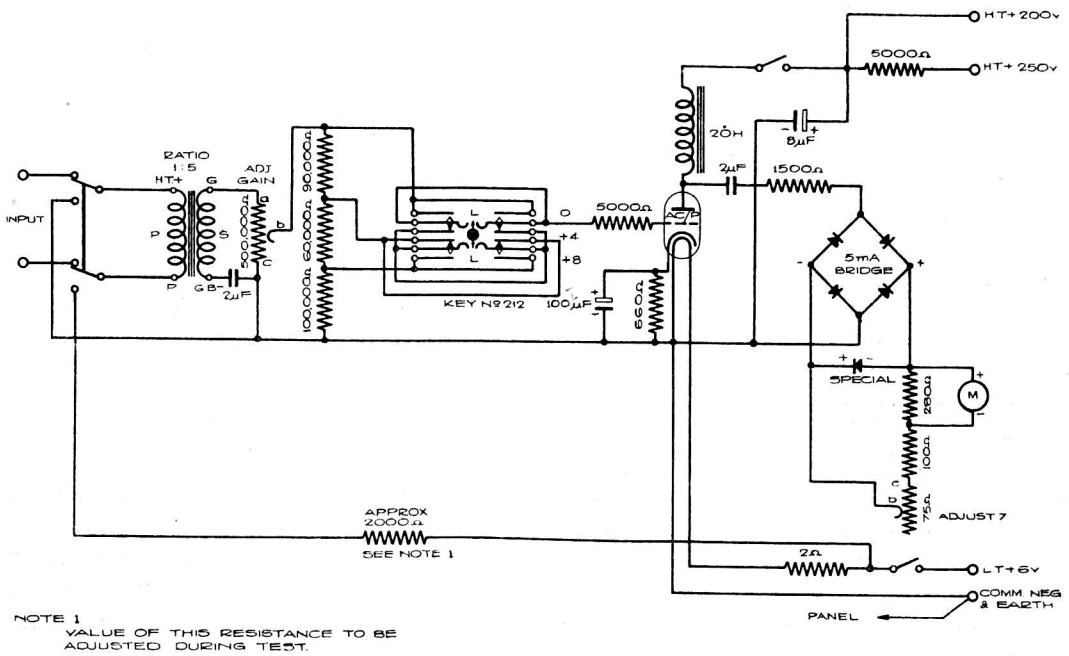
LINE VOLUME METER, LVM/2

Function

The line volume meter is a portable programme meter for use at O.B. points for checking the volume at which the programme is sent to line, and at programme repeater points on long O.B. music lines for checking both the volume received from the incoming line and that sent to the outgoing line. In the former case its input is connected in parallel with the line



Drawing No. A3559. Issue 5

across the output terminals of the O.B. amplifier, and in the case of an intermediate repeater [see Item 10.2 (PER/2)] it is connected to one of the CH.PH jacks so that it can be switched by the operation of the checkphone key, either across the input or across the output of the repeater. It is designed to operate off the same battery supplies as are used for operating the O.B. amplifiers or portable repeaters, as the case may be, and to give readings comparable with those of a standard programme meter except that it is calibrated to read at full scale, according to the setting of its volume range switch, volumes of either zero, +4 db or +8 db.

It contains many novel features, principal among which is the use of metal rectifiers both for the linear rectification of the voltage applied to the input terminals and also for obtaining the logarithmic law for the operation of the programme meter. The method of calibration is also novel, the pulse obtained by interrupting a steady D.C. being used to

Function (*Contd*)

deflect the meter and the gain being adjusted so that the deflection obtained has a predetermined value. The instrument is thus completely self-contained and there is no need for an external tone source in order to perform the routine calibration in the field.

Circuit

The input to the instrument is connected via an input transformer, gain control and calibrated volume switch to the grid of an amplifying valve, in the output of which is connected a bridged-type, full-wave metal rectifier. Across the output of this rectifier is connected a meter provided with a special non-linear shunt which includes a second metal rectifier. The value of the resistance included in the shunt is made adjustable to permit of calibration.

The impedance of a metal rectifier of the type employed is practically constant when the rectifier is passing currents having values approximating to that for which the rectifier is rated, but for currents very much smaller than this the impedance-current characteristic is non-linear. The bridge rectifier in the output of the valve operates, under the conditions provided by the circuit, effectively as a linear rectifier, but the rectifier in the meter shunt circuit operates over the non-linear portion of its impedance characteristic. It has been specially chosen so that with the particular values of shunt resistance used the load in the output of the bridge rectifier varies in such a way that over the working range of the instrument the current indicated by the meter varies proportionally to the logarithm of the applied voltage.

The meter is a Ferranti 0/1 milliammeter and is of the same type as the 0/2 milliammeter used for the standard programme meter with the internal shunt removed. The scale is divided and designated in the same way and the working range extends from divisions 1 to 7. The instrument like other programme meters is calibrated so that each division corresponds to a change of 4 db. in the applied voltage.

In series with the input to the linear rectifier, a 1500 ohm resistance is connected in order both to provide a suitable output load for the valve and also to swamp the effect of any curvature of the impedance characteristic of the bridge rectifier and reduce the effect of temperature variation.

Operation

The calibration adjustments cover two features, namely,

(a) adjustment of the galvanometer shunt to provide the logarithmic law.
(b) adjustment of the sensitivity of the complete instrument so that the application of a standard voltage produces a definite deflection of the galvanometer.

The calibration for logarithmic law is carried out in the control room since it involves the use of tone. Tone at 1,000 c/s and at a voltage level of −20 db is applied to the input and the *volume range switch is set to zero.* Then by means of the **Adj Gain** control the sensitivity is adjusted so as to obtain a reading of 2 divisions on the meter. The input level is then increased to zero voltage level and the **adjust 7** control adjusted with a screwdriver to make the meter read 7. The input level is then again reduced to −20 db. and the process repeated so as to obtain meter readings of 2 on −20 db. and 7 on 0 db.

The calibration should be checked in the manner described at regular *monthly* intervals.

Operation (*Contd*)

The calibration for sensitivity does not involve any external apparatus and must be carried out *every time the volume meter is to be used*, immediately prior to the transmission This is most important in order to compensate for variation in the battery voltage and in the impedance of the metal rectifiers due to temperature changes. With the volume range switch on zero and with nothing connected to the input terminals, the **impulse operate** switch is thrown in the opposite direction to the **impulse** arrow. This connects the L.T. battery across the primary of the input transformer. The switch is then thrown to the **operate** position, in the direction indicated by the arrow. The current is thus interrupted producing an A.C. impulse in the grid circuit of the valve which causes the meter to flick.

The time constant of the circuit has been set by the inclusion of the 2 μF series condenser in the input circuit of the valve to secure a pulse of suitable duration, and the value of the resistance (approx. 2,000Ω) included in series with the supply is selected for the particular instrument to secure that with the correct sensitivity setting the meter will flick up to 2.

When calibrating the instrument in the field, therefore, the **Adj Gain** control must be adjusted to secure a deflection of 2 divisions on the impulse obtained when the **impulse operate** switch is operated in the manner described. The switch should be operated as often as is necessary in order to obtain the required condition but the needle must be allowed to come to rest between the tests. A piece of card or paper with a straight edge laid across the face of the meter so that the edge coincides with the centre of the line designated ' 2 ' may be found to assist in the accurate determination of the correct gain control setting.

The line volume meter has a high input impedance and is connected like a voltmeter across the circuit in which the volume is to be measured, e.g. across the output of an O.B. amplifier. The **volume range** switch, which consists of a fixed potentiometer with three tapping points, is set to the position corresponding to the volume to be sent to line and the gain control of the amplifier is adjusted so that on the loud passages the instrument peaks up to 7. If the volume to be sent to line does not actually correspond with any of the range settings provided, the most convenient range should be chosen and the gain of the amplifier adjusted accordingly. For example, if the volume required is +2 db. the volume range switch should be set in the + **4 db.** position and the amplifier gain control adjusted so that the meter will not peak beyond 6½ divisions on loud passages.

Supply Data

Valve	*Anode Feed* mA	*Filament* Volts	Amps.
ACP	approx. 10	4	1

High Tension Supply .. .. either 200 or 250 volts
Low Tension Supply .. .. 6 volts (adjusted to 4 volts for heater by a series resistance)
Grid Bias .. .. automatic.

Test Data

Frequency characteristic (obtained by direct reading of the meter with a constant voltage input applied at all the test frequencies)

50 – 5,000 c/s. .. .. ±1 db. } Relative to response
5,000 – 8,000 c/s. .. .. −3 db. } at 1,000 c/s.