TRANSMISSION MEASURING SET PER J94020A

1. GENERAL

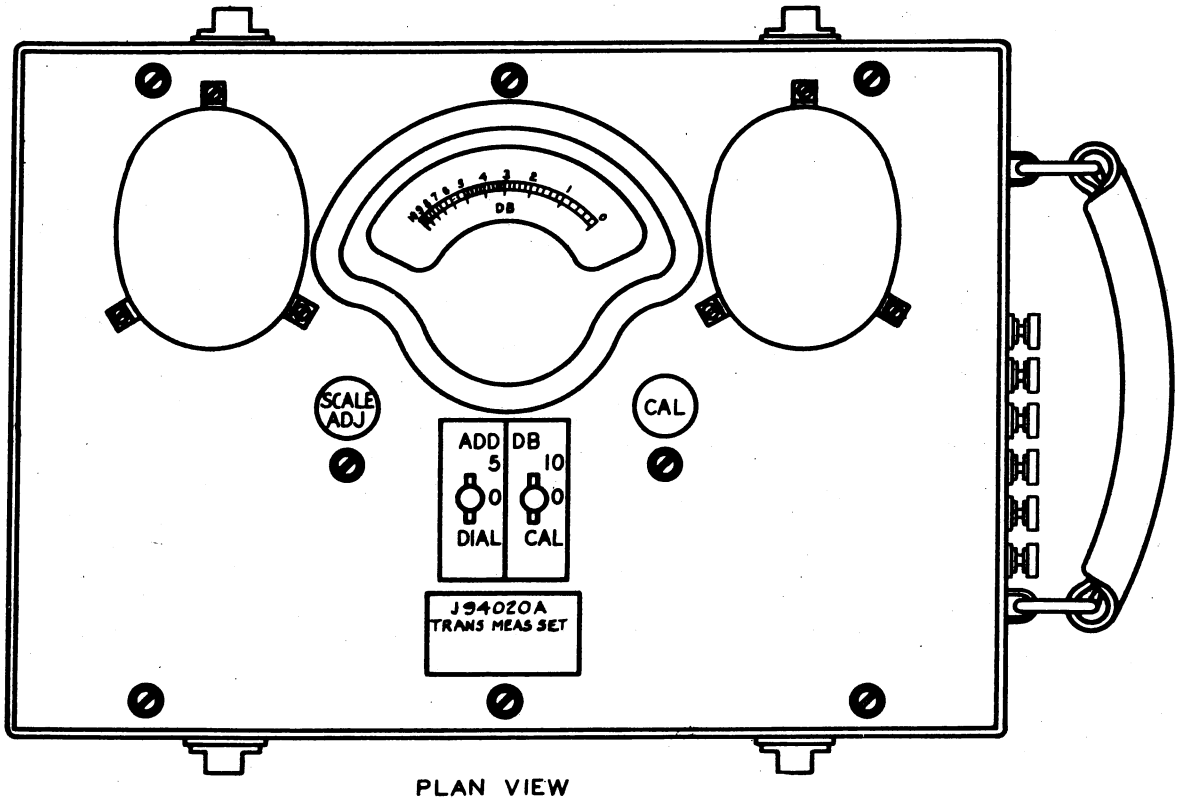
1.01 This section describes the J94020A transmission measuring set which is a portable receiving set for measuring transmission losses from 0-25 db in the 300 to 4000-cycle frequency range. An external source of standard testing power is required for calibrating and for measuring.

1.02 The set contains an amplifier which normally operates from a power source of 60 cycles and 105-125 volts. Connection is made by means of a detachable plug ended rubber insulated cord supplied with the set. When 60-cycle power is not available it can be made to operate from dry cells or regular office batteries in accordance with instructions given on Drawing SD-91016-01.

2. EQUIPMENT AND CIRCUIT FEATURES

2.01 The receiving set is assembled in a size "C" test set casing, the approximate dimensions of which including the cover are 14-3/4" x 10" x 9". It is equipped with a leather carrying handle and weighs 37 pounds. The meter and the adjustable features of the set, consisting of two keys and two potentiometers, are mounted on the surface panel as shown in Fig. 1.

2.02 A cover is provided to protect the surface equipment when not in use. Two vacuum tubes are located beneath the tube guards, one an amplifier, and the other a rectifier. These tubes need not be removed during normal handling of the set. A meter having a 10 db scale range indicates the measured losses directly in db.



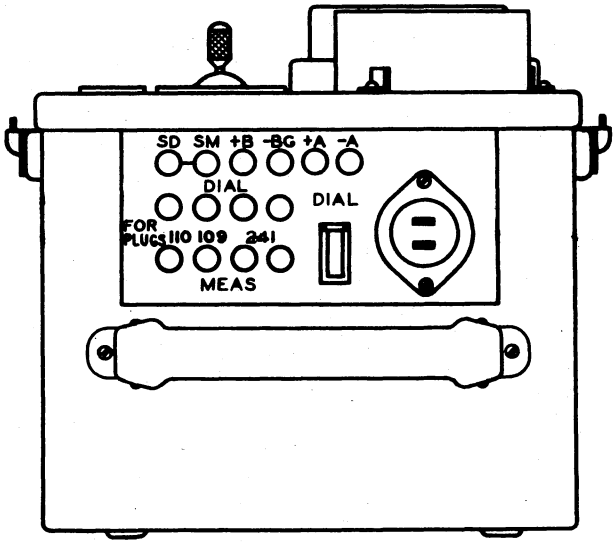
PLAN VIEW

Fig. 1.

The scale is calibrated in .2 db steps between 0 and 5 db and in .5 db steps from 5 to 10 db.

2.03 The lever type keys control the connection of the measuring jacks to the dialing jacks when required for setting up a machine switching connection, the removal of the 5 db and the 10 db pads from the circuit to extend the measuring range of the set to 25 db and the insertion of a 5 db pad when required for calibrating the set. The potentiometers are adjusted by means of screwdrivers when the calibration of the set is required. The potentiometer designated SCALE ADJ adjusts the characteristic of a copper-oxide rectifier to match the meter scale and the one designated CAL compensates for changes in the amplifier gain or rectifier sensitivity.

2.04 The external connections for power supply and for testing are made at the jack panel as shown in Fig. 2.



END VIEW

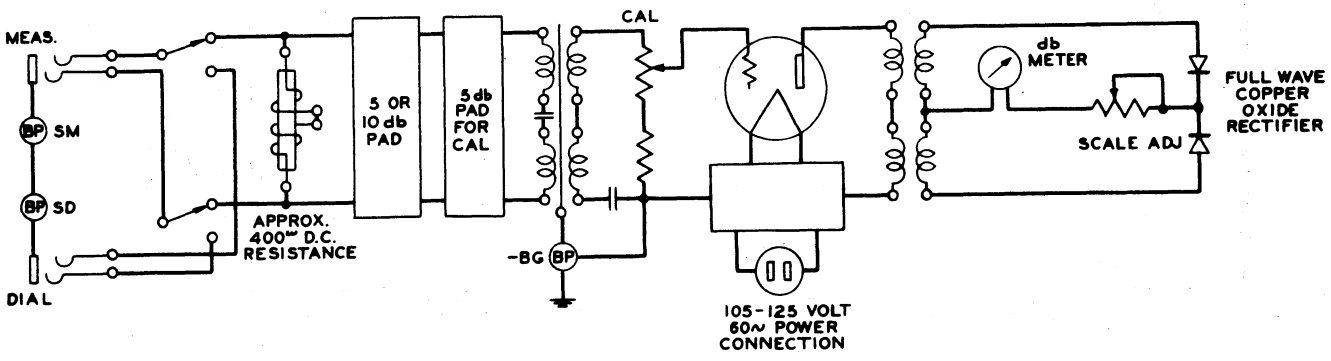
Fig. 2.

2.05 Two groups of jacks are provided for making the test connections to the set. One group of jacks designated MEAS provides for connecting the set to the circuit being measured; the other group designated DIAL provides for connecting a dialing set when required for controlling or establishing connections. The designations indicate the type of plug which may be used with them. One jack designated DIAL is of the same type as the TEST jack on dial equipment. The SD and SM binding posts are in the sleeve circuit and are normally strapped. They permit setting up multiple sleeve circuit connections where required. The -BG binding post should be connected to an office frame ground. The other binding posts are required only when the set is arranged for dry cell or office battery operation.

2.06 The circuit of the measuring set is shown in schematic form on Fig. 3.

2.07 The principal features of the input circuit are jack terminations, a key for connecting the DIAL jacks to the MEAS jacks, a retardation coil for holding a circuit connection when necessary, and a series of pads adjustable in 5 db steps by means of keys to control the calibrating and the testing range. A single stage amplifier supplied from 60-cycle power increases the sensitivity of the set for measuring losses to 25 db and is adjustable by means of a potentiometer over about a 10 db range for purposes of calibration. A full wave copper-oxide rectifier changes the amplified received testing current to direct current to actuate the db meter. The scale adjusting rheostat described above is also shown. A condenser is provided in series with the input transformer to prevent the flow of direct current in this circuit. The input transformer and the condensers in the low and the high sides form a high pass filter to cut off at about 300 cycles.

2.08 The circuit label in the cover of the carrying case shows the detailed ar-



SCHEMATIC DIAGRAM OF CIRCUIT

Fig. 3.

rangement of the jacks, the keys which control the loss pads in the input circuit and the amplifier circuit.

2.09 Three loss pads of the lattice type are provided, two of 5 db and one of 10 db, of which the 10 and one of the 5 db pads are connected in the circuit when the keys are normal. These are removed, respectively, by the operation of the 10 key and the 5 key. The operation of the CAL key connects an additional 5 db loss pad in the circuit for calibrating which produces a mid-scale reading when one milliwatt is supplied to the measuring circuit.

2.10 The loss ranges with indications between 5 and 0 on the meter scale and the respective key positions are given in the following table:

Loss Range - db	Scale Reading	5 Key	10 Key
20-15	5-0	5	10
15-10	5-0	0	10
10-5	5-0	5	0
5-0	5-0	0	0
CAL	5	0	CAL
CAL	0	5	CAL

The positions of the keys are designated with the amount to be added to the meter scale readings to obtain the measured loss in db. When calibrating the set, the amount indicated by the scale and the key are not to be added.

2.11 When 60-cycle power is not available, the set must be changed to operate from dry cells or regular office batteries. One arrangement includes a six-volt storage battery or dry cells for filament supply and three 45-volt dry cells for plate voltage supply. A filament rheostat will be required to adjust the filament supply voltage. Another arrangement makes use of the usual repeater plate and filament supply when available. The required external connections and the internal wiring changes for either arrangement are made to the binding posts of the set as indicated on the circuit Drawing SD-91016-01.

3. TRANSMISSION PERFORMANCE

3.01 The set has been designed for use in offices where the standard testing power of 1 milliwatt is available, in which case it may be calibrated as often as desired. Immediately after calibration its accuracy for the frequency used in calibrating is ± .2 db for the 0-5 range of the meter scale and ± .5 db for the remainder. After the set has been in use for an hour and temperature saturation has been reached the calibration remains constant to within a few tenths db.

3.02 The frequency characteristic of the set is approximately flat from 300 to 4000 cycles so that when calibrated at 1000 cycles the additional error when measuring with frequencies in this range should not exceed ± .5 db. When calibrated at each measuring frequency, this error is eliminated.

3.03 The impedance of the input circuit is approximately 600 ohms for all positions of the keys except "DIAL". For this position the impedance termination supplied to the line under test is dependent on the circuit connected to the dial jacks. Bridged across the input to the measuring circuit is a retardation coil which provides for "holding" a circuit when required.

4. OPERATING FEATURES

4.01 The set should be operated in a horizontal position. Connect the -BG binding post to a building or frame ground and make the connections to the 60-cycle power supply by means of the extension cord.

4.02 The calibration of the set should be checked and readjustments made if necessary as follows:

(a) Connect a one milliwatt source of testing power to the MEAS jacks, using a cord and plug inserted in the jack with a corresponding number designation.

(b) With both keys normal on the set, operate the CAL key.

(c) Adjust the CAL rheostat until a reading of 5 db is indicated on the meter.

(d) Operate the 5 key and adjust the SCALE ADJ rheostat until the meter indicates 0 db. (A slight overadjustment will reduce the number of repetitions of this correction.)

(e) Repeat (b), (c), and (d) until the meter indication is correct at both points without further adjustment of either dial.

(f) Restore the keys to normal and remove the connection to the local source of testing power.

4.03 A circuit can be measured as follows:

(a) With all keys normal on the set, operate the key to DIAL. This connects the DIAL jacks to the MEAS jacks so that a dial or telephone set can be used in obtaining connections over the test line.

(b) Obtain the connection to the source of testing power over the circuit to be tested in accordance with the

procedure given in other sections of Practices, using the MEAS jacks which correspond to the type of plug on the test cord.

(c) Operate the 5 key or the 10 key as required to obtain a meter scale reading between 0 and 5 db, if possible. The key designation added to the meter scale reading is the measured loss of the circuit.

(d) Remove the cord and plug from the circuit to release the connection.

5. MAINTENANCE

5.01 Vacuum tubes used in the set should meet standard tests for tubes of these types. The slide wire rheostat and potentiometer should be maintained in accordance with standard instructions.