SECTION 3

AMPLIFIER TESTERS: TE2 SERIES

TRANSISTOR AMPLIFIER TESTER TE2/1

Introduction

This tester provides access to the input and output terminals of standard BBC plug-in audio units, and enables a.c. measuring equipment to be connected. The tester contains a 24-volt d.c. power supply unit together with programme and d.c. test meters. It is built on two panels (Fig. 3.1) suitable for bay mounting.

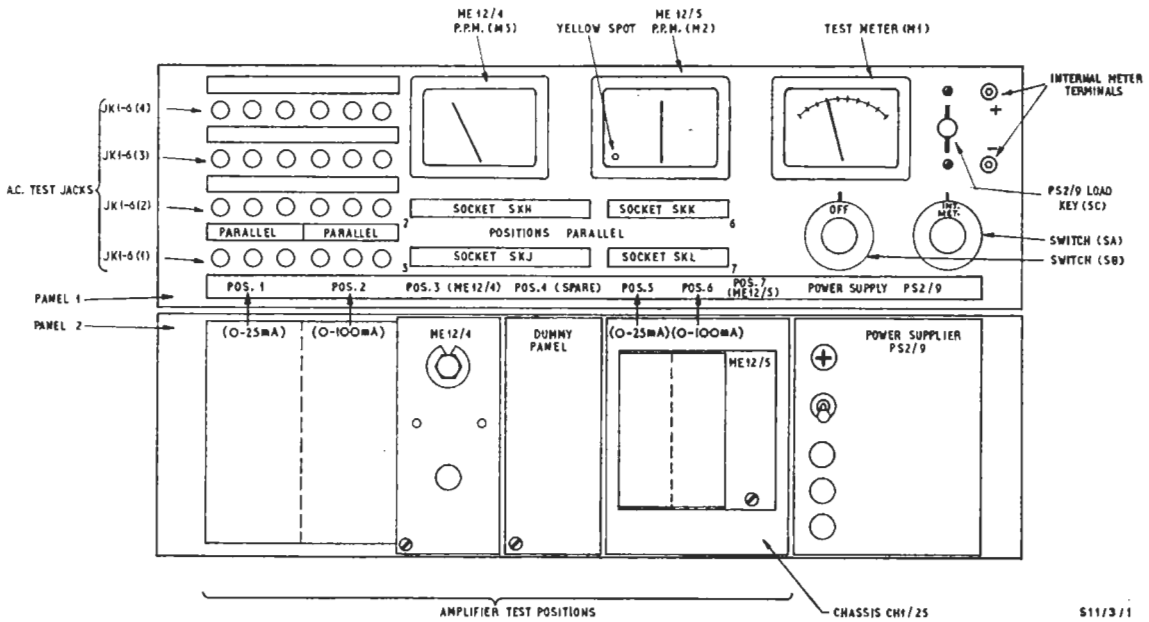

Fig. 3.1. Transistor Amplifier Tester TE2/1: Panel Layout

Drawing No. DB 12806

General Description

A standard PN3/23 housing, as shown in the lower part of Fig. 3.1, accommodates the audio units to be tested. Each position which accepts a unit is denoted by a number, the extreme left-hand position being designated *1*. Programme meter amplifiers ME12/4 and ME12/5 are fitted to positions 3 and 7 respectively and form part of the tester. Position 4 is fitted with a dummy panel and is unwired. Position 8 contains the power supplier PS2/9 which provides a 24-volt d.c. supply to the units under test. Positions 1, 2, 5 and 6 remain vacant and are available for the acceptance of units to be tested.

Another panel containing three test meters and a small jackfield is mounted above the PN3/23, as shown in the upper part of Fig. 3.1, and is connected to it by means of three 18-way plugs and sockets. The input and output tags associated with each test position on the lower panel are connected via the 18-way plugs and sockets to individual positions on the jackfield. Two of the test meters are associated with the programme meter amplifiers ME12/4 and ME12/5 respectively. The third meter is used for measuring the supply current to the unit under test; this meter may also be used as a general purpose ammeter or voltmeter.

A set of three types of extension lead is provided with each tester so that units may be connected to the test panel while being examined in more detail

on a bay shelf or bench.

Mains power units other than a power supplier PS2/9 cannot be tested directly with the TE2/1.

Circuit Description (Fig. 4)

The output from the power supplier is fed via capacitor C1 to test jack JK6 (2). Ripple voltage appears on this jack and may be examined by means of external test equipment.

With switch SA set to *PS2/9 Volts*, the 24-volt supply is extended to test meter M1 via the plug and socket *P* and resistor R16. The latter is a multiplier and causes the meter to behave as a voltmeter with a full-scale deflection of 25 volts. Hence with test positions 1 to 7 vacant the meter registers the open-circuit voltage delivered from the power supply unit. A full-load condition of 500 mA is applied by operating key SC (*PS2/9 Load*), which connects resistor R17 in parallel with the supply output and at the same time disconnects all supply lines to the test positions.

Resistors R6, R7, R8, R11, R12 and R15 are meter-shunt resistors and are connected in series with the supply lines to test positions 1 to 7. Test meter M1 may be connected across any of these shunts by means of switch SA, so that the individual current feed to each unit under test may be measured.

When switch SA is set to position 1 (*Int. Met.*), test meter M1 is extended to a second switch SB. The latter is connected to the terminals designated *Internal Meter* and also to a universal shunt and multiplier for current and voltage measurements. The universal shunt consists of resistors R1, R2 and R3, which provide the 100-mA, 25-mA and 2·5-mA ranges respectively. Resistors R4 and R5 are multipliers and are switched in series with the meter to provide the 2·5-volt and 25-volt ranges respectively. The instrument is protected against overload by means of two silicon diodes MR1 and MR2 which are connected in parallel with the meter. The movement has a full-scale deflection of 100 μA, and a sensitivity corresponding to 10,000 ohms/volt.

It is built out to give a 300-mV drop at full-scale deflection.

Allocation of Test Positions

Test positions 1 and 2 are allocated for testing those types of audio transistor units which employ a standard plug-in chassis CH1/18C. Position 1 is reserved for units which draw up to a maximum of 25 mA and position 2 for units drawing up to a maximum of 100 mA.

Position 3 is reserved specifically for testing a programme meter amplifier ME12/4.

Test positions 5 and 6 are allocated for testing units housed in a miniature chassis CH1/19. Position 5 is reserved for units which draw up to a maximum of 25 mA and position 6 for units drawing up to a maximum of 100 mA.

Position 7 is reserved specifically for testing a programme meter amplifier ME12/5.

Position 8 is required for the housing of the power supplier, PS2/9, which should be removed if it is necessary to test another supply unit of this type.

Operation

Measurement of Power Supply Voltage

Operate switch SA to *PS2/9 Volts*. The voltage indicated on the 25-volt range of test meter M1 should be 25 ±0·5 volts, with no amplifiers fitted in any of the test positions.

Voltage Regulation of Supply Unit

Under the same conditions as those mentioned in the paragraph above, the key designated *PS2/9 Load* should be depressed and the change in voltage indicated by test meter M1 noted. This variation should not exceed 0·5 volt.

Measurement of Ripple on a Power Supply Unit

Connect the high-impedance input of an amplifier-detector to the jack designated *Ripple PS2/9*. The indication on the amplifier-detector should be better than −70 dB with the *PS2/9 Load* key depressed.

Measurement of Supply Current to a Unit

Plug the unit to be tested into an appropriate test position on the lower panel and set switch SA to the position number and range required. The current supplied to the unit will be indicated by test meter M1.

A unit which is mounted on a chassis other than the CH1/18C or CH1/19 cannot be plugged into any of the test positions. Units of this type may still however be connected for d.c. current feed measurements by the use of extension leads.

A.C. Testing of a Unit

Plug the unit to be tested into an appropriate test position on the lower panel and apply tests in accordance with the individual unit specification. It will be noted that all the test jacks are designated according to position and function.

Test positions 5 and 6 are each provided with two

input jacks. The microphone amplifier AM9/5, in particular, employs two inputs.

Test positions 1 and 2 are each provided with three output jacks. The line sending amplifier AM7/2, in particular, employs all three outputs. These three jacks are designated *Output 1*, *Output 2* and *Main Output*. This last is employed for an amplifier with a single output.

Testing of Programme Meter Amplifiers ME12/4 and ME12/5

Replace the appropriate programme meter amplifier with the one to be tested and test in accordance with the individual unit specification. The programme meter associated with the amplifier ME12/5 is distinguished by a yellow spot on the dial face.

If the amplifier requires adjustment of the preset internal controls these can be made accessible by the use of the relevant extension lead.

Use of Internal Meter M1 as a Multirange D.C. Test Meter

Set switch SB to the current or voltage range required and set switch SA to the position marked *Int. Met.* Access to the meter is obtained by connecting probe leads to the terminals marked *Internal Meter.*

Use of Extension Leads

Plug an appropriate extension lead to the relevant *Positions Parallel* socket on the front of the upper panel, and connect the amplifier under test to the free socket on the lead. Tests can then be carried out as if the amplifier were plugged to the parallel test position on the lower panel except that the inside of the amplifier will be exposed for more detailed examination. During this test it is necessary for the parallel test position on the lower panel to remain vacant.

Testing and Maintenance of TE2/1

Test Equipment Required

Variable source of d.c. up to 25 volts
1000-ohm rheostat or resistors
Tone source
Avometer Model 8
Amplifier-detector
Oscilloscope

General Tests

Check the PS2/9 output voltage on open circuit with test meter M1. The reading should be 25 $\pm$0·5 volts. Apply a 500-mA load by depressing the *PS2/9 Load* key. The voltage on load should not differ from the open-circuit voltage by more than 0·5 volt.

Connect the oscilloscope to the jack designated *Ripple PS2/9* and ensure that ripple is present. The ripple level should be measured with the amplifier-detector, using the latter in the high-impedance mode. The measurement should give a result better than —70 dB.

Each test position on the lower panel should be checked by plugging in appropriate amplifiers. The presence of current feed may be checked by means of test meter M1. The continuity of the wiring to the input and output test jacks should be checked by connecting tone to the input jack and a detecting instrument such as an oscilloscope to the associated output jacks. In the case of programme meter amplifiers ME12/4 and ME12/5, zero-level tone should be applied to the respective input jack and the associated programme meter checked for correct reading.

The extension leads should be checked for continuity.

Testing Meter M1

In order to test the general purpose ammeter/voltmeter, switch SA should be set to *Int. Met.* and the appropriate range selected by means of switch SB. Reference voltage or current should be applied to the terminals marked *Internal Meter*, and using an Avometer Model 8 as a standard test meter, M1 should be checked for correct reading. If the variation in the readings between the Avometer and the test meter exceeds 4 per cent of full-scale deflection, it will be necessary to repeat the test using a substandard instrument as a reference. If as a result of the subsequent test the error still exceeds 2 per cent of full-scale deflection, it will be necessary to locate the fault in the tester TE2/1 and rectify it.

To assess the accuracy of meter M1 in making current feed measurements, all units should be removed from test positions 1 to 7 inclusive, and switch SA set to measure the current of test position 2.

Connect the rheostat or resistors (about 250 ohms) in series with the Avometer, the latter having been set to the 100-mA d.c. range. Using test probes, connect the series combination to tags 9 and 10 of socket SKH, which is one of the four *Positions Parallel* sockets on the upper panel. Adjust the rheostat or resistors to give a 100-mA (full scale deflection) reading on the Avometer. The current

read on the test meter M1 should not disagree with this Avometer reading by more than 4 per cent. This test should be repeated for test positions 3 and 6 using sockets SKJ and SKK respectively.

The accuracy of the meter M1 in measuring current feeds to test positions 1, 5 and 7 can best be measured by a similar procedure to that given above for positions 2, 3 and 6 except that the rheostat or resistors should now be adjusted (about 1,000 ohms) to give full scale deflection on the Avometer on its 25-mA range. Test position 7 has a parallel socket SKL, but extension leads are necessary for measurements on test positions 1 and 5.

To determine the accuracy of the meter in measuring the voltage of the PS2/9 power supply, set the Avometer to an appropriate range for measuring up to 25 volts d.c. and connect the instrument between tags 9 and 10 of socket SKH. Switch SA should be set to *PS2/9 Volts* and the reading of test meter M1 compared with that of the Avometer. The variation in the two readings should not exceed 0·5 volt.

C.W.P.M.(X) 4/65

PANEL 1

METER SHUNTS FOR POSITION CURRENT FEEDS

-24V FEEDS TO TEST POSITION SOCKETS

RIPPLE OUTPUT FOR FEED TO ∞ AMP DET

JK6(2)

50A R17A R17 500mA LOAD

SC(N/L) TO(2) (ANCHOR TAG)

PS2/9 LOAD KEY

PLP (16) PLP (17)

C1 2

(PANEL 2)

A.C MAINS L N E

SKG(1) SKG(2) SKG(3) SKG(15)

POWER SUPPLIER PS2/9

SKG(9) SKG(10) 24V

SKP (4) PLP (4)

SKP (5) PLP(5)

R16 0-25V (PS2/9 VOLTS)

R6 0-25mA S19 PLP (12) SKP(12) SKF(9) TEST POS.7 (ME12/5)

R7 0-100mA S21 PLP (9) SKP(9) SKC(9) TEST POS.3(ME12/4)

R8 R9 0-100mA S6 PLP (11) SKP(11) SKF(6) TEST POS.6

R10 R11 0-25mA S9 PLP (10) SKP(10) SKE(6) TEST POS.5

R12 R13 0-100mA S12 PLP (8) SKP(8) SKB(9) TEST POS.2

R14 R15 0-25mA S16 PLP (7) SKP(7) SKA(9) TEST POS.1

S1 S14 S15 S10 S11 S7 S8 S4 S5 S20 S18

NOTE STRAPS

PS2/9 V INT MET SA(b)4 SA(b)6 SA(b)8 SA(b)10 SA(a)

PLP (5) SKP(5) + EARTH FOR ALL TEST POS. SKA(10)

UNIVERSAL SHUNT AND RESISTORS FOR MULTI-RANGE USE OF TEST-METER

R1 0-100mA R2 0-25mA R3 0-2·5mA R4 0-2·5V R5 0-25V

S25 S26 S28 S29 S22 S23 S24

6(25V) 5(2·5V) 4(2·5mA) 3(25mA) 2(100mA)

M1 RANGE SWITCH

OFF SB(a) T M1 INTERNAL METER TERMINALS

OFF SB(b) T

S3 MR1 SX640 MR2 SX640 M1 0-100μA S2 TEST-METER mA/V

INTERNAL METER PS2/9 VOLTS & CURRENT FEED SWITCH

SA(b) INT MET SA(a)3 SA(a)5 SA(a)7 SA(a)9 PS2/9 VOLTS

POS.2 PARALLEL SKH

PARALLELED WITH SKB VIA PLUGS PLM & PLN

POS.3 PARALLEL SKJ

PARALLELED WITH SKC VIA PLUGS PLM, PLN & PLP

POS.6 PARALLEL SKK

PARALLELED WITH SKS VIA PLM. R21 10k PARALLELED WITH SKS VIA PLN

POS.7 (ME12/5) PARALLEL SKL

PARALLELED WITH SKT VIA PLUGS PLM, PLN & PLP

TEST POSITIONS SOCKETS (PANEL 2)

TEST POS.1 SKA

-24V FEED FROM SKP(7)

+ EARTH FROM SKP(5)

TEST POS.2 SKB

-24V FEED FROM SKP(8)

TEST POS.3(ME12/4) SKC

-24V FEED FROM SKP(9)

TEST POS.5 SKR

-24V FEED FROM SKP(10)

R19 10k

PLE & SKE

TEST POS.6 SKS

R20 10k

PLF & SKF

TEST POS.7 SKT

FROM SKP (11)

-24V FEEDS

FROM SKP (12)

CH1/25 INCLUDES SKR, SKS & SKT ALSO PLE & PLF DOES NOT INCLUDE SKE & SKF

TEST JACKS (PANEL 1)

SKM(1) PLM(1) SKM(2) PLM(2) POS.1 INPUT JK1(4)

SKN(1) PLN(1) SKN(2) PLN(2) POS.1 OUTPUT 1 JK1(3)

SKN(3) PLN(3) SKN(6) PLN(6) POS.1 OUTPUT 2. JK2(3)

SKN(4) PLN(4) SKN(5) PLN(5) POS.1 MAIN OUTPUT JK3(3)

SKM(3) PLM(3) SKM(6) PLM(6) POS.2 INPUT JK2(4)

SKN(7) PLN(7) SKN(8) PLN(8) POS.2 OUTPUT 1 . JK4(3)

SKN(9) PLN(9) SKN(12) PLN(12) POS.2 OUTPUT 2. JK5(3)

SKN(10) PLN(10) SKN(11) PLN(11) POS.2 MAIN OUTPUT JK6(3)

SKM(15) PLM(15) SKM(18) PLM(18) POS.3 (ME12/4) INPUT JK3(2)

SKP(1) PLP(1) S30 R18 2k M3 PPM.(ME12/4)

SKP(2) PLP(2) S27

SKM(4) PLM(4) SKM(5) PLM(5) POS.5 600Ω INPUT JK3(4)

SKM(7) PLM(7) SKM(8) PLM(8) POS.5 60Ω INPUT JK4(4)

SKN(13) PLN(13) SKN(14) PLN(14) POS.5 OUTPUT JK1(2)

SKM(9) PLM(9) SKM(12) PLM(12) POS.6 600Ω INPUT JK5(4)

SKM(10) PLM(10) SKM(11) PLM(11) POS.6 60Ω INPUT JK6(4)

SKN(16) PLN(16) SKN(17) PLN(17) POS.6 OUTPUT JK2(2)

SEE NOTE 2

SKP(3) PLP(3) S13 M2 P.P.M (ME12/5)

SKP(6) PLP(6) S17

SKM(16) PLM(16) SKM(17) PLM(17) POS.7 ME12/5 INPUT JK4(2)

SPARE JK5(2)

JACKS 1-6(1) PARALLELS

NOTES 1. TAGS DESIGNATED 'S' ARE ON A PRINTED CARD MOUNTED ON THE REAR OF THE THREE METERS M1, M2 AND M3.

2. TEST POSITIONS 5 AND 6 SPECIFICALLY ARRANGED AND DESIGNATED FOR AMPS AM9/5, BUT UNITS EMPLOYING SIMILAR TAG ALLOCATIONS FOR INPUT, OUTPUT AND SUPPLIES MAY BE TESTED IN THESE POSITIONS.

PLU (FOR PLUGGING TO PARALLEL SOCKETS SKH & SKJ)

SKU(5) SKU(6) SKU(7) SKU(8) SKU(9) SKU(10) SKU(11) SKU(12) SKU(13) SKU(14) SKU(15)

SKU R22 10k

PLU(5) PLU(6) PLU(7) PLU(8) PLU(9) PLU(10) PLU(11) PLU(12) PLU(13) PLU(14) PLU(15)

FLEXIBLE EXTENSION LEADS FOR EXTERNAL CONNECTION OF AMPS. OR UNITS.

PLV SKV(1) SKV(3) SKV(2) SKV(3) SKV(5) SKV(6) SKV(8) SKV(9) SKV(10)

SKV

PLV(1) PLV(3) PLV(2) PLV(3) PLV(5) PLV(6) PLV(8) PLV(9) PLV(10)

PLW SKW(1) SKW(2) SKW(3) SKW(4) SKW(5) SKW(6)

SKW

PLW(9) PLW(10) PLW(10) PLW(8) PLW(3) PLW(1)

TRANSISTOR AMPLIFIER TESTER TE2/1 : CIRCUIT

TE2/1