

# EK-516

## ELECTRONIC KEY TELEPHONE SYSTEM

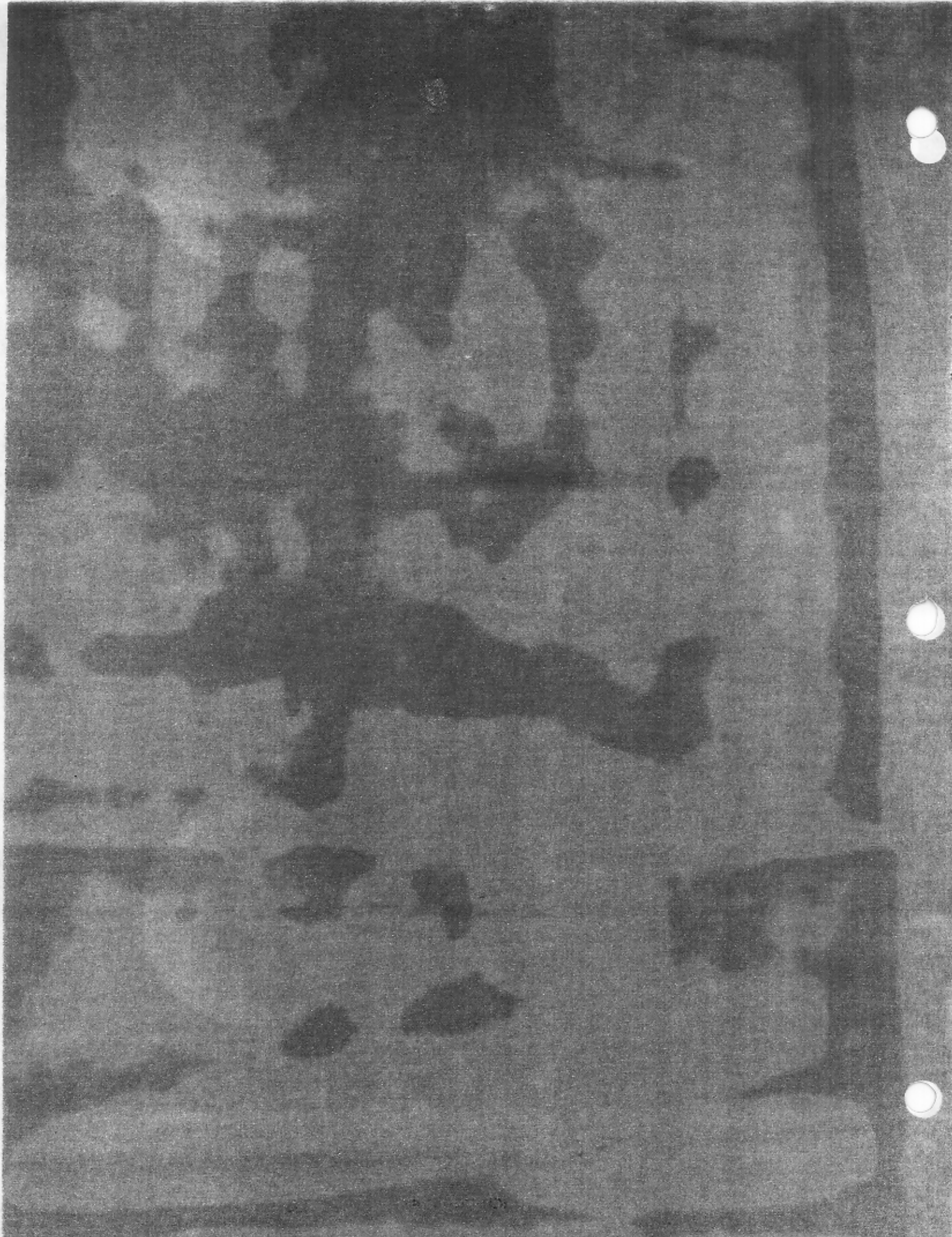


# INSTALLATION MANUAL



TIE / COMMUNICATIONS, INC.

5 RESEARCH DRIVE  
SHELTON, CT. 06484 (203) 929-7373







December 10, 1980

SUBJECT: Power Line Surge Protection in All TIE Electronic Key Telephone Systems.

TO ALL TIE CUSTOMERS

This letter is issued for the following purposes:

1. To recommend that all of TIE's electronic key telephone systems presently in production (EK-308, EK-516, EK-717, EK-1236, EK-2040, and EK-2260) and all future systems be equipped with a power line surge protection device.
2. To recommend that TII® Model 428 Plug-In Powerline Surge Protector, or an equivalent device, be used for this purpose.

EXPLANATION

The failure of electronic circuit components occurring after thunderstorms has been investigated. This investigation has revealed that systems without power line surge protection are more susceptible to damage from power line surges than protected systems. The cost of a surge protector is small compared to the cost of extensive component replacement or repair. Its installation will prevent or minimize the damage resulting from violent thunderstorm activity, while preserving customer satisfaction with TIE/communications' electronic key systems.

DESCRIPTION OF THE SURGE PROTECTOR

The TII® #428 Plug-In Powerline Surge Protector is a 15-amp self-contained unit which plugs into a standard 3-prong, parallel blade, grounded 117VAC wall outlet. The system power supply should be plugged into the duplex receptacle on the surge protector. A cover plate screw holds the TII #428 unit in place.

The unit contains a long-life pilot lamp which glows when normal AC line voltage is present and extinguishes when power is off or during power line surges. The TII #428 unit contains a gas tube surge protector which operates at 300V or higher potentials. MOV voltage clamping diodes are connected across the output to reduce low-level transients and ripple effects. The unit measures 4.9 x 3.3 x 3 inches and weighs 10 ounces.

The TII #428 unit is available from TII® Industries, Inc. or from the telephone-equipment supply houses.

ASSISTANCE

If technical questions or problems arise in this matter, consult TIE's Technical Service Department.





# INTRODUCTION

The purpose of this manual is to provide the descriptive and procedural information necessary to install, test and maintain the TIE EK-516 Electronic Key Telephone System. It is assumed that the installer has a basic understanding of key systems theory and operation. With that knowledge and this manual, the installer will be able to install, test, and maintain the EK-516 system.

The EK-516 key service unit, power supply, and telephones are the fundamental components of the system. Information on installation, connections, strapping, and testing is provided.

It is recommended that the installer thoroughly familiarize himself with the information contained in this manual prior to initiating installation of the system.

It is further recommended that this manual and other job related information be left at the job site to aid personnel on repair and rearrangement visits. Options, and any special wiring should be recorded for use by personnel on future visits to the job. This can save both time and money.

If, during installation, or service calls, problems or questions arise that cannot be resolved by using the information contained in this and related manuals, assistance is available from the TIE Technical Service Department, Monday through Friday, as follows:

For assistance in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, between 8:30 AM and 5:30 PM, Pacific time, call:

415-592-1929

For assistance in Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin, between 8:30 AM and 5:30 PM, Central time, call:

312-595-4400

For assistance in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee and Texas, between 8:30 AM and 5:30 PM, Eastern time, call:

404-447-1314

For assistance in all other states, between 8:30 AM and 5:30 PM, Eastern time, call:

203-929-7373

For EMERGENCY assistance at times other than above, call:

203-929-7920





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## TIE EK-516 KEY SERVICE UNIT INSTALLATION

### 1.00 INTRODUCTION

1.01 This section provides a general description, operational, installation, testing and maintenance information required for TIE's HOMEFONE™ II/BUSINESS-COM™ II key telephone system.

### 2.00 GENERAL

2.01 The TIE/communications EK-516 system is an electronic key telephone system which utilizes a central microcomputer for controlling the switching between the calling key telephone set and the C.O. lines and/or other key telephone sets or intercom/door boxes within the system. Each telephone is equipped with a microcomputer which transmits the station status to the CPU on a real time basis.

2.02 The system operates on two pairs of wires (*quad*) which connect each telephone, intercom box or door box to the KSU.

2.03 The EK-516 system is a direct access system that requires only the depression of a single key at the telephone for connection to the desired party or C.O. line. No dialling is required for internal calls. All stations are arranged for "handsfree talkback" on internal calls. The system consists of three major items:

- The Key Service Unit (KSU).
- The Power Supply.
- Multi-button key telephones, intercom boxes, door boxes or single line telephones equipped with applique boxes (*stations*).

### 3.00 SPECIFICATIONS

#### 3.01 Physical Dimensions:

##### KSU

Height - 22.5" (57.1 cm)  
Width - 16.9" (43.0 cm)  
Depth - 5.1" (13.0 cm)

##### Power Supply

Height - 12.0" (30.5 cm)  
Width - 8.5" (21.6 cm)  
Depth - 4.6" (10.6 cm)

##### Telephone

Height - 4.2" (10.7 cm)  
Width - 7.4" (18.8 cm)  
Depth - 8.8" (22.4 cm)

#### 3.02 System Capacity:

3.03 A maximum of 5 C.O. lines and a maximum of 16 stations (*telephones or boxes*) may be provided in the system.

#### 3.04 Intercom Paths:

3.05 The maximum number of intercom paths which may be provided in the system is 2.

#### 3.06 BLF Positions:

3.07 One EK-516 BLF telephone may be installed in the system as an attendant's position. This telephone is equipped with a busy lamp field to provide the attendant an off-hook status of all telephones in the system. All telephones in the system function as DSS stations on internal calls, without the BLF.

#### 3.08 Power Requirements:

3.09 AC power requirements for the system are: 117 VAC,  $\pm 10\%$ , 60 Hz, single phase.

3.10 The EK-516 power supply provides  $\pm 18$  and  $+24$  VDC as required for a fully equipped KSU. The EK-516 power supply is fitted with a 3' cord.

3.11 Station Loop:

3.12 The system functions on standard 4-wire, inside, non-twisted, 24-gauge quad up to a distance of 500 feet. Up to 800 feet of 22-gauge may be used when longer distances are required.

## 4.00 SYSTEM COMPONENTS

4.01 The TIE EK-516 key telephone system is comprised of the following components:

a) EK-516 Key Service Unit.

The basic EK-516 KSU provides the initial capacity for 2 C.O. lines, 1 DSS intercom path with handsfree answerback, and the interface circuits required for ten telephones. The following components make up the basic EK-516 KSU:

EK-516 Cabinet (1)

CPU-5A (1)

8SU-5A (1)

2SU-5A (1)

CMI-5A (1)

LTB-A (1)

LTB-D (4)

LTB-E (1)

Each of the above components is described in the following paragraphs.

b) EK-516 Power Supply.

The EK-516 power supply is a wall-mounted unit which provides the  $\pm 18$  and  $+24$  VDC potentials required for a fully operational EK-516 system.

c) EK-516 Telephones.

Two types of telephones are provided in the system:

1. The EK-516 telephone - An electronic microcomputer controlled key telephone equipped with a

wood-grain faceplate, G3 type handset, 6' handset cord, 7' modular plug-ended 4-conductor line cord, and 24 buttons which provide all station features. Faceplates are available in colors also. Seven of the buttons are equipped with long life LED's. The button functions are:

HOLD

PRIVACY RELEASE

All-Call/Mic Mute (also DND when implemented)

16 DSS buttons

4 C.O. line buttons

1 Miscellaneous button - This button may be used for a 5th C.O. line button, the Station Monitor feature or for use with the Called-Party Monitor unit.

The EK-516 key telephone is arranged with a "Do Not Disturb" feature which blocks background music, intercom and all-call page calls when activated (requires installer modification).

2. The EK-516 BLF telephone - This telephone has all of the features of the EK-516 set plus a busy lamp field. One of these stations may be equipped in the system. This set is usually used as an attendant's telephone. It provides an off-hook status indication of all other telephones in the system. This set requires a BLU-5A circuit card in the KSU to provide the station interface. A 25-pair cable is required to connect the EK-516 BLF set to the KSU.

d) Other Station Units.

Eleven additional components may be provided in the system as part of the station equipment:

1. Intercom Boxes - This box is



used as a station when DSS calls and access to C.O. lines is not required at the station. The unit consists of a housing, loudspeaker, microphone, 3 LED's, 3 push-buttons, volume control, printed circuit board and modular cord.

2. Door Boxes - This box is used to communicate with persons at an outside door location. The door box consists of a housing, loudspeaker, microphone, and printed circuit board.
3. Door Chime Box - This unit is the same as the door box, but is equipped with a push-button. This unit is capable of generating one of two distinctive tones (*strapping option*) for easy recognition of two separate locations. Tones are received at the telephone locations within the system.
4. RDK and TDK-NT, Rotary and DTMF Tone Dial Kits - Standard rotary and DTMF dials equipped with a dial terminal board (DTB) which plugs into the 516 telephone.
5. ODK, OUTPUT PULSE DIAL <sup>®</sup> Kit - TIE OUTPUT PULSE DIAL equipped with a dial terminal board which plugs into the 516 telephone.
6. Applique Box - The applique box provides an interface between a single line telephone (*such as a decorator phone*) and the 516 system. It permits the single line telephone to function as a multi-button set. The box contains a 6-button key assembly, loudspeaker, microphone, volume control, 7' modular line cord and a printed circuit board. The button functions are:  
 HOLD  
 PRIVACY RELEASE  
 2 C.O. Line Buttons  
 MISCELLANEOUS Button (*C.O. line or station monitor*)  
 AC/MIC MUTE button (*also DND when implemented*)
7. 402 Speakerphone - The 402 Speakerphone is a cosmetically matching speakerphone for use with the EK-

516 key telephone set.

8. SPK-5A Called-Party Monitor - This unit is a circuit board which is installed in the 516 telephone set to provide the Call Monitor feature. It utilizes the 5th (*Miscellaneous*) button. This unit overrides all other functions of the 5th button and therefore should not be installed in telephones where the 5th C.O. line or the Station Monitor feature is required.
9. FL-SW, Flash Switch Assembly - Consisting of a woodgrain faceplate and a switch to be mounted on the keystack assembly and wired via spade-tipped leads to the telephone. It is used when the system is installed behind a PABX requiring 'open loop' flashing.
10. WL-MTG KIT, EK-516 - EK-516 telephone wall-mounting kit.
11. WL MTG KIT, APP. BOX - Applique box wall mounting kit (*may also be used for 402 Speakerphone*).

e) KSU Circuit Boards

14 circuit boards (*printed circuit assemblies*) are available for use in the KSU. Following is a list of the printed circuit assemblies and their functions:

BLU-5A: This unit is installed in the KSU (*see figure 3*). It is the interface circuit required when an EK-516 BLF telephone is installed in the system. This unit controls the busy station indication at the attendant's telephone. Maximum 1 per system.

COU-5A: This unit provides a single C.O. line circuit for the 4th and 5th lines when an LNU-5A is equipped; or the 3rd and 4th lines when the MOU-5A or ICU-5A card is used. Maximum 2 per system. See table 2.

CMI-5A: This unit is installed in the KSU (*see figure 3*) as part of the basic system. It is used to provide part of the common switch-

ing matrix which is used for the 5th C.O. line, the 2nd DSS intercom path, or the Station Monitor circuit. Maximum 1 per system.

CPU-5A: This unit is the central processor unit of the KSU. All KSU functions are controlled by this unit. Maximum 1 per system.

ICU-5A: This unit plugs into the CMI-5A to provide the 2nd DSS intercom path for the system. Maximum 1 per system. Cannot be used if system has MOU-5A card. See table 2.

LNU-5A: This unit plugs into the CMI-5A to provide the 3rd C.O. line circuit if the system is not equipped with an MOU-5A or ICU-5A card. Maximum 1 per system. See table 2.

LTB-A: Line Terminal Board assembly provides KSU connections for 1st three C.O. lines and miscellaneous inputs to the system (*i.e.*, MOH, BGM, alarms, etc.). Maximum 1 per system.

LTB-D: Line Terminal Board assembly provides KSU connections for 4 EK-516 telephones and/or ICM/Door boxes to the KSU. Maximum 4 per system.

LTB-E: Line Terminal Board assembly allows for connection of 2 additional C.O. lines (*maximum* 5) to the KSU. Maximum 1 LTB-E per system.

MOU-5A: Station Monitor unit. This unit plugs into the CMI-5A circuit to provide the station monitor feature of the KSU. This unit cannot be used if the system is equipped for 2 DSS intercoms or 5 C.O. lines. Maximum 1 per system. See table 2.

SHU-5A: This unit is a music-on-hold music source. The music is synthesised and one of two melodies may be selected as a strapping option on the card. Maximum 1 per system.

8SU-5A: This unit is installed in the KSU as part of the basic system. This card provides the interfaces required for 8 telephones or

applique boxes in the system. Maximum 1 per system.

2SU-5A: One unit is installed in the KSU as part of the basic system. This card provides the interfaces for 2 telephones or applique boxes to the KSU. An additional 2SU-5A card is required for each 2 telephones added to the system up to a maximum of 4 cards. See table 1.

2IU-5A: This unit is installed in the KSU for interfacing 2 ICM/Door boxes. The maximum number of 2IU-5A cards in the system is 3 (6 boxes). See table 1.

4.02 Table 1 shows the maximum number of telephones, and ICM/Door box combinations which are possible within the system.

4.03 Table 2 shows the number of C.O. lines and circuit cards which may be used with CMI-5A matrix.

Table 1 - Telephone and ICM/Door Box Combinations Available

NUMBER OF TELEPHONES	NUMBER OF ICM/DOOR BOXES	EXPANSION CIRCUIT CARDS REQUIRED	
10	0	N/A	N/A
	1 or 2		2IU-5A-1
	3 or 4		2IU-5A-1 & -2
	5 or 6		2IU-5A-1, -2 & -3
11 or 12	0	2SU-5A-2	N/A
	1 or 2		2IU-5A-2
	3 or 4		2IU-5A-2 & -3
13 or 14	0	2SU-5A-2 & -3	N/A
	1 or 2		2IU-5A-3
15 or 16	0	2SU-5A-2, -3 & -4	N/A

Table 2 - C.O. Line, Intercom Paths or Station Monitor Combinations Available

NUMBER OF C.O. LINES	SECOND ICM USED	MONITOR USED	CARDS REQUIRED FOR CMI-5A MATRIX	NUMBER OF COU-5A CARDS REQUIRED
1 or 2	NO	NO	0	0
	NO	YES	MOU-5A	
	YES	NO	ICU-5A	
	YES	YES	Second ICM and Monitor features in the same system is not possible.	
3	NO	NO	LNU-5A	0
	NO	YES	MOU-5A	1
	YES	NO	ICU-5A	
	YES	YES	Second ICM and Monitor features in the same system is not possible.	
4	NO	NO	LNU-5A	1
	NO	YES	MOU-5A	2
	YES	NO	ICU-5A	
	YES	YES	Second ICM and Monitor features in the same system is not possible.	
5	NO	NO	LNU-5A	2

Notes: 1. Systems with 5 C.O. lines cannot have either the 2nd ICM path or the Monitor feature.

2. When the telephone is equipped with a Called-Party Monitor, the 5th button on that set cannot pick up the 5th C.O. line or utilize the Station Monitor feature.

## 5.00 FEATURES

5.01 The TIE EK-516 key telephone system provides the following features:

- a) Alarm Repeating: Alarms from a customer-provided security system may be transmitted to all stations within the system and also to outside door boxes to alert neighbors.
- b) All-Call Paging: All stations within the system may be paged by use of one button from any station (except door boxes) in the system.
- c) Alternate Point Answer: An intercom call may be answered from any telephone in the system.
- d) Busy Station Display: One station in the system may be equipped as an attendant's station with a visual indication of the off-hook status of each telephone in the system.
- e) C.O. Line Pickup & Hold: All telephones in the system may have up to 5 C.O. line pickups and a HOLD button for holding the calls.
- f) Call-Announcing: The system provides internal call-announcing to each station with handsfree answer-back.
- g) Courtesy Signalling: Station user on an outside call receives a discrete signal when called on the intercom.
- h) Direct Station Selection: This feature is provided on all telephones within the system and requires only one key operation to talk to the called station. This single button DSS operation eliminates the need for dialling to establish an intercom call.
- i) Distinctive Visual Indications: The system provides distinctive visual indications at each telephone for the following:

Incoming C.O. Ringing (50 IPM flash).

I-Hold (50 IPM double flash).

System Hold (someone else - 100 IPM wink).

I-Use (18 IPM double wink).

Intercom Call Signal, Recall & Microphone On (150 IPM flutter).

- j) Do Not Disturb: When activated by depressing the AC/DND button, the BGM is turned off, all-call announcements and intercom calls are blocked from the station.
- k) Flexible C.O. Audible: Each telephone may be programmed to receive C.O. audible signals.
- l) Handsfree Talkback: The station user can answer intercom calls from across the desk or across the room without touching the telephone.
- m) Microcomputer: The system is microcomputer controlled with non-volatile programs. Therefore, there is no start-up time when the system comes back into service from such conditions as a commercial power failure.
- n) Modular Plugs and Jacks: The system functions on only two pairs of wires arranged for modular plugs and jacks for ease of installation.
- o) Music-On-Hold & Background Music: The system is equipped with connections to provide music-on-hold to the outside party on held calls and background music to the stations through the loudspeakers inside the stations.
- p) Multi-trunk Conferencing: This feature allows the station user to connect two outside calls together at his station for a three-way conference.
- q) Non-locking Keys: The telephone sets have non-locking keys with built-in long-life LED's (light emitting diodes) providing the status of functions associated with the keys.

- r) One-step Call Forwarding: Depressing a DSS key at the telephone while on an outside call will automatically place the outside line on hold.
- s) Power Failure Transfer: When a commercial power failure occurs, the C.O. lines are automatically cut-through to predetermined telephones. Telephones may be equipped with a high-voltage buzzer for detection of C.O. audible during power failure conditions.
- t) Privacy of Calls: The system provides for automatic exclusion with privacy release capability on C.O. line calls should the station user wish to conference with another inside party.
- u) Self Identifying Keys: No internal dialling or directory consultation is required to establish internal calls, as the keys may be designated with the names of personnel, rooms, and/or departments. Keys are designated with numbers from the factory.
- v) Timed Recall: Calls placed on HOLD will automatically ring back the holding station after a set timed interval which is adjustable from 20 to 140 seconds or recall may be disabled.
- w) Types of dials: The system uses rotary and standard DTMF type dials or specialized dials which include TIE's OUTPUT PULSE DIAL ® and TIE's MEMORY ® OUTPUT PULSE DIAL ®.
- x) Night C.O. Audible: When the system has a BLF telephone, depressing a Night Transfer button will make all telephones ring at night.

## 6.00 BASIC KSU INSTALLATION

### 6.01 Selection of Equipment Location

6.02 Considering the factors listed below, select a suitable site for installation of the KSU.

- a) The TIE EK-516 KSU is configured for wall-mounting only.
- b) Availability of 117 VAC,  $\pm 10\%$ , 60 Hz, single-phase, 3-wire (*parallel blade and ground*) power outlet. See also paragraph 6.09.
- c) Location of the CO/PBX line terminations. The LTB-A and LTB-E terminal board assemblies are supplied from the factory with 4-conductor modular plug-ended 6' line cords which plug into an FCC approved RJ-14-C (USOC code) jacks. These jacks should be placed by the installer at the KSU location so that the 7' cord attached to the LTB-A/E assemblies may be plugged in without adding cable.
- d) Location of the majority of local stations. The practical objective of equipment location is to minimize cable runs.
- e) Location of telephone ducts, or conduit, if provided.
- f) A well ventilated area having a temperature range of from  $+32^{\circ}$  ( $0^{\circ}\text{C}$ ) to  $+112^{\circ}$  ( $+45^{\circ}\text{C}$ ) Fahrenheit is recommended.
- g) A good earth ground must be provided, using 14-gauge or larger wire. A cold-water pipe with insulated joints and meters bypassed with 14-gauge or larger straps will provide a suitable ground.
- h) Availability of space to allow for accessing and servicing the equipment. Consider also:

Lighting.

Flammables in the area.


Flooding possibility.

Moving machinery or equipment.



6.03 KSU Mounting

6.04 The EK-516 KSU is designed for wall-mounting ONLY.

 When a concrete, masonry, or damp surface is selected for the mounting site, the KSU **MUST** be mounted on a customer-provided backboard.

6.05 On the surface to which the KSU is to be mounted, locate the 4 points which correspond to the keyhole type mounting holes in the back panel of the KSU assembly. Figure 1 provides the dimensions between mounting hole centers for the KSU.

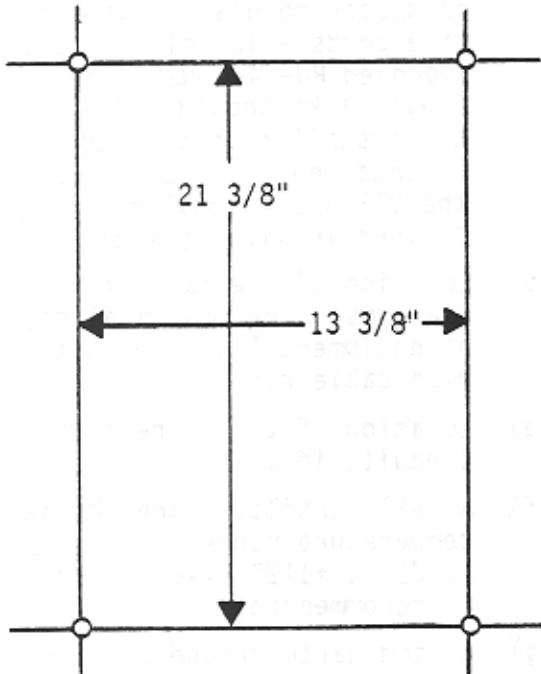


Figure 1  
KSU Mounting Hole Centers

6.06 The method of fastening the assembly will be determined by the surface to which it is to be fastened. Using suitable fasteners, secure the assembly to the mounting surface. A fully loaded KSU weighs approximately 28 pounds.

6.07 Mounting the Power Supply

6.08 The TIE EK-516 Power Supply is designed for wall-mounting ONLY.

6.09 Select a mounting location close enough to the KSU to permit its 4' power cord (attached by 5 screw terminals to the CPU-5A) to plug into the power supply and close enough to the AC power outlet to permit the 3' power supply cord to be plugged in.

6.10 On the surface to which the power supply is to be mounted, locate the 4 points which correspond to the keyhole type mounting holes in the back panel of the power supply. Figure 2 provides the dimensions between mounting hole centers for the power supply.

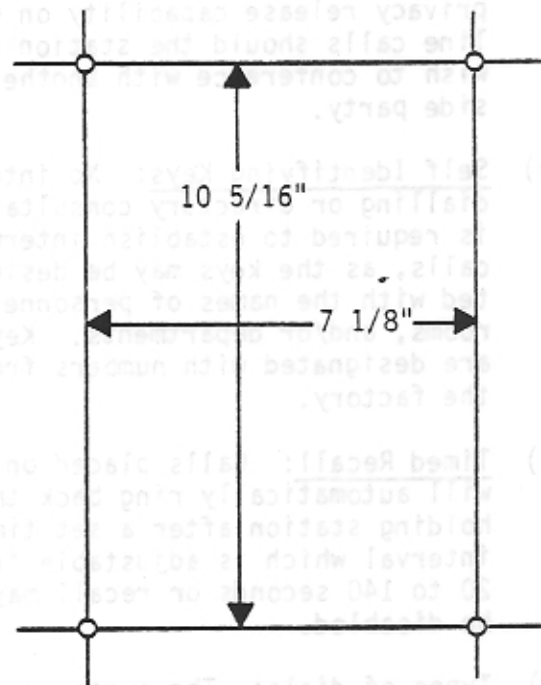



Figure 2  
Power Supply Mounting Hole Centers

6.11 Using suitable fasteners, secure the power supply to the mounting surface. The power supply weighs approximately 17 pounds.

6.12 Grounding the System

6.13 After the KSU and power supply have been mounted, the KSU **MUST** be properly grounded.

 Do not use the 3rd wire (green) of the AC line cord for earth ground.

6.14 It is recommended that the AC service outlet used be the 3-wire (parallel blade and ground) type. A 3-wire to duplex adapter SHOULD NOT be used.

6.15 An additional earth ground must be provided for proper operation of the system. In most installations, a metallic cold-water pipe will provide a good earth ground. The installer should check that the cold-water piping is metallic throughout and has no joints or sections of non-metallic pipe. If the cold-water piping is found to be inadequate for grounding purposes, an alternate grounding means must be used.

6.16 The grounding wire used should be as short as possible and 14-gauge or larger. This wire should be connected to the KSU grounding lug located on the KSU just to the left of the power cable clamp at the bottom of the KSU.

#### 6.17 Basic KSU Connections

6.18 The EK-516 KSU comes from the factory with 4 circuit cards installed. These cards are the CPU-5A, CMI-5A, 8SU-5A and 2SU-5A-1. Refer to figure 3 for location of these cards.

6.19 The intercard ribbon cables should be checked for proper insertion in their respective connectors. Refer to figure 3. Check the following cables:

- a) 4 cables (①, ②, ③ & ④) connect the CPU-5A to the CMI-5A.
- b) 4 cables (⑤, ⑥, ⑦ & ⑧) connect the CPU-5A to the 8SU-5A.
- c) 1 cable (⑨) connects the CPU-5A to the 2SU-5A-1.
- d) 3 common multiple cables connect the CPU-5A to the 2SU-5A-1. These cables are designated ⑩, ⑪, & ⑫ on figure 3.

#### 6.20 LTB- Installation

6.21 After the basic KSU cables have been checked, the LTB-A, LTB-D and LTB-E Line Terminal Board assemblies should be checked and installed in their connectors on the CPU-5A. Refer to fig-

ures 4A, 4B and 4C for the LTB- terminal layouts. Figure 5 shows the locations for the LTB's. Proceed as follows:

- a) Check the LTB-A (figure 4A) line cord connections. The LTB-A provides the inputs for 3 C.O. lines to the system. Two modular plug-ended line cords are factory-wired to the LTB-A for connecting the C.O. lines into the system.



*The installer should provide the C.O. line terminations in accordance with the following system configurations.*

1. C.O. lines 1 and 2 should always be provided with an RJ-14C jack. LTB-A terminals 1T/1R and 2T/2R are the KSU input terminals.
2. If the system is to be equipped with the 2nd DSS intercom (ICU-5A) or the Monitor feature (MOU-5A), C.O. lines 3 and 4 should always be provided with an RJ-14C. LTB-E terminals 4T/4R and 5T/5R are the KSU input terminals.
3. If the system has NO ICU-5A or MOU-5A and 3 or more C.O. lines, the 3rd C.O. line should be provided with an RJ-11C. LTB-A terminals 3T/3R are the input terminals. An LNU-5A must be used for the 3rd C.O. line.
4. If the system has 4 or 5 C.O. lines, an RJ-14C should be provided. LTB-E terminals 4T/4R and 5T/5R are the KSU input terminals. A COU-5A card is required for each C.O. line.

Check that the GN/RD pair of the 1st line cord is connected to terminals 1T/1R on the LTB-A and that the YL/BK pair is connected to terminals 2T/2R. The GN/RD pair of the 2nd line cord is connected to terminals 3T/3R. If the system is not equipped for

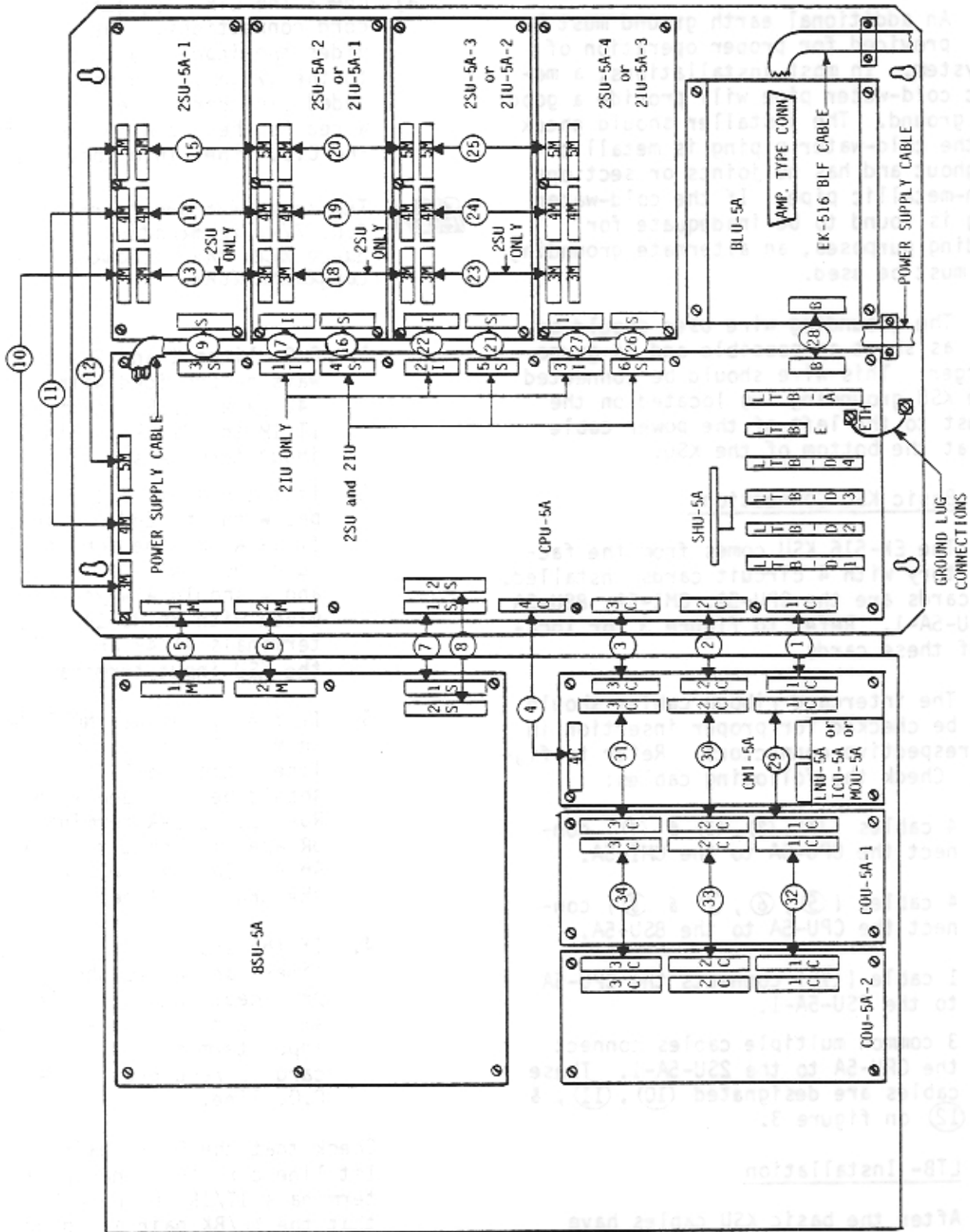


Figure 3 - TIE EK-516 Key Service Unit Card Layout

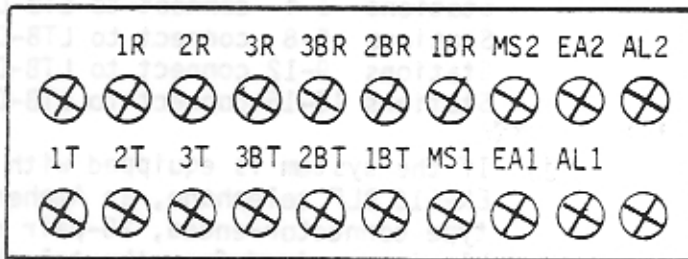


FIGURE 4A - LTB-A TERMINAL LAYOUT

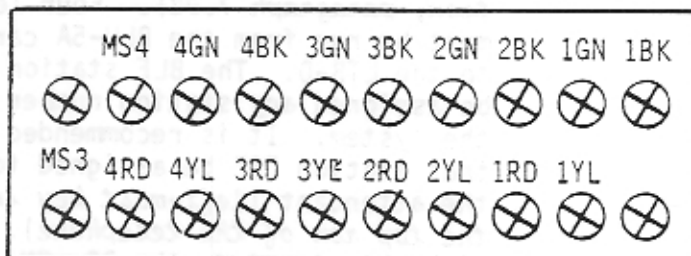


FIGURE 4B - LTB-D TERMINAL LAYOUT

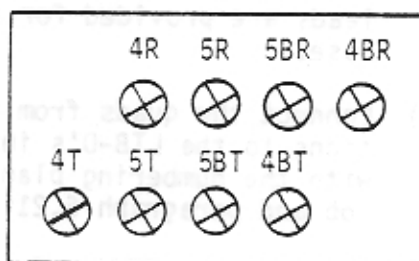


FIGURE 4C - LTB-E TERMINAL LAYOUT

more than 2 C.O. lines or if the system requires an ICU-5A or MOU-5A, the 2nd line cord on the LTB-A will not be used. This cord should not be removed from the terminal strip. This is in accordance with FCC rules, part 68.

- b) If an external music source is to be used for MOH and/or BGM, the music source should be connected to the MS1/MS2 terminals on the LTB-A. Separate terminals are provided on the LTB-D if a separate MOH source is required. Refer to paragraph 6.72. Shielded wire is recommended, with the shield grounded at the music source.

- c) If external paging is to be provided

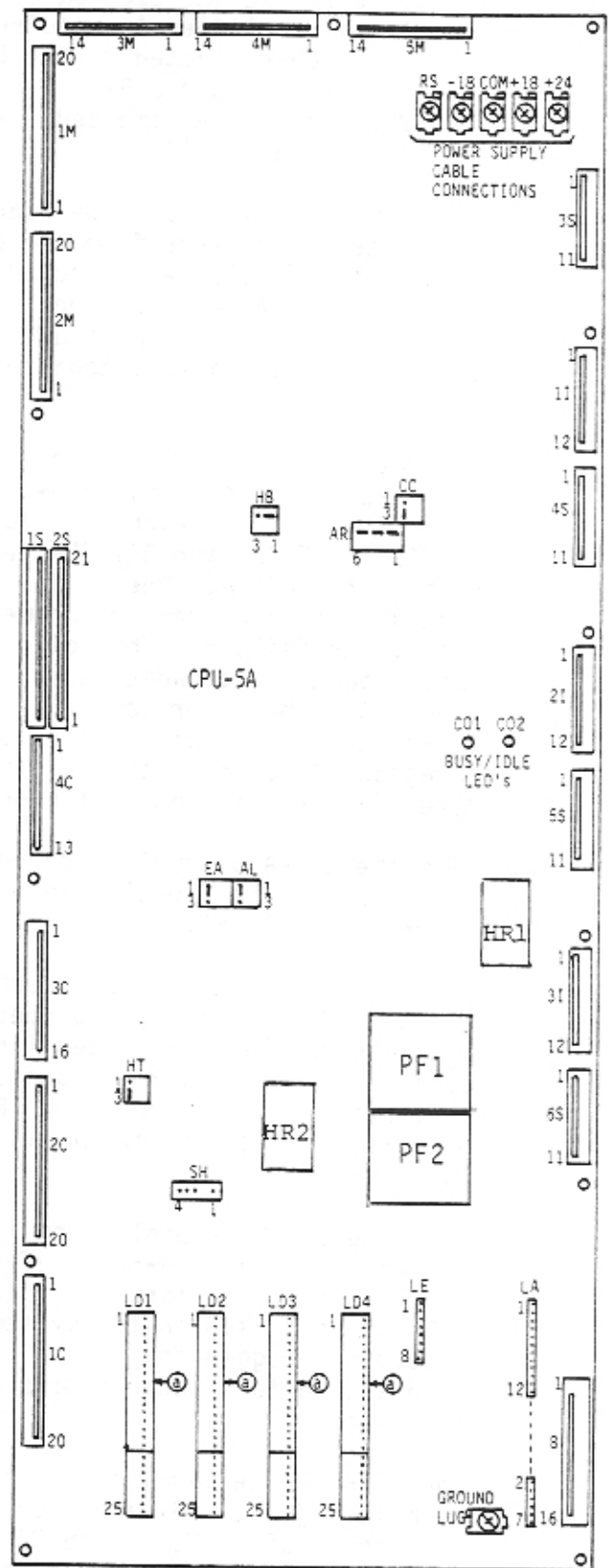


Figure 5 - CPU-5A Abbreviated Card Layout

(accessed by the All-Call button), an external amplifier is required and should be connected to the EA1/EA2 terminals on the LTB-A. Shielded wire is recommended. Refer to paragraph 6.34.

Stations 1-4 connect to LTB-D1.  
Stations 5-8 connect to LTB-D2.  
Stations 9-12 connect to LTB-D3.  
Stations 13-16 connect to LTB-D4.

- d) If alarm repeating is to be used in the system, the leads from the alarm system should be connected to the AL1/AL2 terminals on the LTB-A. See CPU-5A Strapping for alarm system options (refer to paragraph 6.24).
- e) If power failure bells are to be provided in the system, connect a pair of wires from each bell to the 1BT/1BR, 2BT/2BR and 3BT/3BR terminals on the LTB-A. The bells will ring only in the event of commercial power failure. The bells should be the type which will ring from C.O. line generator (105 VAC, 20 Hz; i.e., C4 type). Refer to paragraph 4.02 in section -2 for power failure station assignments.
- f) Plug the LTB-A assembly into the connector on the CPU-5A. Refer to figure 5 for location.
- g) The LTB-E Terminal Board assembly (figure 4C) is factory-equipped with one modular plug-ended line cord. The GN/RD pair is connected to terminals 4T/4R and the YL/BK pair is connected to terminals 5T/5R.
- h) Plug the LTB-E assembly into its connector on the CPU-5A. Refer to figure 5 for location. If the LTB-E is not used in the system, it should be plugged in and the line cord stored for future expansion of the system.
- i) Four LTB-D Line Terminal Board assemblies (figure 4B) are provided with the basic KSU. 4 LTB-D's will provide the connection terminals for all stations (telephones and boxes) in the system. The quads from the stations should be terminated on the LTB-D's as follows (see table 3):

- j) If the system is equipped with an EK-516 BLF telephone, an Amphenol type connector-ended, 25-pair cable is required from the telephone to the KSU. This cable is plugged into the connector on the BLU-5A circuit card (see BLU-5A Installation, paragraph 7.02). Four leads must be run from the BLU-5A card to the LTB-D. The BLF station may be assigned any station number in the system. It is recommended that station "1" be assigned to the attendant (left-most key in the top row of the telephone). With this in mind, the RD, GN, YL, and BK leads from the BLU-5A would be connected to 1RD, 1GN, 1YL, and 1BK on LTB-D1. Four spade-tipped leads are provided for this purpose.
- k) Connect the quads from the stations to the LTB-D's in accordance with the numbering plan for the job and paragraph 6.21i.
- l) Referring to figure 5, plug the LTB-D's into their respective connectors. Any unused LTB-D's should be plugged into the CPU-5A for use at a future date.



Table 3 - LTB- Terminal Assignments

CONNECTION SOURCE	TERMINAL BOARD	TERMINAL	SEE PARA.	STATION	TERMINAL BOARD	TERMINAL	SEE PARA.	
C.O. LINE 1	LTB-A	1T 1R	6.21 a1	1	LTB-D1	1GN 1RD 1YL 1BK	6.21f	
C.O. LINE 2		2T 2R						
C.O. LINE 3 WITHOUT ICU or MOU		3T 3R	6.21 a3	2				
C.O. LINE 3 WITH ICU or MOU or C.O. LINE 4 WITHOUT ICU or MOU	LTB-E	4T 4R	6.21 a2 & 6.21 a4	3		3GN 3RD 3YL 3BK		
C.O. LINE 4 WITH ICU or MOU or C.O. LINE 5		5T 5R		4		4GN 4RD 4YL 4BK		
P.F. BELL - LINE 1	LTB-A	1BT 1BR	6.21e	5		1GN 1RD 1YL 1BK		
P.F. BELL - LINE 2		2BT 2BR		6		2GN 2RD 2YL 2BK		
P.F. BELL - LINE 3 WITHOUT ICU or MOU		3BT 3BR		7		3GN 3RD 3YL 3BK		
P.F. BELL - LINE 3 WITH ICU or MOU or P.F. BELL - LINE 4 WITHOUT ICU or MOU	LTB-E	4BT 4BR		8		4GN 4RD 4YL 4BK		
P.F. BELL - LINE 4 WITH ICU or MOU or P.F. BELL - LINE 5		5BT 5BR		9		1GN 1RD 1YL 1BK		
EXTERNAL AMPLIFIER	LTB-A	EA1 EA2		6.21c		10		2GN 2RD 2YL 2BK
ALARM SIGNAL		AL1 AL2		6.21d		11		3GN 3RD 3YL 3BK
BGM/MOH SOURCE		MS1 MS2		6.21b		12		4GN 4RD 4YL 4BK
MOH SOURCE SEPARATE FROM BGM	LTB-D	MS3 MS4		6.74		13		1GN 1RD 1YL 1BK
						14		2GN 2RD 2YL 2BK
						15		3GN 3RD 3YL 3BK
					16	4GN 4RD 4YL 4BK		

6.22 CPU Option Strapping

6.23 Seven option connectors are provided on the CPU-5A card to implement the following system options. Refer to figure 5 for connector location.

- AL - Alarm Signal Repeating  
(See paragraph 6.24)
- AR - Automatic Recall Timing  
(See paragraph 6.29)
- CC - Control Check  
(See paragraph 6.32)
- EA - External Amplifier  
(See paragraph 6.34)
- HB - Busy Station Alert Tone  
(See paragraph 6.39)
- HT - Hold Tone Source  
(See paragraph 6.41)
- SH - Internal MOH Source  
(See paragraph 6.48)

6.24 Alarm Signalling Repeating

6.25 The EK-516 system may be used to transmit an alarm signal to every station in the system. When activated by an external alarm system, a high-pitched warbling tone is transmitted to all stations. Strapping of the AL connector on the CPU-5A card permits this alarm signal to be activated by either an open circuit or a closed circuit between the external alarm leads. Refer to figure 5 for AL connector location.

6.26 Strap the AL connector as follows:

- a) For closed circuit activated alarm, strap 1-2 (Factory strapping).
- b) For open circuit activated alarm, strap 2-3.

6.27 The system may be optionally arranged to transmit the alarm signal to a door box so that it can be heard by neighbors or by those outside

the building. The KSU connections for the activating alarm system leads are made to terminals AL1/AL2 on the LTB-A line terminal board. See paragraph 6.21d.

6.28 Instructions for providing the alarm to door boxes is provided under paragraph 7.15d, 2IU strapping options.

#### 6.29 Automatic Recall Timing

6.30 The system is arranged to resignal a station which has placed a call on HOLD and left it on HOLD for a predetermined length of time. This 'time-to-recall' period may be adjusted from 20 to 140 seconds in increments of 20 seconds.

6.31 Strap the AR connector on the CPU (see figure 5) as follows to provide the desired 'time-to-recall' period. Removal of all straps will disable the recall feature.

- 20 seconds - strap 1-2
- 40 seconds - strap 3-4
- 60 seconds - strap 1-2 and 3-4
- 80 seconds - strap 5-6
- 100 seconds - strap 1-2 and 5-6
- 120 seconds - strap 3-4 and 5-6
- 140 seconds - strap 1-2, 3-4 & 5-6

Note: The system is strapped at the factory to provide 140 seconds for recall.

#### 6.32 Control Check

6.33 Located on the CPU-5A is a connector designated CC. This connector is used by the factory for setting the talkback voice switching level. This connector should always be strapped 2-3 when the system is in service.

#### 6.34 External Amplifier

6.35 An external paging amplifier may be connected to the EK-516 system. This will permit call-announcements to be heard in large or noisy areas such as a manufacturing area, warehouse, lumber yard, barn, garden, etc.

6.36 The KSU may be strapped to transmit all-call announcements only, or all-call announcements and background mu-

sic to the external paging system. This strapping is performed on the EA option connector on the CPU-5A card (see figure 5).

6.37 Strap the EA connector as follows:

- a) For all-call only - strap 2-3
- b) For all-call and BGM - strap 1-2 (factory strapping)

6.38 The external paging amplifier is connected to the EA1/EA2 terminals on the LTB-A line terminal board (see paragraph 6.21c and figure 4A). It is recommended that shielded cable be used for connecting the KSU to the external paging system. The shield should be grounded at the external amplifier.

#### 6.39 Busy Station All-Call Alert Tone

6.40 Because of the single audio path in the EK-516 key telephone set, all-call announcements can NOT be received when the telephone is busy on a C.O. line call. However, the KSU may be strapped to transmit tone to telephones busy on C.O. line calls whenever the all-call circuit is used. This tone is normally provided in home installations and is NOT provided in business installations. The HB connector on the CPU-5A (see figure 5) is strapped as follows for all-call alert tone:

- a) NO All-call alert tone - strap 2-3
- b) With All-call alert tone - strap (factory strapping) 1-2

#### 6.41 Hold Tone Source

6.42 The EK-516 system may be arranged for music-on-hold from either an internal or 1 of 2 external sources. The external source could be the BGM source or a separate MOH source. If an internal music source is desired, an SHU-5A card is required (refer to paragraph 6.48).

6.43 An HT option connector is provided on the CPU-5A card (see figure 5) which programs the system for either the internal or external MOH source, or the

external BGM source. To provide this option, strap the HT connector as follows:

- a) When the SHU-5A or external MOH source is used - strap 1-2
- b) When the external BGM source is used strap 2-3 (*factory strapping*) and for MOH refer to paragraph 6.72.

#### 6.44 Multi-trunk Conference

6.45 The system is designed to provide multi-trunk conferencing. This permits a maximum of 2 C.O. lines to be conferenced together to one telephone. Two separate conferences may be set up simultaneously.

6.46 To initiate a conference, the station user establishes the 1st call and places it on HOLD. A 2nd call is established and placed on HOLD. Then by simultaneously depressing both C.O. line keys, the conference is established.

6.47 The multi-trunk conference feature is an integral part of the system and is not intended to be removed as a feature. No provision is made to deny the station user from forming a conference between two C.O. lines.

#### 6.48 Internal MOH Music Source

6.49 When an internal MOH music source is required, an SHU-5A card is installed in the SH connector on the CPU-5A card (see figure 5). The SHU-5A provides two different melodies for the music-on-hold. An option connector, "T", is provided on the SHU-5A card (see figure 6) to choose one of the two melodies. Strap either 1-2 or 2-3 to make the selection.

6.50 To install the SHU-5A, simply plug it into the SH connector on the CPU-5A. Refer to figure 7 for orientation of the card.

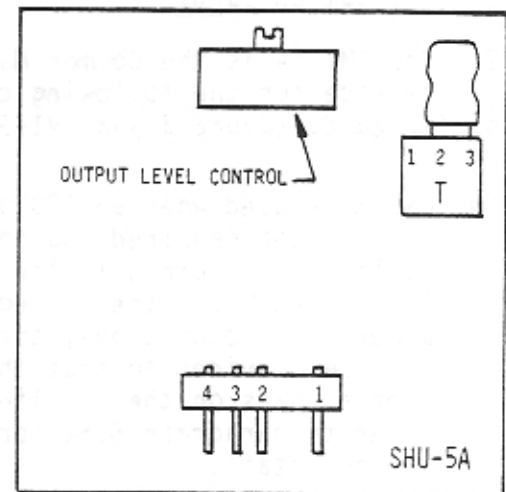


Figure 6 - SHU-5A Abbreviated Card Layout

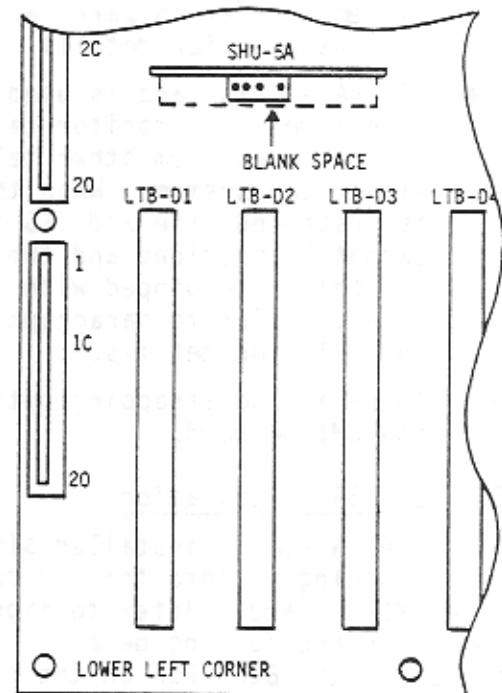


Figure 7  
SHU-5A Orientation on CPU-5A Card

6.51 CMI Option Cards

6.52 The CMI-5A is the Common Matrix Interface for the following circuit cards (refer to figure 3 for CMI-5A location):

- LNU-5A - used when an ICU or MOU card is not required and the 3rd C.O. line is required in the system. If the 3rd C.O. line is required under these conditions, the LNU-5A must be provided so that the 3rd line appears on the 3rd line key. Refer to paragraph 6.54 for installation detail.
- ICU-5A - When the system requires a 2nd DSS intercom path, this card is plugged into the CMI-5A. When this card is installed, the Monitor feature cannot be provided and only 4 C.O. lines may be equipped in the system. Refer to paragraph 6.58 for installation details.
- MOU-5A - This card is used to provide a means to monitor telephones and/or boxes from other telephones within the system. When this card is installed, the 2nd DSS intercom cannot be provided and the system can only be equipped with 4 C.O. lines. Refer to paragraph 6.60 for installation details.

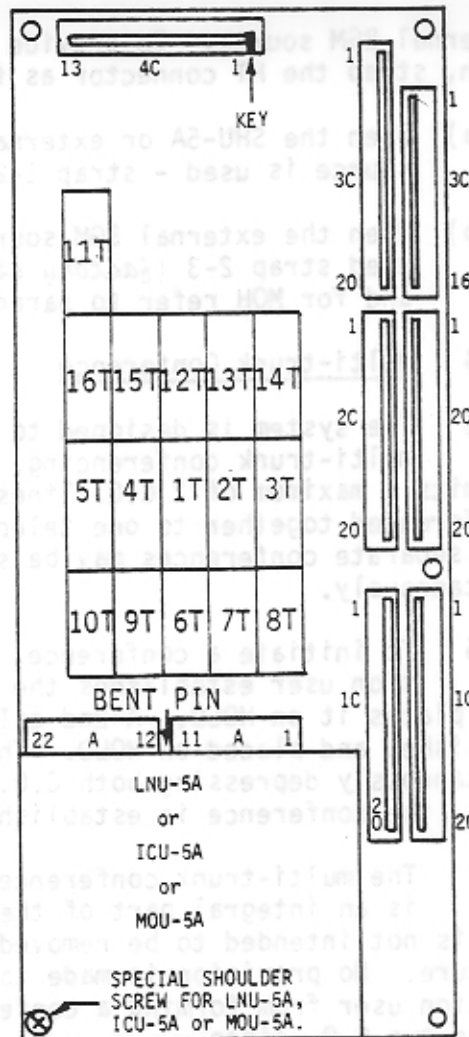


Figure 8 - CMI-5A Abbreviated Card Layout

on the CMI-5A card. Refer to figure 8 for orientation and holding detail. Note the position of the BENT PIN on the card and on figure 8.

*Note: No connection should be made to 3T/3R on the LTB-A.*

6.60 MOU-5A Installation

6.61 The MOU-5A is installed simply by plugging it into the "A" connector on the CMI-5A card. Refer to figure 8 for orientation and holding detail. Note the position of the BENT PIN on the card and on figure 8.

6.62 Located on the MOU-5A circuit card is an option connector designated "M". This connector is used for factory testing. This connector should always be strapped 1-2 when the card is in service.

6.53 There are no strapping options on the CMI-5A card.

6.54 LNU-5A Installation

6.55 The LNU-5A is installed simply by plugging it into the "A" connector on the CMI-5A card. Refer to figure 8 for orientation and holding detail. Note the position of the BENT PIN on the card and on figure 8.

6.56 An LED is provided on the LNU-5A to indicate when the circuit is in use.

6.57 The C.O. line used with the LNU-5A is terminated in the KSU on terminals 3T/3R of the LTB-A board. Refer to paragraph 6.21a3 for telephone company installer instructions.

6.58 ICU-5A Installation

6.59 The ICU-5A is installed simply by plugging it into the "A" connector

6.63 8SU-5A Option Strapping

6.64 The 8SU-5A circuit card is part of the basic KSU and serves 8 EK-516 telephones. The 8SU card is the interface and switching matrix between stations 1 through 8 and the rest of the system.

6.65 Each interface circuit (8) serves 1 telephone and provision is made on a per telephone basis for the following options:

- Off-hook C.O. Aud. (8 on-hook) Signals

This is factory standard strapping. A telephone with this strap will receive C.O. audible signals from all C.O. lines at all times. The audible signal is muted if the telephone is off-hook.

- On-hook C.O. Aud. (only) Signals
- No C.O. Audible Signals

A telephone with this strap will receive C.O. audible signals for all C.O. lines only when the telephone is on-hook.

- Background Music (BGM)

Stations with this strap will receive BGM when an external music source is connected to the MS1/MS2 terminals on the LTB-A line terminal board. This is factory standard strapping.

6.66 Figure 3 shows the location of the 8SU-5A card in the KSU. Figure 9 shows the layout of the card, fuses, option connector arrangement, and intercard ribbon cable connectors.

6.67 Table 4 shows the telephone option strapping for all 16 (maximum number) stations, if they were equipped with telephones. The basic KSU comes from the factory equipped for 10 telephones.

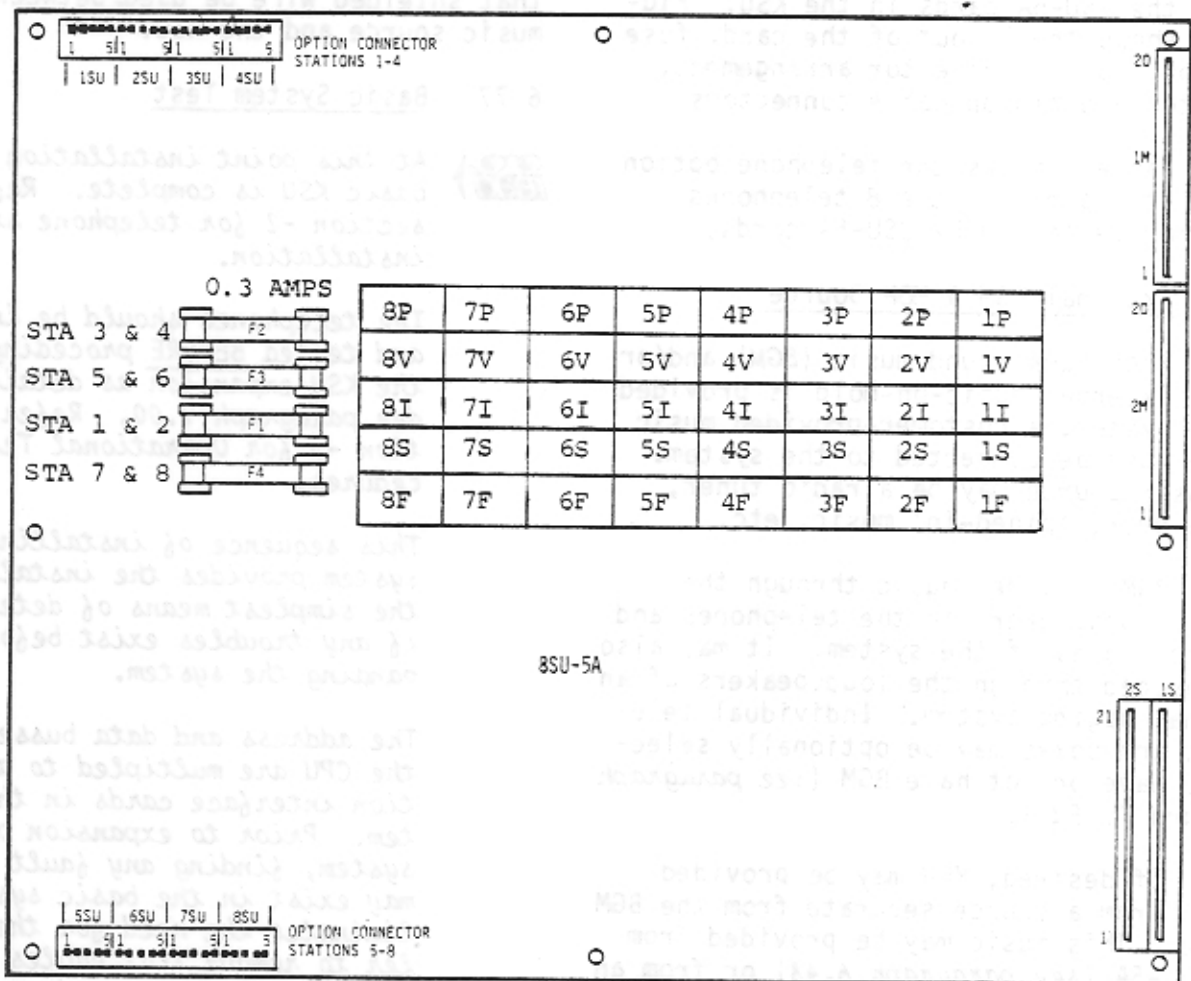


Figure 9 - 8SU-5A Abbreviated Card Layout



Table 4 - KSU Strapping for EK-516 Telephone Options

STATION NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
STATION CARD		8SU-5A								2SU-5A-1		2SU-5A-2		2SU-5A-3		2SU-5A-4	
CONNECTOR DESIGNATION		1SU	2SU	3SU	4SU	5SU	6SU	7SU	8SU	9SU	10SU	9SU	10SU	9SU	10SU	9SU	10SU
FEATURE	OFF-HOOK (and ON-HOOK) SIGNALLING	Remove strap if C.O. Audible is NOT required								STRAP 1-2							
	ON-HOOK (ONLY) SIGNALLING									STRAP 2-3							
	BACKGROUND MUSIC (BGM)									STRAP 4-5 *							

\* Remove 4-5 strap if BGM is not provided to eliminate system noise.

### 6.68 2SU-5A Option Strapping

6.69 The 2SU-5A circuit serves two EK-516 key telephones. The basic KSU is equipped with one 2SU-5A (2SU-5A-1) which serves stations 9 and 10. Each 2SU-5A is equipped to provide the telephone options (see paragraph 6.65) for the two telephones which it serves.

6.70 Figure 3 shows the locations of the 2SU-5A cards in the KSU. Figure 10 shows the layout of the card, fuse location, option connector arrangement, and intercard ribbon cable connectors.

6.71 Table 4 shows the telephone option strapping for the 8 telephones which may be served by 2SU-5A cards.

### 6.72 External BGM & MOH Source

6.73 When background music (BGM) and/or external music-on-hold is provided in the system, a customer-provided music source must be connected to the system. The music source may be a radio tuner, a tape deck, 'piped-in' music, etc.


6.74 BGM provides music through the loudspeakers in the telephones and intercom boxes of the system. It may also be provided through the loudspeakers of an external paging system. Individual telephones and boxes may be optionally selected to have or not have BGM (see paragraph 6.65 and 7.15d2).

6.75 If desired, MOH may be provided from a source separate from the BGM source. This music may be provided from the SHU-5A (see paragraph 6.48) or from an external source. The external MOH source

is connected to terminals MS3/MS4 on one of the LTB-D line terminal boards. Refer to table 3.

6.76 The music source should have an output level control and be capable of providing up to 1 volt RMS output. The output of the source is connected to MS1/MS2 terminals on the LTB-A line terminal board assembly or terminals MS3/MS4 on the LTB-D assembly. It is recommended that shielded wire be used between the music source and the KSU.

### 6.77 Basic System Test

 At this point installation of the basic KSU is complete. Refer to section -2 for telephone station installation.

The telephones should be installed and tested BEFORE proceeding with the KSU expansion as detailed under paragraph 7.00. Refer to section -3 for Operational Test procedures.

This sequence of installing the system provides the installer with the simplest means of determining if any troubles exist before expanding the system.

The address and data busses from the CPU are multiplexed to all station interface cards in the system. Prior to expansion of the system, finding any fault which may exist in the basic system, eliminates the need for the installer to remove flat cables (open the busses) to expansion cards, to prove the fault back into the basic system.

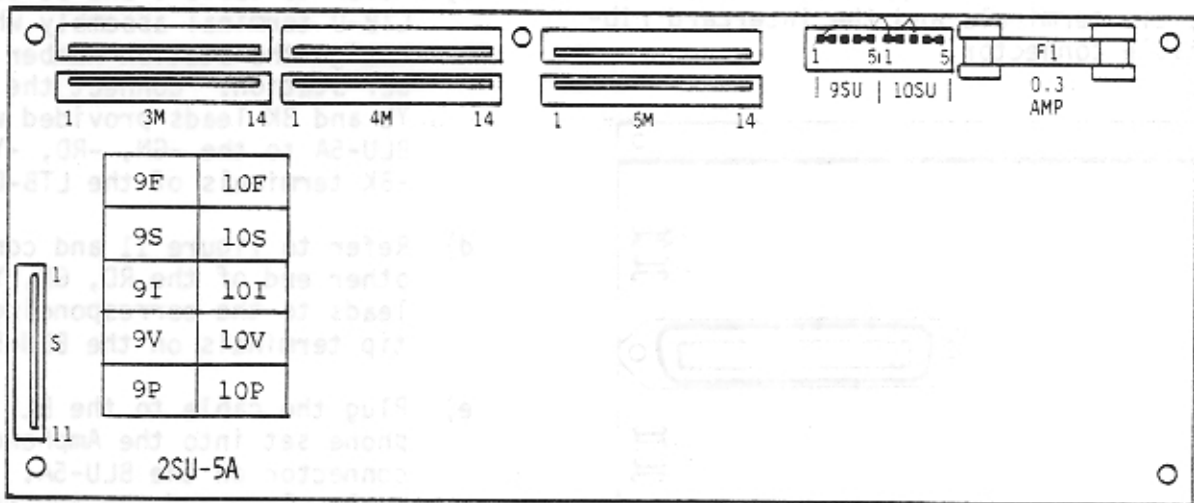


Figure 10 - 2SU-5A Abbreviated Card Layout

## 7.00 KSU EXPANSION

**read** → *DO NOT attempt expansion of the system until the basic system (1st 10 telephones) has been installed and tested. Refer to the "READ" paragraph on the preceding page.*

7.01 Paragraphs 6.00 through 6.77 provide instructions for installing the basic KSU as it comes from the factory. The following paragraphs will provide instructions for installing optional circuits which may be added to the system. The circuit cards which may be added to the system are:

- BLU-5A. This card is used when the system is equipped with an EK-516 BLF telephone (see paragraph 7.02).
- 2SU-5A-2, -3 and -4. These cards are used when more than 10 telephones are added to the system (see paragraph 7.08).
- 2IU-5A-1, -2 & -3. These cards are used when intercom or door boxes are added to the system (see paragraph 7.12).
- COU-5A-1 & -2. These cards are used when adding the 3rd and 4th C.O. lines to the system when the 2nd DSS intercom or the Station Monitor feature is provided; or

when the 4th and 5th C.O. lines are provided without the 2nd DSS intercom or the Station Monitor feature (see paragraph 7.16).

### 7.02 BLF Kit Installation

**read** → *Install and test the BLU-5A and the BLF telephone (see sections -2 & -3) before further expansion of the system.*

7.03 When the EK-516 BLF telephone is installed in the system, a BLU-5A circuit card is supplied with the BLF telephone. A 25-pair cable is required between the BLF telephone and the BLU-5A card. An Amphenol type connector (57 series) is mounted on the BLU-5A card for connection to the telephone. No quad cable is required for the BLF telephone. The connector on the BLU-5A card is a male connector.

7.04 The station number is assigned to the BLF telephone by connecting 4 leads between the appropriate LTB-D terminal assembly and the BLU-5A card. Four spade-tipped leads are provided for this purpose. It is recommended that the BLF telephone, when used as an attendant's station, be assigned station number "1". This is the left-most key in the top row on each telephone set.

7.05 Figure 3 shows the location of the BLU-5A card in the KSU. Figure 11 shows the layout of the card, in-

cluding the amphenol type connector, the spade-tip terminals and the intercard ribbon cable connector.

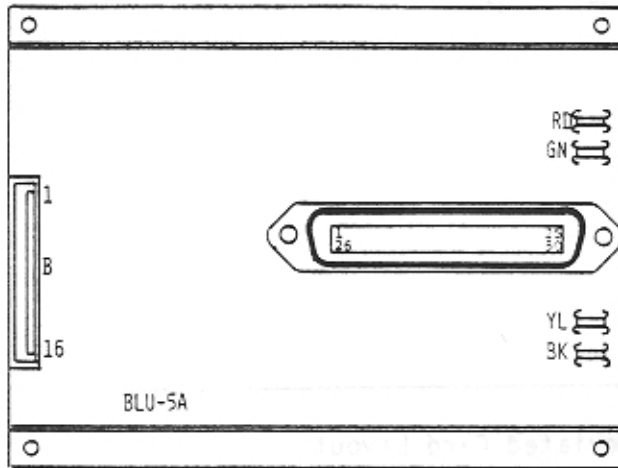


Figure 11

BLU-5A Abbreviated Card Layout

7.06 Provided with the BLU-5A card are the following items:

- a) Four spade-tipped leads; RD, GN, YL and BK.
- b) One ribbon cable.
- c) Six mounting screws.
- d) One cable clamp.

7.07 To install the BLU-5A, proceed as follows:

- a) Refer to figure 3 for location of the BLU-5A. Using the screws provided, mount the BLU-5A as shown in the figure.
- b) Insert the ribbon cable between the B connectors on the BLU-5A and the CPU-5A. To insert the flat ribbon cable into the connector, grasp each side of the flat cable between the thumb and forefinger, place the cable into the connector and push into place. This is cable #28 in figure 3.



When installing the flat ribbon cable, be certain that the exposed contacts of the cable are facing the terminals of the connector.

c) Refer to table 3 and select the LTB-D terminal assembly which will assign the station number to the BLF station. Connect the GN, RD, YL and BK leads provided with the BLU-5A to the -GN, -RD, -YL and -BK terminals of the LTB-D.

d) Refer to figure 11 and connect the other end of the RD, GN, YL and BK leads to the corresponding spade-tip terminals on the BLU-5A.

e) Plug the cable to the BLF telephone set into the Amphenol type connector on the BLU-5A. With the cable clamp and the two remaining screws provided with the BLU-5A, secure the BLF telephone cable to the KSU (refer to figure 3).

f) Test the BLF telephone in accordance with the procedure in section -3.

7.08 2SU-5A Expansion

Install 2SU-5A expansion cards, 1 at a time, and the associated telephones. Each card, with the associated telephones, should be tested before installing the next expansion card. This will simplify fault location if necessary (see 6.77).

7.09 When more than 10 telephones are required in the system (up to a maximum of 16), a 2SU-5A card must be installed for each two telephones added to the system. A maximum of three 2SU-5A's may be added:

2SU-5A-2 serves stations 11 and 12.  
2SU-5A-3 serves stations 13 and 14.  
2SU-5A-4 serves stations 15 and 16.

7.10 2SU-5A cards which are shipped individually from the factory include 4 ribbon cables and 5 mounting screws.



When additional 2SU-5A's are installed, they MUST be in consecutive (adjacent) order; i.e., 2SU-5A-3 CANNOT be installed if 2SU-5A-1 has been installed. In that case, the 2SU would have to be moved and 2SU-5A-2 installed in its place. Refer to figure 3.

7.11 To install an additional 2SU-5A card:

- a) Refer to figure 3 and using the 5 screws provided with the card, mount the 2SU next to the last 2SU card installed.
- b) Insert the 4 ribbon cables (supplied with the card) between the new card and the preceding 2SU card. Using figure 3, note that cables 13, 14, 15 and 16 are used for 2SU-5A-2; cables 18, 19, 20 and 21 are used for 2SU-5A-3; and cables 23, 24, 25 and 26 are used for 2SU-5A-4.



When installing the flat ribbon cable, be certain that the exposed contacts of the cable are facing the terminals of the connector.

- c) To insert the flat ribbon cable into

the connector, grasp each side of the flat cable between the thumb and forefinger, place the cable into the connector and push into place.

- d) Using table 4, move the option connector pins to the positions which will provide the desired options for the telephones served by the 2SU card. Figure 10 shows the option connector locations.
- e) Test each 2SU-5A card and the associated telephones in accordance with section -3 before installing the next expansion card.

7.12 2IU-5A Installation

**Read** Install 2IU-5A expansion cards, 1 at a time, and the associated ICM/Door boxes. Each card, with the associated boxes, should be tested before installing the next expansion card. This will simplify fault location, if necessary (see 6.77).

7.13 When intercom and/or door boxes are required for the job (up to a maximum of 6), a 2IU-5A card must be installed for each 2 boxes to be equipped in the system. A maximum of three 2IU-5A's may be installed:

- 2IU-5A-1 serves stations 11 and 12.
- 2IU-5A-2 serves stations 13 and 14.
- 2IU-5A-3 serves stations 15 and 16.

**Read** When 2IU-5A's are added to the system, they must be installed to serve the lowest numbered stations in the system immediately following the highest numbered telephone station. A 2IU-5A card CANNOT precede a 2SU-5A card in the system.

7.14 2IU-5A cards are shipped individually from the factory and include 4 ribbon cables and 5 mounting screws.

7.15 To install a 2IU-5A card:

- a) Refer to figure 3 and using the 5 screws provided with the card, mount the 2IU next to the last 2SU or 2IU card installed.
- b) Insert the 4 ribbon cables (supplied with the card) between the

new card and the preceding card. Using figure 3, note that cables 14, 15, 16 and 17 are used for 2IU-5A-1; cables 19, 20, 21 and 22 are used for 2IU-5A-2; and cables 24, 25, 26 and 27 are used for 2IU-5A-3.

**Read** When installing the flat ribbon cable, be certain that the exposed contacts of the cable are facing the terminals of the connector.

c) To insert the flat ribbon cable into the connector, grasp each side of the flat cable between the thumb and forefinger, place the cable into the connector and push into place.

d) Using table 5, move the option connector pins to the positions which will provide the desired options for the boxes served by the 2IU card. Figure 12 shows the option connector locations. The options available for use at intercom or door boxes are:

1. Is the box an ICM box or a Door box?  
For ICM box - strap 1-2.  
For Door box - remove 1-2.
2. Is BGM desired at ICM box or is alarm desired at door box?  
If yes - strap 3-4.  
If no - remove strap 3-4.

e) Test each 2IU-5A card and the associated boxes in accordance with section -3 before installing the next expansion card.

Figure 12 - 2IU-5A Abbreviated Card Layout

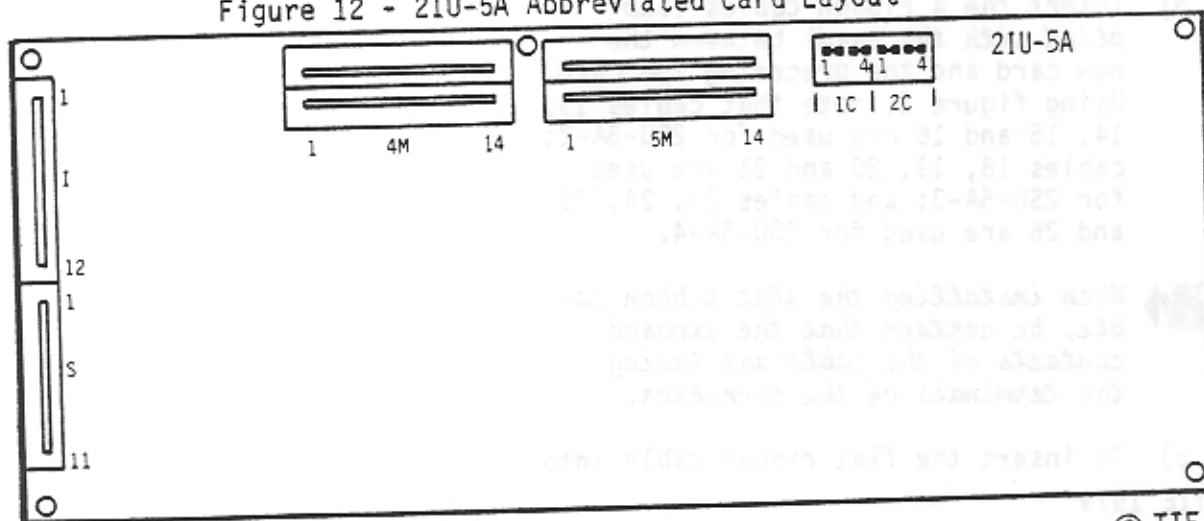





Table 5 - KSU Strapping for EK-516 Box Options

STATION NUMBER		11	12	13	14	15	16
STATION CARD		2IU-5A-1		2IU-5A-2		2IU-5A-3	
CONNECTOR DESIGNATION		1C	2C	1C	2C	1C	2C
F E A T U R E	INSERT FOR ICM BOX or REMOVE FOR DOOR BOX	1-2					
	BGM FOR ICM BOX or ALARM FOR DOOR BOX	3-4					

7.16 COU-5A Installation

 Install the COU-5A cards, 1 at a time, with the associated C.O. line. Each card, and the associated line should be tested before installing the next expansion card. This will simplify fault location if necessary (see 6.77).

7.17 When the system requires more than 2 C.O. lines and the system IS equipped with an ICU or MOU card, two additional C.O. lines may be added. If the system requires more than 3 C.O. lines and IS NOT equipped with an ICU or MOU card, two additional C.O. lines may be added. In either case, a COU-5A card is required for each of the two additional lines. A maximum of two COU-5A cards may be installed in the system.

COU-5A-1 will serve line 3 or line 4 depending upon the conditions described above.

COU-5A-2 will serve the last (4th or 5th) C.O. line depending upon the system configuration.

7.18 The COU-5A cards are installed in dedicated positions in the KSU (see figure 3).

7.19 The COU-5A cards are shipped individually from the factory and include 3 ribbon cables and 5 mounting screws.

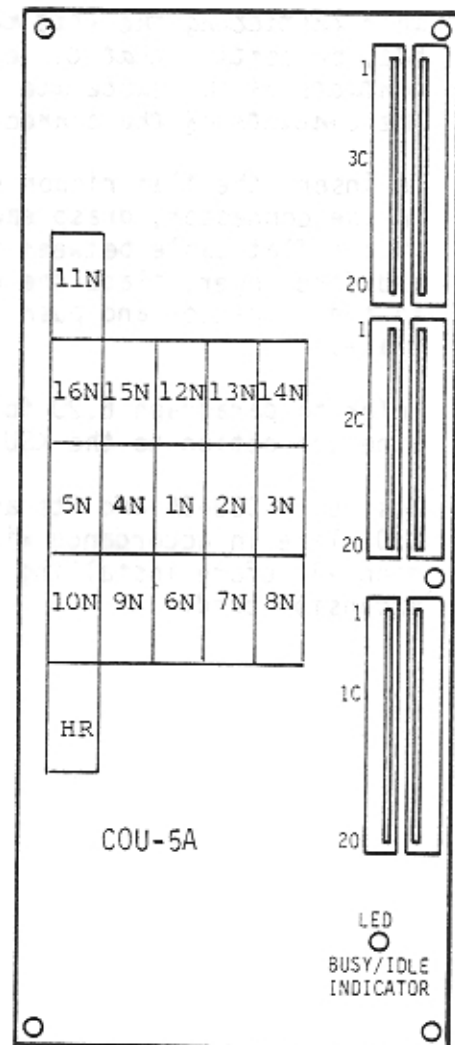


Figure 13 - COU-5A Abbreviated Card Layout

7.20 There are no strapping options on the COU-5A card. An LED is provided to indicate a busy or idle condition. Figure 13 shows the ribbon cable connectors and the LED.

7.21 To install a COU-5A card:

- a) Refer to figure 3 and using the 5 screws provided with the card, mount the COU next to the CMI-5A or COU-5A-1.
- b) Insert the 3 ribbon cables (supplied with the card) between the new card and the preceding card. Using figure 3, note that cables 29, 30 and 31 are used for COU-5A-1 and that cables 32, 33 and 34 are used for COU-5A-2.



When installing the flat ribbon cable, be certain that the exposed contacts of the cable are facing the contacts of the connector.

- c) To insert the flat ribbon cable into the connector, grasp each side of the flat cable between the thumb and forefinger, place the cable into the connector and push into place.
- d) Refer to paragraph 6.20 for C.O. line connection to the KSU.
- e) Test each COU-5A and its associated C.O. line in accordance with section -3 before installing the next expansion card.

Table 2 - KSU Strapping

STATION NUMBER	STATION CARD	CONNECTOR DESIGNATION
		INSERT FOR ICM BOX
		REMOVE FOR ICM BOX
		80M FOR ICM BOX
		ALARM FOR ICM BOX

7.16 COU-5A Installation

7.17 When the system requires more than 2 C.O. lines and the system is equipped with an ICM or MCM card, the additional C.O. lines may be added to the system requires more than 2 C.O. lines and is NOT equipped with an ICM or MCM card, two additional C.O. lines may be added. In either case, a COU-5A card is required for each of the two additional lines. A maximum of two COU-5A cards may be installed in the system.

7.18 The COU-5A cards are installed in dedicated positions in the KSU (see Figure 3).

7.19 The COU-5A cards are shipped individually from the factory and include 3 ribbon cables and 5 mounting screws.

## TIE EK-516 STATION - INSTALLATION



\* May be CO5. Sta.  
Monitor or Called-  
Party Monitor key.

Figure 1 - TIE EK-516 Key Telephone Set

### 1.00 INTRODUCTION

1.01 This section contains information for installation of the six types of station equipment which may be used with the TIE EK-516 key service unit. The six types are:

1. EK-516 key telephone set.
2. EK-516 BLF key telephone set.
3. EK-516 Intercom Box.
4. EK-516 Door Box.

5. EK-516 Door Chime.
6. EK-516 Applique Box for Single Line Sets.

### 2.00 GENERAL INSTALLATION

2.01 Installation of all types of the stations listed above is usually a matter of running cable, installing dials and faceplates, designating the keys and number plates, and plugging the instrument into a modular connector.



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5 RESEARCH DRIVE  
SHELTON, CT., 06484 (203) 929-7373

2.02 A small percentage of the stations installed will require optional equipment to be installed in addition to the basic set. These options are a Called-Party Monitor, a FLASH key assembly or an Applique box for single line sets. Each of these items will be covered in detail in the following paragraphs, along with information for installing different types of dials. Speakerphone installation will be covered in a separate section.

### 2.03 Cable Installation

2.04 All stations in the system with the exception of the BLF telephone may be installed using standard 4-conductor, non-shielded inside wiring cable (*quad*). The quad may be random twist or twisted pair type. Distribution cables and distribution boxes may be used but all stations must be 'home-run' to the KSU. No bridged stations are permitted in the system.


2.05 Cable leads for all stations, except the BLF telephone, are wired to modular jacks located in the vicinity of the station. The cable for door boxes is terminated on screw terminals inside the box.

2.06 The BLF telephone requires a 25-pair cable terminated in an Amphe-nol type connector (57-series, female, red caps) on both ends. No quad cable is required for the BLF telephone.

### 2.07 Proper Wiring

2.08 The interface circuits in the KSU for the EK-516 telephone are different from the interface circuits used for the boxes. Telephones SHOULD NOT be plugged into cables wired for intercom boxes and vice-versa.

2.09 Check carefully for proper connections at the KSU and the modular jack before plugging the station in. The instrument will not function properly, and damage may result, if the cable is not properly connected to the KSU.

 *Tip-to-tip and ring-to-ring polarity MUST be observed throughout the system.*

### 2.10 Cable Limits

2.11 Maximum cable length for each station will depend on the wire size used. Maximum cable lengths are:

24-gauge wire - 500 feet

22-gauge wire - 800 feet

### 2.12 Cable Designation and Function

2.13 The RD/GN pair of each quad is used for 2-way audio transmission between the KSU and the telephone type station. The RD/GN pair of the quad to each box is used as a transmit pair.

2.14 The YL/BK pair of each quad is used for data and power transmission between the KSU and the telephone type station. The YL/BK pair of the quad to each box is used as a receive pair.

## 3.00 EK-516 TELEPHONE DESCRIPTION

3.01 The TIE EK-516 telephone is an electronic key telephone which is usable only with the TIE EK-516 key service unit. The telephone uses a 2-pair cable to connect to the KSU. One pair is used for audio transmission and the other pair is used for data and power transmission.

3.02 The EK-516 telephone set utilizes a 500 type network, dial and handset. This permits the set to operate as a single line set when connected directly to a C.O. or PBX line.

3.03 The EK-516 telephone is a multi-button telephone with access to as many as five C.O. lines and 1 DSS intercom path or 4 C.O. lines and 2 DSS intercom paths for access to the other 15 stations in the system. HOLD, Privacy Release, All-Call and other modern key system functions are also provided.

3.04 The EK-516 BLF telephone is the same as the EK-516 set except that it is also equipped with LED's in each DSS key to indicate which stations in the system are off-hook. The BLF telephone utilizes a 25-pair cable instead of the

conventional quad.

3.05 Figure 1 shows the EK-516 telephone with the keys and their functions.

3.06 Each EK-516 telephone contains a microcomputer which implements the commands received from the microcomputer in the KSU and transmits to that computer any change in status of the telephone set on a real time basis. The program in the telephone is nonvolatile and will not be affected by power removal such as the event of a commercial power failure.

#### 4.00 EK-516 TELEPHONE INSTALLATION

4.01 The installation procedures in the following paragraphs provide detailed instructions for the following:

- a) Power failure stations (paragraph 4.02).
- b) Dial installation (paragraph 4.09).
- c) DO NOT DISTURB (paragraph 4.13i).
- d) Dial replacement (paragraph 4.14).
- e) Called-Party Monitor installation (paragraph 4.19).
- f) FLASH key installation (paragraph 4.25).
- g) Telephone connections to the system (paragraph 4.28).

#### 4.02 Power Failure Stations

4.03 Up to 10 telephones in the system can be power failure stations. As most installers terminate the station quads prior to installing the telephones, consideration should be given to station number assignments prior to terminating the quads on the LTB-D assemblies in the KSU. During a commercial power failure, or if the KSU is switched off or unplugged, the C.O. lines will automatically be cut-through to predetermined telephones as follows:


C.O. line 1 to stations 1 and 5.  
C.O. line 2 to stations 2 and 6.  
C.O. line 3 to stations 3 and 7.  
C.O. line 4 to stations 9 and 11.  
C.O. line 5 to stations 10 and 12.

4.04 During a power failure the C.O. lines are also extended to the BT/BR terminals on the LTB-A/E assemblies for use with bells. These bells may be of the loud ringing type which will ring from C.O. generator and placed at appropriate locations around the job site. At least one ringer is required per C.O. line.

4.05 In addition to, or in lieu of, power failure bells, high impedance buzzers may be installed in the power failure telephones.

4.06 During a power failure condition, the power failure telephones function as single line telephones. The keys and LED's (lights) on the telephones are NOT operable. However, outside calls may be placed on the assigned line from these stations (if the station is equipped with a dial which DOES NOT use local power). Incoming calls may be answered on the assigned line.

4.07 As previously stated, to provide an indication of an incoming call at the power failure telephone, the telephone must be equipped with a high impedance (high voltage) buzzer which will respond to C.O. ringing signals.

 Only FCC approved buzzers and/or bells may be connected to the C.O. lines. To further comply with FCC regulations, the combined ringer equivalence numbers (REN) of all ring detection devices on one line MUST NOT EXCEED 5.0.

4.08 Refer to paragraph 4.13f for buzzer installation procedure.

#### 4.09 Dial Installation

4.10 The EK-516 telephone is shipped from the factory without a dial installed in the set. A variety of dials may be used in the EK-516 telephone. These dials include the conventional rotary dial, 7 and 8 lead standard DTMF



Table 1 - Dial Connections

DIAL TYPE				ROTARY		TONE						TIE 250B		LINE POWERED DP GENERATOR	
TERMINAL		DTB TERM	ANU TERM	DIAL	HAND SET	(8 LEAD)		(7 LEAD)		(5 LEAD)		DIAL	HAND SET	DIAL	HAND SET
T CONN	FAC STRAP					DIAL	HAND SET	DIAL	HAND SET	DIAL	HAND SET				
17	●	R1	LGN	●		●		●		●		●		●	
3	●	L1	--	●		●		●		●		●		●	
9		AG	AG												
16		F	LRD	GN		GN		GN		●		BL		GN	
4		C	C			OR/BK		OR/BK		OR/BK		VI		RD	
13		RR	RR	BL		BK		BK		●		GN		WH	
5		B	BK		BK	BL	BK	BL	BK		BK		BK		BK
12	●	R	W2	● WH	WH	RD/GN	WH	RD/GN		RD/GN	WH	●	WH	●	WH
6	●	T	RD	●	RD	RD	RD	RD	RD	RD	RD	●	RD	●	RD
11	●	GN	GN	● WH		WH		WH		WH		●		●	
14	●	S	W1	●	WH	WH/BL	WH	WH	WH	BL	WH	●	WH	●	WH
15	●	K2	--	●		●		●		●		●		●	
7	●	K1	--	●		●		●		●		●		●	
10		LK	--												
8		OG	OG									BK			
2		SG	SG									HVY BK			
1		RB	RB									OR			
--		P3/P4	FL	YL/YL											
D CONN															
1-2	●●			●●		REMOVE		REMOVE		REMOVE		●●		REMOVE	
3-4	●●			●●		●●		●●		●●		●●		●●	
5-6	●●			●●		●●		●●		●●		●●		●●	
SPK CONN															
1-2	●●			●●		●●		●●		●●		●●		●●	
3-4	●●			●●		●●		SEE NOTE		●●		●●		●●	
5-6	●●			●●		REMOVE		REMOVE		REMOVE		●●		●●	
7-8	●●			●●		REMOVE		REMOVE		REMOVE		●●		●●	

Note: Remove straps 3-4, 5-6 & 7-8. Strap 4-5 on SPK-5A.

type dials, TIE's 250B OUTPUT PULSE DIAL®, and some line-powered dial-pulse generators.

4.11 It should be noted by the installer that customer instructions for using line-powered dials should include the following operating conditions:

- a) The station user should NOT go from 'button-to-button' if a dialling error is made. The hookswitch should be used (hang up) and start again. This provides sufficient time for the dial to recognize the open interval and reset itself for another call.

b) Dials with "last-number-recall"

will lose their memory after a short time because power is removed from the dial when the set is on-hook.

4.12 Dials may be installed in the EK-516 telephone using TIE's dial terminal board (DTB) or by using the spade-tip terminals on the ANU board without a DTB. Dial kits from TIE include a dial terminal board and dial mounting brackets for installing the dials in the set. The dial mounting brackets are mounted to the dial using the mounting screws provided with the dial.



If dials are ordered from sources other than TIE, dial mounting brackets must be ordered also. If

the supplier does not supply dial brackets for TIE telephones, the brackets may be ordered separately from TIE. TIE dial kits include dial mounting brackets and the dial terminal board (DTB).

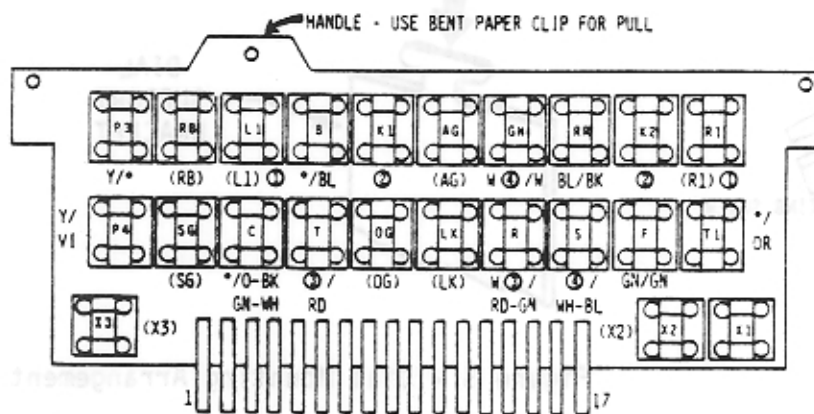


Figure 2 - Dial Terminal Board (DTB)

#### 4.13 Install the dial as follows:

- Remove the faceplate from the telephone by placing a small screwdriver or paper clip in the slot between the faceplate and the housing (bottom of the faceplate) and pry gently upward to disengage the faceplate. Pull the faceplate forward to remove it.
- Loosen the captive screws (bottom center of set and upper left faceplate corner) and remove the housing from the set. The loudspeaker leads may be disconnected for convenience in working on the set.
- Table 1 shows the dial connections and strapping connections which are required for each type of dial to be installed. Connections are shown with or without a DTB board installed in the set. If the Called-Party Monitor is to be installed (paragraph 4.19), the DTB should be removed from the dial leads and the leads terminated on the spade-tip terminals on the ANU board. The Called-Party Monitor is installed in the T connector which is normally used for the DTB.

- When the DTB is used the factory

straps must be removed from the T connector. The installer should check that the straps shown in table 1 are in place on the DTB and if not install them. Four straps are provided with the DTB. Figure 2 shows the layout of the DTB and figure 3 shows the layout of the HANU board.

- After making the dial connections to the DTB, or to the ANU board, the power failure buzzer (if required at the station) should be mounted on the dial and connected. If the buzzer is not required, proceed to step h. If the buzzer is required proceed to step f.

- Mount the buzzer under the screw for the dial bracket on the right side of the dial as shown in figure 4.

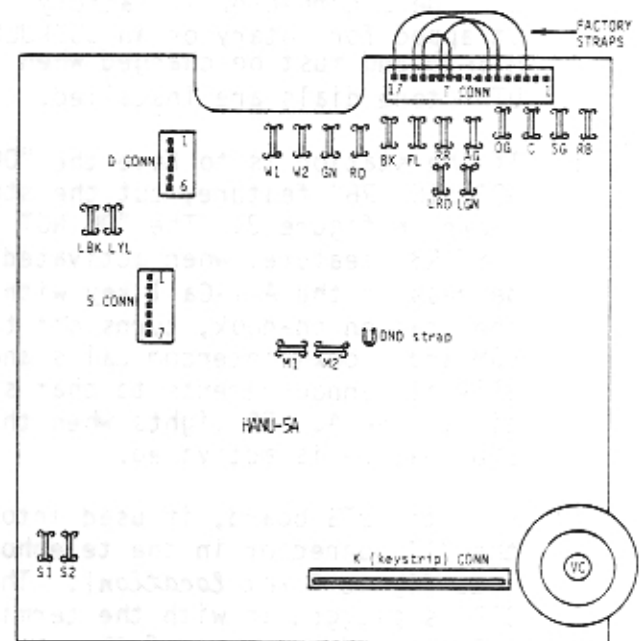


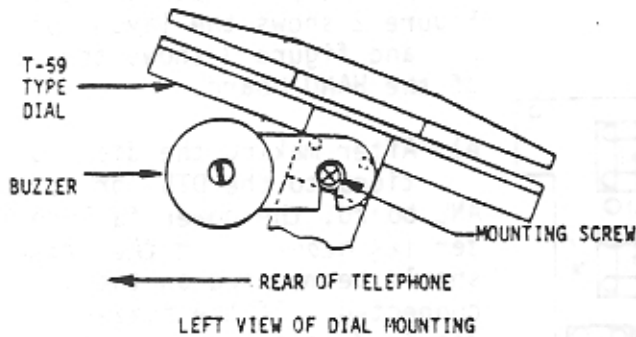
Figure 3 - HANU Abbreviated Card Layout

- Connect the buzzer leads to terminals F and R1 on the DTB.



If the station is a power failure station and is to be equipped with a Called-Party Monitor, the buzzer cannot be installed in the set. If a power failure audible signal is required at the station, a 267

type modular adapter may be used. The telephone set is plugged into one jack and the buzzer or bell (fitted with a modular cord) plugged into the other jack.



Buzzer is mounted on keypad type dials in the same manner.

Figure 4 - Buzzer Mounting Arrangement

- h) Check that the "D" connector is strapped in accordance with table 1. The D connector is factory strapped for rotary or an OUTPUT PULSE DIAL<sup>®</sup> and must be changed when DTMF tone dials are installed.
- i) If the station is to have the "DO NOT DISTURB" feature, cut the strap shown in figure 3. The "DO NOT DISTURB" feature, when activated by depressing the All-Call key with the station on-hook, turns off the BGM and blocks intercom calls and all-call announcements to that station. The AC LED lights when the DND feature is activated.
- j) Plug the DTB board, if used into the "T" connector in the telephone (see figure 3 for location). The DTB is plugged in with the terminals toward the rear of the set, with pin 1 on the right side.
- k) The dial is then mounted by placing the slots of the dial brackets over the tabs of the support brackets and sliding the complete dial assembly to the right (see figure 5).
- l) Replace the upper housing and faceplate (connect the loudspeaker leads if they were removed previously).

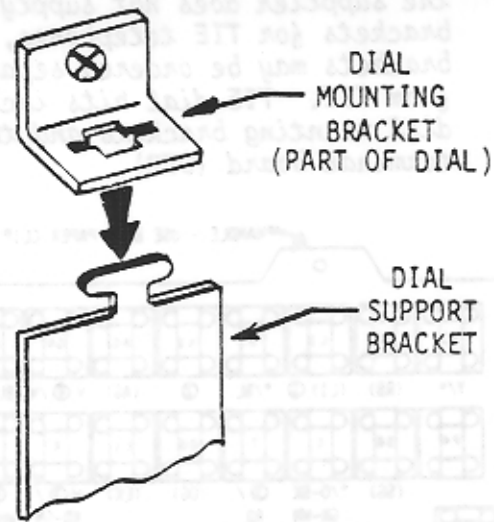


Figure 5 - Dial Mounting Arrangement

#### 4.14 Dial Replacement

4.15 The easiest way to change a dial in the EK-516 telephone set is to replace the complete assembly. This can be done if the set is NOT equipped with a Called-Party Monitor. If the set is equipped with a Call Monitor, the dial leads must be plugged into the spade-tip terminals on the ANU board.

4.16 Most standard dials with leads terminated in spade-tips, may be connected to the DTB and installed in the set. Connect the leads of the dial to the DTB or the ANU as shown in table 1. Refer to figure 2 for DTB terminal layout and figure 3 for the ANU layout.

4.17 Remove the dial brackets from the old dial and remount them on the new dial. Before installing the new dial in the telephone, strap the "D" connector as required. See table 1.

4.18 Mount the new dial in the set and remount the upper housing and faceplate.

#### 4.19 Called-Party Monitor

4.20 The Called-Party Monitor (SPK-5A) circuit permits the station user to make a call (up to the time it is answered) without lifting the handset. The station user depresses the Call Monitor button (5th line key) and a C.O.

line key. Dial tone is received from the loudspeaker in the telephone. The user then dials the number of the desired party. When the called party answers, the station user must lift the handset to carry on the conversation.

4.21 Another use of the Call Monitor is when the station user is placed on HOLD by the distant party. Depressing the Call Monitor button permits the user to hangup the handset until the holding party returns to the call. At that time, the handset must be used again to resume the conversation.

4.22 The SPK-5A consists of a printed circuit board which plugs into the T connector of the set. A short tail cable is connected to the SPK-5A which plugs into the "S" connector of the set. Mounted on the SPK-5A board is an option connector. This connector is used to implement dial strapping depending upon which type of dial is used. Refer to table 1 and figure 6.

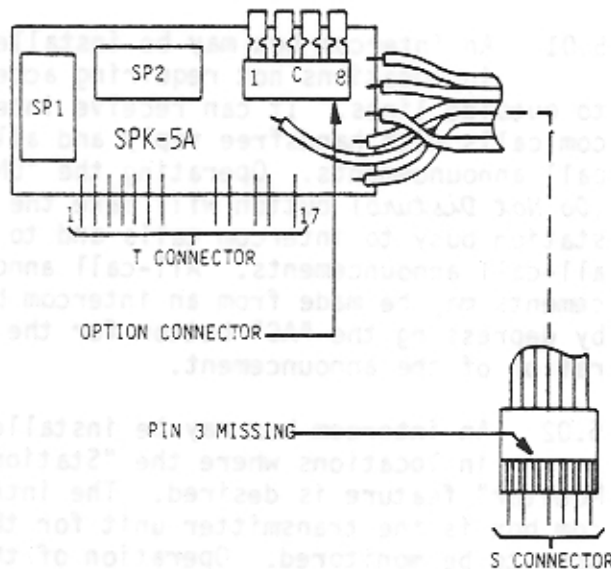


Figure 6 - SPK-5A Abbreviated Card Layout

4.23 When the telephone is to be equipped with an SPK-5A, the DTB board must be removed from the T connector. The dial leads are unplugged from the DTB and plugged into the spade-tip terminals on the ANU board.

4.24 To install the SPK-5A:



If the set is equipped with a power failure buzzer, refer to the "READ" paragraph following 4.13g.

- a1) In sets without dial installed -- install the dial in accordance with paragraph 4.09 and table 1 without a DTB. DO NOT strap the T connector.
- a2) In sets with the dial installed -- if the dial is connected to a DTB, remove the DTB and install the dial in accordance with table 1 without the DTB. DO NOT strap the T connector.
- b) Strap the option connector on the SPK-5A in accordance with table 1. Figure 6 shows the SPK-5A and the option connector.
- c) Plug the SPK-5A into the T connector with the component side toward the rear of the set.
- d) Dress the tail cable of the SPK-5A to the left past the D connector to the S connector (see figure 3). Note that pin 3 on the plug of the tail cable is missing. Plug the tail cable into the S connector using figures 3 and 6 for orientation.

#### 4.25 FLASH Key Installation

4.26 The EK-516 telephone set may be arranged for "open loop" FLASH key operation. When this type of flashing is desired, a FLASH key kit must be installed in the set. The loop is opened for the duration of the depressed FLASH key. The kit consists of a new faceplate with a hole for the FLASH key and a push-button with two spade-tipped leads attached. To install the FLASH key, proceed as follows:

- a) Remove the faceplate and housing from the set (paragraph 4.13 a & b).
- b) Referring to figure 7, mount the key on the upper right side of the key assembly as shown in the figure.
- c) Connect the BL lead from the key to terminal AG on the ANU board.




- d) Connect the BR lead from the key to terminal C on the ANU board.
- e) Remove straps 3-4 and 5-6 from the D option connector. Strap 4-5 on the D option connector.
- f) Replace the upper housing and install the new faceplate.

4.27 The EK-516 telephone may be arranged to ground the T & R conductors of the C.O. line for flashing. In this case, the 5th C.O. line key is used for this purpose. This option can only be used when the system is NOT equipped with the 5th C.O. line and NO circuit card (LNU, ICU or MOU) is installed on the CMI-5A card in the KSU. Ground is applied to the T & R conductor of the selected C.O. line for as long as the 5th line key is depressed. To install this option:

- a) Make sure that the KSU is grounded (paragraph 6.12 in section -1).
- b) Referring to figure 3 in section -1, and using a short piece of wire, connect the 3T and 3R terminals on the LTB-A assembly to the GROUND LUG on the KSU.
- c) Redesignate C05 button "MISC".

#### 4.28 Telephone Connections to the System

4.29 After all internal connections are made in the EK-516 telephone set and the faceplate has been installed, the 4-wire cord of the set is plugged into a modular connector which has been wired to a "telephone interface" card (8SU or 2SU) at the KSU.

 *Telephones plugged into modular connectors wired for intercom boxes will NOT function.*

4.30 When the telephone is plugged in, a short burst of tone may be heard at all stations in the system.

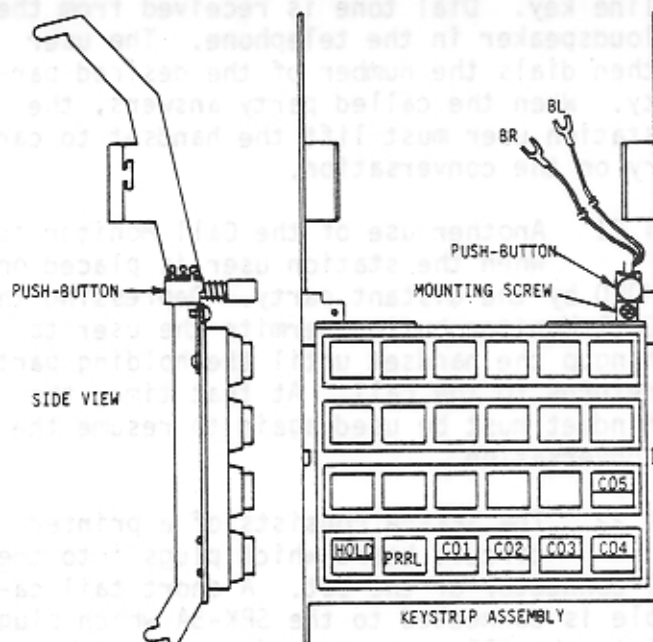


Figure 7 - FLASH Key Installation

## 5.00 INTERCOM BOX INSTALLATION

5.01 An intercom box may be installed in locations not requiring access to outside lines. It can receive intercom calls with handsfree reply and all-call announcements. Operating the "DND" (Do Not Disturb) button will make the station busy to intercom calls and to all-call announcements. All-call announcements may be made from an intercom box by depressing the "AC" button for the duration of the announcement.

5.02 An intercom box may be installed in locations where the "Station Monitor" feature is desired. The intercom box is the transmitter unit for the area to be monitored. Operation of the "MON" button at an intercom box permits that station to be monitored from any telephone (telephones only) in the system. While the monitor function is activated at an intercom box, the box may still receive intercom calls or initiate all-call announcements.

5.03 The intercom box is designed to sit on a desk (or similar surface) or may be wall-mounted.

5.04 For desk use, two soft rubber strips of pressure-sensitive back-



ing are provided with the unit to prevent sliding. To install the strips:


- a) Turn the unit upside-down.
- b) Remove the covering from the soft rubber strips.
- c) Insert the strips into the slots in the bottom of the unit.

5.05 To wall-mount the unit:

- a) The unit should be located on a surface near the modular connector.
- b) Remove the rear cover from the unit by loosening the captive screw in the front of the unit.
- c) Mount the rear cover of the unit on the mounting surface using the hardware provided.
- d) Mount the box assembly on the rear cover and secure with the front screw.

5.06 Intercom Box Connections to the System

5.07 The intercom box plugs directly into a modular jack wired to an intercom interface card (2IU-5A) in the KSU. To identify those jacks wired for an intercom box, a label is provided with each intercom box. This label should be affixed to the modular jack which is wired for an intercom box.

 If the intercom box is plugged into a modular jack wired for an EK-516 telephone, it will not function properly, and will draw excessive current causing a fuse to blow in the KSU.

## 6.00 DOOR BOX/DOOR CHIME INSTALLATION

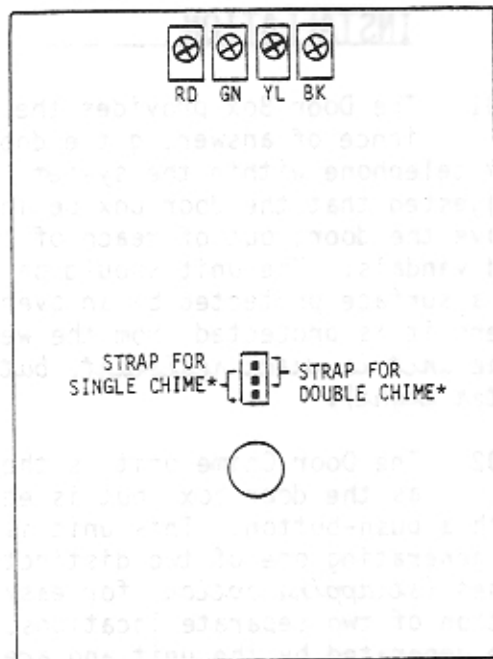
6.01 The Door Box provides the convenience of answering the door from any telephone within the system. It is suggested that the door box be installed above the door, out of reach of children and vandals. The unit should be mounted on a surface protected by an overhang where it is protected from the weather (*the unit is water resistant, but not water tight*).

6.02 The Door Chime unit is the same as the door box, but is equipped with a push-button. This unit is capable of generating one of two distinctive tones (*strapping option*) for easy recognition of two separate locations. Tones are generated by the unit and are received at all telephone locations within the system.

6.03 Installation

6.04 The Door Box/Door Chime should be installed as follows:

- a) Remove the rear cover by loosening the captive screw in the front of the unit.
- b) Feed the quad from the KSU through one of the square holes in the rear cover and mount the cover on a flat surface with the hardware provided. Mount the cover with the slots at the bottom.
- c) Connect the quad leads to the terminals on the printed circuit card of the unit (see figure 8).
- d) If the box is a Door Chime, place the option strap in the position to select one of the two tones (*single chime or double chime*) to be transmitted by the box (see figure 8).
- e) The quad from the door box must be wired to an intercom interface card (2IU-5A) in the KSU. Check the wiring carefully. The box will NOT function properly and may blow fuses in the KSU if connected to a telephone interface.



\* DOOR CHIME boxes only.

Figure 8 - Door Box Connection Points

- f) Test the door box for proper operation.
- g) Install the front assembly onto the rear cover and secure by tightening the screw in the front of the unit.

## 7.00 APPLIQUE BOX INSTALLATION

7.01 Single line telephones (500 type, decorator sets, etc.) may be installed in the EK-516 system by using an EK-516 Applique Box.

7.02 The Applique Box provides the interface between the single line set and the system, permitting the single line set to function as a multi-button set. The button functions provided for this type of set are:

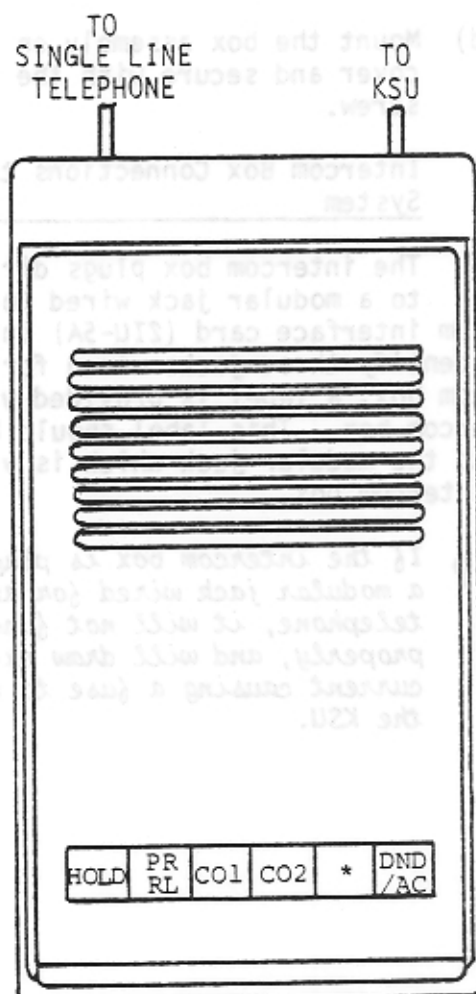
- HOLD
- PRivacy ReLease
- All-Call/Mic Mute
- 3 C.O. line pickups (with LNU-5A) or 2 C.O. line pickups with ICU-5A or MOU-5A.

The DND feature is an option for this station.

7.03 The single line telephone which may be used with an Applique Box must be equipped with a 4-conductor line cord terminated in a modular plug. The GN/RD conductors are used for the network connections and the YL/BK conductors are used for hookswitch connections. A "make" (normally open) or a "break" (normally closed) hookswitch contact may be used for the off-hook indication to the Applique Box.

7.04 To install the Applique Box, proceed as follows:


- a) If not already equipped, connect a modular plug-ended line cord to the single line set. The GN/RD leads connect to the network (usually L1 and L2, F and C, or RR and C). Refer to the manufacturer's installation instructions.



\* May be CO3, MON or GND key.

Figure 9  
Applique Box Key and Cord Arrangement

- b) The YL/BK conductors of the line cord must be connected to either a "make" contact (normally open) or a "break" contact (normally closed) of the hookswitch assembly. This contact MUST NOT be used for any other purpose in the set.
- c) Plug the line cord for the single line set into the modular jack in the rear of the set on the HOLD button side. The Applique Box cord is plugged into the modular jack on the AC button side of the set. Refer to figure 9.
- d) If the YL/BK conductors were connected to a "break" contact and the DND feature is not required at the station, there is no need to open the Applique Box. Installation is complete.
- e) If the YL/BK conductors were connected to a "make" contact, or if the DND feature is required at the station, continue to the next step.
- f) Remove the faceplate from the Applique Box by placing a small screwdriver or a paper clip in the slot between the faceplate and the housing (bottom of faceplate) and pry gently upward to disengage the faceplate. Pull the faceplate forward to remove it.
- g) Loosen the captive screws (top and bottom, center) to remove the upper housing.

 When removing the upper housing, be careful when lifting the housing off the set -- the line key assembly is held in place by 4 tabs on the upper housing. Push the key assembly toward the rear of the set to disengage it from the tabs.

- h) The housing is connected to the ANU board by the loudspeaker leads. Lay the housing to the side of the set.
- i) If the YL/BK leads to the telephone are connected to a "make" contact on the hookswitch assembly, cut the strap shown in figure 10 for the hookswitch option.
- j) If the DND feature is required at the station, cut the strap shown in figure 10 for the DND option.

- k) To replace the housing -- insert the two tabs at the top of the keystrip opening in the housing into the corresponding holes in the keystrip P.C. board. Make sure that the lower edge of the P.C. board rests on the flange of the lower tabs. Secure the housing by tightening the two screws.
- 1) Replace the faceplate.

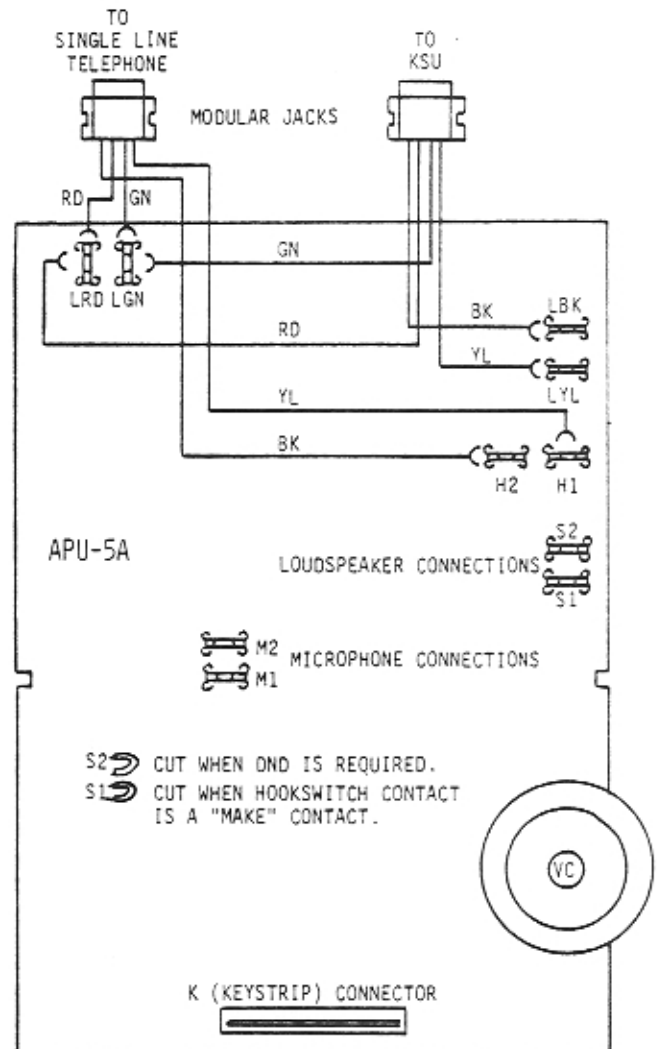



Figure 10 - APU-5A Abbreviated Card Layout

#### 7.05 Connection to the System

7.06 The Applique Box must be plugged into a modular jack wired to a "telephone" interface (2SU-5A or 8SU-5A) at the KSU.

 The Applique Box will not function if plugged into a modular jack wired for an intercom box.



## OPERATIONAL TESTS

### 1.00 INTRODUCTION

1.01 This section covers operational tests, including expected results and what to do when they do not occur, maintenance recommendations and recommended spare parts lists.

1.02 The initial test procedures will cover testing the basic KSU (4 circuit boards - CPU-5A, CMI-5A, &SU-5A and 2SU-5A-1) and the 1st 10 telephones which may be installed in the system.

1.03 As the system is expanded, after the basic system has been tested and functions properly, test procedures for each expansion sequence will be covered in the following order:

- a) Basic KSU Tests (paragraph 2.00 and tests 1 through 8).
- b) BLU-5A Expansion (test 9).
- c) 2SU-5A Expansion Tests (paragraph 3.00).
- d) 2IU-5A Expansion Tests (tests 10 & 11).
- e) COU-5A Expansion Tests (test 12).

### 2.00 BASIC KSU TESTS

2.01 When the basic KSU installation is complete, the installer should test both C.O. lines and all telephones (up to 10) in the system for proper operation. All operating features should be tested at each telephone, where applicable.

2.02 If the KSU is being installed in the sequence provided in section -1, the expansion cards will not have been installed at this time. This will simplify fault location, if required. Expansion card and station tests are covered in their proper sequence.

2.03 When power is applied to the sys-

tem initially, the matrix and power failure relays in the KSU should operate immediately. Operation of these relays can be heard when the system is plugged in. Two or three seconds later, one relay in each telephone will operate and a short burst of tone may be heard from the telephone loudspeakers.

2.04 The installer should test the system systematically in order to cover all the features at all the telephones. In some cases, two persons will be required to substantiate feature operation.



*The circuit boards in the KSU and stations contain CMOS solid state devices. Normal precautions should be taken when handling these components. Handle circuit boards by the edges; do NOT touch the solid state components. Disconnect the AC line cord before inserting or disconnecting the ribbon cables from the circuit boards.*

2.05 The KSU is designed to be removed from service without disabling all telephones in the system. Some telephones will automatically be connected to the C.O. lines when power is removed from the KSU (see paragraph 4.02 in section -2). Those telephones will receive incoming ringing signals if they have been arranged in accordance with paragraphs 4.05 through 4.08 in section -2.

2.06 The following tables outline each test and the result to be expected. If the expected result does not occur, information is provided to locate the fault and correct the result.

2.07 The procedure outlined in the "Problem Procedure", following each test, assumes that a fault found to be on a printed circuit board in the KSU will result in replacement of the P.C.



board; and that a fault found to be in the printed circuit board of a telephone will result in replacement of the telephone. No repair procedures for P.C. boards will be covered in this section.

2.08 The background music (BGM), when provided and All-call paging features will be tested first. When working properly, these two features indicate that most of the system is functioning correctly and correction of subsequent expected results will be more easily accomplished.

2.09 The EK-516 telephones utilize non-locking keys. The line key may be depressed before lifting the handset from its cradle when seizing a C.O. line. However, if the handset has not been removed before 5 seconds have elapsed, after depressing the line key, the processor will ignore that the line key had been depressed.

2.10 Test Procedure

2.11 Before starting the tests, plug in the power supply cord at the AC outlet. If background music (BGM) and/or music-on-hold (MOH) is provided, turn on the music source. If BGM is provided, the testing will start with test procedure #1. If BGM is not provided, the testing will start with procedure #2. Prior to starting the test procedures:



Before starting the tests, the installer should measure the output voltages of the power supply. It should be measured at the power lead entrance terminals at the top of the CPU-5A (see figure 5 in section -1). The measurements should be made from the COM terminal (white lead) to the other 4 terminals as follows:

1. (-) meter lead to COM terminal -  
(+) meter lead to +18VDC terminal (red lead) measures 18VDC  $\pm$  1 volt.  
(+) meter lead to +24VDC terminal (blue lead) measures 20 to 30VDC (-4 to +6 tolerance).  
(+) meter lead to RS terminal (yellow lead) measures 10VDC  $\pm$  1 volt.
2. (+) meter lead to COM terminal -  
(-) meter lead to -18VDC terminal (black lead) measures 18VDC  $\pm$  1 volt.

2.12 Simplified schematics are provided to aid the installer or service personnel, should a problem develop during or after installation.



TEST	ACTION	EXPECTED RESULT
#1 System idle with BGM.	See paragraph 2.11 in this section.	BGM heard from all telephones arranged for BGM. See table 4 in section -1

#### PROBLEM PROCEDURE

NO BGM heard at all telephones - See figure 1 on page D6.

1. No power to BGM source (*not turned on or unplugged*).
2. Music source not connected properly. Check for music at MS1/MS2 terminals on LTB-A with butt set.
3. LTB-A not correctly plugged in (*see figure 5 in section -1*).
4. Still no music-
  - a. Listen at the -GN/-RD terminals on the LTB-D assemblies. If music is heard proceed to step f. ANY "shorted" GN/RD quad pair will "kill" the music.
  - b. If no music on LTB-D terminals, check P relay operation on the 8SU and 2SU cards. Refer to figures 9 and 10 for P relay locations. Temporarily shut off the KSU power supply switch. While observing the P relays on the 8SU or 2SU, turn the power back on. The P relays for all stations which are to have BGM should operate.
  - c. If the relays do not operate, check the option straps 4-5 (*see table 4 in section -1*) on the 8SU and 2SU cards.
  - d. If relays operate, and still no music, check the flat cables between the CPU-5A and the 8SU and 2SU cards (*check that the exposed contacts are facing the contacts of the connector*).
  - e. If still no music, replace the CPU-5A.
  - f. If music is heard at -GN/-RD terminals on LTB-D assemblies, check the fuses on the 8SU and 2SU cards. Reversed or shorted YL/BK leads to the telephones will blow the fuses.
  - g. If fuses are blown check the quads to all stations before replacing fuses. Check the terminations on the LTB-D's. Check that the leads are correct at the modular jack at each station.
  - h. If fuses are not blown, check voltage across YL/BK pair to any telephone at the telephone. If no voltage (*approximately 36 volts*) is present, check quad wiring.
  - i. If voltage measurement is correct, check DTB or T connector wiring at the telephones.

NO BGM at some telephones -

1. Follow steps a, f, g and h for each station with no music. If P relay does not operate for a single station, and the 4-5 strap is present on the 8SU or 2SU, replace the 8SU or 2SU.

TEST	ACTION	EXPECTED RESULT
#2A Seizure and All-call	At a telephone, lift the handset from its cradle.	BGM removed, if provided.
PROBLEM PROCEDURE		
<p>Music NOT removed -</p> <p>1. This is an internal telephone function. Check the hookswitch of the set. Replace the set if required.</p>		
#2B All-call visual indications.	Depress and <u>hold</u> the All-call (AC) button at a telephone.	LED in the HOLD key lit steadily at all telephones.
<p>NO LED lit at any telephone -</p> <p>1. Repeat the ACTION from another telephone.</p> <p>a. If the expected result is satisfactory at the 2nd telephone, check the hookswitch and the flat cable between the keystrip assembly and the ANU board in the 1st telephone. If the problem still exists, replace the 1st telephone.</p> <p>b. Still NO LED's lit -</p> <p>Check the AC power to the AC power supply - green LED lit on power supply.  Check fuses on 8SU and 2SU cards.  Check LTB-D assemblies (see figure 5 in section -1) and the quad connections.  Check the flat cables (make sure that the exposed contacts are facing the contacts of the connector).  Recheck the power supply terminal voltages on CPU (see "READ" following paragraph 2.11).</p> <p>If voltages to the CPU-5A appear correct, refer to Replacement Card Procedure on the following page to isolate the fault and replace the card.</p> <p>When the LED in the HOLD button lights at all stations when an All-call key is depressed, it proves that data can be transmitted to and from the stations to the processor in the KSU.</p>		
<p>#2C All-call audible.</p> <p>See figure 2 on page D6.</p>	<p>While depressing the AC button at a station, make an announcement.</p> <p style="text-align: center;">continued</p>	<p>All telephones should receive double splash-tone and the announcement (except the calling station).</p>

## REPLACEMENT CARD PROCEDURE

1. After all items detailed preceding the "See replacement card procedure" instruction have been followed, and the expected results have not been obtained, do the following:
  - a) If no telephones are assigned to stations 9 and 10, move the LTB-D-1 assembly to the LTB-D-3 position. Telephones should now be assigned to both the 8SU and 2SU circuit cards.

*Note: This procedure is intended to locate a fault on the CPU, CMI, 8SU-5A or the 2SU-5A-1. These four cards are factory installed as part of the basic KSU. As the address and data busses are multiplexed to all cards in the system, a fault can be located on any one of the cards and affect the operation of the entire system. This procedure should locate that fault.*
2. If the expected result of the test is not obtained on station 9 or 10, disconnect flat cables 9, 10, 11 and 12 (see figure 3 in section -1) to the 2SU-5A at the CPU end. Perform the test again on stations 1-8. If the expected result is obtained, replace the 2SU-5A-1 card.
3. If the expected result still is not obtained, reconnect flat cables 9, 10, 11 and 12. Disconnect flat cables 5, 6, 7 and 8 at the CPU end. Perform the test on stations 9 and 10. If the expected result is obtained, replace the 8SU-5A card.
4. If the expected result is still not obtained, reconnect flat cables 5, 6, 7 and 8. Disconnect flat cables 1, 2, 3 and 4 to the CMI card at the CPU end. Perform the test again, at any station. If the expected result is obtained, replace the CMI-5A card.
5. If the expected result still is not obtained, replace the CPU-5A card.

## TEST #2C PROBLEM PROCEDURE

All LED's lit but no audio at any station - See figure 2.

1. Repeat the ACTION from another telephone.
  - a. If the expected result is satisfactory at the 2nd telephone, check the following at the 1st telephone:
    - NO side tone - Handset defective or improperly wired.
    - Dial, DTB, or T connector not properly connected or strapped.
    - Open GN/RD pair. Check modular jack and/or LTB-D connections.
    - I relay not operating on 8SU or 2SU card (see figure 9 or 10 in section -1) - check the flat cables to interface card.
    - Swap telephones - replace the telephone or the interface card.
  - b. If still no splash-tone or audible from 2nd telephone, proceed as follows:
    - No side tone at calling telephone -
      - I relay not operating on 8SU or 2SU - see replacement card procedure. Refer to figure 3 for "I" relay number and location and

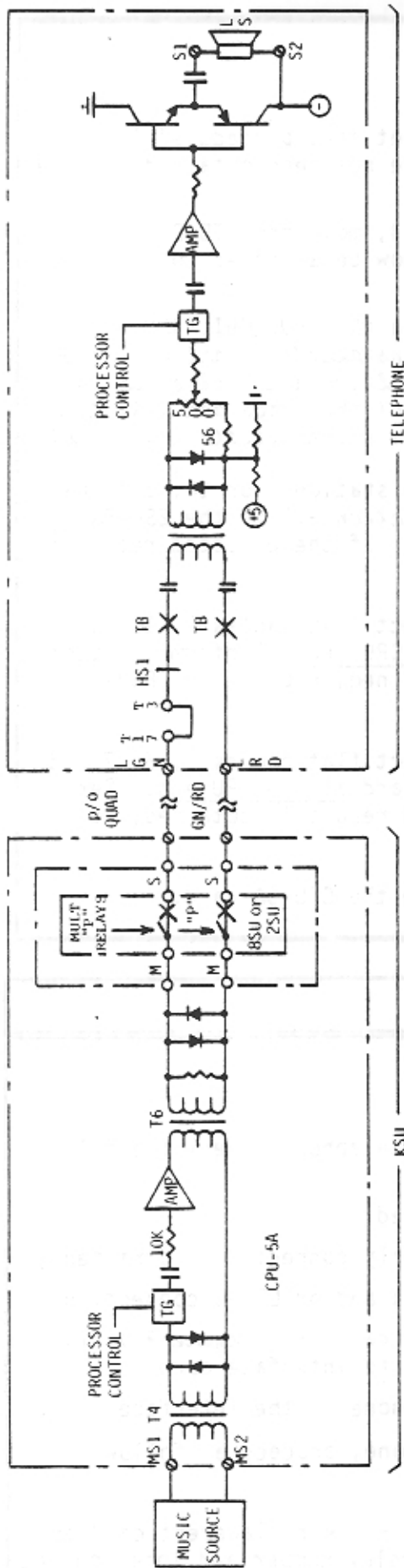


Figure 1 - Background Music (BGM) Simplified Schematic

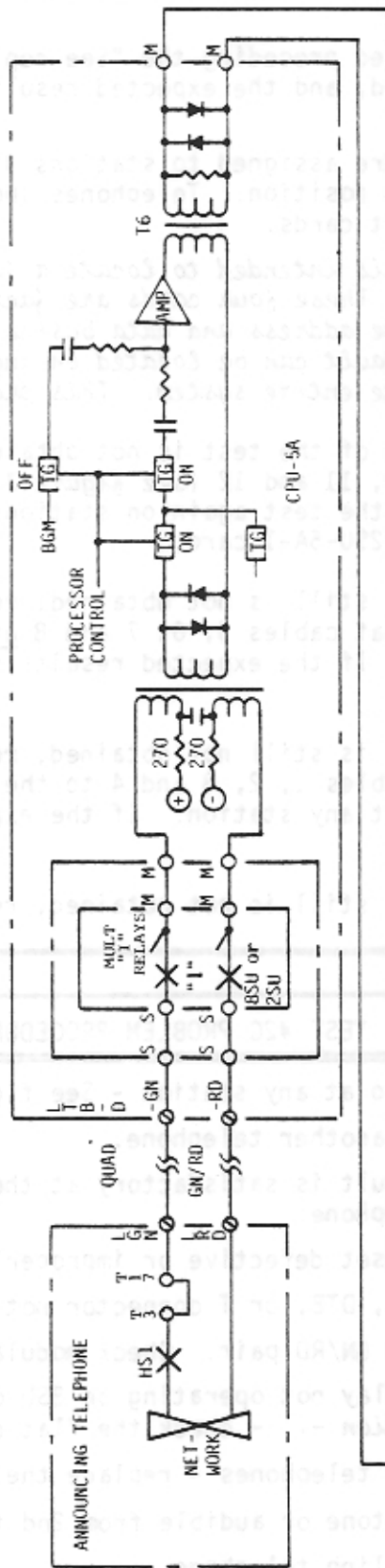
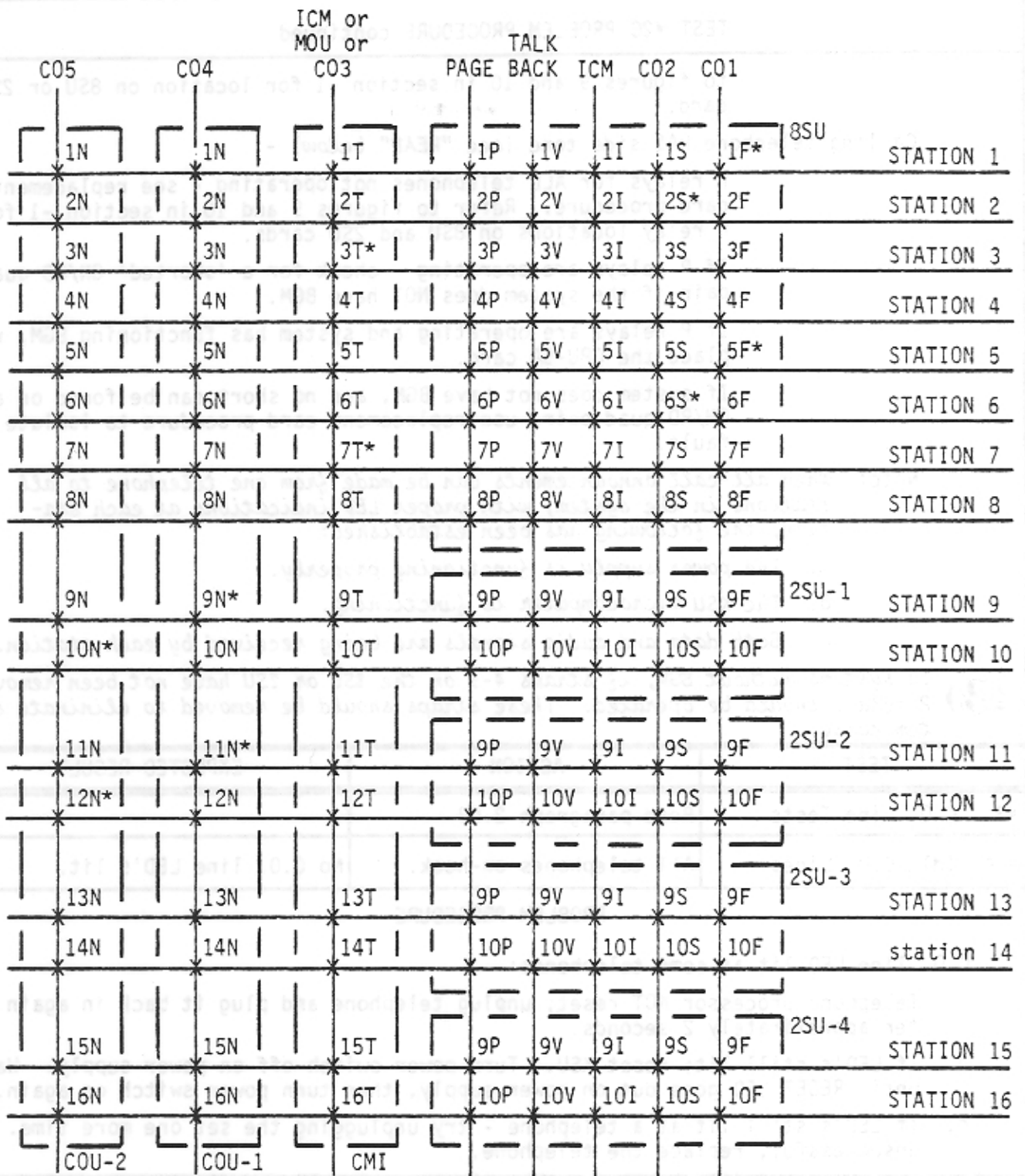


Figure 2 - All-call Paging Simplified Schematic (Audio Path)





\* These relays are normally operated when power is on. They are released by the CPU when required to close the matrix.

Figure 3 - EK-516 Switch Matrix

TEST #2C PROBLEM PROCEDURE continued

to figures 9 and 10 in section -1 for location on 8SU or 2SU card.

Calling telephone HAS side tone (see "READ" below) -

P relays for ALL telephones not operating - see replacement card procedure. Refer to figures 9 and 10 in section -1 for P relay locations on 8SU and 2SU cards.

If P relays are operating - check for a 'shorted' GN/RD quad pair if the system does NOT have BGM.

If P relays are operating and system has functioning BGM, replace the CPU-5A card.

If system does not have BGM, and no short can be found on any GN/RD quad pair, use replacement card procedure to isolate the fault.

Note: When all-call announcements can be made from one telephone to all stations in the system, with proper LED indications at each station, the following has been established:

- a. The power supply is functioning properly.
- b. The KSU microcomputer is functioning.
- c. Both data and audio signals are being received by each station.



In systems without BGM, if straps 4-5 on the 8SU or 2SU have not been removed, P relays should be operated. These straps should be removed to eliminate system noise.

TEST	ACTION	EXPECTED RESULT
#3 C.O. Line Tests	Read paragraph 2.09	
#3A Idle C.O. Lines	All telephones on-hook.	No C.O. line LED's lit.

PROBLEM PROCEDURE

1. C.O. line LED lit at some telephones:
  - a. Telephone processor NOT reset; unplug telephone and plug it back in again after approximately 2 seconds.
  - b. If LED's still lit; reset KSU. Turn power switch off on power supply. Wait until RESET LED goes out on power supply, then turn power switch on again.
  - c. If LED's still lit at a telephone - try unplugging the set one more time. If unsuccessful, replace the telephone.

#3B C.O. Line Seizure	At a telephone, go off-hook	BGM removed, if provided.
	Depress C.O. line button.	C.O. Line LED lights steadily at all telephones except calling telephone. LED winks twice every 3 seconds (I-USE) at calling telephone. Dial tone received.

See problem procedure on page D9

## TEST #3B PROBLEM PROCEDURE

1. No LED light -
  - a. At one or some stations, replace the telephone.
  - b. At all telephones;
 

Check the LED on the circuit card in the KSU (*lines 1 and 2 on the CPU-5A and line 3 on the LNU-5A, if provided*). If LED does not light for lines 1 or 2 on CPU, replace the CPU. If the LED will light for line 1 or 2, but not 3, replace the LNU-5A card.
2. No dial tone - See figure 4.
  - a. Check the C.O. line and LTB-A connections.
  - b. Matrix malfunction:
 

For the 1st C.O. line, the "F" relay should operate for the telephone under test. See figure 3 for proper F relay and figure 9 or 10 in section -1 for location.

For the 2nd C.O. line the "S" relay should operate for the telephone under test.

For the 3rd C.O. line (*if provided with an LNU-5A on the CMI card*), the "T" relay should operate for the telephone under test. See figure 8 in section -1 for location.

Check the flat cable connections to the appropriate interface card. Check that the LNU-5A is plugged into the CMI correctly (*figure 8 in section -1*).

Replace the interface card - 8SU, 2SU or CMI.

TEST	ACTION	EXPECTED RESULT
#3C Dialling	Dial the number of another C.O. line in the system.	Ringback tone heard in the telephone handset.

## TEST #3C PROBLEM PROCEDURE

1. Can not break dial tone -
  - a. C.O. line problem; check at entrance terminal.
  - b. GN/RD pair of quad reversed; check LTB-D connections.
  - c. Modular jack not properly wired in the telephone or at the quad end.
  - d. Dial improperly connected (*see table 1 in section -2*); T connector improperly strapped.
  - e. Dial defective; replace.
  - f. Telephone defective; replace.

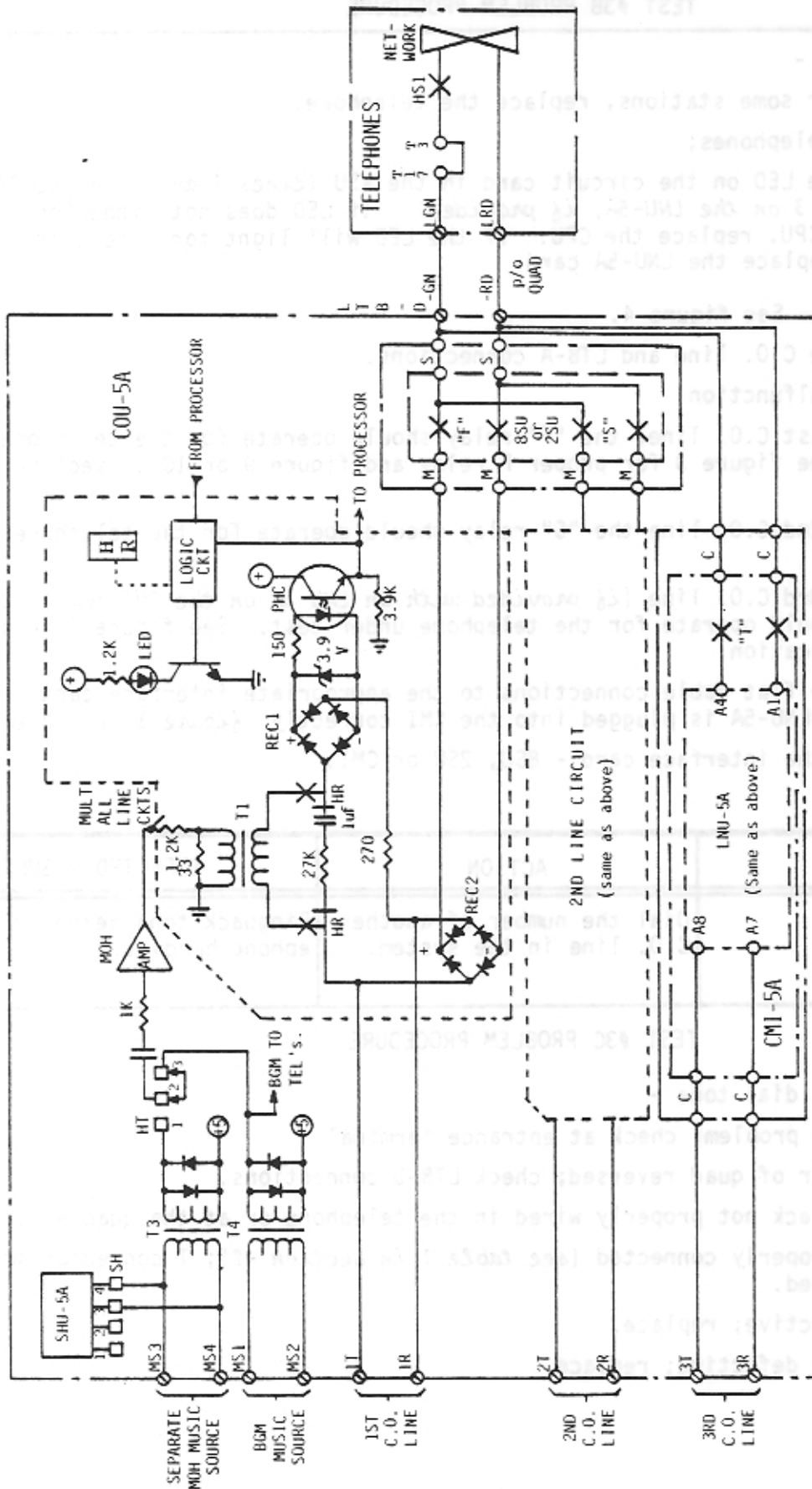


Figure 4 - C.O. Line Calling Simplified Schematic

TEST	ACTION	EXPECTED RESULT
#3D Incoming Ring	Wait after dialling. If the system has one line only, call a known party and have them call you back.	A few seconds after dialling, incoming ring tone should be heard at telephones strapped to receive C.O. audible (1 second on, 2.5 seconds off).  The LED in the line key of the incoming call should flash at 50 IPM (approximately once each second) at all telephones.
TEST #3D PROBLEM PROCEDURE		
<ol style="list-style-type: none"> <li>1. No C.O. audible at one or some telephones -               <ol style="list-style-type: none"> <li>a. Telephone not strapped for C.O. audible in KSU (see table 4 in section -1).</li> <li>b. Telephone defective; replace.</li> </ol> </li> <li>2. No C.O. audible at any telephone -               <ol style="list-style-type: none"> <li>a. Telephones not strapped for C.O. audible in KSU (see table 4 in section -1).</li> <li>b. C.O. line not properly connected; check LTB-A.</li> <li>c. Line circuit not responding to C.O. audible signals: If line 1 <u>OR</u> 2, or lines 1, 2 <u>AND</u> 3; replace the CPU-5A. If line 3 only, replace LNU-5A (check that LNU-5A is plugged in correctly; figure 8 in section -1).</li> </ol> </li> <li>3. No flashing LED's at any telephone -               <ol style="list-style-type: none"> <li>a. Replace the CPU-5A.</li> </ol> </li> <li>4. No flashing at one or some telephones -               <ol style="list-style-type: none"> <li>a. Replace the telephone.</li> <li>b. Replace the CPU-5A.</li> </ol> </li> </ol>		
#3E C.O. Line Answer	Lift the handset at the C.O. audible telephone.  DO NOT HANG-UP	C.O. audible muted (low level) if telephone is arranged for off-hook signalling (see table 4 in section -1).
	Depress the flashing C.O. line key.  DO NOT HANG-UP          See problem procedure on page D12	LED's in called C.O. line keys steadily lit at all telephones except the answering telephone. LED flashes at I-USE rate at answering telephone.  Conversation established between the two telephones.



## TEST #3E PROBLEM PROCEDURE

1. No C.O. audible muting; replace the telephone.
2. LED's go out or continue to flash -
  - a. Replace the answering telephone.
  - b. Replace the CPU-5A.
3. No talk path established -
  - a. Dial improperly connected (see table 1 in section -2); T connector not properly strapped.
  - b. Dial defective; replace.
  - c. Telephone defective; replace.
  - d. Matrix malfunction (F, S or T relay does not operate); replace 8SU, 2SU or CMI.

TEST	ACTION	EXPECTED RESULT
#3F Hold	At the calling telephone, depress the HOLD button.	The LED in the 1st line key at calling telephone should flash twice (2 quick flashes) each second (approximately). This is the "I-HOLD" rate.
	DO NOT HANG-UP.	The LED's in the 1st line key at all other telephones should wink twice each second (approximately). This is the system hold rate.
	Note: <u>flash</u> refers to LED going <u>ON</u> . <u>wink</u> refers to LED going <u>OFF</u> .	Music (if MOH is provided) should be heard at the answered telephone.

## TEST #3F PROBLEM PROCEDURE

1. No HOLD flash at any telephone; LED's still lit -
  - a. If line still connected, HOLD button not functioning; replace telephone.
  - b. If still connected; replace CPU.
2. No HOLD flash at any telephone; LED's go out -
  - a. Line released, hold relay not operating in line circuit; If line 1 OR 2, or lines 1, 2 AND 3, replace CPU-5A.
  - b. If line 3 only, replace LNU-5A.
3. No "I-HOLD" flash at calling telephone -
  - a. One or some telephones; replace telephone.
  - b. Any telephone; replace CPU-5A.

Continued on Page D13

## TEST #3F PROBLEM PROCEDURE continued

4. No music at the 2nd telephone - See figure 4.
  - a. Music source not turned on.
  - b. Music source not properly connected.
  - c. If external music source other than BGM is used, or the SHU-5A is used - SHU-5A not plugged in (see 6.48 in section -1) or defective.  
HT option connector on CPU not properly strapped (see 6.41 in section -1).
  - d. MOH amplifier not functioning - If no MOH on any line, replace CPU-5A.
  - e. If MOH not functioning on line 1 OR 2, replace CPU-5A. If MOH not functioning on line 3 only, replace LNU-5A.

TEST	ACTION	EXPECTED RESULT
#3G Timed Recall	<p>Action from #3F. Do not release the HOLD condition.</p> <p><i>Note: Only the telephone with the "I-HOLD" flash will receive the recall C.O. audible signal. This can be any telephone in the system; even if the telephone is NOT strapped for C.O. audible signals in the KSU.</i></p>	<p>Depending upon KSU strapping, (paragraph 6.29 in section -1), incoming C.O. audible should be heard at the calling telephone (only) after the proper period of time has elapsed.</p> <p>LED at calling telephone changes from "I-Hold" rate to recall rate (150 IPM).</p>
	<p>Reanswer the calling telephone by depressing the flashing line button.</p>	<p>Same as test #3E.</p>


## TEST #3G PROBLEM PROCEDURE

1. No C.O. audible after proper time has elapsed -
  - a. Check KSU strapping (see paragraph 6.29 in section -1).
  - b. If test #3D was successful at that telephone, replace the CPU-5A.
  - c. If not a normal C.O. audible telephone, replace the telephone.
  - d. If still no audible, replace the CPU-5A.
2. If reanswer is unsuccessful, see test #3E problem procedure.

TEST	ACTION	EXPECTED RESULT
#3H Privacy	At the calling telephone, depress the HOLD button.	Same as #3F.
	At the calling telephone (telephone A), depress the line key with the steady LED ( <i>lit but not flashing</i> ).  DO NOT HANG-UP	No music is heard on the line; no conversation can be established with the answered telephone (telephone B).
TEST #3H PROBLEM PROCEDURE		
<p>1. No privacy between stations A &amp; B -</p> <ol style="list-style-type: none"> <li>a. At telephone A, put the line back on hold (<i>depress the HOLD button</i>).</li> <li>b. At telephone B, put the line back on hold (<i>depress the HOLD button</i>).</li> <li>c. At a 3rd telephone (telephone C), depress the button for the 2nd held line. Music should be heard if MOH is provided.</li> <li>d. At telephone A, depress the button for the 2nd held line. If music is heard, or if conversation can be established between telephones A &amp; C, replace the CPU-5A.</li> </ol>		
#3I Privacy Release	At telephone B ( <i>or C</i> ), depress the PR RL button.	Conversation established between telephones A & B ( <i>or C</i> ).
TEST 3I PROBLEM PROCEDURE		
<p>1. No privacy release between telephones A &amp; B -</p> <ol style="list-style-type: none"> <li>a. With both lines connected to each other and both on hold - at telephone A, depress the line key for the 1st line.</li> <li>b. At telephone B (<i>or C</i>) depress the line key for the 1st line. Both telephones should <u>not</u> be connected together.</li> <li>c. At telephone A, depress the PR RL button. If test is successful, replace telephone B (<i>or C</i>). If test is not successful, replace the CPU-5A.</li> </ol> <p><i>Note: The line key at one telephone and the PR RL key at the other telephone must be depressed at the same time (simultaneously) for the test to be successful.</i></p>		

TEST	ACTION	EXPECTED RESULT
<p>#4A Intercom Call - Origination</p> <p><i>System WITHOUT ICU card</i></p> <p><i>See test #5 for systems WITH an ICU-5A card installed on the CMI-5A.</i></p>	<p>At a telephone, go off-hook and depress a DSS button for the intercom telephone to be called.</p> <p>DO NOT HANG-UP</p> <p><i>Note:</i> <i>All subsequent intercom tests will assume successful completion of this test, to and from all telephones in the system.</i></p>	<p>At the originating telephone: Single splash-tone heard in the handset.</p> <p>At the called telephone: Single splash-tone heard from the loudspeaker. HOLD LED flashes at 150 IPM (approximately 2½ times each second).</p> <p>HOLD LED lit steadily at all but the called telephone. Conversation possible between the two telephones - the originating telephone via the handset and the called telephone by the talkback mode.</p>

## TEST #4A PROBLEM PROCEDURE

 The installer should be certain of the telephone number assignments when the test is made. If the DSS key is depressed for its own station (key 1 at station 1), no splash-tone will be heard and the HOLD LED will NOT light. This test is useful in determining the station number at a telephone when it is unknown.

1. No side tone at the originating telephone - SEE FIGURE 5.
  - a. Repeat the ACTION from another telephone.
 

If the expected result is satisfactory at the 2nd telephone, check the following at the 1st telephone:

Handset defective or improperly wired.

Dial, DTB or T connector not properly connected or strapped.

I relay not operating on 8SU or 2SU card (see figure 9 or 10 in section -1) - check flat cables to interface card.

Swap telephones - replace telephone or interface card (8SU or 2SU).
  - b. If the expected result is not satisfactory at the 2nd telephone, proceed as follows:
 

No side tone at the calling telephone -

I relay not operating on 8SU or 2SU; see replacement card procedure (page D5) and refer to figure 3 for I relay number and location. Figures 9 and 10 in section -1 show the card location of the relays.
2. Calling telephone has side tone. No splash tone heard at either location -
  - a. Replace the CPU-5A.
3. Calling telephone receives splash-tone. No splash tone at called telephone -
  - a. Defective or improperly wired called telephone. Check T connector straps and loudspeaker connections. Replace called telephone.
  - b. V relay not operating in interface card. See figure 3 and figures 9 and 10 in section -1. Refer to replacement card procedure (page D5).

*Continued on page D16.*

Notes for figure 5:

1. Two intercom calls are shown with the system equipped with an ICU card plugged into the CMI-5A card.
2. When the system is equipped with an ICU card, the ICU path is always used for the 1st intercom call.
3. In systems without an ICU card, the 2nd intercom path shown in the figure is always used.
4. In systems without an ICU card, there is no time-out limit for calls in the talkback mode.
5. In systems equipped with an ICU card, both intercom paths use the voice switching circuit on the CPU-5A card. A 30-second time-out interval limits the holding time of the voice switching circuit. The called station should be answered with the handset if the intercom call is expected to exceed the 30-second time period.

TEST #4A PROBLEM PROCEDURES continued

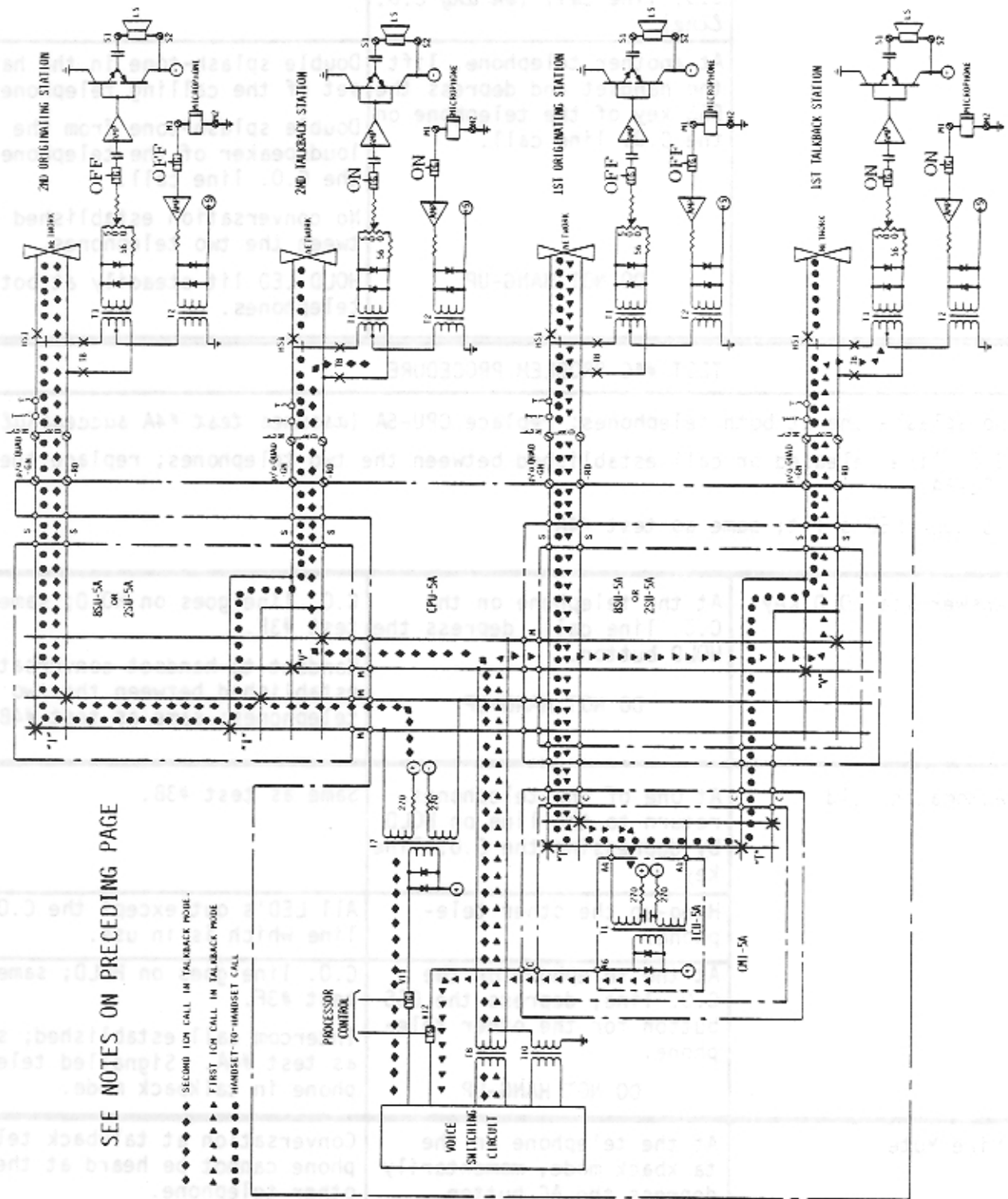
3. continued.
  - c. Voice switching circuit not functioning; replace CPU-5A.
4. Both telephones receive splash-tone. Talkback can not be heard at calling telephone -
  - a. Microphone leads unplugged or reversed. Microphone circuit defective.
  - b. Defective voice switching circuit; replace CPU-5A.
5. HOLD LED does not light or does not flash -
  - a. At all telephones; replace CPU-5A.
  - b. At one or some telephones; replace the telephone.

TEST	ACTION	EXPECTED RESULT
#4B Handset answer.	At the telephone in the talkback mode, lift the handset from its cradle.	Handset-to-handset conversation possible between the two telephones.  HOLD LED at the called telephone changes to steady.

TEST #4B PROBLEM PROCEDURE

1. No side tone at called telephone -
  - a. Handset defective or improperly wired.
  - b. Dial, DTB or T connector not properly connected or strapped.
  - c. I relay not operating on interface card (1SU or 2SU), use replacement card procedure.
2. HOLD LED does not change from flashing to steady -
  - a. If telephone has side tone; replace CPU-5A.





SEE NOTES ON PRECEDING PAGE

- ◆ SECOND 1ON CALL IN TALKBACK MODE.
- ▲ FIRST 1ON CALL IN TALKBACK MODE
- HANDSET-TO-HANDSET CALL

Figure 5 - Intercom Call Simplified Schematic

TEST	ACTION	EXPECTED RESULT
#4C Courtesy Signalling	At a telephone, establish a C.O. line call (on any C.O. line).	Same as test #3B & C.
	At another telephone, lift the handset and depress the DSS key of the telephone on the C.O. line call.  DO NOT HANG-UP	Double splash-tone in the handset of the calling telephone. Double splash-tone from the loudspeaker of the telephone on the C.O. line call. No conversation established between the two telephones. HOLD LED lit steadily at both telephones.
TEST #4C PROBLEM PROCEDURE		
<ol style="list-style-type: none"> <li>1. No splash-tone at both telephones; replace CPU-5A (assumes test #4A successful).</li> <li>2. C.O. line released or call established between the two telephones; replace the CPU-5A.</li> <li>3. No HOLD LED's lit; same as test #4A.</li> </ol>		
#4D Answer Via HOLD Key	At the telephone on the C.O. line call, depress the HOLD button.  DO NOT HANG-UP	C.O. line goes on HOLD; same as test #3F. Handset-to-handset conversation established between the two telephones; same as test #4B.
#4E Automatic Hold	At one of the telephones, return to the line on HOLD by depressing the C.O. line key.	Same as test #3B.
	Hang-up the other telephone.  At the telephone on the C.O. line, depress the DSS button for the other telephone.  DO NOT HANG-UP	All LED's out except the C.O. line which is in use. C.O. line goes on HOLD; same as test #3F. Intercom call established; same as test #4A. Signalled telephone in talkback mode.
#4F Mike Mute	At the telephone in the talkback mode, momentarily depress the AC button.  DO NOT HANG-UP	Conversation at talkback telephone cannot be heard at the other telephone.  LED in the AC button at the talkback telephone lit steadily.
See problem procedure on page D19		

## TEST #4F PROBLEM PROCEDURE

1. Microphone is not muted when AC key is depressed or the LED in the AC button does not light; replace the telephone.

TEST	ACTION	EXPECTED RESULTS
#4G Restore Talkback	At the telephone in the talkback mode, depress the AC button a second time.	LED in the AC button goes out. Conversation at the talkback telephone can now be heard at the other telephone.

## TEST #4G PROBLEM PROCEDURE

1. If LED in AC key does not go out or if microphone circuit is not restored to operation; replace the telephone.

#4H Do Not Disturb  <i>Note: This option is installed by cutting a strap inside the telephone set. The tester must know which telephones are arranged for this feature.</i>  Refer to paragraph 4.13i in section -2.	At the telephone to be tested, with the telephone <u>on-hook</u> , depress the DND/AC button.	LED in the DND/AC button lit. <i>Note: Button designation should be changed when DND feature is activated at the telephone.</i>
	At another telephone, go off-hook and depress the DSS key for the telephone with the lit DND/AC button.	Busy tone heard at the calling telephone. No splash-tone at called telephone.
	At the DND telephone, with the DND/AC button lit, go off-hook and call another set using the DSS button.	Call established; same as test #4A.
	At the DND telephone, with the DND/AC button lit, go off-hook, depress and hold the lit DND/AC button.	Double splash-tone heard at all telephones and all-call announcement possible; same as test #2.
	At the DND telephone, with the telephone <u>on-hook</u> , depress the lit DND/AC button.	AC LED goes out. Telephone can be called from any other telephone.

## TEST #4H PROBLEM PROCEDURE

1. DND/AC LED does not light or does not go out when DND/AC is depressed 2nd time -
  - a. Check that strap in telephone is cut (see figure 3 in section -2).
  - b. Replace telephone.
2. No busy tone to calling telephone or DND telephone is disturbed -
  - a. Replace the DND telephone.
  - b. Replace the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#4I Alternate Point Answer	At a telephone, go off-hook and depress a DSS button for another telephone.	Called telephone gets splash-tone and goes to talkback mode. Same as test #4A.
	At a 3rd telephone, lift the handset.	3rd party can not pick up the call.
	At the 3rd telephone, depress the PR RL button.	3rd party picks up the call in the handset-to-handset mode; same as test #4B.
TEST #4I PROBLEM PROCEDURE		
<ol style="list-style-type: none"> <li>1. Call is picked up at 3rd telephone before depressing PR RL button -               <ol style="list-style-type: none"> <li>a. Replace the 3rd telephone.</li> <li>b. Replace the CPU-5A.</li> </ol> </li> <li>2. Call can not be picked up at the 3rd telephone -               <ol style="list-style-type: none"> <li>a. Replace the 3rd telephone.</li> <li>b. Use replacement card procedure (page D5) to determine whether interface card (8SU or 2SU) or CPU-5A should be replaced.</li> </ol> </li> </ol>		
#4J Intercom Exclusion and Privacy Release  <i>Note: To permit a 3rd party to enter an intercom call, both parties must be in the handset-to-handset mode.</i>	At a telephone, go off-hook and depress a DSS button for another telephone.	Called telephone gets splash-tone and goes to talkback mode. Same as test #4A.
	At a 3rd telephone, lift the handset.	3rd party excluded from the call.
	At the telephone in the talkback mode, lift the handset from its cradle.	1st and 2nd parties in the handset-to-handset mode. Same as test #4B.
	With the 3rd telephone off-hook, depress the PR RL button at the 1st telephone.	3rd party enters the call; 3-way conversation can take place with all 3 parties handset-to-handset.
TEST #4J PROBLEM PROCEDURE		
<ol style="list-style-type: none"> <li>1. 3rd party enters the call before PR RL keys depressed -               <ol style="list-style-type: none"> <li>a. Replace 3rd telephone.</li> <li>b. Replace CPU-5A.</li> </ol> </li> <li>2. 3rd party can not enter the call with PR RL key depressed -               <ol style="list-style-type: none"> <li>a. Defective telephone at 1st station. Replace the 1st telephone.</li> <li>b. Replace CPU-5A.</li> </ol> </li> </ol>		

TEST	ACTION	EXPECTED RESULT
<p>#5A Intercom Call - Origination</p> <p>System <u>WITH</u> ICU card</p> <p>See test #4 for systems <u>WITHOUT</u> an ICU-5A card installed on the CMI-5A.</p>	<p>At a telephone, go off-hook and depress a DSS button for the intercom telephone to be called.</p> <p>DO NOT HANG-UP</p> <p>Note: All subsequent intercom tests will assume successful completion of this test, to and from all telephones in the system.</p>	<p>At the originating telephone: Single splash-tone heard in the handset.</p> <p>At the called telephone: Single splash-tone heard from the loudspeaker. HOLD LED flashes at 150 IPM (approximately 2½ times each second). HOLD LED lit steadily at all but the called telephone.</p> <p>Conversation possible between the two telephones - the originating telephone via the handset and the called telephone by the talkback mode.</p>

## TEST #5A PROBLEM PROCEDURE



The installer should be certain of the telephone number assignments when the test is made. If the DSS key is depressed for its own station (key 1 at station 1), no splash-tone will be heard and the HOLD LED will not light. This test is useful in determining the station number at a telephone when it is unknown.

1. No side tone at the originating telephone - SEE FIGURE 5.
  - a. Repeat the ACTION from another telephone.
 

If the expected result is satisfactory at the 2nd telephone, check the following at the 1st telephone:

Handset defective or improperly wired.

Dial, DTB or T connector not properly connected or strapped.

T relay not operating on the CMI card (see figure 8 in section -1) - check flat cables to the interface card.

Swap telephones or replace the CMI card.
  - b. If the expected result is not satisfactory at the 2nd telephone, proceed as follows:
 

No side tone at the calling telephone -

T relay not operating on the CMI card; see replacement card procedure (page D5). T relay number corresponds to the station number. Figure 8 in section -1 shows the location of the relays on the CMI card.
2. Calling telephone has side tone. No splash-tone at either location -
  - a. Replace the CPU-5A.
3. Calling telephone receives splash-tone. No splash-tone at called telephone -
  - a. Defective or improperly wired called telephone. Check T connector straps and loudspeaker connections. Replace called telephone.
  - b. V relay not operating on the interface card (8SU or 2SU). See figure 3 and figures 9 and 10 in section -1. Refer to replacement card procedure (page D5).

Continued on page D22



TEST #5A PROBLEM PROCEDURE continued


3. continued.
  - c. Voice switching circuit not functioning; replace CPU-5A.
4. Called telephone receives splash-tone. No splash-tone at calling telephone -
  - a. Open in flat cable between CMI and CPU; check cable #4 or replace.
  - b. Defective transformer on ICU-5A; replace ICU.
  - c. Defective gate on CPU-5A; replace CPU.
5. Both telephones receive splash-tone. Talkback can not be heard at calling telephone-
  - a. Microphone unplugged or reversed in called telephone. Microphone circuit defective. Replace telephone.
  - b. Defective voice switching circuit; replace CPU-5A.
6. HOLD LED does not light or flash -
  - a. At all telephones; replace CPU-5A.
  - b. At one or some telephones; replace telephone.

TEST	ACTION	EXPECTED RESULT
#5B Handset Answer	At the telephone in the talkback mode, lift the handset from its cradle.  DO NOT HANG-UP	Handset-to-handset conversation possible between the two telephones.  HOLD LED at called telephone changes from flashing to steady  HOLD LED goes out at all but the two telephones.

TEST #5B PROBLEM PROCEDURE

1. No side tone at called telephone -
  - a. Handset defective or improperly wired.
  - b. Dial, DTB or T connector not properly connected or strapped.
  - c. T relay not operating for called telephone on CMI card. Repeat test #7A and this test for another called telephone. If successful at the 2nd called telephone, replace the CMI card. If not successful the 2nd time, replace the CPU-5A.
2. HOLD LED does not change from flashing to steady -
  - a. If called telephone has side tone, replace the CPU-5A.
3. If all other LED's do not go out, replace the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#5C 2nd Intercom Call	With the 1st intercom call set up using the ICU, set up a 2nd intercom call with the 3rd and 4th telephones. Use the ACTION in test #7A.	2nd intercom call established between the 3rd and 4th telephones. <i>If this test is not successful, use the problem procedure for test #4A.</i>
#5D 2nd ICM Call - Handset Answer	At the 4th telephone, in the talkback mode, lift the handset.	2nd handset-to-handset call established. Same as test #4B.
#5E Call To A Busy Telephone On An ICM Call	Hang-up the 3rd and 4th telephones. 1st and 2nd telephones still engaged in the 1st intercom call  At the 3rd telephone, lift the handset and depress the DSS button for the 1st telephone.	Courtesy tone ( <i>double splash-tone</i> ) heard in the handset of the 3rd telephone and from the loudspeaker of the 1st telephone.  Tones NOT heard at the 2nd telephone. ( <i>See note.</i> )  HOLD LED lit steadily at all telephones.  No conversation between the 1st and 3rd telephones possible.
<i>Note: It is possible that the courtesy tones may be heard by the 2nd telephone, by loudspeaker to transmitter coupling at called telephone.</i>		
TEST #5E PROBLEM PROCEDURE		
<ol style="list-style-type: none"> <li>1. No courtesy-tone - <ol style="list-style-type: none"> <li>a. At calling telephone; replace the CPU-5A.</li> <li>b. At one of the two telephones; replace the telephone.</li> </ol> </li> <li>2. Conversation possible between all three telephones; no courtesy-tones - <ol style="list-style-type: none"> <li>a. Repeat the test from the 3rd telephone to the 2nd telephone. If successful, replace the 1st telephone (<i>defective PR RL key</i>).</li> <li>b. If the same result is obtained, replace the CPU-5A.</li> </ol> </li> </ol>		
#5F Answer Via HOLD Key	Same as test #4D	Same as test #4D
#5G Automatic Hold	Same as test #4E	Same as test #4E
#5H Mike Mute	Same as test #4F	Same as test #4F
#5I Restore Talkback	Same as test #4G	Same as test #4G
#5J Do Not Disturb	Same as test #4H	Same as test #4H
#5K Alternate Point Answer	Same as test #4I	Same as test #4I
#5L Intercom Exclusion and Privacy Release	Same as test #4J	Same as test #4J.

TEST	ACTION	EXPECTED RESULT
<p>#6 Station Monitor</p> <p>#6A Monitor Activate</p> <p>Note: Any number of telephones may be monitored and any number of telephones may be the monitor telephones.</p>	<p> The Station Monitor feature requires that an MOU-5A circuit card be installed on the CMI card in the KSU. This feature can not be used if the system is equipped with an ICU card or an LNU card. To test the Station Monitor feature to Intercom Boxes refer to test # 9.</p> <p>Telephones equipped with SPK-5A Called-Party Monitor units CAN NOT be "monitored" and CAN NOT be used as the "monitor" telephone. Both telephones and intercom boxes may be "monitored". ONLY telephones can be used as "monitor" stations.</p> <p>At a telephone to be monitored, WITHOUT lifting the handset, momentarily depress the MON button (see figure 1 in section -2).</p> <p>At the telephone to be the monitor station, go OFF-HOOK and momentarily depress the MON button. Then hang-up.</p>	<p>LED in the MON button flashes at 150 IPM (approximately 2½ times each second).</p> <p>LED in all other telephones except telephones equipped with SPK units lit steadily.</p> <p>The LED in the MON button at the monitor telephone changes from steady to I-USE rate (double wink approximately every 3 seconds) after hang-up.</p> <p>Conversation at the monitored telephone can be heard at the monitor telephone.</p>

## TEST #6A PROBLEM PROCEDURE

1. LED in monitored telephone does not flash at 150 IPM -
  - a. Telephone equipped with SPK unit. Can not be monitored.
  - b. Defective telephone; replace.
  - c. MOU-5A not plugged into CMI-5A.
  - d. Check flat cables to CMI-5A from CPU.
  - e. Defective MOU-5A, defective CMI or defective CPU-5A (test from other sets before replacing circuit cards).
2. LED in monitor telephone does not wink at I-USE rate -
  - a. Telephone equipped with SPK unit. Can not be monitor telephone.
  - b. Defective telephone; replace.
  - c. If condition 1 above is satisfactory, replace CPU-5A.
3. LED not lit steadily at all other telephones except SPK sets -
  - a. Defective telephone; replace.
  - b. If replacement telephone is not satisfactory, replace CPU-5A.

Continued on page D26

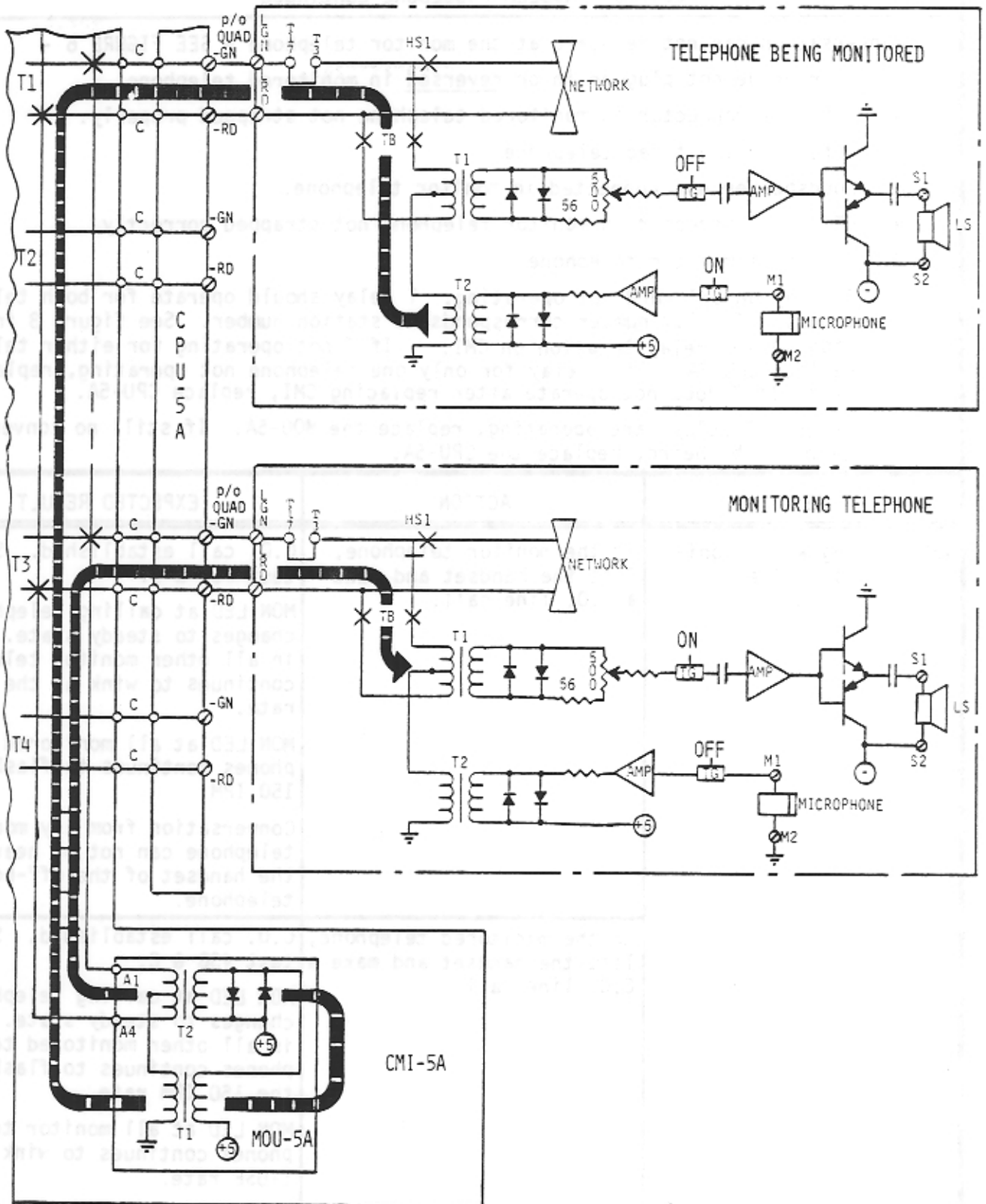


Figure 6 - Station Monitor Audio Circuit Simplified Schematic

TEST #6A PROBLEM PROCEDURE continued

4. Conversation can not be heard at the monitor telephone - SEE FIGURE 6 -
  - a. Microphone not plugged in or reversed in monitored telephone.
  - b. DTB or T connector in monitored telephone not strapped properly.
  - c. Defective monitored telephone.
  - d. Loudspeaker not connected in monitor telephone.
  - e. DTB or T connector in monitor telephone not strapped correctly.
  - f. Defective monitor telephone.
  - g. T relay on CMI card not operating. T relay should operate for both tele-  
phones. T relay number corresponds to station number. See figure 8 in sec-  
tion -1 for relay location on CMI. If T not operating for either telephone  
replace CPU-5A. If T relay for only one telephone not operating, replace CMI  
card. If T does not operate after replacing CMI, replace CPU-5A.
  - h. If both T relays are operating, replace the MOU-5A. If still no conversa-  
tion can be heard, replace the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#6B Calling While Moni- tor Is Active	At the monitor telephone, lift the handset and make a C.O. line call.	C.O. call established. Same as test #3B & C.  MON LED at calling telephone changes to steady state. LED in all other monitor telephones continues to wink at the I-USE rate.  MON LED at all monitored tele- phones continues to flash at 150 IPM.  Conversation from any monitored telephone can not be heard in the handset of the off-hook telephone.
	At the monitored telephone, lift the handset and make a C.O. line call.	C.O. call established, Same as test #3B & C.  MON LED at calling telephone changes to steady state. LED in all other monitored tele- phones continues to flash at the 150 IPM rate.  MON LED at all monitor tele- phones continues to wink at the I-USE rate.  Conversation from the calling telephone can not be heard at any of the monitor telephones.

See problem procedure on page D27



## TEST #6B PROBLEM PROCEDURE

1. Monitor activity not terminated when either monitor or monitored telephone goes off-hook -
  - a. Repeat the test at another telephone. If successful, replace the 1st telephone.
  - b. If not successful the 2nd time, replace the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#6C Monitor Release	At a monitored telephone, WITHOUT lifting the handset, depress the flashing MON button.	If all other monitor or monitored stations have been released, the MON LED will go out.  If other stations are still active, the MON LED will change from flashing to steady state.
	At a monitor telephone, WITHOUT lifting the handset, depress the winking MON button.	If all other monitor or monitored stations have been released, the MON LED will go out.  If other stations are still active, the MON LED will change from the I-USE rate to steady state.

## TEST #6C PROBLEM PROCEDURE

1. MON LED does not change state -
  - a. Defective telephone; replace.

#7A C.O. Line Multi-line Conference	At a telephone, make a C.O. line call on the 1st line.	Same as test #3B & C.
	Place the call on HOLD.	Same as test #3F.
	Make another C.O. call on the 2nd C.O. line.	Same as test #3B & C.
	Place that call on HOLD.	Same as test #3F.
	Simultaneously depress both winking C.O. line buttons.	Both outside parties and the telephone under test are connected together in a conference.

## TEST #7A PROBLEM PROCEDURE

1. No conference -  
Replace the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#7B Internal Conference	At a telephone, lift the handset and call another inside telephone.	Same as test #4A or #5A.
	Answer the called telephone with the handset.	Same as test #4B or #5B.
	Tell the person at the 1st telephone not to hang-up and depress another DSS button.	2nd telephone disconnected from the call. 3rd telephone in the talkback mode. Same as test #4A or #5A.
	Answer the 3rd telephone with the handset.	Same as test #4B or #5B.
	At the 1st telephone, depress the PR RL button.	All three telephones connected together in a conference.
TEST #7B PROBLEM PROCEDURE		
<p>1. Conference not established -</p> <p>a. PR RL button defective; replace telephone.</p> <p>b. Replace CPU-5A.</p>		
#8A Loop Flash	<i>This test should be performed if the telephone set has been equipped with a Flash key in accordance with paragraph 4.25 in section -2. The output from the FLASH key is an open in the GN side of the telephone quad for the duration of the depressed key.</i>	
	At the telephone, lift the handset and depress a C.O. line key.	Dial tone received. Same as test #3B.
	Dial the digit "2".	Dial tone removed. Same as test #3C.
	Depress the FLASH key momentarily.	Dial tone returns when the key is released.
TEST #8A PROBLEM PROCEDURE		
<p>1. Dial tone not returned when button is released -</p> <p>a. FLASH key not installed properly; refer to paragraph 4.25 in section -2.</p> <p>b. Defective FLASH key; replace.</p>		

TEST	ACTION	EXPECTED RESULT
#8B Ground Flash	<p><i>This feature is generally used when the EK-516 system is installed behind a PABX which requires a ground on the transmission path to transfer inside calls or to recall the attendant.</i></p> <p><i>This feature can not be used if any circuit card (ICU, LNU, or MOU) is plugged into the CMI card. This feature also requires that ground be connected to terminals 3T/3R on the LTB-A Line Terminal Board. Refer to paragraph 4.27 in section -2.</i></p> <p>If the PABX is arranged for transfer of outside calls, have the attendant extend an incoming call to you.</p> <p>Momentarily depress the 'MISC' key (right-most button in the 2nd row; see figure 1 in section -2).</p>	<p>Incoming call received. Same as test #3D &amp; E.</p> <p>Inside dial tone received or attendant recalled (may hear attendant ringing signal).</p>

## TEST #8B PROBLEM PROCEDURE

1. No inside dial tone or attendant recall -
  - a. KSU not grounded.
  - b. Ground not connected to 3T/3R terminals on LTB-A.
  - c. T relay on CMI not operating. T relay corresponds to station number. See figure 8 in section -1 for relay location on CMI card.
  - d. If T is operating check flat cables between CMI and CPU.
  - e. If T is not operating:
    - Defective button or defective telephone (*try another station*); replace.
    - Defective CMI-5A; replace.
    - Defective CPU-5A.

## 3.00 KSU EXPANSION CARD TESTS

3.01 As previously stated, the basic KSU should be completely tested before proceeding with KSU expansion. When installed in this manner, any fault which may exist, will be confined to the expansion card or the unit (*telephone or box*) which it serves.

3.02 The following test procedures will assume a fully working basic KSU. In some rare cases, a fault may be in the CPU; that part of the CPU which functions only with the expansion unit being tested.

3.03 2SU Expansion Tests

3.04 As each additional 2SU-5A card is installed, the associated telephone which it serves, should be tested also.

3.05 To test the 2SU and its telephones, proceed with tests 1 through 8. Keep in mind that if a fault is encountered, it should only have to be isolated to the telephone or the 2SU card just installed. When reference is made in the test outline to the replacement card procedure, the only determination to be made will be whether the fault lies in the 2SU

or the CPU-5A.

3.06 After the last 2SU card and its telephones are installed and tested, proceed with the BLF telephone, if required in the system. The BLF telephone requires installation of the BLU-5A unit. The following test procedure details testing the BLF telephone and the BLU-5A. The subsequent test procedures detail testing the remaining expansion cards and units.

TEST	ACTION	EXPECTED RESULT
#9A BLF Telephone	Test the BLF telephone in accordance with test procedures 1 through 8, as required.	Same as results of tests 1 through 8.
#9B Busy Lamp Field	Go off-hook at each telephone in the system.  <i>Note: Only telephones in the system provide an off-hook indication to the BLF. Intercom and door boxes will not light the LED in the BLF.</i>	The LED in the DSS button for each telephone in the system should light.
#9C Night C.O. Audible	At a telephone, make a C.O. line call on the 1st line to the 2nd line.	C.O. audible heard at all telephones strapped for C.O. audible in the KSU.
	At the BLF telephone, depress the Night Transfer button (small white button above the top row of keys).  <i>Note: The NT key is a locking key and is in the Night Transfer position when it is locked down</i>	C.O. audible heard from <u>all</u> telephones in the system.

#### TEST #9 PROBLEM PROCEDURE

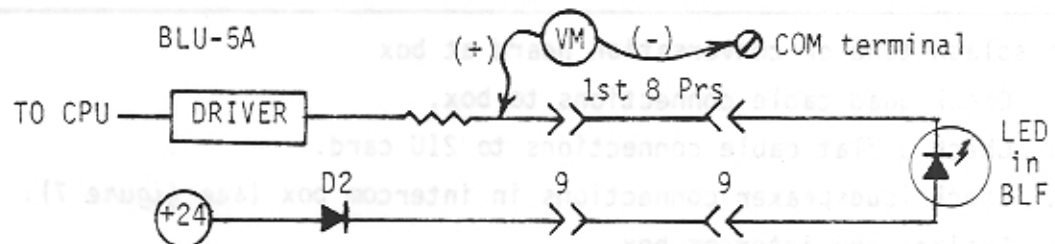
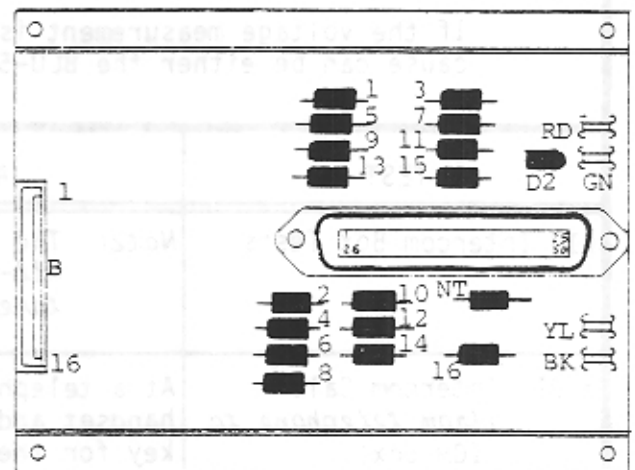
1. No LED's lit in any of the DSS buttons with their corresponding telephone off-hook (see figure 11 in section -1) -
  - a. Check the flat cable between the BLU-5A and the CPU-5A.
  - b. Using a DC voltmeter, connect the minus lead (-) to the COM power terminal (white lead) on the CPU. +24 volts should be measured on diode D2 nearest the GN terminal on the BLU-5A. If +24 is not measured on diode D2 replace the BLU-5A. If +24 is measured on the diode, measure at pin 9 on the amphenol type connector. If +24 is measured on pin 9 of the connector, plug the telephone cable back into the connector and proceed with step c. If +24 is not measured on pin 9, replace the BLU-5A.

Continued on page D31.

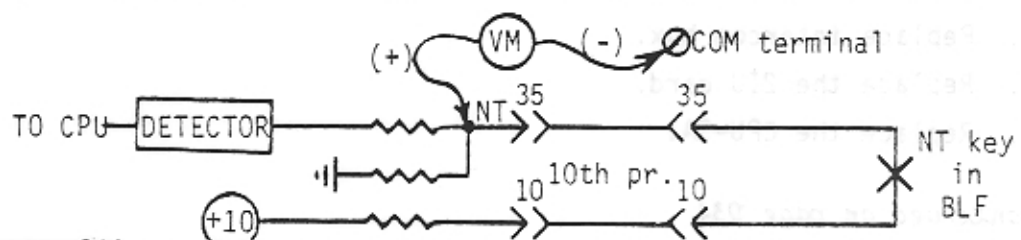
## TEST #9 PROBLEM PROCEDURE continued

**read** DO NOT use an ohmmeter for the following test. If the polarity is incorrect or if the correct polarity current is too high, the LED's in the BLF telephone will be damaged.

- c. Make sure that all telephones are ON-HOOK for this test. With the minus (-) lead of the voltmeter connected to the COM terminal on the CPU-5A, refer to the figure at the right and connect the plus (+) meter lead to the end of each resistor which is numbered. The number corresponds to the DSS LED in the BLF. If approximately 24 volts is measured at the numbered end of each resistor, the LED in the BLF is conducting properly.
- d. If 24 volts is not indicated on one or more, but not all, resistors; either the cable lead or the diode circuit in the telephone is defective.
- e. If 24 volts is not indicated on any of the resistors, the 24 volt lead to the BLF telephone is defective.
- f. If all measurements are correct, but some of the LED's do not light, the probable cause is the BLU-5A; replace.
- g. If all measurements are correct, but none of the LED's light, the probable cause is the CPU-5A.



2. C.O. audible not heard from all telephones when NT key is locked down -
- a. Connect the minus (-) lead of a voltmeter to the COM terminal on the CPU-5A. Connect the plus (+) lead of the voltmeter to the end of the resistor marked NT in the figure above. With the NT key DOWN, the meter should measure about 10 volts. With the NT key UP, no voltage will be measured.
- If the voltage measurement is NOT correct, the problem is either the cable or the NT key in the telephone. An ohmmeter test can be made across the ter-



Continued on page D32



## TEST #9 PROBLEM PROCEDURE continued

minals of the NT key WITH THE TELEPHONE UNPLUGGED.

If the voltage measurement is correct, and the NT key does not function, the cause can be either the BLU-5A or the CPU-5A.

TEST	ACTION	EXPECTED RESULT
#10 Intercom Box Tests	<i>Note: The following tests assume proper operation of the All-call and, if provided, the Station Monitor feature at all telephones in the system.</i>	
#10A Intercom Call (from telephone to ICM box)	At a telephone, lift the handset and depress a DSS key for the ICM box.	At the originating telephone: Single splash-tone heard in the handset.  At all telephones: HOLD LED lit steadily.  At the intercom box: Single splash-tone heard from loudspeaker. AC LED flutters indicating that microphone is on.  Talkback conversation between box and calling telephone possible.

## TEST #10A PROBLEM PROCEDURE

1. No splash-tone or conversation heard at box
  - a. Check quad cable connections to box.
  - b. Check 3 flat cable connections to 2IU card.
  - c. Check loudspeaker connections in intercom box (see figure 7).
  - d. Replace the intercom box.
  - e. Replace the 2IU card.
  - f. Replace the CPU-5A.
2. No talkback heard at calling telephone from intercom box -
  - a. Check quad cable connections to box.
  - b. Check 3 flat cable connections to 2IU card.
  - c. Check microphone connections in intercom box (see figure 7).
  - d. Replace intercom box.
  - e. Replace the 2IU card.
  - f. Replace the CPU-5A.

Continued on page D34

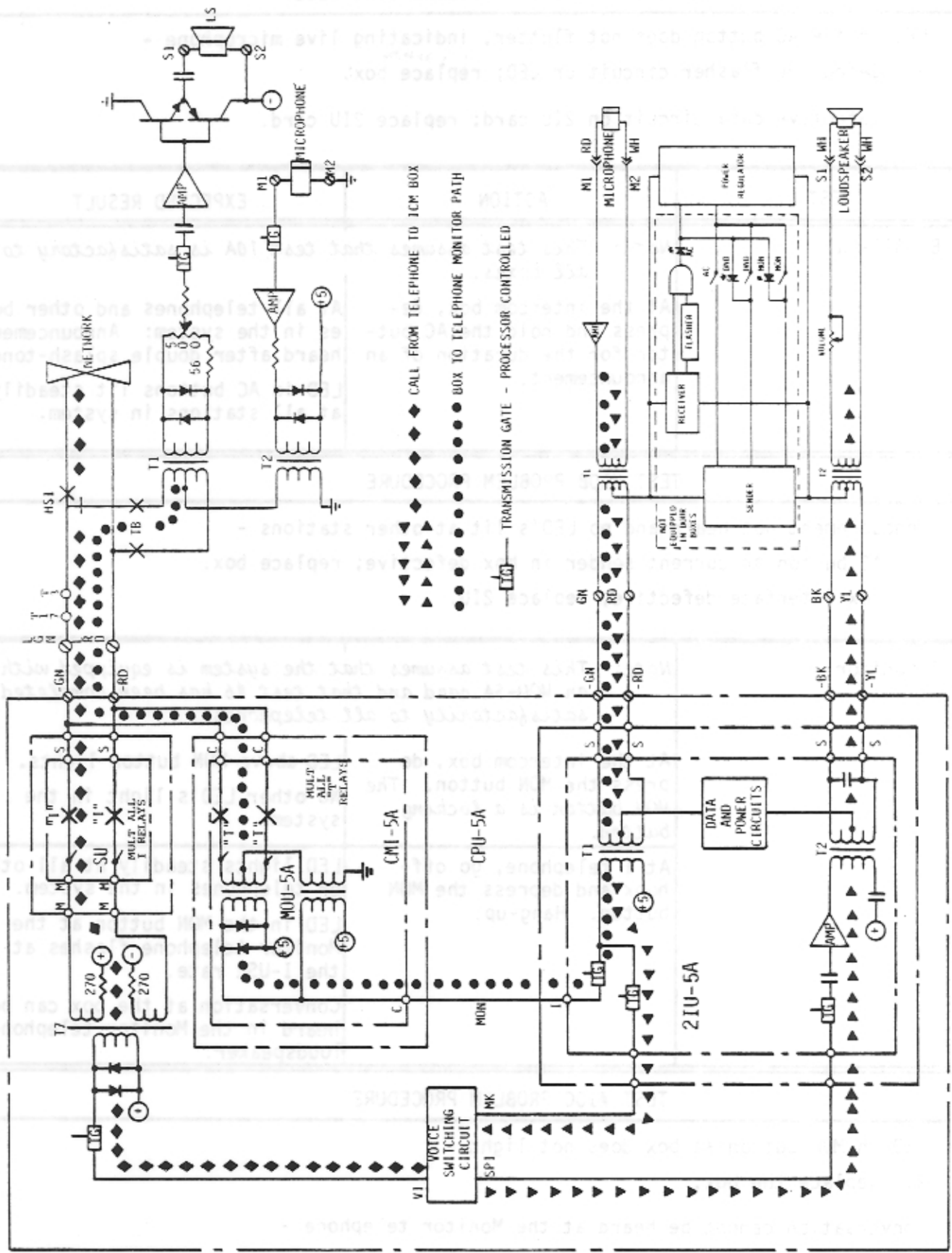


Figure 7 - Monitor and Intercom Audio Paths to Intercom Box - Simplified Schematic

TEST #10A PROBLEM PROCEDURE continued

3. LED in the AC button does not flutter, indicating live microphone -
  - a. Defective flasher circuit or LED; replace box.
  - b. Defective data circuit on 2IU card; replace 2IU card.

TEST	ACTION	EXPECTED RESULT
#10B All-call	<p><i>Note: This test assumes that test 10A is satisfactory to all boxes.</i></p> <p>At the intercom box, depress and hold the AC button for the duration of an announcement.</p>	<p>At all telephones and other boxes in the system: Announcement heard after double splash-tone.</p> <p>LED in AC buttons lit steadily at all stations in system.</p>

TEST #10B PROBLEM PROCEDURE

1. Announcement not heard and no LED's lit at other stations -
  - a. AC button or current sender in box defective; replace box.
  - b. Box interface defective; replace 2IU.

#10C Monitor	<p><i>Note: This test assumes that the system is equipped with an MOU-5A card and that test #6 has been completed satisfactorily to all telephones.</i></p> <p>At the intercom box, depress the MON button. The MON button is a locking button.</p>	<p>LED above MON button lights.</p> <p>No other LED's light in the system.</p>
	<p>At a telephone, go off-hook and depress the MON button. Hang-up.</p>	<p>LED lights steadily at all other telephones in the system.</p> <p>LED in the MON button at the Monitor telephone flashes at the I-USE rate.</p> <p>Conversation at the box can be heard in the Monitor telephone loudspeaker.</p>

TEST #10C PROBLEM PROCEDURE

1. LED in MON button at box does not light -
  - a. Replace the box.
2. Conversation cannot be heard at the Monitor telephone -
  - a. Current sender in box defective; replace box.

Continued on page D35

## TEST #10C PROBLEM PROCEDURE continued

2. continued.
- b. Monitor transmission gates defective on interface card; replace 2IU card.
  - c. Broken lead on MOU-5A card; replace.

TEST	ACTION	EXPECTED RESULT
#10D Do Not Disturb	<p><i>Note: If telephones in the system have had the strap cut in the telephone for this feature, this test assumes that the Do Not Disturb feature functions at those telephones.</i></p> <p>At the intercom box, depress the DND button. <i>The DND button is a locking button.</i></p> <p>At a telephone, go off-hook and depress the DSS button for the DND intercom box.</p> <p>At a telephone, make an all-call announcement.</p>	<p>LED in the DND button lights.</p> <p>Busy tone heard in the handset of the calling telephone. No tone heard at the intercom box.</p> <p>Splash-tone and all-call announcement NOT heard at the DND intercom box.</p>

## TEST #10D PROBLEM PROCEDURE

1. LED in DND button at box does not light -
  - a. Replace the box.
2. DND box is disturbed when called or by all-call announcement -
  - a. Current sender in box defective; replace box.
  - b. Defective data circuit on 2IU; replace 2IU card.
  - c. Defective current detector on CPU; replace CPU-5A.

#11A Door Box Tests- Box Idle	Listen at door box in systems with BGM.	No BGM heard at door box.
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## TEST #11A PROBLEM PROCEDURE

1. BGM heard at door box -
  - a. Check station strapping on 2IU card (*refer to paragraph 7.15d and table 5 in section -1*).
  - b. Replace interface card (2IU).

TEST	ACTION	EXPECTED RESULT
#11B All-Call	At a telephone, make an all-call announcement.	Announcement not heard at door box.
TEST #11B PROBLEM PROCEDURE		
1. All-call announcements heard at door box - <ol style="list-style-type: none"> <li>a. Check station strapping on the 2IU card (refer to paragraph 7.15d and table 5 in section -1).</li> <li>b. Replace interface card (2IU).</li> </ol>		
#11C Call to door box	At a telephone, lift the handset and depress the DSS key for the door box.	Single splash-tone heard at the door box and conversation between the box and the telephone possible.
TEST #11C PROBLEM PROCEDURE		
1. Same as test #10A.		
#11D Door Chime	At the door box, depress the button.	Single tone or double tone from all telephones in the system.
	At a telephone, lift the handset and depress the DSS key for the door box.	Same as test #11C.
TEST #11D PROBLEM PROCEDURE		
1. Door chime not heard at the telephones - <ol style="list-style-type: none"> <li>a. Tone generator not functioning or button circuit defective; replace box.</li> <li>b. Box interface defective; replace 2IU.</li> </ol>		
#12 COU-5A cards	<p><i>Note: This procedure assumes that the C.O. lines in the basic KSU have been tested to all telephones and are functioning properly.</i></p> <p>Do tests #3A through #3I for each COU-5A, as it is installed, to all telephones in the system.</p>	<p>Same as expected results for tests #3A through #3I.</p>
See problem procedure on page D37		



## TEST #12 PROBLEM PROCEDURE

1. Test #3B through #3I -
  - a. No LED light: At one or some telephones; replace telephone.  
At all telephones; replace CPU-5A.
  - b. No dial tone: Check C.O. line.  
(all sets)  
Check LTB-E connections.  
Check flat cable connections to COU card.  
Check for N relay operation on COU (See figure 3. Figure 13 in section -1 shows location on card. N relay not operating, replace COU card. Still not operating; replace CPU-5A.
  - c. No C.O. audible: Replace COU-5A.
  - d. No HOLD: Replace COU-5A. Still no HOLD; replace CPU-5A.
  - e. No music-on-hold: Replace COU-5A.
2. If the problem is not covered in step 1 above, refer to the specific test (#3A through #3I) for more detailed procedure.

## 4.00 TELEPHONE REPLACEMENT PARTS

4.01 The following list of parts is recommended as an inventory for replacement parts for EK-516 key telephone sets. Consult TIE's current price list for part number and price.

Handset Assembly (includes transmitter, receiver, caps, and 6' cord).

6' Handset Cord,  $\frac{1}{2}$  modular.

9' Handset Cord,  $\frac{1}{2}$  modular.

13' Handset Cord,  $\frac{1}{2}$  modular.

7' Modular Line Cord.

14' Modular Line Cord.

25' Modular Line Cord.

Transmitters.

Receivers.

Transmitter Cups.

Modular Jack - (handset cord).

Modular Jack - (line cord).

Short Bar 'B'.

Microphone Assembly.

Loudspeaker Assembly.

Clear Cap (line key).

Clear Cap (DSS key).

Amber Cap (PR RL key).

Red Cap (Hold Key).

Designation Sheets (EK-516).

Dial Mounting Brackets (rotary).

Dial Mounting Bracket (push-button dial).

Faceplates (rotary and push-button, as required).

## 5.00 KSU REPLACEMENT PARTS

5.01 The following list of parts is recommended as an inventory for replacement parts for the EK-516 KSU and power supply. Consult TIE's current price list for part number and price.

Power Supply

Fuse 2A AGC.

Fuse 3A AGC.

Key Service Unit

CPU-5A Processor Card.

8SU-5A 8-Telephone Station Card.

2SU-5A 2-Telephone Station Card.

CMI-5A Common Matrix Card.

MOU-5A Monitor Unit.

LNU-5A 3rd Line Card.

ICU-5A 2nd Intercom Unit.

SHU-5A MOH Source Card.

COU-5A Line Card.

2IU-5A Box Interface Card

BLU-5A Busy Lamp Station Unit.

LTB-A Line Terminal Board (C.O. lines 1, 2 & 3 and Misc. Inputs).

LTB-D Line Terminal Board (Stations)

LTB-E Line Terminal Board (4th & 5th C.O. lines).

Fuse 0.3A AGC.

Flat Cable Kit - KSU

Flat Cable Kit - 2SU

Flat Cable Kit - 2IU

Flat Cable Kit - COU

## TIE 450M-0 MEMORY<sup>®</sup> OUTPUT PULSE DIAL<sup>®</sup> - CONNECTIONS IN TIE EK-516 KEY TELEPHONE SETS

### 1.00 INTRODUCTION

1.01 This section details the installation of TIE's MEMORY<sup>®</sup> OUTPUT PULSE DIAL<sup>®</sup> in the TIE EK-516 key telephone set. The TIE 450M-0 dial may be connected to either a dial terminal board (DTB) or to terminals on the HANU printed circuit board of the telephone.

1.02 Installation of the DTB in the TIE EK-516 telephone set is described in section -2 of this manual.

**read** *If the telephone is equipped with a Called-Party Monitor (SPK-5A), the 450M-0 dial CAN NOT be used in the EK-516 telephone. Power consumption of the telephone equipped with an SPK-5A prohibits the use of the 450M-0 dial. The power regulation circuits on the interface card will drop out of regulation causing data transmission errors between the KSU and the telephone.*

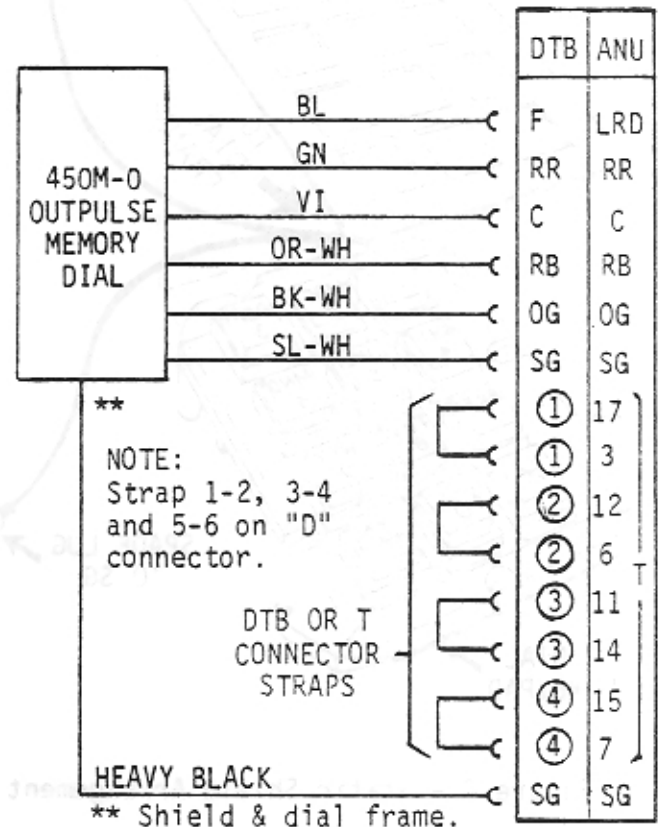


Figure 1 - Dial Connections

### 2.00 CONNECTIONS

2.01 Figure 1 shows the connections between the 450M-0 dial and the DTB terminals.

### 3.00 STATIC PROTECTION

3.01 Due to the type of integrated circuits used in the 450M type dials, static protection is required. A static shield is installed on the dial at the factory and MUST be connected to the SG terminal on the DTB when the dial is installed in the telephone.

3.02 Figure 2 illustrates the shield mounting and grounding arrangement

on the dial. The heavy black lead is connected to SG on the DTB.

### 4.00 PROGRAMMING AND DIALLING

4.01 Dialling may be accomplished with the 450M-0 dial in the conventional manner, or up to 10 numbers may be programmed for instant recall and automatically outputted by depressing only 2 buttons.

4.02 To program, proceed as follows (assume 212-555-1212 is to be stored in position 6):

a) Lift the handset (a line key need not be depressed).

- b) Key # 6 2 1 2 5 5 5 1 2 1 2. Hang up. Programming is complete for position 6.

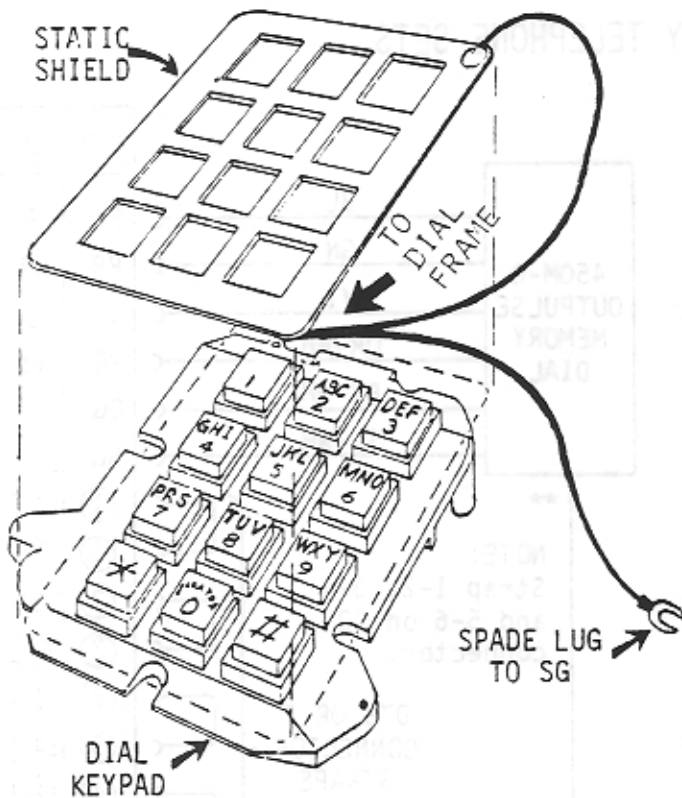


Figure 2 - Static Shield Arrangement

4.03 To dial the number, lift the handset and depress a line key. When dial tone is received, depress \* 6. Dialing to 212-555-1212 will be accomplished automatically.

4.04 To store numbers in any storage position, 1 through 0, simply depress # plus the position (1-0) plus the number. Recall of the number is automatically accomplished by dialing \* plus the storage position (1-0).

4.05 Reprogramming is done by depressing # plus the position plus the new number. The number may be erased from any storage position by simply depressing # plus the position and hang up.

4.06 Last Number Recall: The 450M-0 dial will remember the last number that was dialed. If a busy condition is encountered, hang up. To redial, simply go off-hook and depress \*. The last

number dialled will automatically be outputted again. This feature will work on numbers drawn from memory or on numbers keyed directly on the line.

4.07 Delay After Access Code: When the EK-516 system is installed behind a PABX, an access code (usually 9) is required for outside trunks. In this situation, a delay during outputting is generally required after the access digit for the PABX to select an outside trunk.

4.08 Programming for delay after an access digit(s) is done as follows (assume 9+327-4800 is to be stored in position 5):

- Lift the handset and depress # 5 9 # 3 2 7 4 8 0 0.
- To dial the number: lift the handset, wait for dial tone. Depress \* 5.
- When 2nd dial tone is received, depress \*. The remaining digits (327-4800) will be outputted.

4.09 The "pause" may be programmed after any digit simply by depressing # when programming if more than 1 access digit is required. To resume outputting after the pause, the user simply depresses \*. If required, more than 1 pause may be programmed.

#### 4.10 Pulsing Speed

4.11 The TIE 450M-0 dial comes from the factory arranged for 10 pulses per second (PPS) outputting. The pulsing rate may be changed to 20 PPS by moving a small pin connector on the dial P.C. board. Figure 3 shows the location of the connector.

4.12 For 10 PPS outputting the connector pin is connected between pins 2 and 3 as shown in the figure.

4.13 For 20 PPS outputting the connector pin is connected between pins 1 and 2.

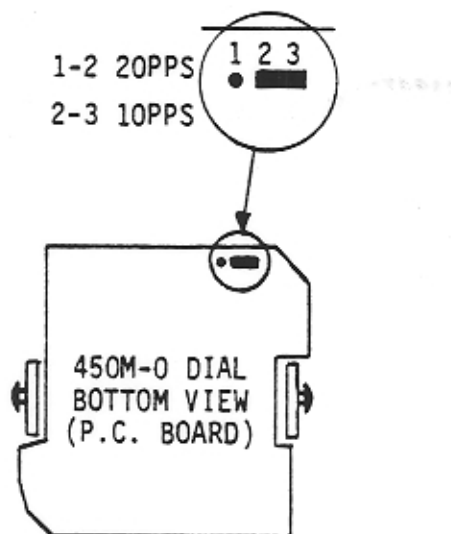


Figure 3 - Pulsing Speed Strapping Location

## 5.00 POWER FAILURE OR REMOVAL

### CAUTION

Removal of power from the KSU will result in loss of numbers programmed in the TIE 450M-0 dials as well as operation of the dial while power is removed.

The same results will occur during utility company power failures.

5.01 If power is intentionally removed from the KSU, the attendant should be notified before-hand in order to prevent trouble reports of defective dials.

5.02 If a power failure occurs or power is intentionally removed from the KSU, dials may be reprogrammed in the conventional manner after power is restored.

5.03 The installer should verify that power is not being removed from the KSU during night or after closing hours.





## TIE EK-516 POWER SUPPLY

### 1.00 INTRODUCTION

1.01 This section provides information on the EK-516 power supply. Input/output voltage and current specifications are provided as well as functional information on fuses, indicators and controls.

### 2.00 GENERAL

2.01 Input: 117 VAC,  $\pm 10\%$ , 60 Hz, single-phase, fused at 3 Amperes.

2.02 Output voltages:

+18 VDC,  $\pm 5$  volts with less than 35mv p-p ripple, with over-current protection circuit.

-18 VDC,  $\pm 5$  volts with less than 35mv p-p ripple, with over-current protection circuit.

+24 VDC, -4 to +6 volt tolerance, with less than 1 volt p-p ripple, fused at 2 Amperes.

### 3.00 CONTROL

3.01 Power switch: An on/off rocker type switch is provided on the front panel of the supply.

3.02 Power indicator: A neon indicator lamp is located next to the power switch. This indicator should be lit when the power switch is on. If indicator is not lit, the power is off or the line fuse is blown.

3.03 Line fuse: The line fuse is a 3-Ampere fuse located below the power indicator.

3.04 Overload indicator: As stated above, the supply is equipped with

over-current protection circuits. These circuits will turn off the supply if excessive current (3.5 Amperes) is drawn from either of the 18 volt supplies.

3.05 The "O-CURRENT" LED will light to indicate that the supply has been shut down by the over-current protection circuit.

3.06 To restore power, turn the power switch off. Wait until all LED's are out, then reoperate the power switch.

3.07 If the "O-CURRENT" LED lights again, check the KSU for short circuits.

3.08 Power Failure: The supply is equipped with a circuit which provides a reset pulse to the microcomputer on the CPU-5A when a power failure longer than 40 milliseconds has occurred.

3.09 The Power Failure LED will light whenever this automatic reset pulse is generated to provide a visual indication that a power failure has occurred. The LED will remain lit until turned off by operating the switch next to the P.F. LED.

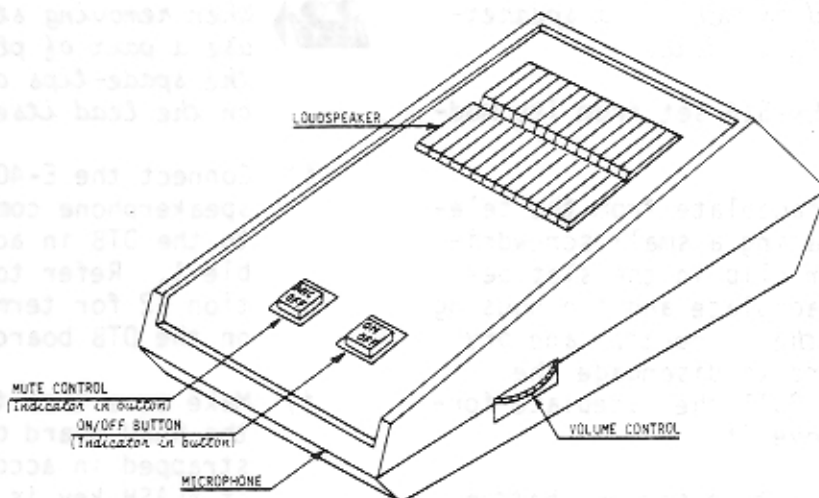
3.10 Output fuse: There is only one output fuse on the power supply. This fuse is for the +24 volt supply and is rated at 2 Amperes.

### 4.00 INSTALLATION

4.01 Refer to paragraph 6.07 in section -1 for power supply mounting details and to paragraph 2.11 in section -3 for test details.



## TIE EK-516/E-402 SPEAKERPHONE - INSTALLATION



### 1.00 INTRODUCTION

1.01 This section provides the electrical and mechanical information required for installation of the TIE E-402 Speakerphone when used with all models of the TIE EK-516 key telephone set.

### 2.00 GENERAL

2.01 The EK-516 key telephone sets will provide handsfree loudspeaker telephone operation when used with the TIE E-402 Speakerphone.

2.02 Speakerphone operation may be enabled without the loss of any of the normal operating features associated with the EK-516 key telephone set. To assure optimum performance of the E-402, however, it is recommended that the EK-516 be strapped, in the KSU, for 'on-hook' signalling (refer to paragraph 6.65 and table 4 in section -1 for details).

2.03 No additional equipment is required when connecting the E-402 to the EK-516 telephone sets. The E-402 derives its power by direct connection from the EK-516 set.

2.04 The E-402 is directly compatible with the EK-516 when used with the four types of TIE dials as follow:

ROTARY - SRDK (TIE part number 14526), 6-lead dial equipped with 2 sets of shunt contacts and a DTB board.

TONE - TDK-C (TIE part number 14525-A), conventional 11-lead speakerphone compatible tone dial equipped with a DTB.

OUTPUT PULSE - ODK (TIE part number 14505), 5-lead (+ shield) OUTPUT PULSE DIAL<sup>®</sup> equipped with a DTB.

MEMORY OUTPUT PULSE - 450M-ODK (TIE part number 14551) 6-lead (+ shield) MEMORY<sup>®</sup> OUTPUT PULSE DIAL<sup>®</sup> equipped with a DTB. Refer to section -4 for programming and dialling information.

### 3.00 INSTALLATION

3.01 To install the TIE E-402 Speakerphone with the EK-516 key tele-

phone set, proceed as follows:



When the E-402 Speakerphone is installed with the EK-516 telephone set, a dial terminal board (DTB) must be used as well as a speakerphone compatible dial.

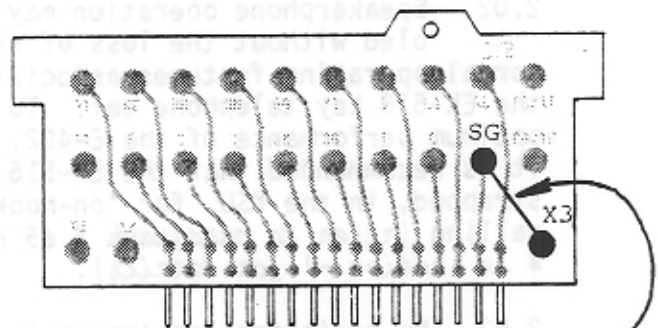
- a) Unplug the EK-516 set from its modular jack.
- b) Remove the faceplate from the telephone by placing a small screwdriver or paper clip in the slot between the faceplate and the housing (bottom of the faceplate) and pry gently upward to disengage the faceplate. Pull the faceplate forward to remove it.
- c) Loosen the captive screws (bottom center of set and upper left faceplate corner) and remove the housing from the set. Disconnect the loudspeaker leads for convenience in working on the set.
- d) Remove the dial, and DTB if equipped. If the telephone is not equipped with a DTB, remove the straps from the T connector.
- e) Located in the center rear of the set is the modular line cord connector. Adjacent to the right side of the connector is a rubber filler plug. Remove the filler plug and insert the E-402 cord through the opening. Be careful not to pull the spade-tips off the leads while inserting the cord.
- f) If a MEMORY<sup>®</sup> OUTPUT PULSE DIAL<sup>®</sup> is to be installed proceed to step g). If any of the other dials in table 1 are to be installed, proceed to step h).
- g) Modify the DTB by soldering a strap between SG and X3. This strap must be soldered to the back of the DTB as shown in figure 1. Use a small piece of 24-gauge wire for the strap. Be careful to avoid solder bridges to adjacent runs on the DTB.

- h) If the DTB board to be used for the E-402 has straps connected to its terminals, remove straps L1 to R1 and K1 to K2, if present.



When removing straps from the DTB, use a pair of pliers and pull on the spade-tips only. Do not pull on the lead itself.

- i) Connect the E-402 leads and the speakerphone compatible dial leads to the DTB in accordance with table 1. Refer to figure 2 in section -2 for terminal designations on the DTB board.
- j) Make sure that the D connector on the HANU board of the set is strapped in accordance with table 1. If FLASH key is required, see 6.00
- k) Plug the DTB board into the T connector in the telephone set. The DTB is plugged in with the terminals toward the rear of the set, with pin 1 on the right side.
- l) Located directly in front of the E-402 cord entrance hole, in the base of the set, are 2 square holes, separated by a narrow strip. Hook the strain-relief hook over the narrow strip to secure the E-402 cord.
- m) Mount the dial by placing the slots of the dial brackets over the tabs of the support brackets and sliding the complete dial as-



Strap when MEMORY<sup>®</sup> dials are used. Refer to paragraph 3.01g.

Figure 1 - DTB (Solder side) Strap Location



Table 1 - DTB Connections for E-402 Speakerphone and Dial

DTB BOARD	ROTARY		11 LEAD TONE		TIE 250B		MEMORY OUTPUT PULSE	
	DIAL	E-402	DIAL	E-402	DIAL	E-402	DIAL	E-402
P3	YL	LBL		LBL		LBL		LBL
P4	YL	GN	GN-WH	GN		GN		GN
RB		OR		OR	OR	OR	OR-WH	OR
SG		BL		BL	HVY BK	BL	SL-WH #	BL
L1	**	SL	**	SL	**	SL	**	SL
C			VI & OR-BK				VI	
B			BL					
T			RD					
RR	BL	WH	BK		GN	WH	GN	WH
OG					BK		BK-WH	
AG		RD		RD		RD		RD
LK		LGN		LGN		LGN		LGN
R	WH		RD-GN					
GN	WH		WH					
S			WH-BL					
K1	**	BK	**	BK	**	BK	**	BK
K2	**	YL	**	YL	**	YL	**	YL
F	GN		GN		BL		BL	
R1	**	BR	**	BR	VI**	BR	**	BR
T1			OR	WH				
X1		PK		PK		PK		PK
X2		VI		VI		VI		VI
X3							HVY BK#	
D CONN		1-2 3-4 5-6 ∅		3-4 5-6 ∅		1-2 3-4 5-6 ∅		1-2 3-4 5-6 ∅

# Refer to figure 1,

\*\* Remove strap if present.

∅ If FLASH key is required, see paragraph 6.00.

sembly to the right (refer to figure 5 in section -2).

n) Reconnect the loudspeaker leads (see figure 3 in section -2) to the S1/S2 terminals on the HANU board.

o) When installing OUTPUT PULSE DIALS®, make sure that the HVY BK lead is

connected as shown in table 1.

p) Replace the upper housing and faceplate.

3.02 No internal connections or adjustments are required in the E-402 Speakerphone.

## 4.00 OPERATION

4.01 Operation of the E-402 Speakerphone is simple and straight-forward.

The E-402 is illustrated on page G1 of this section. The basic controls that are of concern to the user are pointed out in the drawing. The control functions are as follows:

**ON/OFF BUTTON** Momentarily depressing the ON/OFF button is the same as lifting the handset of the EK-516 telephone set. A line button must be depressed to select the desired C.O. line or a DSS button for an intercom call. An LED in the ON/OFF button indicates when the E-402 is ON.

Momentarily depressing the ON/OFF button the second time will turn the E-402 OFF.

**HANDSET TO E-402** When the station user decides to go from handset operation to speakerphone operation, simply depress the ON/OFF button on the E-402 and hang-up the EK-516 handset.

**VOLUME CONTROL** The volume control is conventional and adjusts the level of sound from the loudspeaker in the E-402. Best performance is usually obtained with low levels of volume control.

**MIC OFF BUTTON** The MIC OFF button turns the microphone OFF to provide privacy when desired by the station user. When the MIC OFF button is lit, the distant party will not hear any conversation from the speakerphone end.

## 5.00 SPEAKERPHONE LOCATION

5.01 The E-402 is designed to match the EK-516 in size and appearance. The two sets complement each other when placed side-by-side. The units should sit directly on a hard surface (e.g., desk, table, credenza, etc.) and as far away as possible from noise sources, such as typewriters, radios, etc.

5.02 DO NOT place the E-402 in hard-surfaced corners or under low shelves; these locations may cause echo or transmission problems.

5.03 The unit should be placed at least 2-inches back from the edge of the surface upon which it sits. Obstacles should NOT be placed in front of the microphone.

## 6.00 FLASH KEY OPERATION

6.01 If the system requires that FLASH keys be provided at telephones with 402 Speakerphones, the telephones should be arranged for flashing in the following manner:

- a) If "grounding button" flashing is required, refer to paragraph 4.27 in section -2 for instructions.
- b) If "open loop" flashing is required;
  1. DO NOT follow the instructions in paragraph 4.26 of section -2.
  2. Mount the FLASH key as detailed under paragraph 4.26 a) & b).
  3. Move the red lead from terminal LRD to terminal FL on the ANU board.
  4. Connect the BL lead from the FLASH key to the LRD terminal. Connect the GN lead from the FLASH key to the FL terminal.
  5. Strap the D connector in accordance with table 1.

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TEST (2 LINK) . . . . .	.023, TEST #5K
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ICM (1 LINK) . . . . .	.016, TEST #4B
ICM (2 LINK) . . . . .	.022, TEST #5B
VIA HOLD KEY (1 LINK) . . . . .	.018, TEST #4D
VIA HOLD KEY (2 LINK) . . . . .	.023, TEST #5F
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## MDU-SA

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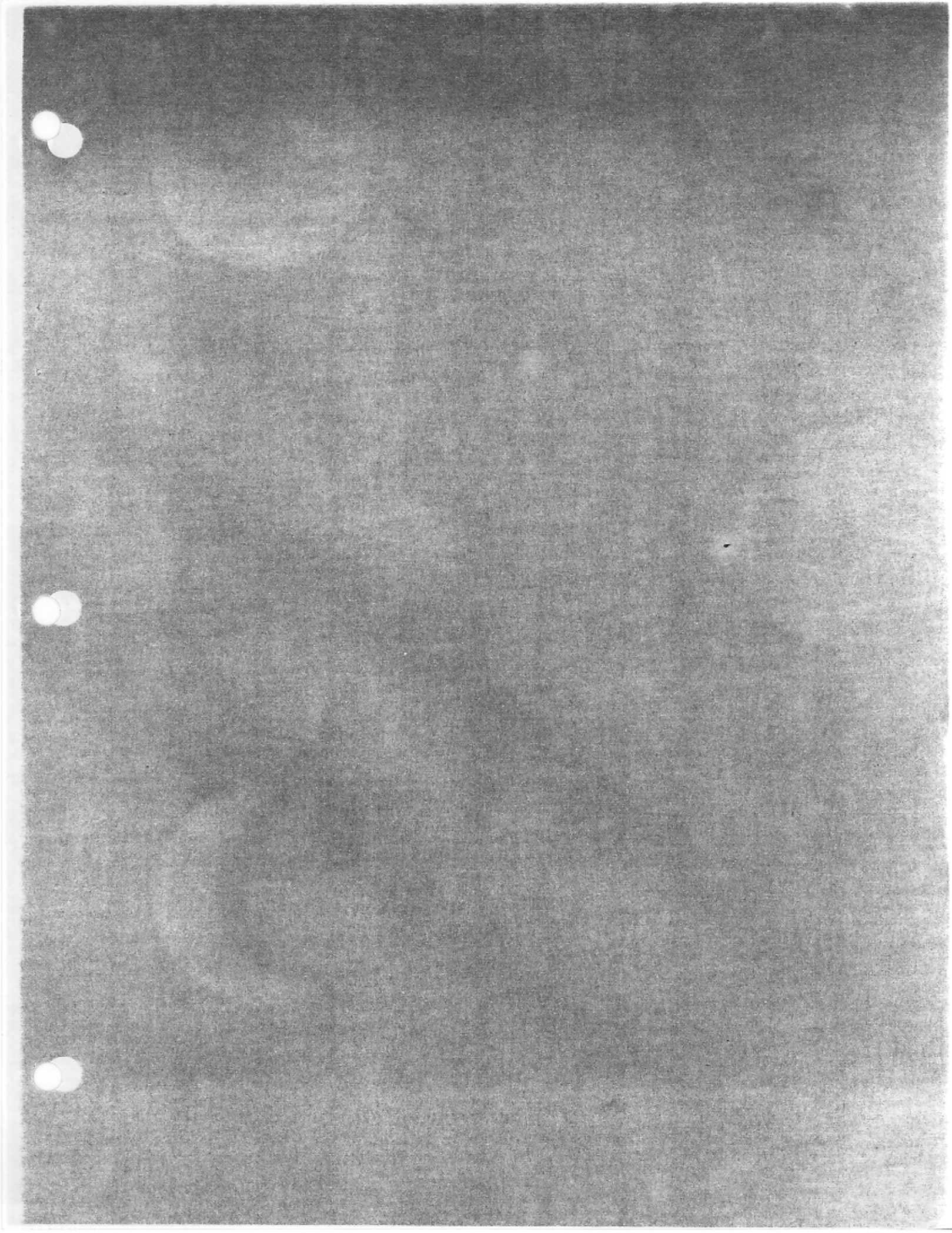
## WEIGHT

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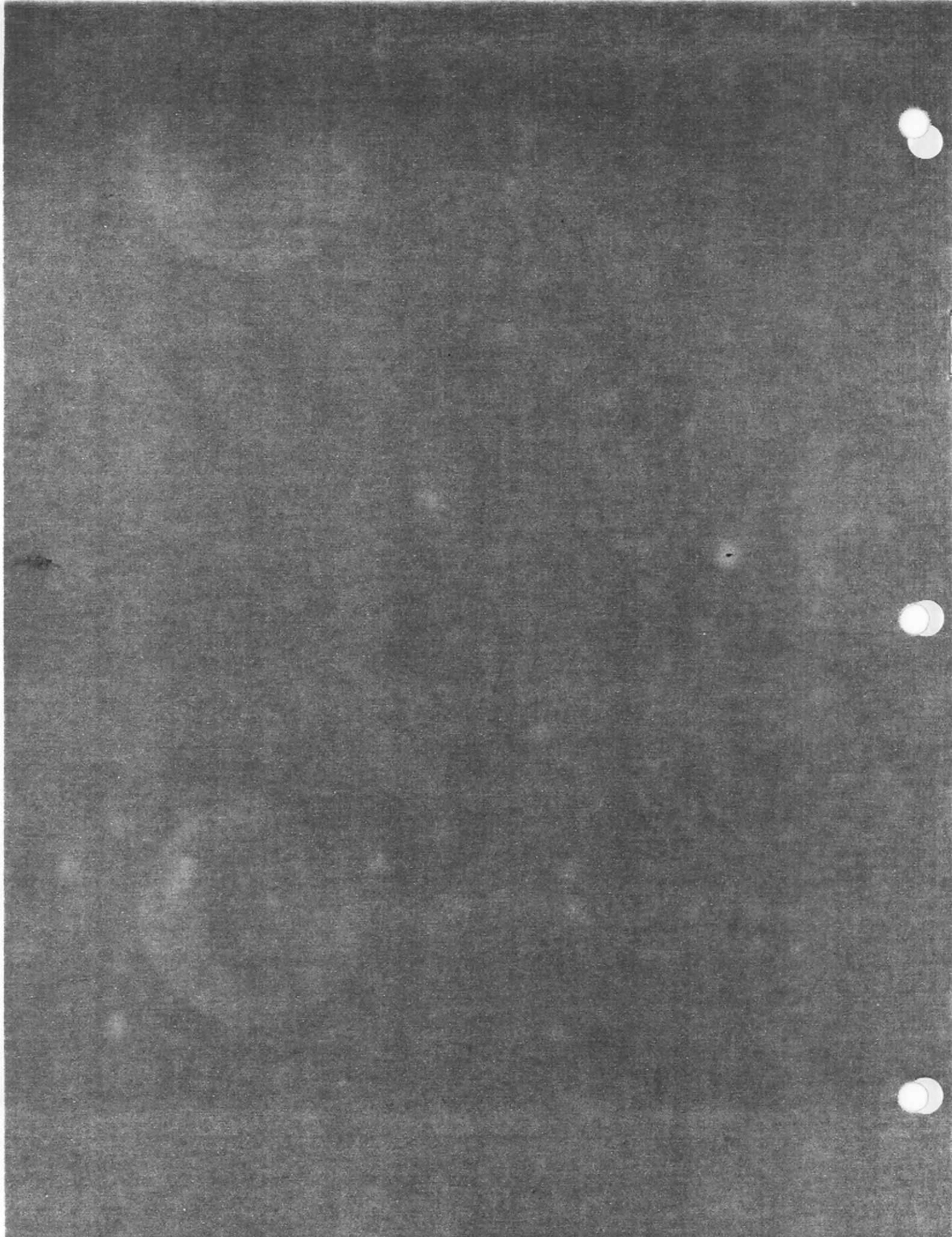
## WL-MTG KIT - APP. BOX . . . . .83, 4.01d11

## WL-MTG KIT - EK-516 . . . . .83, 4.01d10











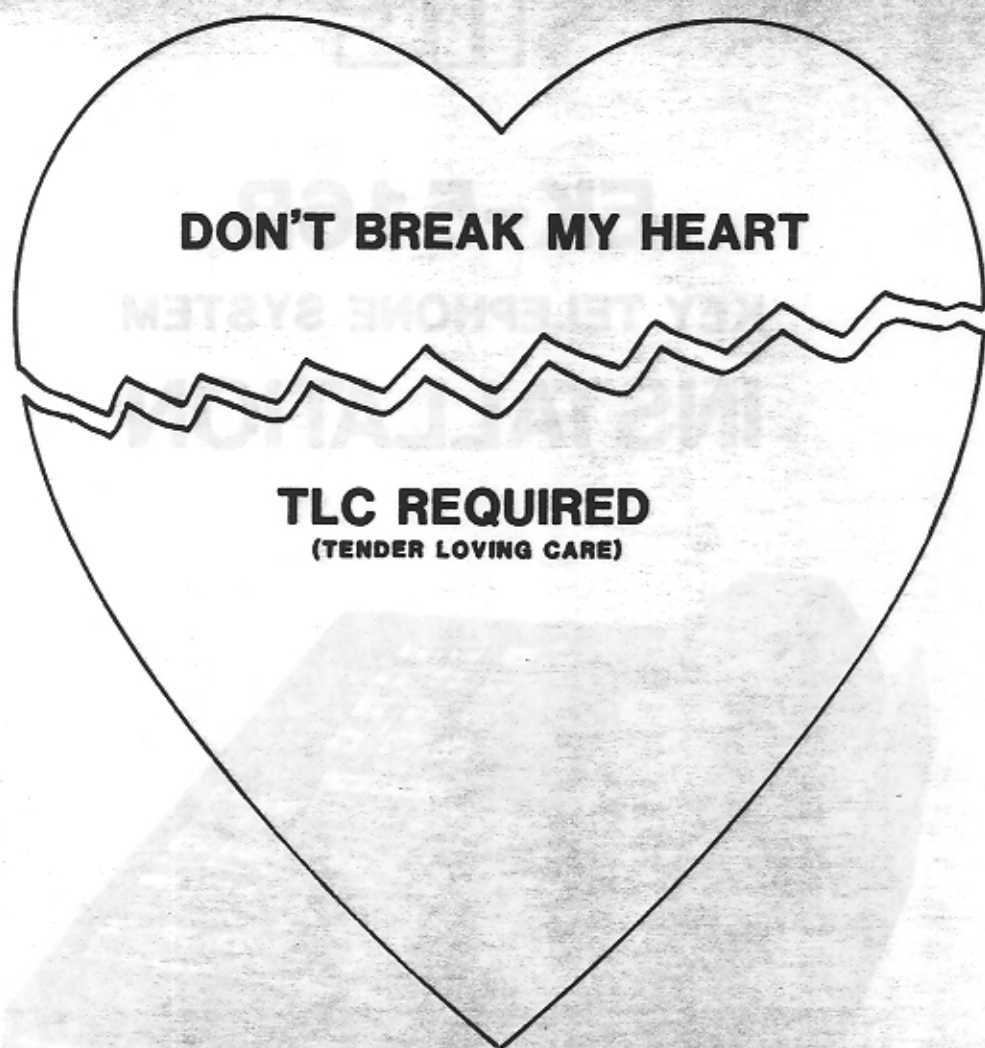
# EK-516B

## KEY TELEPHONE SYSTEM INSTALLATION



**This addendum must be used with the  
EK-516 Installation Manual,  
Section 3821, dated 12/1980.**

© TIE 1981



**DON'T BREAK MY HEART**

**TLC REQUIRED**  
(TENDER LOVING CARE)

**Circuit cards are the HEART of this key system.**

**ALWAYS**

**use a grounded wrist strap when handling circuit cards.**





TIE's EK-516B Key Telephone System is registered in accordance with provisions of Part 68 of the Federal Communications Commission's Rules and Regulations. Customers are advised that under FCC regulations the following provisions must be adhered to:

#### MEANS OF CONNECTION

Connection to telephone company lines must be made with FCC-approved plugs and jacks. Connections to TIE's EK-516B system must be made with the RJ-14C and RJ11C connectors.

#### NOTIFICATION TO TELEPHONE COMPANY

Customers must give sufficient notice to the telephone company before connecting and disconnecting customer-provided equipment to telephone company lines. Customers must further advise the telephone company as to the particular lines affected and the FCC Registration Number and Ringer Equivalence Number of the equipment.

EK-516B Registration Number: BJ286G-67683-KN-E

EK-516B Ringer Equivalence: 0.4B.

#### INCIDENCE OF HARM

The telephone company shall notify customers, where practical, in the event that customer-provided equipment causes harm to the telephone network of possible temporary discontinuance of service. In the event of such discontinuance of service, the telephone company must attempt to advise the customer prior to such discontinuance, afford customers an opportunity to correct the problem and advise customers of their right to bring complaint procedures before the FCC.

#### COMPATIBILITY TO TELEPHONE NETWORK

Customers shall be given prior notification of any alteration to telephone company equipment, operations or procedures which may be expected to affect customer-provided equipment operation.

#### RESPONSIBILITY TO GRANTEE

When power failure telephones are equipped in the system, installation and maintenance of the equipment is to be effected only by an authorized agent of TIE/communications.

Alterations or modifications of the equipment not expressly shown in TIE installation procedures are prohibited.

The customer is advised to disconnect the equipment from telephone company lines in the event of suspected equipment malfunction. Disconnections MUST be made at the RJ14C or RJ11C connectors.

The TIE EK-516B system is NOT authorized for use in coin or party line applications.

FCC Rules Part 15 Information - See back of this notice.

NOTICE TO CUSTOMERS  
1988 Edition

BT

Notice to Customers, continued.

This equipment generates and uses radio frequency energy. If not installed and used according to the manufacturer's instructions, this equipment may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device, in accordance with the specifications in FCC Rules, Part 15, Subpart J. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. Interference to radio or television reception caused by this equipment can be determined by turning the equipment off and on. If an interference problem exists, correction of the problem may be effected by one or more of the following measures:

- reorient the receiving antenna.
- relocate the receiver with respect to the equipment.
- plug the equipment and receiver into different outlets so that both are on different branch circuits.

If necessary, the user should consult the dealer for additional assistance. The following booklet, prepared by the Federal Communication Commission, may also be helpful:

"How to Identify and Remove Radio-TV Interference Problems".

This booklet may be ordered from the U.S. Government Printing Office, Washington, D.C., 20402, using Stock No. 004-000-00345-4.



## INTRODUCTION

The purpose of this manual is to provide the descriptive and procedural information necessary to install, test and maintain the TIE EK-516B Electronic Key Telephone System. It is assumed that the installer has a basic understanding of key systems theory and operation. With that knowledge and this manual, the installer will be able to install, test, and maintain the EK-516B system.

The EK-516B key service unit, power supply, and telephones are the fundamental components of the system. Information on installation, connections, strapping, and testing is provided.

It is recommended that the installer thoroughly familiarize himself with the information contained in this manual prior to initiating installation of the system.

It is further recommended that this manual and other job related information be left at the job site to aid personnel on repair and rearrangement visits. Options, and any special wiring should be recorded for use by personnel on future visits to the job. This can save both time and money.

If, during installation, or service calls, problems or questions arise that cannot be resolved by using the information contained in this and related manuals, assistance is available from the TIE Technical Service Department, Monday through Friday, as follows:

For assistance in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, between 8:30 AM and 5:30 PM, Pacific time, call:

415-592-1929

For assistance in Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin, between 8:30 AM and 5:30 PM, Central time, call:

312-595-4400

For assistance in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee and Texas, between 8:30 AM and 5:30 PM, Eastern time, call:

404-447-1314

For assistance in all other states, between 8:30 AM and 5:30 PM, Eastern time, call:

203-929-7373

For EMERGENCY assistance at times other than above, call:

203-929-7920

# INTRODUCTION

The purpose of this manual is to provide the effective and procedural information necessary to install, test and maintain the TRK EK-218B Electronic Key Telephone System. It is assumed that the installer has a basic understanding of key telephone theory and operation. With that knowledge and the manual, the installer will be able to install, test and maintain the EK-218B system.

The EK-218B key service unit (power supply) and telephone are the fundamental components of the system. Information on installation, connections, wiring, and testing is provided.

It is recommended that the installer thoroughly familiarize himself with the information contained in this manual prior to installing installation of the system.

It is further recommended that this manual and other job related information be left at the job site to aid personnel on repair and troubleshooting calls. Ground and any special wiring should be recorded for use by personnel on future visits to the job. This can save both time and money.

If, during installation, or service calls, problems or questions arise that cannot be resolved by using the information contained in this and related manuals, contact is available from the TIE Technical Service Department Monday through Friday, as follows:

For assistance in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Iowa and Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, between 8:30 AM and 5:30 PM, Pacific time, call:

1-800-555-1234

For assistance in Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Nebraska, New York, Ohio, South Dakota, and Wisconsin, between 8:30 AM and 5:30 PM, Central time, call:

1-800-555-1234

For assistance in Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, Virginia and West Virginia, between 8:30 AM and 5:30 PM, Eastern time, call:

1-800-555-1234

For assistance in all other states, between 8:30 AM and 5:30 PM, Eastern time, call:

1-800-555-1234

For EMERGENCY assistance, please call 1-800-555-1234

1-800-555-1234

## TIE EK-516B INSTALLATION

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### 1.00 INTRODUCTION

1.01 This addendum provides descriptive information, installation details and retrofit procedures on TIE's EK-516B key telephone system.

1.02 Update details are also provided, where applicable, on adding new features to the EK-516A system.

1.03 The information in this addendum supplements the information contained in TIE Practices, Section 3821, EK-516 Installation Manual, Issue 1, dated June 1979.

### 2.00 GENERAL

2.01 The following paragraphs describe the differences between the new EK-516B key service unit and the older EK-516A key service unit. The telephone sets, applique, intercom and door boxes are the same for both systems.

2.02 TIE's EK-516B key telephone system is comprised of the following components:

- EK-516B Key Service Unit

The basic EK-516B KSU provides the initial capacity for 2 C.O. lines, 1 DSS intercom path with handsfree

talkback, and the interface circuits required for 10 telephones. The following components make up the basic EK-516B KSU:

EK-516B KSU (1)  
CPU-5B (1)  
8SU-5A (1)  
2SU-5A (1)  
CMI-5A (1) with PHU-5A (1)  
LTB-A (1)  
LTB-D (4)  
LTB-E (1)

- The C.O. line cards which may be required to expand the number of C.O. lines to a maximum of 5 are:

COU-5B (Maximum 2)  
LNU-5B (Maximum 1)

- The 8SU-5A, 2SU-5A, 2IU-5A and BLU-5A circuit cards have not been changed.

2.03 The following paragraphs describe the feature changes incorporated in the EK-516B key telephone system:

- a) Multi-Line Conferencing

The Multi-line Conferencing feature has been made a strapping option. The EK-516B comes from the factory without this feature. The installer must change the strapping on the MC connector on the CPU board to provide the option. Multi-line conferencing is standard and not an option on the EK-516A system.

- b) Intercom Timeout

The intercom timeout interval has been made an optional feature on both single and two link EK-516B systems. This feature is provided by strapping the TM connector on the CPU-5B board. The EK-516A system had no timeout provision when configured with only 1 link.

The intercom timeout period has been increased from 30 seconds (EK-516A) to 45 seconds (EK-516B) nominally. The timeout period is NOT adjustable.

**c) Flexible Night Audible**

The EK-516B provides flexible programming for night C.O. audible signalling. Each station can be programmed for one of the following ringing schemes:

- Receive no C.O. audible.
- Receive C.O. audible during both day and night hours.
- C.O. audible during night hours only (when NT key is operated at BLF station). In 516A systems, all stations ring when NT key is operated.

**d) Automatic Hold Release Time**

The automatic hold release feature has been changed so that a strapping option selects a short timing interval (90 msec nominal) or a long timing interval (600 msec nominal). This strapping is done on the AH connector located on the COU-5B, CPU-5B & LNU-5B boards. Adjustable timing was not provided in the EK-516A system.

**e) External Paging Only**

An "external paging only" feature has been added. By strapping on the AP connector the installer may elect to have All-call announcements blocked from all telephones and boxes and routed to an external paging system. This option should not be used if the system is equipped with an ICM box, an Applique Box or a Door Chime Box. Applique, ICM and Door Chime boxes can only signal using the All-call, thus their signalling capability would be limited to external loudspeakers if EPO is implemented.

**f) Auxiliary Paging Amplifier Control**

Switch contacts have been provided for auxiliary control of an external paging system.

**g) I-Use Indication**

The "I-USE" visual indication on C.O. line keys has been eliminated to conform with other TIE electronic key systems.

**h) Unequipped C.O. Line Positions**

Unequipped C.O. lines cannot be placed on hold inadvertently, thus causing recall timeout and subsequent recall of the station. This change is accomplished by adding a flexible circuit assembly (PHU-5A) to the CMI-5A card. This circuit may be added to existing EK-516A systems.

**i) Visual Indicators**

Visual indications have been added to the system to aid in maintenance and troubleshooting. These are:

CP CPU program running.  
RS Reset signal from P.S. present.  
+10 voltage present.  
-10 voltage present.  
YP voltage present.

**j) Loud Bell Unit (LBU-5A)**

The system has been arranged to accept an optional LBU-5A card which provides contacts for control of external loud bells and ringers for common C.O. audible. The LBU-5A CANNOT be used in EK-516A systems.

**k) Installation Cable Kit**

An optional installation kit may be used for making station connections to 66 blocks instead of the screw terminals on the LTB-D connectors. The kit consists of a 4-foot long 25-pair cable terminated on one end with plugs which plug into the LTB connectors and an Amphenol type connector on the other. Each cable provides wiring for 8 stations. This kit may be used with either the 516A or 516B system.

**l) New Circuit Cards**

The following new circuit cards are provided with each EK-516B KSU and may also be used in the existing EK-516A systems:

COU-5B  
CPU-5B  
LNU-5B  
PHU-5A

The LBU-5A can only be used in the EK-516B KSU.



////////////////////////////////////  
 //  
 // **WARNING** //  
 //  
 //

// THE CIRCUIT CARDS USED IN THE EK-516B SYSTEM CONTAIN //  
 // STATIC SENSITIVE DEVICES. A GROUNDED WRIST STRAP //  
 // MUST ALWAYS BE WORN WHEN HANDLING THE CIRCUIT CARDS. //

// WHEN INSTALLING OR REMOVING CIRCUIT CARDS OR RIBBON //  
 // CABLES, POWER SHOULD BE TURNED OFF AT THE POWER //  
 // SUPPLY. AN ON/OFF SWITCH HAS BEEN PROVIDED ON THE //  
 // SUPPLY FOR THIS PURPOSE. //

// WHEN CONNECTING OR DISCONNECTING THE CABLE BETWEEN //  
 // THE POWER SUPPLY AND THE KSU, POWER SHOULD BE TURNED //  
 // OFF AT THE POWER SUPPLY. //

3.00 KSU INSTALLATION

3.01 The EK-516B key service unit is installed in the same manner as the EK-516A key service unit. Refer to par. 6.00 in section 1 of the installation manual for details. Figure 3 in the installation manual shows the layout of the KSU.

The circuit cards used in the EK-516B system contain static sensitive devices. A grounded wrist strap must always be worn when handling circuit cards.



When installing or removing circuit cards or ribbon cables, power must be turned OFF at the power supply. An ON/OFF switch has been provided on the supply for this purpose.

When connecting or disconnecting the cable between the power supply and the KSU, power should be turned OFF at the power supply.

3.02 The EK-516B key service unit comes from the factory with 4 circuit cards installed. These cards are the CPU-5B, CMI-5A, 8SU-5A and one 2SU-5A. A PHC-5A (Flexible Hold Prevention circuit) is installed on the CMI-5A card.

3.03 KSU strapping and other differences in installation between the EK-516B and EK-516A KSUs are detailed under par. 4.00 of this addendum.

3.04 Installation Cable Kit

3.05 An installation kit, consisting of a 4-foot 25-pair cable terminated with an Amphenol type connector on one end and LTB connectors on the other, is available for use when 66 blocks are to be used for terminating station cables. Each cable will serve 8 stations. Two cables may be used when more than 8 stations are equipped in the system. The cable may be plugged directly into an Amphenol connector equipped 66 block.

3.06 Table 1 shows all connections between LTB-D connectors (LD1-4) and station quads.

3.07 Refer to figure 1 for cable installation details. In figure 1, the 1st cable (installed in the LD1-2 connectors) is omitted for clarity. The 1st cable is connected in the same manner as shown for the LD3-4 connectors. Note the position of the key in position 9 in all 4 connectors.



Table 1 - Cable Installation Connections

CIRCUIT DESIGNATION	LTB-D DESIG	LD1-4		CABLE COLOR	CONN PINS	66 CLIP	QUAD** COLORS	
		CONN	PIN					
1ST or 9ST 1SR or 9SR	1RD 1GN	1*	18&19 20&21	DBL-BK & VI-BK DBL-WH & VI-WH	26 1	1 2	RD GN	
1PP or 9PP 1PN or 9PN	1YL 1BK		24 25	DBL-GN DBL-YL	27 2	3 4	YL BK	
2ST or 10ST 2SR or 10SR	2RD 2GN		14&15 16&17	OR-BK & VI-GN OR-WH & VI-YL	28 3	5 6	RD GN	
2PP or 10PP 2PN or 10PN	2YL 2BK		22 23	OR-GN OR-YL	29 4	7 8	YL BK	
3ST or 11ST 3SR or 11SR	3RD 3GN		10&11 12&13	DGN-BK & WH-BK DGN-WH & WH-BL	30 5	9 10	RD GN	
3PP or 11PP 3PN or 11PN	3YL 3BK		8 7	DGN-RD DGN-YL	31 6	11 12	YL BK	
4ST or 12ST 4SR or 12SR	4RD 4GN		3 4	BR-BK BR-WH	32 7	13 14	RD GN	
4PP or 12PP 4PN or 12PN	4YL 4BK		6 5	BR-GN BR-YL	33 8	15 16	YL BK	
5ST or 13ST 5SR or 13SR	1RD 1GN		2*	18&19 20&21	SL-BK & WH-GN SL-WH & WH-YL	34 9	17 18	RD GN
5PP or 13PP 5PN or 13PN	1YL 1BK			24 25	SL-GN SL-YL	35 10	19 20	YL BK
6ST or 14ST 6SR or 14SR	2RD 2GN			14&15 16&17	RD-BK & LBL-BK RD-WH & LBL-WH	36 11	21 22	RD GN
6PP or 14PP 6PN or 14PN	2YL 2BK			22 23	RD-GN RD-YL	37 12	23 24	YL BK
7ST or 15ST 7SR or 15SR	3RD 3GN			10&11 12&13	LBL-GN & BK-OR LBL-YL & BK-WH	38 13	25 26	RD GN
7PP or 15PP 7PN or 15PN	3YL 3BK			8 7	BK-PK BK-YL	39 14	27 28	YL BK
8ST or 16ST 8SR or 16SR	4RD 4GN			3 4	YL-BK YL-WH	40 15	29 30	RD GN
8PP or 16PP 8PN or 16PN	4YL 4BK			6 5	YL-GN YL-RD	41 16	31 32	YL BK
MS3 (MOH MS4 ONLY)	MS3 MS4	1 ONLY		1 2	PK-BK PK-WH	42 17	33 34	
MS3 (MOH MS4 ONLY)	MS3 MS4	2 ONLY		1 2	PK-GN PK-YL	43 18	35 37	
LB1 (LOUD LB2 BELL)	MS3 MS4	3 ONLY		1 2	PK-BK PK-WH	42 17	33 34	
EP1 (PAGE EP2 CONT.)	MS3 MS4	4 ONLY		1 2	PK-GN PK-YL	43 18	35 36	
SPARE					LGN-BK	44	37	
SPARE					LGN-WH	19	38	
SPARE					LGN-RD	45	39	
SPARE					LGN-YL	20	40	
					46	41		
					21	42		
					47	43		
					22	44		
					48	45		
					23	46		
					49	47		
					24	48		
					50	49		
					25	50		

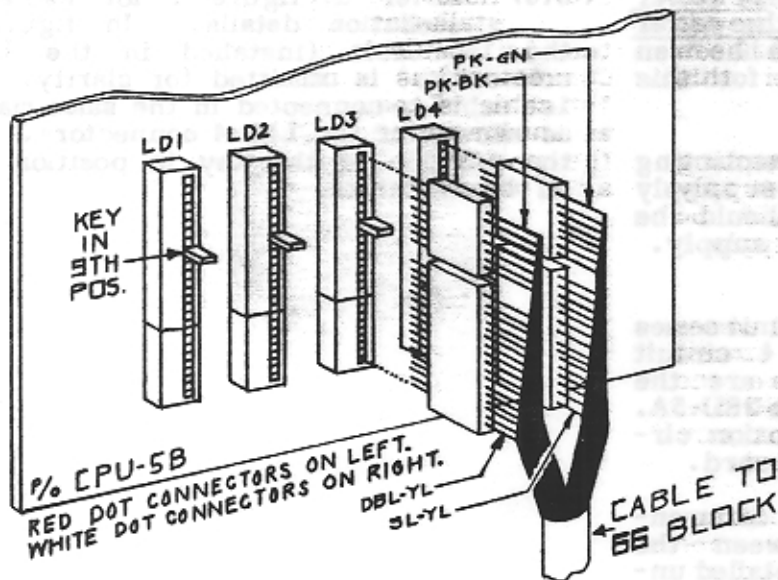


Figure 1 - Cable Installation Detail

\* CIRCUITS 1-8 ARE PLUGGED INTO CONNECTORS LTB-D1 AND LTB-D2. CIRCUITS 9-16 ARE PLUGGED INTO CONNECTORS LTB-D3 & LTB-D4.

\*\* POLARITY MUST BE OBSERVED ON LEADS TO THE TELEPHONES.

4.00 EK-516B KSU OPTIONS

4.01 CPU-5B Options

4.02 Fifteen options are provided by the CPU-5B to implement the following system features. Refer to figure 2 for CPU-5B board layout.

- Auxiliary Paging Amplifier Control (See addendum par. 4.14)

AH1 Hold Release Timing - Line 1 (See addendum par. 4.03)

AH2 Hold Release Timing - Line 2 (See addendum par. 4.03)

AL Alarm Signal Repeating (See par. 6.24 in inst. manual)

AP All-Call Paging (See addendum par. 4.05)

AR Automatic Recall Timing (See par. 6.29 in inst. manual)

BL BLF Station Night Transfer (See addendum par. 4.07)

CC Control Check (See par. 6.32 in inst. manual)

EA External Amplifier (See par. 6.34 in inst. manual)

HB Busy Station Alert Tone (See par. 6.39 in inst. manual)

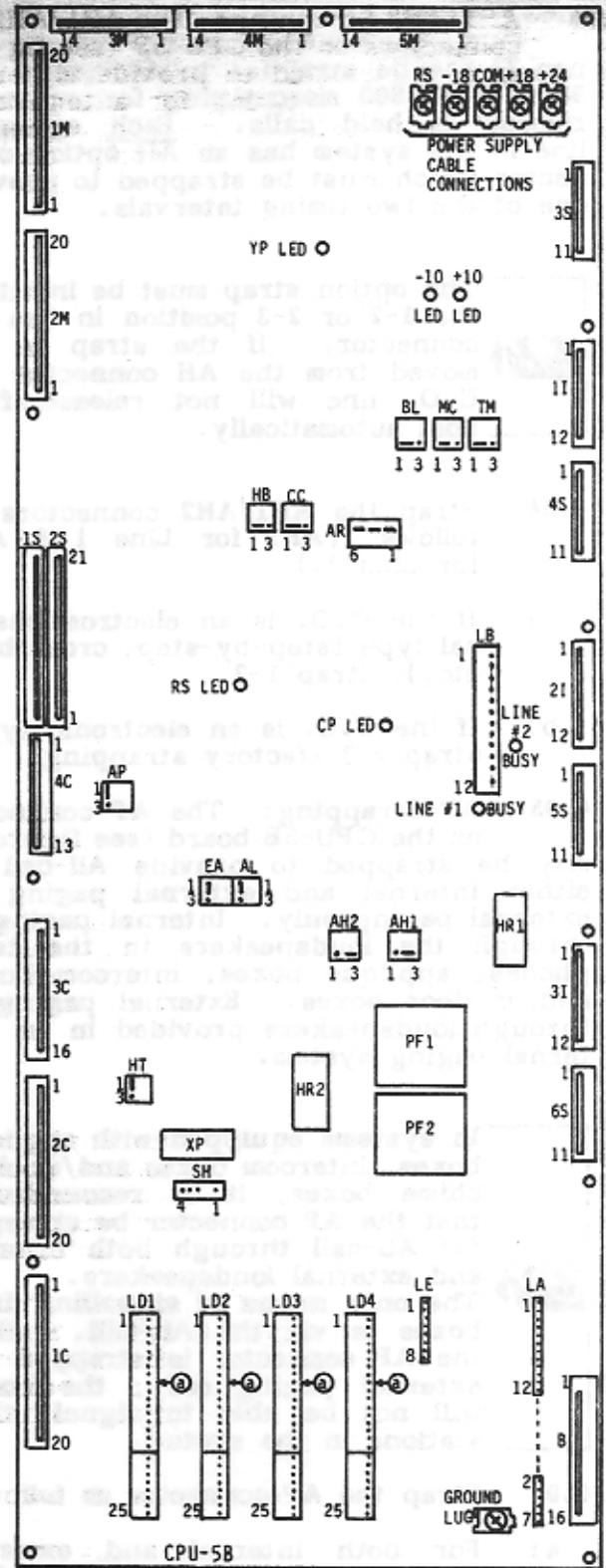
HT Hold Tone Source (See par. 6.41 in inst. manual)

LB Loud Bells (LBU-5A) (See addendum par. 4.08)

MC Multi-Line Conferencing (See addendum par. 4.12)

SH Internal MOH Source (See par. 6.48 in inst. manual)


TM Intercom (Talkback) Timing (See addendum par. 4.13)



KEY  
NOTE: LTB-A, LTB-D's & LTB-E terminal assemblies are installed with screw terminals to the left.

Figure 2 - CPU-5B Connector Locations


**4.03 AH1/AH2 Strapping:** The AH1/AH2 connectors on the CPU-5B (see figure 2) can be strapped to provide either 90 msec or 600 msec timing for automatic release of held calls. Each equipped line in the system has an AH option connector which must be strapped to provide one of the two timing intervals.

 The option strap must be in either the 1-2 or 2-3 position in the AH connector. If the strap is removed from the AH connector the C.O. line will not release from hold automatically.

**4.04** Strap the AH1/AH2 connectors as follows: (AH1 for Line 1 & AH2 for Line 2.)

- a) If the C.O. is an electromechanical type (step-by-step, cross-bar, etc.), strap 1-2.
- b) If the C.O. is an electronic type, strap 2-3 (factory strapping).

**4.05 AP Strapping:** The AP connector on the CPU-5B board (see figure 2) may be strapped to provide All-call to either internal and external paging or external paging only. Internal paging is through the loudspeakers in the telephones, applique boxes, intercom boxes and/or door boxes. External paging is through loudspeakers provided in an external paging system.

 In systems equipped with applique boxes, intercom boxes and/or door chime boxes, it is recommended that the AP connector be strapped for All-call through both internal and external loudspeakers. The only means of signalling from boxes is via the All-call. When the AP connector is strapped for external paging only, the boxes will not be able to signal other stations in the system.

**4.06** Strap the AP connector as follows:

- a) For both internal and external all-call paging, strap 1-2 (factory strapping).
- b) For all-call via external loudspeakers only, strap 2-3.
- c) If strap is left out, it's the same as strapping 2-3.

**4.07 BL Strapping:** The BL connector on the CPU-5B board (see figure 2) may be strapped to provide two different Night Transfer schemes for night C.O. audible. Strap the BL connector as follows:


- a) **Programmable Night Signals:** For night audible signalling as strapped for individual stations on the 2SU and 8SU cards, strap 1-2 (factory strapping). Refer also to par. 4.17.
- b) **No Night Signalling:** For NO night audible signalling to ALL stations, strap 2-3.
- c) If strap is left out, NO night C.O. audible will occur.

**4.08 LB Connector:** The LB connector on the CPU-5B (see figure 2) is provided for installation of the LBU-5A. If loud bells or buzzers are required for common C.O. audible, during both day and night hours, an LBU-5A circuit card must be installed in the LB connector.

**4.09** A dry contact output rated at 1 Ampere is provided by the LBU-5A.

**4.10** The interrupted output of the LBU is via terminals MS3/MS4 on the LTB-D board in connector LD3 (see figure 2). Refer to figure 4B in section 1 of the manual for layout of the LTB-D terminal board.

**4.11** Figure 3 shows 3 different common C.O. audible loud-ringing arrangements which can be used with the LBU-5A card. When AC bells or buzzers are used, the maximum generator supply voltage applied to the MS3/MS4 terminals is 90 volts.

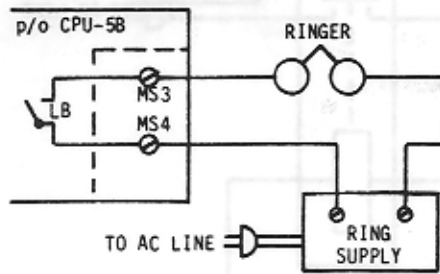
 **DO NOT** apply commercial 117VAC power line voltage to the MS3/MS4 terminals on the LTB-D board.

**4.12 MC Strapping:** The MC connector on the CPU-5B board (see figure 2) is provided to determine whether multi-line conferencing is to be used in the system. Strap the MC connector as follows:

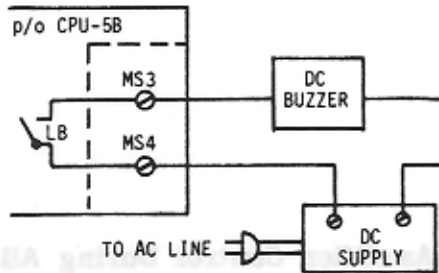
- a) If conferencing is NOT desired, strap 1-2 (factory strapping).
- b) If conferencing IS desired, strap 2-3.



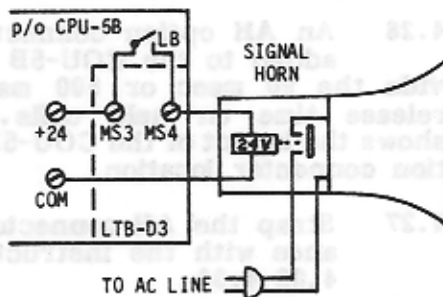
- c) If MC strap is left out, it's the same as strapping 2-3.



AC Ringer Connections



DC Buzzer Connections



Loud Bell or Horn Connections

Figure 3 - External Bells or Buzzer

**4.13 TM Strapping:** The TM connector on the CPU-5B board (see figure 2) is provided to change the intercom time-out interval on calls in the talkback mode. This timing applies to systems with either 1 or 2 intercom links. The length of the timeout interval cannot be changed; it is fixed at either 45 seconds (nominal) or no timeout interval. Strap the TM connector as follows:

- For 45 second timeout interval, strap 1-2 (factory strapping).
- For NO timeout interval, strap 2-3.
- If strap is left out, it's the same as strapping 2-3

**4.14 Paging Amplifier Control:** A dry contact output from the CPU-5B for auxiliary control of an external power amplifier is provided. The contact is rated at 1 Ampere and is closed during All-call announcements from any station in the system.

4.15 The control during All-call is via terminals MS3/MS4 on the LTB-D board in connector LD4 (see figure 2). Refer to figure 4B in section 1 of the manual for layout of the LTB-D terminal board.

4.16 Figure 4 shows a method of controlling an external power amplifier during All-call announcements. An auxiliary 24-volt relay is required for this purpose. The contacts on the relay must be rated for the input current required by the amplifier.



**DO NOT** apply commercial 117VAC power line voltage to the MS3/MS4 terminals on the LTB-D board.

#### 4.17 2SU-5A/8SU-5A Options:

4.18 The CPU-5B program used in the EK-516B changes the functions of the C.O. audible strapping on the 2SU-5A and 8SU-5A cards. The BGM function has not been changed.

4.19 The CPU-5B program has been revised to provide more flexible ringing arrangements. In implementing these improvements, on-hook only C.O. audible signalling has been removed; all telephones strapped on the 2SU or 8SU cards to receive C.O. audible will receive signalling when either on-hook or off-hook (when off-hook, signalling is muted).

4.20 If the CPU-5B BL connector is strapped for night signalling under control of 2SU or 8SU strapping (BL strapped 1-2), the 2SU and 8SU cards must be strapped in accordance with table 2. This will provide the three C.O. audible ringing schemes discussed in par. 2.03c. Figure 3 in the manual shows the 2SU and 8SU card locations. Figures 9 and 10 in the manual show the strapping locations on the 2SU and 8SU cards.

4.21 Using table 2, strap the 2SU and 8SU cards for C.O. audible and BGM as required at each station.

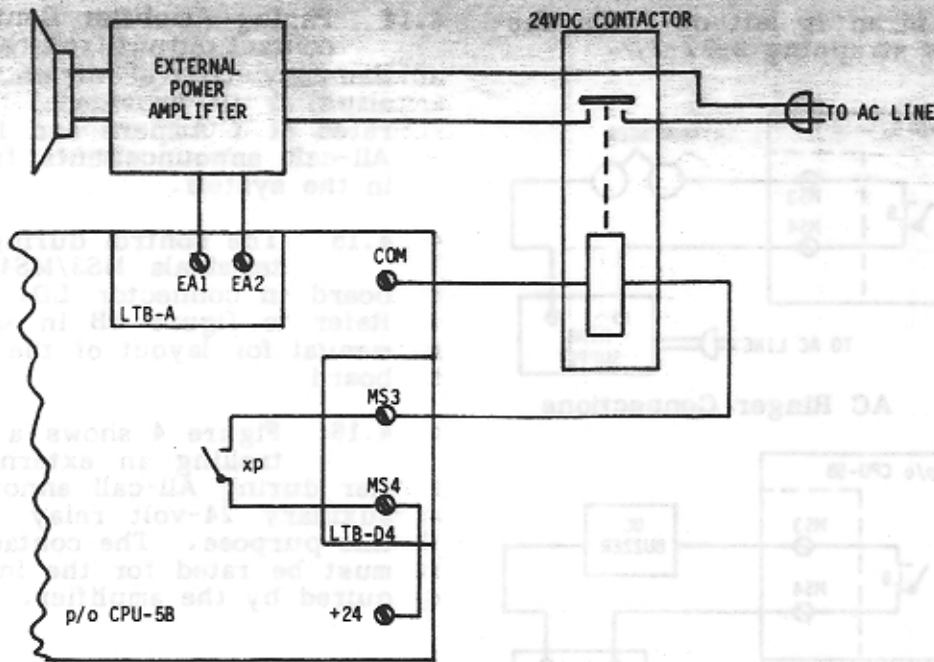


Figure 4 - Connections for External Amplifier Control During All-Call

4.22 CMI-5A Options (PHU-5A)

4.23 The CMI-5A card has a flexible printed circuit (PHU-5A Hold Prevention Circuit) installed in the inside 2C/3C connectors. Refer to figure 5. Install the PHU-5A with the notch between the inside 2C/3C connectors. The foil side of the circuit is toward the relays on the CMI card (diodes next to the outside row of connectors).

4.24 If a COU-5B card is installed, the PHU-5A must be moved to the last equipped COU-5B. The PHU-5A is installed on the COU-5B in the same manner as on the CMI-5A.

4.25 COU-5B Options

4.26 An AH option connector has been added to the COU-5B card to provide the 90 msec or 600 msec automatic release time on held calls. Figure 6 shows the layout of the COU-5B and AH option connector location.

4.27 Strap the AH connector in accordance with the instructions in par. 4.03-4.04.

4.28 When COU-5B cards are added to the system, the PHU-5A flexible printed circuit which is installed on the CMI-5A card must be moved to the last COU-5B

STATION NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
STATION CARD		8SU-5A								2SU-5A-1		2SU-5A-2		2SU-5A-3		2SU-5A-4	
CONNECTOR DESIGNATION		1SU	2SU	3SU	4SU	5SU	6SU	7SU	8SU	9SU	10SU	9SU	10SU	9SU	10SU	9SU	10SU
FEATURE	NO C.O. SIGNALLING	REMOVE STRAPS 1-2 or 2-3															
	DAY AND NIGHT SIGNALLING	STRAP 1-2 (Factory strapping)															
	NIGHT ONLY SIGNALLING	STRAP 2-3															
	BACKGROUND MUSIC	STRAP 4-5 (Remove strap if no BGM is desired at station to eliminate system noise.)															

Table 2 - KSU Strapping for EK-516 Telephone Options



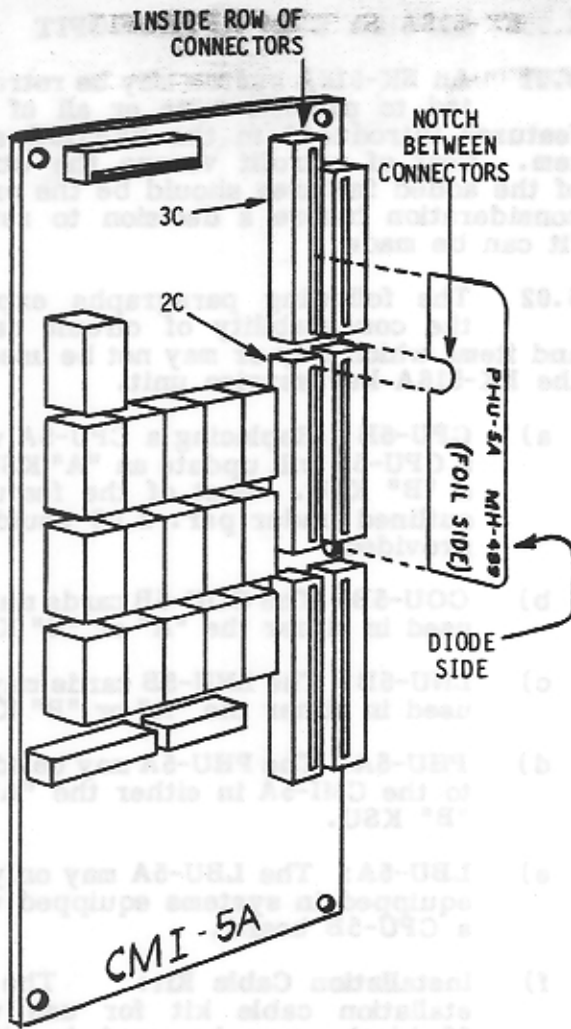


Figure 5 - PHU-5A Installation

card installed. This is required to facilitate flexible cable connections between the CMI-5A and the added COU-5B cards. The PHU-5A is installed on the COU-5B in the same manner as on the CMI-5A. Refer to figure 5 and par. 4.23.

4.29 LNU-5B Options

4.30 An AH option connector has been added to the LNU-5B card to provide the 90 msec or 600 msec automatic release time on held calls. Figure 7 shows the layout of the LNU-5B and AH option connector location.

4.31 Strap the AH connector in accordance with the instructions in par. 4.03-4.04.

4.32 2IU-5A Options

4.33 The 2IU cards are installed and strapped as detailed under par. 7.12-7.14 in the manual.

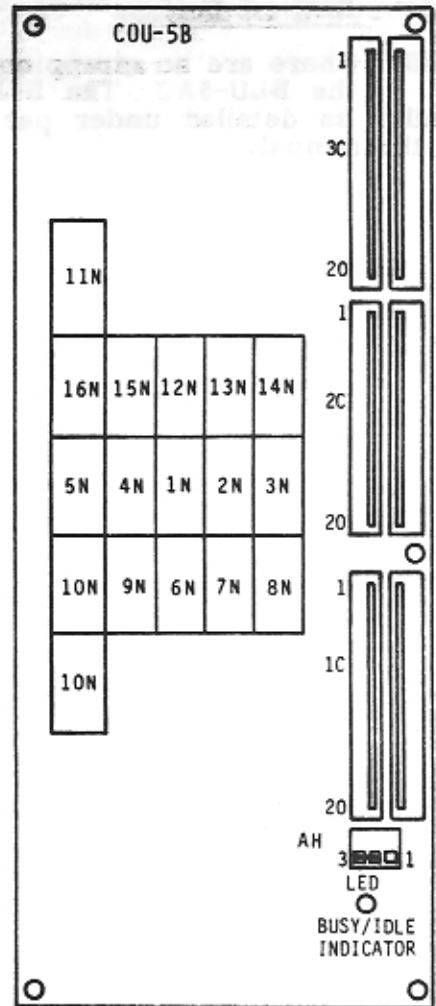


Figure 6 - COU-5B Card Layout

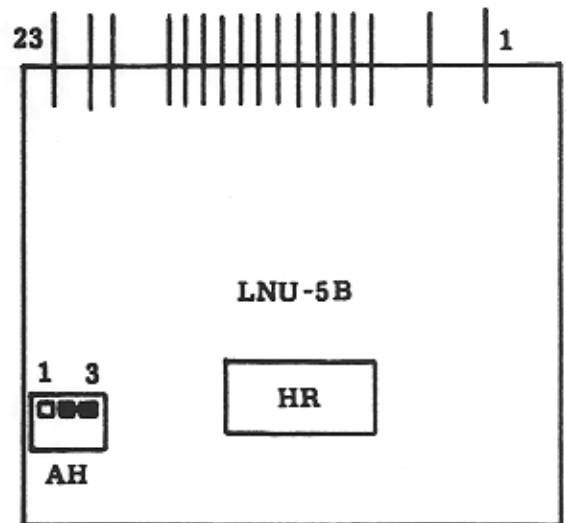


Figure 7 - LNU-5B Card Layout

4.34 BLU-5A Options

4.35 There are no strapping options on the BLU-5A. The BLU-5A is installed as detailed under par. 7.02-7.07 in the manual.

5.00 EK-516A SYSTEM RETROFIT

5.01 An EK-516A system may be retrofitted to provide some or all of the features introduced in the EK-516B system. Cost of retrofit versus the utility of the added features should be the prime consideration before a decision to retrofit can be made.

5.02 The following paragraphs explain the compatibility of circuit cards and items which may or may not be used in the EK-516A key service unit.

- a) CPU-5B: Replacing a CPU-5A with a CPU-5B will update an "A" KSU to a "B" KSU. Most of the features outlined under par. 2.03 would be provided.
- b) COU-5B: The COU-5B cards may be used in either the "A" or "B" KSU.
- c) LNU-5B: The LNU-5B cards may be used in either the "A" or "B" KSU.
- d) PHU-5A: The PHU-5A may be added to the CMI-5A in either the "A" or "B" KSU.
- e) LBU-5A: The LBU-5A may only be equipped in systems equipped with a CPU-5B board.
- f) Installation Cable Kit: The installation cable kit for use with 66 blocks may be used in either the "A" or "B" KSU.

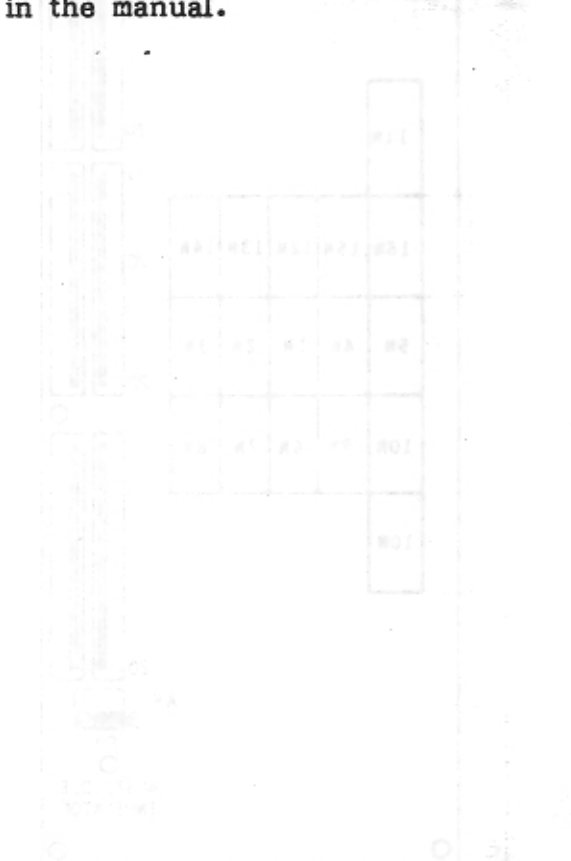


Figure 3 - COU-5B Card Layout

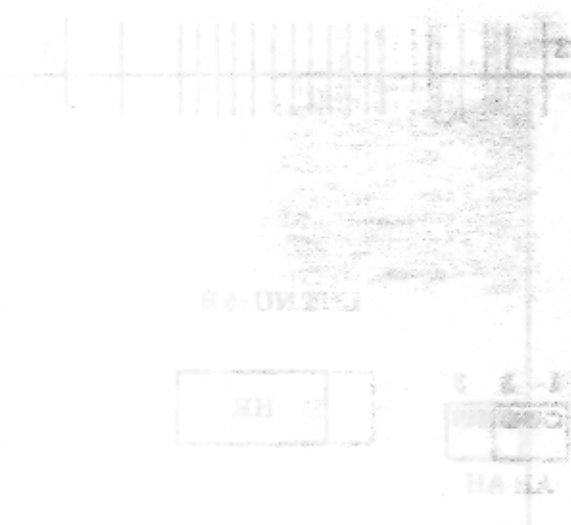


Figure 4 - LNU-5B Card Layout