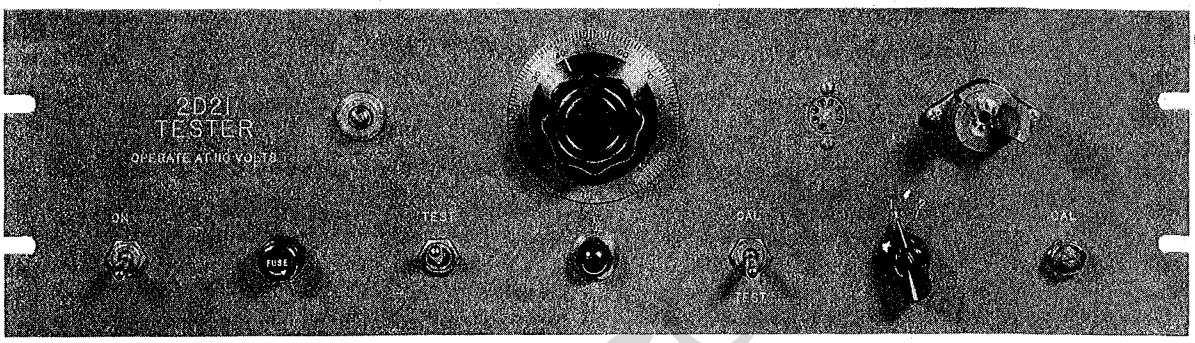
Seeburg

2D21 TESTER

Type 2DT-1



—SPECIFICATIONS—

Equipment Tested:	Type 2D21 Thyratron
Power Requirements:	110 Volts AC, 60 cycle, 30 watts
Panel Mounting:	Relay Rack with standard retma notching
Dimensions:	Width – 19'' Height – 5¼'' Depth (Back of Panel) – 8-3/8'' Depth to clear controls – 9¾''
Net Weight:	11½ Pounds

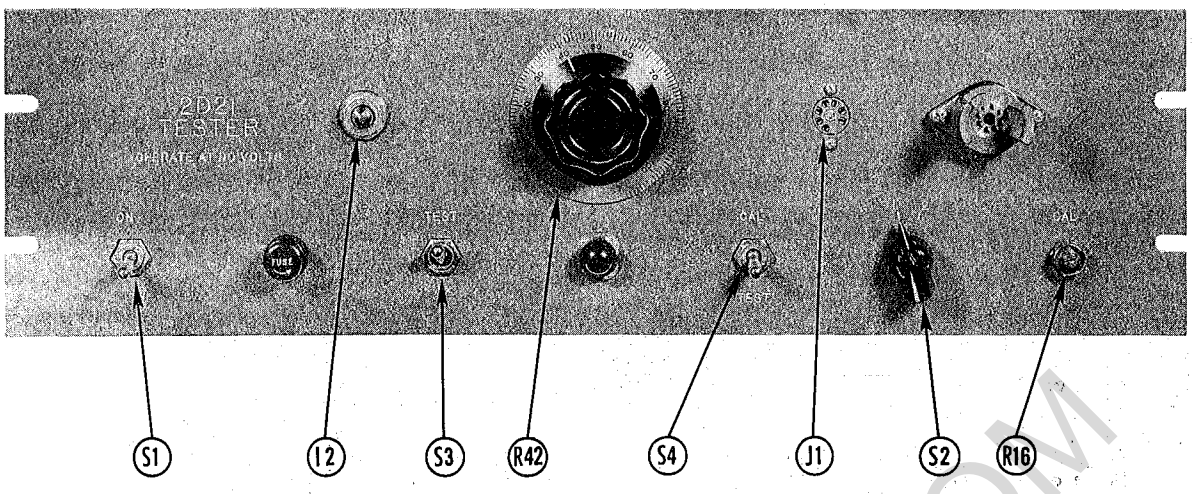


Figure 1.

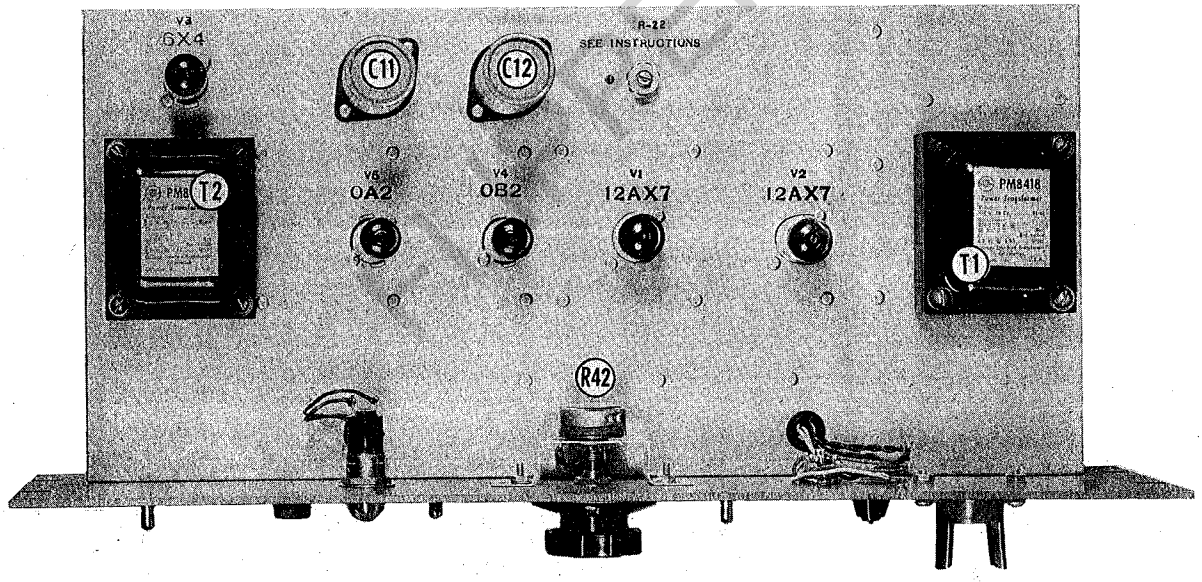


Figure 2.

The Type 2DT-1 Tester is designed to test the Type 2D21 thyratron for use in Seeburg selection and control systems. It will detect complete failures and "borderline" tubes and give positive indication of the tube condition.

Two tests are provided. In one, the tube voltage drop is indicative of the quantity of electrons emitted by the cathode. In this test the tube delivers a peak current several times its rated current for a short pulse and with a relatively long inter-pulse period (low duty cycle). This test determines if the tube is acceptable for use in pulse operation. The second test is a measurement of control grid voltage at which the tube "fires"(ionizes). This test determines if the tube will "fire" when used in trip and stepper service but is not indicative of satisfactory operation unless the tube cathode emission capability is acceptable as indicated by the first test.

In both tests, the tube condition is referred to the position of the control, R42, which is established while using the neon light on the panel as an indicator.

The Tester is assembled on a 19" x 5¼" standard relay rack panel and may be installed in the Seeburg Test Panel or in any standard rack or cabinet. It is designed and calibrated for use at a line voltage of 110 and should be connected to an outlet that is controlled by a Variac or equivalent means of adjusting the supply voltage. Operation at more or less than 110 volts will give higher or lower cathode temperature of the tested tube and result in a corresponding change in the indicated tube condition.

The Tester should be calibrated as directed on this page when it is placed in service and should be checked periodically to compensate for aging of the tubes in it.

A biased diode proves a stable calibration reference voltage. The bias voltage is determined with reference to the diode used in the Tester and is adjusted to the required value at the factory with the sealed screw-driver operated control near the back of the chassis. The diode is quite stable and should not change its characteristics during the life of the instrument. The bias voltage is taken from the supply that is regulated by the OA2 tube, V5, and will not change significantly during the life of the tube or the replacement tubes. An adjustable control is used only to eliminate the requirement, in making the instrument, of selecting resistors that will give the bias voltage needed for the diode in the individual instrument. THE POSITION OF THE CONTROL MUST NOT BE CHANGED UNLESS THE ASSOCIATED FIXED RESISTORS IN THE DIVIDER NETWORK ARE CHANGED. The instrument should be returned to the Factory for basic calibration if these resistors or the position of the control are changed.

CALIBRATION

1. Connect the Tester line cord to a 110-volt, 60-cycle source. Turn on the power with the switch, S1, at the lower left, The pilot light and the instrument tube filaments should light.
2. Allow the instrument to warm up for at least fifteen minutes.
3. Set switch S4 to CALIBRATE (CAL).
4. Set switch S2 to 1.
5. Release lock nut of the CALIBRATE (CAL) control, R16.
6. Hold TEST switch, S3, in down position.
7. Adjust the position of CALIBRATE control, R16, so the neon indicator, I2, flashes at irregular intervals. The correct position of the control is such that a small change to the right (clockwise) will result in no flashes of the indicator light and a small change counter-clockwise will result in regular flashes at a rate of approximately two per second.
8. Release switch S3.
9. Lock R16 in position with the lock nut.
10. Set switch, S4, to TEST.

TUBE TEST

1. Turn on power with switch, S1, at the lower left. The pilot light should light.
2. Set line supply at 110 volts.
3. Allow the instrument to warm up for at least 5 minutes.
4. Insert 2D21 to be tested in socket, J1, and allow 30 seconds for heating.
5. Set Switch, S4, to TEST.
6. Set switch, S2, to 1.
7. Hold switch, S3, in down position.
8. Turn the control knob of R42 to a position at which the neon indicator, I2, flashes at irregular intervals.

   (The reference position of R42 is such that a change of one or two dial divisions to the right (clockwise) will result in no flashes of the indicator light and a change of one or two divisions counter-clockwise will result in regular flashes at a rate of approximately two per second).
9. Read the indicated position of R42 on the dial.

   Tubes having an indicated dial reading of 25 or higher are acceptable for use in the write-in and read-out service of the Tormat selection system. Control positions of 15 to 25 indicate borderline conditions in which the tube will be satisfactory if all other operating conditions are nominal. Tubes should be discarded that are indicated at a control position less than 15 or with which no control position can be found at which the indicator light will flash.
10. Set switch, S2, to 2.
11. Hold switch, S3, in down position.
12. Turn the control knob of R42 to a position at which the neon indicator, I2, glows steadily.

    (The reference position of R42 is such that a change of one or two dial divisions clockwise will result in no glow of the indicator light.)
13. Read the indicated position of R42 on the dial.

    Tubes indicated as acceptable in 8 and 9 and having an indicated dial reading of 15 or higher will operate satisfactory in trip or stepper service. Tubes should be discarded that are indicated at a control position less than 15 or with which no control position can be found at which the indicator light will glow.

OPERATION NOTES

The Tester is designed for use at 110 volts. It is calibrated to indicate the condition of a 2D21 tube so the minimum acceptable tube operation is equivalent to its use in the Tormat Selection System operating at a line supply of 100 volts. Higher or lower line supply to the Tester will give corresponding changes in the indicated tube condition due to changing the cathode temperature of the tube under test and, to some extent, the cathodes of the 12AX7 tubes in the Tester. This characteristic can be used to advantage in gauging the probable behavior of the tube when operating in normal equipment at a line voltage that is above 100 volts. For example, a tube that, in the first test (S2 on 1) may be indicated at 22 – just below the upper limit of the borderline area – with 110-volt supply to the Tester. If the power to the Tester is raised to 117 volts, the indicated tube condition will be higher and will move into the dial range of "acceptable" after its cathode has attained a temperature established by the new condition of heater voltage. Special checks of this nature are indicative only and are no guarantee of tube performance at any particular line voltage condition. They should not be made outside the line voltage limits of 110 to 120 and normal operation of the Tester must be made at 110 volts. Tests below 110 or above 120 endanger the tubes in the Tester and give indications of condition of the tested tubes that are meaningless.

CIRCUIT DESCRIPTION

The tube to be tested is plugged into the socket J1 and has its heater current supplied by the 6.3 volt secondary of T1. When the switch S2 is in position 1, the plate current for the tube is supplied from the condenser C9. C9 is charged by the grounded-positive d. c. from transformer T2 and the 6X4. The supply is held constant at 150 volts by the OA2 voltage regulator V5 across which the divider R35 and R36 is connected. The condenser is charged to approximately 115 volts by the drop across R35. The drop across R36, approximately 35 volts, provides grid bias for the 2D21 that is sufficiently negative with respect to the cathode to prevent plate current flow.

The 12AX7, V2, is a free-running multivibrator developing about seven pulses per second when the Test switch, S3, is closed, Its output is shaped to pulses of short duration by C3 and R14 and is fed through R 7 to the grid of the tested tube. When the grid is driven positive, C9 is discharged through the tube plate circuit of L1, L2 and R15. The resulting negative pulse developed across R15 is coupled through C6 to the pulse transformer, T3, where it is stepped up and inverted in phase so it appears as a positive pulse at the transformer secondary terminals. The amplitude of this pulse is determined by the initial voltage across C9, the plate circuit components and the emissive capability of the tube cathode. The pulse amplitude, then, is a measure of the condition of the tube and is "sensed" by the flip-flop multivibrator 12AX7, V1.

The secondary of T3 is connected through the diode CR2 to the grid of the first section of V1. The diode is biased in opposition to the pulse polarity so no signal reaches the grid of V1 unless its peak amplitude exceeds the bias voltage by enough to start the switching action of the multivibrator. This bias is controlled by R42. It is set by turning the potentiometer to a position that biases the diode so the pulse developed by the 2D21 being tested will result in threshold operation of the multivibrator, V1. This position of R42, referred to its dial scale, is the index of the condition of the 2D21.

The neon light, I-2, indicates when V1 is operating. In the normal, no-signal condition of V1, the second section is conducting so the voltage drop through R13 holds the electrode voltage for the neon light below its ignition level. When V1 is switched by a pulse from the 2D21 under test, the voltage across I-2 rises and the light glows until V1 returns to the no-signal position.

The sensitivity or threshold of operation of the flip-flop multivibrator is established by adjusting the Calibration Control, R16, to a fixed reference signal level. This reference is provided by the bias on the diode CR1 and is used when the Calibrate-Test switch, S4, is in the Calibrate position. In this switch position, the output of the multivibrator, V2, is fed directly to the input of V1 and the peak amplitude is limited by the diode bias. This bias is adjusted at the Factory to a value that provides a known position of R42 for a 2D21 that will give a minimum acceptable pulse for operation in the Tormat Selection System.

In the test in which switch S2 is set to 2 the 2D21 tube in J 1 is connected to an anode supply of 155 volts a. c. supplied from transformer T1. The grid potential for the tube is controlled by the position of the test control, R42, which is switched into a voltage divider across the d. c. supply regulated by the OA2. The bias voltage at which the tube conducts is indicated by the control position at which the indicator I-2 is turned on. The indicator is operated by the voltage drop across resistor R15 when the tested tube is passing current.

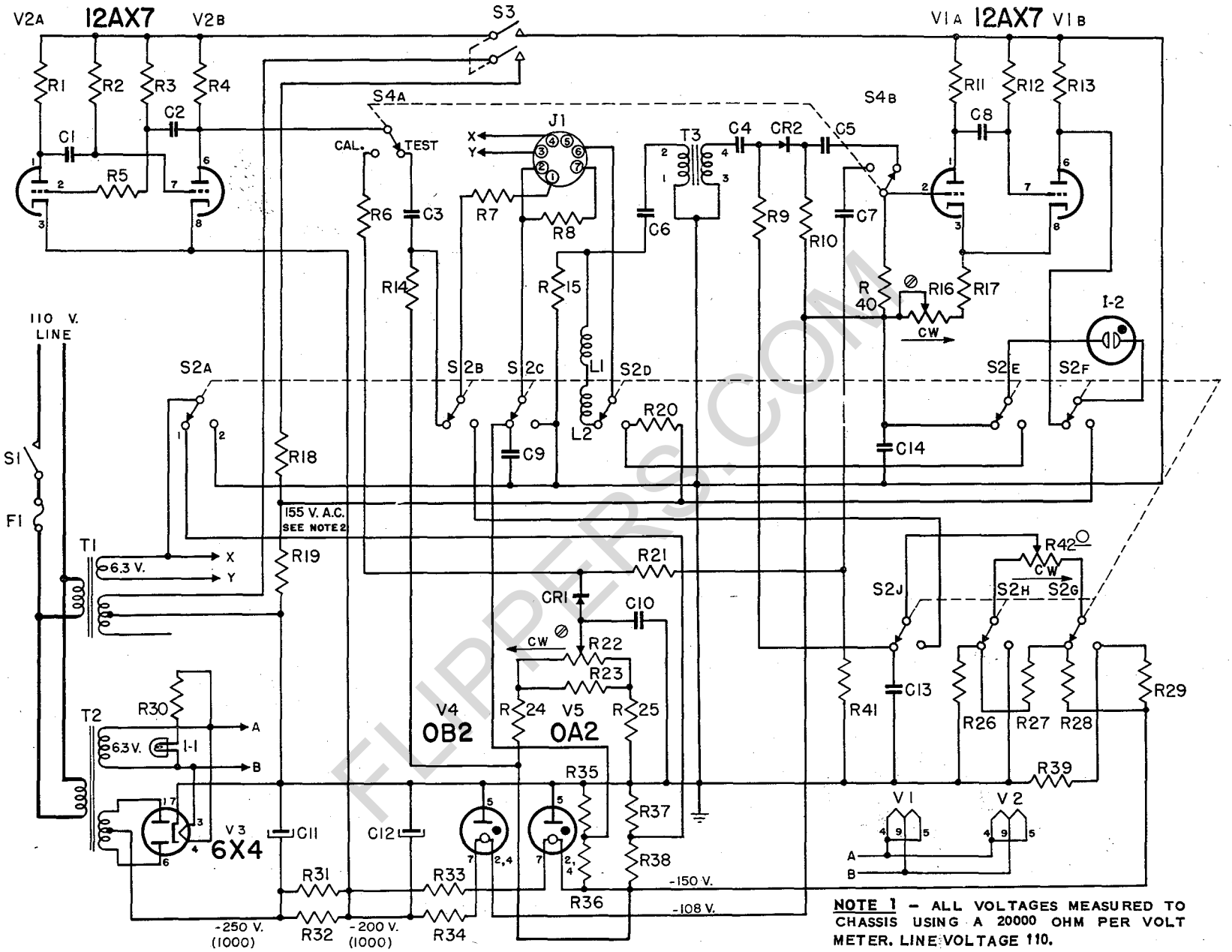


Figure 3. Circuit Diagram

NOTE 1 – ALL VOLTAGES MEASURED TO CHASSIS USING A 20000 OHM PER VOLT METER. LINE VOLTAGE 110.

NOTE 2 – MEASURED WITH S3 CLOSED AND 2D21 REMOVED FROM SOCKET.