



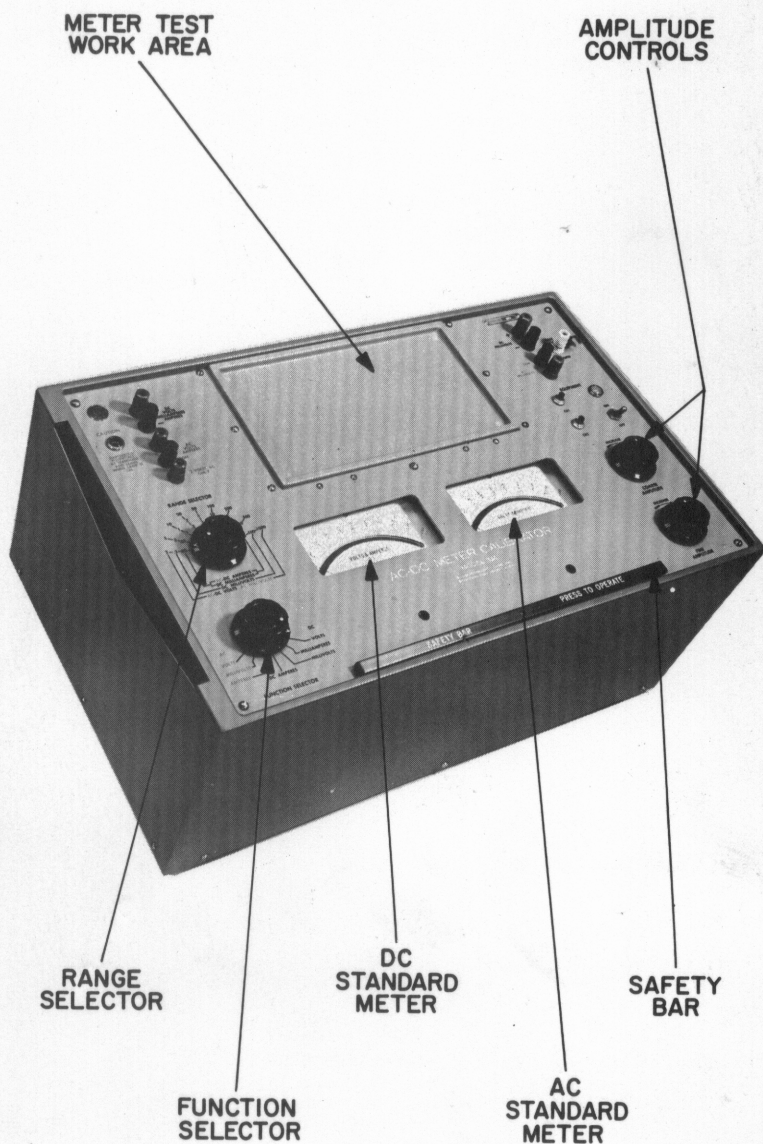
*Manual of
Instructions*

Model
33A

AC-DC
Meter
Calibrator

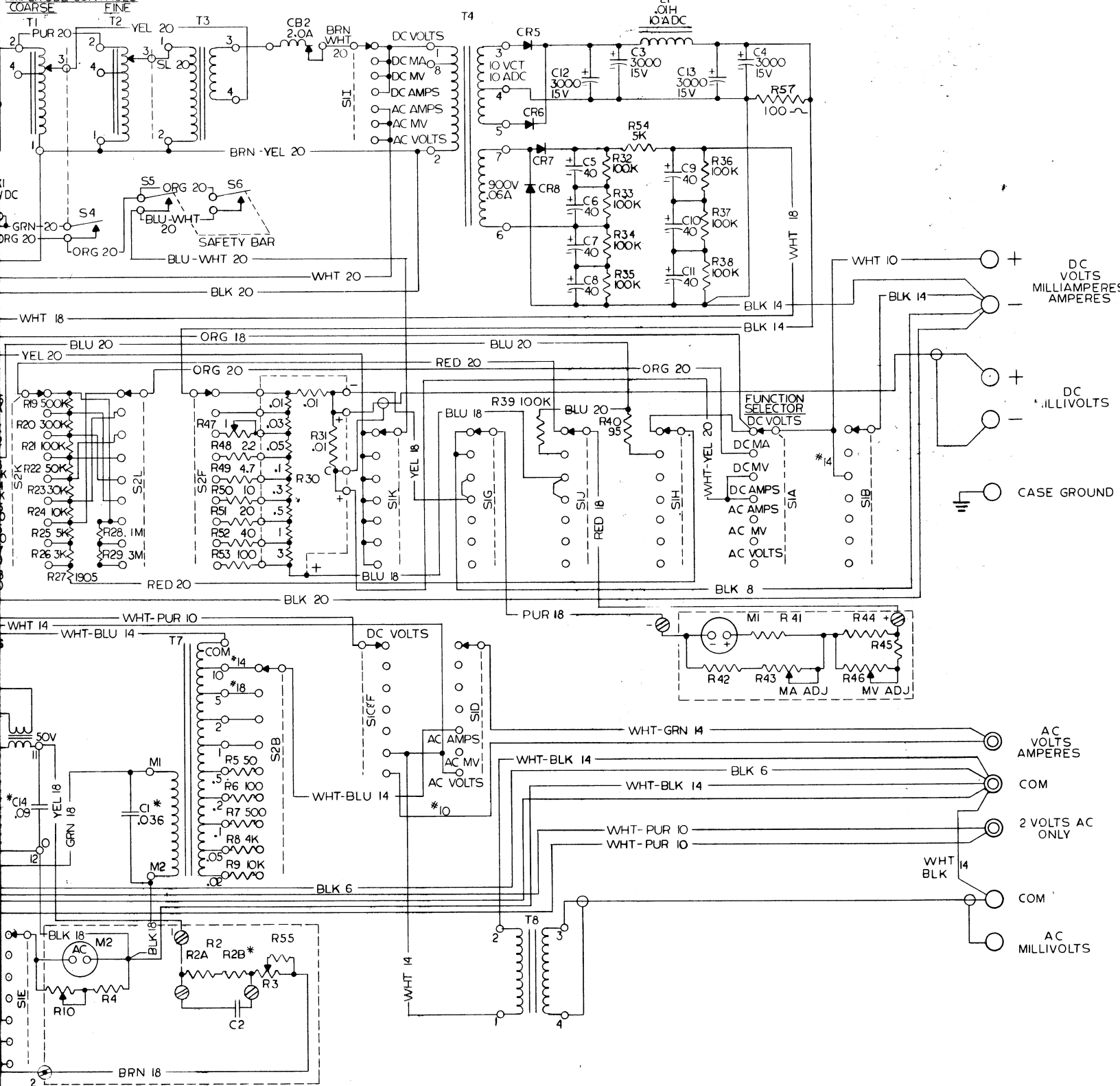
Radio Frequency
LABORATORIES, INC.
Boonton, New Jersey, U. S. A.

Designers and Manufacturers of Electronic Equipment since 1922



Model 33A AC-DC Meter Calibrator.

AMPLITUDE CONTROLS



Schematic Diagram for Model 33A AC-DC Meter Calibrator.

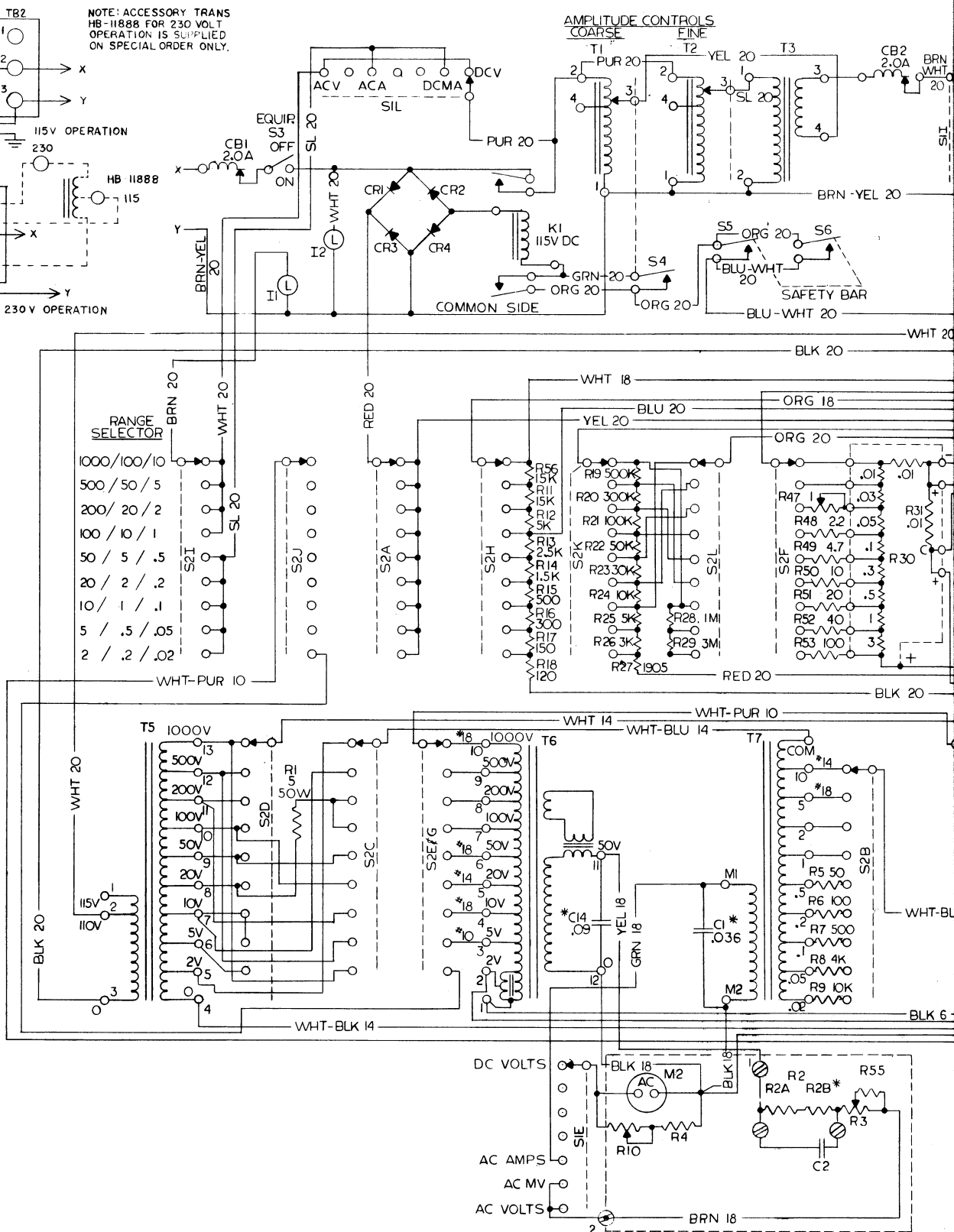
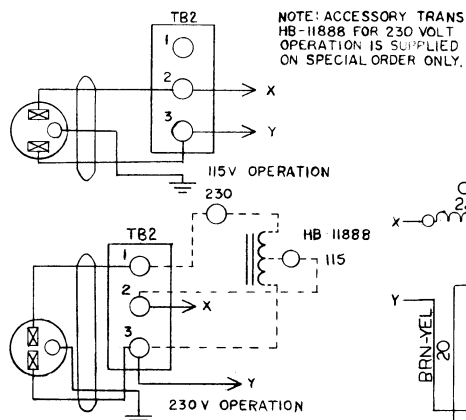


Table of Replaceable Parts

NOTE: Parts marked with an asterisk (*) are recommended for purchase as spare parts in quantity shown below Part No.

SYMBOL NO.	DESCRIPTION	FUNCTION	RFL PART NO.
C1 C3, C4, C12 & C13 C5, C6, C7, C8 C9, C10 & C11	BINDING POST, black.	AC and DC voltage and current terminals.	HA-6481-1* (2)
	BINDING POST, red.	AC and DC voltage and current terminals.	HA-6481-2* (2)
	CAPACITOR, fixed, mylar, 200 V DC, nominal value varies. (See actual part before replacing)	Frequency compensation for current transformer	H-1007-478
	CAPACITOR, fixed, electrolytic: 3000 μ F, 15 V DC.	DC current supply filter capacitor.	
	CAPACITOR, fixed electrolytic: 40 μ F, 475 V DC.	DC voltage supply filter capacitor.	HA-18664

Model 33A

Operational Procedure AND Calibration Data

PRECAUTIONS

1. Do not attempt to by-pass block the safety interlocks built into the instrument.
2. When calibrating any instrument, but especially thermocouple type devices, return the Amplitude controls to zero (full counter-clockwise) before releasing the Safety Bar. This is to prevent transient voltage surges which could be caused by abrupt breaking of the transformer circuits. The transient emf, even though of short duration, could damage instruments of the thermocouple type.

3. When operating the Model 33A on any of the AC voltage or current functions the common terminal must be connected to the case ground terminal to achieve the rated accuracy of the instrument. If this connection is not made calibration errors can occur because of capacitive leakage effects in the instrument transformer circuitry.

Connection should be made from the AC Millivolts Common terminal to the adjacent case ground terminal.

The Model 33A is designed with the output isolated (not connected to case ground) for those situations where an isolated source is absolutely necessary. It must be remembered, however, that using the instrument as an isolated source can introduce calibration errors on the order of 0.2% or more.

4. When the Model 33A is used as an isolated source care should be taken not to come into contact with any of the potential or current terminals and the equipment case. Capacitive reactance between the power transformer windings and the equipment case can develop an emf between any of the output terminals and the case. The potential build-up may exceed 100 volts at 400 c/s but, since the reactance of the capacitive leakage circuit is high, the emf is limited in current and, under normal circumstances, the voltage can barely be sensed by anyone contacting it.

EQUIPMENT SERIAL No. _____

Radio Frequency
LABORATORIES, INC.
Boonton, New Jersey, U. S. A.

APPLYING CALIBRATION DATA	AC MILLIVOLTS	AC VOLTS	AC AMPERES	DC MILLIVOLTS	DC VOLTS	DC MILLIAMPERES	DC AMPERES	METER PARAMETERS
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APPLICATION OF THE CALIBRATION DATA

All calibrations were performed by holding the Model 33 Meter Calibrator to a given scale reading and measuring the resultant output current or voltage. Thus, the calibration data show the percent difference from nominal value present at the terminals. A plus (+) sign indicates the measured output to be higher than the meter reading by the % given; values with a minus (-) sign are lower.

Scale tracking error is applied by adding the percent difference at the downscale point being used to the full scale percent difference of the range and function in use.

Example:

Assume that a calibration is being performed at an emf of 3 volts DC. In this case the 5-volt DC range is used. Assume further that the full scale error of the 5-volt range is -0.1%. The downscale reading for 3 volts on the 5-volt range is 30. In this case assume that the downscale tracking difference for the scale point of 30 is +0.2%. Adding the full-scale difference of -0.1% and the downscale difference of +0.2% results in a percent difference of +0.1% of reading at 3 volts.

AC MILLIVOLTS

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to AC MILLIVOLTS position.
4. Set RANGE SELECTOR to desired range.
5. Connect meter to be calibrated to the AC MILLIVOLTS and COM terminals.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired emf is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (millivolts)	Max. Burden (minimum resistance)	Percent Difference					
		<u>60</u> c/s		<u>400</u> c/s		___ c/s	
		No Load	Full Load	No Load	Full Load	No Load	Full Load
2	25 ohms	<u>-0.20</u>	<u>-0.20</u>	<u>+0.10</u>	<u>+0.10</u>	___	___
5	25 ohms	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	___	___
10	25 ohms	<u>-0.10</u>	<u>-0.12</u>	<u>-0.10</u>	<u>-0.10</u>	___	___
20	25 ohms	<u>-0.20</u>	<u>-0.20</u>	<u>-0.10</u>	<u>-0.10</u>	___	___
50	25 ohms	<u>-0.20</u>	<u>-0.20</u>	<u>-0.10</u>	<u>-0.10</u>	___	___
100	25 ohms	<u>-0.10</u>	<u>-0.10</u>	<u>+0.00</u>	<u>+0.00</u>	___	___
200	25 ohms	<u>-0.18</u>	<u>-0.18</u>	<u>-0.10</u>	<u>-0.10</u>	___	___
500	25 ohms	<u>-0.20</u>	<u>-0.20</u>	<u>-0.15</u>	<u>-0.15</u>	___	___
1000	25 ohms	<u>-0.18</u>	<u>-0.18</u>	<u>-0.20</u>	<u>-0.18</u>	___	___

AC VOLTS

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to AC VOLTS position.
4. Set RANGE SELECTOR to desired range. On ranges 200 to 1000 volts, connect COM terminal to CASE GROUND terminal.
5. Connect meter which is to be calibrated to AC VOLTS and COM terminals. Meters having a full-scale sensitivity of between 1 and 2 volts should be connected to the COM and 2 VOLTS AC ONLY terminals. When meters having a high burden rating are to be calibrated, heavy leads should be used to connect the meter to the emf terminals to prevent error due to voltage drop in the leads.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired voltage is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (volts)	Max. Burden	Percent Difference					
		<u>60</u> c/s		<u>400</u> c/s		____ c/s	
		No Load	Full Load	No Load	Full Load	No Load	Full Load
2	20 VA	<u>-0.20</u>	<u>-0.20</u>	<u>+0.10</u>	<u>+0.10</u>	_____	_____
5	50 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	_____	_____
10	50 VA	<u>-0.10</u>	<u>-0.12</u>	<u>-0.10</u>	<u>-0.10</u>	_____	_____
20	50 VA	<u>-0.20</u>	<u>-0.20</u>	<u>-0.10</u>	<u>-0.10</u>	_____	_____
50	50 VA	<u>-0.20</u>	<u>-0.20</u>	<u>-0.10</u>	<u>-0.10</u>	_____	_____
100	50 VA	<u>-0.10</u>	<u>-0.10</u>	<u>±0.00</u>	<u>±0.00</u>	_____	_____
200	50 VA	<u>-0.18</u>	<u>-0.18</u>	<u>-0.10</u>	<u>-0.10</u>	_____	_____
500	50 VA	<u>-0.20</u>	<u>-0.20</u>	<u>-0.15</u>	<u>-0.15</u>	_____	_____
1000	50 VA	<u>-0.18</u>	<u>-0.18</u>	<u>-0.20</u>	<u>-0.18</u>	_____	_____

AC AMPERES

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to AC AMPERES position.
4. Set RANGE SELECTOR to desired range. On ranges .02 to 1 ampere, connect COM terminal to CASE GROUND terminal.
5. Connect meter to be calibrated to AC AMPERES and COM terminals.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired current is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (amperes)	Max. Burden	Percent Difference					
		<u>60 c/s</u>		<u>400 c/s</u>		<u> c/s</u>	
		No Load	Full Load	No Load	Full Load	No Load	Full Load
.02	15 VA	<u>± 0.00</u>	<u>± 0.00</u>	<u>± 0.00</u>	<u>± 0.00</u>	—	—
.05	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>± 0.00</u>	<u>± 0.00</u>	—	—
0.1	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.05</u>	<u>-0.05</u>	—	—
0.2	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	—	—
0.5	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	—	—
1	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	—	—
2	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	—	—
5	15 VA	<u>-0.05</u>	<u>-0.05</u>	<u>-0.10</u>	<u>-0.10</u>	—	—
10	15 VA	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	<u>-0.10</u>	—	—

DC MILLIVOLTS

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to DC MILLIVOLTS position.
4. Set RANGE SELECTOR to desired range.
5. Connect millivolt meter which is to be calibrated to the DC MILLIVOLTS terminals. Many millivolt meters are supplied with calibrated leads; these particular meters must be calibrated with their own leads to ensure accurate calibration.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired emf is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (millivolts)	Max. Burden	Percent Difference	
		No Load	Full Load
0.2	5 ohms	<u>+0.08</u>	<u>-0.32</u>
0.5	5 ohms	<u>+0.10</u>	<u>-0.30</u>
1	5 ohms	<u>+0.09</u>	<u>-0.31</u>
2	5 ohms	<u>+0.08</u>	<u>-0.32</u>
5	5 ohms	<u>+0.08</u>	<u>-0.32</u>
10	5 ohms	<u>+0.05</u>	<u>-0.35</u>
20	5 ohms	<u>+0.05</u>	<u>-0.35</u>
50	5 ohms	<u>+0.08</u>	<u>-0.32</u>
100	5 ohms	<u>+0.10</u>	<u>-0.30</u>

DC VOLTS

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to DC VOLTS position.
4. Set RANGE SELECTOR to desired range.
5. Connect meter which is to be tested to DC VOLTS terminals.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired voltage is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (volts)	Max. Burden	Percent Difference
2	10 mA	<u>-0.05</u>
5	10 mA	<u>+0.01</u>
10	10 mA	<u>+0.01</u>
20	10 mA	<u>+0.03</u>
50	10 mA	<u>+0.00</u>
100	10 mA	<u>-0.04</u>
200	10 mA	<u>-0.04</u>
500	20 mA	<u>+0.05</u>
1000	30 mA	<u>+0.10</u>

DC MILLIAMPERES

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to DC MILLIAMPERES position.
4. Set RANGE SELECTOR to desired range.
5. Connect meter which is to be calibrated to the DC MILLIAMPERES terminals.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired current is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (milliamperes)	Max. Burden	Percent Difference Full Load	Min. Load
.02	10,000 ohms	<u>+0.00</u>	—
.05	4000 ohms	<u>+0.00</u>	—
0.1	2000 ohms	<u>-0.20</u>	—
0.2	1000 ohms	<u>-0.20</u>	—
0.5	400 ohms	<u>-0.05</u>	—
1	200 ohms	<u>-0.02</u>	—
2	100 ohms	<u>-0.10</u>	—
5	40 ohms	<u>-0.05</u>	—
10	20 ohms	<u>-0.05</u>	<u>+0.15</u>

NOTE

The minimum load calibration is made with a burden of 1 ohm on the 10 mA range. The difference from full load to minimum load on this range serves as a guide to the load calibration differences on all ranges.

DC AMPERES

Operational Procedure

1. Place EQUIPMENT switch in OFF position.
2. Turn COARSE and FINE AMPLITUDE controls fully counter-clockwise.
3. Set FUNCTION SELECTOR to DC AMPERES position.
4. Set RANGE SELECTOR to desired range.
5. Connect meter which is to be calibrated to the DC AMPERES terminals.
6. Place EQUIPMENT switch in ON position.
7. Depress SAFETY BAR. Operate COARSE and FINE AMPLITUDE controls until desired current is obtained.

CAUTION

When calibrating thermocouple type instruments return amplitude controls to zero before releasing SAFETY BAR.

Calibration Data

Range (amperes)	Max. Burden	Percent Difference
.02	.04 VA	<u>+0.00</u>
.05	0.1 VA	<u>+0.02</u>
0.1	0.2 VA	<u>+0.01</u>
0.2	0.4 VA	<u>+0.00</u>
0.5	1 VA	<u>+0.00</u>
1	2 VA	<u>-0.03</u>
2	5 VA	<u>-0.03</u>
5	10 VA	<u>+0.00</u>
10	20 VA	<u>+0.02</u>

METER PARAMETERS

Calibration Data

DC Meter Full scale sensitivity: VOLTAGE 94995 mV

CURRENT 99998 mA

Scale Tracking Data

Meter Scale Indication	Percent Difference (of reading)
10/20/50	<u>+0.00</u>
9/18/45	<u>-0.20</u>
8/16/40	<u>-0.06</u>
7/14/35	<u>-0.28</u>
6/12/30	<u>-0.26</u>
5/10/25	<u>-0.28</u>
4/8/20	<u>-0.35</u>

AC Meter Full scale sensitivity: 60 c/s 400 c/s _____ c/s

VOLTAGE 49.998 49.900 _____

CURRENT 101.25 101.480 _____

Scale Tracking Data

Meter Scale Indication	Percent Difference (of reading)		
	<u>60</u> c/s	<u>400</u> c/s	_____ c/s
10/20/50	<u>+0.00</u>	<u>+0.00</u>	_____
9/18/45	<u>-0.04</u>	<u>-0.20</u>	_____
8/16/40	<u>-0.12</u>	<u>-0.12</u>	_____
7/14/35	<u>-0.14</u>	<u>-0.14</u>	_____
6/12/30	<u>-0.26</u>	<u>-0.26</u>	_____
5/10/25	<u>-0.36</u>	<u>-0.36</u>	_____
4/8/20	<u>-0.10</u>	<u>-0.10</u>	_____



Certificate

for

Radio Frequency Laboratories, Model 33A

Serial number 318

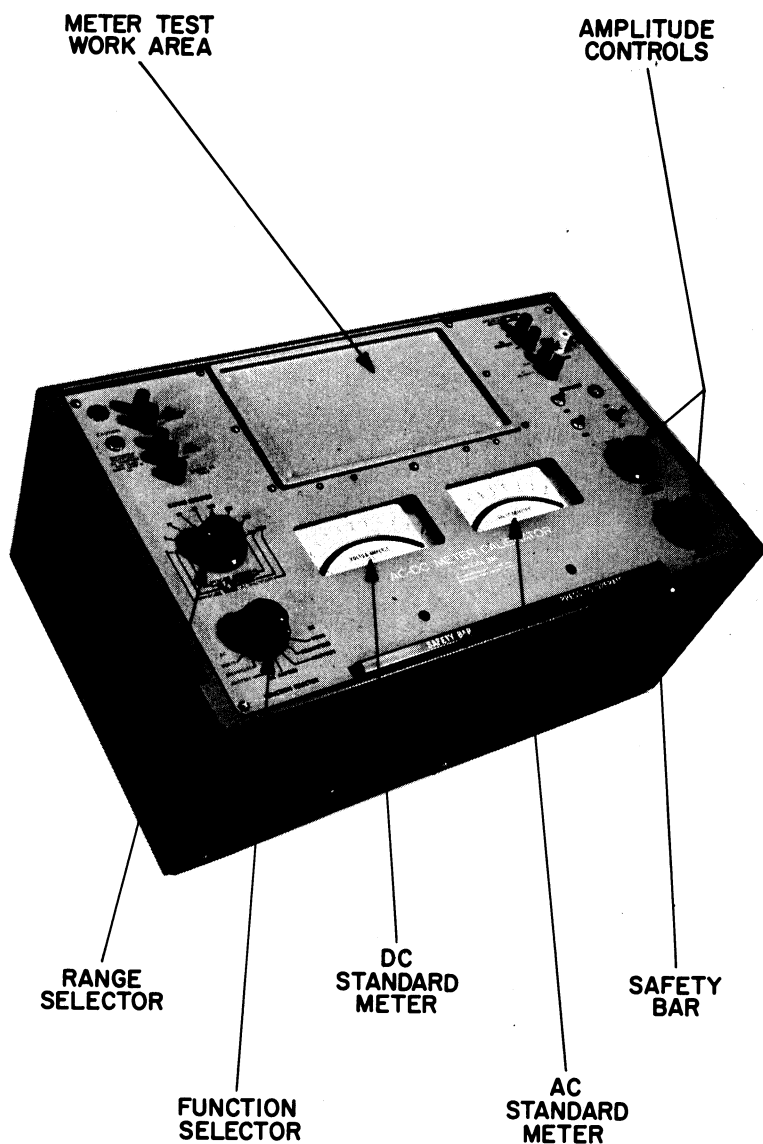
The described instrument was tested at Radio Frequency Laboratories, Inc., Boonton, New Jersey on _____ and was found to have a direct reading accuracy within $\pm 0.35\%$ of full-scale range values.

Calibration was performed at a room temperature of 24 °C. The corrected accuracies are not expected to vary more than $\pm \frac{1.06}{0.25}\%$ per degree centigrade rise above the calibration temperature of 24 °C or more than $-\frac{1.06}{0.25}\%$ per degree centigrade drop below the calibration temperature, within temperature limits of 20 °C to 30 °C.

The certified accuracy of the standards used in the calibration of the described instrument can be traced directly or indirectly in an unbroken line to the National Bureau of Standards, Washington, D.C. / Boulder, Colorado.

Certified by _____ Date _____

Radio Frequency Laboratories, Inc.
BOONTON, NEW JERSEY, U.S.A.



Model 33A AC-DC Meter Calibrator.