TTS-28 PORTABLE STATION TEST SET

DESCRIPTION

CONTENTS

1. GENERAL

1.01 This section covers the description of the TTS-28 portable station test set.

1.02 The Northeast Electronics Corporation Model TTS-28 is a general purpose portable station test set. It provides the functions of a level measuring set which can be operated either on a terminated or bridged basis in a 900-ohm circuit and of the voltage, current, and resistance measuring facilities provided in a multimeter or analyzer. In addition, it provides a through connection from its input terminals to a second set of terminals to which a subscriber set may be connected.

1.03 The different functions which the Model TTS-28 provides are selected by means of a 17-position rotary switch. To use the level measuring and ac voltmeter functions, the power switch must be moved to the ON position.

1.04 The set contains a transistor amplifier for use on the level measuring and ac voltage ranges. The batteries to operate this amplifier and those needed to energize the resistance measuring circuits are located inside in the instrument case.

1.05 The set measures 6 by 7 by 3 inches deep without, and 6 by 7 by 4-3/4 inches deep with the detachable cover in place. These dimensions exclude the carrying handle and rubber feet. The set weighs 4 pounds. Closing the cover will restore the power switch of the transistor amplifier battery to the OFF position. The battery used for the transistor amplifier is a Burgess P6M or equivalent. Two standard penlight flashlight cells provide power for the resistance measuring circuit. Space is provided in the cover for carrying necessary test leads.

1.06 The set should be used in a vertical position.

1.07 Always be certain the power switch is off when the meter is not in use to prevent excessive drain of the batteries.

2. DESCRIPTION

2.01 The Model TTS-28 contains a transistorized amplifier designed to drive the meter for all level measurements and ac voltage measurements. In addition, it provides a through connection from the input (+ and -) terminals to the terminals marked TEL SET and it contains dc voltage, current, and resistance measuring provisions. The front panel view of this set is shown in Figure 1.

LEVEL MEASURING CIRCUIT

2.02 In all level measuring positions of the selector switch a high impedance, high pass filter is inserted between the input terminals and the amplifier input. The filter feeds a voltage divider type of attenuator. The switch arm which selects the tap on this attenuator is connected to the input of the transistor amplifier. This circuit arrangement is shown in the overall schematic, Figure 2.

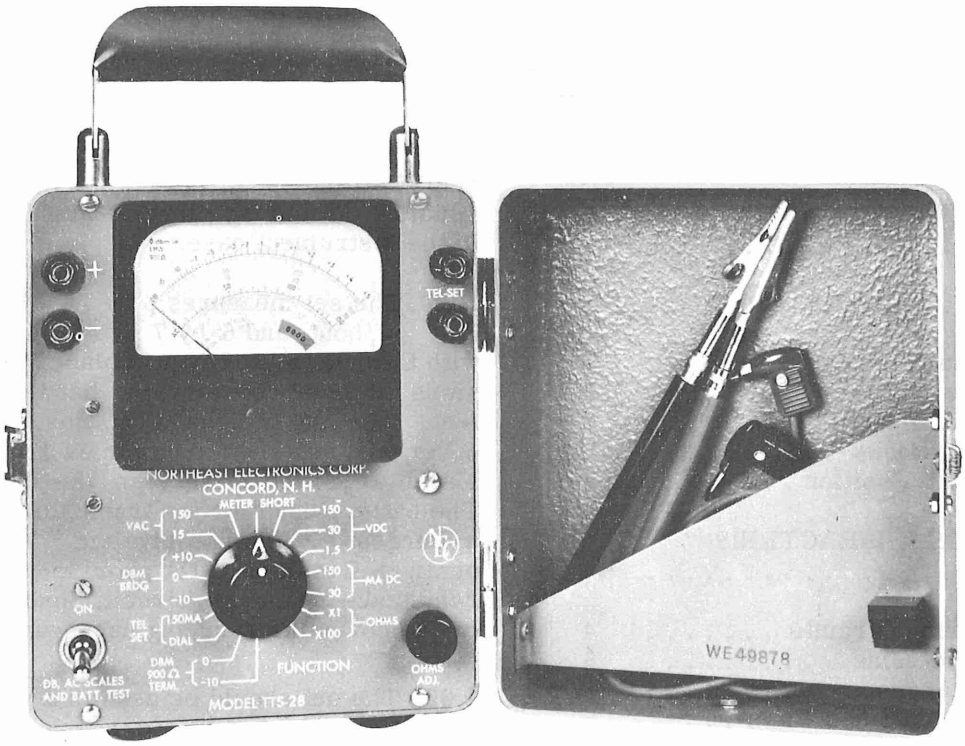

Figure 1 — Front Panel

2.03 The amplifier is a conventional transistor amplifier in which the rectifier bridge supplying the meter is inserted in the feedback path. Specially selected components as well as the use of negative feedback provide stability of effective gain with variations in temperature and battery voltage. The basic circuit of the high pass filter attenuator, the amplifier, and the meter is shown in Figure 3. The amplifier-rectifier combination is designed to deliver approximately 0.5 milliampere in the meter circuit. A 50-microampere meter is required to provide the necessary 20,000 ohms per volt dc sensitivity. Therefore, the meter is shunted when it is used in the amplifier output circuit.

2.04 The amplifier has sufficient gain to provide a 0 dbm meter reading with an input signal of -5 dbm. The meter scale is calibrated from +5 to -15 db. As a result, levels of 25 dbm can be read in the most sensitive position of the attenuator.

2.05 In the bridging position, the filter input is directly connected to the input terminals; in the terminating position, the filter input is shunted by a resistance to provide an input impedance of 900 ohms at 1000 cps. As this resistance is connected directly between the input terminals it also provides a dc holding circuit for the terminal level measuring application.

AC MEASUREMENTS

2.06 For ac voltage measurements, the amplifier input is connected to the input through a suitable voltage divider. In this position the frequency response is ±3 per cent from 50 cps to 20,000 cps.

DC MULTIMETER FUNCTIONS

2.07 The dc multimeter functions are conventional in design and reference to Figure 2 should make the circuits self-explanatory.

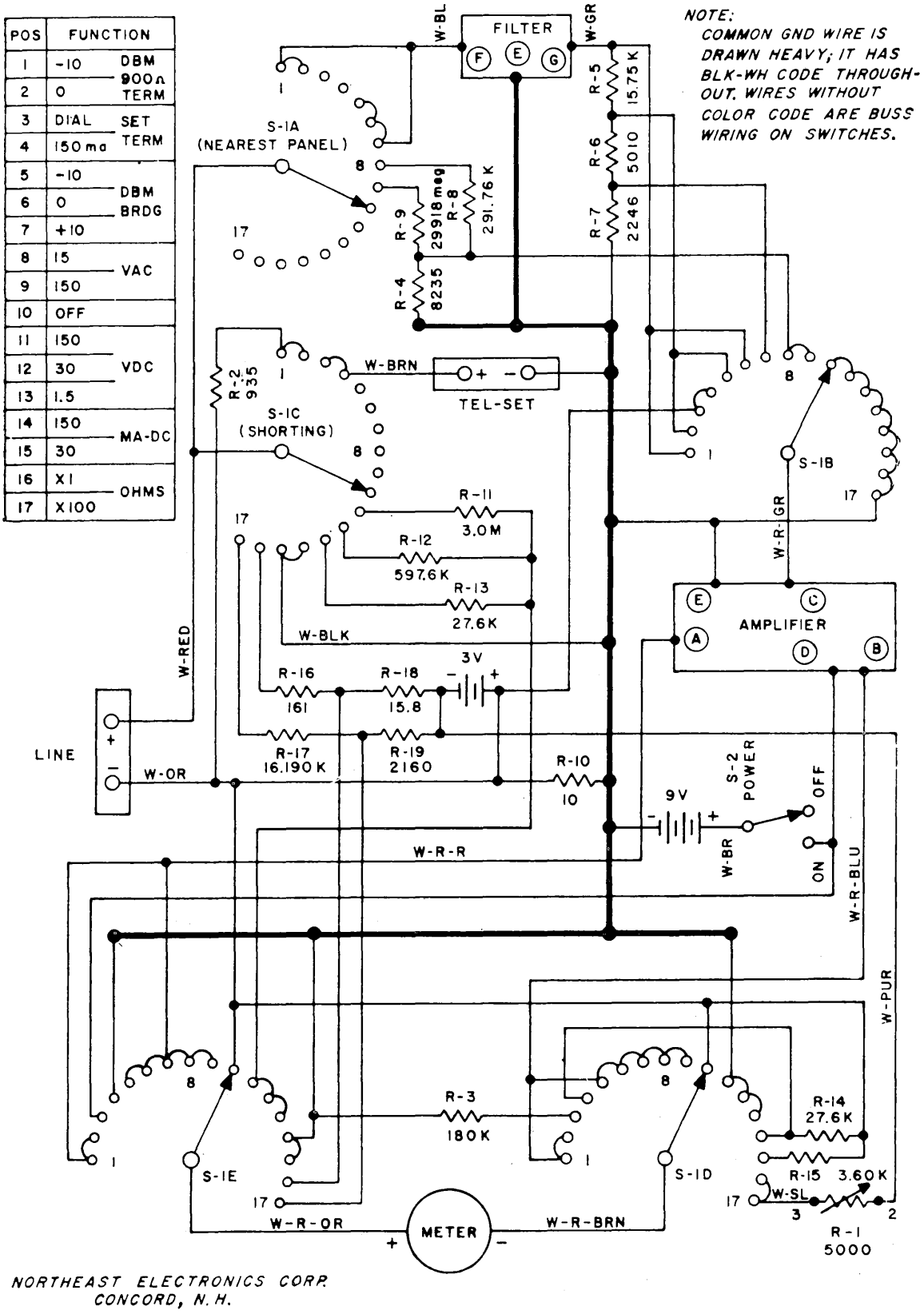

Figure 2 — Model TTS-28 — Schematic

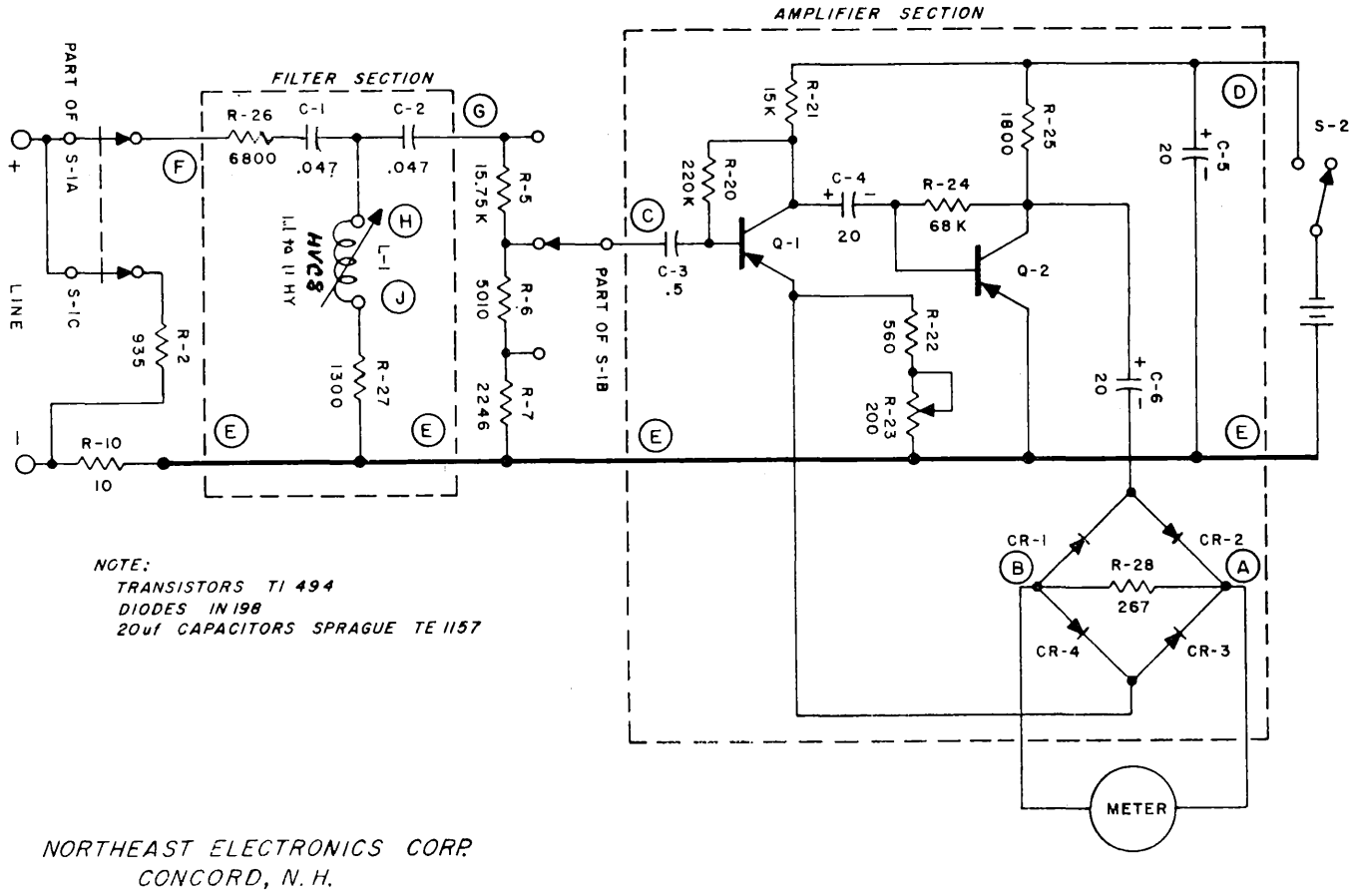

Figure 3 — Model TTS-28 — Level Measuring Circuit

THROUGH CONNECTIONS

2.08 Two positions for through connections between the input terminals and the TEL SET terminals are provided on the rotary switch. One position is marked DIAL. In this position the meter is disconnected from the circuit so that it will not be affected by dial pulses and similar transients. If the power switch is moved to the ON position while the selector switch is in the DIAL position, the meter will indicate the condition of the amplifier battery.

2.09 The second through position inserts a 0-150 ma meter between the input terminals and the TEL SET terminals. This provides a measurement of the input current through the equipment attached to the TEL SET terminals.

METER SHORT POSITION

2.10 In the METER SHORT position, a short circuit is placed across the meter. This position should be used when the meter is being transported or when it is not in use. No circuit is connected to the input terminals in this position of the selector switch.

3. PERFORMANCE CHARACTERISTICS

3.01 The meter face carries the following scales and requires the power switch to be in the position indicated on the following table:

Scale	Range	Color	Power Switch
DB	+5 to -15	Black	On
DC	0 to 150	Red	Off
	0 to 30	Red	Off
AC	0 to 150	Black	On
OHMS	0 to 5K	Green	Off
BATT TEST		Green Arc	On

In addition it carries the following notation: 0 dbm is 1 mw 900 ohms.

LEVEL MEASURING CIRCUITS

3.02 For operation on a 900-ohm terminated basis two level ranges are provided: +5 dbm to -15 dbm, and -5 dbm to -25 dbm.

3.03 The ac impedance of the Model TTS-28 is 900 ohms ±1 per cent at 1000 cps. In the terminated position, a 935-ohm, 3-watt resistor is connected directly across the input terminals to provide a dc holding circuit.

3.04 For operation on a bridging basis, three level ranges are provided: +15 dbm to -5 dbm, +5 dbm to -15 dbm, and -5 dbm to -25 dbm.

3.05 The bridging impedance of the TTS-28 is in excess of 15,000 ohms for frequencies from 625 to 3500 cps.

3.06 The level measuring circuits incorporate a high pass filter. As referred to 1000 cps, the response of the Model TTS-28 is within ±0.3 db from 500 cps to 20,000 cps. At 60 cps the response is down by at least 25 db and at 180 cps by at least 6 db. The level measuring section of the Model TTS-28 is usable to approximately 500 kc, but individual calibration at frequencies above 20 kc is recommended.

3.07 The effects of temperature, battery voltage, attenuator position, and scale nonlinearities are as follows:

Reference Point:	0 dbm on +5 db to -15 db scale; 1000 cps; 70F
Battery Voltage:	6 to 9 volts = ±0.1 db
Attenuator:	+10, 0, -10, = ±0.1 db
Meter Accuracy:	1 per cent of full scale
Temperature:	40 degrees to 120F = -0.3 to +0.1 db

THROUGH CONNECTIONS

3.08 Two positions on the rotary switch provide a through connection for the input terminal (marked + and -) to the terminals marked TEL SET. In the DIAL position the meter is removed from the circuit, in the second position a 0-150 ma dc range is provided to measure the current in the TEL SET. A 10-ohm meter shunt is inserted between the two pairs of terminals in these positions.

MULTIMETER RANGES

3.09 AC voltage measurements are provided in two ranges, namely: 0-15 volts and 0-150 volts. The accuracy of these meter ranges is ±3 per cent full scale. The frequency response on the ac scales is within ±3 per cent from 50-20,000 cps. The meter impedance is in excess of 15,000 ohms per volt.

3.10 DC voltage measurements are provided in three ranges, namely: 0-1.5 volts, 0-30 volts, and 0-150 volts. The accuracy of these ranges is ±3 per cent of full scale and the meter impedance is 20,000 ohms per volt.

3.11 DC current measurements are provided in two ranges, namely: 0-30 ma and 0-150 ma. The accuracy of these ranges is ±3 per cent of full scale. When used to measure dc currents a resistance of 10 ohms appears between the input (+ and -) terminals.

3.12 Resistance measurements are provided in two ranges, namely: 0-5,000 ohms and 0-500,000 ohms. The center position of the meter pointer corresponds to a reading of approximately 200 ohms on the lower and 20,000 ohms on the higher scale.

BATTERIES

3.13 A Burgess P6M or equivalent 9-volt battery is used for the amplifier. For intermittent operation, the normal life of the amplifier battery is over 200 hours. Two penlight flashlight batteries are used for the resistance measuring circuit. They are Burgess No. Z Type AA (1.5 volts) or equivalent.

METER SHORT

3.14 In the METER SHORT position of the rotary switch, the meter is shorted. The selector switch should be turned to this position to provide electrical damping for the meter when it is being transported or when it is not in use. In this position the input terminals are open.

4. MAINTENANCE

4.01 Normally the set should need no maintenance other than replacing worn-out batteries and an occasional check on the calibration of the dbm meter operation.

4.02 The amplifier battery should be tested in accordance with the instructions outlined in the section covering the test methods. If the test shows a worn-out battery, replace it with a Burgess P6M 9-volt transistor battery or equivalent.

4.03 The batteries used in the OHMS circuit should be tested in accordance with the section covering the test methods. If the batteries are defective, they should be replaced with two 1-1/2 volt Burgess No. Z, size AA batteries or equivalent.

4.04 Replacing test leads may be obtained on order by specifying:

"(Quantity) Set of Test Leads For TTS-28 Portable Station Test Set. Obtain from Northeast Electronics Corporation, Concord, New Hampshire."

4.05 The procedure for checking the calibration of the dbm meter operation is covered in the section outlining the test methods.