

OPERATION OF THE MUIRHEAD PORTABLE TRANSMITTER TYPE D-601-A USED WITH RESEARCH LABORATORIES F.M. ADAPTER.

1. STANDARD METHODS.

1.1 The portable transmitter type D-601-A employs a 66 mm. drum (compare 89.5 mm. drum of the fixed transmitter type D-355-B) and a scanning pitch of $\frac{1}{135.4}$ ins., that is, 135.4 lines/in.

1.2 The following picture characteristics are then standard for portable transmitting equipment operated by this Department -

Scanning lines - 135.4 per inch.
Drum speed - 1 revolution per second.
Modulation - Frequency modulation, (subject to reversion to amplitude modulation in emergency).

2. GENERAL EQUIPMENT SWITCHES AND CONTROLS.

2.1 The following apparatus switches and controls should not be altered when closing down at the conclusion of a picture transmission, the object being to retain them in their normal operating position to simplify operating procedure.

2.2 Portable Transmitter Type D-601-A.

(i) A.C. Power.

The MAINS SUPPLY switch at the rear of the unit should be in the OFF position.

(ii) Signal. (See Fig. 2a.)

The 2-WIRE/4-WIRE key in the 4-WIRE position.
The TONE/PICTURE/PHASE key in PICTURE position.
The CHECK LIMITS/FORK/FORK MOD key in FORK position.
The PICTURE F.M./PICTURE A.M./SPEAK key in PICTURE F.M. position.
The meter SELECTOR SWITCH in the LINE position.
The SPEAKER potentiometer at the right-hand end of the control panel (see Fig. 2) adjusted to reasonable level.

(iii) Mechanical.

DRUM SPEED change lever (see Fig. 1) 1 R.P.S./2 R.P.S. in the 1 R.P.S. position.
DRUM START/STOP lever in the STOP position.

2.3 F.M. Adapter. (See Fig. 2b.)

MAINS SWITCH in OFF position.
The CAL. LIMIT WHITE and CAL. VAR. OSC. controls shall not be touched except when checking limits and particular care shall be taken when using the equipment not to knock these controls.

TEST METER
& SELECTOR
SWITCH

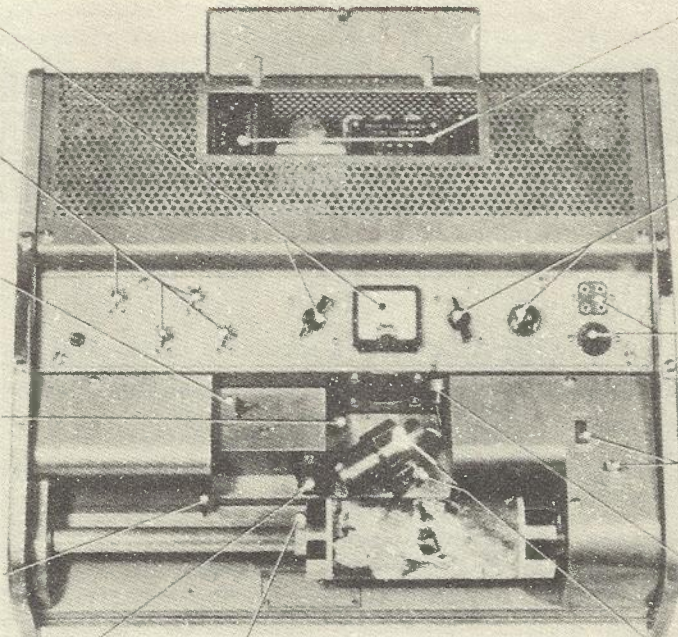
PHONE &
LINE KEYS

APERTURE
VIEWING
SHUTTER

PHOTOCELL
ELECTRICAL
BALANCE
CONTROL

PHOTOCELL
OPTICAL
BALANCE
CONTROL

OBJECTIVE
LENS



MAINS
VOLTAGE
ADJUSTERS

SPEAKER
& OUTPUT
CONTROLS

LINE &
F.M. ADAPTER
CONNECTOR
SOCKETS

DRUM SPEED
CONTROL
& CLUTCH

LAMP SWITCH

LAMP HOUSING
ADJUSTMENT
SCREWS

TRAVERSE NUT RELEASE

FIG. 1. PLAN VIEW MUIRHEAD PICTURE TRANSMITTER TYPE D-601-A.

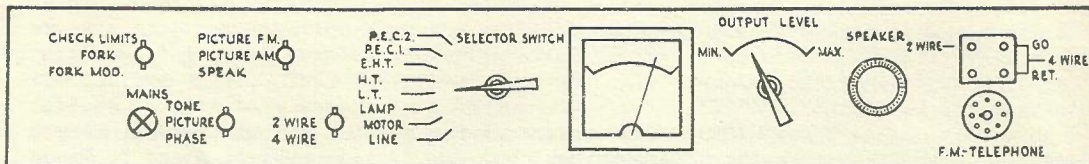


FIG. 2a. TRANSMITTER TYPE D-601-A LAYOUT.

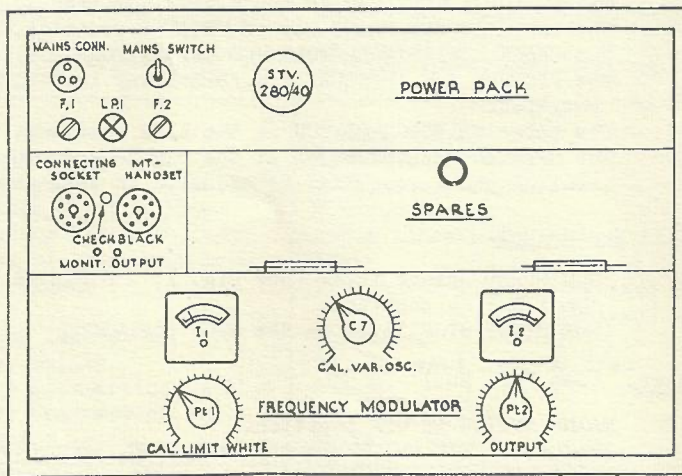


FIG. 2b. F.M. ADAPTER PANEL LAYOUT.

3. TRANSMISSION OF PICTURE BY FREQUENCY MODULATION.

- 3.1 (1) The D-601-A transmitter and the F.M. adapter should be switched to the ON position by means of their individual MAINS SUPPLY switches. A preliminary heating period of at least thirty minutes is necessary before commencing transmission adjustments.
- (2) About 2 minutes after the D-601-A unit has been switched on, a thermal delay switch incorporated in the set will close and the lamps will light. A few seconds later the motor will be heard to start.
- (3) Check that the key positions are as set out in Paragraph 2.2 (ii) above. In addition, check that the LAMP SWITCH is in the ON position.
- (4) Place the picture on the drum as detailed below -

Release the hinged clip, place the lower edge of the paper along the drum and close the clip on it with a long edge at the end of the drum. Rotate the drum toward yourself wrapping the picture around it and secure the other end of the picture with the removable clip.

- (5) Operate the PICTURE F.M./PICTURE A.M./SPEAK key (see Fig. 2a) on the D-601-A unit to SPEAK position and communicate with the receiving operator using the telephone hand-set (which has a built in PRESS TO SPEAK switch) which plugs into the right-hand octal socket on the F.M. adapter sub-panel. When the PICTURE F.M./PICTURE A.M./SPEAK key is in the SPEAK position, the receiving operator can only be heard on the handset receiver. Upon completion of a telephone conversation, restore the PICTURE F.M./PICTURE A.M./SPEAK key to the PICTURE F.M. position and adjust the SPEAKER control so that the receiving operator may be heard in the loud-speaker.
- (6) When the receiving operator requests PICTURE WHITE, place the meter SELECTOR SWITCH in the LINE (see Fig. 2a) position and with the light spot focused on a white edge of the picture, adjust the OUTPUT LEVEL (see Fig. 2a) control on the D-601-A unit to give a meter reading of approximately +5 db. The OUTPUT LEVEL control on the D-601-A provides resistance steps between each stop and is not continuously variable so that an exact setting of +5 db is usually not possible.
- (7) When the adjustment given in (6) above has been made, the output signal to line should be the 1,500 c/s PICTURE WHITE signal. Depressing the "CHECK BLACK" push button key (see Fig. 2b) on the F.M. adapter inserts a 32 db pad between the output of the transmitter and the F.M. adapter and the F.M. adapter output to line should now be 2,300 c/s. For F.M. limits adjustment, ask the far end terminal to transmit 2,300 c/s first and then 1,500 c/s (1 volt each for about 1 minute) from the decade oscillator to the 2-wire or 4-wire return line. When the calibration tone for limit checking is obtained, throw the PICTURE F.M./PICTURE A.M./SPEAK key to the PICTURE F.M. position, and for 4-wire operation the CHECK LIMITS/FORK/FORK MOD key into the CHECK LIMITS position. With the CAL. LIMIT WHITE control set to zero, adjust the CAL. VAR. OSC. control for limit "black" to zero beat against the 2,300 c/s calibration tone from the far end terminal, the correct adjustment of the CAL. VAR. OSC. control being observed either by a headphone connected to the jack pair "MONIT. OUT" in the connecting panel or on the OUTPUT LEVEL meter of the F.M. adapter.

On receiving the control tone of 1,500 c/s, adjust CAL. LIMIT WHITE to zero beat against the 1,500 c/s with the OUTPUT LEVEL control of the D-601-A unit adjusted to give a meter reading of approximately +5 db as described in (6) above. On completion of limit checking, restore the CHECK LIMITS/FORK/FORK MOD key to the FORK position. The above described method of checking limits is a daily routine and is not necessary for each transmission.

- (8) The full process of limit checking is necessary only once per day but for each picture as a rough check "PICTURE BLACK" should be sent by depressing the push button CHECK BLACK key on the F.M. adapter. Ask the receiving operator if his oscillograph "LOOP CURRENT" meter falls to, or below, -35 mA. If this is the case, proceed with the next operating steps as described below. If the receiving operator reports that his oscillograph "LOOP CURRENT" reading is above -35 mA carry out the complete limit checking process described in (7) above.
- (9) Set OUTPUT control on F.M. adapter to give an OUTPUT METER reading of 0.8 to 1.0 volt.
- (10) When the receiving operator requests PHASE, set the TONE/PICTURE/PHASE key to PHASE.
- (11) When phasing is completed, restore the TONE/PICTURE/PHASE key to the PICTURE position. When requested by the receiving operator to send PICTURE, slide the drum to the right (by squeezing the finger operated traverse nut release mounted on the left-hand end of the drum) with the left-hand edge of the picture opposite the objective lens and place the DRUM START/STOP lever in START position.
- (12) At the end of transmission, set the DRUM START/STOP lever to STOP.
- (13) If no further picture is awaiting transmission, switch the individual MAINS SUPPLY switches on the D-601-A transmitter and the F.M. adapter to the OFF position, when advised by the receiving operator that the picture has been received.

4. TRANSMISSION OF PICTURE BY AMPLITUDE MODULATION.

- (1) The D-601-A transmitter should be switched to the ON position by means of its individual MAINS SUPPLY switch. A preliminary heating period of at least thirty minutes is necessary before commencing transmission adjustments.
- (2) About 2 minutes after the D-601-A unit has been switched on, a thermal delay switch incorporated in the set will close and the lamps will light. A few seconds later the motor will be heard to start.
- (3) If the D-601-A transmitter is already set up with an associated F.M. adapter, the only operation necessary to change from F.M. to A.M. transmission is to operate the PICTURE F.M./PICTURE A.M./SPEAK key to the PICTURE A.M. position. In this condition, the F.M. adapter signal circuitry is by-passed.
- (4) Check that the remaining key positions are as set out in Paragraph 2.2 (ii) above.
- (5) Place the picture on the drum as detailed in Paragraph 3.1 (4).

- (6) Operate the PICTURE F.M./PICTURE A.M./SPEAK key on the D-601-A unit to SPEAK position and communicate with the receiving operator using the telephone handset (which has a built in PRESS TO SPEAK switch) which plugs into the right-hand octal socket on the F.M. adapter sub-panel. When the PICTURE F.M./PICTURE A.M./SPEAK key is in the SPEAK position, the receiving operator can only be heard on the handset receiver. Upon completion of a telephone conversation, restore the PICTURE F.M./PICTURE A.M./SPEAK key to the PICTURE A.M. position and adjust SPEAKER control so that the receiving operator may be heard in the loud-speaker.
 - (7) Upon receipt of the request for PICTURE WHITE, place the TONE/PICTURE/PHASE key in PICTURE position and set the drum to send a white portion of the picture.
 - (8) With the meter SELECTOR SWITCH in the LINE position, adjust OUTPUT LEVEL control on the D-601-A unit to give a reading of 0 db.
 - (9) When the receiving operator reports PICTURE WHITE O.K. and requests PHASE, set the TONE/PICTURE/PHASE key to PHASE.
 - (10) When phasing is completed, restore the TONE/PICTURE/PHASE key to the PICTURE position. When requested by the receiving operator to send PICTURE, slide the drum to the right by squeezing the finger operated traverse nut release mounted on the left-hand end of the drum with the left-hand edge of the picture opposite the objective lens and place the DRUM START/STOP lever in START position.
 - (11) At the end of transmission, set the DRUM START/STOP lever to STOP.
 - (12) If no further picture is awaiting transmission, switch the PICTURE F.M./PICTURE A.M./SPEAK key back to its normal operating position of PICTURE F.M.
 - (13) Place the individual MAINS SUPPLY switch on the D-601-A transmitter (and the F.M. adapter, if that unit has been left switched on vide Paragraph 4.1 (3) above) in the OFF position when advised by the receiving operator that the picture has been received, and if no further transmissions are to be effected.
5. The D-601-A transmitter may be operated by itself for A.M. transmission but the above operating instructions are based on the expectation that A.M. transmission shall only be used when F.M. transmission is temporarily not possible and, therefore, prescribes the method of operation by A.M. from a D-601-A transmitter associated with an F.M. adapter.
6. Although the MAINS SUPPLY switch on the F.M. adapter could be switched to the OFF position during A.M. transmission, it is advisable not to do so as F.M. transmission may subsequently be practicable. If the unit has not been switched off, it will not be necessary to wait for a further 15 minutes warm-up period to obtain frequency stability.

7. DESCRIPTION.

- 7.1 A brief description is given of the Muirhead Portable Transmitter Type D-601-A and F.M. Adapter in the attached Appendix. This Appendix emphasises only those features of the equipment which must be understood to enable logical operation of the equipment. A full technical description of this equipment is given in Telegraph Engineering Instruction, Facsimile E 1301.

APPENDIX "A".

MUIRHEAD PORTABLE PICTUREGRAM TRANSMITTER TYPE D-601-A AND
ASSOCIATED AUSTRALIAN POST OFFICE F.M. ADAPTER.

1. INTRODUCTION.

1.1 The general principles of operation of the Type D-601-A portable transmitter and its associated F.M. adapter are similar to those for the Muirhead-Jarvis fixed transmitter, and the unit is designed to interoperate with the Muirhead-Jarvis fixed receiver. Significant features of the equipment are as follows -

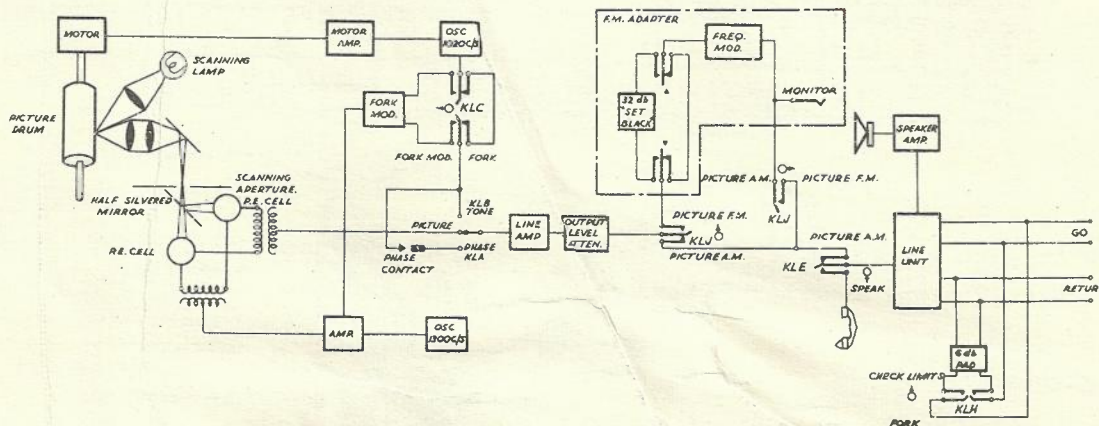
- (i) The equipment is built in two portable units, compactness being accomplished by the use of miniature type valves, and a simpler method of carrier generation and modulation than is employed in the Muirhead-Jarvis fixed transmitter Type D-355-B.
- (ii) The picture carrier is generated by an oscillator whose signal is then modified electronically by the light beam. This eliminates the use of a chopper disc and motor, frequency changing stages and associated filters.
- (iii) The use of photo-multiplier cells to modulate the picture carrier provides an output requiring only one stage of amplification before the input to the frequency modulator unit.
- (iv) Linear transmission is used, that is, no compensation circuit is provided.
- (v) Only amplitude modulated signals are generated from the D-601-A unit but with an associated F.M. adapter F.M. transmission is normally employed.
- (vi) The picture drum is driven by means of a self-starting, hysteresis type synchronous motor.

A plan view of the equipment is given in Fig. 1 and Figs. 2a and 2b show the signal control panels on the two units.

2. GENERAL DESCRIPTION.

2.1 A schematic diagram of the D-601-A unit and associated F.M. adapter are shown in Fig. 3. The principle of operation is as follows -

A lamp fed with 1,300 c/s current is used to illuminate a small area of picture on the transmitter drum. An image of the illuminated area is focused on to a plate with a small aperture, the light passing through this aperture falling on a pair of photo-multiplier cells. Thus, as the drum is rotated and traversed at constant speed, the picture is progressively scanned, the variations in reflected light from the picture causing variations in the current through the photo-multiplier cells. The picture signals modulate a 1,300 c/s carrier which is injected into the photo-multiplier cells. The output, therefore, consists of an amplitude-modulated 1,300 c/s carrier which is amplified and fed into the frequency modulator unit. The output of the frequency modulator, which is fed to line, is a constant level signal varying between the "white" frequency of 1,500 c/s and the "black" frequency of 2,300 c/s.



SCHEMATIC CIRCUIT OF D-601-A UNIT AND ASSOCIATED F.M. ADAPTER.

FIG. 3.

2.2 Basically the circuit and operation of the Australian Post Office F.M. adapter unit is the same as that of the corresponding sending unit in the D-355-B fixed equipment with the exception that the band-pass filter is omitted and that no oscillator is provided for "checking limits" at the sending end as is the case for the Muirhead-Jarvis D-355-B fixed transmitter. To set the operating limits of the portable equipment, the F.M. adapter is provided with calibrated control dials and rechecking of the limits is included in the normal routine lining up procedure using 1,500 c/s and 2,300 c/s from the Decade Oscillator (Panel E) on the Muirhead-Jarvis fixed transmitter type D-355-B at the receiving terminal via the return line for calibrating purposes. All operating switching is carried out from the control panel of the D-601-A unit.

2.3 As with the fixed equipment, a 1,020 c/s fork-controlled oscillator is used to provide power for the drum driving motor and also to send synchronising tone to line. A fork-modulating unit permits the 1,020 c/s fork signal to be sent as a modulation of a 1,300 c/s carrier, enabling synchronisation to be achieved over carrier channels with unlocked carrier oscillators.

2.4 Phasing pulses are transmitted to line as "pips" of signal fed via a pair of phasing contacts operated from the drum driving gear.

2.5 Line termination is 4-wire or 2-wire, the latter being facilitated by the use of hybrid transformers. Telephone and loud-speaker monitoring facilities are also provided as for the fixed equipment.

2.6 The mechanism assembly is shown in Fig. 4. The driving unit comprises a hysteresis motor and gear box, the supply to the motor being at 1,020 c/s from a tuning fork and amplifier. The output spindle rotates at 720 r.p.m. The hysteresis motor is considerably smaller than a phonic motor of the same power and is self-starting.

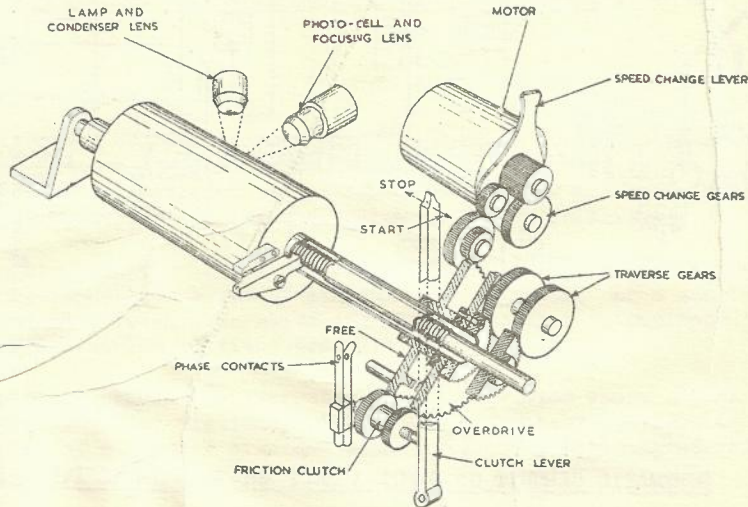


FIG. 4. MECHANISM ASSEMBLY OF PICTURE TRANSMITTER TYPE D-601-A.

The lead screw, which has a buttress thread and is mounted inside the drum spindle, is driven differentially through reduction gearing from this spindle. In order to avoid a high acceleration when the drive is engaged, the drum is driven through a friction clutch and auxiliary gearing which causes it to rotate slightly faster than the desired speed. This overdrive, however, only operates until the drum spindle catches up with an abutment on a timing wheel which is being driven at the correct speed. Thereafter, the clutch slips continuously by the amount of the excess of speed of the auxiliary gearing and the drum rotates at the correct speed. The timing wheel also carries contacts which provide for sending out the phasing signal to a receiver at the commencement of a transmission. In the neutral position of the speed-change lever, the clutch is disengaged and the drum can be turned to any desired position, but phasing signals can be sent whenever the motor is running.

2.7 The principal characteristics of the units are summarised in Table 1.

Drum Speeds	1 or 2 r.p.s.
Drum Diameter	2.6 ins. (66 mm.)
Drum Length	7.75 ins. (197 mm.)
Maximum Picture Size	8 x 7.6 ins.
Scanning Pitch	135.4 lines/inch.
Index of Co-operation	352.
Line Signal	Frequency modulated "White" 1,500 c/s. "Black" 2,300 c/s.
Output Impedance	600 ohms.
Power Supply	200-250 volt A.C. 50 c/s.
Power Consumption D-601-A	130 VA.
Power Consumption F.M. Adapter	30 VA.

TABLE 1.

END.