

B.S.M.#778B
TELEPHOTOGRAPHY

GENERAL DESCRIPTIVE INFORMATION 104A AND 105A COUPLING UNITS

1. GENERAL

1.01 This section describes transmission features of the 104A and 105A coupling units and associated circuits which permit connection of telephotograph apparatus to subscriber lines and PBX extensions. These units furnish a positive means of protecting the telephone facilities from the application of excessive voltage levels.

1.02 The 104A coupling unit shown in Fig. 1 is designed for temporary installations at stations used infrequently for picture transmission. Ordinarily, such installations will be required only for the connection of portable transmitting telephotograph equipment.

1.03 The 105A coupling unit also shown in Fig. 1 is intended for use at locations at which subscribers maintain permanent offices for the transmission of pictures or at stations frequently used for the purpose.

1.04 The circuit arrangements used with the 105A unit at various types of installations are covered in the station installation and maintenance practices, Section C55.711. These circuits are adaptations of the 5A key equipment. In one position of the key the telephone may be used in a normal way but in the other position the line is switched to the coupling unit. Regardless of the position of the key, however, the line is disconnected when the receiver or handset is restored. This feature is included since it avoids a permanent signal should the key be left off normal following the completion of a call.

1.05 The 104A and 105A coupling units are required at any location where telephotograph apparatus transmits signals over exchange or toll message connections. The coupling units are not required on telephotograph channels or on private line telephone circuits which are used for telephotograph transmission on an alternate use basis.

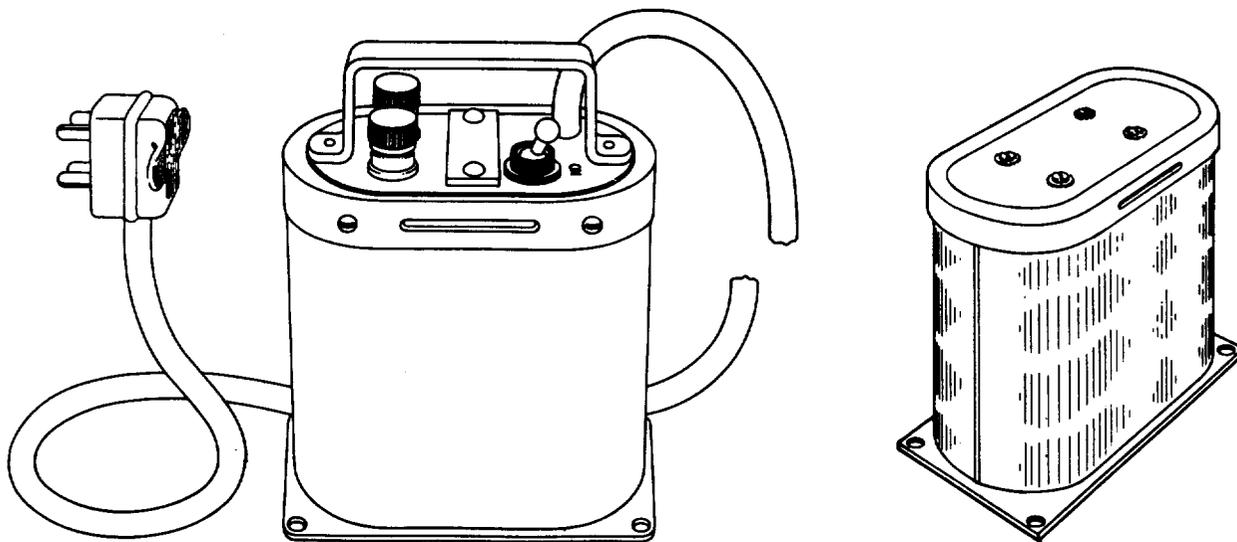


Fig. 1 — 104A (Left) and 105A Coupling Units

2. DESCRIPTION AND OPERATING PRINCIPLES

2.01 The coupling unit consists of a three-winding transformer and cold-cathode tube in a metal case. Since the line winding must serve as a holding circuit it has a comparatively low dc resistance (22 ohms) and the core is of the air-gap construction to prevent saturation due to battery supply current. The drop or apparatus winding is similar to the line winding, and the coil has a nominal impedance ratio of 1:1. The insulation between these two windings is tested at 2000 volts for five seconds. The coil, therefore, provides a substantial dielectric barrier between the subscriber-owned telephotograph equipment and the telephone circuit or apparatus.

2.02 The third winding of the transformer is not brought out of the case but is connected to a 426A electron tube which is protected from breakage by an inner container. The tube is an inert-gas-filled, cold-cathode type. Older units used a 333A tube. The function of this part of the circuit is to prevent the impression of excessive levels on the line in case the transmitting levels should be adjusted to an unduly high value. Transmissions are made at levels of not more than one milliwatt. The coupling units have been designed to transmit levels of this order with no perceptible distortion. For higher levels (which might produce objectionable noise in other circuits) the bridged loss, caused by the tube circuit, rapidly increases. For levels only 3 or 4 db above one milliwatt serious effects will be noted in the received picture; for the range of levels which have been found generally satisfactory there should be no noticeable effect on picture transmission. For the frequency bands now employed by the various telephotograph systems the noise influence is expected to be within the values given in Section AB63.600.

2.03 Due to variations in electron tubes the operating value in terms of the impressed voltage on the line or apparatus winding may be between 0.75 volt and 1.0 volt. In the conducting condition the low impedance of the tube is effectively a shunt on the line. Only two elements of the tube are used; the tube acts to suppress the peaks of the ac voltage wave. This characteristic of the coupling unit not only increases the bridged loss when the tube is conducting but in addition reduces the input impedance of the coupling unit,

thus tending to reduce the voltage across the apparatus winding.

2.04 Fig. 2 illustrates the action of the coupling unit. A signal voltage "E" is generated within the telephotograph equipment. The internal output impedance of this equipment is represented by the 600-ohm resistance shown in series with the generator output. At low signal levels the tube connected to the third winding of the transformer does not conduct and so this winding is effectively open-circuited. When the input level is increased to the point that the tube conducts, a load impedance in addition to that of the line is reflected to the input winding. This additional load impedance is represented in the drawing by the resistance "R." Its value is determined by the conducting resistance of the tube, the resistance of windings 1 and 3, and the turns ratio between these windings. When the added impedance "R" is effectively bridged on the output of the telephotograph equipment it causes an increase in the voltage drop in the internal output impedance within the equipment. This reduces the peak voltage applied to the input winding of the coupling unit and to the line.

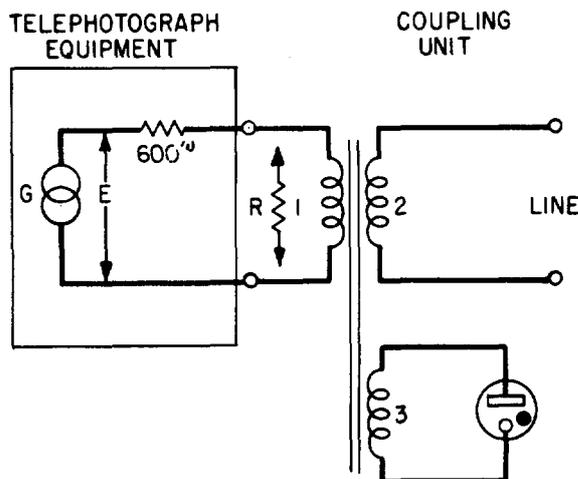


Fig. 2 — Illustration of Coupling Unit Action

2.05 It is of importance that the internal output impedance of the connected telephotograph equipment be at least 500 ohms. Lesser values will tend to nullify the limiting action of the coupling unit. If low impedance telephotograph equipment is encountered it should be isolated from the coupling unit by a pad or building-out resistance.

This pad or resistance should be of the value necessary to build out the telephotograph equipment impedance to 600 ohms.

2.06 The transmission frequency characteristic of the coupling unit for normal operating levels is shown in Fig. 3. It will be noted that the coil introduces a loss of about 2 db between 1200 and 2600 cycles, which is the range in which the present commercial telephotograph systems operate, although some systems may use a lower frequency for synchronizing. The T networks of the coupling unit at 500, 1000 and 1800 cycles for impressed voltages not exceeding the breakdown value are as follows:

Frequency	Series Arm (One Side)	Shunt Arm
500	22.5 + J0.8	60 + J275
1000	22.5 + J1.6	250 + J580
1800	22.5 + J2.8	1220 + J900

2.07 Because of the comparatively high turns ratio required between the third winding and primary, and the desire to limit the size of the unit, the primary and secondary windings have considerably fewer turns than most standard repeating coils. The mutual inductance between the primary and secondary is, therefore, not high and an impedance of 600 ohms connected to one winding will, as seen from the other winding, appear to be about 400 ohms at 1000 cycles.

104A Coupling Unit

2.08 This unit consists of the coupling transformer and electron tube mounted in a case equipped with a metal handle. The handle projects about 1-1/4" above the case. In this unit the apparatus winding is terminated on two binding posts whereas the line winding is brought out through a rubber-jacketed cord. In older units the cord used was type M2DJ and it was terminated in a 273A plug. This arrangement was used because the jack originally supplied at the station was of the 389-type. Current procedures require the use of 404B jacks at the station location. For this reason the 104A coupling unit should be equipped with a D3BA cord and a 283B plug. These items can be supplied in the usual way and changes made locally as required.

2.09 In special cases where a jack can not be made available the cord may be removed from the unit and the installer may wire the unit directly to the telephone line. To do this it is necessary to remove the cover by taking out the four screws on the sides of the case. This exposes the screw terminals to which the leads from the cord are fastened. One of these leads is connected to a toggle switch. The two terminals from which the cord is removed may be wired to the telephone line. As shown on the wiring diagram in Fig. 4, the leads to the electron tube are also fastened to screw terminals. This enables replacement of the tube as well as the cord in the field. The notation "Max. Input .8V" is stamped on the top of the unit.

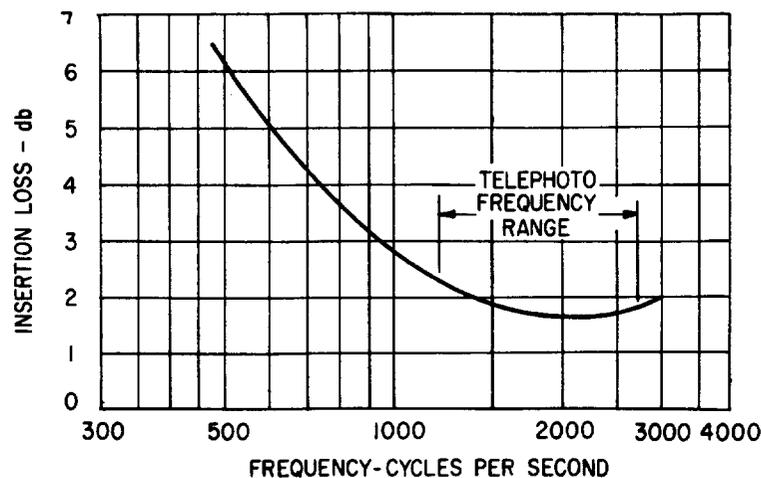


Fig. 3 — Coupling Unit Insertion Loss Between 600-Ohm Impedances at Levels of 1 Milliwatt or Less

2.10 The toggle switch in the 104A unit facilitates disconnecting the line winding from the telephone circuit while the telephone set is in use. The comparatively high bridged loss which the coupling unit would introduce is avoided in this way. During picture transmission this switch should be operated to the "ON" position and the handset or receiver should be replaced, otherwise an appreciable bridged loss will be caused and room noise picked up by the telephone transmitter will impair the picture. It is important that while transferring from one condition to the other the receiver or handset should be removed and the switch closed before the former is replaced or the latter opened. This prevents a disconnect when transferring from the telephone set to the coupling unit or vice versa.

105A Coupling Unit

2.11 The 105A coupling unit consists of a coupling coil and tube housed in a pressed steel case with a black crinkle finish, the over-all dimensions of which are 2-1/16" by 5-1/4". The cover of the unit is firmly fastened to the case and all internal connections are soldered. The line winding is brought out to two screw terminals designated "LINE." Similarly, the apparatus winding is brought out to screw terminals designated "APP." The top of each coil is marked "Max. Input .8V." The wiring diagram of this set is shown in Fig. 4.

2.12 Occasionally the circuit may be arranged in such a way that the coupling unit is in the circuit in both the transmitting and the re-

ceiving conditions. Where this is the case appreciable amplification may be used in the subscriber's equipment and noise induced in the coupling unit will impair the picture. It would be desirable wherever practicable to locate the coupling units several feet away from transformers, motors, etc. Before locating the unit in the proximity of telephotograph or other equipment containing such motors and transformers, it is advisable to check with the subscriber to make certain that no objectionable induction is experienced.

3. MONITORING ARRANGEMENTS

3.01 Monitoring receivers or loudspeaker sets are connected on the station side of the coupling unit. When a receiver is to be used for this purpose, a high impedance type such as the 509, 716C or 717A should be used. Headband types are usually preferred.

3.02 Where the 100-type loudspeaker set is to be used for monitoring it will be desirable to increase its internal input impedance by 3000 to 5000 ohms. A resistor such as the 63- or 106-type may be connected in series with the input of the loudspeaker set. If one of the conductors from the subscriber's machine is grounded the resistor should be connected in the ungrounded side. If the output circuit of the subscriber's machine is ungrounded, resistors of equal value should be connected in each of the two conductors leading to the input circuit of the 100-type loudspeaker set.

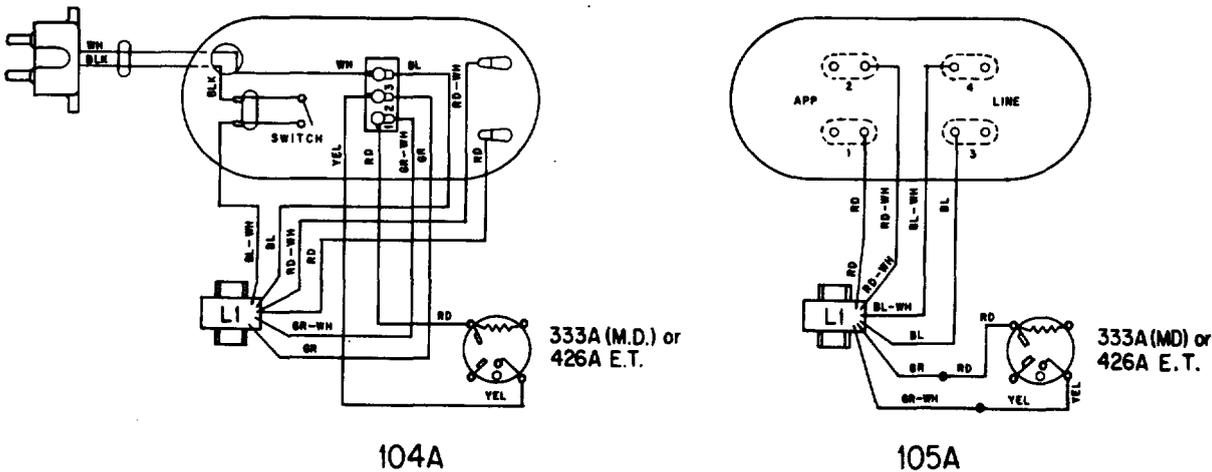


Fig. 4 — Coupling Unit Wiring Diagrams

4. SPECIAL ARRANGEMENTS

4.01 In some cases the subscriber may have a permanent location for picture transmission but use telephotograph equipment which is of portable type and which is occasionally moved from one location to another. In such instances subscribers have requested that the station equipment be arranged to permit the use of a 104A portable coupling unit which would be moved with the telephotograph transmitter. To meet these requirements equipment can be provided as for a permanent location but with the exception that the 105A coupling unit would be replaced by a

404B jack. This would permit the portable equipment to be easily connected or disconnected from the permanent station equipment.

4.02 105A coupling units may be used on special service circuits (other than telephotograph) where it is necessary to protect against the application of excessive voltage levels. Where the coupling units are to be applied on such circuits it must be established that the active and inactive characteristics of the units are compatible with the transmission and protection requirements of the circuit.