PYE TVT

Service Manual

This service manual is for the maintenance of Pye T.V.T. equipment. The performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

The right is reserved to alter the equipment described in this manual in the light of future technical development.

PEAK PROGRAMME METERS

4056/01 and /02

4064/00 and /01

575

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A member of the Pye of Cambridge Group

C O N T E N T S

SECTION 1 - INTRODUCTION

The function of a peak programme meter is to indicate the peak value of an audio programme signal. The indication allows a satisfactory modulation amplitude to be maintained whilst minimising the danger of overloading equipment used in the system. The meter may be switched to monitor various parts of the system, and thus allows the level of programme signals to be checked at required points.

The peak programme meter units described in this manual are complete units, and include the amplifier and the meter.

Two types of units are covered in the manual, each type having two versions. The types differ only in the physical size of the units, the versions differ only in the meter scale used, each type having one standard scale and one extended scale version of the meter.

Circuit arrangements permit the feeding of one or two external slave meters.

The units engage automatically with the associated circuits when correctly inserted into their appropriate positions in the system.

SECTION 2 - SPECIFICATION

Meter Scale (Linear, calibrated in divisions of 4 dB each)

4056/01	calibrated	B A 1 to 7
4056/02	"	1 to 7
4064/00	"	1 to 7
4064/01	"	B A 1 to 7

Frequency Response (Measured at 30 c/s to 15 kc/s)

±1 dB Relative to 1 kc/s

Sensitivity

-4 dBm to read 4 on the meter
-24 dBm " " " " " " when
under BOOST SENSITIVITY conditions.

Input Impedance (Measured at 60 c/s, 1 kc/s, and 8 kc/s)

Greater than 10k ohms ± j2·5k ohms.

Attack Time

Less than 1 milli-second
(adjusted to 2·5 milli-seconds in factory)

Decay Time

8 dB per second.

Stability

±0·05 dB

Input Isolation

Greater than 50 dB.

Supply Requirements

Circuit	100 mA d.c. at 16V
Meter	60 mA d.c. at 24V

Overall Approximate Dimensions

	4056/01 and /02			4064/00 and /01		
Height	$5\frac{3}{4}$ in.	($14\frac{1}{2}$ cm)		$5\frac{3}{4}$ in.	($14\frac{1}{2}$ cm)	
Width	$5\frac{3}{4}$ in.	($14\frac{1}{2}$ cm)		$2\frac{3}{4}$ in.	(7 cm)	
Depth	$9\frac{1}{4}$ in.	($23\frac{1}{2}$ cm)	*	$9\frac{1}{4}$ in.	($23\frac{1}{2}$ cm)	*

* Includes handle and connector.

Approximate Weight

4056/01 and /02		4064/00 and /01	
$3\frac{3}{4}$ lb	(1.7 kg)	3 lb	(1·35 kg)

SECTION 3 - INSTALLATION AND SETTING-UP

3.1 INSTALLATION

3.1.1 Cautionary Note

All systems which contain units using transistors or other semiconductor devices should incorporate efficient arrangements for keeping the transistors at a reasonable working temperature. If a group of amplifiers or other transistorised units is to be used, and an adequate supply of free flowing air is not available, then forced cooling is advisable.

3.1.2 Preparation

If the unit is part of a Pye T.V.T. installation, the voltage and polarity of the supply will have been correctly adjusted, and the unit should be inserted into its compartment as instructed in Section 3.1.3 of this manual.

If the unit is not part of a Pye T.V.T. installation, or is in addition to an existing installation, then carry out the instructions given in the appendix 'Unit Mounting and Wiring Techniques'.

3.1.3 Insertion and Withdrawal

(a) Check that the power supplies are switched off before inserting or withdrawing the unit.

(b) To insert the unit: grasp the handle, and without touching the small catch located inside the handle area, slide the unit fully home into its compartment. Slightly pull the unit to ensure it is secure in the compartment.

(c) To withdraw the unit: grasp the handle so as to lift the small catch inside the handle area. The unit may then be pulled out.

For explanation of certain points in the foregoing, attention is drawn to the appendix 'Maintenance Precautions on Semiconductor Units'.

3.2 SETTING-UP

3.2.1 Controls

There are four external controls positioned on the front panel of the unit, they are:

(a) METER DIM.

This is rotary control used to adjust the intensity

of the meter illumination to the requirements of the operator.

(b) BOOST SENSITIVITY

This is a non-locking push-button switch. When the push-button is held down the sensitivity of the unit is increased by 20 dB, low-level signal readings are then brought (temporarily) 5 divisions up the meter scale, and are thus able to be easily and more accurately read.

(c) SET ZERO

This is a preset control used to set the meter pointer to the left hand (electrical) zero position of the meter.

(d) SET SENS.

This preset control enables the overall sensitivity of the meter circuit to be varied.

Four internal preset controls are provided, they are adjusted at the factory before the unit is despatched, and readjustment is not normally necessary unless the unit requires recalibration. The controls are:

(a) RANGE

The range control enables the ratio of decibels to scale length to be expanded or compressed as required.

(b) BALANCE

The balance control enables the d.c. control pulses to the logarithmic diode system to be equalised between the two diodes.

(c) ATTACK TIME

The attack time control allows the response time of the meter amplifier to be adjusted to any desired time between the upper and lower limits.

(d) SET LAW

The set law control enables small scaling irregularities of the meter pointer movement, which may occur at the extreme ends of the meter scale, to be corrected.

3.2.2 External Meters

If additional meters external to the unit are to be used, either 1 or 2 may be connected to pins 5 and 13 on the mating connector.

Each meter should have an independent SET ZERO control.

If external meters are not to be used a resistor (560 ohms), to simulate the external load, should be connected across pins 5 and 13.

3.2.3 Calibration Check

When the peak programme meter unit leaves the factory the calibration of the unit is correct, If, however, at any time a check of the calibration is desired, it may be performed as follows:-

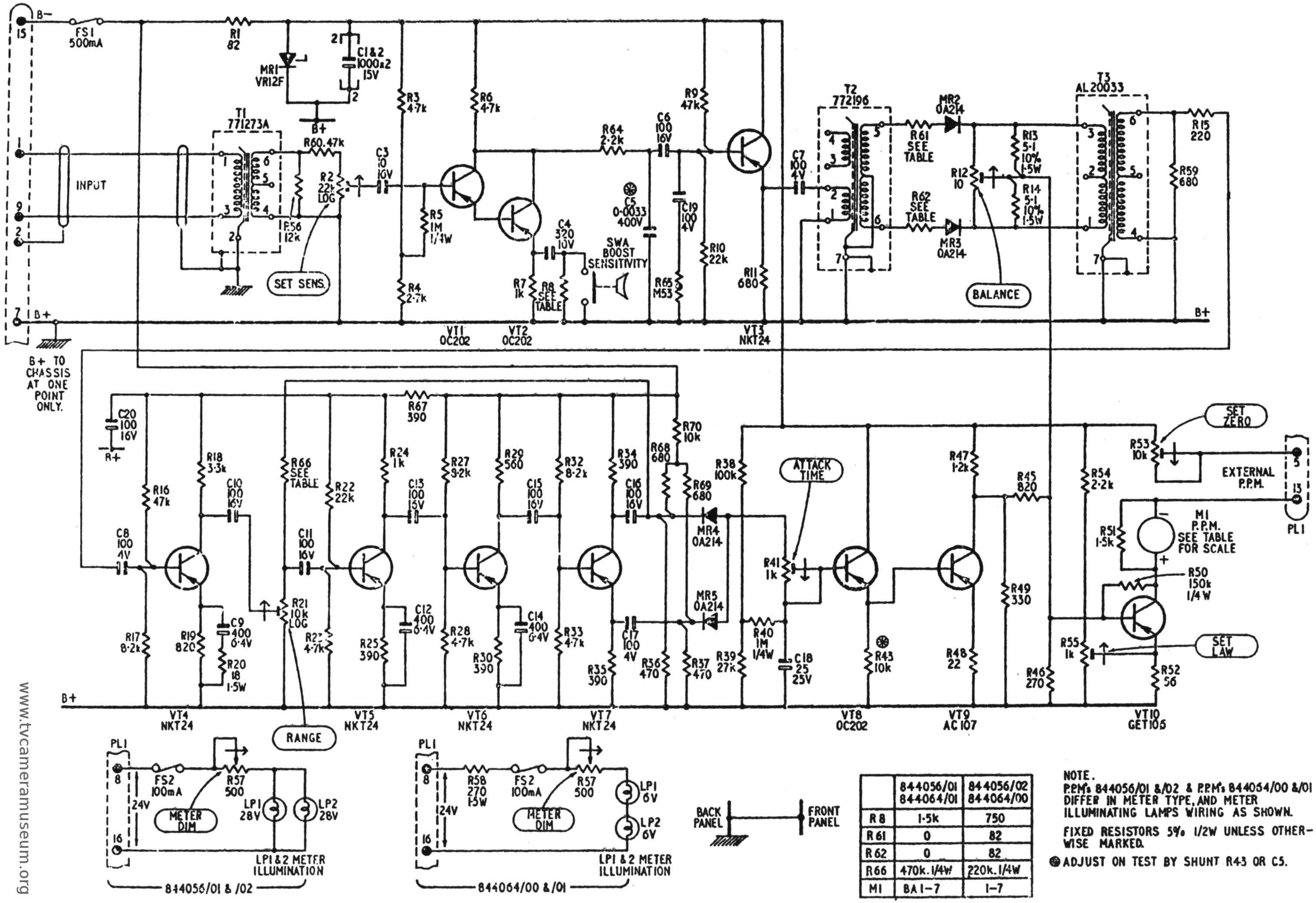
Ensure that the unit is switched off, then check and if necessary adjust the meter pointer to read right hand (mechanical) zero.

Switch the unit on, and allow 30 minutes for it to reach stability. With the signal input disconnected check that the meter pointer is at left hand (electrical) zero, adjusting with the set zero control if necessary. Reconnect the signal input lead.

Apply a steady tone signal of 0 dBm, and adjust the SET SENS. control so that the meter pointer reads '4'.

Calibration should then be satisfactory.

If because of accident or failure of major components, complete recalibration becomes necessary, proceed as in Section 5.1.2.



	844056/01 844064/01	844056/02 844064/00
R8	1·5k	750
R61	0	82
R62	0	82
R66	470k. 1/4W	220k. 1/4W
M1	BA1–7	1–7

NOTE.
P.P.M's 844056/01 &/02 & P.P.M's 844064/00 &/01 DIFFER IN METER TYPE, AND METER ILLUMINATING LAMPS WIRING AS SHOWN.

FIXED RESISTORS 5% 1/2W UNLESS OTHERWISE MARKED.

⊛ ADJUST ON TEST BY SHUNT R43 OR C5.

PEAK PROGRAMME METER UNIT 844056/01 &/02, 844064/00 &/01
PYE T.V.T. LTD., CAMBRIDGE, ENGLAND.

CIRCUIT DIAGRAM

SECTION 4 - TECHNICAL DESCRIPTION

4.1 GENERAL

The function of a peak programme meter is, ideally, to instantly indicate the peak value of an applied signal. This peak value may vary rapidly, and normally the eye would have difficulty in following the excursions of the meter pointer.

To avoid this difficulty, a peak reading is displayed on the meter. The peak reading informs the observer that the signal level may be less than, or equal to, the indicated level, but does not exceed it.

Following a peak value the meter adjusts itself comparatively slowly, but will rapidly rise to a subsequent peak.

To display wide dynamic ranges on a linear voltage scale would require a scale length which would be prohibitive. Because of this a logarithmic law is used, the scale being calibrated in equally spaced divisions of 4 dB.

The fundamental requirements of a peak programme meter amplifier are therefore:

(a) a logarithmic element to convert logarithmic changes in input level to linear deflections on a meter scale.

(b) A peak rectifying network, and

(c) an indicating system.

The logarithmic element used in the circuits controlling this peak programme meter is the small-signal forward characteristic of a silicon junction diode. The incremental forward impedance of this diode varies logarithmically with the linear changes of forward bias the input signal itself controlling the forward bias on the diode to give the required indication of signal level.

The peak programme meter has a right hand mechanical zero position. Under no-signal conditions the pointer of the meter is driven to full scale deflection, i.e. to left hand (electrical) zero, by the standing value of current from a transistorised d.c. amplifier, this amplifier supplies the logarithmic law and the electrical time constants.

In operation, increases in signal input bias VT10 towards cut-off, and the meter pointer, due to the lower value of current applied, is moved rapidly to indicate the signal peak by the tension on the pointer spring. A high input signal will cause the current holding the pointer to drop to zero. This method of operation, using a right hand mechanical zero instrument, precludes damage to the meter by high amplitude input signals causing excessive current to flow in the meter.

4.2 CIRCUIT

The input signal is applied to the base of VT1 via the input transformer T1 and the SET SENSITIVITY potentiometer R2.

VT1 is the first of a pair of transistors arranged in a super-alpha configuration, the base d.c. potential being stabilised by the potential divider formed by R3 and R4, and by the emitter resistor R7.

The super-alpha arrangement provides for wide dynamic range with low distortion, together with a low noise content which, unlike normal transistor circuits where the noise is predominantly low-frequency in character, is evenly distributed throughout the audio spectrum.

Local a.c. negative feedback to the pair is achieved by partially decoupling the emitter resistor R7 by means of C4 and R8.

A switch (SWA) is inserted so as to short circuit R8 when operated. Operation of the switch to the BOOST SENSITIVITY position removes the feedback, and by so doing increases the gain of the stage by 20 dB.

From the pair the signal is fed into the common-collector stage VT3, the capacitor C5 across the transistor base and B+ is used for correction of the high-frequency response, and the thermistor in the base circuit compensates for the change in gain, (due to temperature variations), caused by the voltage drop across the control diodes MR2 and MR3. VT3 provides a low-impedance drive into T2 which, with the diodes MR2 and MR3 and the transformer R3, form the network of the logarithmic control system.

The output signal from T3 is amplified by the common-emitter stages VT4, VT5, and VT6. Overall feedback, providing enhanced stability and freedom from drift, is applied over these stages. The RANGE control (R21) forms part of the collector load of VT4.

From VT6 the signal is applied to a two-phase splitting stage (VT7). This stage supplies an antiphase drive to the rectifying diodes MR4 and MR5.

Negative feedback from the collector of VT7 to the base of VT5 reduces distortion and ensures that the waveform at the cathodes of the rectifying diodes does not differ from that at the base of VT5.

The outputs from the two diodes are connected to the integrating circuit formed by R41 and C18, the charge time of this circuit being adjusted by the ATTACK TIME control R41, thus modifying the rate at which the meter responds to a local peak signal.

The value of the voltage appearing across the integrating circuit varies with the strength of the signal, and passes through the common-collector stage VT8 into the control amplifier VT9. A second d.c. amplifier VT10 is connected to the diode d.c. control line, and applies the amplified control voltage to the meter which is connected in series with the collector of the stage.

A shunt resistor (R51) across the meter enables additional meters, with individual SET ZERO controls, to be connected in series with the meter of the unit (See Section 5.1.6).

Slight non-linearity in the meter system is removed by altering the emitter bias of VT10 by adjustment of R55, the SET LAW control.

SECTION 5 - MAINTENANCE AND FAULT FINDING

WARNING Before commencing any checking, fault finding, or other maintenance work, refer to the appendix 'Maintenance Precautions on Semiconductor Units'.

5.1 MAINTENANCE

5.1.1 Access to Components

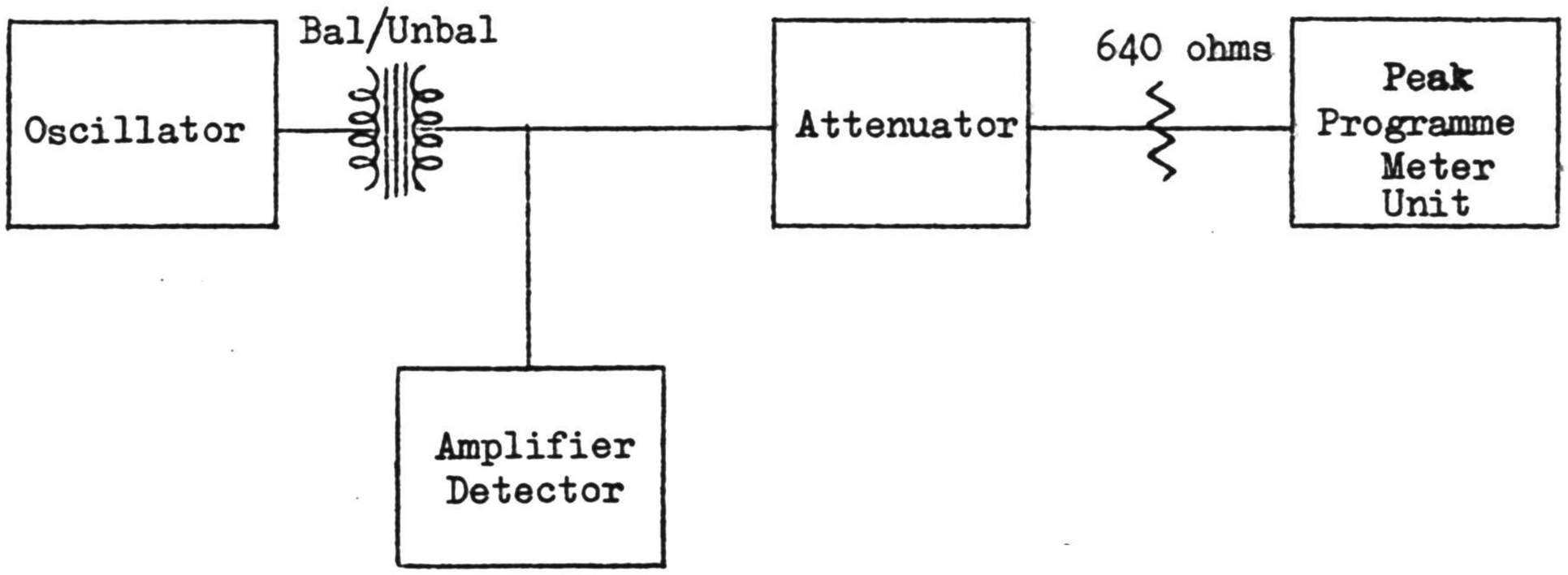
To obtain access to components inside the unit proceed as follows: Lay the unit base upwards onto a flat surface, Unscrew and remove the ribbed dowels at the rear of the unit. Unscrew and remove the screws at the front end of the members which held the dowels. To prevent binding, slacken the screws which hold the members at the bottom of the unit, and hinge out the sides of the unit on to the flat surface so as not to strain the cableform.

5.1.2 Meter Law Adjustment

When during tests, the input signal is varied in 4 dB steps, and the meter indication does not comply with the specified telerances, see 5.1.2 (h), the following procedure should be adopted.

Equipment Required:

Low Distortion Oscillator 1 kc/s, 600 ohms output.
Balance/Unbalance Transformer
Balanced Step Attenuator 40 dB minimum attenuation, in 0·1 dB steps.
Amplifier Detector 30k ohms.



Set the SET ZERO control fully anticlockwise, the BALANCE control to mid position, the SET SENSITIVITY control clockwise and the RANGE control anticlockwise.
Connect the test equipment as indicated.
Set the oscillator to 1 kc/s.

Calibrate the amplifier detector to the instructions of the maker, and switch to 30k ohms.
Set the attenuator to 12·5 dB
Adjust the peak programme meter pointer to indicate right hand (mechanical) zero.
Switch on the peak programme meter unit, and allow 30 minutes to warm up, then

(a) switch the amplifier test panel to 'output' and adjust the output of the oscillator to give a reading of 0 dBm on the amplifier detector.

(b) Remove the input signal lead from the peak programme meter unit, and adjust the SET LAW control so that the meter pointer rests against the left hand stop of the meter, then adjust the SET ZERO control to bring the pointer to left hand zero.

(c) Reconnect the signal input lead, then turn the SET SENSITIVITY control through half its rotation, or so that the meter pointer indicates '1' or 'B' whichever is the first scale division.

(d) Adjust the RANGE control so that the meter pointer indicates '4', then adjust the SET LAW control so that the meter pointer indicates '3'.

(e) Remove the signal input lead, adjust the SET ZERO control so that the pointer indicates left hand zero, reconnect the signal input lead, and adjust the RANGE control so that the meter pointer indicates '4'.

(f) Decrease the sensitivity of the amplifier detector, and set the attenuator to 0·5 dB, then

(i) if the meter pointer indicates '7' or is within the specified tolerance of ±0·5 dB proceed as indicated in (g).

(ii) If the pointer is to the right of '7' set the attenuator to 12·5 dB, and if the error is large rotate the RANGE control so that the meter pointer indicates '5'. If the error is small adjust the RANGE control so that the indicated error is halved, and adjust the SET SENSITIVITY control so that the meter pointer indicates '4'.

(iii) If the meter pointer is to the left of '7' set the attenuator to 12·5 dB, and if the error is large rotate the RANGE control until the pointer of the meter indicates '3'. If the error is small adjust the 'RANGE' control so that the indicated error is halved.

Rotate the SET SENSITIVITY control so that the meter pointer indicates '4'. Decrease the sensitivity of the amplifier detector set, the attenuator to 0·5 dB Repeat (f) (i) and repeat (f)(ii) or (f)(iii) whichever applies, until the meter indication comes within the specified tolerance, then proceed with (g).

(g) With the attenuator set to a position giving attenuation relative to the first scale division on the meter, i.e. if the first scale division on the meter is 'B' set the attenuator to 32 dB, or if the first scale division is '1' set the attenuator to 24 dB and

(i) if the pointer indicates the first scale division or is within ±0·5 dB, proceed as instructed in (h).

(ii) If the pointer is to the left of the first scale division set the attenuator to 12·5 dB, and adjust the SET LAW control so that '3' is indicated, or so that double the original error is indicated, then remove the signal input lead, and adjust the SET ZERO control to reset the pointer to left hand zero. Reconnect the signal input lead and adjust the RANGE control so that the meter pointer indicates '4'.

(iii) If the pointer is to the right of the first scale division set the attenuator to 12·5 dB. Adjust the SET LAW control so that '5' is indicated or so that double the original error is indicated on the meter, remove the signal input lead and adjust the SET ZERO control to bring the meter pointer to left hand zero. Reconnect the signal input lead and adjust the RANGE control until the meter pointer indicates '4'.
Repeat (g) first paragraph then (g) (i), and repeat (g)(iii) whichever applies until the meter reading comes within the specified tolerance, then proceed with (h).

(h) With the attenuator set as in the following table, ensure that meter readings as indicated are obtained.

ATTENUATOR SETTING	METER READING	TOLERANCE
32·5	B	±1dB
28·5	A	"
24·5	1	±0·5dB
20·5	2	"
16·5	3	"
12·5	4	"
8·5	5	"
4·5	6	"
0·5	7	"

(j) Check and adjust if necessary the meter attack time (see Section 5.15).

5.1.3 Test and Adjustment for Frequency Response

If the frequency response of the unit becomes suspect the following procedure will determine what correction is necessary. The procedure should be carried out with the peak programme meter in a 'Calibrated' condition.

Equipment Required:

Low Distortion Oscillator 600 ohms output
Balance/Unbalance Transformer
Amplifier Detector 30k ohms
Balance Step Attenuator (0·1 dB steps).

The equipment should be set up as indicated in the diagram on page 13. Section 5.1.2 (METER LAW ADJUSTMENT).

Procedure

(a) Set the oscillator to give an output frequency of 1 kc/s.

(b) Calibrate the amplifier detector to the instructions of the maker, then switch the amplifier detector impedance switch to 30k ohms.

(c) Adjust the attenuator to 3·5 dB.

(d) Adjust the oscillator amplitude control so that +3·5 dBm is indicated on the meter of the amplifier detector.

(e) Set the SET SENSITIVITY control on the peak programme meter so that '4' is indicated by the meter pointer.

(f) (i) Set the oscillator to give an output of 30 c/s.

(ii) Set the oscillator amplitude control so that +3·5 dBm is indicated on the amplifier detector.

(iii) Set the attenuator so that 4 is indicated on the peak programme meter.

Note the difference in the attenuator settings of (c) and (f) (iii). The figure obtained will indicate in dB the amount (if any) the frequency response is out of specification at 30 c/s. Further tests should be carried out at oscillator frequencies between 30 c/s and 15 kc/s.

The high-frequency response may be brought into specification if necessary by increasing the effective capacitance of C5 by a suitable shunt capacitor.

5.1.4 Decay Time Adjustment

NOTE: The peak programme meter unit must be in a 'Calibrated' condition before carrying out the procedure which follows:

The equipment required for the procedure is as listed for Section 5.1.2 (Meter Law Adjustment) and is set up as indicated on the diagram in that sub-section.

Procedure

Set the attenuator to 12 dB.
Set the oscillator amplitude control to give a reading of 0 dBm on the amplifier detector at 1 kc/s. The peak programme meter pointer should then indicate '4', and if necessary the SET SENSITIVITY control may be slightly adjusted to achieve this.
Set the attenuator to give an attenuation of 0 dBm.
The peak programme meter pointer should then indicate '7'.
If '7' is not indicated the peak programme meter calibration is incorrect and must be corrected.

If the meter pointer does indicate '7' remove the input signal suddenly by smartly pulling out the plug of the input signal lead. Note the time taken for the pointer to fall from '7' to '1'.

If the time taken is not within specification adjust the value of R43 by suitable shunt resistors until the decay time falls within the specified tolerance.

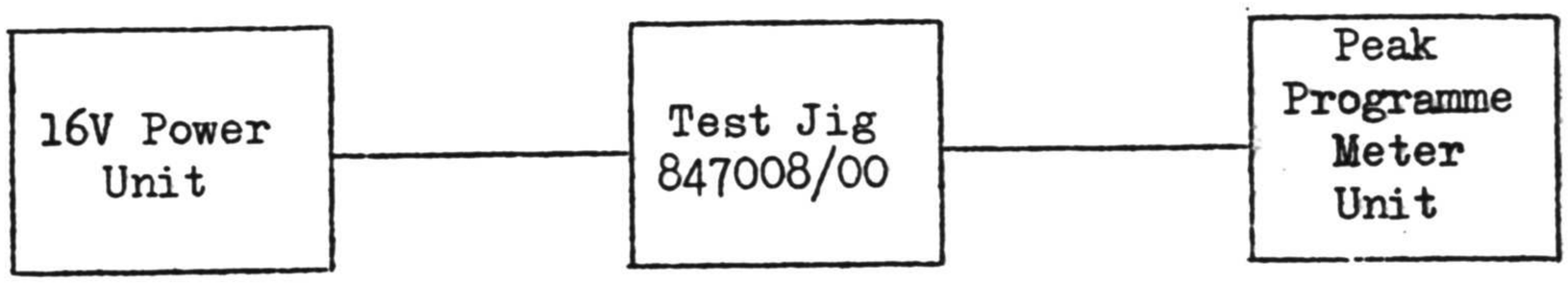
Check that the attack time is within specification by carrying out instruction (g) in Section 5.1.5.

Check that Meter Law **Adjustment** is correct by carrying out the calibration check described in Section 5.1.2.

5.1.5 Attack Time Adjustment

Equipment Required:

Power Supply of 16V d.c.
Test Jig 847008/00



Connect the test equipment as indicated.
Set SWB on the test jig to 'BRIDGE'.
Set the ATTACK TIME control on the peak programme meter unit to fully anticlockwise.
Set the BALANCE control on the peak programme meter to mid-position.

Procedure

(a) Adjust the OUTPUT VOLTAGE control (R2) on the test jig so that the voltage across the OUTPUT TEST terminals is 2·75V.

(b) Switch the PHASE SWITCH (SWC) on the test jig to position 1.

(c) Momentarily press the PULSE SWITCH (SWA) on the test jig, this will deflect the pointer on the peak programme meter. Wait two seconds after the pointer has returned past the first division on the meter, then again momentarily press the PULSE SWITCH and note the maximum deflection point of the meter pointer.

(d) Set the PHASE SWITCH to position 2 and repeat (c).

(e) Repeat (b), (c) and (d), note which phase gives the lower meter reading, and bring that phase reading to '4' (± 1 dB) on the peak programme meter by rotation of the ATTACK TIME control on the peak programme meter.

(NOTE. A clockwise rotation of the control will decrease the meter pointer deflection).

(f) Repeat (b), (c), and (d). Ensure that the pointer indications for phase 1 and phase 2 are the same, adjusting the BALANCE control on the peak programme meter unit to achieve this result.

(g) Again repeat (b), (c), and (d) to ensure that pointer readings are within specification as indicated in (e). Repeat this three times, and if any variation in the pointer deflection appears, rotate the ATTACK TIME control to bring the meter pointer to indicate an average of the three readings.

5.1.6 External Peak Programme Meter Adjustment

If one or two external peak programme meters are used a 2·2k ohms potentiometer must be connected in parallel with each meter to act as a set zero control.

When the unit is switched on, the pointer on each external meter must be set, by means of the external set zero control, to indicate the same as the pointer on the internal meter.

The internal set zero control must then be adjusted to bring the pointers on all the meters as near to zero as possible.

If the original discrepancy between the meter pointers is large, it may be necessary to repeat the procedure several times before an accurate zero reading on all meters is obtained.

5.2 FAULT FINDING

5.2.1 Voltage and Current Analysis

Attention is drawn to the warning given at the commencement of Section 5.

The location of faults will be facilitated by making checks at the points given in the analysis table which follows. The figures given in the table are those measured on a typical unit, and measured figures from other units may be found to vary slightly between units. Deviations from the figures are not necessarily indicative of faults, but if any wide divergency is found, and the supply voltage is within the specified tolerance, investigation into the divergency should be made.

Conditions

All voltages readings on the unit are taken relative to B+, with the unit under 'Calibrated' conditiohs, and with no-signal input, the meter used having a sensitivity of 20000 ohms per volt, and the readings taken on the meter range quoted, with the

supply voltage at 16V and the supply current 84 mA.

The unit should be connected to a suitable d.c. supply and a period of at least 10 minutes allowed to elapse, this will enable the unit to reach a stable condition and steady value readings may then be taken.

The abbreviations used in this table are:

e = emitter b = base c = collector

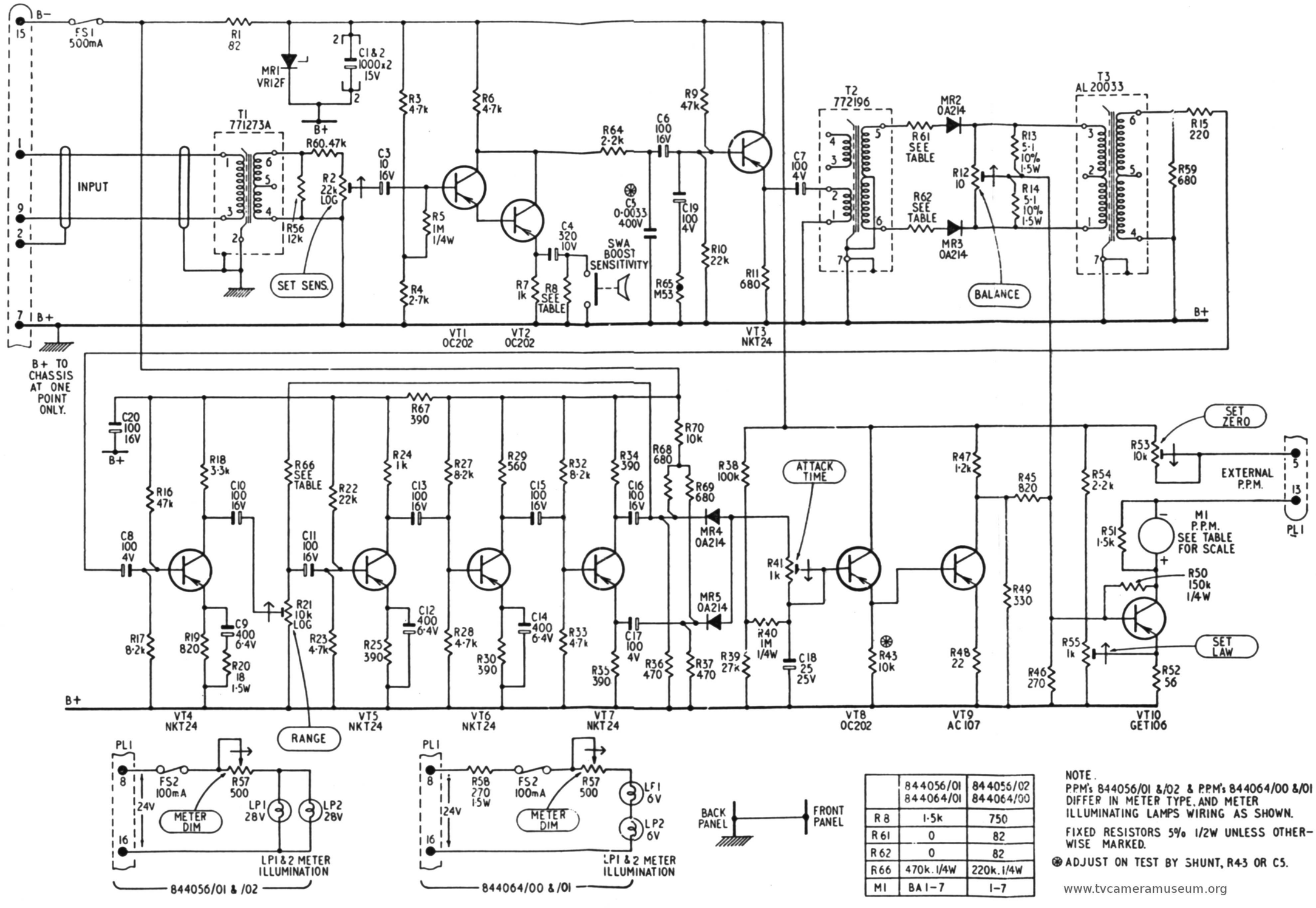
Circuit	Location	Meter Range	Measurement Volts
VT1	e	10	2
OC202	b	10	0·7
	c	10	4·2
VT2	e	10	1·7
OC202	b	10	2
	c	10	4·2
VT3	e	10	3·3
NKT24	b	10	3·3
	c	25	12·3
VT4	e	2·5	1·7
NKT24	b	2·5	1·6
	c	10	5·7
VT5	e	2·5	2·1
NKT24	b	2·5	2·2
	c	10	7·7
VT6	e	10	5·7
NKT24	b	10	5·8
	c	25	8
VT7	e	10	5·5
NKT24	b	10	5·6
	c	25	10·7
VT8	e	2·5	0·2
OC202	b	2·5	0·2
	c	25	12·3
VT9	e	2·5	0
AC107	b	2·5	0·2
	c	2·5	2
VT10	e	2·5	0·3
GET106	b	2·5	0·5
	c	2·5	0·4

5.2.2 High Permeability Cored Transformers

D.C. resistance measuring devices and continuity checking equipment, e.g. Avometers, should not be used for checking the resistance or continuity of certain transformer windings. The reason for this, and the treatment to be applied if d.c. is accidentally used are dealt with in the appendix 'Demagnetisation of High Permeability Cores'.

The transformers in this unit to which the warning applies are listed below, together with the inductance of the windings, the voltage and frequency at which the inductance is measured, the r.m.s. demagnetising voltage, and the pins to which the demagnetising voltage is to be applied.

Cct. Ref.	Inductance/Voltage/Frequency			Demagnetising Volts	Pins
T1	≮ 135H	0·5	50 c/s	30V	1-3
T2	72H	0·2	50 c/s	12·5V	3-4
T3	11H	0·2	50 c/s	6·3V	4-6



	844056/01 844064/01	844056/02 844064/00
R8	1·5k	750
R61	0	82
R62	0	82
R66	470k. 1/4W	220k. 1/4W
M1	BA1-7	1-7

NOTE.
P.P.M's 844056/01 &/02 & P.P.M's 844064/00 &/01 DIFFER IN METER TYPE, AND METER ILLUMINATING LAMPS WIRING AS SHOWN.

FIXED RESISTORS 5% 1/2W UNLESS OTHERWISE MARKED.

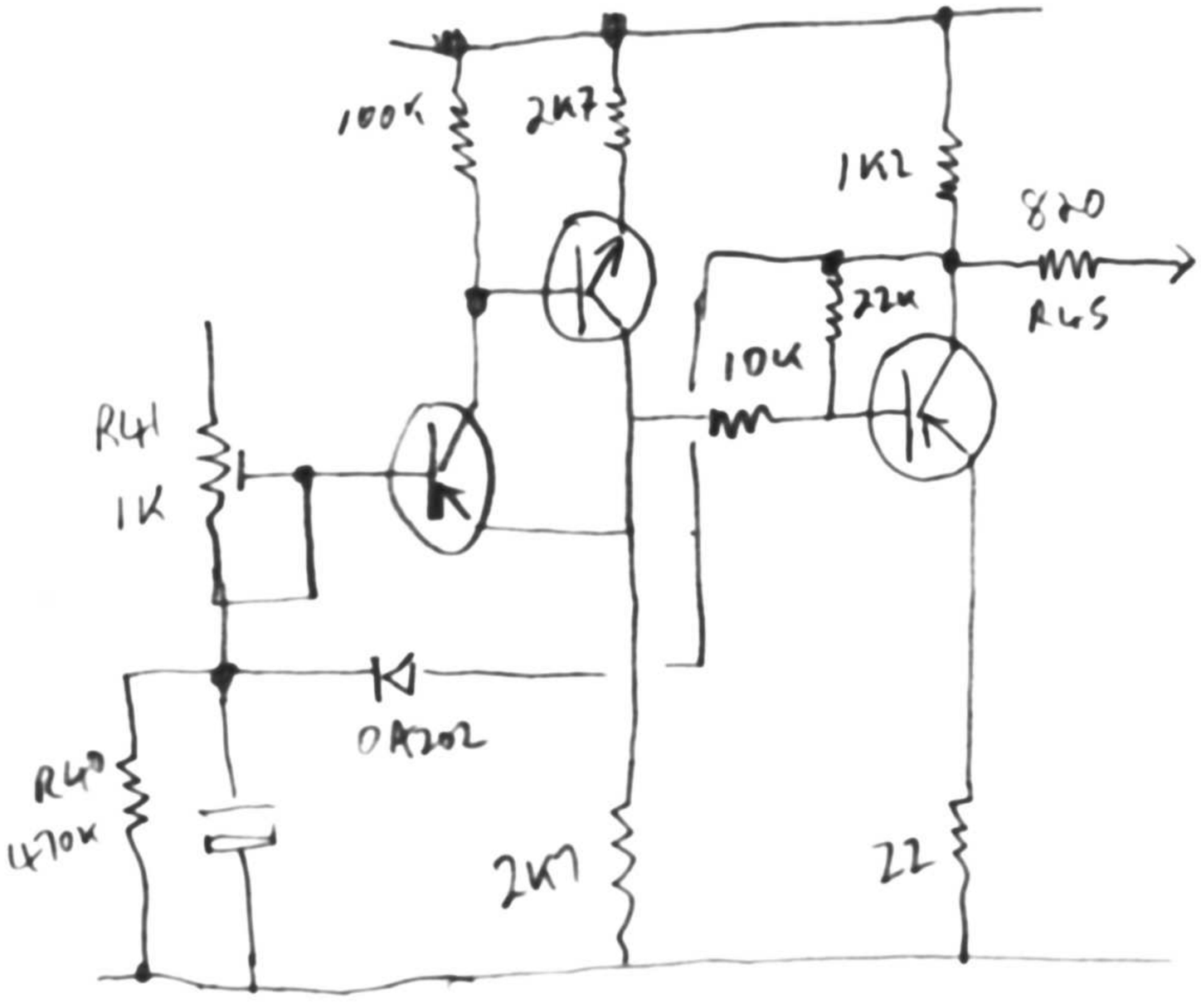
⊛ ADJUST ON TEST BY SHUNT, R43 OR C5.

DTP 2446

PEAK PROGRAMME METER UNIT 844056/01 &/02, 844064/00 &/01
PYE T.V.T. LTD., CAMBRIDGE, ENGLAND.

CIRCUIT DIAGRAM

ISSUE 1



BBC P & ID MODS

for MCR's 19-28