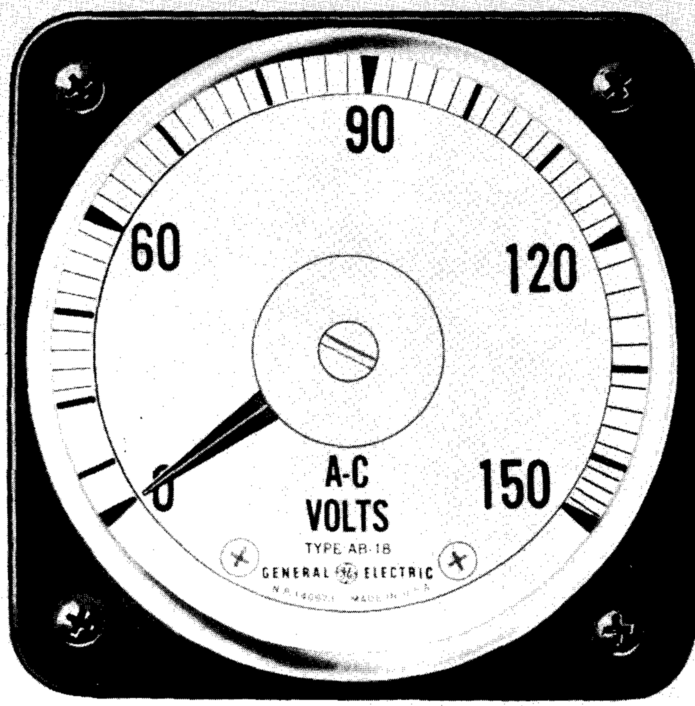
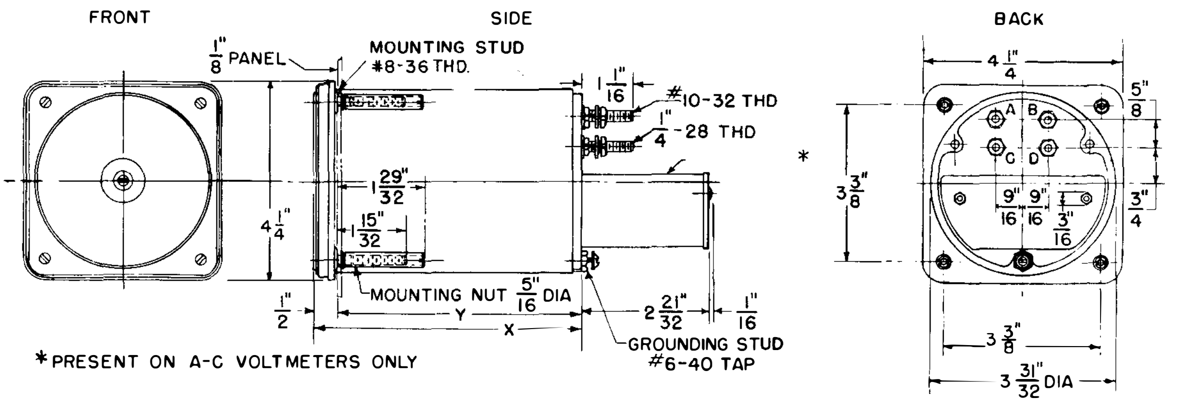
INSTRUCTIONS

GEH-1539D
Supersedes GEH-1539C

TYPES AB AND DB
AMMETERS AND VOLTMETERS



GENERAL ELECTRIC



INSTRUMENT	STUD LOCATION	DIMENSIONS	
		X	Y
Type DB-10 Ammeter	CD	3 15/32"	2 31/32"
Type DB-10 Voltmeter	AB	3 15/32"	2 31/32"
Type DB-10 Ground Detector	CD	3 15/32"	2 31/32"
Type AB-10 Ammeter	AB	4 3/8"	3 7/8"
Type AB-10 Voltmeter	AB	4 3/8"	3 7/8"

Fig. 1. Dimensions of Types AB-10 and DB-10 ammeters and voltmeters and DB-10 ground detectors.

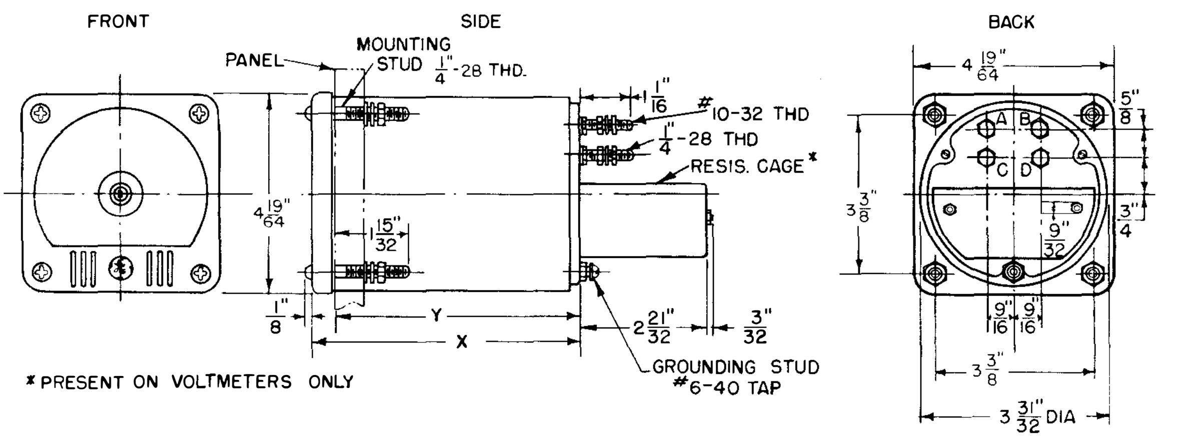


FIG. 2. DIMENSIONS OF TYPES AB-12 AND -13, AND TYPES DB-12 AND -13 AMMETERS, VOLTMETERS AND GROUND DETECTORS.

NOTE: THE LETTERS NEXT TO THE TERMINAL STUDS ARE FOR PURPOSES OF DIMENSIONAL LOCATION ONLY FOR CONNECTIONS, SEE THE APPROPRIATE EXTERNAL CONNECTION DIAGRAM

INSTRUMENT	STUD LOCATION	DIMENSIONS	
		X	Y
D-c Ammeters	CD	3 1/2"	2 31/32"
D-c Voltmeters	AB	3 1/2"	2 31/32"
D-c Ground Detector	CD	3 1/2"	2 31/32"
A-c Ammeters	AB	4 13/32"	3 7/8"
A-c Voltmeters	AB	4 13/32"	3 7/8"

Fig. 2. Dimensions of Types AB-12 and -13, and Types DB-12 and -13 ammeters, voltmeters, and ground detectors.

TYPES
AB-10*,-12*,-13*,-14,-15*,-16,-18, AND -19*
AND
DB-10*,-12*,-13*,-14,-15*,-16,-18, AND -19*
AMMETERS AND VOLTMETERS

INTRODUCTION

These instructions cover the installation of the General Electric Types AB and Types DB a-c and d-c ammeters and voltmeters. These instruments are long-scale, rectangular-pattern, switchboard types designed for flush mounting. The instruments, as supplied, are intended for use on the circuit specified by the customer.

There is a nameplate located on the back of each instrument. This nameplate gives the serial number and such information on the current or voltage rating, frequency rating, transformer ratio, full-scale value, and lead resistance as is applicable to the instrument. On voltmeters, the nameplate also indicates whether the resistor is internal or external.

Ammeters and voltmeters supplied with transformers will have their scales calibrated in primary amperes or primary volts respectively, unless otherwise specified.

A-C AMMETERS

When the circuit exceeds 20 amperes, a current transformer of the ratio indicated on the nameplate must be used. When the circuit exceeds 650 volts a current transformer must be used for purposes of insulation. The current transformer must have a frequency rating which corresponds to that indicated on the instrument nameplate.

A-C VOLTMETERS

When the circuit exceeds 750 volts, a potential transformer of the ratio indicated on the instrument nameplate must be used. The transformer must have a frequency rating which corresponds to that on the instrument nameplate.

An external Form-3 resistor must be used when so indicated on the instrument nameplate. The table below gives the number of tubes in the resistor supplied with instruments of various voltage ratings. When an external resistor is used, it must bear the same serial number as that of the instrument. The

EXTERNAL RESISTORS

Description	Volts	External Resistor
Single-range	150	None
Single-range	175, 300	One 1-tube
Single-range	350	One 1-tube or 2-tube
Single-range	500	One 4-tube or 2-tube
Single-range	600, 750	One 4-tube
Double-range	75/150	None
Double-range	150/300	One 1-tube

* Discontinued type; no longer available

BURDEN DATA

TYPE	Impedance in Ohms	Effective Resistance in Ohms	Inductance in Henries	Volt-amperes	Watts	Vars	Power Factor
120-volt, 60-cycle Potential Circuit							
Voltmeters (150-volt rating)	3020	2960	1.52	4.76	4.67	0.94	0.98
5-ampere, 60-cycle Current Circuit							
Ammeters	0.086	0.05	0.000187	2.15	1.25	1.78	0.58

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

dimensions of the external resistors are given in Fig. 10, 11, and 12.

D-C AMMETERS

D-c ammeters designed for current measurement above 60 amperes necessitate the use of shunts which are to be connected to the ammeter by means of the leads provided. In the event that leads are supplied by the purchaser, their resistance should agree with the value stamped on the instrument nameplate. Any change in the resistance of these leads will introduce an error in the reading. General Electric shunts of the same ampere rating and millivolt drop are interchangeable.

Warning: All ammeter shunts should be connected in the grounded side of the line when possible. When this is not possible, or the circuit cannot be grounded, the metal parts of manually operated contact devices or auxiliary pointer knobs which project through the cover are at line potential. When the cover is removed, also remember that the instrument windings, as well as the scale and pointer, are at line potential. Use caution to avoid contacting this potential.

As the resistance of the shunt leads used in certain applications cannot be predetermined at the factory, it has been found desirable to furnish some d-c ammeters with an internal rheostat to adjust for non-standard lead resistances.

The nameplate on the instrument has an INSTRUMENT + LEAD RESIS. value stamped upon it. This value is to be that of the total circuit, which is considered to include the resistance of the instrument and its leads with the shunt disconnected. This total circuit resistance must be adjusted correctly in order to attain the specified accuracy of the instrument.

To adjust the rheostat for a given lead resistance, proceed as follows:

If a resistance bridge is available, connect it across the shunt end of the leads (shunt disconnected) and the instrument across the opposite end. Set the resistance bridge for the INSTRUMENT + LEAD RESIS. value stamped on the instrument nameplate. Loosen the lock nut (located under the nameplate), and turn the rheostat shaft (which projects through the nameplate) until a zero deflection is secured on the bridge galvanometer. After the correct setting has been obtained, retighten the lock nut.

If a resistance bridge is not available, adjustment may be made by connecting a standard millivoltmeter across the shunt end of the leads (shunt disconnected) and the instrument across the opposite end. Apply a low adjustable d-c voltage across the shunt end of the leads and adjust this voltage until the indication on the standard millivoltmeter agrees with the full-scale millivolts (marked FULL SCALE MV) on the instrument nameplate. Loosen the lock nut (located under the nameplate), and turn the rheostat shaft (which projects through the nameplate) until the ammeter reads full scale. Retighten the lock nut.

Note: The maximum lead resistance is about 1 ohm for a 100-millivolt instrument and about 0.26 ohm for a 50-millivolt instrument.

D-C VOLTMETERS

D-c voltmeters designed for use on circuits above 750 volts and d-c ground detectors for voltages up to and including 750 volts are furnished with external resistors and are connected directly to the circuit to be measured.

INSTALLATION

MOUNTING

The appropriate dimension drawings shown in this book should be followed when drilling the switchboard. All drilling and all wiring on the switchboard should be completed before mounting the instruments. Supporting studs are provided for mounting on the switchboard. Mount the instruments in a level position.

These instruments are practically uneffected by stray fields, but it is advisable to keep transformers and wires carrying heavy current as far as possible from all indicating instruments.

When there is no current flowing through the instrument and it is properly leveled, the pointer should indicate zero. Any deviation from zero should be corrected by means of the zero adjustor.

TERMINAL CONNECTIONS

The threads on the terminal studs and nuts should be clean and bright. The contact surfaces of nuts, busbars, and cable terminals must be thoroughly clean to insure good contact. If a nut turns hard, it should be run over a tap of the proper dimensions; otherwise, the threads on the stud may be ruined or the stud turned in the instrument, thereby breaking the connection. After the instrument has been connected, tighten the nuts sufficiently to insure good contact. Do not overtighten.

The nuts and studs used in these instruments are U. S. standard.

Connect the instrument as shown in the appropriate diagram. The numbers in these connection diagrams correspond to the numbers stamped on the instrument terminals.

On instruments manufactured prior to 1951, the terminal studs are stamped with letters instead of numbers. For such instruments, the connection diagrams in this book may be followed by observing the pictorial positioning of the terminals, rather than the stud markings.

Warning: Care must be exercised in handling high tension wires when installing instruments on such circuits.

POLARITY MARKINGS OF TRANSFORMERS

Transformers of present manufacture have polarity markings of white paint or markers, H_1 for primary and X_1 for secondary, on or near the proper terminal. These markings denote the relative polarity and facilitate the making of proper connections for correct direction of deflection of instruments. The relation of the marked leads is such that instantaneous direction of the current in them is the same; namely, toward the transformer in the marked primary lead and from the transformer in the marked secondary lead, or vice versa. These polarity markings are indicated in the connection diagrams and should be followed irrespective of their physical location on the transformers.

GROUNDING CASES OF A-C INSTRUMENTS

It is frequently desirable to use transformers on circuits of over 150 volts. The cases of instruments which are used with current and potential transformers should be connected to the grounded side of the secondary circuits of such transformers. No. 12 Awg copper wire is suitable for this purpose.

Grounding connections from the grounded side of the secondary circuits to earth should be made in accordance with the provisions of the National Electric Code.

PRINCIPLES OF OPERATION

The d-c instruments utilize a permanent-magnet, moving-coil mechanism adapted for the longscale instrument design. Current passing through the moving coil produces a magnetic field which interacts with the field produced by the permanent magnet, thus supplying the deflecting torque. The moving system deflects until counterbalanced by the instrument control springs.

The a-c instruments (except expanded-scale voltmeters) employ a moving iron mechanism of the attraction-repulsion type. In these instruments, three soft-iron strips of carefully determined configuration are mounted inside the field coil.

When this coil is energized, it magnetizes the three iron strips and also a vane attached to the pivoted shaft. The center iron strip exerts a force of repulsion, and the other two strips a force of attraction, on the moving vane, in such a manner that the pointer moves upscale until the torque is counterbalanced by the instrument control spring.

The expanded-scale, a-c voltmeters utilize a standard electrodynamometer mechanism with a saturable reactor placed in series with the moving coil. The moving-coil circuit is connected in parallel with a circuit consisting of the field and frequency compensating network.

When the voltage source is applied across the saturable reactor, the exciting current varies in a nonlinear fashion with the voltage. The scale distribution corresponds to this nonlinear variation, and the instrument produces an accurate, readable indication in the area of the reference voltage.

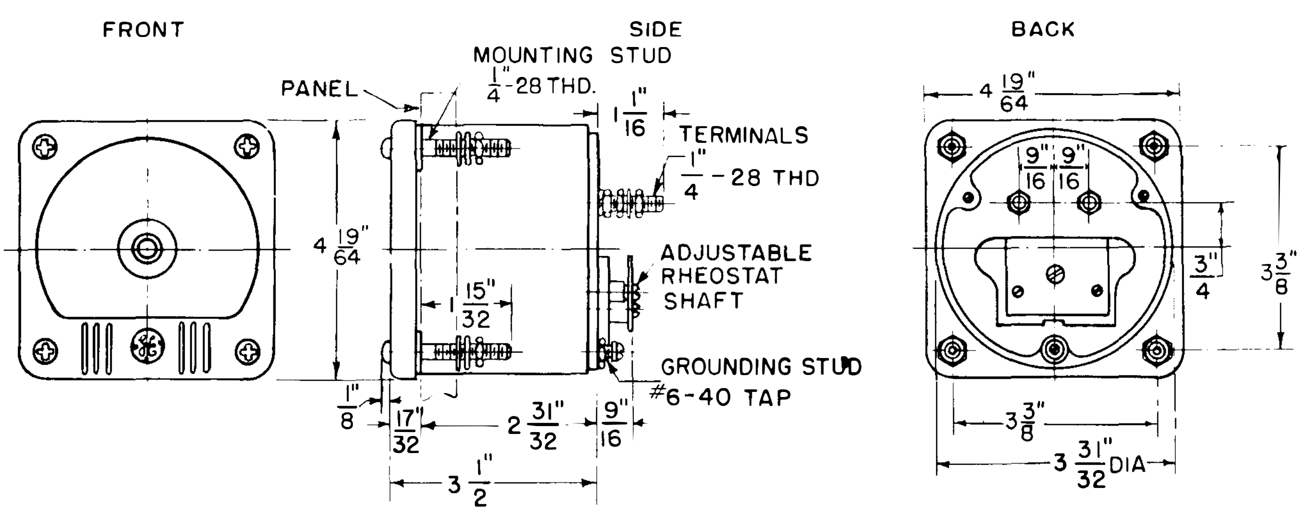


Fig. 3. Dimensions of Types DB-12 and -13 ammeters with rheostat for lead-length compensation.

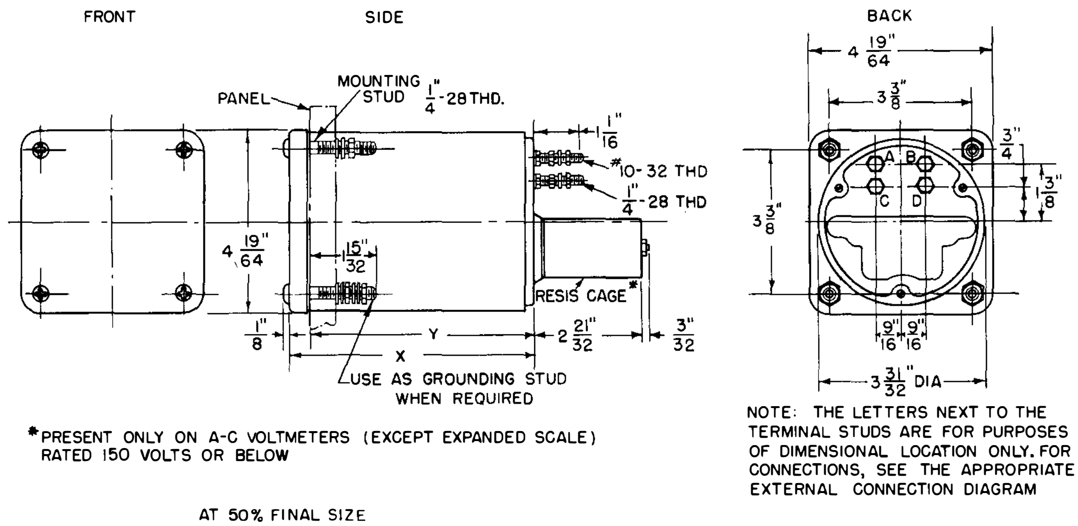


FIG. 4. DIMENSIONS OF TYPES AB-14, -15, AND -19 AND TYPES DB-14, -15, AND -19 AMMETERS, VOLTMETERS, AND GROUND DETECTORS.

INSTRUMENT	STUD LOCATION	DIMENSIONS	
		X	Y
D-c Ammeters	CD	3 9/16"	2 31/32"
D-c Voltmeters	AB	3 9/16"	2 31/32"
D-c Ground Detector	CD	3 9/16"	2 31/32"
A-c Ammeters	AB	4 15/32"	3 7/8"
A-c Voltmeters	AB	4 15/32"	3 7/8"
A-c Voltmeters (expanded-scale)	AB	5 29/32"	5 5/16"

Fig. 4. Dimensions of Types AB-14, -15, and -19 and Types DB-14, -15, and -19 ammeters, and voltmeters, and ground detectors

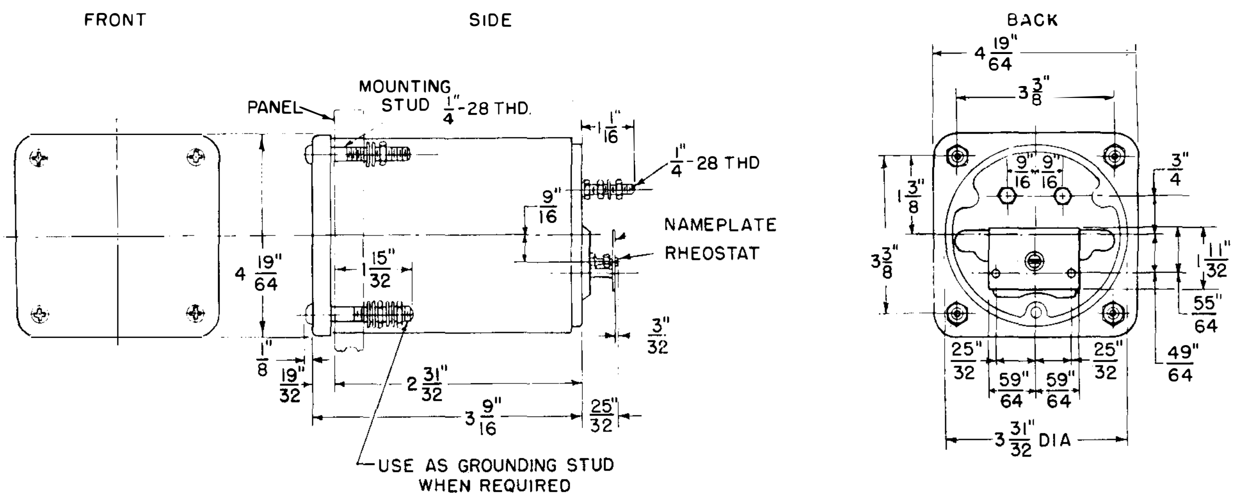
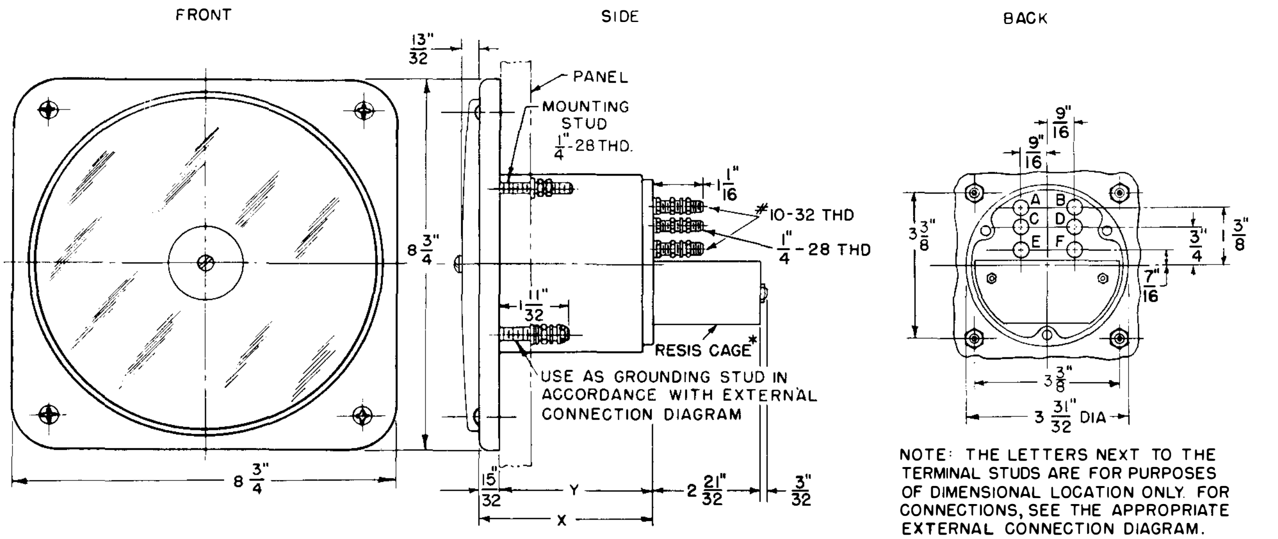


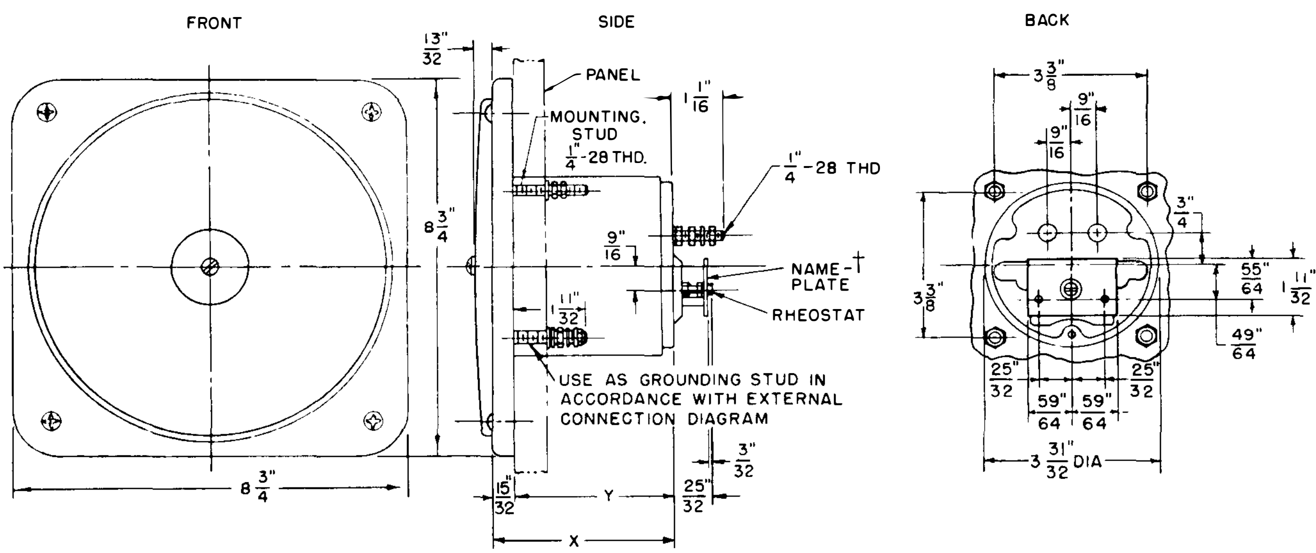
Fig. 5. Dimensions of Types DB-14, -15, and -19 ammeters with rheostat for lead-length compensation.



* PRESENT ONLY ON A-C VOLTMETERS (EXCEPT EXPANDED SCALE) RATED 150 VOLTS OR BELOW

INSTRUMENT	STUD LOCATION	DIMENSIONS (MODEL NO. ENDING IN "1")		DIMENSIONS (MODEL NO. ENDING IN "2")	
		X	Y	X	Y
D-c Ammeter	CD	3 5/16"	2 27/32"	4 7/32"	3 3/4"
D-c Voltmeter	AB	3 5/16"	2 27/32"	4 7/32"	3 3/4"
D-c Ground Detector	CD	3 5/16"	2 27/32"	4 7/32"	3 3/4"
A-c Ammeter	AB	4 7/32"	3 3/4 "	4 7/32"	3 3/4"
A-c Ammeter (double-rated)	AB EF	4 7/32"	3 3/4 "	4 7/32"	3 3/4"
A-c Voltmeter	AB	4 7/32"	3 3/4 "	4 7/32"	3 3/4"
A-c Voltmeter (expanded-scale)	AB	5 21/32"	3 3/16"	4 7/32"	3 3/4"

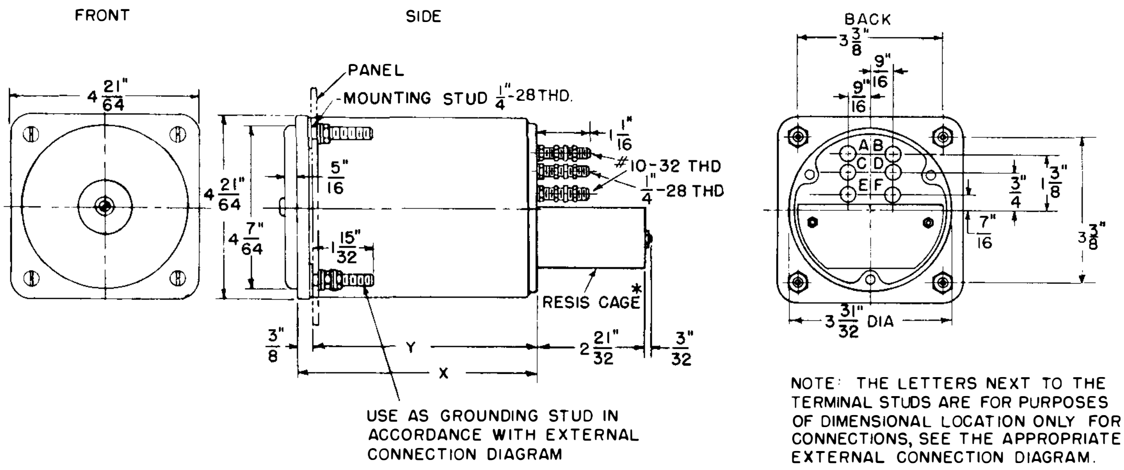
Fig. 6. Dimensions of Types AB-16 and DB-16 ammeters, voltmeters, and ground detectors.



DIMENSIONS	X	Y
MODEL NO. ENDING IN "1"	3 5/16"	2 27/32"
MODEL NO. ENDING IN "2"	4 7/32"	3 3/4 "

Fig. 7. Dimensions of Type DB-16 ammeters with rheostat for lead-length compensation.

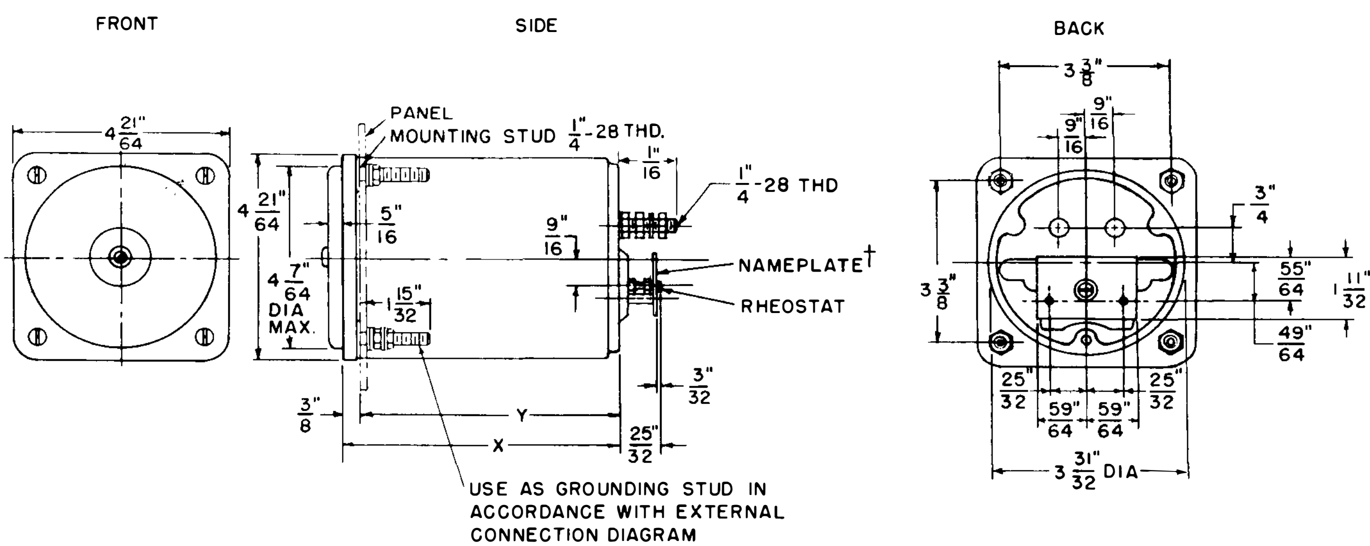
†Nameplate is in this location only on instruments having Model No. ending in "2".



* PRESENT ONLY ON A-C VOLTMETERS (EXCEPT EXPANDED SCALE) RATED 150 VOLTS OR BELOW

INSTRUMENT	STUD LOCATION	DIMENSIONS (MODEL NO. ENDING IN "1")		DIMENSIONS (MODEL NO. ENDING IN "2")	
		X	Y	X	Y
D-c Ammeter	CD	3 11/32"	2 31/32"	4 1/4"	3 7/8"
D-c Voltmeter	AB	3 11/32"	2 31/32"	4 1/4"	3 7/8"
D-c Ground Detector	CD	3 11/32"	2 31/32"	4 1/4"	3 7/8"
A-c Ammeter	AB	4 1/4 "	3 7/8 "	4 1/4"	3 7/8"
A-c Ammeter (double-rated)	AB EF	4 1/4 "	3 7/8 "	4 1/4"	3 7/8"
A-c Voltmeter	AB	4 1/4 "	3 7/8 "	4 1/4"	3 7/8"
A-c Voltmeter (expanded-scale)	AB	5 11/16"	5 5/16"	4 1/4"	3 7/8"

Fig. 8. Dimensions of Types AB-18 and DB-18 ammeters, voltmeters, and ground detectors.



DIMENSIONS	X	Y
MODEL NO. ENDING IN "1"	3 11/32"	2 31/32"
MODEL NO. ENDING IN "2"	4 1/4 "	3 7/8 "

Fig. 9. Dimensions of Type DB-18 ammeters with rheostat for lead-length compensation.

†Nameplate is in this location only on instruments having Model No. ending in "2".

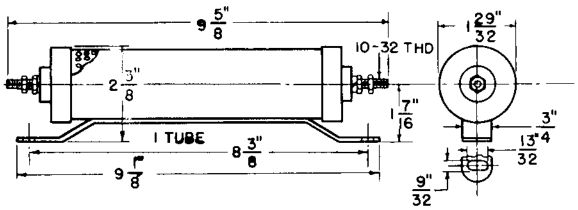


Fig. 10. Single-tube, Form-3 resistor.

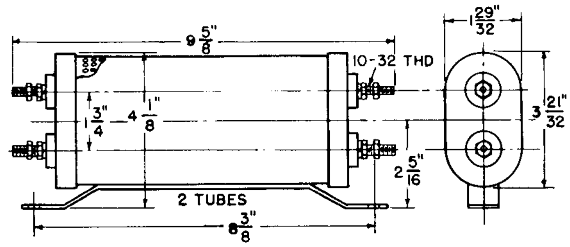


Fig. 11. Two-tube, Form-3 resistor.

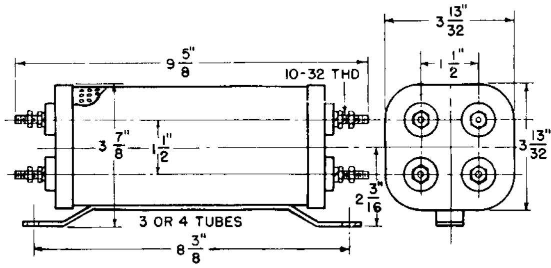


Fig. 12. Four-tube, Form-3 resistor.

CONNECTION DIAGRAMS

(Back Views)

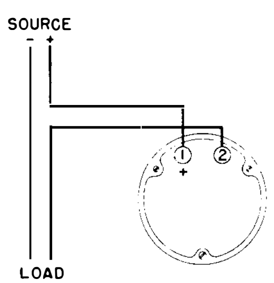


Fig. 13. Self-contained d-c ammeter.

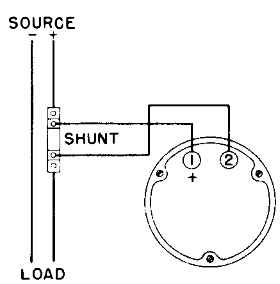


Fig. 14. D-c ammeter with external shunt.

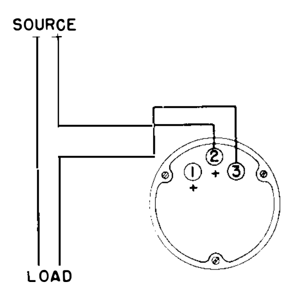


Fig. 15. Low range on double-rated d-c ammeter.

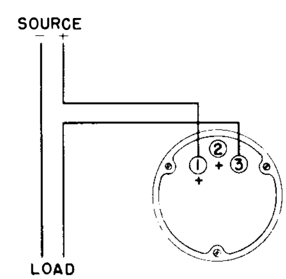


Fig. 16. High range on double-rated d-c ammeter.

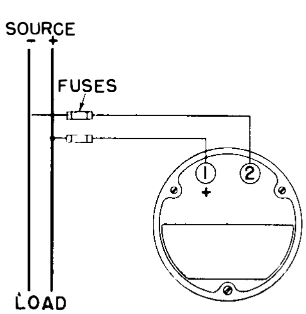


Fig. 17. Self-contained d-c voltmeter.

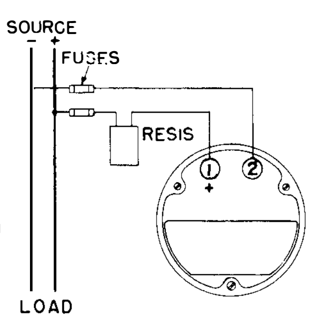


Fig. 18. D-c voltmeter rated above 750 volts (with external resistor).

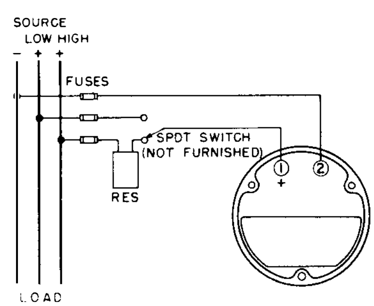


Fig. 19. Double-rated d-c voltmeter (illustrating use of switch to select range).

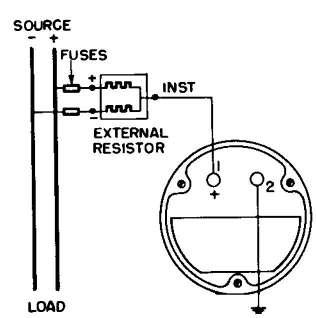


Fig. 19a. D-c ground detector for voltages up to and including 750 volts (with external resistor).

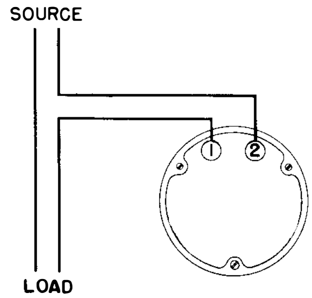


Fig. 20. Self-contained a-c ammeter.

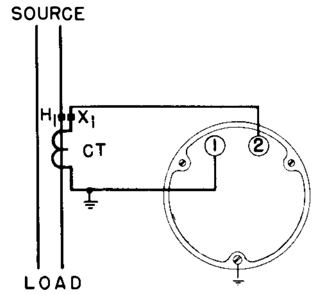


Fig. 21. A-c ammeter (Types AB-10, -12, and -13 only) with current transformer.

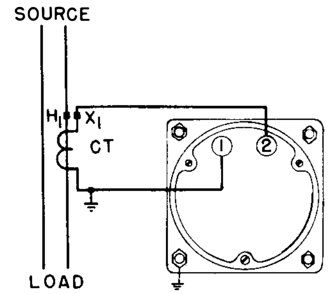


Fig. 22. A-c ammeter (Types AB-14, -15, -16, -18, and -19 only) with current transformer.

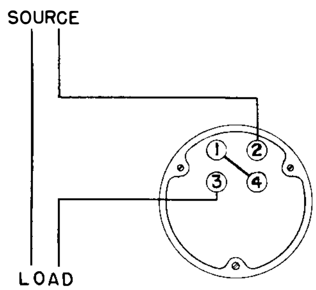


Fig. 23. Low range on double-rated a-c ammeter.

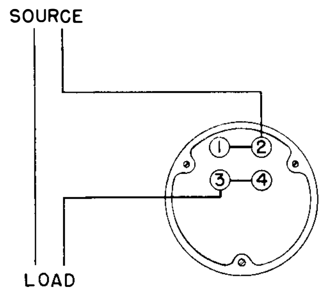


Fig. 24. High range on double-rated a-c ammeter.

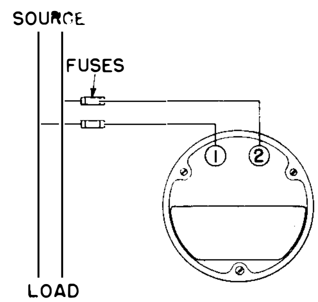


Fig. 25. Self-contained a-c voltmeter.

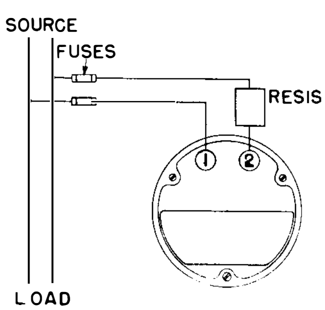


Fig. 26. A-c voltmeter rated above 150 volts (with external resistor).

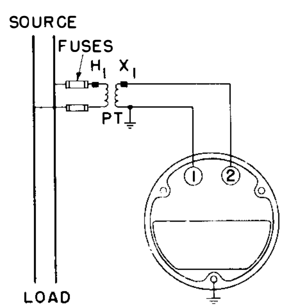


Fig. 27. A-c voltmeter (Types AB-10, -12, and -13 only) with potential transformer.

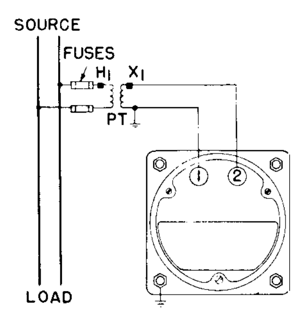


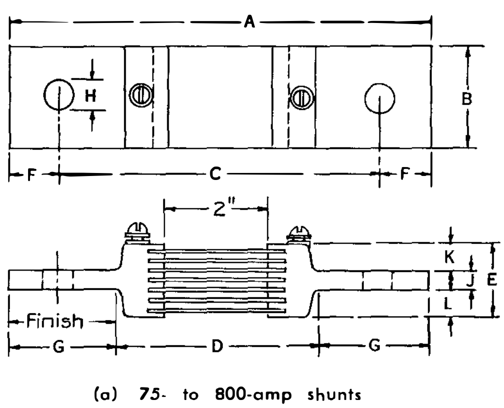
Fig. 28. A-c voltmeter (Types AB-14, -15, -16, -18, and -19 only) with potential transformer.

FORM-15, 50-MILLIVOLT SHUNTS

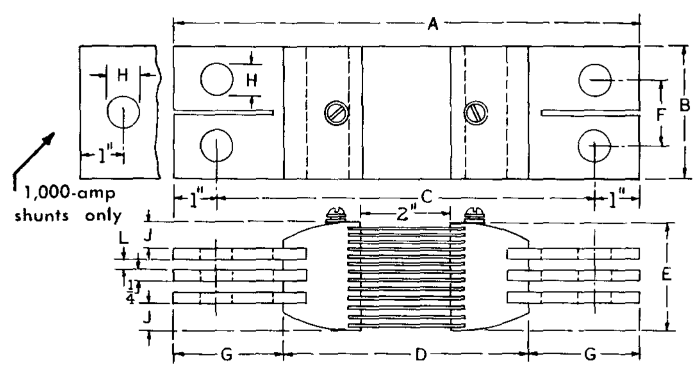
Amp	Fig. No. 29	A	B	C	D	E	F	G	H	J	K	L	Connection Strips Each End
	DIMENSIONS IN INCHES												
75	a	6 1/4	1 1/8	5 1/4	3 11/16	1/2	1/2	1 9/32	13/32	1/4	1/8	1/8	1
80	a	6 1/4	1 1/4	5 1/4	3 11/16	1/2	1/2	1 9/32	13/32	1/4	1/8	1/8	1
100	a	6 1/4	1 1/2	5 1/4	3 11/16	1/2	1/2	1 9/32	13/32	1/4	1/8	1/8	1
150	a	6 3/4	1 1/2	5 1/4	3 11/16	11/16	3/4	1 17/32	17/32	1/4	7/32	7/32	1
200	a	6 3/4	1 1/2	5 1/4	3 11/16	7/8	3/4	1 17/32	17/32	1/4	5/16	5/16	1
250	a	6 3/4	1 1/2	5 1/4	3 11/16	1 1/16	3/4	1 17/32	17/32	1/4	13/32	13/32	1
300	a	6 3/4	1 1/2	5 1/4	3 11/16	1 1/4	3/4	1 17/32	17/32	1/4	1/2	1/2	1
400	a	8 1/4	1 1/2	6 1/4	3 7/8	1 5/8	1	2 3/16	17/32	3/8	5/8	5/8	1
500	a	8 1/4	1 7/8	6 1/4	3 7/8	1 5/8	1	2 3/16	17/32	3/8	5/8	5/8	1
600	a	8 1/4	2	6 1/4	3 7/8	1 13/16	1	2 3/16	21/32	3/8	23/32	23/32	1
800	a	8 1/4	2 5/8	6 1/4	3 7/8	2	1	2 3/16	21/32	3/8	13/16	13/16	1
1000	b	9 3/4	3	7 3/4	4 3/4	1 11/16	....	2 1/2	21/32	15/32	....	1/4	2
1200	b	10	3	8	5	2 5/16	1 3/4	2 1/2	17/32	25/32	....	1/4	2
1500	b	10	3	8	5	2 5/16	1 3/4	2 1/2	17/32	17/32	....	1/4	3
2000	b	10 1/2	4	8 1/2	5 1/2	2 15/32	2 1/2	2 1/2	21/32	39/64	....	1/4	3
2500	b	10 1/2	4	8 1/2	5 1/2	2 15/16	2 1/2	2 1/2	21/32	19/32	....	1/4	4
3000	b	11 1/4	4	9 1/4	6 1/4	3 9/16	2 1/2	2 1/2	21/32	29/32	....	1/4	4
4000	c	11 1/2	4	9 1/2	6 1/2	7	4 21/32	2 5/8	2 1/2	....	....	....	5
5000	c	11 3/4	5	9 3/4	6 3/4	7 1/2	4 1/2	2 5/8	2 1/2	....	....	....	5
6000	c	13 3/4	6	11 3/4	8 3/4	8	4 21/32	2 7/8	3	....	....	....	5
8000	c	15 3/4	6	13 3/4	10 3/4	9 1/2	6 7/32	3 1/8	3	....	....	....	7
10000	c	17 1/4	8	15 1/4	12 1/4	10 1/2	5 3/4	3 5/8	....	....	....	....	7

For current values above 10,000 amp, the best arrangement is to use two or more shunts in parallel with a separate set of leads for each shunt.

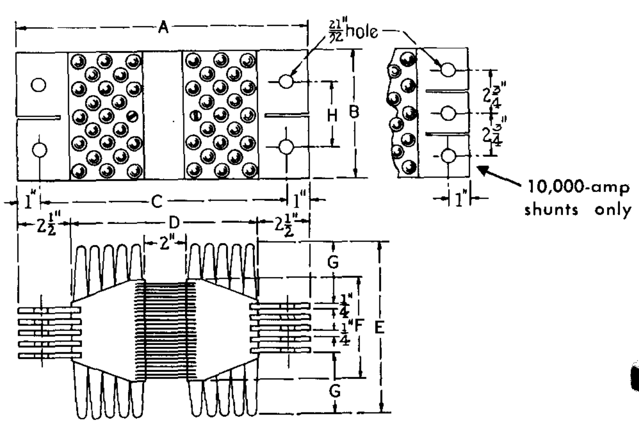
The Form-15 shunts for 800 amp and below have single-leaf terminals; above 800 amp, multileaf terminals are provided.



(a) 75- to 800-amp shunts



(b) 1,000- to 3,000-amp shunts



(c) 4,000- to 10,000-amp shunts

Fig. 29. Dimensions of Form-15 shunts, 75 to 10,000 amperes, 50-millivolt drop.

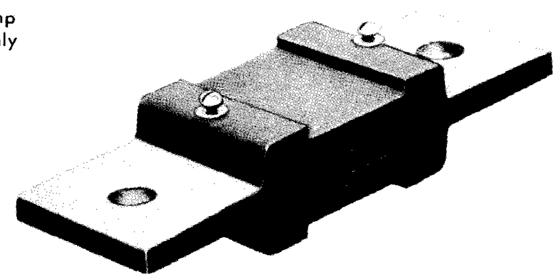


Fig. 30. Form-15 shunts, 75 to 800 amperes.

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