

## 144C1 COUPLING UNIT

### DESCRIPTION AND OPERATION

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#### 1. GENERAL

**1.01** This section describes the 144C1 coupling unit used to interconnect transmission circuits associated with a +60 volt mark/-30 volt space electronic hub circuit. This form of hub operation is used in No. 2 and No. 9B telegraph serviceboard and testboard offices using electronic regeneration. The 144C1 coupling unit provides two independent electronic one-way paths. Each path is capable of receiving either standard hub voltages (+60 volt mark/-30 volt space) or full-duplex hub voltages

(-10 volt mark/-60 volt space). The output of each path is arranged for connection to a +60 volt mark/-30 volt space electronic hub circuit. When arranged for receiving standard hub voltages (+60 volt mark/-30 volt space), the 144C1 coupling unit path serves as a one-way, hub-to-hub repeater. When arranged for receiving full-duplex hub voltages (-10 volt mark/-60 volt space), the 144C1 coupling unit path serves as a link connecting a full-duplex line circuit to a full-duplex concentration group. The full-duplex line circuit may be provided by a 144A1 coupling unit, 43A1 telegraph carrier channel terminal, 43B1 data carrier channel terminal, or 108-/109-type data set.

**1.02** This section is reissued to include information pertaining to the substitution of 262A electronic switches for the 429A electron tubes, and the substitution of a KS-21703 hybrid integrated network (HIN) for the 396A electron tube. Since this reissue constitutes a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. DESCRIPTION OF EQUIPMENT

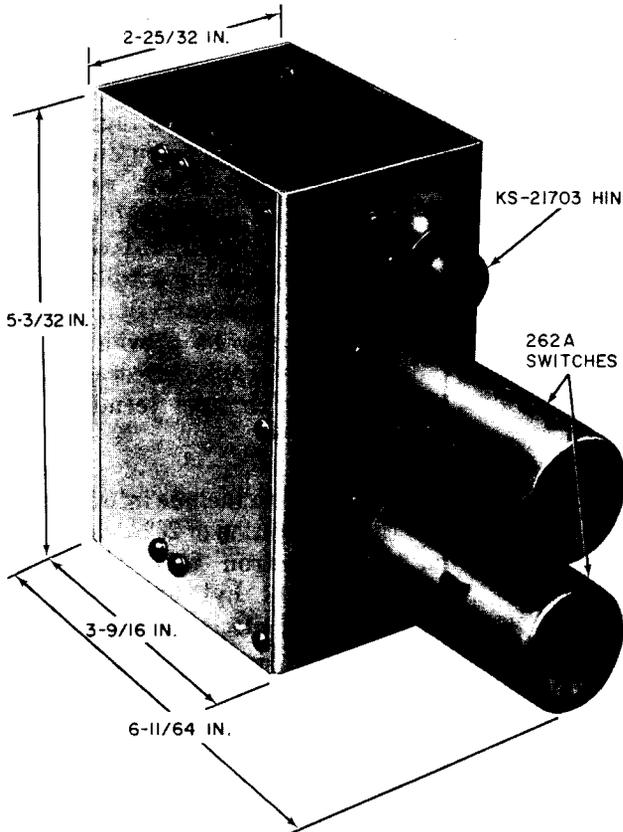
##### A. 144C1 Coupling Unit

**2.01** The 144C1 coupling unit is a plug-in type unit arranged to mount on a shelf-type mounting plate equipped with a receptacle through which external connections are made. The plug-in feature permits rapid removal and replacement of units for maintenance. The unit is 5-3/32 inches high, 2-25/32 inches wide, and 5-57/64 inches deep when equipped with two 429A electron tubes and one 396A electron tube. In order to eliminate the power required for the tube heaters, the 429A tubes are replaced with 262A switches, and the 396A tube is replaced with a KS-21703 HIN. Figure 1 shows the 144C1 coupling units' physical dimensions when equipped with the KS-21703 HIN and 262A electronic switches. The unit is encased in an aluminum chassis open at the top and bottom to

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provide ventilation. There are no manual operating controls on the unit. A plug located on the rear provides for mounting and making external connections.



**Fig. 1—144C1 Coupling Unit Equipped With KS-21703 HIN and 262A Switches**

**2.02** Five coupling units, occupying the space of three 1-3/4 by 19 inch mounting plates, are arranged to mount side by side on a shelf-type mounting plate. When the unit is equipped with tubes, the high heat dissipation per unit limits an 11 foot 6 inch bay to a maximum of 45 coupling units together with a filament supply panel and a bay fuse panel. The coupling units and associated filament supply and fuse panels should be located in the upper portion of the bay, with the lower portion used for equipment having low heat dissipation. The filament supply and fuse panels should be located above the coupling units. In installations where only a few coupling units are required, the common filament supply panel may be omitted and an individual filament adjusting

resistance provided for each coupling unit. Coupling units equipped with 262A switches and KS-21703 HINs do not require a filament supply.

#### **262A Switch**

**2.03** The 262A switch is a direct replacement for the 429A electron tubes mounted in sockets V2 and V3. The switch contains a 2-stage, directly coupled circuit whose driver stage controls the output to the hub. The various components are mounted on a printed wiring board and attached to a 9-pin tube base. The board assembly mounts into a perforated can which fits over the board forming a cylindrical-shaped unit measuring approximately 1-1/5 inches across and 3-3/16 inches tall. The perforations in the assembly provide for heat dissipation.

#### **C. KS-21703 HIN**

**2.04** The KS-21703 HIN is a replacement for the 396A electron tube mounted in socket V1. The HIN consists of a solid state network attached to a 9-pin tube base sealed in a cylindrical metal case. No modification of equipment circuitry is required to accommodate the HIN.

### **3. PRINCIPLES OF OPERATION**

#### **A. Interconnection of Half-Duplex Hub Circuits**

**3.01** The 144C1 coupling unit may be used to repeat signals from one hub to a second hub. For this application, the coupling unit receives the regular +60 volt mark/-30 volt space hub voltages from either a hub potentiometer or from the output of a regenerative repeater. The output of the coupling unit connects to a hub potentiometer. Figures 2 and 3 show two examples of how the 144C1 coupling unit may be used to interconnect half-duplex hub circuits. Other specific applications are shown on various serviceboard BSPs and SD drawings.

**3.02** Figure 2 shows the 144C1 coupling unit interconnecting a hub circuit of receive only legs to a two-way, half-duplex hub circuit of the same concentration group. Interconnection of two or more hubs in this manner is occasionally necessary in order to split a hub to reduce electrical capacity to ground. For simplification, Fig. 2 shows only one path of the 144C1 coupling unit in use. If needed, the other path of the coupling unit may

be used simultaneously to interconnect two other hub circuits in the same manner.

**3.03** Figure 3 shows the 144C1 coupling unit used to connect from the send hub of a main concentration of half-duplex legs to the send hub of a second concentration of half-duplex legs. In this case, no connection is made between the receive and send hubs of the second concentration group. A half-duplex repeater must be used to connect the receive hub of the second concentration group to the receive hub of the first concentration group. A regenerative repeater used at the first concentration group then regenerates signals to and from all legs on both concentration groups.

**B. Full-Duplex Service**

**3.04** The 144C1 coupling unit may be used as a one-way coupling circuit connecting a line or loop repeater operating in the full duplex mode

to a full-duplex concentration group. In this application, the coupling unit acts as a connecting link between a -10 volt mark/-60 volt space full-duplex potentiometer and the regular +60 volt mark/-30 volt space hub potentiometer. The negative full-duplex potentiometer voltages disable the coupling unit's duplex control circuitry, and allow spaces to pass simultaneously in both directions through the coupling unit. Figure 4 shows the 144C1 coupling unit used in conjunction with two 144A1 coupling units for full-duplex operation. A full-duplex potentiometer is connected to the RL lead of each 144A1 coupling unit to enable the 144A1 coupling unit to operate full duplex. The RL lead of each 144A1 coupling unit is actually a full-duplex receive hub operating on -10 volt mark/-60 volt space signals. The 144C1 coupling unit interconnects the full-duplex hub used by the 144A1 coupling unit to a half-duplex hub circuit consisting of a hub potentiometer and the SL lead of the other 144A1 coupling unit.

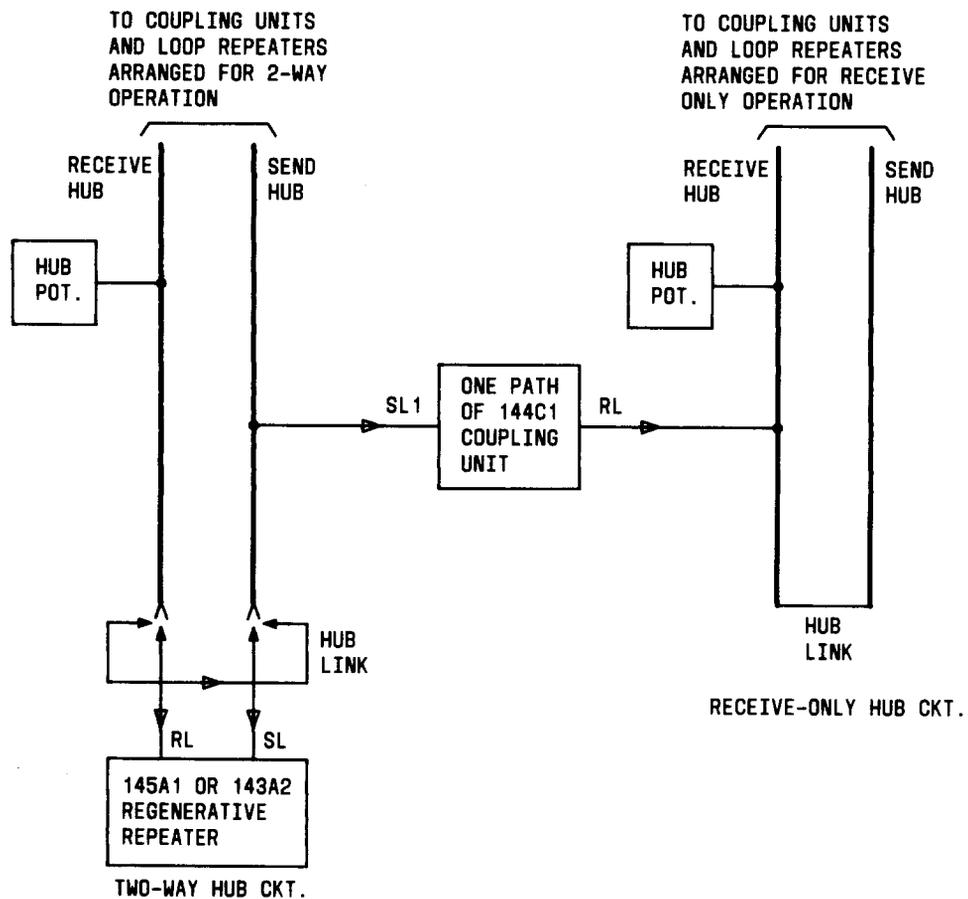


Fig. 2—Connection of Two-Way Hub Circuit to Receive—Only Hub Circuit

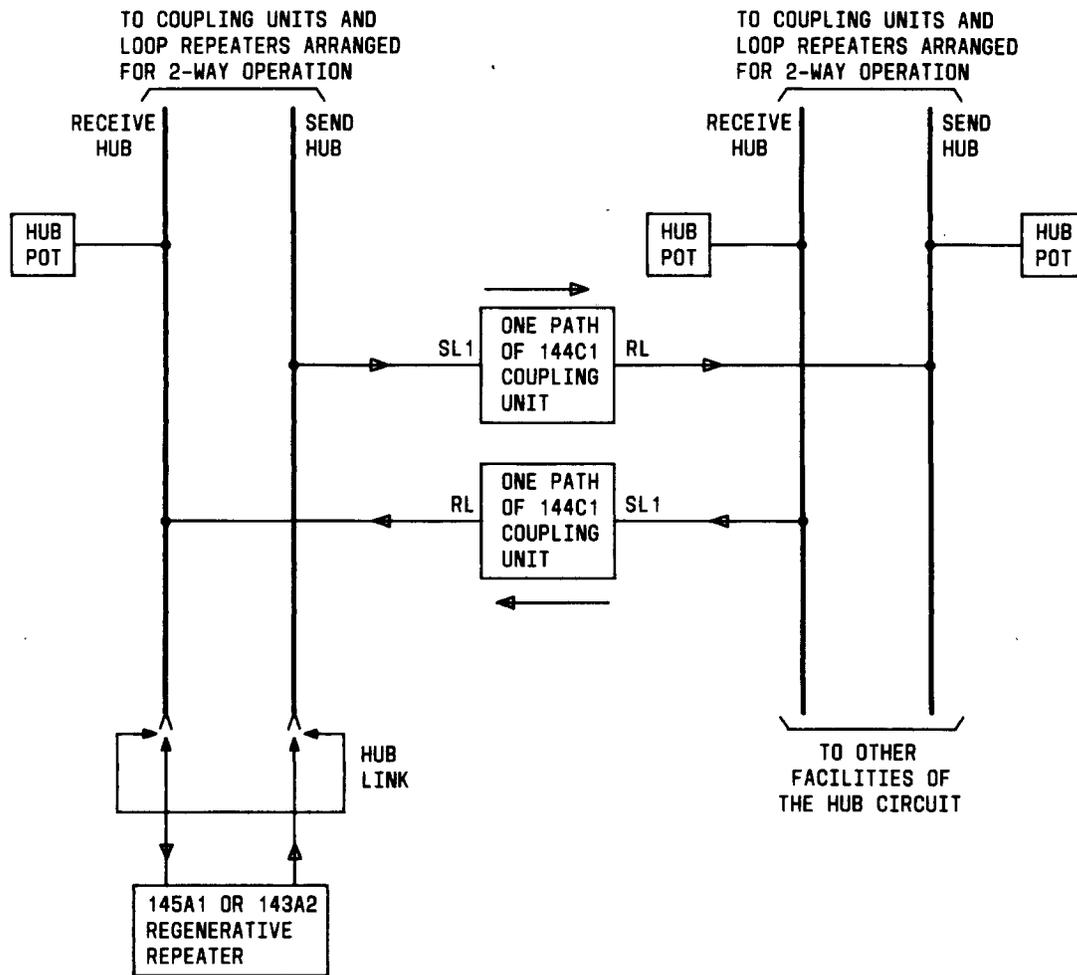


Fig. 3—Interconnection of Two-Way Hub Circuits

3.05 One-way facilities (send only or receive only) may be connected to the RL leads of the 144C1 coupling unit, as required. One-way facilities transmitting toward the west or receiving from the east are connected to point A in Fig. 4. One-way facilities transmitting toward the east or receiving from the west are connected to point B in Fig. 4.

#### 4. DESCRIPTION OF OPERATION

##### A. General

4.01 The 144C1 coupling unit circuit shown in Fig. 5 is described in the following paragraphs. Since the 144C1 coupling unit is a dual unit providing two identical paths, circuit operation is described for one path only. It should be understood that

the circuit operations described apply equally well to both paths. Coupling units equipped with 262A switches and KS-21703 HINs operate the same as coupling units equipped with 429A and 396A electron tubes. For simplicity, the circuit operation is described in terms of tube operation.

##### B. Full-Duplex Service

4.02 The -10 volt mark/-60 volt space signals at a full-duplex potentiometer are connected to the 144C1 coupling unit via the SL2 lead. The SL2 lead ties the incoming voltage signals to grid 3 of tube V1 via the R2/R3 voltage divider terminating in -130 volts. The voltage divider places a -20 volt mark/-70 volt space potential on grid 3. The left half of tube V1 (pins 2-3-4) is arranged to conduct for mark and cutoff for space. When

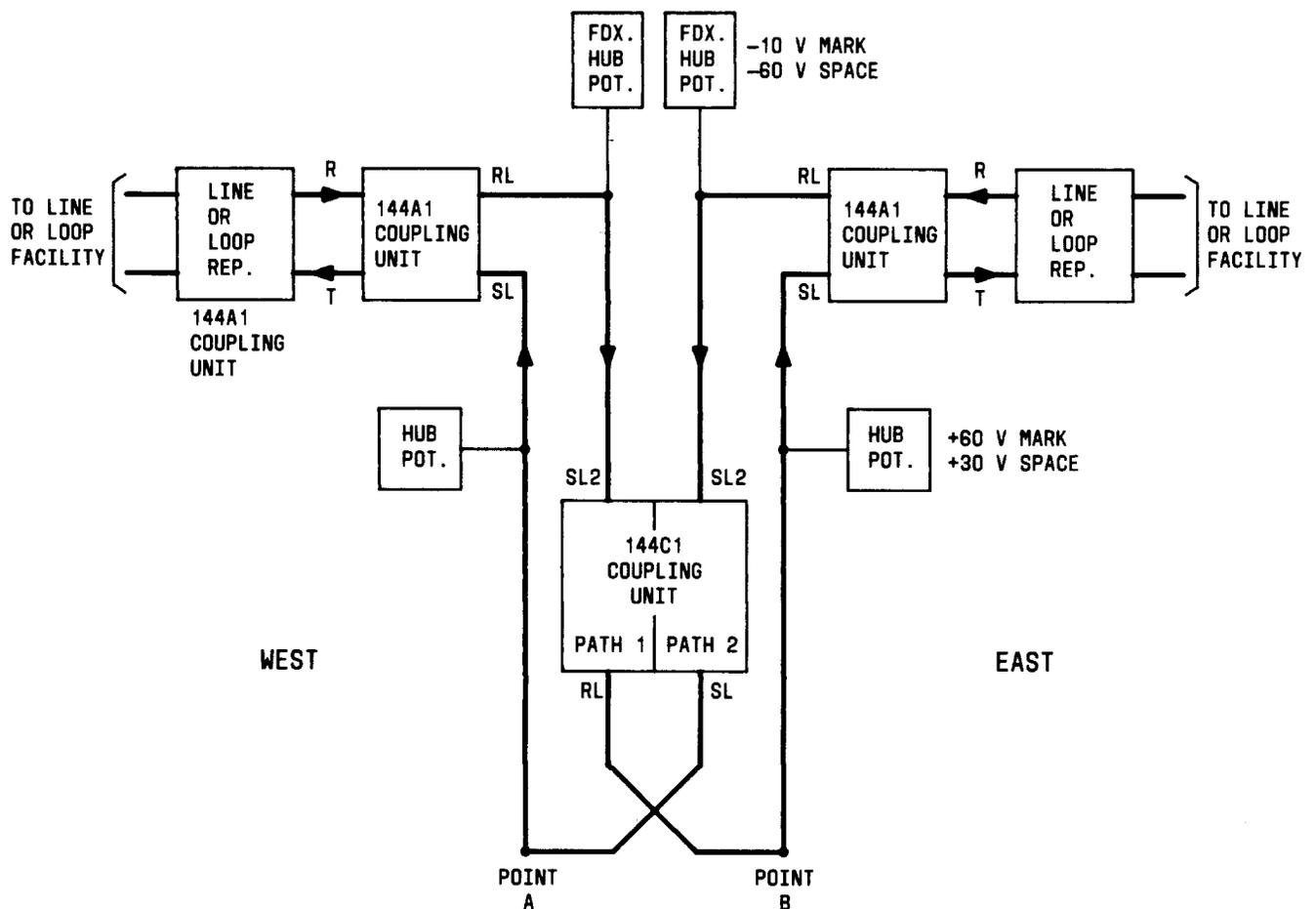


Fig. 4—144C1 Coupling Unit Arranged for Full-Duplex Service in Conjunction with 144A1 Coupling Units

conducting (mark), the plate voltage at terminal 4 of tube V1 is zero or slightly negative. When cutoff (space), the plate voltage at terminal 4 of tube V1 is +105 volts. The plate voltages are coupled to the control grid of tube V2 via the R7/R8 voltage divider terminating in the -330 volt bias supply. The voltage divider places a -175 volt mark/-128 volt space potential on control grid 8. Tube V2 is arranged to cutoff for mark and conduct for space. The plate of V2 connects through resistors R9 and R10 to the RL lead, which connects to a hub potentiometer. When cutoff (mark), the plate of tube V2 draws no current and the hub potentiometer produces a hub voltage of +60 volts. When conducting (space), the plate of tube V2 draws a current of 30 mA causing the hub potentiometer to produce a hub voltage of -30 volts.

### C. One-Way Hub-to-Hub Service

**4.03** The 144C1 coupling unit operation is identical for one-way, hub-to-hub service and full-duplex service with the following exception. The +60 volt mark/-30 volt space signals for hub-to-hub service are applied to lead SL1 instead of lead SL2 used for -10 volt mark/-60 volt space full-duplex signals. The SL1 lead routes the incoming half-duplex mark/space signals through an additional resistance (R1) before applying the signals to grid 3 of tube V1. The R1/R2/R3 voltage divider causes the incoming half-duplex mark/space signals to produce -20 volt mark/-70 volt space potentials on grid 3. The circuit operation thereafter is identical to that described for full-duplex service and is explained in 4.02.



for Testing 144-Type Coupling Units and 96A1 Electronic Loop Repeaters) and Section 312-210-500 (144A1, 144B1, and 144C1 Coupling Units—Tests and Adjustments).

**6. REFERENCES**

**6.01** The following drawings and sections provide additional information for the 144C1 coupling unit and associated equipment.

SECTION	TITLE
312-210-500	144A1, 144B1, and 144C1 Coupling Units—Tests and Adjustments.
103-824-101	165B1 Test Set for Testing 144-Type Coupling Units and 96A1 Electronic Loop Repeaters—Description.

SECTION	TITLE
103-824-501	165B1 Test Set for Testing 144-Type Coupling Units and 96A1 Electronic Loop Repeaters—Operation
103-469-100	KS-21697 HIN Tester—Description
666-101-100	No. 2 Telegraph Serviceboard—Description and Operating Principles
666-102-100	No. 9B Telegraph Serviceboard—Hub Operation

NUMBER	TITLE
SD-+CD-70639-01	144C1 Coupling Unit Circuit
SD-+CD-70635-01	165B1 Test Set Circuit