OPERATING INSTRUCTIONS for the PRECISION

MODEL 120

HIGH SENSITIVITY A.C.-D.C. CIRCUIT TESTER

PRECISION TEST EQUIPMENT
Standard of Accuracy

PRECISION Apparatus Company, Inc.
70-31 84th Street, Glendale 27, L. I., N. Y.

Guarantee

This is to certify that we, the PRECISION APPARATUS COMPANY, INC., guarantee this Instrument, manufactured by us, to be free from defects in material and workmanship under normal use and service. Our obligation under the guarantee is limited to repairing or replacing this instrument through the Service Department, provided that original purchase has been duly registered and instrument is returned *prepaid* within *one year* from date of sale. *Stamped and addressed registration card is furnished with every instrument.*

This guarantee is expressly in lieu of all other guarantees, expressed or implied and of all other obligations on our part, and no other Representative or person is authorized or permitted to make any guarantee or to assume for this Company any liability not strictly in accordance with the foregoing.

This guarantee will not apply to any product which has been tampered with or altered in any way, or which has been subjected to misuse, negligence or accident, or which has the serial number altered, effaced or removed.

PRECISION APPARATUS COMPANY, INC.

PRECISION TEST EQUIPMENT IS PRECISION TEST EQUIPMENT *Standard of Accuracy* **GUARANTEED FOR ONE FULL YEAR**

OPERATING INSTRUCTIONS for the

PRECISION MODEL 120

High Sensitivity, Multi-Range Test Set

Manual . . . Net Price: $.40

The PRECISION Model 120 has set an unparalleled standard for compact, efficient, laboratory instrument engineering and design.

The Model 120 was developed in response to correlation of actual field specifications for a reliable, rugged, portable instrument for modern electronic circuit checking — laboratory, production and maintenance.

The **120** provides FORTY-FOUR AC AND DC RANGES which are much wider spread than has ever been previously associated with professional instruments of its size and type.

The Model 120
starts Extra Low and goes Extra High

from **1.2 VOLTS Full Scale, AC-DC** (.02 volt per DC scale division) → *to* **6000 VOLTS Full Scale, AC-DC** (to 60KV DC with optional 'TV' Probe)

from **60 MICROAMPERES Full Scale** (1 microampere per scale division) → *to* **12 AMPERES DC, Full Scale** (uses special low-loss circuit)

from **−20 DB to +3 DB Low Scale** (0 DB=1 milliwatt, 600 ohms) → *to* **+56 DB to +77 DB High Scale** (uses extra-high sensitivity circuit)

from **0-200 OHMS Full Scale**
- 2 OHMS at Center Scale
- .025 OHMS first scale division
- 1½ volt internal battery

→ *to* **0-20 MEGOHMS Full Scale**
- 200,000 OHMS at Center Scale
- Not crowded at Full Scale reading
- 15 volts internal battery

These EXTRA-wide-spread ranges, plus an almost unending list of most-wanted EXTRA features, make the **120** a truly "Application-Engineered" test set.

★ **8 DC Voltage Ranges: 20,000 OHMS per VOLT**
0—1.2—3—12—60—300—600—1200—6000 volts.

★ **8 AC Voltage Ranges: 5000 OHMS per VOLT**
0—1.2—3—12—60—300—600—1200—6000 volts.

★ **8 AC Output Ranges:**—same as AC voltage ranges above. With built-in blocking capacitor to 600 volts.

★ **7 DC Current Ranges:** 0—60—300 Microamperes
0—1.2—12—120—600 MA 0—12 amperes.

★ **5 Resistance Ranges:** Self-contained batteries
0—200—2000—200,000 ohms
0—2—20 megohms.

★ **8 Decibel Ranges:** −20 DB to +77 DB
0 DB=1 Milliwatt, 600 ohms.

★ **Extra-Large 5¼ inch, rugged PACE Meter**—40 microamperes sensitivity, 2% accuracy. Double-jewelled D'Arsonval movement.

★ **1% Multipliers and Shunts.**
Wire-wound and Deposited-film types.

★ **2 Low Resistance Jacks** serve all standard ranges. Separately identified and isolated jacks provide for extra-high ranges.

★ **"TRANSIT" Safety Position** on Rotary Range Selector provides effective damping of meter movement for utmost protection during transportation and periods of storage.

★ **"Custom-Molded Phenolic Case and Panel** set a new standard for compact, efficient, laboratory instrument styling. Deeply engraved panel characters afford maximum legibility for life of the instrument.

Introduction

All functions of the Model 120 are available at the "COMMON" and "+" panel jacks with the exception of the ranges indicated in yellow, and the "output" ranges. Ranges indicated in yellow, (6000V. DC and AC, 1200V. DC and AC, 12 amperes DC) and the output ranges, are available thru use of the common panel jack and the related special jacks at the left side of the instrument panel.

All measurements (except AC voltage and output ranges) are made with the "AC-DC" selector switch in the DC position.

It will be noted that all jacks on the Model 120 are heavy duty "banana" type. This feature assures most consistent and uniformly positive contacts. These jacks will accept standard spring type "banana" plugs or the extra-low resistance, slit solid-brass plugs furnished as standard equipment on the #227-B test leads supplied with the Model 120.

If slit solid-brass plugs ever become loose, insert a pen-knife blade between the slits, and the plug is restored to tension.

* * * * *

A special safety feature of the Model 120 is the "TRANSIT" position on the range selector switch. This position is active in either position of the AC-DC switch. "TRANSIT" position creates a direct short-circuit across the meter terminals which thereby provides effective damping of the meter movement for utmost protection during transportation and non-use periods.

It is good practice to develop the habit of leaving the range selector in the "TRANSIT" position whenever measurements have been completed.

Each Model 120 Multi-Range Test set is very carefully inspected and tested before shipment. It is possible, however, that the mechanical zero adjustment of the meter might require a slight readjustment before initial use. To accomplish this, first set the instrument in the position most commonly used, (usually horizontal), then slowly adjust the small screw-head-type zero adjuster on the meter case, using a small screwdriver. Align the meter pointer with the zero line at the left end of the DC scale.

* * * * *

General Caution: *"Before attempting to measure any unknown values of voltage or current, first set the range selector switch to the highest range for the function being measured. Then apply the unknown voltage or current. Reduce the range selector switch setting, one range at a time, until a proper range is selected as will provide a good deflection of the meter.*

* * * * *

Special Precaution: *When employing the 6000V. ranges, extreme care must be observed in the manner of handling test prods, jacks and the high voltage circuits under analysis. We recommend the use of* "PRECISION" *extra-high voltage super-flex test leads, (Part #228-B) which have been specifically designed for extra safety of operation at 6000 volts (DC or 60 cycles AC.)*

AC VOLTAGE MEASUREMENTS

5000 ohms per Volt Sensitivity

The extra-high AC sensitivity of the Model 120 permits applications to a wide range of modern electronic circuit tests.

The lesser degree of circuit loading affords more accurate measurements of AC potentials in high impedance circuits.

* * * * *

For all AC ranges from 1.2 Volts to 600 Volts, use the "+" and "COMMON" panel jacks.

1—Set "AC-DC" selector switch to "AC" position.

2—Select desired voltage range on range selector switch.

3—Read AC voltage measurements on either the RED AC arc or the BLUE 1.2V or 3V AC arcs, depending upon the range selected, as follows:—

0-1.2V AC, read directly on BLUE "1.2V AC" arc.

0-3V AC, read directly on BLUE "3V AC" arc.

0-12V AC, read directly on the RED AC arc... Use black numerals above the red arc.

0-60V AC, read directly on the RED AC arc... Use black numerals above the red arc.

0-300V, AC, read directly on the RED AC arc... Use black numerals above the red arc.

0-600V AC, read on the RED AC arc. Use 0-60 black numerals and MULTIPLY READINGS BY 10.

For 1200V AC Range:—remove test lead from the regular "+" jack and insert into the special "1200V" jack. Set range switch to the "600V-1200V-6000V" position. Read on the RED AC arc. Use black 0-12 numerals and MULTIPLY READINGS BY 100.

For 6000V AC Range:—remove test lead from the regular "+" jack and insert into the special "6000V AC" jack. Set range switch to the "600V-1200V-6000V" position. Read on the RED AC arc. Use black 0-60 numerals, MULTIPLY READINGS BY 100.

NOTE: Polarity of test leads is of no importance when making AC voltage measurements with the Model 120.

DC Voltage Measurements
20,000 ohms per Volt Sensitivity

For all DC ranges from 1.2 volts to 600 volts, use the "+" and "COMMON" panel jacks.

1—Set "AC-DC" Selector switch to "DC" position.
2—Select desired voltage range on range selector switch.
3—Read DC voltages on the BLACK "DC" arc as follows:

0-1.2V DC, read the 0-12 numerals and DIVIDE readings by 10.

0-3V DC, read the 0-300 numerals and DIVIDE readings by 100.

0-12V DC, read the 0-12 numerals DIRECTLY.

0-60V DC, read the 0-60 numerals DIRECTLY.

0-300V DC, read 0-300 numerals DIRECTLY.

0-600V DC, read the 0-60 numerals and MULTIPLY reading by 10.

For 1200V DC range:—Remove the RED "+" test lead from the regular "+" jack and insert into the special "1200V" jack. Set the range switch to "600V-1200V-6000V" position. Read on 0-12 scale and MULTIPLY READINGS BY 100.

For 6000V DC range:—Remove the RED "+" test lead from the regular "+" jack and insert into the special "6000 V DC" jack. Set the range switch to "600V-1200V-6000V" position. Read on the 0-60 scale and MULTIPLY READINGS BY 100.

* * * * *

All voltage measurements (AC and DC) are made with test leads applied across (in parallel with) the load. It is important to observe proper polarity when making DC voltage tests.

* * * * *

Important Precautions When Testing High Voltage Circuits. *Never attempt adjustment or test of any High Voltage circuits unless a complete circuit diagram is available to identify the location of all high potential terminals. For voltages up to 6000 volts always employ well insulated test leads, such as the PRECISION High Voltage Super-Flex test leads, Part #228-B, available from all PRECISION Distributors and factory service division. For voltages above 6000 volts DC, use High Voltage Multiplier Probe Model TV-2B. Make sure hands and shoes are DRY whenever performing any tests involving high voltages.*

All resistance measurements are made with the test leads inserted into the "COMMON" and "+" panel jacks.

1—Set "AC-DC" selector switch to "DC" position for all resistance measurements.

2—Set the range selector switch to the desired resistance range.

3—Short the tips of the test leads together and then rotate the "ADJ. OHMS" control until the meter pointer lines up with the ZERO calibration on the ohms scale.

4—Disengage the test prod tips from each other and proceed with resistance measurements by placing the test tips ACROSS the component whose resistance is to be measured. (See CAUTION and SPECIAL PRECAUTION).

All resistance measurements are read on the 0-2K ohms uppermost meter arc:

"Rx $\frac{1}{10}$" range:— DIVIDE all ohms readings by 10.
(range is 0-200 ohms at full scale; center scale = 2 ohms)

"Rx1" range:— read ohms scale directly.
(2000 ohms = full scale; center scale = 20 ohms)

(200,000 ohms = full scale; center scale = 2000 ohms)
"Rx100" range:—multiply all ohms readings by 100.

"Rx1000" range:—multiply all ohms readings by 1000.
(2 Megohms = full scale; center scale = 20,000 ohms)

"Rx10,000" range:—multiply all ohms readings by 10,000
(20 Megohms = full scale; center scale = 200,000 ohms)

Caution: *Always first disengage one end of the component (whose resistance is to be checked) from the circuit* BEFORE *making resistance measurements. Otherwise an indication of the true resistance value may not be obtained due to the possibility of the circuit therein involved effectively shunting the resistance to be measured. Such would reduce the true reading by an amount proportionate to the resistance of the included shunt network.*

Special Precaution: *Whenever making resistance measurements* ALWAYS *be sure the circuit is absolutely* COLD *or free from live voltage of any amount. Failure to observe this precaution could seriously damage any ohmmeter.*

* * * * *

The Rx $\frac{1}{10}$ range of the Model 120 provides an exceptionally low, direct reading ohmmeter facility, powered by only 1½ volts battery source. Such low operating voltage affords utmost safety when making tests in circuits which cannot tolerate higher potentials and also assures best possible battery life. Battery contact resistance is minimized by use of specially designed, high spring tension, machined and plated brass contacts.

Two 1½ volt batteries, (Eveready D-99 or equal), are employed IN PARALLEL for optimum Rx$\frac{1}{10}$ circuit conditions. A single battery is adequate for the Rx1, Rx100 and Rx1000 ranges. The Rx10,000 range is powered by an Eveready #411 or equal, 15 volt miniature battery.

The Model 120 has convenient, quick-change, molded battery compartments. No tools are needed to extract or install the batteries (with case open). Polarity markings are permanently molded-in. See illustration on page 21, which reveals placement of ohmmeter batteries.

Standard flashlight cells (Eveready 950 or equal) can be used in place of the D-99 cells. However longer useful life is to be expected from the D-99's.

Ohmmeter batteries should be replaced whenever full scale, (zero) deflection cannot be obtained with test leads shorted and with "ADJ. OHMS" control rotated fully clockwise.

It should be noted that batteries can show up as "weak" on the Rx1/10 scale, even though still serviceable for the Rx1, Rx100 and Rx1000 ranges. This is attributable to the higher current requirement of the Rx1/10 range. If the Rx1/10 range is seldom employed, battery replacement should then be judged by performance of the other 1½ volt powered ranges.

For all DC current ranges from 60 microamperes to 600 milliamperes use the regular "+" and "COMMON" panel jacks.

1—Set "AC-DC" Selector switch to "DC" position.

2—Select the desired current range on range selector switch.

3—Read the DC current measurements on the regular BLACK "DC" arc as follows:

0-60 Microamperes, read the 0-60 numerals DIRECTLY.

0-300 Microamperes, read the 0-300 numerals DIRECTLY.

0-1.2 Milliamperes, read the 0-12 numerals and DIVIDE by 10.

0-12 Milliamperes, read the 0-12 numerals DIRECTLY.

0-120 Milliamperes, read the 0-12 numerals and MULTIPLY by 10.

0-600 Milliamperes, read the 0-60 numerals and MULTIPLY by 10.

For 0-12 Amperes range:—Remove the RED "+" test lead from the regular "+" jack and insert into the special "12 AMPS" jack. Set the range switch to "600 MA-12 AMPS" position. Read the "0-12" numerals DIRECTLY.

NOTE: When using the "12 Amps" DC range, never remove test leads from the panel jacks while current is flowing through the circuit. Failure to observe this may result in arcing at the banana jacks, and though it would not necessarily injure the meter, the jacks might gradually char.

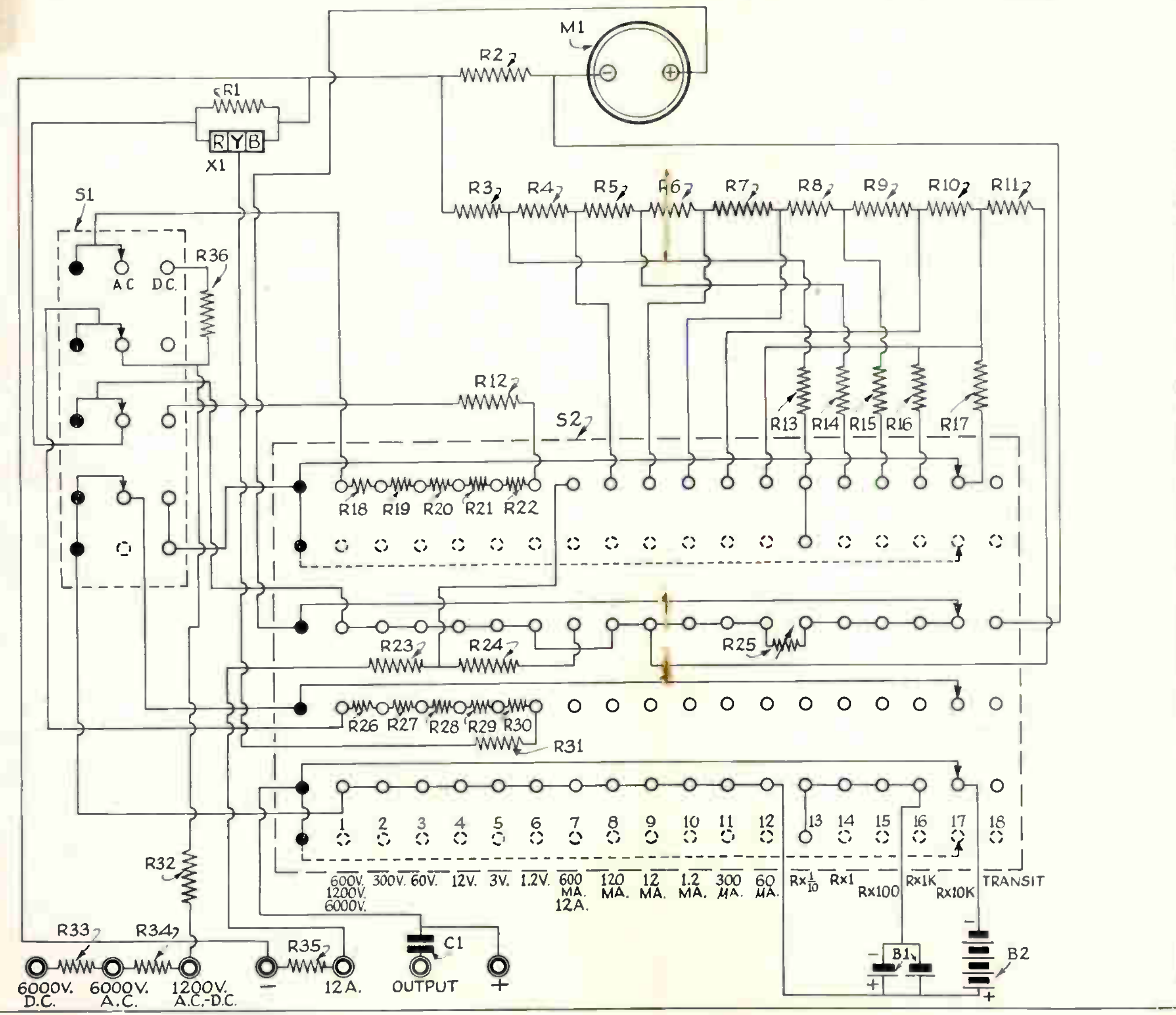
* * * * *

All current measurements are made with test leads in SERIES with the load. Observe proper test lead polarity whenever making DC current tests.

* * * * *

When the range selector switch is in the "600 MA-12 AMPS" position, the Model 120 provides an especially low resistance current measuring network. This is most important for least possible disruption of external operating conditions in low voltage circuits, consistent with the convenience of reliable multi-range test facilities.

DWG. NO. 1060



ITEM	PART NO.	SPECIFICATION
43	S2	RANGE SELECTOR
42	S1	FUNCTION SELECTOR
41	M1	METER 40 μA., 2000 Ω
40	X1	METER RECTIFIER
39	C1	0.1-MFD.
38	B2	15V. BATTERY
37	B1	2 EA. - 1½V. BATTERIES
36	R36	9 MEG. Ω
35	R35	0.017 Ω
34	R34	24 MEG. Ω 2W.
33	R33	72 MEG. Ω 2W.
32	R32	3 MEG. Ω
31	R31	2560 Ω
30	R30	9K Ω
29	R29	45K Ω
28	R28	240K Ω
27	R27	1.2 MEG. Ω
26	R26	1.5 MEG. Ω
25	R25	13750 Ω "OHMS ADJ." CONTROL
24	R24	99.7 Ω
23	R23	0.323 Ω
22	R22	36K Ω
21	R21	180K Ω
20	R20	960K Ω
19	R19	4.8 MEG. Ω
18	R18	6 MEG. Ω
17	R17	192,225 Ω
16	R16	12225 Ω
15	R15	423 Ω
14	R14	3.33 Ω
13	R13	0.333 Ω
12	R12	20K Ω
11	R11	3333 Ω
10	R10	13.33K Ω
9	R9	1666.7 Ω
8	R8	833.33 Ω
7	R7	750 Ω
6	R6	66.667 Ω
5	R5	8.333 Ω
4	R4	6.667 Ω
3	R3	1.667 Ω
2	R2	3K Ω
1	R1	5500 Ω

PRECISION APPARATUS CO., INC.

TITLE: MODEL 120
44 RANGE AC/DC
CIRCUIT TESTER SCHEMATIC
20000 OHMS PER VOLT DC.
5000 OHMS PER VOLT AC.

DRAWN BY: Wm Kadlecek Jr. DATE: 3-2-54
CHECKED BY: [illegible] DATE: 3-4-54

The high AC voltage range sensitivity of the Model 120, provides an excellent basis for use as an output indicator, with a minimum of circuit loading.

Insert test leads into the "COMMON" and "OUTPUT" panel jacks. Set "AC-DC" switch to "AC" position.

All "OUTPUT" voltage ranges are selected in the same manner as the AC Voltage Ranges from 1.2 volts up to 600 volts, except that the "OUTPUT" jack is used instead of the regular "+" jack.

The "OUTPUT" jack incorporates a series blocking capacitor—.1 mfd. 600 volt rating. This permits measurement of AC voltages at circuit points wherein DC potentials are simultaneously present.

To extend output facilities to 1200V and 6000V AC, set the instrument in the same manner as for the corresponding regular AC high voltage range except include a suitably rated .1 mfd. capacitor in series with the "+" test lead.

There are two test points which are most frequently used to obtain output meter indications. Both are associated with the last audio stage of the receiver:—

1. Connect test prods across voice coil of speaker or secondary of output transformer. If speaker is disconnected from secondary winding of output transformer, substitute a resistor of value equivalent to rated impedance of speaker voice coil.
2. Connect test prods to plate and ground of a single-ended audio output stage or plate to plate of a push-pull stage. As in example #1, use resistive loading of output transformer secondary, if speaker is not connected.

NOTE:—The internal blocking capacitor, in series with the Model 120 "OUTPUT" jack, is conservatively rated at 600 working volts. Additional, suitably rated capacitors must be used whenever any tests are made whereat the sum of DC plus peak AC exceeds 600 volts. Such additional external capacitor should be a .1 mfd. unit.

An output meter can also be used to compare tube performance. Note the difference in output indications when each tube is substituted in a receiver or amplifier under test.

The Model 120 incorporates a wide-range, direct reading, calibrated Decibel Scale providing Db readings from −20 to +77, in eight steps. Zero DB = 1 milliwatt into 600 ohms or .7746 volts across 600 ohms.

Two Db scales are provided on the meter.

1. The bottom BLACK arc is a special expanded low range, covering from −20 to +3 Db. (It is directly related to the 1.2 volts AC range.) To use this expanded scale, set the AC-DC switch to the "AC" position and the range selector to the "1.2V" position. Insert the test leads into the "COMMON" and "+" panel jacks.
2. The RED (−10 to +11 Db) scale provides for ranges ABOVE +3 Db and up to +77 Db. This red Db arc relates to all AC voltage above 1.2 volts.

To use the Model 120 for Db readings ABOVE +3 Db set range selector as follows: (with "AC-DC" switch set to "AC" position)

DB RANGE	ADD TO RED* DB SCALE	RANGE SELECTOR SETTING
−10 to +11 Db	0	3 volts
+ 2 to +23 Db	+12	12 volts
+16 to +37 Db	+26	60 volts
+30 to +51 Db	+40	300 volts
+36 to +57 Db	+46	600 volts
+42 to +63 Db**	+52	1200 volts
+56 to + 77 Db***	+66	6000 volts

*For convenience of use of the Model 120 as a DB meter these additional range factors will be found printed at the lower right corner of the meter scale-plate.
**Use 1200 V jack for +42 to +63 DB range.
***Use 6000 V AC jack for +56 to +77 DB range.

Caution: *If Db tests are to be made at circuit locations whereat DC is present, either use an external series blocking capacitor of suitable rating or use the built-in "OUTPUT" capacitor jack of the* 120.

NOTE: Refer to Decibel Chart at end of manual for interpretation of DB readings in terms of power and voltage ratios.

Qualitative Paper Condenser Tests

The insulation resistance of paper and mica condensers is expressed in megohm-microfarads. A good 1 mfd. condenser will have an insulation resistance of approximately 450 megohms. Insulation resistance of condensers of similar voltage rating is inversely proportional to its capacity, so that a .1 mfd. condenser will have ten times the insulation resistance of a 1 mfd. condenser, or 4500 megohms. It therefore can be readily seen that it is not practical to use regular ohmmeters for measuring leakages in paper or mica condensers.

In the method described below, a high DC potential is applied to the condenser, in series with the proper DC VOLTS range of the Model 120 to determine whether it has abnormal leakage.

The necessary DC potential can be obtained from an external power supply or from a radio receiver. Voltage to be applied to the condenser should approximate its rated voltage.

1. Measure the DC voltage obtainable from DC power supply. Then select the proper meter range that would indicate the greatest deflection for the voltage available.
2. With the power supply OFF, insert the condenser to be tested IN SERIES with one of the test leads.
3. Turn ON power supply. An instantaneous deflection due to the charge of the condenser will be indicated on the meter.
   - A—In the case of a good condenser, the needle pointer will recede to the zero voltage mark.
   - B—If the meter pointer remains above the zero mark, then this indicates that the condenser has abnormal leakage.
   - C—If the meter pointer remains at or near the full value of the supply voltage, then the condenser is "shorted."
   - D—If no meter deflection is obtained, then this indicates that the condenser is "open" or that the capacity is too low in value to produce a noticeable meter deflection when charging.

NOTE: After this test is completed, always first disconnect the negative test lead from the capacitor *before turning off the power supply*, to prevent slamming the meter pointer due to discharge of the condenser under test.

Current Measurements of Leakage in Electrolytic Condensers

The leakage in an electrolytic condenser is measured in terms of DC current (per microfarad) flowing through the condenser when rated DC voltage is applied.

All electrolytic condensers have inherent current leakage. However, if leakage above an allowable amount is present, it can then be termed as poor. Allowable leakage is dependent upon such factors as age and manufacturers' specifications of a condenser, design of power unit, filter system and rectifier tube of the circuit in which the condenser is incorporated. In general, considering an 8 mfd. condenser that has been in use, (rated at 450 volts), the maximum allowable leakage is approximately .5 MA. per mfd. or 4 MA. total.

The following will permit computation of allowable leakages:—

A—For condensers rated at 300 volts or more, leakage of approximately .5 MA per microfarad is permissible.

B—For condensers rated between 100 to 275 volts, permissible leakage is approximately .2 MA per microfarad.

C—For condensers rated below 100 volts, permissible leakage is approximately .1 MA per microfarad.

Caution: *When obtaining electrolytic leakage measurements, high voltage is employed. It is therefore extremely important that the following instructions be followed to prevent damage to meter.*

Before leakage tests can be performed, the electrolytic must always be short-checked. If the condenser to be tested is in use, it must be first disconnected from its associated circuit. Then check for short, using the 0-200,000 ohms (Rx100) range of the Model 120.

Proper test lead polarity must be observed. The polarity prescribed in steps 2 and 3 is based upon the internal ohmmeter battery polarity as it appears at the "+" and "COMMON" jacks.

After short-check, the electrolytic may be tested for leakage. A DC power supply is required, whose output voltage approximates the voltage rating of the condenser to be tested. In the absence of a separate power supply, one may use the DC supply from a radio receiver. In the case of testing an electrolytic in a receiver, the latter is usually the most convenient source of test voltage.

1. Set "AC-DC" switch to the "DC" position and rotate RANGE SELECTOR to the 120 MA position.
2. Connect lead from (positive) terminal of power supply to the "+" panel jack, with a PROPER LIMITING RESISTOR in series. Where voltage applied to condenser is above 100 volts, the limiting resistor should be approximately 4000 ohms. When the applied voltage is below 100 volts, the value of the limiting resistor should be approximately 900 ohms. This limiting resistor is very important and should not be omitted.
3. Connect the "COMMON" jack to the (positive) ANODE terminal of condenser. Negative (or can) terminal of the electrolytic is to be connected to negative terminal of the power supply. (From these connections, it can be seen that the test jacks, limiting resistor, condenser terminals and voltage source are in series connection.)
4. After series connections are made, turn on switch of power supply. The meter pointer will deflect to near full scale and then should gradually recede to the zero mark or near zero, after the expiration of about 2 or 3 minutes. THIS PROCEDURE IS KNOWN AS "FORMING" THE CONDENSER.

   NOTE: A steady meter deflection, without receding to or near zero (after forming process) indicates a shorted or leaky electrolytic that should be rejected WITHOUT FURTHER TESTING.

5. After "forming," short out the limiting resistor and read leakage current of the condenser under test directly on the 120 MA scale. If the meter reading is under 12 MA, set range selector to the 12 MA position for a better meter indication. (For computation of permissible condenser leakages, refer to basis noted previously.)

Caution: *After the foregoing test is completed, always first disconnect the negative test lead from the electrolytic* BEFORE TURNING OFF THE POWER SUPPLY, *to prevent slamming of the meter pointer due to discharge of the condenser under test.*

An Understanding of "TEST SET ACCURACY"

There is frequent question as to the meaning of statements concerning instrument accuracy.

The overall accuracy of a test instrument is usually specified as the arithmetic sum of the individual contributing circuit component tolerances. Therefore, a ±2% meter in conjunction with a ±1% multiplier produces an instrument or test set of ±3% overall tolerance or accuracy. Should a meter rectifier be also included in the circuit, the overall circuit tolerance is then that of the METER plus MULTIPLIER plus RECTIFIER.

Chance selection of meters and multipliers can occasionally provide combinations which may produce unusually close overall accuracy. This, however, cannot be specified as the overall tolerance of a production run, because it is just as possible for component combinations to run in non-cancelling direction.

The usual interpretation of overall accuracy, as applied to actual meter scaleplate readings is "THE SPECIFIED OVERALL TOLERANCE, AS OF FULL SCALE." This means that if a meter scale has 60 divisions, and if ±3% overall accuracy is specified, then the meter pointer may permissibly read plus or minus 1.8 divisions (.03x60) of true value, AT ANY POINT ON THE SCALE.

In terms of a voltage or current range, (instead of just divisions), let us assume a full scale value of 600 volts. ±3% of 600 volts is ±18 volts. Therefore, when reading on a 600 volt range there is a permissible error of plus or minus 18 volts. On a 60 volt range, the allowable error would be plus or minus 1.8 volts, etc.

Such permissible deviations must be taken into consideration when making comparative readings between two or more instruments. The overall potential reading errors are cumulative. Two units, each of ±3% overall accuracy, *may* reveal a total reading differential of 6% as compared to each other.

Because of the non-linear nature of an ohmmeter scale, tolerance on "OHMS" scales is related to linear scale length and not to actual resistance readings. Therefore, concerning ohmmeter ranges, if the instrument overall tolerance is ±3%, the ohmmeter reading may vary plus or minus 3% of the total scale length, on either side of the true resistance value.

Factors, such as temperature, also affect overall accuracy. The meter armature, being copper-wound, is quite susceptible to resistance changes with temperature. In the "PRECISION" 120, the meter "copper" is swamped, to minimize this source of error which would be common to the entire instrument circuit.

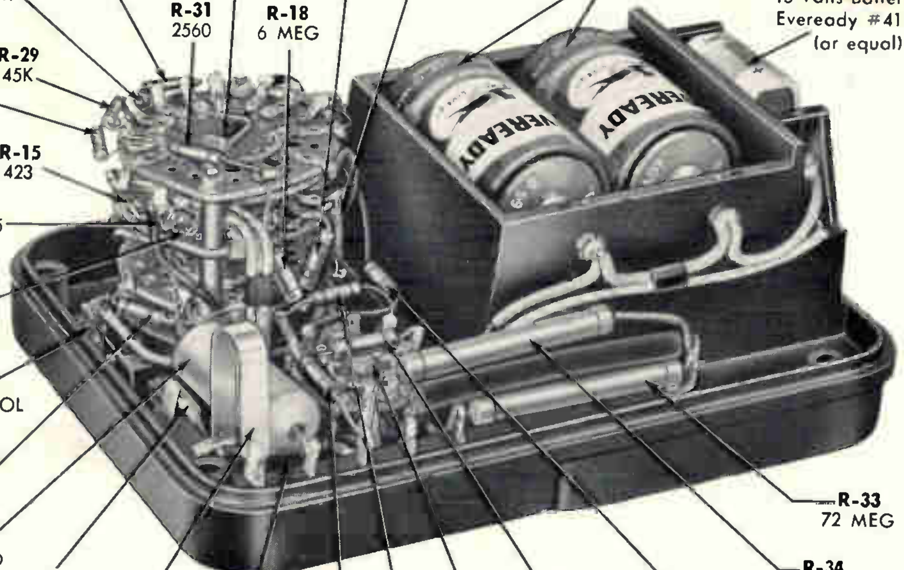
Compensating design of the AC meter-rectifier circuit minimizes temperature effects on AC voltage readings.

The Model 120 uses a rugged PACE, double-jewelled, double-bridge construction. D'Arsonval type meter of ±2% accuracy or better. All shunts, calibrating resistors and multipliers are ±1% tolerance or better. Overall DC instrument accuracy is accordingly maintained within ±3%; AC circuit accuracy (including meter rectifier) is closely maintained within ±5% or better.

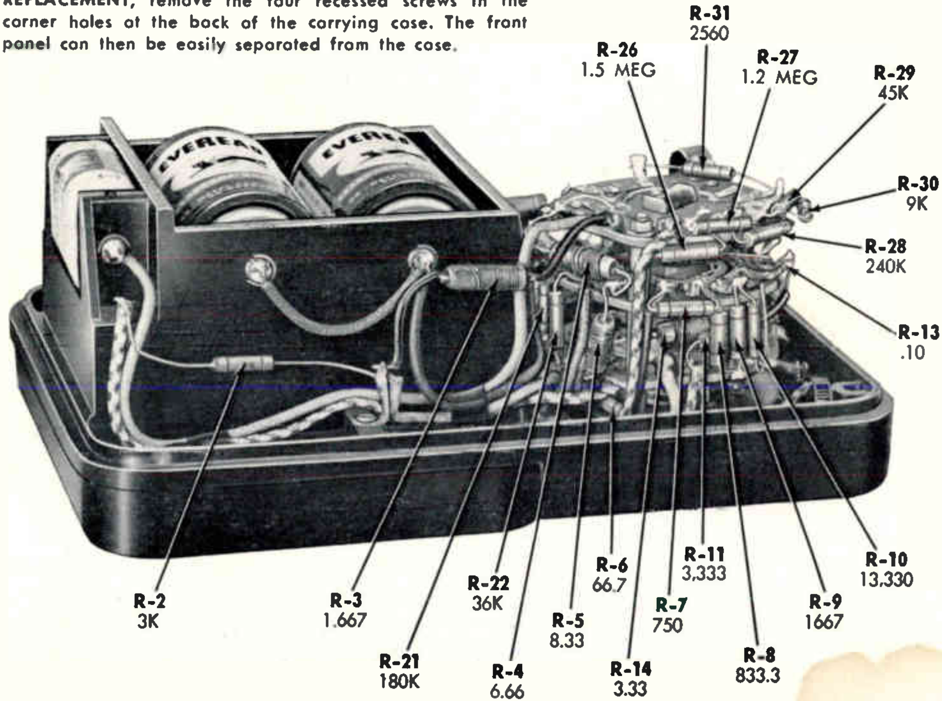
The foregoing is only a brief resume on the subject of instrument accuracy. More detailed information appears in many radio and electrical texts and journals, as well as in "standards" literature published by professional engineering societies such as AIEE, ASA and IRE.

MODEL 120

Location of Components



TO OPEN THE MODEL 120 FOR OHMMETER BATTERY REPLACEMENT, remove the four recessed screws in the corner holes at the back of the carrying case. The front panel can then be easily separated from the case.



NOTE: A relatively small overload can damage or alter the characteristics of AC meter rectifiers. The rectifiers employed in the Model 120 are checked very carefully before the instrument leaves the factory, Rectifiers cannot be guaranteed when overloaded.

Registration card and guarantee certificate are enclosed with this instrument. Mail the registration card at once. The PRECISION one year warranty can extend only to duly registered equipment. Always give model and serial number when writing for information relative to this instrument.

Series 120 Accessories Included:

2—EVEREADY #D-99 (OR EQUAL) 1½ VOLT BATTERIES.

1—EVEREADY #411 (OR EQUAL) 15 VOLT BATTERY.

1—SET #227-B SUPER-FLEX, GENERAL PURPOSE TEST LEADS.

Additional Accessories Available for the Model 120

TV-2B

LC-3

★ **TV-2B**:—Super-High Voltage Safety Test Probe for 30 KV. direct reading DC voltage range. Indispensable for test and maintenance of TV circuits.

★ **LC-3**:—Custom crafted, top-grain leather instrument case. Ever ready type. Provides utmost instrument protection with maximum utility and convenience.

★ **ST-1**:—Retractable, snap-on stand, permits convenient 45 degree table mount. Ideal for laboratory and production testing.

★ **228-B**: — Super-Flex high voltage test leads for general purpose tests up to 6000 V. (DC or 60 cycles AC).

ST-1

228-B

The foregoing accessories, as well as replacement ohmmeter batteries, can be ordered from the same PRECISION distributors from whom the Model 120 is procured.

The factory service Department responds promptly to all requests for prices, parts and service. Because C.O.D. charges by freight, express or post-office are relatively high, it is recommended that all parts orders be accompanied by check, money-order or small stamps.

PRECISION Apparatus Company, Inc.

70-31 84th Street, Glendale 27, L. I., N. Y.

MEMORANDA

DECIBEL CHART

NEG. (−) Voltage Ratio	NEG. (−) Power Ratio	−DB+	POS. (+) Voltage Ratio	POS. (+) Power Ratio
1.0000	1.0000	0	1.000	1.000
.9772	.9550	.2	1.023	1.047
.9550	.9120	.4	1.047	1.096
.9333	.8710	.6	1.072	1.148
.9120	.8318	.8	1.096	1.202
.8913	.7943	1.0	1.122	1.259
.8710	.7586	1.2	1.148	1.318
.8511	.7244	1.4	1.175	1.380
.8318	.6918	1.6	1.202	1.445
.8128	.6607	1.8	1.230	1.514
.7943	.6310	2.0	1.259	1.585
.7762	.6026	2.2	1.288	1.660
.7586	.5754	2.4	1.318	1.738
.7413	.5495	2.6	1.349	1.820
.7244	.5248	2.8	1.380	1.905
.7079	.5012	3.0	1.413	1.995
.6918	.4786	3.2	1.445	2.089
.6761	.4571	3.4	1.479	2.188
.6607	.4365	3.6	1.514	2.291
.6457	.4169	3.8	1.549	2.399
.6310	.3981	4.0	1.585	2.512
.6166	.3802	4.2	1.622	2.630
.6026	.3631	4.4	1.660	2.754
.5888	.3467	4.6	1.698	2.884
.5754	.3311	4.8	1.738	3.020
.5623	.3162	5.0	1.778	3.162
.5495	.3020	5.2	1.820	3.311
.5370	.2884	5.4	1.862	3.467
.5248	.2754	5.6	1.905	3.631
.5129	.2630	5.8	1.950	3.802
.5012	.2512	6.0	1.995	3.981
.4898	.2399	6.2	2.042	4.169
.4786	.2291	6.4	2.089	4.365
.4677	.2188	6.6	2.138	4.571
.4571	.2089	6.8	2.188	4.786
.4467	.1995	7.0	2.239	5.012
.4365	.1905	7.2	2.291	5.248
.4266	.1820	7.4	2.344	5.495
.4169	.1738	7.6	2.399	5.754
.4074	.1660	7.8	2.455	6.026
.3981	.1585	8.0	2.512	6.310
.3890	.1514	8.2	2.570	6.607
.3802	.1445	8.4	2.630	6.918
.3715	.1380	8.6	2.692	7.244
.3631	.1318	8.8	2.754	7.586
.3548	.1259	9.0	2.818	7.943
.3467	.1202	9.2	2.884	8.318
.3388	.1148	9.4	2.951	8.710
.3311	.1096	9.6	3.020	9.120
.3236	.1047	9.8	3.090	9.550

NEG. (−) Voltage Ratio	NEG. (−) Power Ratio	−DB+	POS. (+) Voltage Ratio	POS. (+) Power Ratio
.3162	.1000	10.0	3.162	10.00
.3090	.09550	10.2	3.236	10.47
.3020	.09120	10.4	3.311	10.96
.2951	.08710	10.6	3.388	11.48
.2884	.08318	10.8	3.467	12.02
.2818	.07943	11.0	3.548	12.59
.2754	.07586	11.2	3.631	13.18
.2692	.07244	11.4	3.715	13.80
.2630	.06918	11.6	3.802	14.45
.2570	.06607	11.8	3.890	15.14
.2512	.06310	12.0	3.981	15.85
.2455	.06026	12.2	4.074	16.60
.2399	.05754	12.4	4.169	17.38
.2344	.05495	12.6	4.266	18.20
.2291	.05248	12.8	4.365	19.05
.2239	.05012	13.0	4.467	19.95
.2188	.04786	13.2	4.571	20.89
.2138	.04571	13.4	4.677	21.88
.2089	.04365	13.6	4.786	22.91
.2042	.04169	13.8	4.898	23.99
.1995	.03981	14.0	5.012	25.12
.1950	.03802	14.2	5.129	26.30
.1905	.03631	14.4	5.248	27.54
.1862	.03467	14.6	5.370	28.84
.1820	.03311	14.8	5.495	30.20
.1778	.03162	15.0	5.623	31.62
.1738	.0320	15.2	5.754	33.11
.1698	.02884	15.4	5.888	34.67
.1660	.02754	15.6	6.026	36.31
.1622	.02630	15.8	6.166	38.02
.1585	.02512	16.0	6.310	39.81
.1549	.02399	16.2	6.457	41.69
.1514	.02291	16.4	6.607	43.65
.1479	.02188	16.6	6.761	45.71
.1445	.02089	16.8	6.918	47.86
.1413	.01995	17.0	7.079	50.12
.1380	.01905	17.2	7.244	52.48
.1349	.01820	17.4	7.413	54.95
.1318	.01738	17.6	7.586	57.54
.1288	.01660	17.8	7.762	60.26
.1259	.01585	18.0	7.943	63.10
.1230	.01514	18.2	8.128	66.07
.1202	.01445	18.4	8.318	69.18
.1175	.01380	18.6	8.511	72.44
.1148	.01318	18.8	8.710	75.86
.1122	.01259	19.0	8.913	79.43
.1096	.01202	19.2	9.120	83.18
.1072	.01148	19.4	9.333	87.10
.1047	.01096	19.6	9.550	91.20
.1023	.01047	19.8	9.772	95.50
.1000	.01000	20.0	10.000	100.00

VOLTAGE RATIOS BEYOND THE RANGE OF THE ABOVE TABLES

A. Ratios **LESS** than the tables: **MULTIPLY** ratio by 10 successively until the result can be found in the tables. From the decibel value found in the table **SUBTRACT** 20DB for each time the multiple of 10 was used.

For example: To find the DB value of a given *voltage ratio* of .01259, we proceed as follows:— .01259 × 10 = .1259, (which *is* a value within the range of the table). The table indicates the voltage ratio of .1259 = −18.0 DB. Now *subtract 20DB* (because we had to multiply the original ratio by 10, *once*). Subtracting 20DB from −18.0 DB gives us the figure −38 DB.

B. Ratios **GREATER** than the tables **DIVIDE** ratio by 10 successively until the result can be found in the tables. To the DB value found in the table **ADD** 20DB for each time the divisor of 10 was used.

For example: To find the DB value of a given *voltage ratio* of 39.81, we proceed as follows:— 39.81 ÷ 10 = 3.981, (which *is* a value within the range of the table). The table indicates the voltage ratio of 3.981 = +12.0 DB. Now *add 20DB* (because we had to divide the original ratio by 10, *once*). 20 DB + 12.0 DB = 32 DB.

PRECISION
TEST EQUIPMENT

Standard of Accuracy

RADIO • TELEVISION • ELECTRICAL
INDUSTRIAL • LABORATORY

PRINTED IN U.S.A.