

# INSTALLATION • OPERATION • MAINTENANCE I N S T R U C T I O N S

## — 221 LINE — SWITCHBOARD INSTRUMENTS FOUR AND ONE -HALF-INCH CLASSIFICATION 100° SCALE TYPE

### GENERAL

Type 221 instruments are designed and built to meet or exceed the requirements of American Standard C39.1 for electrical indicating switchboard instruments. The rated accuracy class is one per cent.

#### CASES

The first letter in the Type designation indicates the form of case used.

K = Rectangular Flush Case, Flange mounted.

#### MECHANISMS

The second letter in the type designation indicates the principle of operation.

X = Permanent magnet moving coil

A = Repulsion, moving iron

Y = Electrodynamic

C = Rectifier plus X

#### DESCRIPTION OF TAUT BAND SUSPENSION INSTRUMENTS

*CAUTION: When the instrument mechanism is exposed, avoid contact with the tension springs. These springs are precisely made and positioned, and any pressures inadvertently applied to them may cause misalignment of the moving element.*

The X-221 is a pivotless, bearingless d.c. instrument of the permanent magnet moving coil type. A suspension system is employed which replaces the conventional pivots, jewels, and control spring. At each end of the moving coil is attached a thin metallic band. At the front and rear bridges these bands are connected to tension springs. The tension springs exert axial forces which keep the metallic bands taut and the moving element from sagging. The taut bands serve to carry current to the moving coil, and also provide the necessary deflection counter-torque.

The A-221 Ammeters and Voltmeters employ

similar suspensions but operate on the repulsion, moving iron principle.

The taut band design eliminates pivot friction and allows the instrument to withstand severe conditions of shock and vibration. The suspension system assures longer life with reduced maintenance costs.

The Y221 wattmeters and power factor meters are the Electrodynamic pivot and jewel type.

#### DIAL NOTES

References to type style number, use of external components if required, coil ratings, calibration data etc., are made on the dial.

### INSTALLATION

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

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

Before energizing the instrument, adjust the pointer to zero by means of the zero adjuster at the front of the instrument.

### CIRCUIT PRECAUTIONS

#### HIGH VOLTAGE OPERATION

All instruments are insulated for 800 volt maximum service.

When voltmeters are used with external resistors on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be grounded.

Ammeters with external shunts must be used with leads having the resistance specified in the dial notes. If the circuit voltage exceeds the insulation

SUPERSEDES I.L. 43-221D

\*Denotes Change from Superseded Issue.

EFFECTIVE OCTOBER 1967

## K-221 LINE SWITCHBOARD INSTRUMENTS

rating of the instrument, the shunt should be in the grounded side of the line.

### GROUNDING OF CASES

Instruments, when mounted on grounded metal structures, are considered adequately grounded when secured to the structures by metal hardware. For mounting on insulated structures any one of the three case to base mounting screws may be used as a grounding terminal.

## REPAIRS AND RENEWAL PARTS

The usual procedures and practices employed for servicing mechanisms of pivot-jewel type instruments cannot be applied to suspension type instruments. For this reason we recommend that all TBS instruments in need of mechanism servicing be returned to 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.

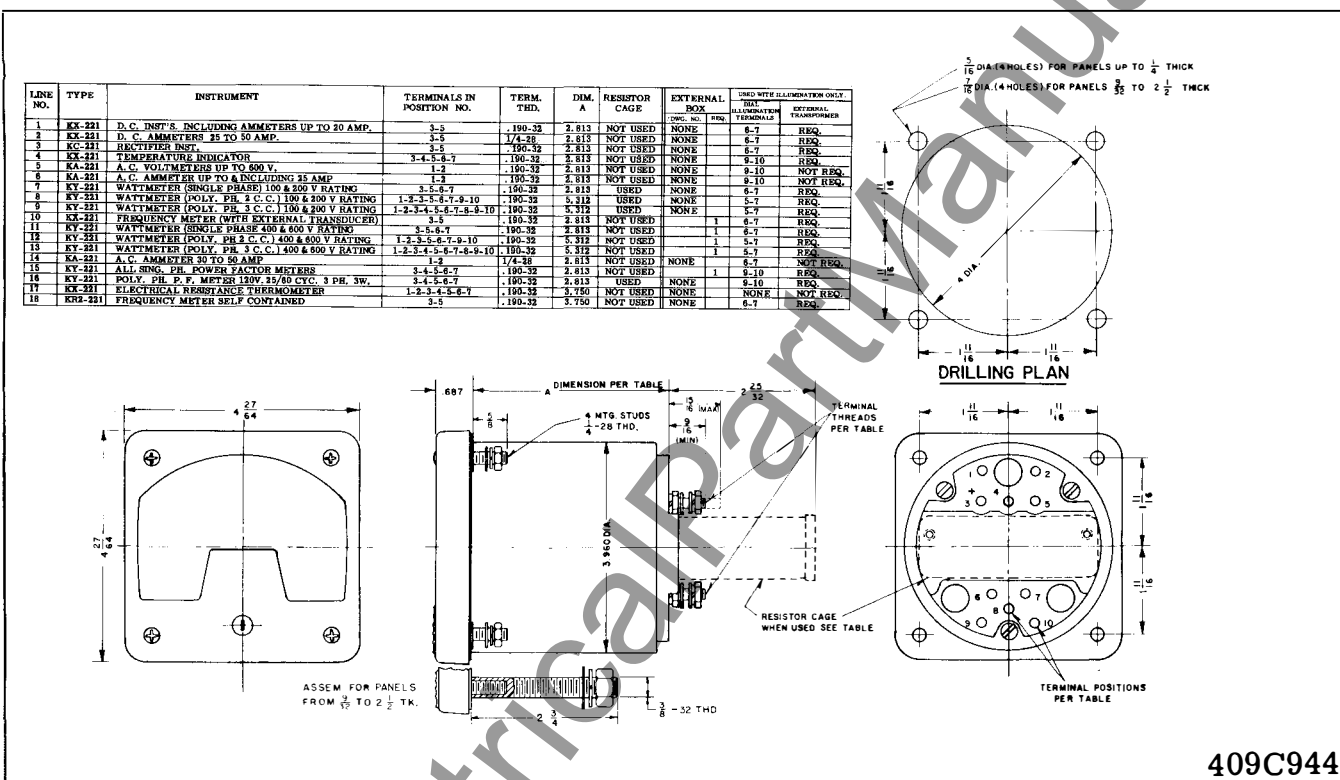


Fig. 1. Outline Dimensions and Drilling Plan for Type K-221 Instruments.

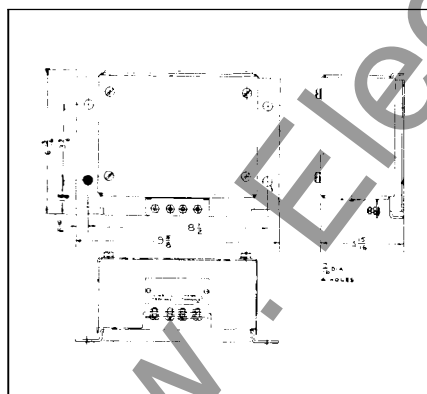


Fig. 2. Outline Dimensions and Drilling Plan for Transducer used with Frequency Meter.

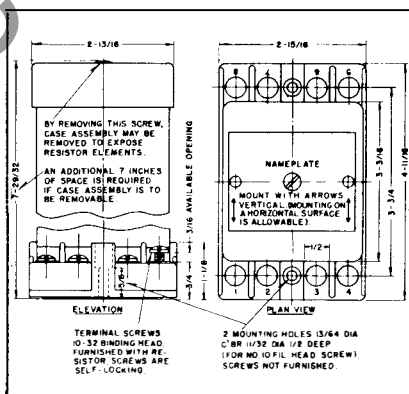


Fig. 3. Outline Dimensions and Drilling Plan for VR-825 External Resistor.

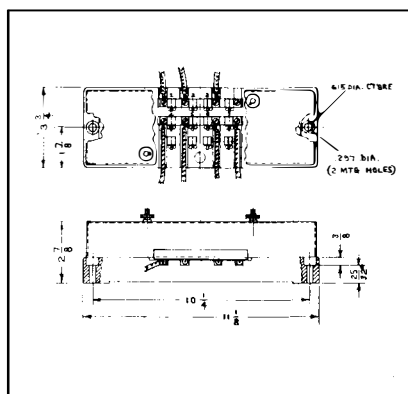


Fig. 4. Outline Dimensions and Drilling Plan for Phase Shifting Transformer used with 3-phase, 3-wire, and 3-phase 4-wire, Varmeter.

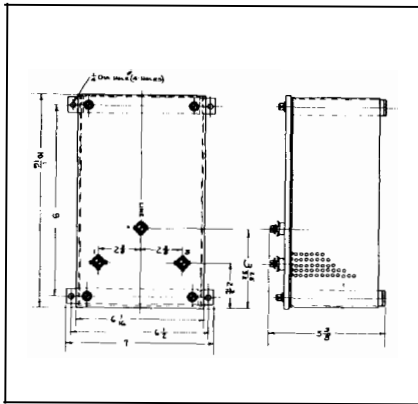


Fig. 5. Outline dimensions and Drilling. Plan Reactive Compensator used with Single Phase Varmeter.

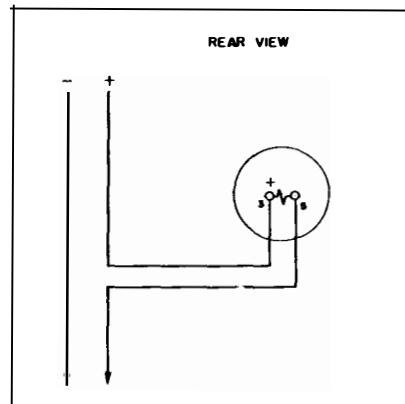


Fig. 6 Type X-221 Ammeter and Milliometer (self contained).

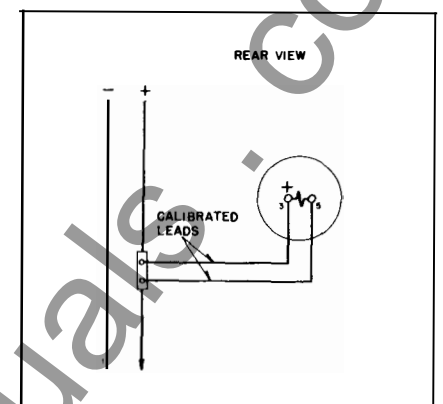


Fig. 7. Type X-221 Ammeter with External Shunt.

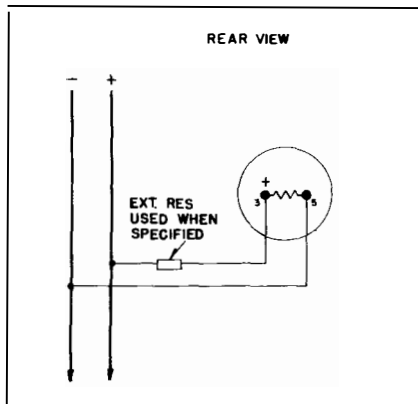


Fig. 8. Type X-221 Voltmeter.

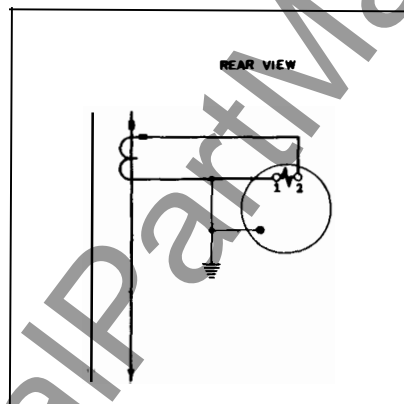


Fig. 9. Type A-221 Ammeter with Current Transformer.

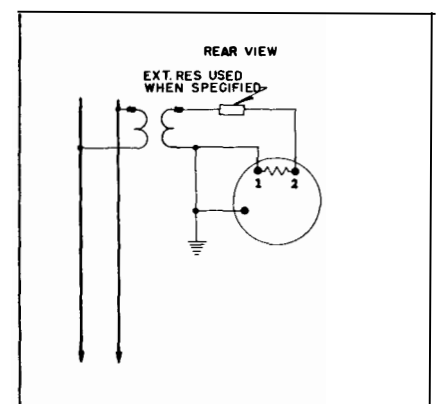


Fig. 10. Type A-221 Voltmeter with Potential Transformer.

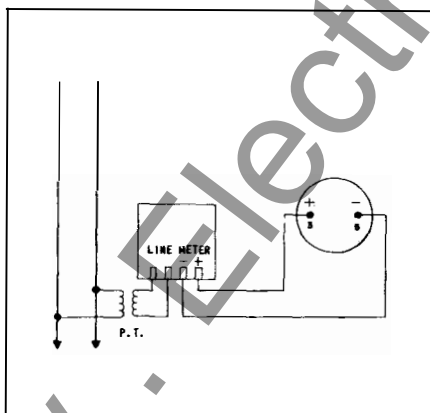


Fig. 11. Type X-221 Frequency Meter with External Transducer and Potential Transformer.

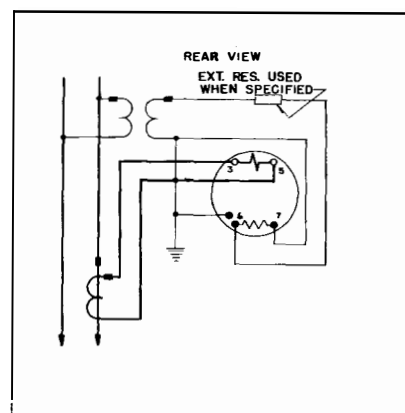


Fig. 12. Type Y-221 Single Phase Wattmeter with Current Transformer and Potential Transformer.

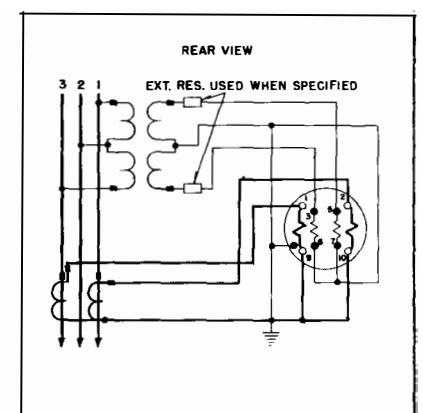


Fig. 13. Types Y-221 polyphase 2 current coil wattmeter with Current Transformer and Potential Transformer.

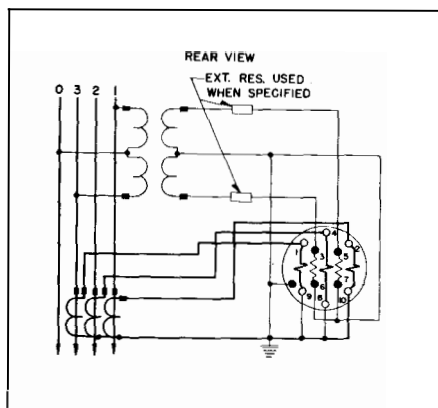


Fig. 14. Types Y-221 Polyphase 3 current coil wattmeter with Current Transformer and Potential Transformer.

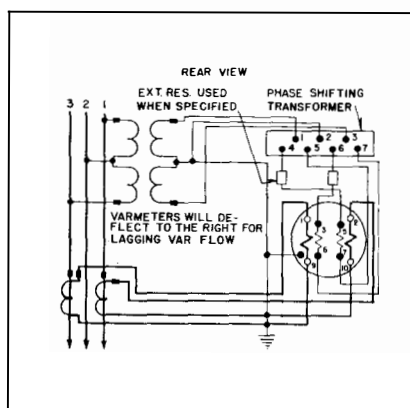


Fig. 15. Types Y-221 Polyphase 2 Current Coil Varmeter with Current Transformer and Potential Transformer.

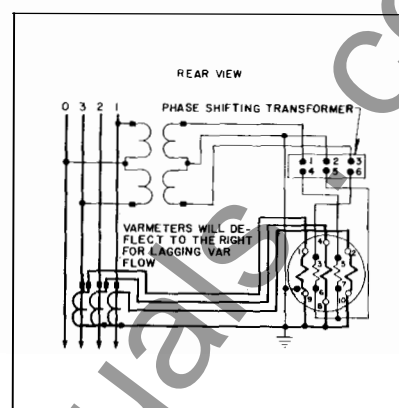


Fig. 16. Types Y-221 Polyphase 3 Current Coil Varmeter with Current Transformer and Potential Transformer.

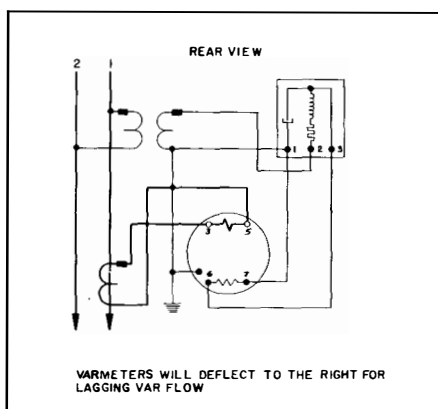


Fig. 17. Types Y-221 Single Phase Varmeter with C.T. and P.T.

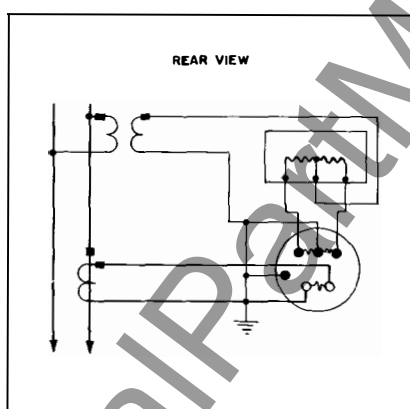


Fig. 18. Type KY-221 Single Phase Power Factor Meter With External Reactor.

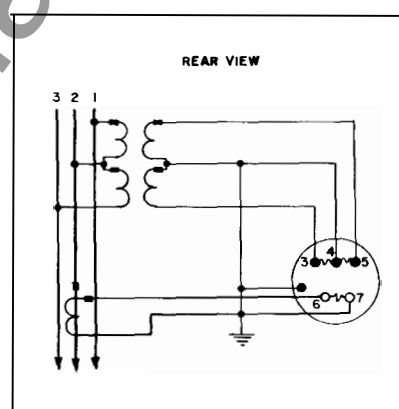


Fig. 19. Type KY-221 3-Phase 3-Wire Power Factor Meter.

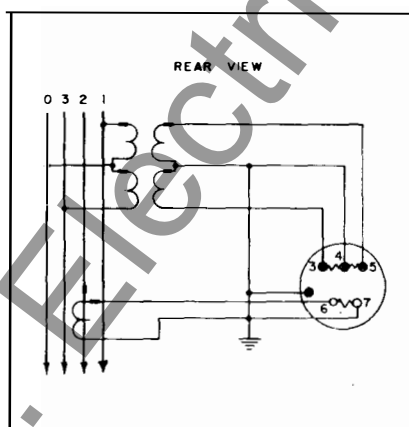
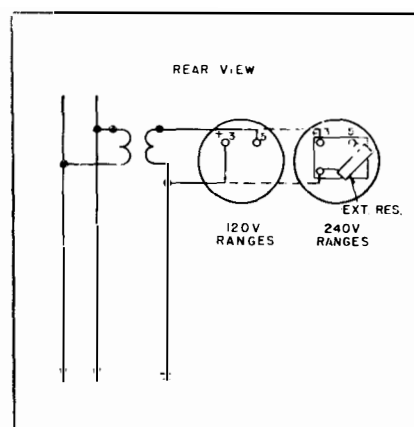
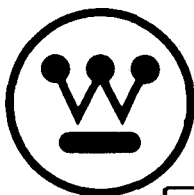


Fig. 20 Type KY-221 3-Phase 4-Wire Power Factor Meter External Wiring



\* Fig. 21 Type KR3-221 Self Contained Frequency Meter



Westinghouse I.L. 43-221H

# INSTALLATION • OPERATION • MAINTENANCE I N S T R U C T I O N S

## — 221 LINE — SWITCHBOARD INSTRUMENTS FOUR AND ONE -HALF-INCH CLASSIFICATION 100° SCALE TYPE

### GENERAL

Type 221 instruments are designed and built to meet or exceed the requirements of American Standard C39.1 for electrical indicating switchboard instruments. The rated accuracy class is one per cent.

### CASES

The first letter in the Type designation indicates the form of case used. K = Rectangular Flush Case, Flange mounted.

### MECHANISMS

The second letter in the type designation indicates the principle of operation.

- X = Permanent magnet moving coil
- A = Repulsion moving iron
- Y = Electrodynamic
- C = Rectifier plus X
- J = Power Factor Transducer Plus X

All of the above mechanisms employ the taut band suspension bearing system except the Y types.

*CAUTION: When the instrument mechanism is exposed, avoid contact with the tension springs. These springs are precisely made and positioned, and any pressures inadvertently applied to them may cause misalignment of the moving element.*

### DIAL NOTES

References to type, style number, use of external components if required, coil ratings, calibration data etc., are made on the dial mask.

### INSTALLATION

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

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

Before energizing the instrument, adjust the pointer to zero by means of the zero adjuster at the front of the instrument.

### CIRCUIT PRECAUTIONS

**CAUTION: DO NOT REMOVE COVER WHILE THE INSTRUMENT IS ENERGIZED. DIAL AND POINTER MAY BE AT HAZARDOUS VOLTAGE LEVELS.**

### HIGH VOLTAGE OPERATION

All instruments are insulated for 800 volt maximum service.

When voltmeters are used with external

*All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.*

## K-221 LINE SWITCHBOARD INSTRUMENTS

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resistors on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be grounded.

Ammeters with external shunts must be used with leads having the resistance specified in the dial notes. If the circuit voltage exceeds the insulation rating of the instrument, the shunt should be in the grounded side of the line.

### GROUNDING OF CASES

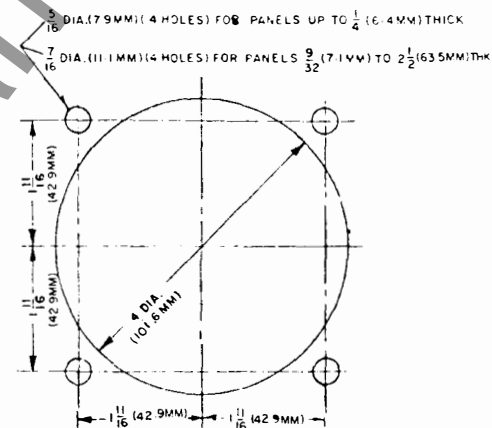
Ground instruments cases with No. 12 AWG

Copper Wire to any one of the three instrument case to base screws.

### REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory, or at any authorized Instrument Repair Facility (see Service Directory 43-000). However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts always give complete nameplate data.

LINE NO.	TYPE	INSTRUMENT	TERMINALS IN POSITION NO.	TECH. INCH. (U.S.S.)	DIM. A INCHES	DIM. A (MM)	RESISTOR CAGE	EXTERNAL BOX TYPE	ELECTROLUMINESCENT DIALS
1	FE-221	D.C. INSTRS. INCLUDING AMMETERS UP TO 20 AMP.	3-5	10-32	2.813	(71.5)	NOT USED	NONE	REQ.
2	FE-221	D.C. AMMETERS 25 TO 60 AMP.	3-5	1/4-28	2.813	(71.5)	NOT USED	NONE	REQ.
3	FE-221	RECTIFIER INST.	3-5	10-32	2.813	(71.5)	NOT USED	NONE	REQ.
4	FE-221	TEMPERATURE INDICATOR	3-5-6-7	10-32	2.813	(71.5)	NOT USED	NONE	REQ.
5	FE-221	A.C. VOLTMETERS UP TO 600 V.	1-2	10-32	2.813	(71.5)	NOT USED	NONE	NOT REQ.
6	FE-221	A.C. AMMETERS UP TO 4 INCL. 75 AMP.	1-2	10-32	2.813	(71.5)	NOT USED	NONE	NOT REQ.
7	FE-221	WATTMETER (SINGLE PHASE) 100 & 200 V. RATING	3-5-6-7	10-32	2.813	(71.5)	USED	NONE	REQ.
8	FE-221	WATTMETER (3 PH 3W) 100 & 200 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	USED	NONE	REQ.
9	FE-221	WATTMETER (3 PH 4W) 100 & 200 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	USED	NONE	REQ.
10	FE-221	WATTMETER (SINGLE PHASE) 400 & 600 V. RATING	3-5-6-7	10-32	2.813	(71.5)	NOT USED	NONE	REQ.
11	FE-221	WATTMETER (SINGLE PHASE) 400 & 600 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	NOT USED	VR-825	REQ.
12	FE-221	WATTMETER (3 PH 3W) 400 & 600 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	NOT USED	VR-825	REQ.
13	FE-221	WATTMETER (3 PH 4W) 400 & 600 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	NOT USED	VR-825	REQ.
14	FE-221	A.C. AMMETER 30 TO 50 AMP.	1-2	10-32	2.813	(71.5)	NOT USED	NONE	NOT REQ.
15	FE-221	ALL SIN. PH. POWER FACTOR METERS	3-4-5-6-7	10-32	2.813	(71.5)	NOT USED	VR-876	REQ.
16	FE-221	INST. PH. P.F. METER 120V. 25/50 CYC. 3PH. 3W.	3-4-5-6-7	10-32	2.813	(71.5)	USED	NONE	REQ.
17	FE-221	ELECTRICAL RESISTANCE THERMOMETER	1-2-3-4-5-6-7	10-32	3.750	(95.3)	NOT USED	NONE	NOT REQ.
18	FE-221	FREQUENCY METER SELF CONTAINED	3-5	10-32	3.750	(95.3)	NOT USED	NONE	REQ.
19	FE-221	A.C. VOLTMETER ABOVE 600V. TO 800V.	1-2	10-32	2.813	(71.5)	NOT USED	NONE	NOT REQ.
20	FE-221	D.C. 500 MA. SCALE INSTRUMENTS	3-4-5	10-32	2.813	(71.5)	NOT USED	NONE	REQ.
21	KJ-221	TRANSFORMER TYPE PF METER 1PH. & 3PH.	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	NOT USED	NONE	NOT REQ.
22	KY-221	VARMETER (SINGLE PHASE) 100 & 200 V. RATING	3-5-6-7	10-32	2.813	(71.5)	USED	VV2-876	REQ.
23	KY-221	VARMETER (3 PH 3W) 100 & 200 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	USED	MV-832	REQ.
24	KY-221	VARMETER (3 PH 4W) 100 & 200 V. RATING	1-2-3-4-5-6-7-8-9-10	10-32	5.312	(134.9)	USED	MV-832	REQ.



DRILLING PLAN

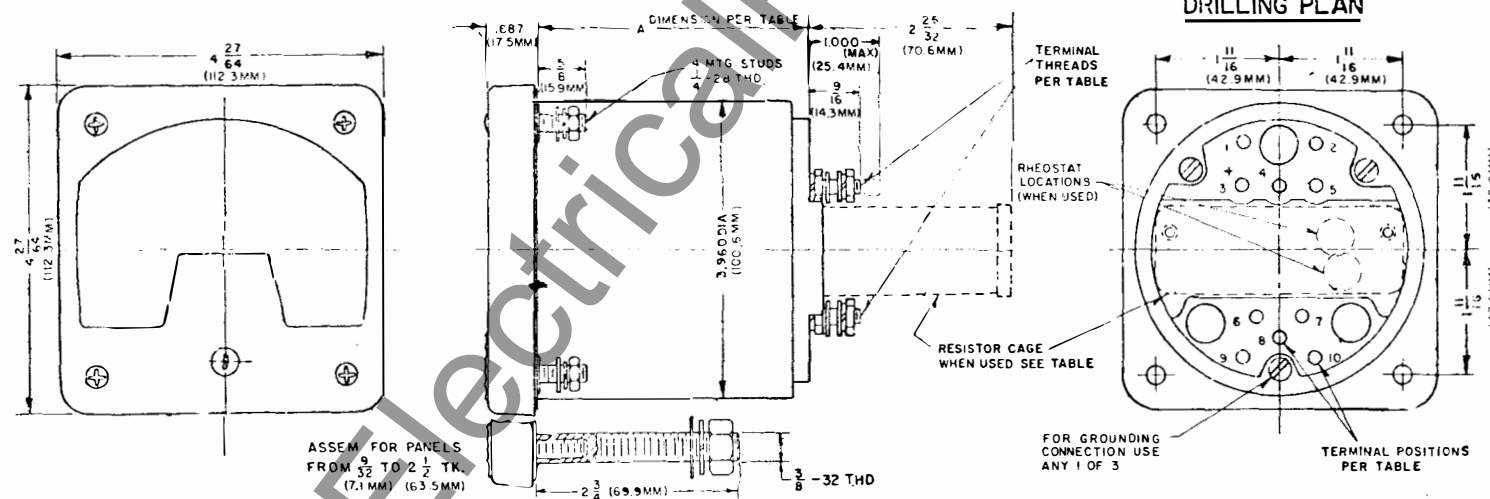
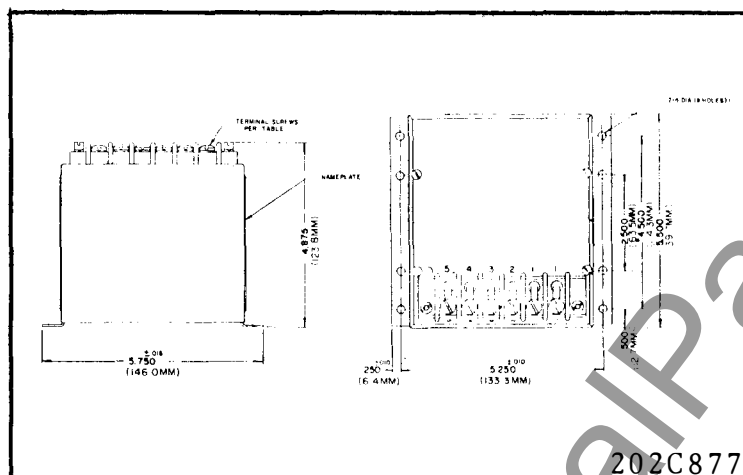


Fig. 1. Outline Dimensions and Drilling Plan for Type K-221 Instruments.

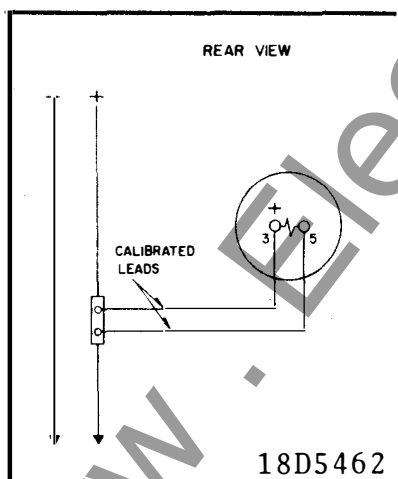
409C944

Technical drawings of the 16C5805 integrated circuit. The top drawing is a 'TOP VIEW' showing a square package with pins on all four sides. Dimensions include a width of 0.400 inches (10.16 mm) and a height of 0.150 inches (3.81 mm). The bottom drawing is an 'ELEVATION' view showing the side profile of the package. Dimensions include a width of 0.400 inches (10.16 mm) and a height of 0.150 inches (3.81 mm). Both views show the internal structure of the package, including the die and bonding wires.



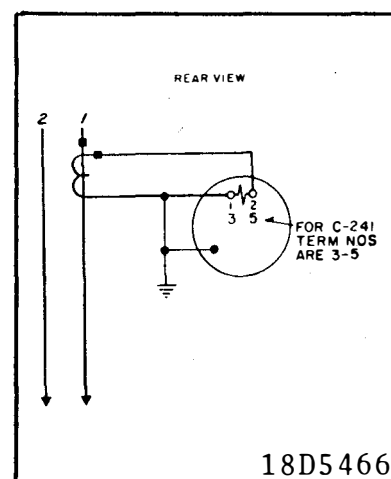
REAR VIEW

18D5461



REAR VIEW

18D5463





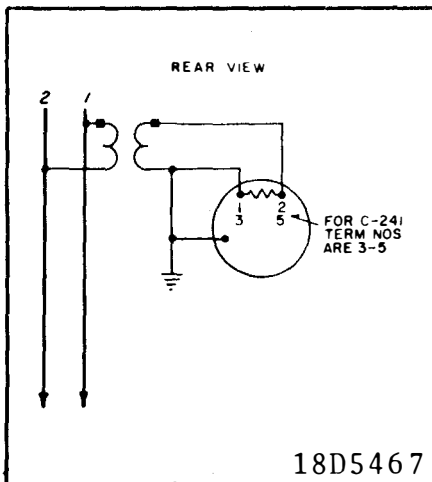


Fig. 10. Type A-221 Voltmeter with Potential Transformer.

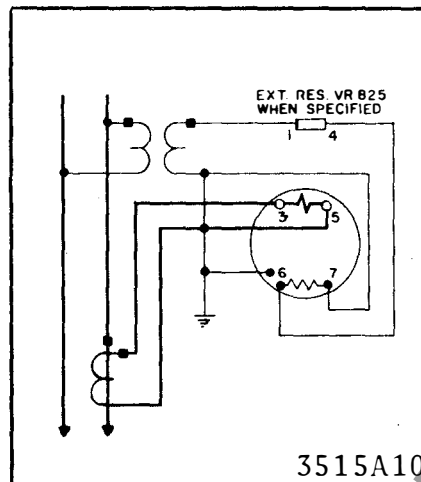


Fig. 11. Type Y-221 Single Phase Wattmeter with Current Transformer and Potential Transformer.

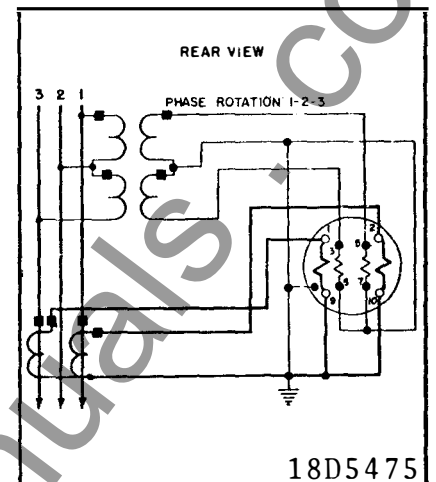


Fig. 12. Types Y-221 polyphase 2 current coil wattmeter with Current Transformer and Potential Transformer.

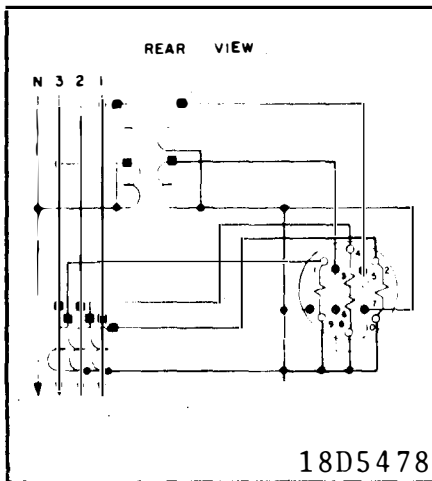


Fig. 13. Types Y-221 Polyphase 3 current coil wattmeter with Current Transformer and Potential Transformer.

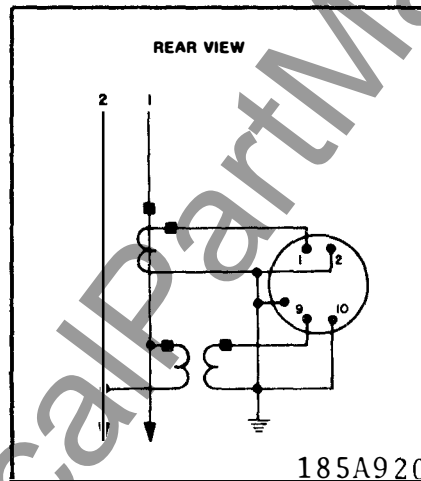


Fig. 14. Type KJ-221 Single Phase Power Factor Meter.

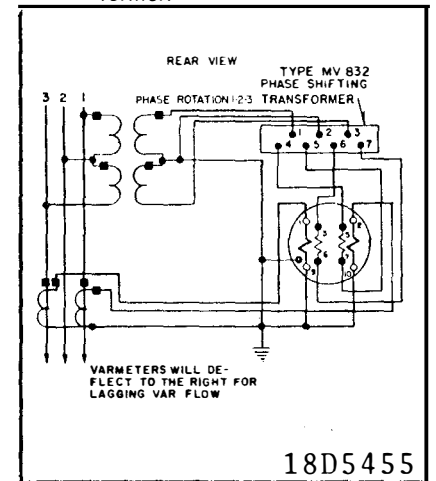


Fig. 15. Types Y-221 Polyphase 2 Current Coil Varmeter with Current Transformer and Potential Transformer.

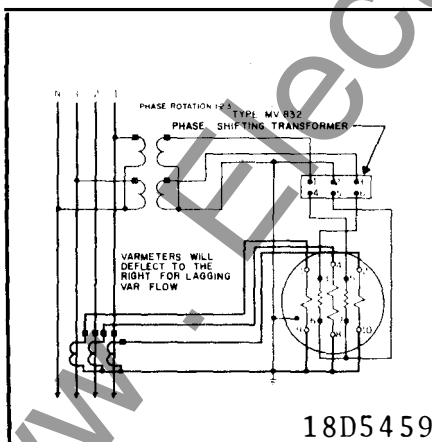


Fig. 16. Types Y-221 Polyphase 3 Current Coil Varmeter with Current Transformer and Potential Transformer

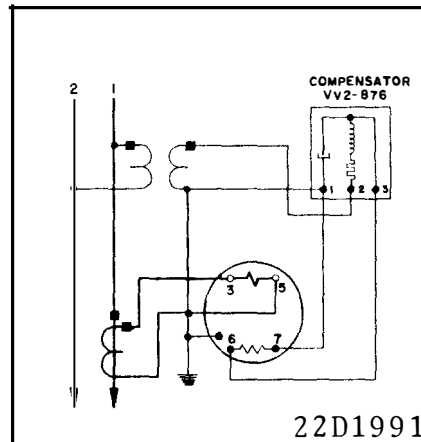


Fig. 17. Types Y-221 Single Phase Var-meter with C.T. and P.T.

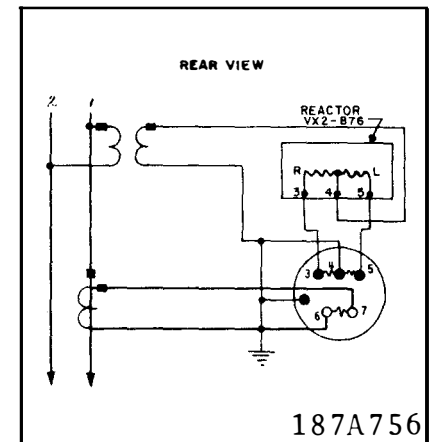


Fig. 18. Type KY-221 Single Phase Power Factor Meter with External Reactor.

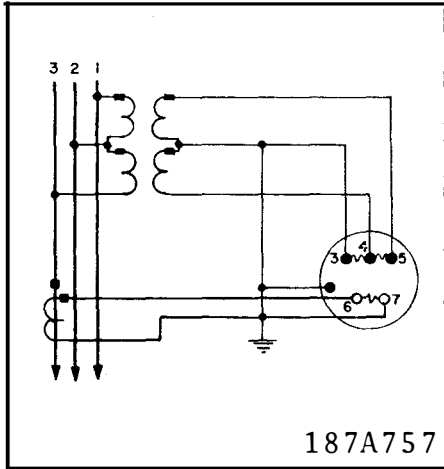


Fig. 19. Type KY-221 3-Phase 3-Wire Power Factor Meter.

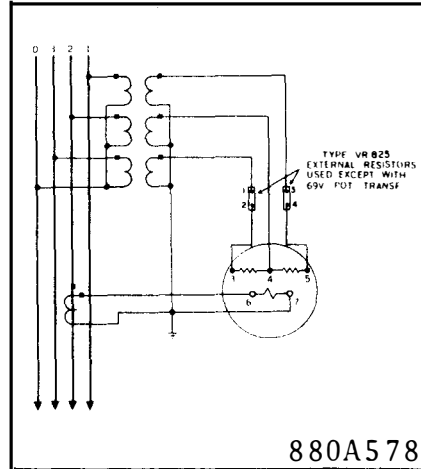


Fig. 20. Type KY-221 3-Phase 4-Wire Power Factor Meter External Wiring.

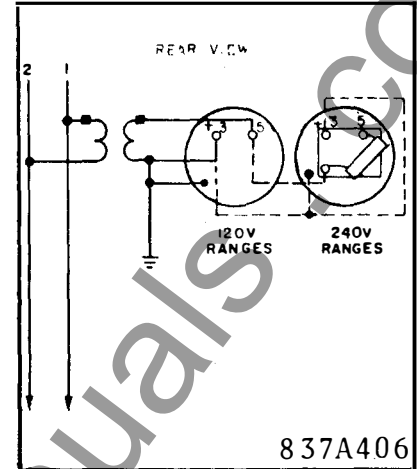


Fig. 21. Type KR3-221 Self Contained Frequency Meter.

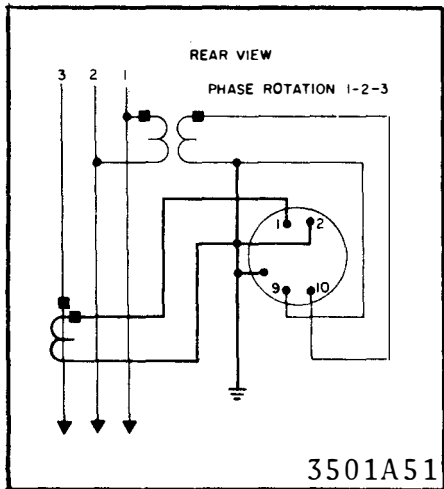


Fig. 22. Type KJ-221 3-phase, 3-wire Power Factor Meter.

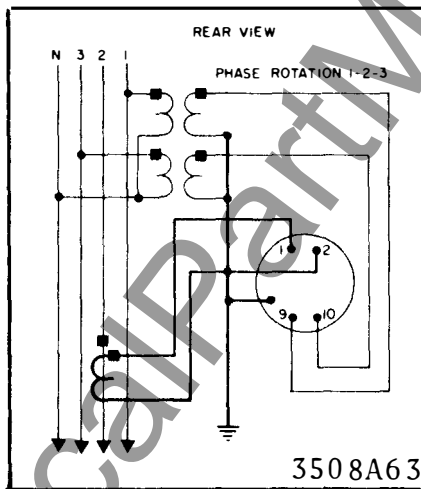


Fig. 23. Type KJ-221 3-phase, 4-wire Power Factor Meter.

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**RELAY-INSTRUMENT DIVISION**

**NEWARK, N. J.**

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