-25 ammeter calibration adjustments are made by changing the resistance of the wire lead in series with the element. When connected to an external shunt, leads listed for use with the instrument, or leads of specified resistance should be used.

Type X-25 milliammeter calibration adjustments are made by changing the resistance of the internal shunt. Some ranges not provided with element shunts are adjusted by changing the strength of the magnet.

Type T-25 radio frequency instrument calibration adjustments are made by changing the value of the resistance in series with the thermocouple. To avoid burning out the thermocouple, the instrument should not be loaded above full scale.

Radio frequency instruments have the left terminal, as viewed from the rear, bonded to the metal chassis and dial of the instrument. This prevents electrostatic effects between pointer and dial and provides points of zero potential inside the instrument.

Radio frequency instruments, particularly when operated from external thermocouples, should be arranged with effective R.F. by-pass and ground connections to minimize the effect of capacity currents.

Type C-25 rectifier type voltmeter calibration adjustments are made by changing the value of series resistance. Rectifier type milliammeters are calibrated by changing the strength of the magnet. Rectifier type instruments indicate correctly at 25C. with 60 cycle pure sine wave.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. When returning an instrument for repairs, obtain a returned material tag from your dealer or your nearest Westinghouse Sales Office to assure proper identification at the factory.

Orders for renewal parts should include the name of the part and the style and serial number of the instrument, appearing on the dial.

Spare Lamps

Internally illuminated instruments use #46 Mazda Lamps (6.3 volts 0.25 amp.) Westinghouse Style No. 1,001,663. These are rated at 3000 hour life at rated voltage. 10 percent overvoltage greatly decreases life.

For 110 to 140 volts, Type MT miniature transformer, Style #1246352 (6.3 volt secondary) is available.

Special Notes

For 3 element A-25 instruments, temperature indicators, Z-25 D-C. Wattmeters or for special instruments, see separate leaflets.

EXTERNAL CONNECTION DIAGRAMS (REAR VIEW)

Direct Current, Radio Frequency Instruments and Lighting Circuit

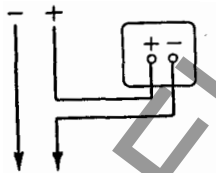


FIG. 1—AMMETER AND MILLIAMMETER, SELF-CONTAINED

FIG. 2—AMMETER WITH EXTERNAL SHUNT

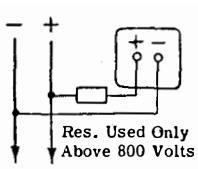


FIG. 3—VOLTMETER

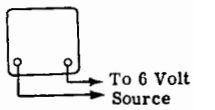


FIG. 4—FOR ALL INSTRUMENTS WITH ILLUMINATION

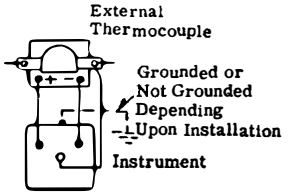


FIG. 5—RF AMMETER EXTERNAL THERMOCOUPLE

Alternating Current Instruments

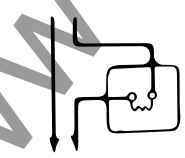


FIG. 6—AMMETER SELF-CONTAINED

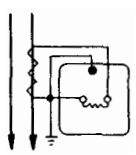
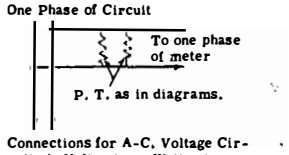


FIG. 7— AMMETER WITH CURRENT TRANSFORMERS



Connections for A-C. Voltage Circuits in Voltmeters, Wattmeters, Freq. Meters or Power Factor Meters when P.T. are not required.

FIG. 8— VOLTMETER

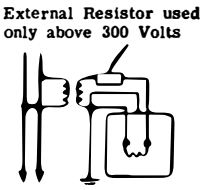


FIG. 9—VOLTMETER WITH POTENTIAL TRANSFORMERS

ALTERNATING CURRENT INSTRUMENTS—Continued

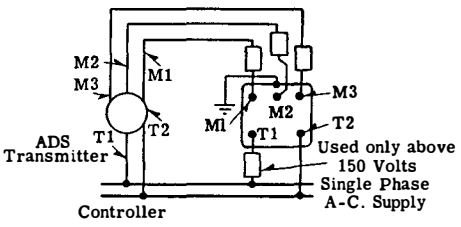


FIG. 10—POSITION INDICATOR

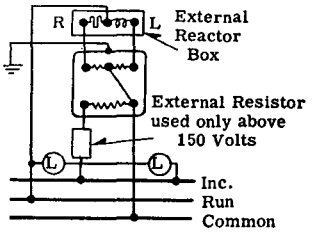


FIG. 11—SYNCHROSCOPE

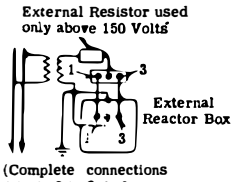


FIG. 12—FREQUENCY METER

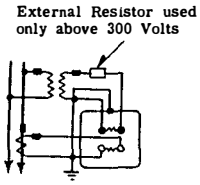


FIG. 13—WATTMETER, SINGLE PHASE

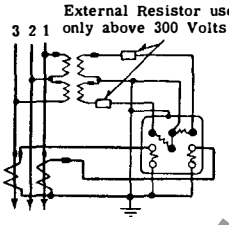


FIG. 14—WATTMETER, 3 PHASE, 3 WIRE

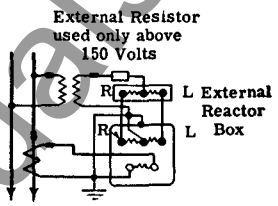
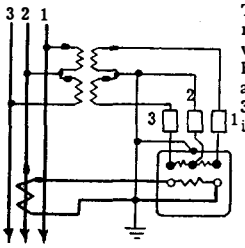


FIG. 15—POWER FACTOR METER, SINGLE PHASE



Type Y-25 requires external resistors to lines 1 and 3 for voltages above 300 only. Below 300 no external resistors are used. Type I-25 requires 3 external resistors as shown in this diagram.

FIG. 16—POWER FACTOR METER, 3 PHASE, 3-WIRE

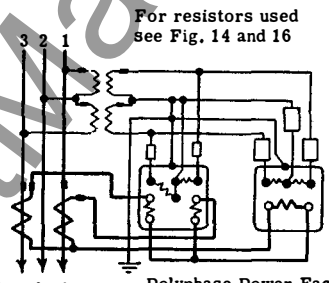


FIG. 17—POLYPHASE WATTMETER AND POWER FACTOR METER

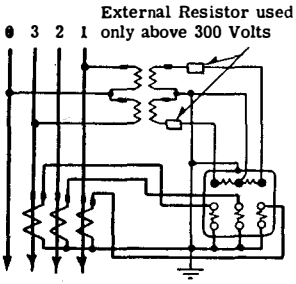


FIG. 18—WATTMETER, 3-PHASE, 4-WIRE (Y.C.T.)

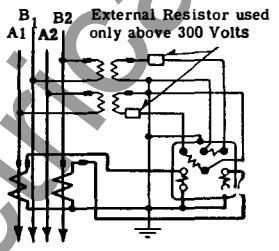
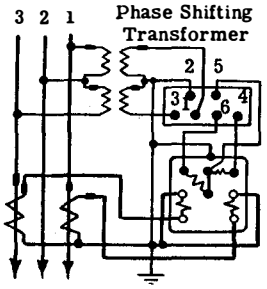


FIG. 19—WATTMETER, 2-PHASE, 4-WIRE



For 0-Lag Scale Reverse Current Coil Connections

FIG. 20—VARMETER, 3-PHASE, 3-WIRE

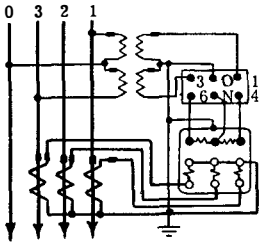


FIG. 21—VARMETER 3-PHASE, 4-WIRE

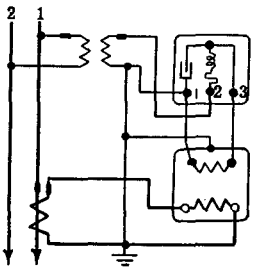


FIG. 22—VARMETER, SINGLE PHASE—2 WIRE

Standard Phase Rotation (1-2-3) used.

OUTLINE DIMENSIONS IN INCHES

Projection Mounting
Type U-25

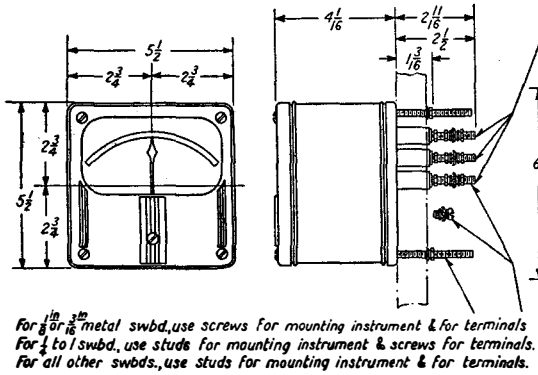


FIG. 23

Flush Mounting
Type K-25

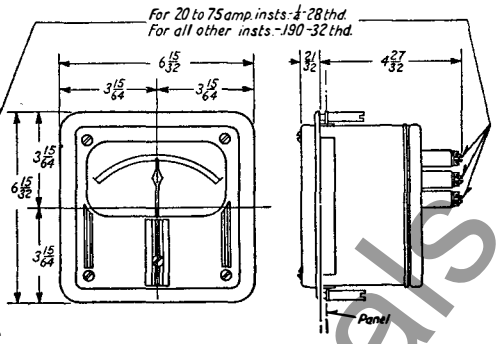


FIG. 24

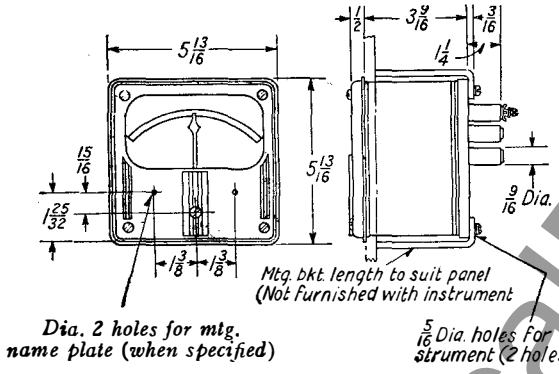


FIG. 25—FLUSH MOUNTING—TYPE M-25

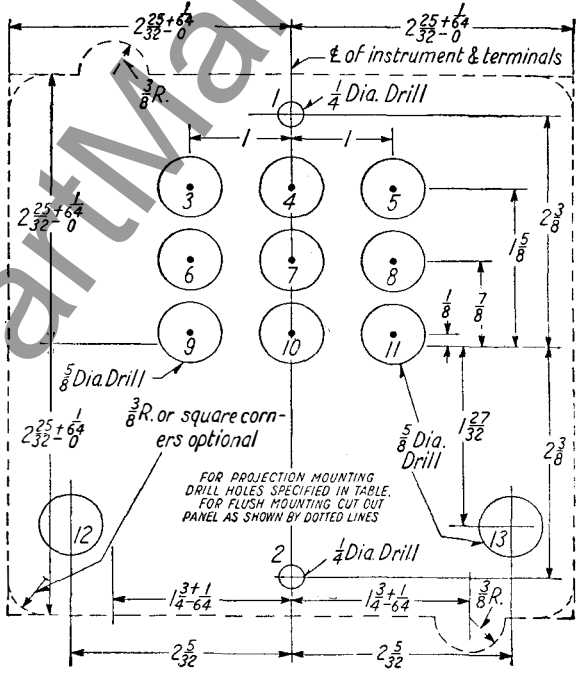


FIG. 26

For A-C. or D-C. Ammeter or Voltmeter	Drill Holes 1-2-6-8
For Frequency Meter	" " 1-2-6-7-8
For Single Phase Wattmeter	" " 1-2-3-5-6-8
For Power Factor Meter	" " 1-2-3-4-5-6-8

For Synch., 360° Scale P. F. or Pos. Ind.	Drill Holes 1-2-3-4-5-6-8
For Polyphase Watt or Varmeters, 4 Pot. Terms.	" " 1-2-3-4-5-6-7-8-9-11
For 3 C.C. P'-ph. Watt or Varmet., 3 Pot. Terms	" " 1-2-3-4-5-6-7-8-9-10-11
For Instruments with Internal Illumination	" " 12 and 13

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Meter Division, Newark, N. J.

Westinghouse Press
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OUTLINE DIMENSIONS IN INCHES

Projection Mounting
Type U-25

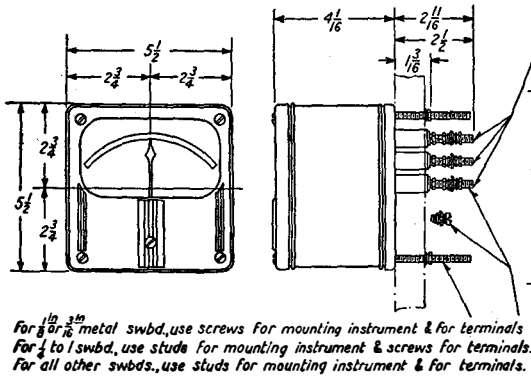


FIG. 23

Flush Mounting
Type K-25

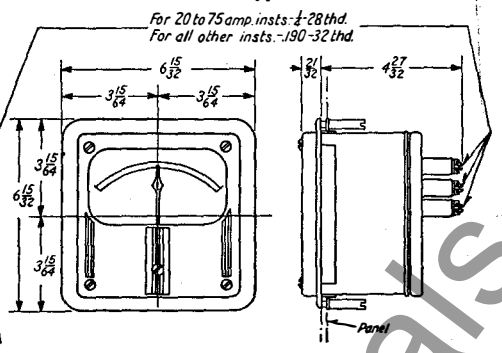


FIG. 24

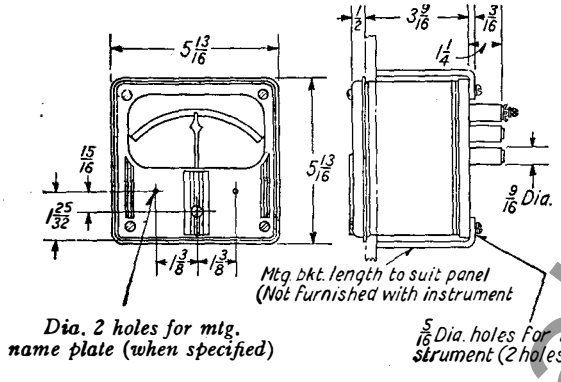
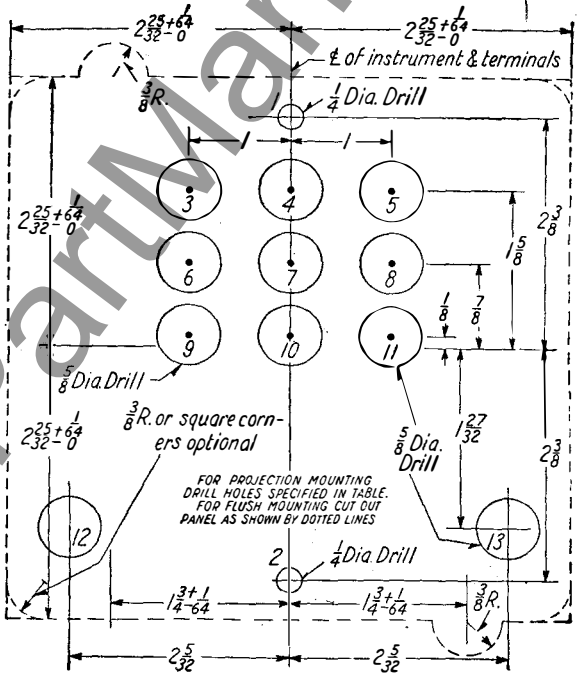


FIG. 25—FLUSH MOUNTING—TYPE M-25



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For A-C. or D-C. Ammeter or Voltmeter	Drill Holes 1-2-6-8
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For Single Phase Wattmeter	" " 1-2-3-5-6-8
For Power Factor Meter	" " 1-2-3-4-5-6-8

For Synch., 360° Scale P. F. or Pos. Ind.	Drill Holes 1-2-3-4-5-6-8
For Polyphase Watt or Varmeters, 4 Pot. Terms.	" " 1-2-3-4-5-6-7-8-9-11
For 3 C.C. P'-ph. Watt or Varmet., 3 Pot. Terms	" " 1-2-3-4-5-6-7-8-9-10-11
For Instruments with Internal Illumination	" " 12 and 13

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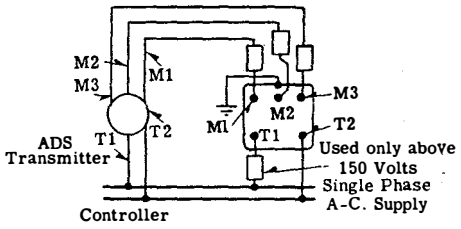


FIG. 10—POSITION INDICATOR

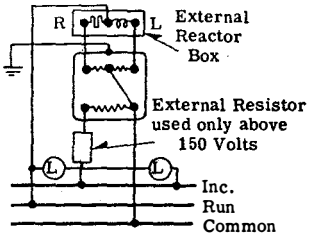


FIG. 11—SYNCHROSCOPE

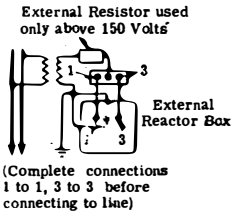


FIG. 12—FREQUENCY METER

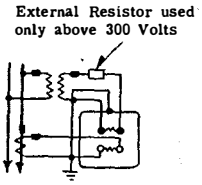


FIG. 13—WATTMETER, SINGLE PHASE

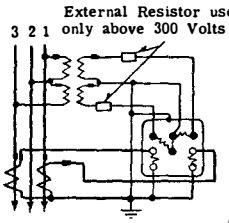


FIG. 14—WATTMETER, 3 PHASE, 3 WIRE

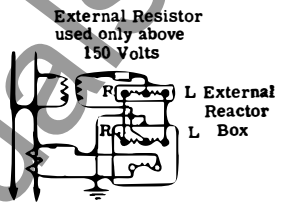
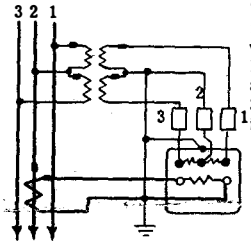


FIG. 15—POWER FACTOR METER, SINGLE PHASE



Type Y-25 requires external resistors to lines 1 and 3 for voltages above 300 only. Below 300 no external resistors are used. Type I-25 requires 3 external resistors as shown in this diagram.

FIG. 16—POWER FACTOR METER, 3 PHASE, 3-WIRE

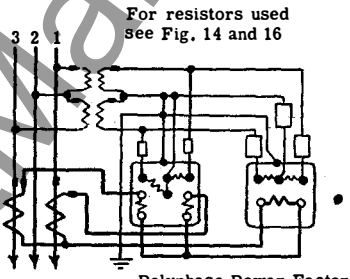


FIG. 17—POLYPHASE WATTMETER AND POWER FACTOR METER

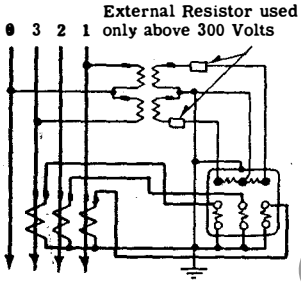


FIG. 18—WATTMETER, 3-PHASE, 4-WIRE (Y.C.T.)

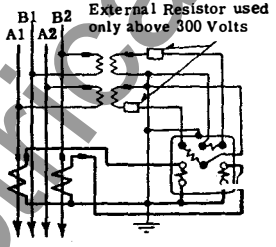


FIG. 19—WATTMETER, 2-PHASE, 4-WIRE

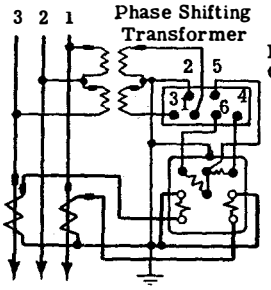


FIG. 20—VARMETER, 3-PHASE, 3-WIRE

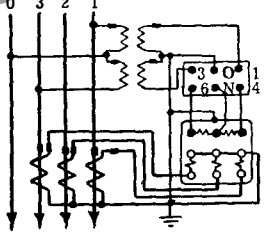


FIG. 21—VARMETER 3-PHASE, 4-WIRE

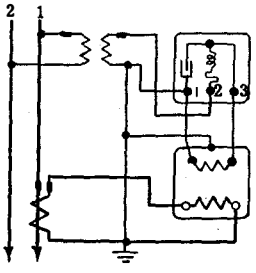


FIG. 22—VARMETER, SINGLE PHASE—2 WIRE

Standard Phase Rotation (1-2-3) used.

factor the current connections should be interchanged. Polyphase power factor meters are adjusted by changing the value of resistance in the potential circuits. Single-phase instruments are adjusted by changing the air gap of the iron in the reactor or changing the value of resistance in the voltage circuit.

Type Y-25 frequency meters are of the crossed-coil electro dynamic type, the coils being connected into a network consisting of a reactor and a capacitor forming a resonant circuit.

If errors are found, the calibration may be corrected by adjusting the external reactor box. For this purpose an iron screw is provided, accessible through a hole in the perforated metal case. Changing the internal resistor which shunts one of the moving coils varies the over-all width of the scale range.

Type I-25 synchroscopes operate on the rotating iron vane principle. Calibration may be checked by connecting both circuits to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position. If the rotation is irregular, the currents in the reactor branch and resistance branch should be equalized.

Type I-25, 360-degree scale power factor meters are similar in mechanical construction to the synchroscope, the electrical characteristics being different. Leads must be connected in the proper sequence to have the indicator follow the controller properly in the right direction.

Permanent Magnet Moving Coil Types

Type X-25 voltmeter calibration adjustments are made by changing the value of resistance in series with the element. When used with an external resistor on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be kept at ground potential.

Type X-25 ammeter calibration adjustments are made by changing the resistance of the wire lead in series with the element. When connected to an external shunt, leads listed for use with the instrument, or leads of specified resistance should be used.

Type X-25 milliammeter calibration adjustments are made by changing the resistance of the internal shunt. Some ranges not provided with element shunts are adjusted by changing the strength of the magnet.

Type T-25 radio frequency instrument calibration adjustments are made by changing the value of the resistance in series with the thermocouple. To avoid burning out the thermocouple, the instrument should not be loaded above full scale.

Radio frequency instruments have the left terminal, as viewed from the rear, bonded to the metal chassis and dial of the instrument. This prevents electrostatic effects between pointer and dial and provides points of zero potential inside the instrument.

Radio frequency instruments, particularly when operated from external thermocouples, should be arranged with effective R.F. by-pass and ground connections to minimize the effect of capacity currents.

Type C-25 rectifier type voltmeter calibration adjustments are made by changing the value of series resistance. Rectifier type milliammeters are calibrated by changing the strength of the magnet. Rectifier type instruments indicate correctly at 25C. with 60 cycle pure sine wave.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. When returning an instrument for repairs, obtain a returned material tag from your dealer or your nearest Westinghouse Sales Office to assure proper identification at the factory.

Orders for renewal parts should include the name of the part and the style and serial number of the instrument, appearing on the dial.

Spare Lamps

Internally illuminated instruments use #46 Mazda Lamps (6.3 volts 0.25 amp.) Westinghouse Style No. 1,001,663. These are rated at 3000 hour life at rated voltage. 10 percent overvoltage greatly decreases life.

For 110 to 140 volts, Type MT miniature transformer, Style #1246352 (6.3 volt secondary) is available.

Special Notes

For 3 element A-25 instruments, temperature indicators, Z-25 D-C. Wattmeters or for special instruments, see separate leaflets.

EXTERNAL CONNECTION DIAGRAMS (REAR VIEW)

Direct Current, Radio Frequency Instruments and Lighting Circuit

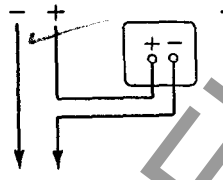


FIG. 1—AMMETER AND MILLIAMMETER, SELF-CONTAINED

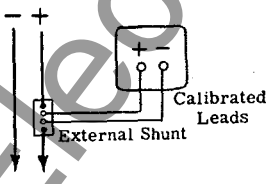


FIG. 2—AMMETER WITH EXTERNAL SHUNT

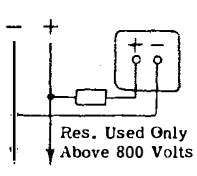


FIG. 3—VOLTMETER

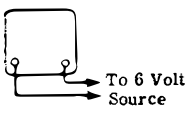


FIG. 4—FOR ALL INSTRUMENTS WITH ILLUMINATION

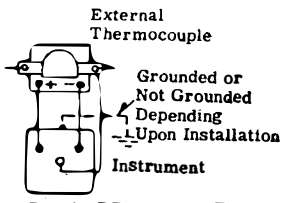


FIG. 5—RF AMMETER EXTERNAL THERMOCOUPLE

Alternating Current Instruments

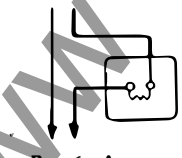


FIG. 6—AMMETER SELF-CONTAINED

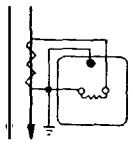
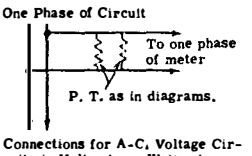


FIG. 7— AMMETER WITH CURRENT TRANSFORMERS



Connections for A-C. Voltage Circuits in Voltmeters, Wattmeters, Freq. Meters or Power Factor Meters when P.T. are not required.

FIG. 8— VOLTMETER

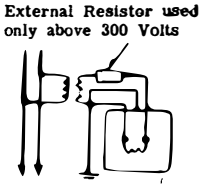


FIG. 9—VOLTMETER WITH POTENTIAL TRANSFORMERS

Westinghouse

—25 LINE—
SWITCHBOARD INSTRUMENTS
SIX-INCH CLASSIFICATION
INSTRUCTIONS

GENERAL

Cases

The first letter in type designates the form of case used.

U = Rect. Proj. Base M't'd 5½" x 5½".
K = Rect. Flush, Flange M't'd 6½" x 6½".
M = Rect. Flush, Base M't'd 5 13/16" x 5 13/16".

Mechanisms

The second letter in type designates the principle of operation.

A = Repulsion Moving Iron.
X = Permanent Magnet Moving Coil.
T = Thermocouple plus x.
C = Rectifier plus x.
Y = Electrodynamic.
I = Rotating Iron Vane.

Insulation Rating

All Ammeters and Voltmeters are insulated for 750 volt maximum service. Wattmeters, power factor meters, frequency meters and synchroscopes are insulated for 250 volt service.

Dial Notes

References to type, style number, use of external shunts, calibration data, etc., are referred to on dial.

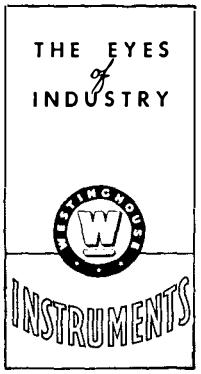
The full scale marking of an indicating instrument is not necessarily the same as the ratings of the current and voltage coils. The coil ratings are based upon temperature requirements. Full scale values are chosen to give clear, simple scale markings of the values of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 7.5, 8, or decimal multiples of these values.

These coil ratings are given in the data lines near the bottom of the dial plate, and are not necessarily part of the calibration data of the instrument. The calibration data are marked on the dial and in the case of Wattmeters and Varmeters comprise the calibration constant K and the ratios of the current and potential transformers when these are used.

The constant K is the product of the ratios of the current and potential transformers. It is equal to the number of Kilowatts (or Kilovars) indicated per Kilowatt (or Kilovar) applied to the coils, on a single phase test circuit.

Installation

Unpack instruments carefully. Terminal and mounting hardware, and any external resistors or reactors may be in separate packages.



Drill panels and connect according to the diagrams in this leaflet, or according to switchboard drawings if instruments are supplied as part of a switchboard.

On any instruments which operate with spring control, such as ammeters, voltmeters or wattmeters, adjust the pointer to zero by means of the zero adjuster before energizing the windings. Power factor meters, position indicators, synchroscopes and frequency meters do not have zero adjusters.

CIRCUIT PRECAUTIONS

The secondary circuits of all instrument transformers should be grounded.

The external connecting diagrams for the A-C. instruments show the proper locations for ground connections for the secondary circuits of the instrument transformers, aud for the instrument cases.

The ground connection of the cases should be omitted when instruments are mounted on "live front" switchboard panels.

CALIBRATION

A-C. Instruments

Types A-25 ammeters and voltmeters operate on the repulsion iron vane principle. Calibration adjustments are made by shifting the outer end of the spring in its holder. After loosening the small clamping screw, the zero adjuster should be left in mid-position, the pointer being set to zero by shifting the small tail piece of the inner spring adjuster located beneath the spring, using a small suitable tool. The outer spring clamping screw must be tightened before shifting the inner spring adjuster.

Type Y-25 wattmeters are the electrodynamic type. Polyphase wattmeters may be checked on single phase circuits by testing each element separately, or the current coils may be connected in series and the potential coils in parallel, and both elements tested at the same time. Calibration adjustments are made by changing the resistance of the potential circuit.

Varmeters are exactly like the wattmeters, except that they indicate the reactive volt-amperes by means of external phase shifting transformers. They are often made with zero center scales. When used on unidirectional circuits the scales are marked "lag" and "lead" as in power factor meters. When intended for tie lines or other duo-directional circuits, the lag and lead notations are generally omitted and directional markings are substituted, to show direction of reactive power flow.

Type Y-25 power factor meters are of the crossed-coil, electrodynamic type. Maximum accuracy is obtained when current in the current coils is from 40 to 125 per cent of coil rating and voltage on the potential circuit from 75 to 125 per cent of normal. Polyphase power factor meters are designed to indicate correctly only on balanced load.

In order to test external 3 phase connections first check in reference to phase sequence (1—2—3).

A trial connection may be checked by shunting part of the current from the stationary coil with a low resistance wire (about 0.1 ohm) across the current terminals. If the pointer movement is toward the lag side of the scale, connections are correct. If the pointer movement is toward the lead side of the scale the connections to the first and third potential terminals should be interchanged on the line side of external resistors if any are used.

Further incorrect action may be due to the current connection being in the wrong phase, or reversed, giving six possible vector directions on three phase, one of which is correct for the power factor meter.

Should the pointer remain at one end of the scale regardless of change in power

OUTLINE DIMENSIONS IN INCHES

Projection Mounting
Type U-25

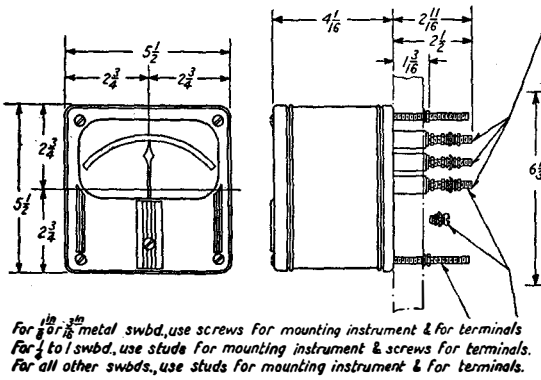


FIG. 23

Flush Mounting
Type K-25

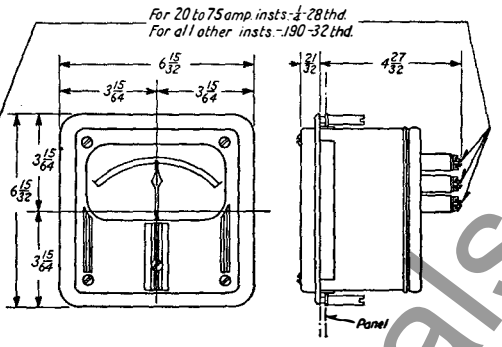


FIG. 24

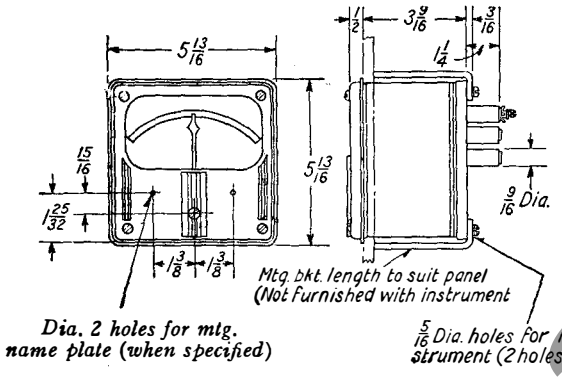


FIG. 25—FLUSH MOUNTING—TYPE M-25

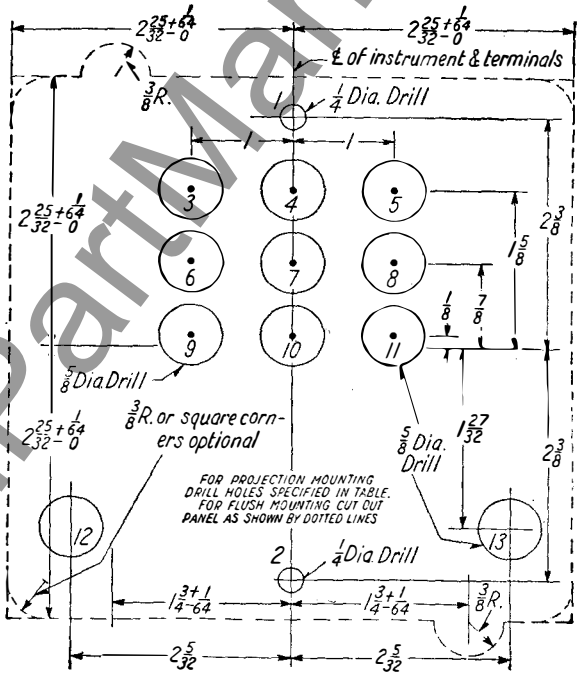


FIG. 26

For A-C. or D-C. Ammeter or Voltmeter	Drill Holes 1-2-6-8
For Frequency Meter	" " 1-2-6-7-8
For Single Phase Wattmeter	" " 1-2-3-5-6-8
For Power Factor Meter	" " 1-2-3-4-5-6-8

For Synch., 360° Scale P. F. or Pos. Ind.	Drill Holes 1-2-3-4-5-6-8
For Polyphase Watt or Varmeters, 4 Pot. Terms.	" " 1-2-3-4-5-6-7-8-9-11
For 3 C.C. P'-ph. Watt or Varmet., 3 Pot. Terms	" " 1-2-3-4-5-6-7-8-9-10-11
For Instruments with Internal Illumination	" " 12 and 13

Westinghouse Electric Corporation
Meter Division, Newark, N. J.

Westinghouse Press
Printed in U.S.A. (Rep. 12-48)

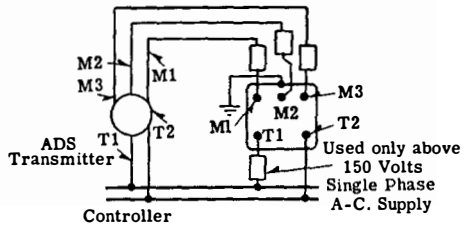


FIG. 10—POSITION INDICATOR

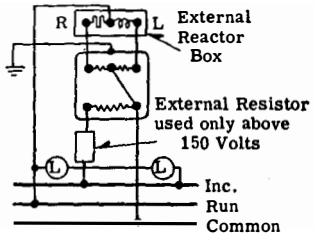


FIG. 11—SYNCHROSCOPE

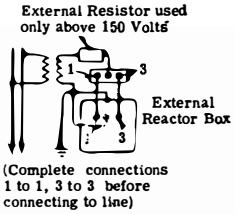


FIG. 12—FREQUENCY METER

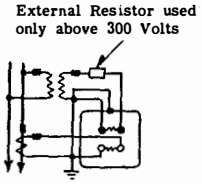


FIG. 13—WATTMETER, SINGLE PHASE

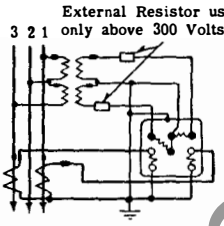


FIG. 14—WATTMETER, 3 PHASE, 3 WIRE

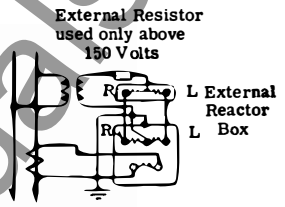
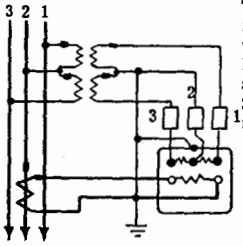
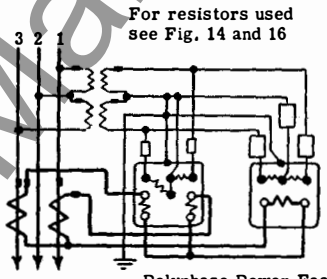


FIG. 15—POWER FACTOR METER, SINGLE PHASE



Type Y-25 requires external resistors to lines 1 and 3 for voltages above 300 only. Below 300 no external resistors are used. Type I-25 requires 3 external resistors as shown in this diagram.

FIG. 16—POWER FACTOR METER, 3 PHASE, 3-WIRE



Std. Polyphase wattmeter

Polyphase Power Factor Meter when used with 2 Current Transformers as used for Wattmeter

FIG. 17—POLYPHASE WATTMETER AND POWER FACTOR METER

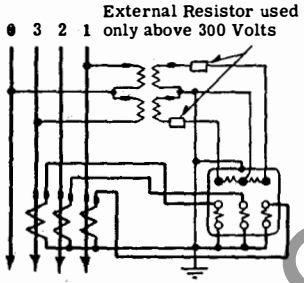


FIG. 18—WATTMETER, 3-PHASE, 4-WIRE (Y.C.T.)

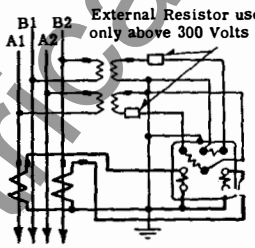
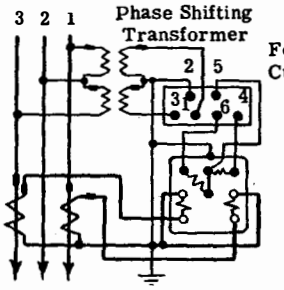


FIG. 19—WATTMETER, 2-PHASE, 4-WIRE



For 0-Lag Scale Reverse Current Coil Connections

FIG. 20—VARMETER, 3-PHASE, 3-WIRE

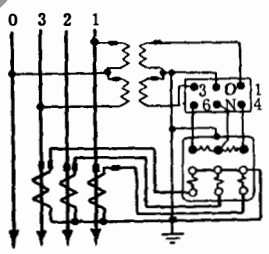


FIG. 21—VARMETER 3-PHASE, 4-WIRE

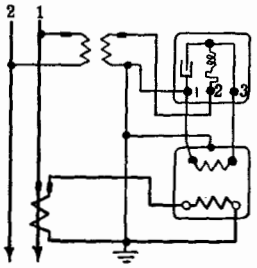


FIG. 22—VARMETER, SINGLE PHASE—2 WIRE

Standard Phase Rotation (1-2-3) used.

factor the current connections should be interchanged. Polyphase power factor meters are adjusted by changing the value of resistance in the potential circuits. Single-phase instruments are adjusted by changing the air gap of the iron in the reactor or changing the value of resistance in the voltage circuit.

Type Y-25 frequency meters are of the crossed-coil electro dynamic type, the coils being connected into a network consisting of a reactor and a capacitor forming a resonant circuit.

If errors are found, the calibration may be corrected by adjusting the external reactor box. For this purpose an iron screw is provided, accessible through a hole in the perforated metal case. Changing the internal resistor which shunts one of the moving coils varies the over-all width of the scale range.

Type I-25 synchroscopes operate on the rotating iron vane principle. Calibration may be checked by connecting both circuits to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position. If the rotation is irregular, the currents in the reactor branch and resistance branch should be equalized.

Type I-25, 360-degree scale power factor meters are similar in mechanical construction to the synchroscope. The inner coils are wound as current coils and the outside stator coils wound as potential coils. Connections may be checked the same as for type Y-25-one hundred degree scale power factor meters.

Type I-25 position indicators are similar in mechanical construction to the synchroscope, the electrical characteristics being different. Leads must be connected in the proper sequence to have the indicator follow the controller properly in the right direction.

Permanent Magnet Moving Coil Types

Type X-25 voltmeter calibration adjustments are made by changing the value of resistance in series with the element. When used with an external resistor on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be kept at ground potential.

Type X-25 ammeter calibration adjustments are made by changing the resistance of the wire lead in series with the element. When connected to an external shunt, leads listed for use with the instrument, or leads of specified resistance should be used.

Type X-25 milliammeter calibration adjustments are made by changing the resistance of the internal shunt. Some ranges not provided with element shunts are adjusted by changing the strength of the magnet.

Type T-25 radio frequency instrument calibration adjustments are made by changing the value of the resistance in series with the thermocouple. To avoid burning out the thermocouple, the instrument should not be loaded above full scale.

Radio frequency instruments have the left terminal, as viewed from the rear, bonded to the metal chassis and dial of the instrument. This prevents electrostatic effects between pointer and dial and provides points of zero potential inside the instrument.

Radio frequency instruments, particularly when operated from external thermocouples, should be arranged with effective R.F. by-pass and ground connections to minimize the effect of capacity currents.

Type C-25 rectifier type voltmeter calibration adjustments are made by changing the value of series resistance. Rectifier type milliammeters are calibrated by changing the strength of the magnet. Rectifier type instruments indicate correctly at 25C. with 60 cycle pure sine wave.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. When returning an instrument for repairs, obtain a returned material tag from your dealer or your nearest Westinghouse Sales Office to assure proper identification at the factory.

Orders for renewal parts should include the name of the part and the style and serial number of the instrument, appearing on the dial.

Spare Lamps

Internally illuminated instruments use #46 Mazda Lamps (6.3 volts 0.25 amp.) Westinghouse Style No. 1,001,663. These are rated at 3000 hour life at rated voltage. 10 percent overvoltage greatly decreases life.

For 110 to 140 volts, Type MT miniature transformer, Style #1246352 (6.3 volt secondary) is available.

Special Notes

For 3 element A-25 instruments, temperature indicators, Z-25 D-C. Wattmeters or for special instruments, see separate leaflets.

EXTERNAL CONNECTION DIAGRAMS (REAR VIEW)

Direct Current, Radio Frequency Instruments and Lighting Circuit

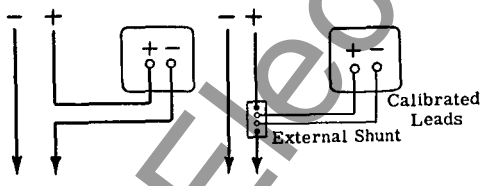


FIG. 1—AMMETER AND MILLIAMMETER, SELF-CONTAINED

FIG. 2—AMMETER WITH EXTERNAL SHUNT

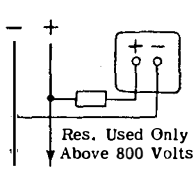


FIG. 3—VOLTMETER

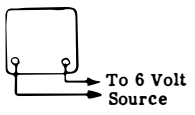


FIG. 4—FOR ALL INSTRUMENTS WITH ILLUMINATION

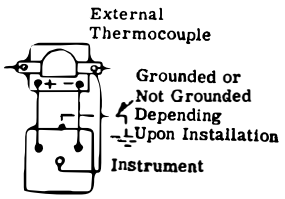


FIG. 5—RF AMMETER EXTERNAL THERMOCOUPLE

Alternating Current Instruments

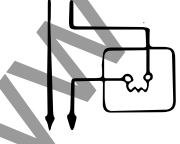


FIG. 6—AMMETER SELF-CONTAINED

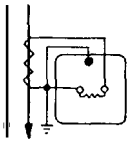
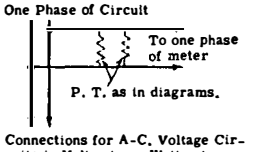


FIG. 7— AMMETER WITH CURRENT TRANSFORMERS



Connections for A-C. Voltage Circuits in Voltmeters, Wattmeters, Freq. Meters or Power Factor Meters when P.T. are not required.

FIG. 8— VOLTMETER

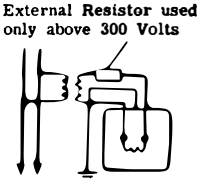


FIG. 9—VOLTMETER WITH POTENTIAL TRANSFORMERS

Westinghouse

—25 LINE—
SWITCHBOARD INSTRUMENTS
SIX-INCH CLASSIFICATION
INSTRUCTIONS

GENERAL

Cases

The first letter in type designates the form of case used.

U = Rect. Proj. Base M't'd 5½" x 5½".
K = Rect. Flush, Flange M't'd 6½"x6½".
M = Rect. Flush, Base M't'd 5 13/16" x 5 13/16".

Mechanisms

The second letter in type designates the principle of operation.

A = Repulsion Moving Iron.
X = Permanent Magnet Moving Coil.
T = Thermocouple plus x.
C = Rectifier plus x.
Y = Electrodynamic.
I = Rotating Iron Vane.

Insulation Rating

All Ammeters and Voltmeters are insulated for 750 volt maximum service. Wattmeters, power factor meters, frequency meters and synchroscopes are insulated for 250 volt service.

Dial Notes

References to type, style number, use of external shunts, calibration data, etc., are referred to on dial.

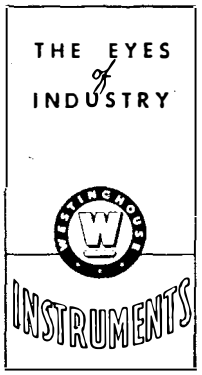
The full scale marking of an indicating instrument is not necessarily the same as the ratings of the current and voltage coils. The coil ratings are based upon temperature requirements. Full scale values are chosen to give clear, simple scale markings of the values of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 7.5, 8, or decimal multiples of these values.

These coil ratings are given in the data lines near the bottom of the dial plate, and are not necessarily part of the calibration data of the instrument. The calibration data are marked on the dial and in the case of Wattmeters and Varmeters comprise the calibration constant K and the ratios of the current and potential transformers when these are used.

The constant K is the product of the ratios of the current and potential transformers. It is equal to the number of Kilowatts (or Kilovars) indicated per Kilowatt (or Kilovar) applied to the coils, on a single phase test circuit.

Installation

Unpack instruments carefully. Terminal and mounting hardware, and any external resistors or reactors may be in separate packages.



Drill panels and connect according to the diagrams in this leaflet, or according to switchboard drawings if instruments are supplied as part of a switchboard.

On any instruments which operate with spring control, such as ammeters, voltmeters or wattmeters, adjust the pointer to zero by means of the zero adjuster before energizing the windings. Power factor meters, position indicators, synchroscopes and frequency meters do not have zero adjusters.

CIRCUIT PRECAUTIONS

The secondary circuits of all instrument transformers should be grounded.

The external connecting diagrams for the A-C. instruments show the proper locations for ground connections for the secondary circuits of the instrument transformers, aud for the instrument cases.

The ground connection of the cases should be omitted when instruments are mounted on "live front" switchboard panels.

CALIBRATION

A-C. Instruments

Types A-25 ammeters and voltmeters operate on the repulsion iron vane principle. Calibration adjustments are made by shifting the outer end of the spring in its holder. After loosening the small clamping screw, the zero adjuster should be left in mid-position, the pointer being set to zero by shifting the small tail piece of the inner spring adjuster located beneath the spring, using a small suitable tool. The outer spring clamping screw must be tightened before shifting the inner spring adjuster.

Type Y-25 wattmeters are the electrodynamic type. Polyphase wattmeters may be checked on single phase circuits by testing each element separately, or the current coils may be connected in series and the potential coils in parallel, and both elements tested at the same time. Calibration adjustments are made by changing the resistance of the potential circuit.

Varmeters are exactly like the wattmeters, except that they indicate the reactive volt-amperes by means of external phase shifting transformers. They are often made with zero center scales. When used on unidirectional circuits the scales are marked "lag" and "lead" as in power factor meters. When intended for tie lines or other duo-directional circuits, the lag and lead notations are generally omitted and directional markings are substituted, to show direction of reactive power flow.

Type Y-25 power factor meters are of the crossed-coil, electrodynamic type. Maximum accuracy is obtained when current in the current coils is from 40 to 125 per cent of coil rating and voltage on the potential circuit from 75 to 125 per cent of normal. Polyphase power factor meters are designed to indicate correctly only on balanced load.

In order to test external 3 phase connections first check in reference to phase sequence (1—2—3).

A trial connection may be checked by shunting part of the current from the stationary coil with a low resistance wire (about 0.1 ohm) across the current terminals. If the pointer movement is toward the lag side of the scale, connections are correct. If the pointer movement is toward the lead side of the scale the connections to the first and third potential terminals should be interchanged on the line side of external resistors if any are used.

Further incorrect action may be due to the current connection being in the wrong phase, or reversed, giving six possible vector directions on three phase, one of which is correct for the power factor meter.

Should the pointer remain at one end of the scale regardless of change in power

OUTLINE DIMENSIONS IN INCHES

Projection Mounting
Type U-25

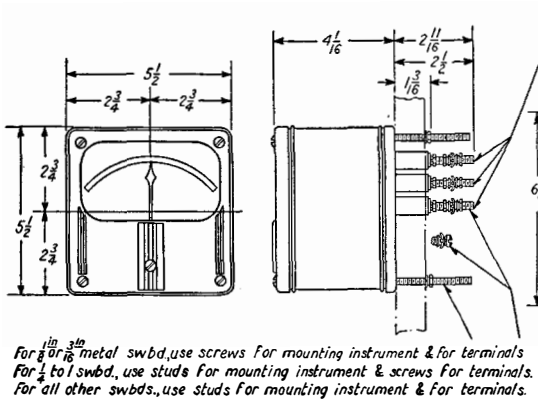


FIG. 23

Flush Mounting
Type K-25

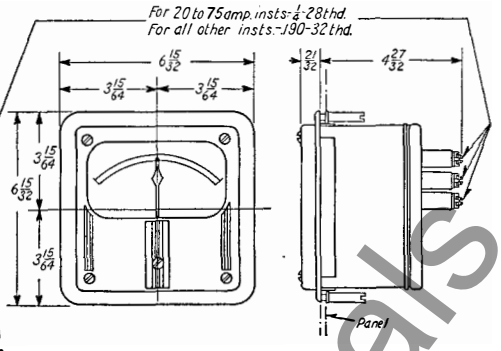


FIG. 24

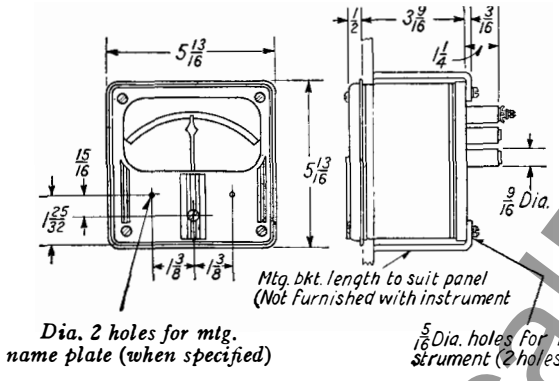


FIG. 25—FLUSH MOUNTING—TYPE M-25

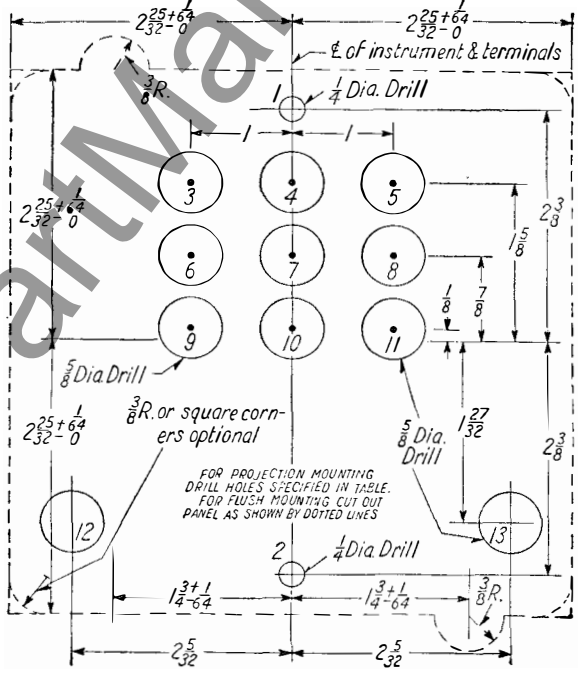


FIG. 26

For A-C. or D-C. Ammeter or Voltmeter	Drill Holes 1-2-6-8
For Frequency Meter	" " 1-2-6-7-8
For Single Phase Wattmeter	" " 1-2-3-5-6-8
For Power Factor Meter	" " 1-2-3-4-5-6-8

For Synch., 360° Scale P. F. or Pos. Ind.	Drill Holes 1-2-3-4-5-6-8
For Polyphase Watt or Varmeters, 4 Pot. Terms.	" " 1-2-3-4-5-6-7-8-9-11
For 3 C.C. P'-ph. Watt or Varmet., 3 Pot. Terms	" " 1-2-3-4-5-6-7-8-9-10-11
For Instruments with Internal Illumination	" " 12 and 13

Westinghouse Electric Corporation
Meter Division, Newark, N. J.

Westinghouse Press
Printed in U.S.A. (Rep. 12-46)

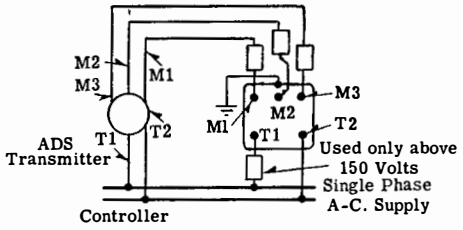


FIG. 10—POSITION INDICATOR

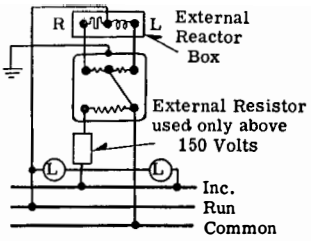


FIG. 11—SYNCHROSCOPE

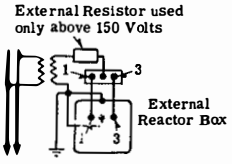


FIG. 12—FREQUENCY METER

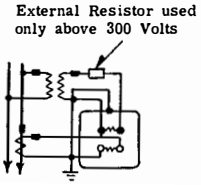


FIG. 13—WATTMETER, SINGLE PHASE

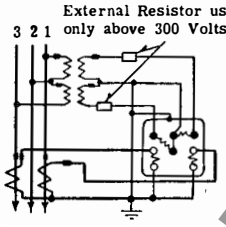


FIG. 14—WATTMETER, 3 PHASE, 3 WIRE

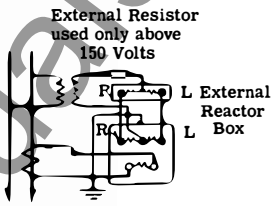
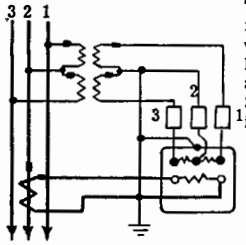


FIG. 15—POWER FACTOR METER, SINGLE PHASE



Type Y-25 requires external resistors to lines 1 and 3 for voltages above 300 only. Below 300 no external resistors are used. Type I-25 requires 3 external resistors as shown in this diagram.

FIG. 16—POWER FACTOR METER, 3 PHASE, 3-WIRE

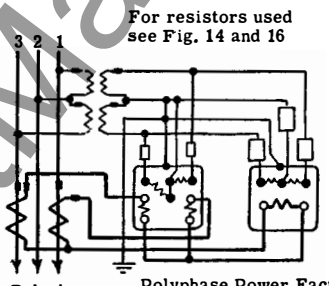


FIG. 17—POLYPHASE WATTMETER AND POWER FACTOR METER

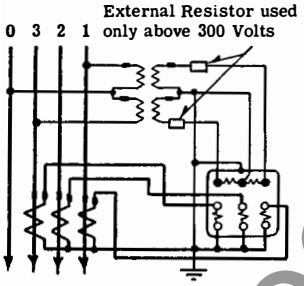


FIG. 18—WATTMETER, 3-PHASE, 4-WIRE (Y.C.T.)

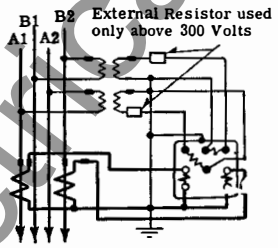
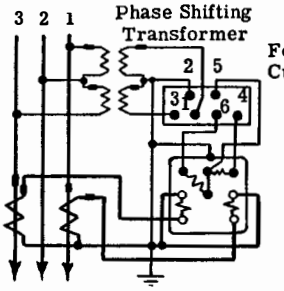


FIG. 19—WATTMETER, 2-PHASE, 4-WIRE



For 0-Lag Scale Reverse Current Coil Connections

FIG. 20—VARMETER, 3-PHASE, 3-WIRE

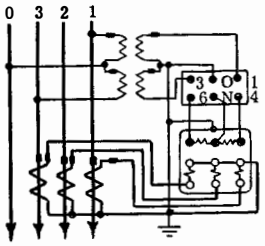


FIG. 21—VARMETER 3-PHASE, 4-WIRE

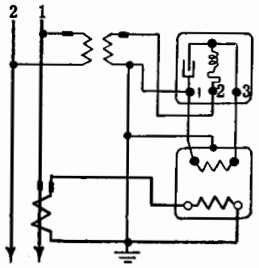


FIG. 22—VARMETER, SINGLE PHASE—2 WIRE

Standard Phase Rotation (1-2-3) used.

factor the current connections should be interchanged. Polyphase power factor meters are adjusted by changing the value of resistance in the potential circuits. Single-phase instruments are adjusted by changing the air gap of the iron in the reactor or changing the value of resistance in the voltage circuit.

Type Y-25 frequency meters are of the crossed-coil electro dynamic type, the coils being connected into a network consisting of a reactor and a capacitor forming a resonant circuit.

If errors are found, the calibration may be corrected by adjusting the external reactor box. For this purpose an iron screw is provided, accessible through a hole in the perforated metal case. Changing the internal resistor which shunts one of the moving coils varies the over-all width of the scale range.

Type I-25 synchroscopes operate on the rotating iron vane principle. Calibration may be checked by connecting both circuits to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position. If the rotation is irregular, the currents in the reactor branch and resistance branch should be equalized.

Type I-25, 360-degree scale power factor meters are similar in mechanical construction to the synchroscope. The inner coils are wound as current coils and the outside stator coils wound as potential coils. Connections may be checked the same as for type Y-25-one hundred degree scale power factor meters.

Type I-25 position indicators are similar in mechanical construction to the synchroscope, the electrical characteristics being different. Leads must be connected in the proper sequence to have the indicator follow the controller properly in the right direction.

Permanent Magnet Moving Coil Types

Type X-25 voltmeter calibration adjustments are made by changing the value of resistance in series with the element. When used with an external resistor on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be kept at ground potential.

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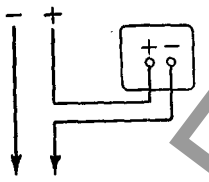


FIG. 1—AMMETER AND MILLIAMMETER, SELF-CONTAINED

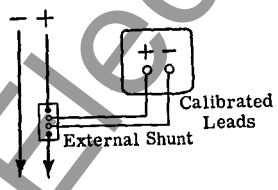


FIG. 2—AMMETER WITH EXTERNAL SHUNT

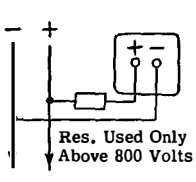


FIG. 3—VOLTMETER

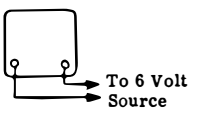


FIG. 4—FOR ALL INSTRUMENTS WITH ILLUMINATION

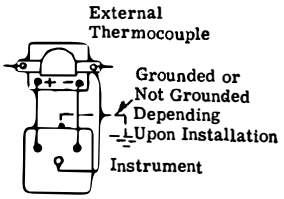


FIG. 5—RF AMMETER EXTERNAL THERMOCOUPLE

Alternating Current Instruments

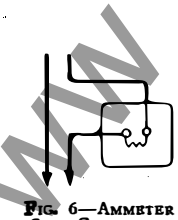


FIG. 6—AMMETER SELF-CONTAINED

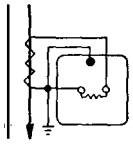
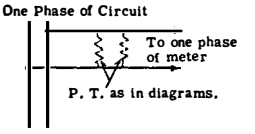


FIG. 7— AMMETER WITH CURRENT TRANSFORMERS



Connections for A-C. Voltage Circuits in Voltmeters, Wattmeters, Freq. Meters or Power Factor Meters when P.T. are not required.

FIG. 8— VOLTMETER

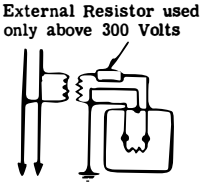


FIG. 9—VOLTMETER WITH POTENTIAL TRANSFORMERS

Westinghouse

—25 LINE—
SWITCHBOARD INSTRUMENTS
SIX-INCH CLASSIFICATION
INSTRUCTIONS

GENERAL

Cases

The first letter in type designates the form of case used.

U = Rect. Proj. Base M't'd 5½" x 5½".
K = Rect. Flush, Flange M't'd 6½" x 6½".
M = Rect. Flush, Base M't'd 5 13/16" x 5 13/16".

Mechanisms

The second letter in type designates the principle of operation.

A = Repulsion Moving Iron.
X = Permanent Magnet Moving Coil.
T = Thermocouple plus x.
C = Rectifier plus x.
Y = Electrodynamic.
I = Rotating Iron Vane.

Insulation Rating

All Ammeters and Voltmeters are insulated for 750 volt maximum service. Wattmeters, power factor meters, frequency meters and synchroscopes are insulated for 250 volt service.

Dial Notes

References to type, style number, use of external shunts, calibration data, etc., are referred to on dial.

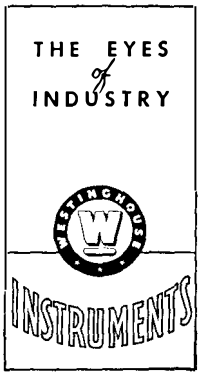
The full scale marking of an indicating instrument is not necessarily the same as the ratings of the current and voltage coils. The coil ratings are based upon temperature requirements. Full scale values are chosen to give clear, simple scale markings of the values of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 7.5, 8, or decimal multiples of these values.

These coil ratings are given in the data lines near the bottom of the dial plate, and are not necessarily part of the calibration data of the instrument. The calibration data are marked on the dial and in the case of Wattmeters and Varmeters comprise the calibration constant K and the ratios of the current and potential transformers when these are used.

The constant K is the product of the ratios of the current and potential transformers. It is equal to the number of Kilowatts (or Kilovars) indicated per Kilowatt (or Kilovar) applied to the coils, on a single phase test circuit.

Installation

Unpack instruments carefully. Terminal and mounting hardware, and any external resistors or reactors may be in separate packages.



Drill panels and connect according to the diagrams in this leaflet, or according to switchboard drawings if instruments are supplied as part of a switchboard.

On any instruments which operate with spring control, such as ammeters, voltmeters or wattmeters, adjust the pointer to zero by means of the zero adjuster before energizing the windings. Power factor meters, position indicators, synchroscopes and frequency meters do not have zero adjusters.

CIRCUIT PRECAUTIONS

The secondary circuits of all instrument transformers should be grounded.

The external connecting diagrams for the A-C. instruments show the proper locations for ground connections for the secondary circuits of the instrument transformers, and for the instrument cases.

The ground connection of the cases should be omitted when instruments are mounted on "live front" switchboard panels.

CALIBRATION

A-C. Instruments

Types A-25 ammeters and voltmeters operate on the repulsion iron vane principle. Calibration adjustments are made by shifting the outer end of the spring in its holder. After loosening the small clamping screw, the zero adjuster should be left in mid-position, the pointer being set to zero by shifting the small tail piece of the inner spring adjuster located beneath the spring, using a small suitable tool. The outer spring clamping screw must be tightened before shifting the inner spring adjuster.

Type Y-25 wattmeters are the electrodynamic type. Polyphase wattmeters may be checked on single phase circuits by testing each element separately, or the current coils may be connected in series and the potential coils in parallel, and both elements tested at the same time. Calibration adjustments are made by changing the resistance of the potential circuit.

Varmeters are exactly like the wattmeters, except that they indicate the reactive volt-amperes by means of external phase shifting transformers. They are often made with zero center scales. When used on unidirectional circuits the scales are marked "lag" and "lead" as in power factor meters. When intended for tie lines or other duo-directional circuits, the lag and lead notations are generally omitted and directional markings are substituted, to show direction of reactive power flow.

Type Y-25 power factor meters are of the crossed-coil, electrodynamic type. Maximum accuracy is obtained when current in the current coils is from 40 to 125 per cent of coil rating and voltage on the potential circuit from 75 to 125 per cent of normal. Polyphase power factor meters are designed to indicate correctly only on balanced load.

In order to test external 3 phase connections first check in reference to phase sequence (1—2—3).

A trial connection may be checked by shunting part of the current from the stationary coil with a low resistance wire (about 0.1 ohm) across the current terminals. If the pointer movement is toward the lag side of the scale, connections are correct. If the pointer movement is toward the lead side of the scale the connections to the first and third potential terminals should be interchanged on the line side of external resistors if any are used.

Further incorrect action may be due to the current connection being in the wrong phase, or reversed, giving six possible vector directions on three phase, one of which is correct for the power factor meter.

Should the pointer remain at one end of the scale regardless of change in power

Position Indicator

Type UI-25

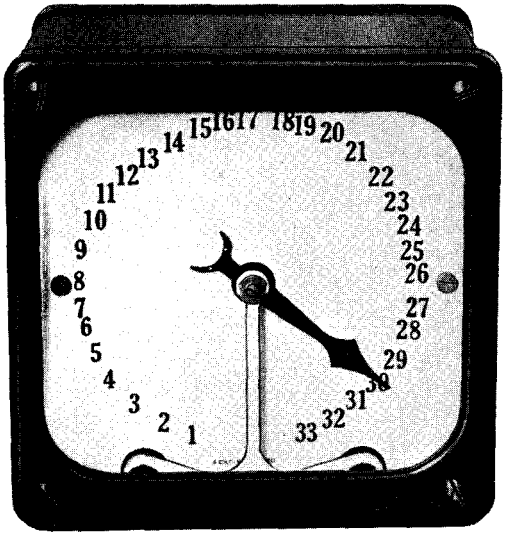


FIG. 1—A 33 POSITION INDICATOR

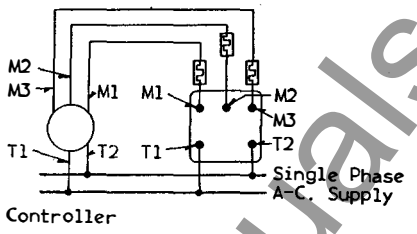


FIG. 3—POSITION INDICATOR CONNECTIONS

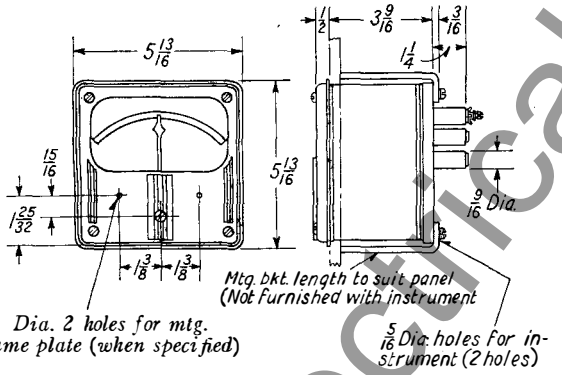


FIG. 2—FLUSH MOUNTING—TYPE M-25 STYLES AS LISTED ON PAGE 1

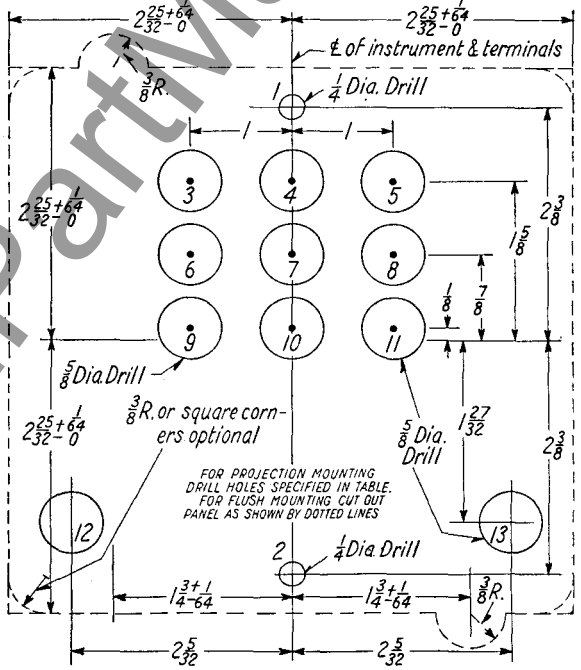


FIG. 4—DRILL HOLES 1, 2, 3, 4, 5, 6 AND 8

Westinghouse Electric & Manufacturing Company

Meter Division, Newark, N. J.

Westinghouse Press
Printed in U.S.A.

Position Indicator

Type UI-25

INSTRUCTIONS

120 Volt Styles

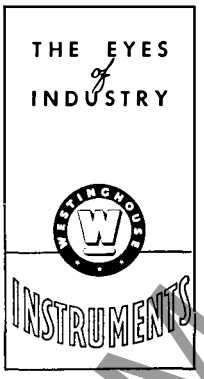
S# 1009966 — 9 positions
S# 1009967 — 17 positions
S# 1156644 — 33 positions

GENERAL

The Type UI-25 position indicator is used for the remote indication of the positions of mechanisms. The style numbers listed on this leaflet are principally used for indicating the positions of the tap changer on transformer equipment and operate on the rotating iron principle, similar to that used in synchronoscopes. A 33 position indicator is illustrated in Fig. 1.

CONSTRUCTION AND OPERATION

The Type UI-25 instruments operate as duplicate position telemeter receivers. The operating instruments, both sending and receiving, are similar to miniature synchronous motors excited by alternating current. The sending units are geared or otherwise mechanically driven by the mechanisms, the positions of which are to be indicated at a remote point, in such a way as to turn the transmitter armature. The sending and receiving instruments are tied together electrically by several connecting wires in a manner similar to the connections between a synchronous motor and a generator. With such connections, the rotor of the receiving instrument automatically remains in duplicate position to that of the transmitter. The name, "Synchrotie", is descriptive of the action.



The Type UI-25 receiver movement is enclosed in a square switchboard type instrument case designed to match other instruments of the H or 25 line types. The transmitting unit is actuated by the tap changer operating mechanism to which it is mechanically connected so that each tap changer position is definitely geared to the same angular position of the transmitter.

Note:

This instruction leaflet pertains only to the style numbers listed on this sheet and furnished for use with a complete transformer equipment. For general instructions on other styles of position indicator equipment refer to I. L. 43-249, copies of which are obtainable from the Meter Division at Newark, N. J. or through the district office.

INSTALLATION

If the indicator is shipped as a separate item it should be unpacked carefully

240 Volt Styles

S# 1009968 — 9 positions
S# 1009969 — 17 positions
S# 1156645 — 33 positions

and mounted on the switchboard as usual for indicating instruments. The connections should be made as per Fig. 3 and as shown on the general wiring diagram supplied with the transformer apparatus. After installing the indicator it should be checked by operating the tap changer.

A half-revolution error in the indications of any receiving instrument is caused by the reversal of the leads to the single phase supply line. Reversed direction of operation is caused by incorrect sequence of the three wire system of rotor connections, M_1, M_2, M_3. A "phase" error of 120 degrees indicates that the leads M_1, M_2, M_3, are not connected to the corresponding terminals of the transmitter.

MAINTENANCE

The indicator should not require any field adjustments. Keep the indicator clean with cover tightly in place. Avoid excessive vibrations or shocks.

REPAIRS AND PARTS

Major repairs can be most satisfactorily done at the factory or Westinghouse Service Shops. However, for customers equipped to do their own work, parts may be furnished on order. In ordering any part or requesting any other information, always give entire nameplate reading.

★ Supersedes I. L. 3235

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

—25 LINE—
SWITCHBOARD INSTRUMENTS
SIX-INCH CLASSIFICATION

GENERAL

Cases

The first letter in type designates the form of case used.

U = Rect. Proj. Base M't'd 5½" x 5½".
K = Rect. Flush, Flange M't'd 6½" x 6½'.
M = Rect. Flush, Base M't'd 5-13/16" x 5-13/16".
Z = Permanent Magnet Moving Coil with Electromagnet.

Mechanisms

The second letter in type designates the principle of operation.

A = Repulsion Moving Iron.
X = Permanent Magnet Moving Coil.
T = Thermocouple plus x.
C = Rectifier plus x.
Y = Electrodynamic.
I = Rotating Iron Vane.

Insulation Rating

All Ammeters and Voltmeters are insulated for 750 volt maximum service. Wattmeters, power factor meters, frequency meters and synchroscopes are insulated for 250 volt service.

Dial Notes

References to type, style number, use of external shunts, calibration data, etc., are referred to on dial.

The full scale marking of an indicating instrument is not necessarily the same as the ratings of the current and voltage coils. The coil ratings are based upon temperature requirements. Full scale values are chosen to give clear, simple scale markings of the values of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 7.5, 8, or decimal multiples of these values.

These coil ratings are given in the data lines near the bottom of the dial plate, and are not necessarily part of the calibration data of the instrument. The calibration data are marked on the dial and in the case of Wattmeters and Varmeters comprise the calibration constant K and the ratios of the current and potential transformers when these are used.

The constant K is the product of the ratios of the current and potential transformers. It is equal to the number of Kilowatts (or Kilovars) indicated per Kilowatt (or Kilovar) applied to the coils, on a single phase test circuit.

Installation

Unpack instruments carefully. Terminal and mounting hardware, and any external resistors or reactors may be in separate packages.

Drill panels and connect according to the diagrams in this leaflet, or according to switchboard drawings if instruments are supplied as part of a switchboard.

On any instruments which operate with spring control, such as ammeters, voltmeters or wattmeters, adjust the pointer to zero by means of the zero adjuster before energizing the windings. Power factor meters, position indicators, synchroscopes and frequency meters do not have zero adjusters.

CIRCUIT PRECAUTIONS

The secondary circuits of all instrument transformers should be grounded.

The external connecting diagrams for the A-C instruments show the proper locations for ground connections for the secondary circuits of the instrument transformers, and for the instrument cases.

The ground connection of the cases should be omitted when instruments are mounted on "live front" switchboard panels.

CALIBRATION

A-C. Instruments

Types A-25 ammeters and voltmeters operate on the repulsion iron vane principle. Calibration adjustments are made by shifting the outer end of the spring in its holder. After loosening the small clamping screw, the zero adjuster should be left in mid-position, the pointer being set to zero by shifting the small

tail piece of the inner spring adjuster located beneath the spring, using a small suitable tool. The outer spring clamping screw must be tightened before shifting the inner spring adjuster.

Type Y-25 wattmeters are the electrodynamic type. Polyphase wattmeters may be checked on single phase circuits by testing each element separately, or the current coils may be connected in series and the potential coils in parallel, and both elements tested at the same time. Calibration adjustments are made by changing the resistance of the potential circuit.

Varmeters are exactly like the wattmeters, except that they indicate the reactive volt-amperes by means of external phase shifting transformers. They are often made with zero center scales. When used on unidirectional circuits the scales are marked "lag" and "lead" as in power factor meters. When intended for tie lines or other duo-directional circuits, the lag and lead notations are generally omitted and directional markings are substituted, to show direction of reactive power flow.

Type Y-25 power factor meters are of the crossed-coil, electrodynamic type. Maximum accuracy is obtained when current in the current coils is from 40 to 125 per cent of coil rating and voltage on the potential circuit from 75 to 125 per cent of normal. Polyphase power factor meters are designed to indicate correctly only on balanced load.

In order to test external 3 phase connections first check in reference to phase sequence (1—2—3).

A trial connection may be checked by shunting part of the current from the stationary coil with a low resistance wire (about 0.1 ohm) across the current terminals. If the pointer movement is toward the lag side of the scale, connections are correct. If the pointer movement is toward the lead side of the scale the connections to the first and third potential terminals should be interchanged on the line side of external resistors if any are used.

Further incorrect action may be due to the current connection being in the wrong phase, or reversed, giving six possible vector directions on three phase, one of which is correct for the power factor meter.

Should the pointer remain at one end of the scale regardless of change in power factor the current connections should be interchanged. Polyphase power factor meters are adjusted by changing the value of resistance in the potential circuits. Single-phase instruments are adjusted by changing the air gap of the iron in the reactor or changing the value of resistance in the voltage circuit.

Type Y-25 frequency meters are of the crossed-coil electro dynamic type, the coils being connected into a network consisting of a reactor and a capacitor forming a resonant circuit.

If errors are found, the calibration may be corrected by adjusting the external reactor box. For this purpose an iron screw is provided, accessible through a hole in the perforated metal case. Changing the internal resistor which shunts one of the moving coils varies the over-all width of the scale range.

Type I-25 synchroscopes operate on the rotating iron vane principle. Calibration may be checked by connecting both circuits to the same source. The pointer should then indicate synchronism. If the pointer does not indicate synchronism, it should be shifted to the vertical position. If the rotation is irregular, the currents in the reactor branch and resistance branch should be equalized.

Type I-25, 360-degree scale power factor meters are similar in mechanical construction to the synchroscope. The inner coils are wound as current coils and the outside stator coils wound as potential coils. Connections may be checked the same as for type Y-25 one-hundred degree scale power factor meters.

Permanent Magnet Moving Coil Types

Type X-25 voltmeter calibration adjustments are made by changing the value of resistance in series with the element. When used with an external resistor on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be kept at ground potential.

Type X-25 ammeter calibration adjustments are made by changing the resistance of the wire lead in series with the element. When connected to an external shunt, leads listed for use with the instrument, or leads of specified resistance should be used.

Type X-25 milliammeter calibration adjustments are made by changing the resistance of the internal shunt. Some ranges not provided with element shunts are adjusted by changing the strength of the magnet.

Type T-25 radio frequency instrument calibration adjustments are made by changing the value of the resistance in series with the thermocouple. To avoid burning out the thermocouple, the instrument should not be loaded above full scale.

Radio frequency instruments have the left terminal, as viewed from the rear, bonded to the metal chassis and dial of the instrument. This prevents electrostatic effects between pointer and dial and provides points of zero potential inside the instrument.

Radio frequency instruments, particularly when operated from external thermocouples, should be arranged with effective R.F. by-pass and ground connections to minimize the effect of capacity currents.

Type C-25 rectifier type voltmeter calibration adjustments are made by changing the value of series resistance. Rectifier type milliammeters are calibrated by changing the strength of the magnet. Rectifier type instruments indicate correctly at 25C. with 60 cycle pure sine wave.

Type Z-25 D-C Wattmeter calibration may be changed when required by varying the internal resistance which is in series with the moving element. Under no condition must the external resistance in series with the voltage coil be changed.

Use only the special leads furnished with the instrument for connections to the ammeter shunt or leads of resistance specified on the dial. No special leads are required for the voltage circuit connections.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. When returning an instrument for repairs, obtain a returned material tag from your dealer or your nearest Westinghouse Sales Office to assure proper identification at the factory.

Orders for renewal parts should include the name of the part and the style and serial number of the instrument, appearing on the dial.

Spare Lamps

Internally illuminated instruments use #46 Mazda Lamps (6.3 volts 0.25 amp.) Westinghouse Style No. 1,001,663. These are rated at 3000 hour life at rated voltage. 10 percent overvoltage greatly decreases life.

For 110 to 140 volts, Type MT miniature transformer, Style #1246352 (6.3 volt secondary) is available.

Special Notes

For 3 element A-25 instruments, temperature indicators, or for special instruments, see separate leaflets.

EXTERNAL CONNECTION DIAGRAMS (REAR VIEW)

Direct Current, Radio Frequency Instruments and Lighting Circuit

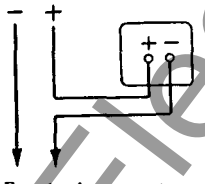


FIG. 1—AMMETER AND MILLIAMMETER, SELF-CONTAINED

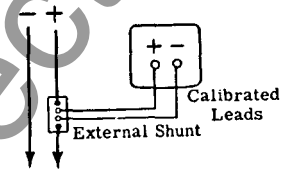


FIG. 2—AMMETER WITH EXTERNAL SHUNT

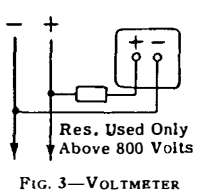


FIG. 3—VOLTMETER

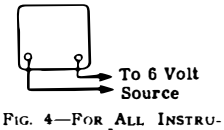


FIG. 4—FOR ALL INSTRUMENTS WITH ILLUMINATION

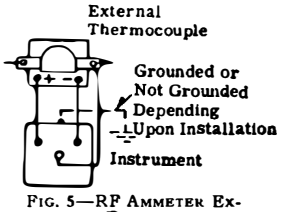


FIG. 5—RF AMMETER EXTERNAL THERMOCOUPLE

Alternating Current Instruments

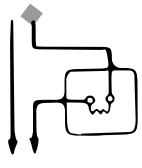


FIG. 6—AMMETER SELF-CONTAINED

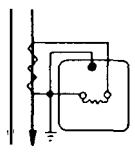
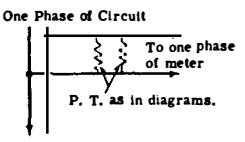


FIG. 7—AMMETER WITH CURRENT TRANSFORMERS



Connections for A-C. Voltage Circuits in Voltmeters, Wattmeters, Freq. Meters or Power Factor Meters when P.T. are not required.

FIG. 8—VOLTMETER

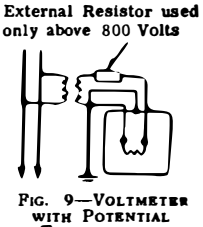


FIG. 9—VOLTMETER WITH POTENTIAL TRANSFORMERS

ALTERNATING CURRENT INSTRUMENTS - Continued

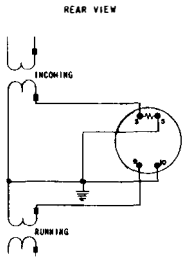


Fig. 10-Type I25 Single Phase Synchroscope

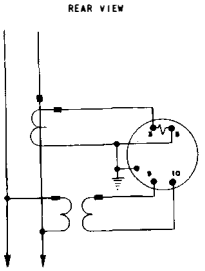


Fig. 11-Type I25 Single Phase Power Factor Meter

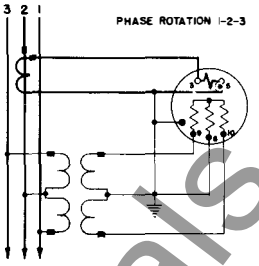


Fig. 12-Type I25 Polyphase Power Factor Meter

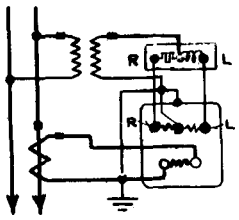


Fig. 13-Type Y25 Single Phase Power Factor Meter

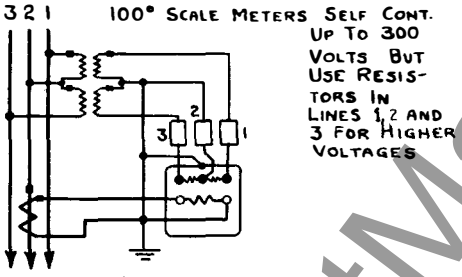


Fig. 14-Type Y25 Power Factor Meter, 3-Phase, 3-Wire

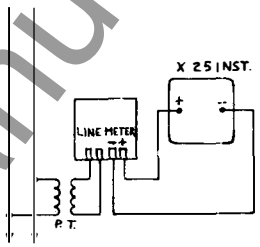


Fig. 15-Transducer Type Frequency Meter

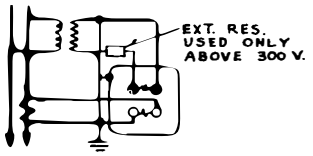


Fig. 16-Wattmeter, Single Phase

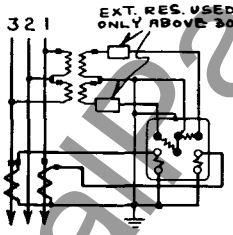


Fig. 17-Wattmeter, 3-Phase, 3-Wire

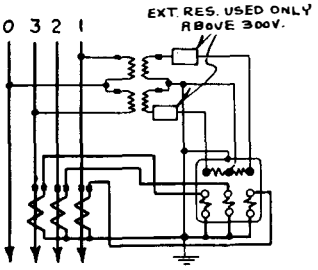


Fig. 18-Wattmeter, 3-Phase, 4-Wire

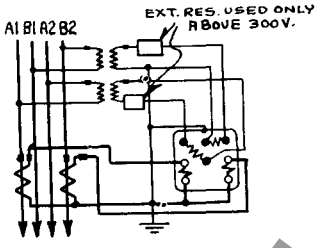


Fig. 19-Wattmeter, 2-Phase, 4-Wire

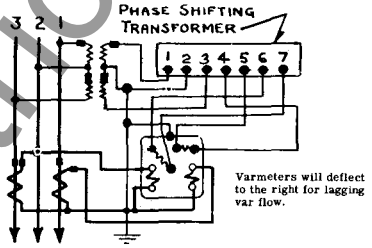


Fig. 20-Varmeter, 3-Phase, 3-Wire

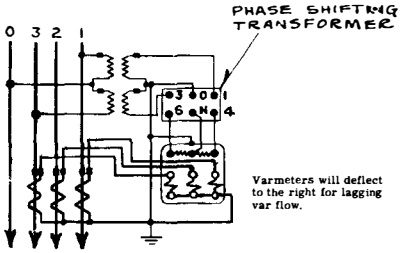


Fig. 21-Varmeter, 3-Phase, 4-Wire

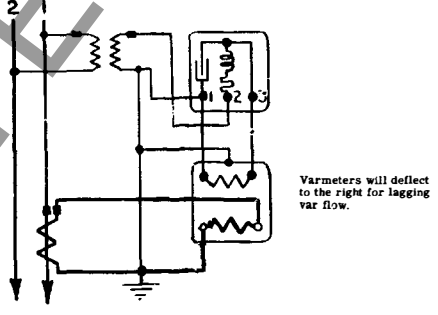


Fig. 22-Varmeter, Single Phase, 2 Wire

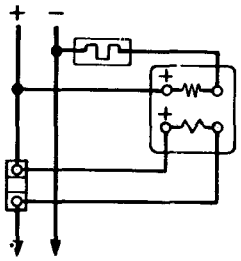


Fig. 23-Type Z-25 DC Wattmeter

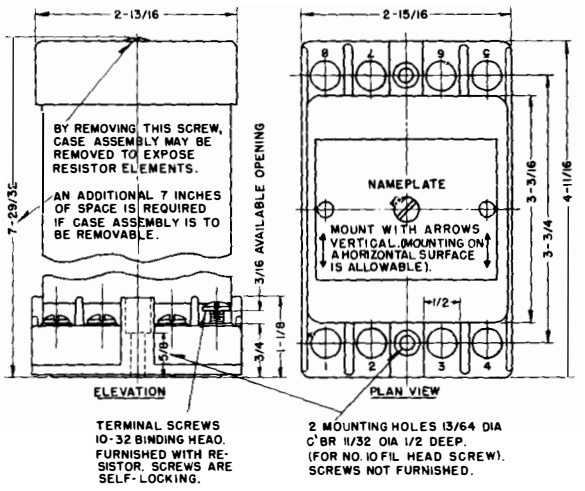


Fig. 24 Outline and Drilling Plan for Type VR-825 External Resistor

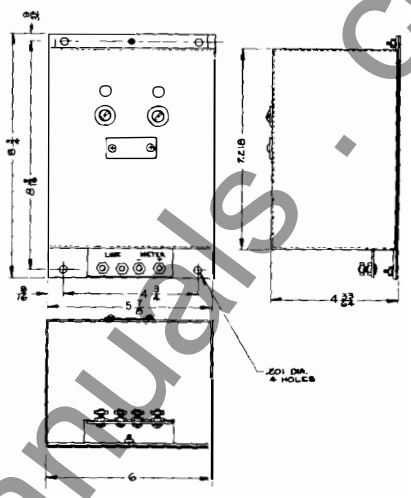


Fig. 25 Outline and Drilling Plan for Transducer used with Frequency Meter

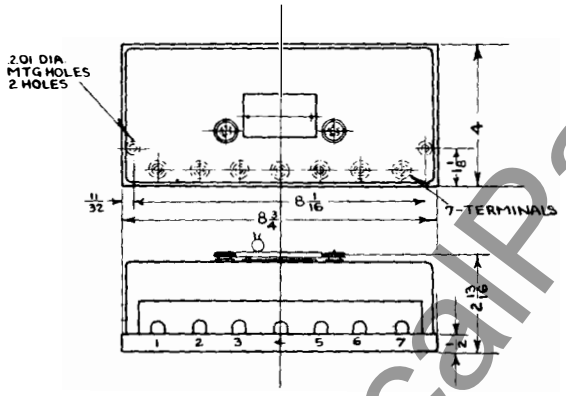


Fig. 26 Outline and Drilling Plan for Phase Shifting Transformer used with 3-Phase, 3-Wire Varmeter

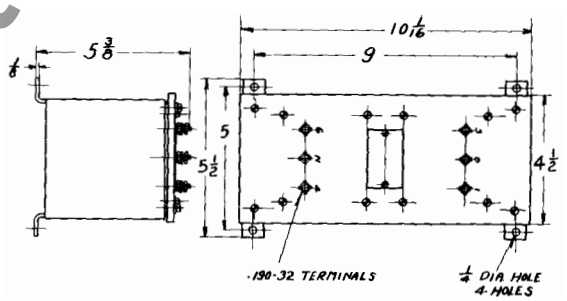


Fig. 27 Outline and Drilling Plan for Phase Shifting Transformer used with 3-Phase, 4-Wire Varmeter

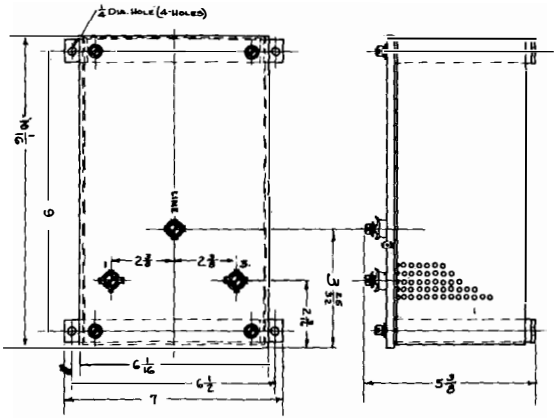


Fig. 28 Outline and Drilling Plan for Reactive Compensator used with Single Phase Varmeter.

OUTLINE DIMENSIONS

Projection Mounting
Type U-25
(Except UI-25)

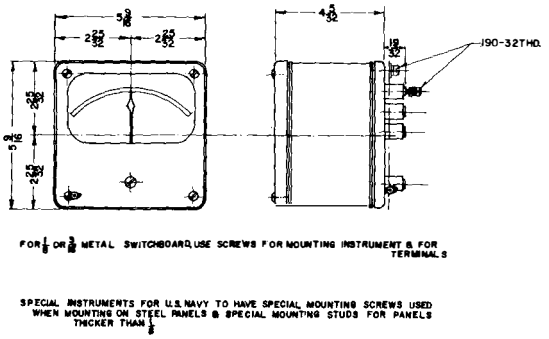


Fig. 29

Flush Mounting
Type K-25
(Except KI-25)

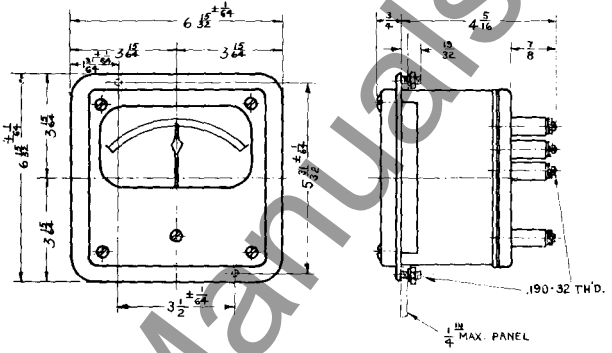


Fig. 30

Projection Mounting
Type UI-25

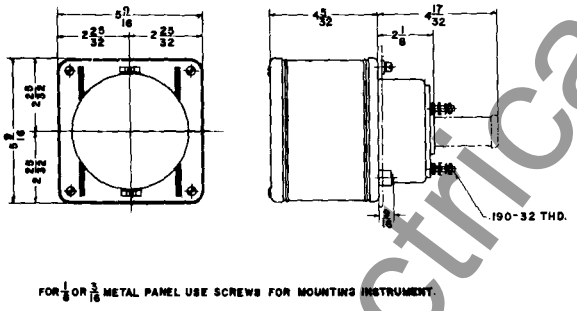


Fig 31

Flush Mounting
Type KI-25

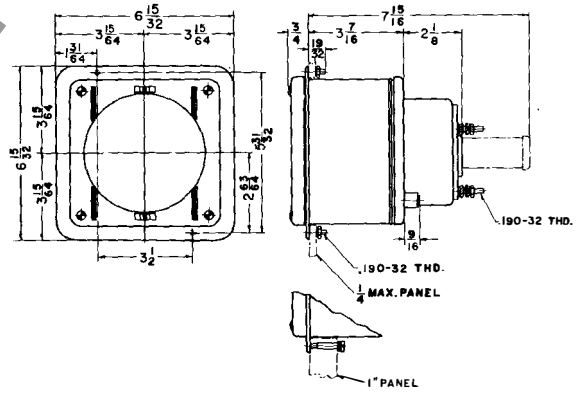
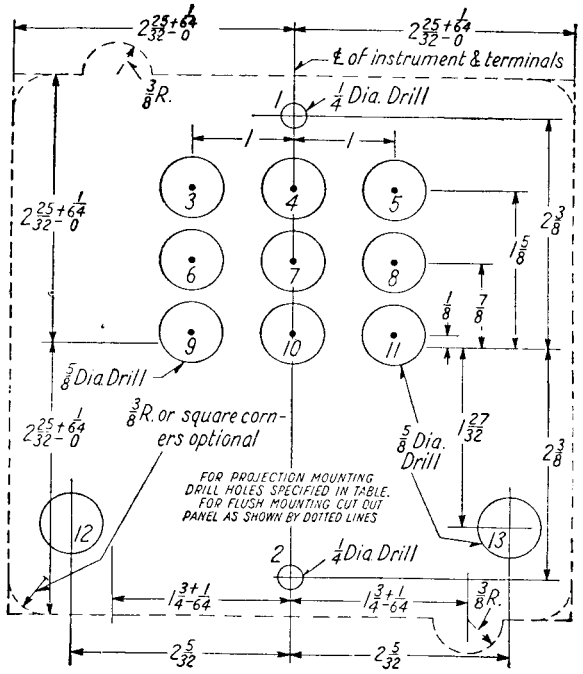


Fig. 32

DRILLING PLAN



FRONT VIEW

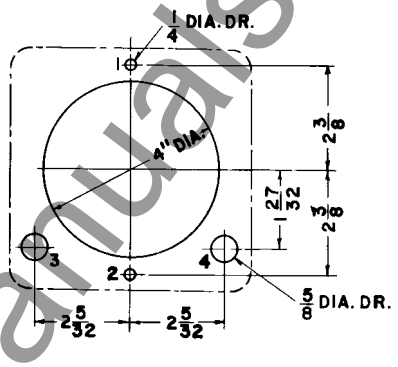


Fig. 34

1.	A. C. or D. C. Ammeter, Voltmeter Clocks	Drill Holes	1-2-6-8
2.	Freq. Meter Self Contained Ground Detectors and Differential Voltmeter	”	” 1-2-6-7-8
3.	For Single Phase Wattmeter & D. C. Wattmeter	”	” 1-2-3-5-6-8
4.	For P. F. Meter & Self. Cont. Temp. Indicator	”	” 1-2-3-4-5-6-8
5.	For Polyphase Wattmeter 3 Pot. Terms.	”	” 1-2-3-4-5-6-8-9-11
6.	For Polyphase Wattmeter 4 Pot. Terms.	”	” 1-2-3-4-5-6-7-8-9-11
7.	For 3 C. C. Wattmeter.	”	” 1-2-3-4-5-6-7-8-9-10-11
8.	For Dial Illumination Lamp Terms.	”	” 12-13
9.	For Total Hour Meter	”	” 1-2-6-8
10.	For 125 Synchroscope or Power Factor	”	” Per Fig. 34

Fig. 33

WESTINGHOUSE ELECTRIC CORPORATION

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