

INSTRUCTIONS FOR OPERATING THE PRECISION SERIES 910, 912 and 915 DYNAMIC ELECTRONOMETERS

The Series 910, 912 and 915 Dynamic Electronometers are modern push-button operated radio tube analyzers. They also provide a system for obtaining qualitative analysis of ballast units and paper condensers.

The tube analyzer circuit of these instruments makes use of an exclusive PRECISION engineered tube test system, which in one operation, effectively checks the two most important electrical characteristics of a radio tube, namely, MUTUAL CONDUCTANCE AND CATHODE STRUCTURE (EMISSION).

The novel automatic interlocking PUSH-BUTTON element selector, incorporated in the Series 910, 912 and 915, provides for simplicity in operation, visible filament continuity tests, speedy short check, cathode leakage, ballast unit tests, and rapidly locates all tube elements for application of individual test voltages.

From the features listed, it will be noted how accurate and reliable testing can be efficiently and easily accomplished with the Series 910, 912 and 915 laboratory testers.

TUBE ANALYZING FEATURES

1. A DYNAMIC TUBE TESTER employing an exclusive PRECISION engineered circuit, which in one operation, effectively tests all radio receiving tubes for both MUTUAL CONDUCTANCE and CATHODE STRUCTURE (EMISSION).
2. TESTS ALL TYPE TUBES: ACCOMMODATES ALL FILAMENT VOLTAGES from 1.4 to 110 volts, including the new 35, 45, 50, 70, 85 and 110 volt filaments. TESTS ALL LOKTALS, BANTAM JUNIORS (Miniature Hearing Aid and Pocket Radio Tubes), BANTAMS, SINGLE-ENDED (Television Amplifiers), REGULAR OCTALS (MG, G AND METALS), SPRAY-SHIELD AND GLASS TYPES, AND THE NEW MINIATURE 7 PIN TYPES.
3. TUBE MERIT indications are read directly on a three colored ENGLISH READING SCALE.
4. DOUBLE WINDOW ROLLER TUBE CHART provides speedy, easy reading tube references. New charts furnished from time to time at no charge.
5. DUAL FREE-POINT FILAMENT TERMINAL SELECTION locates terminals of ALL filaments (single, double, center-tapped and tapped) regardless of any rotating pin positions.
6. VISIBLE FILAMENT CONTINUITY TESTS show up open filaments for ALL types of tubes regardless of filament base connections. This PRECISION developed feature eliminates delay by immediately determining whether or not the filament of a tube under test is intact.
7. AUTOMATIC PUSH-BUTTON SYSTEM: PRECISION designed interlocking push-button selector system affords the extreme in flexibility for non-obsolete FREE POINT TUBE ANALYSIS and insures ability to accommodate future tube releases.
8. SPECIFIC INDIVIDUAL LOADS AND VOLTAGES (control grid, screen, plate, etc.,) applied to respective elements of tube under test.
9. VARYING A.C. SIGNAL applied to control grids.
10. METER-READS IN PLATE CIRCUIT: Indications therefore are entirely dependent upon control action of ALL intervening elements.
11. OPEN ELEMENTS: Shows up tubes with any open element. The PRECISION DYNAMIC TEST NECESSITATES ALL ELEMENTS intact for proper reading.
12. TESTS diodes, triodes, rectifiers, tetrodes, pentodes, multi-purpose tubes, gaseous types OZ3-OZ4 and remote control gaseous types OA4 and 2A4 regardless of varying filaments or other element positions.
13. MULTI-SECTION TUBES: Individual tests for each section of multi-section tubes including visible tests of the fluorescent screen and winking effect on cathode ray indicator tubes. No shifting of tubes necessary to obtain all tests.

14. HOT CATHODE LEAKAGE TEST: Sensitive neon method quickly shows up poor cathode structure in accord with leakage specifications of leading tube manufacturers.
15. HOT INTER-ELEMENT SHORT TESTS made ingeniously simple through the use of PRECISION Automatic Interlocking Push-Buttons.
16. NOISE TEST pin jacks incorporated for earphone or amplifier connection. Each element can be separately tested for noise through use of free-point Automatic Interlocking PUSH-BUTTON ELEMENT SELECTOR SYSTEM.
17. BALLAST TEST: The regular tube test sockets accommodate all ballast unit tests for open and loose elements and leakage between sections of multi-section ballasts, made possible through the Precision Push-Button system.
18. PILOT LIGHT TESTS for all miniature screw base and bayonet type lamps.
19. ACCURACY of the tube test circuit is closely maintained by the use of individual calibrating controls, adjusted and sealed against laboratory standards.
20. LARGE MODERN PRECISION SQUARE METER.
21. TUBE SELECTION REFERENCES plainly marked on panel. Nothing to remember.
22. PILOT LIGHT ON-OFF INDICATOR: Fused line plug.
23. MICRO-LINE ADJUSTMENT read directly on meter, provided by use of variable heavy duty line voltage control. No arbitrarily tapped transformer employed.
24. TELEPHONE CABLED WIRING EMPLOYED THROUGHOUT.
25. PAPER CONDENSER LEAKAGE TESTS. SENSITIVE NEON METHOD.

It is strongly suggested that the following be read carefully in order to obtain the utmost benefit in accurate tube and set testing results which the PRECISION DYNAMIC ELECTRONOMETERS afford.

To obtain a quicker understanding for ease in operation, it is first best to take into consideration the function of each control, switch and part incorporated on the instrument panel.

CONTROL "A"

When rotated to 1,2,3,4,5,6,7,8, or 9, selects the control grid of the particular tube under test regardless of element pin position.

CONTROL "B"

Selects the correct filament voltage for the tube under test, providing a complete range of operating potentials from 1.4 through 110 volts. It will be noted that this control may be set to any one of 18 positions numbered from 1 to 18. Necessary filament voltages are applied when set according to roller chart data listed under column "B".

CONTROL "C"

Provides a variable A.C. signal which is automatically applied to the control grid selected by CONTROL "A".

CONTROL "D"

Is a special tapered potentiometer. When tube analyses are taken, this control functions as a variable meter shunt enabling the setting of calibration limits for all tubes as noted on the tube test roller chart.

CONTROL "E"

Is primarily a screen-grid selector. Its major function is to pick out (regardless of element pin position) the screen-grid of multi-element tubes and at the same time, apply correct screen voltage and load. CONTROL "E" also provides for the following:

- (a) correct voltages and loads for general purpose triodes.
- (b) correct voltages and loads for testing rectifiers and diodes.
- (c) correct voltages and loads for testing the gaseous types 0Z3-0Z4 rectifiers.
- (d) proper circuit connections for obtaining visible test of the fluorescent screens of all cathode ray tuning indicators.

CONTROL "F"

Acts as a free-point filament return terminal selector when rotated through positions 1 through 12.

THE LINE ADJUSTMENT CONTROL

Is used to adjust the line voltage by bringing the meter pointer to arrow-head center of the scale plate marked "LINE". This control is a heavy duty wire wound potentiometer, thus assuring positive micro-voltage adjustment.

THE AUTOMATIC PUSH-BUTTON SYSTEM

Consists of 12 push-buttons identified as "OFF - A (Filament Continuity) - B - C - D - E - F - G - H - J - READ METER - TUBE MERIT". These buttons perform the following functions:

OFF BUTTON:

"OFF" button, when in the down or depressed position, shuts instrument "off", and simultaneously releases any other buttons that may have been previously depressed. To turn instrument "ON", press lightly on "double-action" "TUBE MERIT" button located at opposite end of the push-button system.

TUBE MERIT BUTTON:

This double action button has been so designed as to perform two entirely different functions depending upon the operating pressure.

1. A light pressure, as described above, releases the "OFF" button and thereby turns instrument "on", and provides immediate "LINE" indication on meter, as long as CONTROL "A" is in any one of the tube testing positions 1 through 9.

2. When fully despressed, the "TUBE MERIT" button, aside from interrupting the "LINE" indication on METER, also provides an ingenious mechanical arrangement which allows any required number of the lettered buttons "A" through "J" to be held down ("locked") and remain in the depressed position.

READ METER BUTTON:

This button merely provides meter reading for tube quality indications.

LETTERED BUTTONS A-B-C-D-E-F-G-H-J connect to corresponding prong positions of the sockets, permitting an arrangement whereby any combination of electrodes required, may be connected into the appropriate portion of the test circuit, regardless of element pin positions. This lettered set of push-buttons operates through the circuit in conjunction with CONTROLS "A", "E" AND "F", providing a complete FREE-POINT TUBE ANALYSIS SYSTEM affording extreme flexibility for future tube releases.

The manipulation of these lettered buttons serves the following purposes:

1. Lettered BUTTON "A" provides for VISIBLE (NEON LAMP) FILAMENT CONTINUITY tests unless otherwise noted on roller tube chart.
2. Provides for HOT INTER-ELEMENT SHORT CHECK and CATHODE LEAKAGE TESTS.
3. Provides for proper tube circuit selections for quality indications.
4. Provides for qualitative BALLAST UNIT TESTS.

THE PROPER CONTROL AND PUSH-BUTTON SETTINGS FOR EACH TUBE TO BE TESTED ARE INDICATED ON THE TUBE TEST ROLLER CHART.

SOCKETS: This instrument employs individual loktal, octal, combination 7 prong, Bantam Jr., 6 prong, 5 prong and 4 prong sockets. All tube analyses, i.e., filament continuity, hot cathode leakage, hot neon short check, tube quality tests and ballast unit tests are obtained from ANY ONE of the required sockets. This instrument also includes the new miniature "BUTTON" 7 pin socket.

OVERHEAD CONNECTOR CAP: The bakelite encased twin grid cap, (connected to flexible lead) accommodates the top caps of both octal and non-octal types of tubes.

THE METER employed is of square, modern design and ruggedly constructed. The movement is a D'Arsonval type of 2% accuracy. The English reading scale plate incorporates a wide three color sector divided into markings of REPLACE - WEAK - GOOD for tube merit indication.

"CONDENSER TEST" TIP JACK: This tip jack, in conjunction with either one of the "NOISE TEST" jacks, provides for checking paper condensers and also for neon lamp continuity testing.

"NOISE TEST" TIP JACKS provide for audible noise tests on tubes.

THE NEON LAMP "SHORT INDICATOR" affords a visible indication for filament continuity, short checking and ballast tests.

THE PILOT LIGHT TEST SOCKET located in center of combination 7 prong socket, accommodates all miniature screw and bayonet base pilot lamps. Voltages are selected at CONTROL "B" in accord with corresponding filament voltage switch position, and CONTROL "F" at number 1.

GENERAL OPERATING INSTRUCTIONS

With "OFF" BUTTON depressed, connect fused plug of instrument to any 50-60 cycle 110-125 volt A.C. source.

(a) Refer to the tube test roller chart for the tube number required and set CONTROLS "A", "B", "C", "D", "E" and "F" to positions designated for that tube.

NOTE:-For simplicity in locating any tube type number, it will be helpful to note that all tubes are listed in strict numerical order beginning at the top of the left hand window opening, continuing downward to the end of the roll and thence to the top of the right hand window opening, etc.

(b) Lightly press (and then remove finger from) the "double action" "TUBE MERIT" BUTTON to turn instrument "ON". (It will be noted that this button thereby remains in the normal "UP" position.) Then rotate "LINE ADJUSTMENT" knob to bring pointer of meter to arrow-head (center of scale) marked "LINE".

NOTE:-In the even that "TUBE MERIT" BUTTON is accidentally fully depressed, then "LINE" indication will not be had. To disengage this button, merely depress the "OFF" button (which will ALWAYS release any previously depressed buttons); also "LINE" indication will be had on meter ONLY when CONTROL "A" is set to the tube test positions 1 through 9.

(c) Insert tube to be tested into its respective socket and allow to heat (connect overhead cap when necessary). Any deviation of the meter pointer from the "LINE" position should at this time be corrected by rotating the "LINE ADJUSTMENT" knob to again bring meter pointer to arrow-head (center of scale).

FILAMENT CONTINUITY, HOT CATHODE LEAKAGE AND INTER-ELEMENT SHORT TESTS.

After settings are made as noted above, then proceed to obtain these tests by simply depressing lettered buttons A-B-C-D-E-F-G-H-J in consecutive order and watch neon lamp SHORT INDICATOR for glow or continuous flicker.

IMPORTANT:-NEON LAMP INDICATION SHOULD BE HAD ONLY ON FILAMENT CONTINUITY "A" BUTTON, OR WHATEVER OTHER BUTTON OR BUTTONS MAY BE DESIGNATED ON TUBE CHART FOR FILAMENT CONTINUITY.

Inasmuch as the filament of the tube under test is disengaged when the "FILAMENT CONTINUITY" BUTTON is depressed, it is necessary that this button be immediately returned to normal position (by depressing any other button) and thereby allow tube to remain in a heated condition for further test. Tube under test should be rejected as defective (open filament) if neon lamp fails to glow when the "FILAMENT CONTINUITY" BUTTON is depressed.

DISREGARD ANY MOMENTARY NEON LAMP FLASHES AS BUTTONS ARE DEPRESSED. These flashes are merely the discharge of condenser in short check circuit.

NOTE:-When manipulating the lettered push-buttons for obtaining FILAMENT CONTINUITY, CATHODE LEAKAGE and INTER-ELEMENT SHORT TESTS, it is important that the "TUBE MERIT" BUTTON be in its normal or "UP" position. This will allow for individual tube element tests and automatic release action on each of the previously depressed buttons, thereby permitting only one button at a time to be in the down position.

A discernable neon lamp glow or continuous flickering when any one of the other lettered buttons "B" to "J" are depressed, indicates an inter-electrode high resistance leakage or short in the tube under test and should be rejected without further testing, (unless otherwise noted on the tube test roller chart).

While making combined CATHODE LEAKAGE and INTER-ELEMENT SHORT TESTS, it is advisable to tap the tube as each of the lettered buttons is depressed. Inasmuch as these tests are made while the tube is in a heated condition, the tube should be allowed time to heat up sufficiently. In this manner, shorts or leakages that may occur due to expansion of internal elements can be more readily detected.

Inasmuch as all tube elements connect to individual lettered push-buttons, there is no necessity to employ a separate cathode leakage button. Cathode leakage will therefore be detected when the respective button, corresponding to a particular tube's cathode, is depressed.

AUDIBLE NOISE TEST.

An audible noise test of defective and noisy tubes can be had if desired, by inserting an earphone or audio amplifier system into the "NOISE TEST" tip jacks. The testing procedure is the same as outlined for obtaining HOT CATHODE LEAKAGE TEST and HOT INTER-ELECTRODE SHORT TEST described above.

An intermittent or constant loud audible hum when making CATHODE LEAKAGE and HOT INTER-ELECTRODE SHORT TESTS will indicate loose or shorted tube elements, a cause for fading and noisy radio reception. A loud audible hum when "FILAMENT CONTINUITY" BUTTON is depressed, is normal and is indicative of a continuous filament.

DO NOT ATTEMPT TO OBTAIN TUBE QUALITY METER INDICATION UNTIL AFTER SHORT TESTS ARE MADE, ELSE SERIOUS DAMAGE MAY RESULT TO INSTRUMENT.

TUBE QUALITY INDICATION.

With all controls set at their respective positions for the tube under test and line adjustment made, first fully depress "TUBE MERIT" BUTTON and then depress, one at a time, ONLY THOSE LETTERED PUSH-BUTTONS DESIGNATED ON THE TUBE TEST ROLLER CHART for that particular tube. After the buttons called for have been depressed, a tube quality indication on the meter will be obtained when the "READ METER" BUTTON is depressed and held down.

In the event that the wrong lettered push-button has been depressed, merely depress the "OFF" BUTTON which also functions as a GENERAL RELEASE. This action will disengage and return all buttons up to normal position. This same procedure should be followed after completion of test is made on a tube and it is desired to continue test procedure on another tube (or another section of a tube as noted below).

DIODE TEST INDICATION (NOTE CAREFULLY).

When testing the section of a tube identified by the word "DIODE" as noted on the tube chart, DO NOT REFER TO THE ENGLISH READING SCALE. It will be noted that within the red REPLACE sector, there is an arrow line with small letters marked "DIODES". A poor DIODE reading will be indicated if the pointer of meter does not reach the line marked "DIODES". A good DIODE reading will be indicated if the needle pointer falls anywhere beyond this line even though the pointer still remains in the REPLACE sector.

SPECIAL ROLLER CHART NOTATIONS.

1. As will be noted on the roller tube chart, certain few tubes are accompanied by notations such as "OK over $\frac{1}{4}$ of scale" or "OK over $\frac{1}{3}$ of scale". This implies that even though the meter pointer may fall within the red REPLACE sector, the tube is not to be rejected unless it falls below the portions of the scale mentioned.

2. VISIBLE EYE TESTS. As noted on the tube test roller chart, the advanced tube test circuit features incorporated in the PRECISION Dynamic Electronometers provide two visible fluorescent screen (eye) tests aside from the regular triode section test.

(a) Visible indications of the fluorescent screen.

(b) Open and close effect of the shadow section.

PROCEDURE:- Upon completion of triode section test, (as noted on tube test roller chart), reset controls for EYE SECTION TEST and depress "TUBE MERIT" BUTTON. Depress the first button called for, and a visible luminous screen will be had when "READ METER" BUTTON is depressed. Then depress the second button called for, with "READ METER" BUTTON still held down, to obtain closing eye effect. DISREGARD METER INDICATIONS ON EYE TESTS.

3. 70A7 and 117N7 RECTIFIER TEST. Because of unusual internal connections, the 70A7 and 117N7 RECTIFIER sections require a special test procedure.

Buttons (A and E) or (A) respectively, as noted on the tube chart, must be depressed simultaneously along with the "READ METER" BUTTON. Normal meter indication will be obtained for a few seconds and will then gradually recede (fade) because the 70A7 and 117N7 filament connections must necessarily be isolated from the test circuit to provide merit indication for the rectifier section. RECTIFIER merit is therefore to be judged only by the initial meter deflection. Buttons (A) or (A and E) must be immediately returned to normal position if it is desired to keep the filaments of the 70A7 or 117N7 in a heated condition.

GAS TYPE RECTIFIERS OZ3 and OZ4.

When testing these gas rectifier types, it will be noted that the meter pointer will remain, for a short interval, in the REPLACE sector and then deflect into the GOOD sector. This condition is normal for a good gas rectifier. However, should the meter pointer remain constantly in the REPLACE sector (after the lapse of several seconds), then the gas rectifier can be termed as defective.

MULTI-SECTION TUBE TESTS.

Full wave rectifiers and multi-section tubes such as double triodes, triode-diodes, pentode-diodes, duo-diodes, frequency converters, pentode-triodes and pentode-rectifiers, contain either a second plate, a second triode or other combination of sections. These tubes are designated on the tube chart wherein each of these sections is separately described and settings given.

Treat each of these sections as if testing individual tubes for "TUBE QUALITY", as outlined above, by settings controls and lettered push-buttons designated for each section. The circuit employed in this instrument permits testing of the individual sections of multi-section tubes and it is therefore strongly suggested that a complete test be given to these types since any one poor section will hinder proper operation in the radio receiver.

NOTE:-It is advisable, when obtaining a TUBE QUALITY indication, to tap the tube under test. At times it will be noted that such tapping may cause a noticeable meter pointer fluctuation. Such fluctuation indicates loose internal element structure which may cause a noisy, fading condition when operating in a radio receiver.

TUBE BRAND VARIATIONS.

In determining the tube test limits for this instrument, Precision engineers in cooperation with the engineering divisions of leading tube manufacturers, have spent considerable time checking thousands of tubes in the production run of all tube types of each and every leading tube manufacturer. From the information so gathered, the data on the roller chart, accompanying this instrument, has been compiled.

Inasmuch as extensive and intensive research is constantly being made in the radio tube industry to improve and stabilize the electrical and mechanical construction of tubes, it is not uncommon for a tube manufacturer to make a change in a particular tube's specifications. This change, though not necessarily readily noticeable in radio set performance, may nevertheless be made to improve tube stability and life. This change or variation may, however, indicate itself on a dynamic tube tester and therefore necessitate a new set of test limits, for that particular type number produced by the manufacturer who has made this change.

Therefore, should a particular type number of a given manufacturer be found to vary consistently from the assigned average roller chart limits, merely redetermine the new CONTROL "D" average setting required to pass these tubes at approximately the center of the letter "G" of the word "GOOD" in the green sector, and record same for future reference with respect to that manufacturer.

It can readily be seen that a consistently low or high reading for any particular tube type of a definite manufacturer is not to be taken as indicative of a poor or better run of tubes, nor as a defect in the tube tester.

PILOT LIGHT TESTS.

The miniature base socket located in the center of the combination seven prong tube socket accommodates all miniature screw and bayonet base type pilot lamps, Christmas tree bulbs, etc. Test procedure is as follows:

(a) Select proper filament voltage with CONTROL "B" in accord with voltage specifications as indicated in paragraph pertaining to the description and function of this control.

(b) Turn instrument "ON" and adjust for "LINE" before inserting bulb into miniature socket. Also set CONTROL "F" at position number 1 and CONTROL "A" at number 2.

IMPORTANT NOTE:-If difficulty is ever experienced when testing tubes with OVERHEAD grid caps, always FIRST check for continuity between flexible grid cap lead and bakelite encased dual cap connector. The flexible wire occasionally breaks at the point of entrance to the cap connector.

BALLAST INFORMATION

BALLAST TESTING: The neon short check circuit in conjunction with the lettered push-buttons provides a simple and effective method for obtaining the following ballast tests:

1. Point to point continuity test of each tapped section of multiple section ballasts.
2. Tests for loose elements.
3. Tests for leakage between separate sections of multi-purpose ballasts.

BALLAST RESISTOR CODE: A sample and interpretation of the code appearing on standard octal type and replacement type ballasts are as follows:

(RMA STANDARD OCTAL TYPE) BK49AG
(REPLACEMENT TYPE) BKX55AG

The first letter "B" on both types, if used, indicates ballast action.

The letter "K", "L" or "M" on both types, indicates type of pilot lamp.

The letter "X" or "Y" or "Z" immediately following the pilot lamp designation denotes a particular SERIES of base wiring and appears only on replacement type ballasts.

The numerals "49" or "55" appearing on the respective types, indicates the total voltage drop produced by the ballast resistor including the pilot lamp.

The letter "A" or B-C-D-E-EI-F-G-H-J, appearing on both types and immediately following the voltage drop numerals, designates the particular BASE WIRING circuit used.

The letter "G" following the base wiring circuit designation on both types, if used, indicates octal base glass unit.

A letter "J" following the base wiring designation such as K55CJ, refers to an internal jumper between pins 3 and 4. (See TEST PROCEDURE.)

Where the letter "P" or "PR" appears after the base wiring designation, such as K55CP or K55CPR, this indicates an additional resistor section is employed for the rectifier plate circuit. (See TEST PROCEDURE.)

FOR STANDARD RMA OCTAL TYPE BALLASTS, THE BASE WIRING DESIGNATION (A-B-C-D-E-EI-F-G-H-J) IS THE ONLY INFORMATION NECESSARY FOR TEST PURPOSES.

FOR REPLACEMENT TYPE BALLASTS, THE X,Y OR Z SERIES AND BASE WIRING DESIGNATION IS THE INFORMATION NECESSARY FOR THE TESTING OF THESE TYPES.

BALLAST TEST PROCEDURE

The OCTAL SOCKET is used to accommodate all octal base type ballasts.

1. ALL CONTROLS MUST BE IN THE FOLLOWING POSITIONS DESIGNATED BEFORE ANY ATTEMPT IS MADE TO TEST BALLAST UNITS:

Set CONTROL "A" to #7 position
Set CONTROL "B" to #16 position
Set CONTROL "C" to 0 position
Set CONTROL "D" to 0 position
Set CONTROL "E" to #7 position
Set CONTROL "F" to #12 position

2. Turn instrument "ON" and adjust for "LINE" indication on meter.
3. Refer to the test data list on bottom of page and classify the ballast unit to be tested according to its RMA or XYZ SERIES and BASE WIRING, and note LETTERED PUSH-BUTTONS called for and then insert ballast unit into its respective socket.

CAUTION:- NEVER DEPRESS "READ METER" BUTTON DURING BALLAST TESTS.

First fully depress "TUBE MERIT" BUTTON, so that locking action will be obtained on the lettered BUTTONS "A" through "J". The lettered push-buttons called for are then depressed, one at a time, in the order as indicated on previously mentioned BALLAST DATA LIST and each button depressed therefore remains in the down position. All depressed buttons are released to the normal "UP" position (by use of "OFF" BUTTON) only after all of the tapped sections of a ballast unit have been tested.

NOTE:- Disregard "FILAMENT CONTINUITY" marking on "A" BUTTON and employ this button, whenever called for, in the same manner as the other lettered buttons.

A continuous neon lamp glow after each consecutive lettered push-button called for is depressed, indicates that the section is not open. An open section (anywhere in the chain) will cause neon lamp to become extinguished when that section lettered push-button is depressed.

It is advisable to tap the ballast unit after each of the push-buttons called for is depressed. In this manner, loose elements can be ascertained by noticing any flickering of neon lamp.

Where letter "J" follows the base wiring designations such as K55CJ, then it is necessary to include BUTTON "B" for test purposes and it should be the last one to be depressed.

Where letter "P" or "PR" follows the base wiring designation such as K55CPR or K55CP, then it is necessary to include BUTTON "D" for test purposes and it should be the first button to be depressed.

The circuits of the base wiring designations "F", "G", "H" or "J" such as M42H, consist of two multi-purpose sections in one unit and as will be noted in the BALLAST DATA LIST, each individual section is tested as an independent unit. The necessary lettered push-buttons for either section are enclosed in parentheses.

*** LEAKAGE TESTS:** Tests for leakages between sections of multi-purpose ballast units having BASE WIRING designations "F", "G", "H" or "J" (as noted above) are accomplished by depressing both buttons "BJ" with all other push-buttons remaining in the (UP) normal position. A neon lamp glow will indicate leakage between the two independent sections, and the ballast unit should be rejected as being defective.

Where letter "J" follows the multi-purpose type base wiring designation "F", "G", "H" or "J" such as K49FJ or K49GJ, then it is necessary to include BUTTON "B" when testing the second section of such ballasts. This additional button should be the last one to be depressed when testing this section.

All ballast type resistors (used in battery and AC-DC receivers) having a single resistance element across the filament prongs of their respective bases, may be accommodated for test purposes by employing BUTTON "A", and unit inserted in proper socket.

TEST DATA LIST FOR RMA CODED OCTAL BALLAST UNITS AND FOR
REPLACEMENT (Four and Octal Prong) "XYZ" SERIES

BASE WIRING	DEPRESS	BASE WIRING	DEPRESS	BASE WIRING	DEPRESS
A	A	C	AF	E	AFJD
X-A	A	X-C	AC	E1	AF
Y-A	F	Y-C	FH	F	(A) (J)*
Z-A	A	Z-C	AD	G	(A) (J)*
B	AF	D	AFJ	H	(AF) (J)*
X-B	AC	X-D	ACB	J	(AFD) (J)*
Y-B	FH	Y D	FHJ		
Z-B	AD				

* Check for leakage between sections as noted in Operating Instructions heading "LEAKAGE TESTS".

TO TEST PRIVATELY CODED BALLAST UNITS, REFER TO BALLAST UNIT MANUFACTURER FOR THEIR CONVERSION REPLACEMENT LISTINGS OF PRIVATELY CODED BALLAST UNITS.

QUALITATIVE PAPER CONDENSER TESTS:- The CENTER PIN of the "Bantam Junior" socket, located at the upper left hand side of panel, is used in conjunction with either one of the "NOISE TEST" pin jacks to obtain paper condenser tests by the sensitive neon lamp method. The self-contained power supply applies the necessary rectified voltage to the paper condenser.

PROCEDURE:

1. Connect instrument to any 50-60 cycle 110-125 volt A.C. source and turn instrument "ON".
2. With CONTROL "A" set to #1 position, rotate "LINE ADJUSTMENT" knob to obtain "LINE" indication on meter.
3. Then fully depress "TUBE MERIT" BUTTON and insert test leads into the previously mentioned jacks. Apply free ends across paper condenser to be tested, while observing indications on neon glow lamp.
 - (a) A steady glow of the neon lamp indicates a low D.C. resistance or short circuited condenser.
 - (b) A flickering neon lamp glow indicates a high resistance leakage condition.
 - (c) No indication on neon lamp indicates that the condenser under test is open or the capacity is too small to cause neon lamp to register visibly.
 - (d) A good condenser will cause an instantaneous neon lamp flash, the duration of which is dependent upon the capacity being tested. The greater the capacity, the longer the duration and vice versa.

Polarity need not be observed when testing paper condensers.

NOTE: The "NOISE TEST" pin jacks may not accommodate the insulated type of test tips as employed on multi-meter test leads, but rather require standard phone tips as found on earphone leads, in order to reach the deep-set open circuiting contacts.

GENERAL NOTES:

If the instrument fails to function, the two one ampere fuses incorporated in the "fused male plug" should be inspected and replaced if necessary. For fuse replacement, it is not necessary to take the plug apart. Two holes, to be found on the top of the plug, allow for insertion of a pointed object which will eject the fuses.

If difficulty is experienced in regard to proper operation of the instrument, replace the 80 type tube to be found on the underside of tester panel. A defective 80 tube will prevent obtaining proper line adjustment indication.

The neon lamp is a G-10 General Electric 115 volt, 1 watt, candelabra base. Replacement, if necessary, should be made only with this type or its equivalent. If difficulty is experienced in obtaining this neon lamp, it may be had by ordering direct from factory with remittance of 55¢ in stamps.

GENERAL INFORMATION

Instructions and guarantee card are enclosed with this instrument. Mail the guarantee card at once for future information to be mailed from this record. New roller tube charts are printed from time to time giving the latest tube data testing information. Unless the registration card is in our files, we have no means of forwarding correct charts. New roller tube charts are supplied, upon request, without charge. When writing for information, always mention Pattern number and Serial number of instrument.

TUBE TEST ACCESSORIES INCLUDED:

- 1 Set of instruction sheets
- 1 Tube test roller chart
- 1 Type 80 rectifier tube
- 1 #40, 6-8 volt pilot lamp
- 1 G-10 neonglow lamp
- 1 Registration card

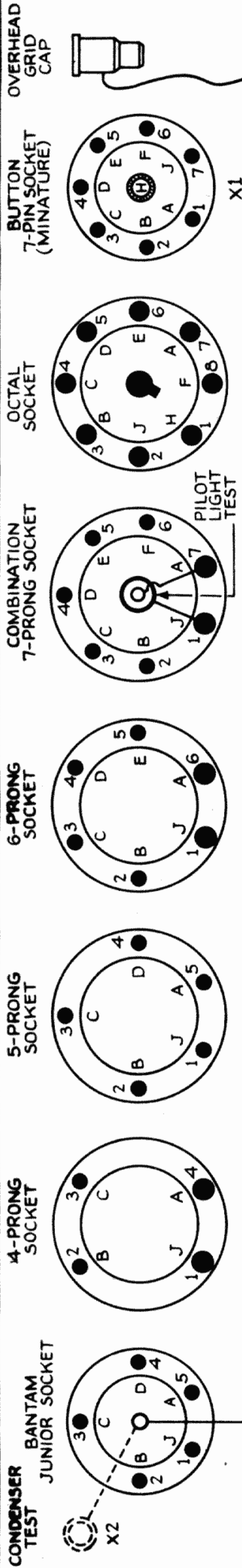
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PRECISION APPARATUS COMPANY

92-27 Horace Harding Blvd.
Elmhurst, L. I., N. Y.

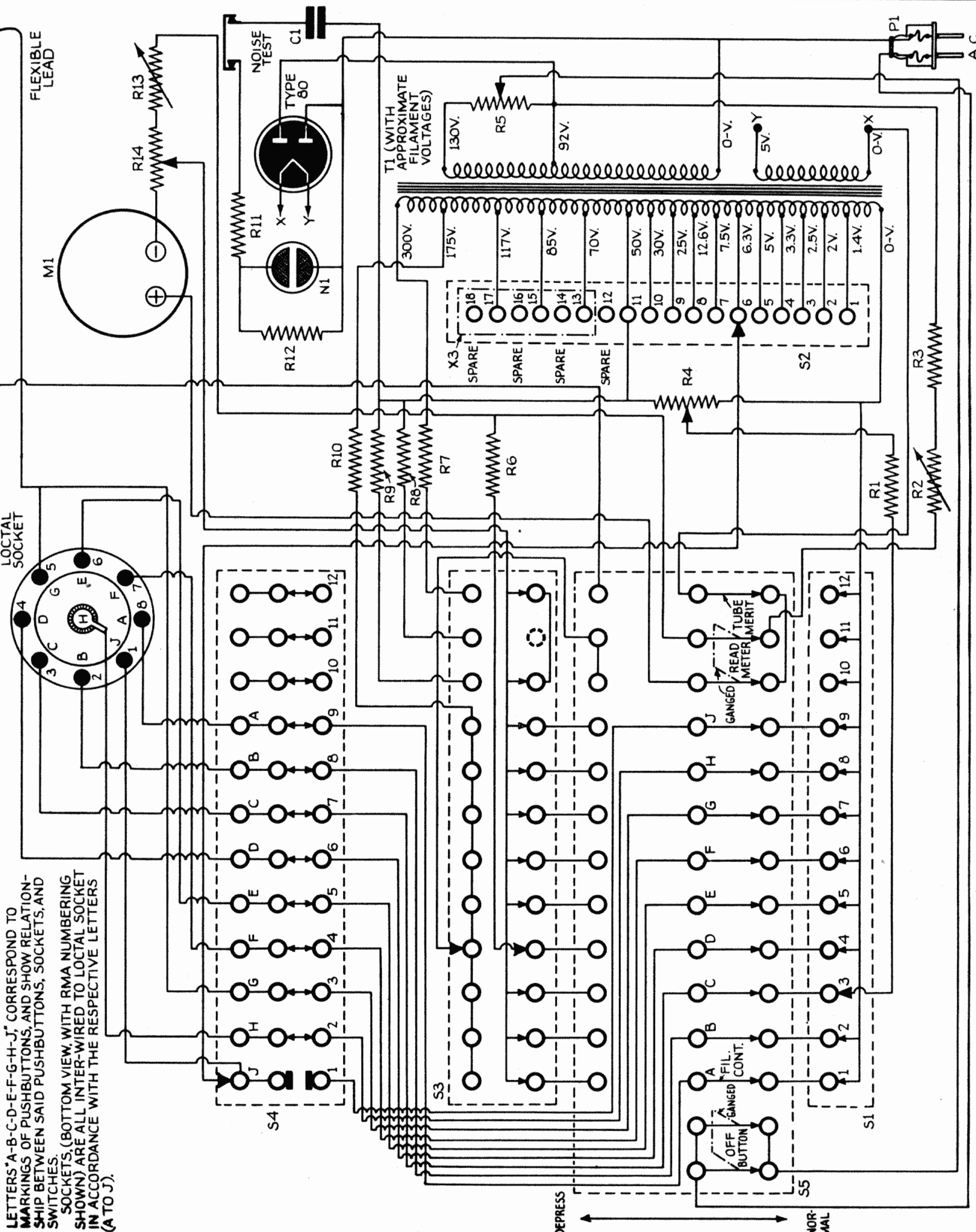


LETTERS "A-B-C-D-E-F-G-H-J" CORRESPOND TO MARKINGS OF PUSHBUTTONS, AND SHOW RELATIONSHIP BETWEEN SAID PUSHBUTTONS, SOCKETS, AND SWITCHES.
SOCKETS, (BOTTOM VIEW, WITH RMA NUMBERING SHOWN) ARE ALL INTERWIRED TO LOCAL SOCKET IN ACCORDANCE WITH THE RESPECTIVE LETTERS (A TO J).

X1= MINATURE BUTTON 7-PIN SOCKET, INCLUDED IN ALL SERIAL NUMBERS ABOVE THE FOLLOWING:
SERIES 910-SERIAL NO. 9748
SERIES 912-SERIAL NO. 5371
SERIES 914-ALL
SERIES 915-SERIAL NO. 1171

X2=CONDENSER TEST "PIN JACK" INCLUDED IN MODELS BEARING SERIAL NUMBERS BELOW THE FOLLOWING:
SERIES 910-SERIAL NO. 9749
SERIES 912-SERIAL NO. 5372
SERIES 914-NONE
SERIES 915-SERIAL NO. 1172
ALL INSTRUMENTS BEARING THESE SERIAL NUMBERS AND ABOVE USE THE CENTER CONTACT OF THE BANTAM JUNIOR SOCKET FOR "CONDENSER TEST."

X3= 18 POSITION FILAMENT VOLTAGE SELECTOR SWITCH FOR FILAMENT VOLTAGES ABOVE 50 VOLTS INCLUDED IN ALL INSTRUMENTS BEARING SERIAL NUMBERS ABOVE THE FOLLOWING:
SERIES 910-SERIAL NO. 9060
SERIES 912-SERIAL NO. 5024
SERIES 914-ALL
SERIES 915-ALL



ITEM	PART NO.	SPECIFICATION
25	S5	PUSHBUTTON ASSEMBLY
24	S4	FILAMENT POSITION SELECTOR OPEN CIRCUITING TYPE ROTARY SWITCH
23	S3	SELECTOR SWITCH "E"
22	S2	FILAMENT VOLTAGE SELECTOR "B"
21	S1	SELECTOR SWITCH "A"
20	R14	300-Ω CONTROL "D"
19	R13	40-Ω SEALED (CALIBRATED)
18	R12	500M-Ω
17	R11	35M-Ω
16	R10	2M-Ω
15	R9	5M-Ω
14	R8	300-Ω
13	R7	3M-Ω
12	R6	40M-Ω
11	R5	300-Ω LINE CONTROL "
10	R4	1M-Ω CONTROL "C"
9	R3	15M-Ω
8	R2	12M-Ω SEALED (CALIBRATED)
7	R1	500-Ω
6	T1	POWER TRANSFORMER
5	P1	DOUBLE-FUSED LINE PLUG
4	M1	4MA., 160M.V. METER
3	C1	0.1-MFD., 400W.V.
2	N1	G-10 NEON LAMP
1	J1	CLOSED CIRCUIT "NOISE TEST" JACK

PRECISION APPARATUS CO.
BROOKLYN, N.Y.
TITLE- SCHEMATIC FOR SERIES 910-912-914-915
DRAWN BY- *M. H. H. H.* DATE 4-13-40
CHECKED BY- *J. H. H.* DATE 4-17-40

IMPORTANT NOTE RELATIVE TO TESTING OF 24A, 35/51, AND 36 TUBES on Precision Dynamic Mutual Conductance Type Tube Testers

Due to recent specification changes in screen-grid composition and structure, the above mentioned tubes of certain tube manufacturers MAY exhibit considerable variations under Dynamic Mutual Conductance type test conditions. If this variation is consistently noted with tubes fresh from stock (**using the test limits now furnished on the roller tube chart**) employ the substitute settings, listed below, for these three tubes.

24A—7 - 3 - 31 - 11 - 1 - 1 - BC
35/51—7 - 3 - 32 - 10 - 1 - 1 - BC
36—7 - 6 - 20 - 17 - 1 - 1 - BC

These substitute calibrations can be employed with ALL brands alike, without further discrepancy. This stabilizing of test results on these three tetrode types is accomplished by subjecting them to a Dynamic Mutual Conductance TRIODE test (**noted above**) instead of the TETRODE data (**noted on roll chart**). The substitute data tests these tubes as triodes, by providing a combined third element action of both plate and screen, which nevertheless provides fully satisfactory and reliable results in addition to eliminating the cause for undeserved tube rejection.