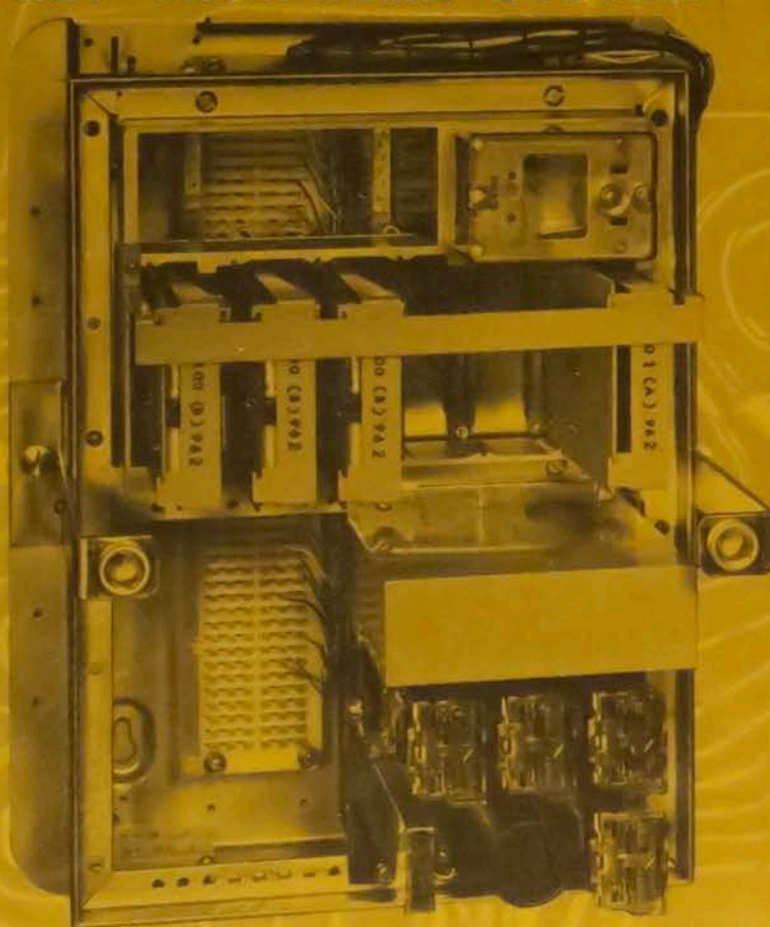


INSTRUCTION MANUAL IM-3007

K-1A2

KEY TELEPHONE SYSTEM



Telecommunications Division

ITT

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

**INSTALLATION
OPERATION AND MAINTENANCE
INSTRUCTIONS**

— PRICE \$2.00 —

PREFACE

This manual has been prepared as a practical guide for the installation, operation and maintenance of K1A2 Key Telephone Systems.

The manual is arranged in five sections. The first section provides a general description of the equipment. The second section provides the necessary information required for the installation of the equipment. The third section explains the details of operation and relay sequence and contains the circuit schematics. The fourth section provides complete maintenance data incident to continued efficient performance for the subscriber. The fifth section contains additional information.

The information and illustrations contained in this manual are based on the latest product information available at the time of publication. As additional information or changes become available they will be provided in the form of addendums. For any additional information contact your local ITT Telecommunications representative.

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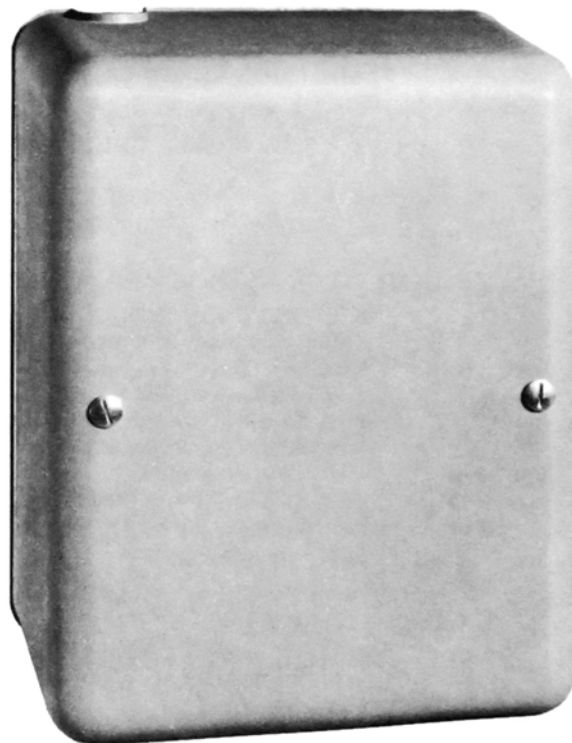
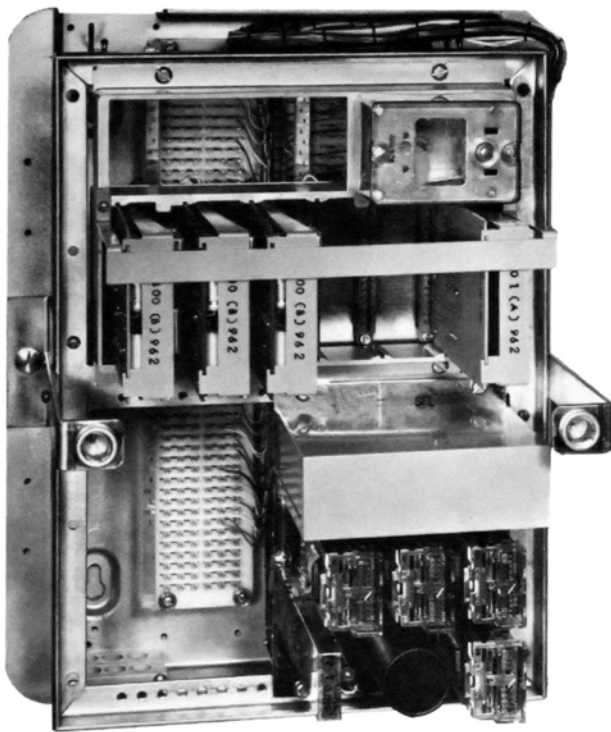
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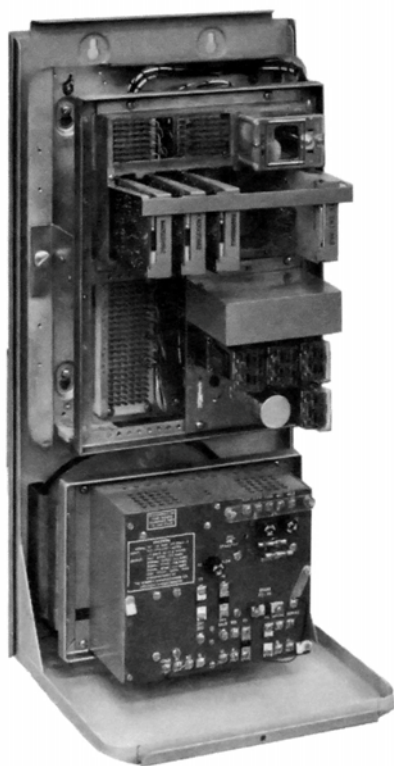
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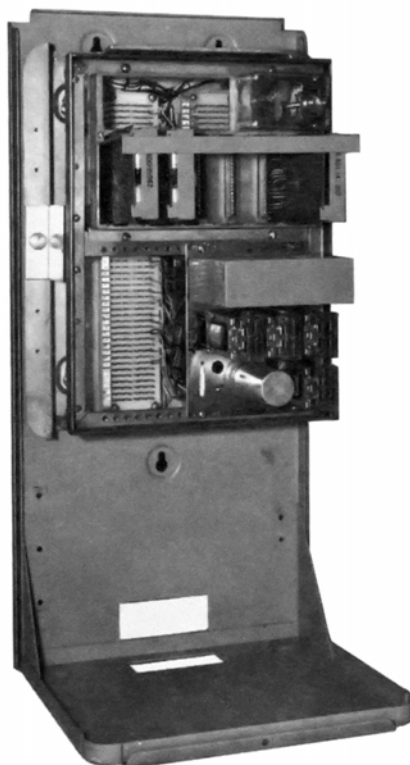
Typical K1A2 Key Telephone System



FLOORSTAND UNIT WITH
POWER SUPPLY. (COVER REMOVED)



FLOORSTAND AND COVER



FLOORSTAND UNIT WITHOUT
POWER SUPPLY. (COVER REMOVED)

K 501 TYPE KEY SERVICE UNIT CODES

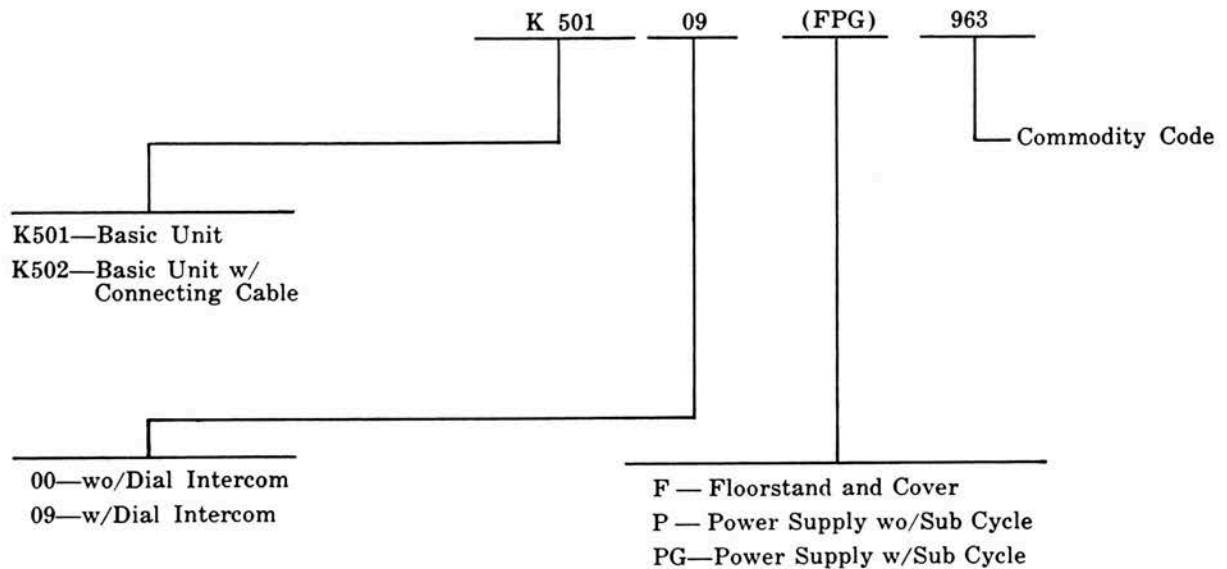
OLD ITT CODE	NEW ITT CODE	MAJOR COMPONENTS					75006(-) CONN. CABLE
		86434 COVER	K207C KTU	96099 FS & C	96101-1 PWR. SUP.	96101-2 PWR. SUP.	
K501()963	K50100()963		—	—	—	—	—
K501(D)963	K50109()963			—	—	—	—
—	K50100(F)963	—	—		—	—	—
—	K50109(F)963	—			—	—	—
—	K50100(FP)963*	—	—			—	—
—	K50109(FP)963*	—				—	—
—	K50100(FPG)963*	—	—		—		—
—	K50109(FPG)963*	—			—		—
—	K50200(FP)963*	—	—			—	
—	K50209(FP)963*	—				—	
—	K50200(FPG)963*	—	—		—		
—	K50209(FPG)963*	—			—		

* Includes power supply cable.

96101-1 Power Supply less ringing sub-cycle.

96101-2 Power Supply with 30 c.p.s. ringing sub-cycle.

BREAKDOWN OF KSU CODE



GENERAL DESCRIPTION

1. INTRODUCTION

The K1A2 Key Telephone System consists of a basic prewired mounting package designated as a Key Service Unit, and is provided to receive and associate "plug-in" units in varying combinations to meet subscribers requirements. The "plug-in" units, designated Key Telephone Units, are new station switching circuits which employ miniature relays and solid state components such as transistors, varistors, diodes etc., assembled on printed circuit "plug-in" cards.

The system is designed to provide means for signaling a subscriber station associated with a Central Office (CO) or Private Branch Exchange (PBX), for holding that line and for indicating by means of visual signals whenever the line is being called, held or is busy. It also provides for originating and holding outgoing calls. On an optional basis, it provides a common talking-manual signaling intercommunicating system and/or a common talking-dial selective signaling intercommunicating system for a maximum of 9 stations.

2. FEATURES

The following features are provided:

- a. Flashing visual signals on incoming calls.
- b. Common audible signals for incoming calls. (Optional.)
- c. Station audible signals for incoming calls, non-bridged ringers. (Optional.)
- d. Steady visual signals while a station associated with the key telephone system makes a line busy.
- e. Holding calls on a line, while another line is used.
- f. Winking or steady visual signal to indicate a held line.
- g. Removal of the hold on a line when a station associated with the key telephone system seizes the line or when the line is momentarily opened at the CO or PBX.
- h. Operation of the CO or PBX line under local power failure conditions.
- i. Release of visual and audible signals (time-out) in approximately 15 or 30 seconds, on a per-line basis, if the call is unanswered and abandoned.

3. SYSTEM COMPONENTS

Each key telephone system consists essentially of a K501 Key Service Unit with or without a 9-station dial intercommunicating circuit, and with an electro-mechanical interrupter. To which is added on the subscriber's premises, a printed circuit type "plug-in" line card on the basis of 1 per CO or PBX line and (if required) 1 - printed circuit type "plug-in" manual intercommunicating card, on the basis of 1 per circuit.

The Key Service Units are available with floor-stand cabinet with or without Power Supply. Power Supplies are of two types; one with and one without ringing sub-cycle. Approximate dimensions of power supplies are 4½" D x 7" H x 8¼" W.

Dimensions of the Floor Stand and cover are: 13" wide, 11¼" deep and 27¾" high.

4. DESCRIPTION OF KEY TELEPHONE SYSTEM COMPONENTS

- a. The K501 KSU consists of: a die-cast backboard upon which are mounted, 2 "quick connect" connecting blocks, cable clamps and hooks for station cables; a mounting frame hinged and locked to the backboard, and upon which is mounted a card mounting assembly including 6 printed circuit connectors and an electro-mechanical interrupter. The interrupter is common to the entire system and provides for lamp flashing, lamp winking and interrupted ringing.

The backboard is arranged so that the hinge and locking bracket may be transposed to permit the gate opening from right to left instead of left to right as factory assembled.

The KSU is completely pre-wired between the connecting blocks, interrupter and all connectors for "plug-in" cards. It is designed for wall mounting and is provided with a light grey fiberglass overall cover. The approximate dimensions are: 16-1/2 in. H x 13-1/2 in. W x 10-1/2 in. D. (See Fig. 1-1).

- b. The K400B KTU is the CO or PBX Line Circuit and consists of a printed circuit board upon which is assembled miniature relays, thermistors, varistors, diodes, capacitors and resistors to provide the necessary switching circuitry. It also provides easily accessible terminals to change optional features by the installer on the subscribers premises. The assembly is approximately 5-1/4 in. L x 3-1/2 in. W x 1-1/4 in. D. (See Fig. 1-2).

SECTION 1

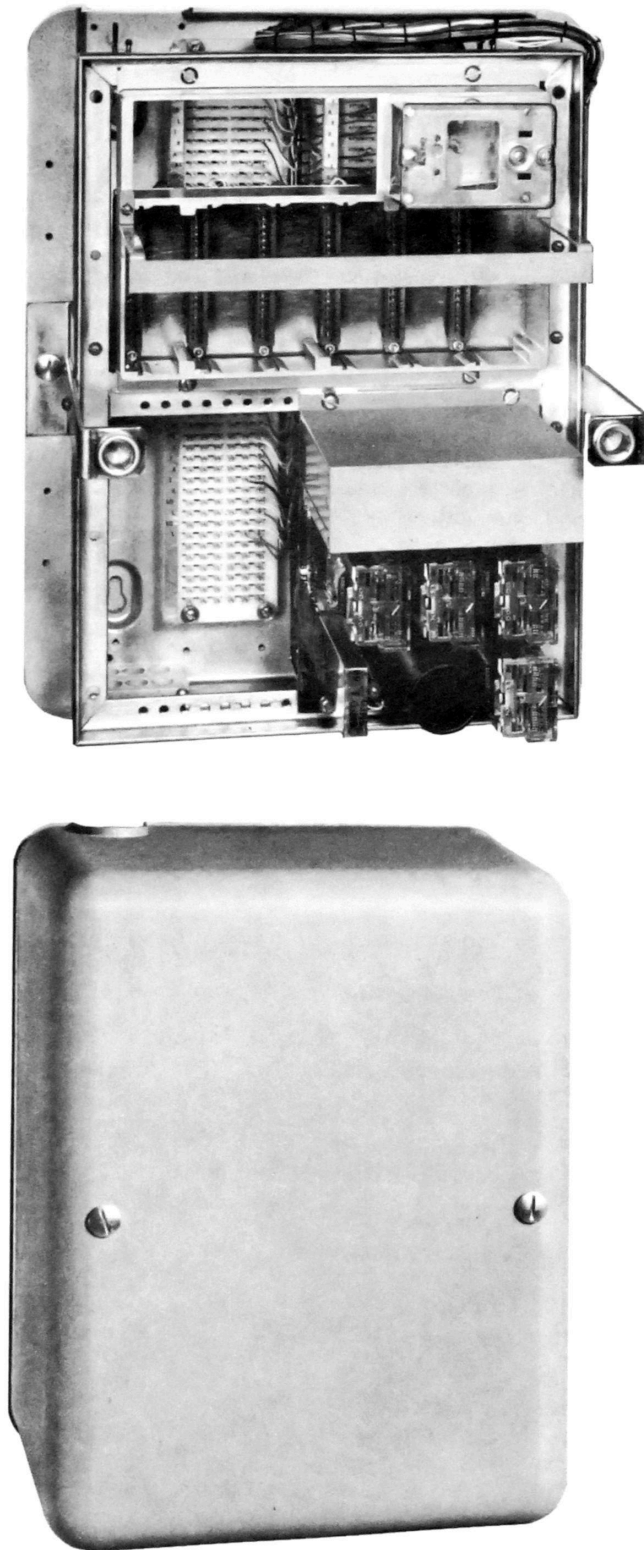


Figure 1-1.
K50109() 1963 Key Service Unit with Cover Removed

- c. The K401A KTU is the Manual Intercommunicating Line Circuit and consists of a printed circuit board upon which is assembled a battery feed inductor, current limiting resistors and a busy lamp relay. The assembly is approximately 5-1/4 in. L x 3-1/2 in. W x 1-1/4 in. D. (See Fig. 1-3).
- d. The K207C KTU provides for a 9-station common talking, dial selective intercommunicating circuit. It is a modular type unit designed to mount within the K501 KSU, and consists of a two-bank selector and wire spring relays and other components, all of which are mounted on a metal panel and wired to a terminal panel having screw type terminals for external connections. The approximate size is 6-15/16 in. H x 5-7/32 in. W x 6-1/2 in. D. (See Fig. 1-4).

5. OPERATING INSTRUCTIONS

5.1 General

Operation of the Key Telephone System is extremely simple. The push buttons on the station

telephones (see Figure 1-5) serve to switch the talking circuit to any one line. Visual signals indicate incoming calls . . . illuminated buttons insure rapid identification of calls and busy lines, and prevent interruptions of calls in progress.

5.2 Central Office or PBX Lines

Incoming Call

Incoming calls on Central Office or PBX lines are audibly indicated by the station ringer or by a buzzer. The Key Telephone Sets equipped with signal lamps also provide a visual signal indicating which line has an incoming call waiting to be answered by illuminating (flashing lamps) the button of the associated line at all stations at which the line appears.

An incoming call is answered by pressing the line pick-up button associated with the audible and/or visual signals received and picking up the telephone handset.

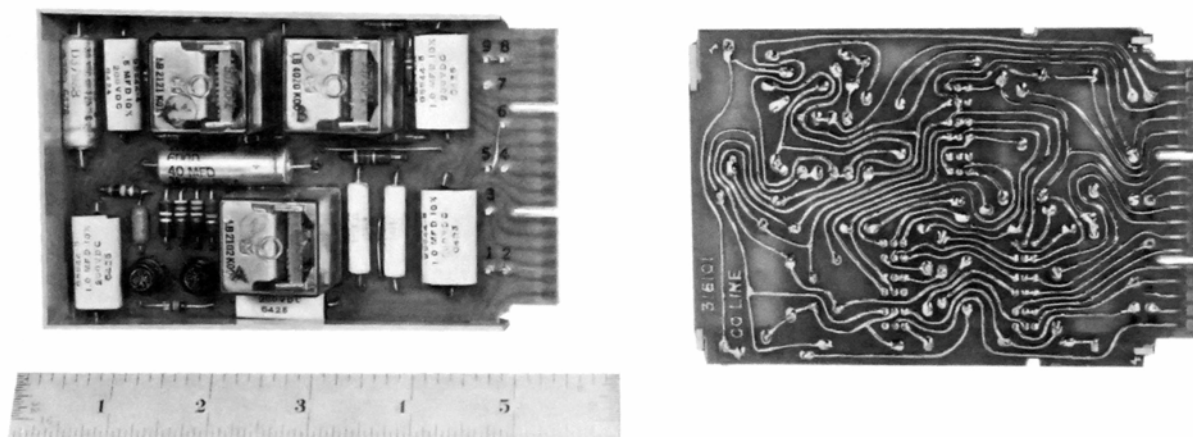


Figure 1-2.
K400(B)962 Key Telephone Unit

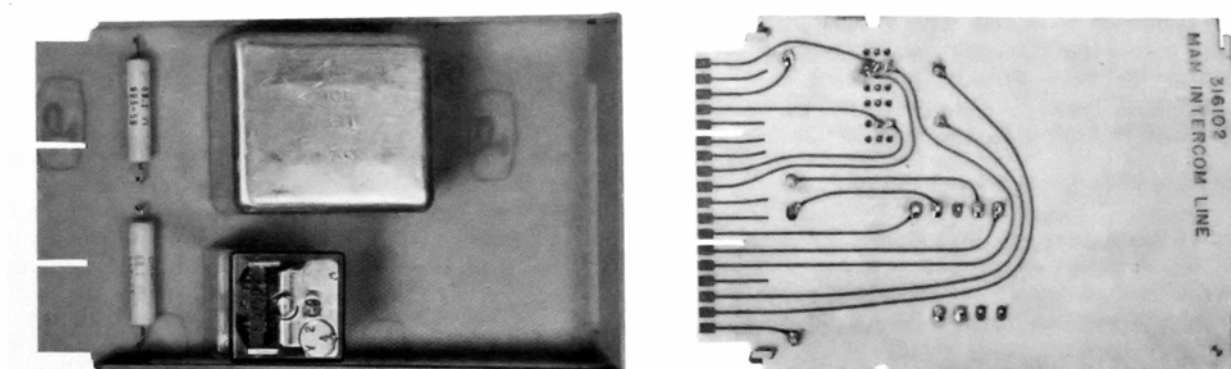


Figure 1-3.
K401(A)962 Key Telephone Unit

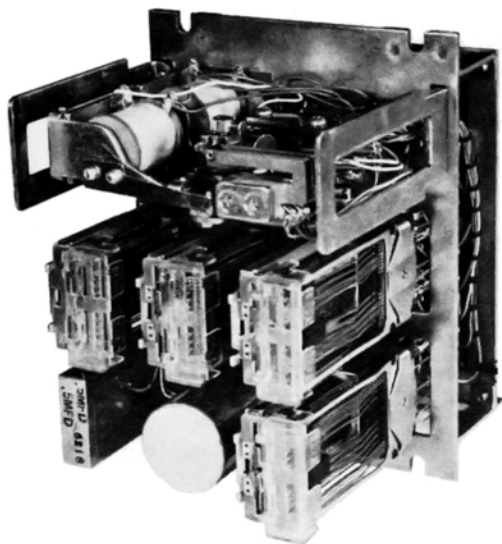


Figure 1-4.
K207C KTU, Dial Intercom Circuit

Outgoing Call

An outgoing call is originated by selecting an idle line, pressing the associated line pick-up button and picking up the telephone handset.

Holding

When it is desired to hold an incoming call for the purpose of obtaining information over another line, transferring an incoming call, etc., the hold button is depressed. This causes a holding bridge to be placed across the line and keeps the lamp associated with the line being held lighted or winking so that other stations will know the line is in use. When the subscriber (or the station to which the call has been transferred) desires to pick up the line again the line pick-up button associated with that line is depressed and the hold condition is automatically released permitting the subscriber (or the person to whom the call was transferred) to converse on the line.

When the wink feature is provided, a visual hold signal in conjunction with the holding feature enables a subscriber to distinguish between a line in a normal busy condition or a line with an incoming call. This "wink" signal feature uses the same signal lamp used for line and busy signals, but has a long "on" period and a short "off" period giving the impression of a wink when the line is in a held condition.

Operation With Local Power Failure

Should a local power failure occur, all lines except the Central Office or PBX lines become inoperative. With Central Office or PBX Lines it is possible during a power failure to make an outgoing call since selection of a line and removal of the station handset permits the subscriber to originate a call regardless of the availability of local power to the Key Telephone System. If, during a local power failure, the local ringing supply remains operative, the com-

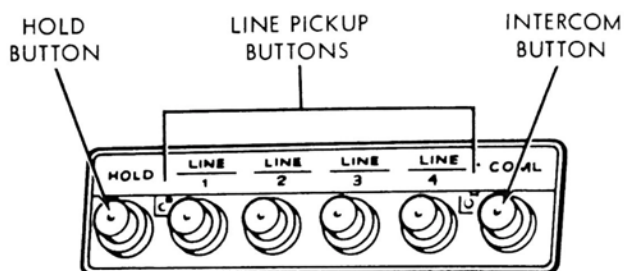


Figure 1-5.
Push Button Panel of Key Telephone Set

mon audible signals, if provided, will operate during an incoming call but will follow the incoming ringing on the line rather than locking in as would be the case when power is available to the relays of the system. During a complete local power failure it is possible, on Central Office and PBX Lines, to receive incoming signals only if ringers are bridged across the lines to operate on incoming ringing current.

Disconnection

Upon completion of the conversation, returning the handset to the cradle will extinguish the signal lamp and restore the line to the idle (non-busy) condition.

5.3 Intercommunication Line

Incoming Call

An incoming call is answered by pressing the line pick-up button associated with the audible and/or visual signals received and picking up the telephone handset.

Outgoing Call — Manual Selection of Stations

An outgoing call is originated by lifting the telephone handset, pressing the line pick-up button associated with the intercom line, and operating the signaling button associated with the intercom line.

Outgoing Call — Dial Selection of Stations

An outgoing call is originated by lifting the telephone handset and depressing the line pick-up button associated with the intercom line. The desired station may then be selected by dialing the required digit or digits. For a nine station line, a single digit from "2" to "0" is used for station identification. At the completion of dialing the buzzer or bell assigned to the called station only will ring for a period of from one to three seconds indicating to the called station that a call is to be answered. If the called station fails to answer the calling station can repeat the audible signal by redialing without hanging up.

INSTALLATION

1. GENERAL

The instructions contained in this section are furnished to aid and assist the installer in the installation of K1A2 Key Telephone Systems.

In preparing for the installation of a K1A2 KTS, the installer should thoroughly read the literature contained in Section 1, so that he will be familiar with the equipment and features of the system.

2. MOUNTING

The K501 Key Service Unit is designed for wall mounting and should be firmly mounted to a wall at convenient height from the floor and in such a position as to allow the equipment gate to swing out to the right to facilitate wiring, inspection and maintenance.

The connecting blocks are furnished with aluminum pressure sensitive tapes, preprinted with terminal designations. The tape is one continuous strip and should be cut at the slots on the fanning strips with the sharp edge of the R714B tool (used for terminating the station cable to the connecting block terminals) before the wires are terminated on the blocks.

Figure 2-1 shows the layout of the connecting blocks and figure 2-2 shows the termination of cable on the blocks.

The location of the apparatus cabinet should be determined primarily with the following considerations in mind:

- a. A centralized location to minimize cable runs to telephone stations.
- b. Accessibility for inspection and maintenance.
- c. Proximity to telephone stations to eliminate possible conversation distractions.
- d. Compatibility with the decor of the premises.
- e. Accessibility of a power outlet for the power supply.

3. WIRING

3.1 General

The K501 Key Service Unit is a factory inter-wired unit. Connections between station apparatus and the Key Service Unit are made on connecting blocks with quick connect terminals.

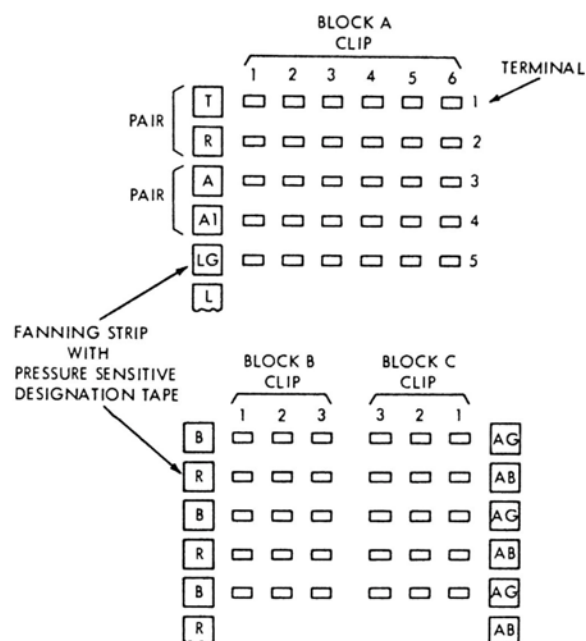


Figure 2-1. Layout of Connecting Blocks

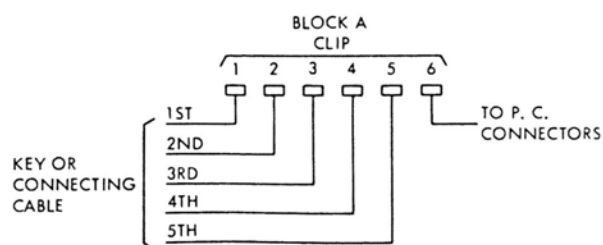


Figure 2-2. Termination of Cables on Connection Blocks

3.2 Connecting Blocks

Connections between station apparatus and the connection blocks are shown in Table 2-2 for the K501 Key Service Unit.

Connect an external power source as shown in the tables when power is not provided as part of the package.

The connecting blocks are designed for use with unskinned plastic insulated wire. Insulated conductors are terminated on the clip by insertion into the clip opening, placing the R714B tool over the clip (with the cutoff blade up) and pushing firmly toward the terminal block. This action forces the wire to a

SECTION 2

fixed position in the clip and at the same time cuts the wire insulation. The force of the blade against the base of the connecting blocks cuts-off the unused end of wire. For wires that are not to be cut off, the "bit" of the R714B tool is reversed so that the cut-off blade is not used.

4. EQUIPPING

4.1 Installation of CO or PBX Line Circuits

K400B KTU's on the basis of one KTU per line required, are plugged into the printed circuit connectors, usually from left to right. The KTU is oriented in a vertical position with the printed circuitry to the left, inserted in the guides on the mounting frame and firmly inserted into the connector. After all units are inserted the screws for the retaining bar are tightened to prevent any KTU's from falling out of the card mounting assembly.

4.2 CO or PBX Line Circuit Options

Options provided on the K400B KTU are as follows:

Z - Short Time-out. (Used with automatic ringing CO or PBX).

W - Interrupted Station Audible Signaling

T - Steady Station Audible Signaling

V - Auxiliary Common Audible Signal Circuit

Y - Winking Hold Lamp

X - Steady Hold Lamp

Each K400B is factory wired for options Z, W and Y. If other options are required by the subscriber, the installer should re-wire the option terminals on the printed circuit board to meet specific requirements. (See Figure 2-3).

4.3 Installation of Manual Intercommunicating Circuit

The K401A KTU is plugged into the selected printed circuit connector in the same manner as the K400B KTU. Strapping of battery feed wires for the K400B KTU is required (See Table 2-2). For suggested wiring for station audible signals see Fig. 2-4.

4.4 Station Apparatus

A connection chart is provided to facilitate connection of the K564 and K565 Key Telephone Sets to the Connecting Blocks of the K501 KSU. (See Table 2-3).

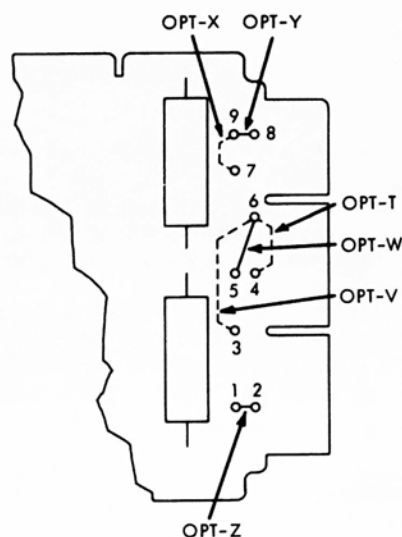


Figure 2-3. K400B KTU Wiring Options

Connector cables for use with the K564()40 and K565()40 Telephone Sets (the mounting cord being terminated in a connector) are available in the following Code Numbers and lengths:

K25025()601	25 feet long
K25050()601	50 feet long
K25100()601	100 feet long

4.5 Common Audible Signaling

Two types of common audible signaling are available in the K1A2 Key Telephone System, with or without auxiliary relay equipment. Refer to par. 2.6 of section 3.

5. POWER SUPPLY

Before the power supply is connected to the K-501 KSU, the power cord should be connected to a wall service outlet and the DC voltage to Talking (A) and Relay (B) Battery outputs measured with a DC Voltmeter. If the voltage obtained is higher than 26 V. DC compensation should be made by moving the tap on the primary of the power supply to a higher value of AC Voltage. Most power supplies are normally tapped at 111, 117 and 123 V. AC.

SPECIAL NOTE:

Since the K400B CO or PBX Line Circuit is designed for grounded ringdown only, it is necessary that the "B" Battery Ground of the Power Supply be connected to a good earth ground. This connection is to be made to terminal 45(BG) on Connecting Block "C" of the K501 KSU.

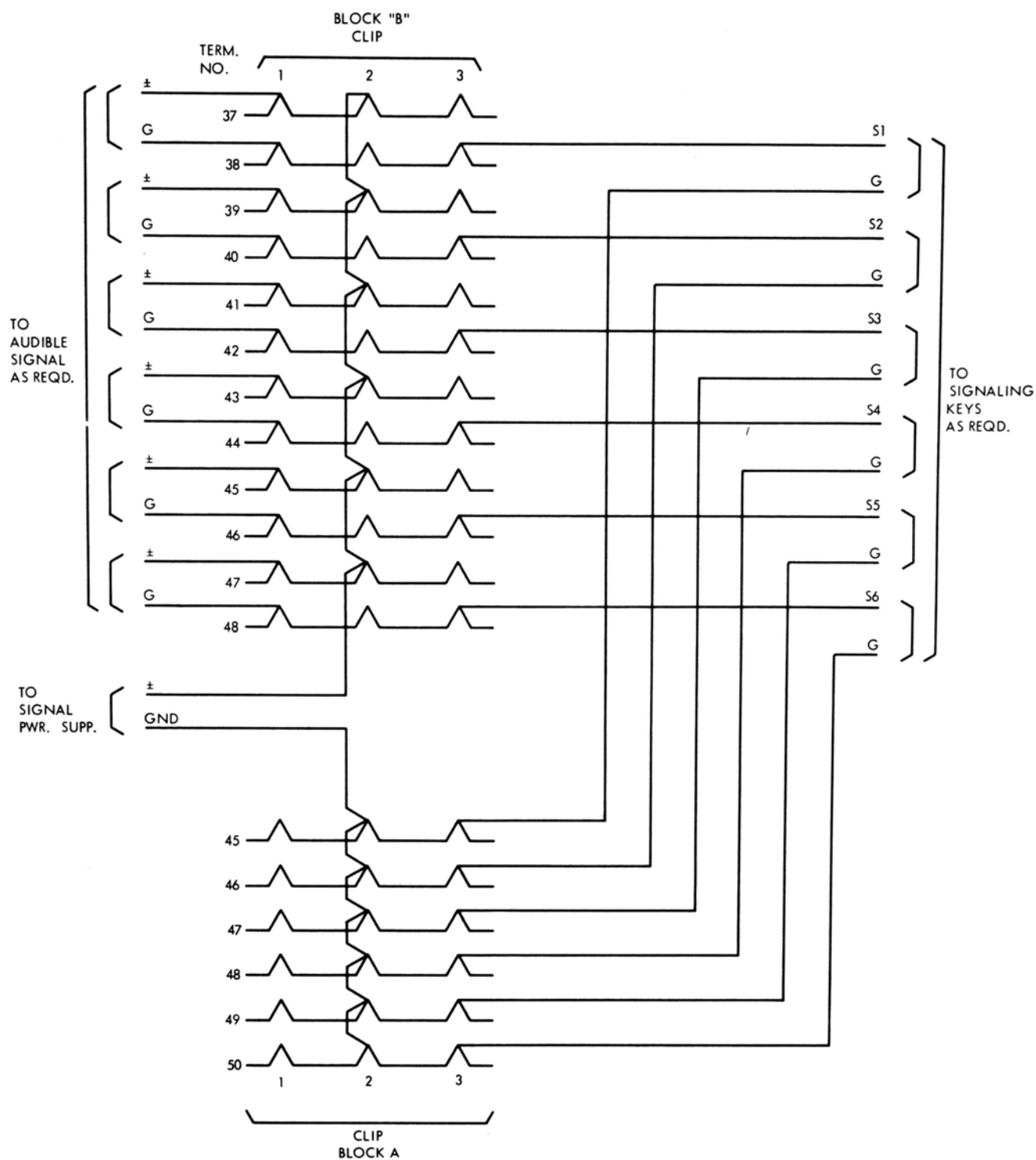


Figure 2-4. Manual Intercom Station Signaling
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SECTION 2

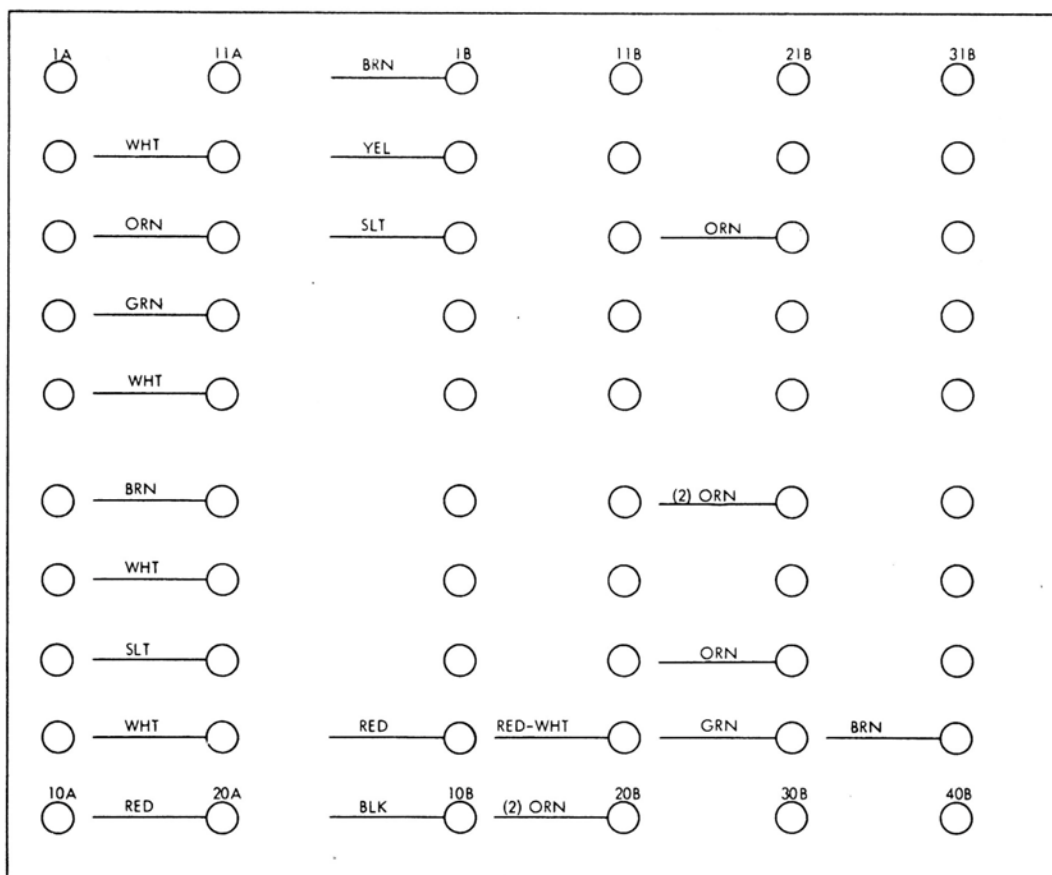


TABLE 2-1 . Terminal Connections for Adding K207C KTU to K501 Key Service Unit

BLOCK "A"								
FEATURE	LEAD DESIG.	TERM. NO.	CLIP					
			1	2	3	4	5	6
LINE 1	T	1	NOTE 1	NOTE 1	NOTE 1	NOTE 1	NOTE 1	NOTE 2
	R	2						
	A	3						
	A1	4						
	LG	5						
LINE 2	L	6						
	T	7						
	R	8						
	A	9						
	A1	10						
LINE 3	LG	11						
	L	12						
	T	13						
	R	14						
	A	15						
LINE 4	A1	16						
	LG	17						
	L	18						
	T	19						
	R	20						
LINE 5	A	21						
	A1	22						
	LG	23						
	L	24						
	T	25						
LINE 6	R	26						
	A	27						
	A1	28						
	LG	29						
	L	30						
DIAL SELECTIVE INTERCOM LINE	T	31						
	R	32						
	A	33						
	A1	34						
	LG	35						
SPARE NOTE 4	L	36						
	T	37						
	R	38						
	T	39						
	R	40						
	LG	41						
	L	42						
	LG	43						
	L	44						
		45						
		46						
		47						
		48						
		49						
		50						

BLOCK "B"				BLOCK "C"								
FEATURE		LEAD DESIG.	TERM. NO.	CLIP			CLIP			TERM. NO.	LEAD DESIG.	FEATURE
				1	2	3	3	2	1			
DIAL SELECTIVE INTERCOM STATION SIGNALS		B "2"	1	NOTE 1	NOTE 1	NOTE 2	NOTE 3	1	AG	LINE 1		
		R "2"	2					2	AB			
		B "3"	3					3	AG		LINE 2	
		R "3"	4					4	AB			
		B "4"	5					5	AG		LINE 3	
		R "4"	6					6	AB			
		B "5"	7					7	AG	LINE 4		
		R "5"	8					8	AB			
		B "6"	9					9	AG	LINE 5		
		R "6"	10					10	AB			
		B "7"	11					11	AG	LINE 6		
		R "7"	12					12	AB			
		B "8"	13					13				
		R "8"	14					14				
		B "9"	15					15				
		R "9"	16					16	CO	COMMON CONTROL LEADS TO OTHER CONNECTING EQUIPMENT		
		B "0"	17					17	BZ			
		R "0"	18					18	BZ1			
	19	19	RN									
	20	20	ST									
	21	21	LF1									
STATION AUDIBLE SIGNALS		LINE 1	B1, BZ1	21	LF1							
			R1, BZ	22	LW1							
		LINE 2	B1, BZ1	22	LW1							
			R1, BZ	23	LF2							
		LINE 3	B1, BZ1	23	LF2							
			R1, BZ	24	LW2							
	LINE 4	B1, BZ1	25	T	LINE 1							
		R1, BZ	26	R								
	LINE 5	B1, BZ1	27	T	LINE 2							
		R1, BZ	28	R								
	LINE 6	B1, BZ1	29	T	LINE 3							
		R1, BZ	30	R								
COMMON AUDIBLE SIGNALING CIRCUIT		CA	31	31	T	LINE 4						
		CA	32	32	R							
		CA	33	33	T	LINE 5						
		CA	34	34	R							
		CA	35	35	T	LINE 6						
		CA	36	36	R							
SPARE NOTE 4			37	37	LG1	LP. GND.						
			38	38	LB1	LP. BAT.						
			39	39	LG2	LP. GND.						
			40	40	LB2	LP. BAT.						
			41	41	BG	RLY. GND.						
			42	42	BB	RLY. BAT.						
			43	43	AG	TLK. GND.						
			44	44	AB	TLK. BAT.						
			45	45	BG	RLY. GND.						
			46	46								
			47	47	RG	R. G. GND.						
			48	48	RB	R. G. ±						
			49	49	RG	BZ. GND.						
			50	50	RB	BZ. ±						

NOTES:

1. Terminate connector or running cables from left to right on clips as required.
2. Shop wiring from apparatus is terminated on this clip.
3. When K401A KTU, manual intercom is required, associated BAT. A and GND. A leads are to be strapped to terms. 44 and 43 of Block C.
4. These spare terms. may be used for manual signaling. (See Fig. 2-4).

TABLE 2-2
CONNECTIONS BETWEEN STATION
APPARATUS AND CONNECTING BLOCKS

TABLE 2-3 (PART I). CONNECTION CHART, K564 AND K565 TELEPHONE SETS, 2-COLOR CONDUCTOR CORDS

CKT. FEAT.		TERMINAL IN SET	MOUNTING CORDS (a)			CONNECTING BLOCK TERMINAL NUMBER		CONNECTING CABLE	
LINE	LEAD DESIG.		50-Cond. K-565/39 /42 phones	42-Cond. K-565/30 /40 phones	34-Cond. K-564/30 /40 phones	SCREW TYPE	AMPHENOL	50-Cond. (a)	40-Cond. (h)
1	R	1R	BLU-WHT	BLU-WHT	BLU-WHT	1-1	1	BLU-WHT	BLU
	T	1T	WHT-BLU	WHT-BLU	WHT-BLU	1-2	26	WHT-BLU	WHT
	A1	1B	ORN-WHT	ORN-WHT	ORN-WHT	1-4	2	ORN-WHT	ORN
	A	1H	WHT-ORN	WHT-ORN	WHT-ORN	1-5	27	WHT-ORN	WHT
LAMP	L	1L	GRN-WHT	GRN-WHT	GRN-WHT	4-1	3	GRN-WHT	GRN
	LG	1LG	WHT-GRN	WHT-GRN	WHT-GRN	4-2	28	WHT-GRN	WHT
2	R	2R	BRN-WHT	BRN-WHT	BRN-WHT	1-6	4	BRN-WHT	BRN
	T	2T	WHT-BRN	WHT-BRN	WHT-BRN	1-7	29	WHT-BRN	WHT
	---	---	SLT-WHT(b)	SLT-WHT(b)	SLT-WHT(b)	1-9	5	SLT-WHT	BRN
	A	2H	WHT-SLT	WHT-SLT	WHT-SLT	1-10	30	WHT-SLT	SL
LAMP	L	2L	BLU-RED	BLU-RED	BLU-RED	4-4	6	BLU-RED	WHT
	LG	2LG	RED-BLU	---	---	---	31	RED-BLU	---
3	R	3R	ORN-RED	ORN-RED	ORN-RED	1-3	7	ORN-RED	BLU
	T	3T	RED-ORN	RED-ORN	RED-ORN	1-8	32	RED-ORN	RED
	---	---	GRN-RED(b)	GRN-RED(b)	GRN-RED(b)	2-1	8	GRN-RED	YEL
	A	3H	RED-GRN	RED-GRN	RED-GRN	2-2	33	RED-GRN	ORN
LAMP	L	3L	BRN-RED	BRN-RED	BRN-RED	4-6	9	BRN-RED	RED
	LG	3LG	RED-BRN	---	---	---	34	RED-BRN	---
4	R	4R	SLT-RED	SLT-RED	SLT-RED	2-4	10	SLT-RED	GRN
	T	4T	RED-SLT	RED-SLT	RED-SLT	2-5	35	RED-SLT	RED
	---	---	BLU-BLK(b)	BLU-BLK(b)	BLU-BLK(b)	2-6	11	BLU-BLK	SLT
	A	4H	BLK-BLU	BLK-BLU	BLK-BLU	2-7	36	BLK-BLU	BRN
LAMP	L	4L	ORN-BLK	ORN-BLK	ORN-BLK	4-9	12	ORN-BLK	RED
	LG	4LG	BLK-ORN	---	---	---	37	---	---
5	R	5R	GRN-BLK	GRN-BLK	GRN-BLK	2-9	13	GRN-BLK	SLT
	T	5T	BLK-GRN	BLK-GRN	BLK-GRN	2-10	38	BLK-GRN	RED
	---	---	BRN-BLK(b)	BRN-BLK(b)	BRN-BLK(b)	2-3	14	BRN-BLK	YEL
	A	5H	BLK-BRN	BLK-BRN	BLK-BRN	2-8	39	BLK-BRN	BLU
LAMP	L	5L	SLT-BLK	SLT-BLK	SLT-BLK	4-3	15	SLT-BLK	BLK
	LG	5LG	BLK-SLT	---	---	---	40	BLK-SLT	---
AUX. SIGS. (d)		1	BLU-YEL	BLU-YEL	---	---	16	BLU-YEL	---
		2	YEL-BLU	YEL-BLU	---	---	41	YEL-BLU	---
		3	ORN-YEL	---	ORN-YEL(b)	---	17	ORN-YEL	---
		4	YEL-ORN	---	YEL-ORN(b)	---	42	YEL-ORN	---
HOLD LAMP	HL		GRN-YEL	---	GRN-YEL(b)	---	18	GRN-YEL	---
	HLG		YEL-GRN	---	YEL-GRN(b)	---	43	YEL-GRN	---
PB SIG	SG		BRN-YEL	BRN-YEL	BRN-YEL	3-1	19	BRN-YEL	ORN
BZ LP	L2(c)		YEL-BRN	YEL-BRN	YEL-BRN	3-2	44	YEL-BRN	BLK
R-R1	RR		SLT-YEL	SLT-YEL	SLT-YEL	3-4	20	SLT-YEL	GRN
B-B1	RT		YEL-SLT	YEL-SLT	YEL-SLT	3-5	45	YEL-SLT	BLK
EXCLUDED CIRCUIT	R	ER	BLU-VIO(e)	BLU-VIO(e)	---	3-6	21	BLU-VIO	BRN
	T	ET	VIO-BLU(e)	VIO-BLU(e)	---	3-7	46	VIO-BLU	BLK
	A1	EB	ORN-VIO(e)	ORN-VIO(e)	---	3-9	22	ORN-VIO	SLT
	A	EH	VIO-ORN(e)	VIO-ORN(e)	---	3-10	47	VIO-ORN	BLK
SPEAKER PHONE	R1	R	GRN-VIO(e)	GRN-VIO(e)	---	3-3	23	GRN-VIO	BLU
	T1	RR(c)	VIO-GRN(e)	VIO-GRN(e)	---	3-8	48	VIO-GRN	YEL
	P3	ON	BRN-VIO(e)	BRN-VIO(e)	---	4-8	24	BRN-VIO	ORN
	P4	ON1	VIO-BRN(e)	VIO-BRN(e)	---	4-10	49	VIO-BRN	YEL
	LK	L1(c)	SLT-VIO(e)	SLT-VIO(e)	---	4-5	25	SLT-VIO	GRN
	AG	N	VIO-SLT(e)	VIO-SLT(e)	---	4-7	50	VIO-SLT	YEL

NOTE: Small letters in parentheses refer to "NOTES" on page 2-9, 2-10

K564()30 with 3-Color Conductors

CKT. FEAT.		LEAD DESIG.	840 MOUNTING CORD (34-CONDUCTOR)	CONN. BLOCK	CABLE (b)
			CONDUCTOR COLOR	TERM. NO.	PAIR COLOR
LINE	R	1R	RED	1-1	BLU
	T	1T	GRN	1-2	WHT
	A1	1B	YEL	1-4	ORN
	A	1H	BLK	1-5	WHT
1	L	1L	WHT-SLT-YEL	4-1	GRN
	LG	LG	WHT-SLT-BLK	4-2	WHT
LINE	R	2R	BLU	1-6	BRN
	T	2T	WHT	1-7	WHT
	A	2H	WHT-BRN-GRN	1-10	SLT
	L	2L	WHT-SLT-BLU	4-4	WHT
LINE	R	3R	WHT-BRN-YEL	1-3	BLU
	T	3T	WHT-BRN-BLK	1-8	RED
	A	3H	WHT-BRN	2-2	ORN
	L	3L	WHT-SLT	4-5	RED
LINE	R	4R	WHT-RED-GRN	2-4	GRN
	T	4T	WHT-RED-YEL	2-5	RED
	A	4H	WHT-RED-BLU	2-7	BRN
	L	4L	WHT-SLT-BRN	4-9	RED
LINE	R	5R	WHT-RED	2-9	SLT
	T	5T	WHT-GRN-YEL	2-10	RED
	A	5H	WHT-GRN-BLU	2-8	BLU
	L	5L	BRN	4-3	BLK
PB SIG		SG	WHT-GRN	3-1	ORN
BZ LP		(c) L2	WHT-YEL-BLK	3-2	BLK
R-R1		RR	WHT-YEL-BLU	3-4	GRN
T-T1		RT	WHT-YEL	3-5	BLK
(g)		ER	WHT-BLK-BLU	3-6	BRN
		ET	WHT-BLK	3-7	BLK
		EB	WHT-BLU	3-9	SLT
		EH	SLT	3-10	BLK
-	-	-	-	-	BLU
-	-	-	-	-	YEL
-	-	-	-	-	ORN
-	-	-	-	-	YEL
-	-	-	-	-	GRN
-	-	-	-	-	YEL
-			WHT-BRN-RED	1-9	BRN
-			WHT-BRN-BLU	2-1	YEL
-			WHT-RED-BLK	2-6	SLT
-			WHT-GRN-BLK	2-3	YEL

K564()40 with 3-Color Conductors

CKT. FEAT.		LEAD DESIG.	858 MOUNTING CORD (34-CONDUCTOR)		CONN. TERM. NO.	CONN. CABLE	
			CONDUCTOR COLOR			TERM. NO.	PAIR COLOR
LINE 1	R	1R	RED		1	1	BLU-WHT
	T	1T	GRN		26	26	WHT-BLU
	A1	1B	YEL		2	2	ORN-WHT
	A	1H	BLK		27	27	WHT-ORN
	L	1L	WHT-SLT-YEL		3	3	GRN-WHT
LINE 2	LG	1G	WHT-SLT-BLK		28	28	WHT-GRN
	R	2R	BLU		4	4	BRN-WHT
	T	2T	WHT		29	29	WHT-BRN
	—	(b)	WHT-BRN-RED		5	5	SLT-WHT
	A	2H	WHT-BRN-GRN		30	30	WHT-SLT
LINE 3	L	2L	WHT-SLT-BLU		6	6	BLU-RED
	—	(f)	—		31	31	RED-BLU
	R	3R	WHT-BRN-YEL		7	7	ORN-RED
	T	3T	WHT-BRN-BLK		32	32	RED-ORN
	—	(b)	WHT-BRN-BLU		8	8	GRN-RED
LINE 4	A	3H	WHT-BRN		33	33	RED-GRN
	L	3L	WHT-SLT		9	9	BRN-RED
	—	(f)	—		34	34	RED-BRN
	R	4R	WHT-RED-GRN		10	10	SLT-RED
	T	4T	WHT-RED-YEL		35	35	RED-SLT
LINE 5	—	(b)	WHT-RED-BLK		11	11	BLU-BLK
	A	4H	WHT-RED-BLU		36	36	BLK-BLU
	L	4L	WHT-SLT-BRN		12	12	ORN-BLK
	—	(f)	—		37	37	BLK-ORN
	R	5R	WHT-RED		13	13	GRN-BLK
LINE 6	T	5T	WHT-GRN-YEL		38	38	BLK-GRN
	—	(b)	WHT-GRN-BLK		14	14	BRN-BLK
	A	5H	WHT-GRN-BLU		39	39	BLK-BRN
	L	5L	BRN		15	15	SLT-BLK
	—	(f)	—		40	40	BLK-SLT
PB SIG	—	—	—		16	16	BLU-YEL
	—	—	—		41	41	YEL-BLU
	—	—	—		17	17	ORN-YEL
	—	—	—		42	42	YEL-ORN
	—	—	—		18	18	GRN-YEL
BZ LP	—	—	—		43	43	YEL-GRN
	—	—	—		19	19	BRN-YEL
	—	—	—		44	44	YEL-BRN
	R-R1	RR	WHT-YEL-BLU		20	20	SLT-YEL
	B-B1	RT	WHT-YEL		45	45	YEL-SLT
(g)	—	ER	WHT-BLK-BLU		21	21	BLU-VIO
	—	ET	WHT-BLK		46	46	VIO-BLU
	—	EB	WHT-BLU		22	22	ORN-VIO
	—	EH	SLT		47	47	VIO-ORN
	—	—	—		23	23	GRN-VIO
—	—	—	—		48	48	VIO-GRN
	—	—	—		24	24	BRN-VIO
	—	—	—		49	49	VIO-BRN
	—	—	—		25	25	SLT-VIO
	—	—	—		50	50	VIO-SLT

K565()40 with 50-Conductor Cord

CKT. FEAT.		LEAD DESIG.	857 MOUNTING CORD (50-CONDUCTOR)		CONN. TERM. NO.	CONN. CABLE	
			CONDUCTOR COLOR (A)			TERM. NO.	PAIR COLOR
LINE 1	R	1R	BLU-WHT	1	1	BLU-WHT	
	T	1T	WHT-BLU	26	26	WHT-BLU	
	A1	1B	ORN-WHT	2	2	ORN-WHT	
	A	1H	WHT-ORN	27	27	WHT-ORN	
LINE 2	L	1L	GRN-WHT	3	3	GRN-WHT	
	LG	1LG	WHT-GRN	28	28	WHT-GRN	
	R	2R	BRN-WHT	4	4	BRN-WHT	
	T	2T	WHT-BRN	29	29	WHT-BRN	
LINE 3	-	(b)	SLT-WHT	5	5	SLT-WHT	
	A	2H	WHT-SLT	30	30	WHT-SLT	
	L	2L	BLU-RED	6	6	BLU-RED	
	LG	2LG	RED-BLU	31	31	RED-BLU	
LINE 4	R	3R	ORN-RED	7	7	ORN-RED	
	T	3T	RED-ORN	32	32	RED-ORN	
	-	(b)	GRN-RED	8	8	GRN-RED	
	A	3H	RED-GRN	33	33	RED-GRN	
LINE 5	L	3L	BRN-RED	9	9	BRN-RED	
	LG	3LG	RED-BRN	34	34	RED-BRN	
	R	4R	SLT-RED	10	10	SLT-RED	
	T	4T	RED-SLT	35	35	RED-SLT	
LINE 6	-	(b)	BLU-BLK	11	11	BLU-BLK	
	A	4H	BLK-BLU	36	36	BLK-BLU	
	L	4L	ORN-BLK	12	12	ORN-BLK	
	LG	4LG	BLK-ORN	37	37	BLK-ORN	
LINE 7	R	5R	GRN-BLK	13	13	GRN-BLK	
	T	5T	BLK-GRN	38	38	BLK-GRN	
	-	(b)	BRN-BLK	14	14	BRN-BLK	
	A	5H	BLK-BRN	39	39	BLK-BRN	
AUX SIGS	L	5L	SLT-BLK	15	15	SLT-BLK	
	LG	5LG	BLK-SLT	40	40	BLK-SLT	
	1		BLU-YEL	16	16	BLU-YEL	
	2		YEL-BLU	41	41	YEL-BLU	
HOLD LAMP	(c) 3		ORN-YEL	17	17	ORN-YEL	
	4		YEL-ORN	42	42	YEL-ORN	
	HL		GRN-YEL	18	18	GRN-YEL	
	HLG		YEL-GRN	43	43	YEL-GRN	
PB SIG.	SG		BRN-YEL	19	19	BRN-YEL	
	BZ LP	(c) L2	YEL-BRN	44	44	YEL-BRN	
	R-R1	RR	SLT-YEL	20	20	SLT-YEL	
	B-B1	RT	YEL-SLT	45	45	YEL-SLT	
* R	ER		(e)BLU-VIO	21	21	BLU-VIO	
	T	ET	(e)VIO-BLU	46	46	VIO-BLU	
	A1	EB	(e)ORN-VIO	22	22	ORN-VIO	
	A	EE	(e)VIO-ORN	47	47	VIO-ORN	
** R1	R		(e)GRN-VIO	23	23	GRN-VIO	
	T1	(c) RR	(e)VIO-GRN	48	48	VIO-GRN	
	P3	ON	(e)BRN-VIO	24	24	BRN-VIO	
	P4	ON1	(e)VIO-BRN	49	49	VIO-SLT	
LK	(c) L1		(e)SLT-VIO	25	25	SLT-VIO	
	AG	N	(e)VIO-SLT	50	50	VIO-SLT	

NOTES:

- Colors are designated, body first stripe second.
- Spare conductors, tape and store in telephone.
- Terminal on telephone network.
- Auxiliary term strip in telephone.
- Exclusion and speakerphone leads not associated with these features, must be disconnected, taped and stored in telephone set when two or more sets are connected in multiple through bridging adaptors.
- Terminals 28, 31, 34, 37 and 40 are strapped on the mounting cord connector.
- These terminals are not used except when the telephone is modified to install an exclusion switch.
- If Superior Cable Co. No. 25 x 24 ICRS "Ring Stripe" Cable is used, colors designated become a two color combination, I.E. BLU-WHT, WHT-BLU, ORN-WHT, WHT-ORN etc. The first color is the body and the second the "ring stripe".

TABLE 2-3 (PART II)
CONNECTION CHART
K564 AND K565 KEY TELEPHONE SET
LS-10352()113
(EARLY K-1A2 SYSTEMS)

CIRCUIT DESCRIPTION

1. PURPOSE OF CIRCUIT

This circuitry consists of "plug-in" printed circuit type assemblies incorporating both electro-mechanical (miniature relay) and solid state (transistors, diodes, etc.) components to provide the means for: (a) signaling subscriber stations on any of a maximum of six CO or PBX lines, (b) holding these lines (c) indicating by means of visual signals whenever the lines are called, held, or busy (d) originating and holding outgoing calls, (e) a manual or dial selective intercommunicating line between subscribers stations, (f) interrupted voltages necessary for lamp flashing, lamp winking, and interrupted ringing, and (g) timeout of locked-in signals after incoming calls are abandoned. The equipment is arranged so that the CO or PBX line circuits, the manual intercommunicating line circuits, and the signal interrupter are furnished on a plug-in basis.

2. WORKING LIMITS

DC voltage for relays, solid state circuits, battery feed circuits and station audible signals (Buzzers) is 20 to 26 volts. AC voltage for station lamps and interrupter motor is 9 to 11 volts. AC voltage for station audible signals (buzzers) is 20 volts or (ringers) is 75 to 105 volts 20 to 30 cps. Loop resistance to a distant CO or PBX is in accordance with maximum loop design of that equipment.

3. FUNCTIONS

This circuit provides for:

- a. Flashing visual signals on incoming calls.
- b. Audible signals for incoming calls.
- c. Timeout of locked-in circuits on unanswered and abandoned incoming calls.
- d. Steady visual signals while a station of the key telephone system makes a line busy.
- e. Holding lines.
- f. Winking or steady visual signals to indicate a held line.
- g. Removing the hold condition when a station of the key telephone system again seizes

the line or when the line is momentarily opened.

- h. Bridging a station audible ringer across the CO or PBX line.
- i. Operation of the CO or PBX line under local power failure conditions.
- j. Talking battery for stations interconnected by the manual intercommunicating line.
- k. Busy lamp indication at stations when the manual intercommunicating line is in use.
- l. Connections to talking battery for the stations when interconnected by the dial intercommunicating line.
- m. Connection to a maximum of nine dial codes for selecting stations on the dial intercommunicating line and operation of the associated signals.
- n. Operating the audible signal on the dial intercommunicating line once for a period of 1 to 3 seconds.
- o. Busy lamp indication of station when the dial intercommunicating line is in use.

4. CONNECTING CIRCUITS

When this circuit is listed in the equipment specification sheet the connecting information thereon is to be followed. The following are additional typical connecting circuits:

- a. Standard line circuits of dial or manual central offices.
- b. Standard PBX line circuits.
- c. Power Supply circuits.
- d. Circuits of the K1A1()961 Key Telephone System, 210170()68.
- e. Circuits of the K301()963 and K311()963 Key Service Units, 210603()68.
- f. Circuits of the K6A()961 Key Telephone System, 210514()68.
- g. Circuits of the K564 and K565 Key Telephone Sets, 21545 and 21546 respectively.
- h. Circuits of the K632 Type Key Telephone Set, 210613()68.




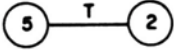
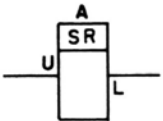


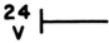

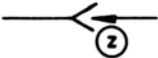

SECTION 3

5. DESCRIPTION OF OPERATION

Parts of the following description of circuits are illustrated through the use of functional schematics (FS). They are compiled from schematic diagrams and connection charts and depict performance of components associated together for a particular function. The functional schematics are circuit diagrams representing a portion of a circuit that provides a specific function, in simplified form,

completely disregarding boundaries of conventional circuit schematics. Free use is made of the detached-type relay contact symbols. The operating path of relays and other components are shown completely from battery to ground. The use of these aids simplifies pinpointing of troubles, since a failure may be localized to a specific area. This circuit description and its associated circuit schematic should be freely used as reference in connection with the functional schematics.

SYMBOLS

	Functional operation path. (FS-1 through FS-4 only)
	Printed circuit card and connector terminal number.
	Modular key telephone unit terminal designation.
	Interwiring lead designation.
	Relay coil, including designation and terminal No. (SR-slow release coil.)
	Relay contact operated, designation above, spring set number and form below.
	Relay released (normal), designation above, spring set number and form below.
	24 volt (nominal) dc battery.
	Battery or AC ground.
	Optional wiring, with option symbol.
	Modular key telephone unit.

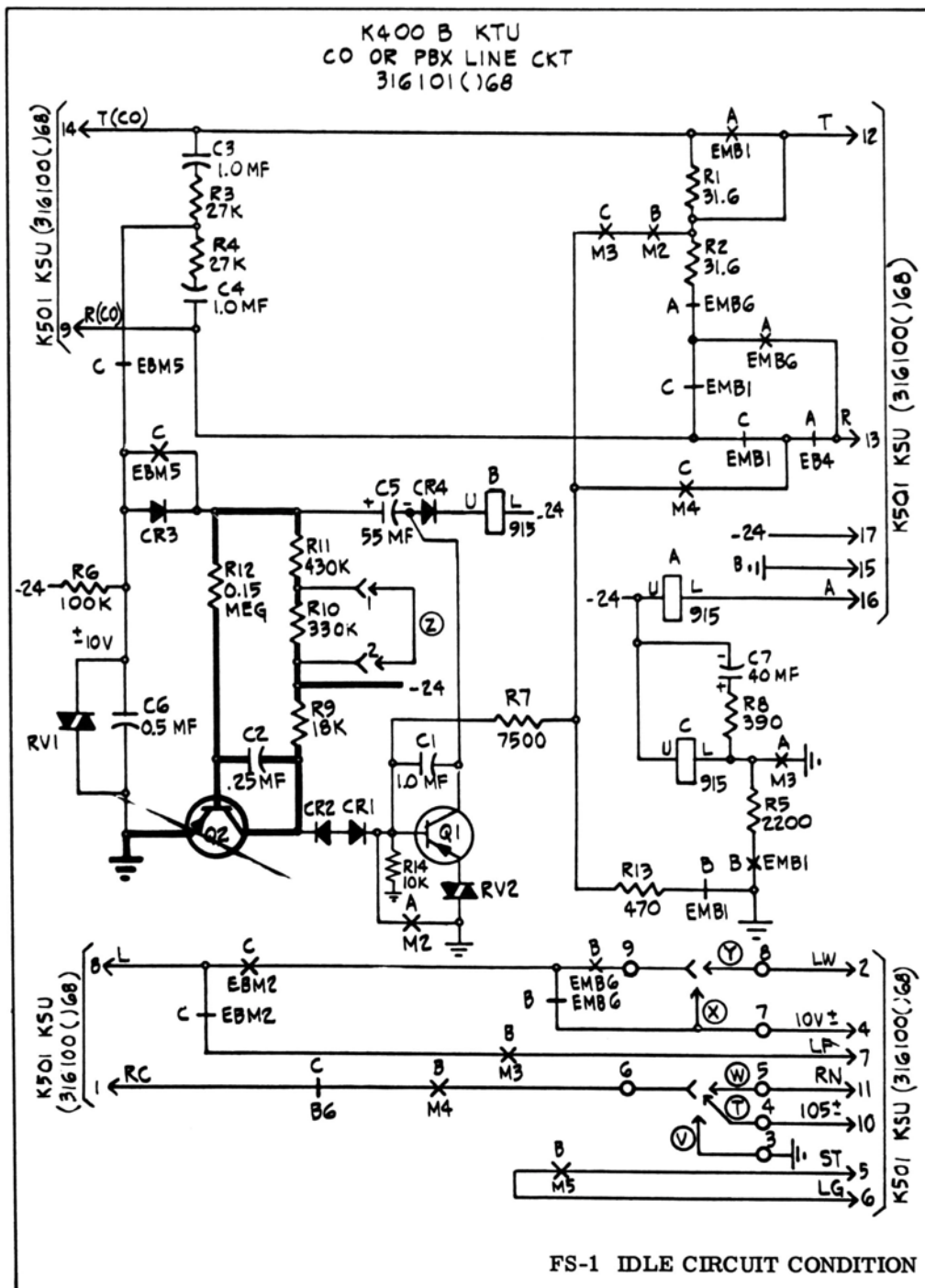
6. CO OR PBX LINE CIRCUIT (CIRCUIT 316101 () 68)

6.1 Incoming Call

6.1.1 Signaling

6.1.1.1 Incoming Signal

When an idle circuit condition exists, all relays are in an unoperated condition and transistor Q1 is in a nonconducting (cutoff) state due to the fact forward bias is blocked by zener diode CR1. Direct current is supplied to the base of transistor Q2 through resistors R10, R11 and R12. This base circuit current normally maintains this point at approximately -4 volts and keeps the transistor in the conducting (on) state. (See FS-1).



SECTION 3

When ringing current is applied to the connecting line, the ac component flows through either capacitor C3 and resistor R3 or capacitor C4 and R4, the EMB5 contacts of relay C, varistor RV1 and to earth ground. The voltage limiting action of varistor RV1 limits the peak signal voltage to approximately 10 volts at the input to varistor RV1. Diode CR3 rectifies the ac signal voltage passing the positive half cycles to the positive side of capacitor C5 to increase its charge to a point where it becomes sufficiently positive to shunt the base current of transistor Q2. Capacitor C2 increases the switching time of the transistor so that it does not cut off immediately. This delay added to the time required to charge capacitor C5, provides protection against false operation of the ringup circuit on disconnect or other transients. The reverse bias at the base of Q2 overcomes the original -4 volts forward bias and cuts off transistor Q2. The collector of transistor Q2 will become negative when conduction ceases. This negative potential is applied to the base of transistor Q1 through diodes CR2 and CR1. Diode CR1 is a zener - type diode that breaks down on approximately 6.2 volts. Transistor Q1 now forward biased will conduct (turn on) and cause relay B to operate. Relay B operated connects: ground to the "ST" lead through contacts M5; the "L" lead to the "LF" lead through contacts M3 and interrupted (option W) or steady (option T) ringing current or ground (option V) to the "RC" lead through contacts M4, for audible signal control. Ground is connected through resistor R5 to the winding of relay C, but the resulting current flow is insufficient to cause the relay to operate. Transistor Q2 will remain nonconducting and transistor Q1 conducting until the call is either answered or timed out. Capacitor C6 bypasses higher frequency voltages induced into the line or resulting from ac ground potential. It offers protection against false operation of the ringup circuit to 25 volts at 60 cycles. Resistor R6 forms a voltage divider with varistor RV1. Its purpose is to maintain the anode of diode CR3 negative in respect to its cathode so that the diode is back biased. This arrangement isolates the base circuit bias of transistor Q2 from ground through varistor RV1. (See FS-2).

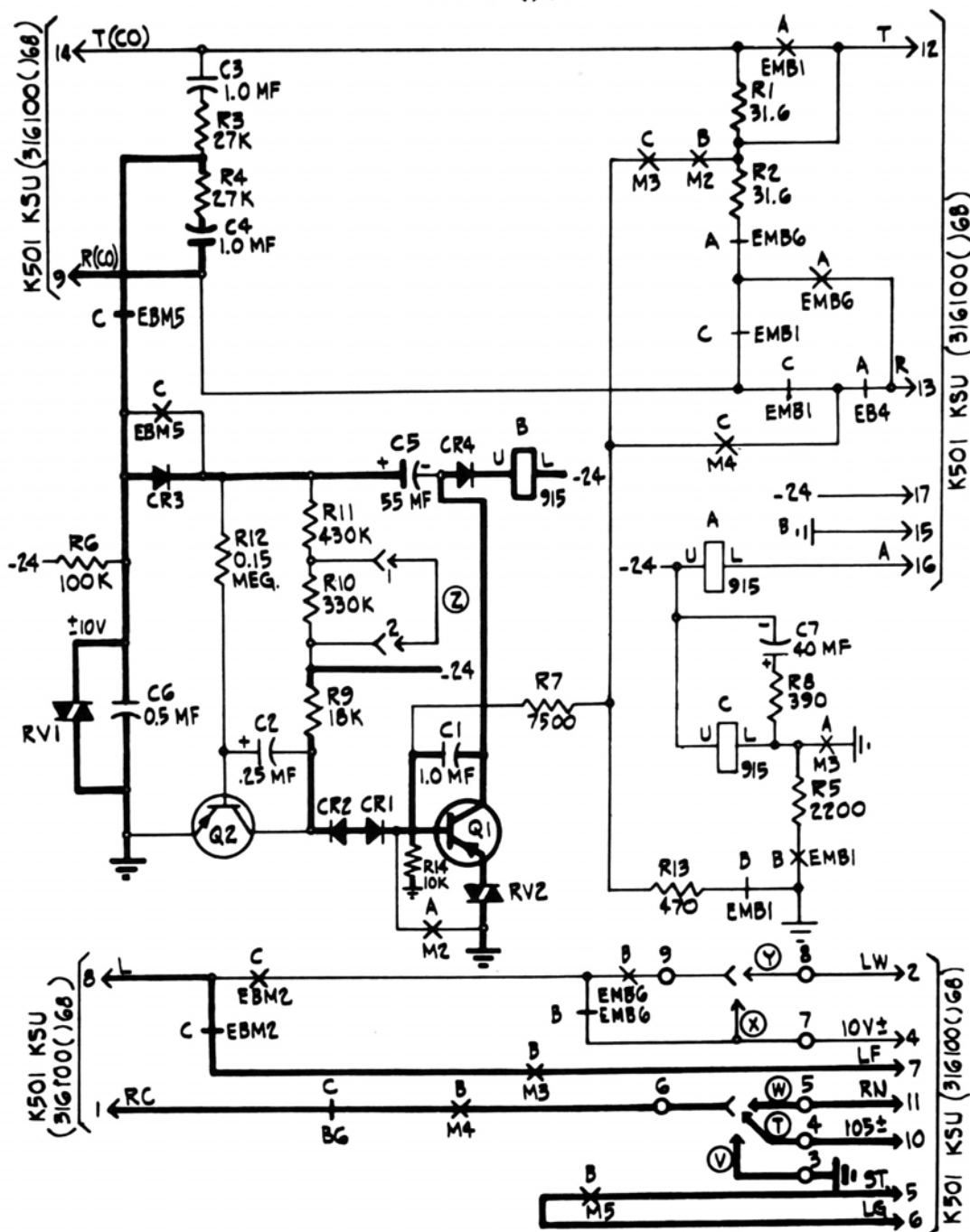
6.1.1.2 Time-Out of Ringup Circuit (Z option not provided).

The potential across capacitor C5, just before transistor Q1 conducts, is approximately 24 volts. The collector of the transistor will change from negative 24 volts to approximately ground when conduction begins. The negative lead of capacitor C5 is also grounded since it is connected to the same point. The potential across the capacitor remains at 24 volts at this time. The difference is that the positive side of the capacitor becomes positive 24 volts when the negative side is grounded. The capacitor will discharge through resistors R11 and R10. Transistor Q2 will remain in the nonconducting state (as described in 6.1.1.1) until the capacitor discharges to a level that will permit sufficient current to flow in the base circuit to cause the transistor to conduct. When an incoming call is signaled with a single ring, the time required to discharge to this level is approximately 26 seconds. Any additional ring received before this level is reached will reset this time to approximately 16 seconds. When the capacitor has sufficiently discharged, transistor Q2 will conduct. The collector will change from negative 24 volts to approximately ground. This removes the negative bias from the base circuit to transistor Q1 causing it to turn off. Relay B will release and the circuit is restored to the idle circuit condition.

6.1.1.3 Time-Out of Ringup Circuit (Z option provided).

This arrangement functions in a manner similar to the arrangement described in 6.1.1.2. The difference is that resistor R10 is shorted, lowering the resistance of the discharge circuit of capacitor C5. This results in shorter discharge times. On incoming calls where one ring is received, the discharge interval is approximately 15 seconds. The discharge time will reset to approximately 9 seconds on any additional ring received before the charge cycle has been completed. Any incoming call which is signaled with machine ringing will time out in approximately 9 seconds after the call is abandoned.

K400 B KTU
CO OR PBX LINE CKT.
316101()GB



FS-2 RINGING CURRENT APPLIED

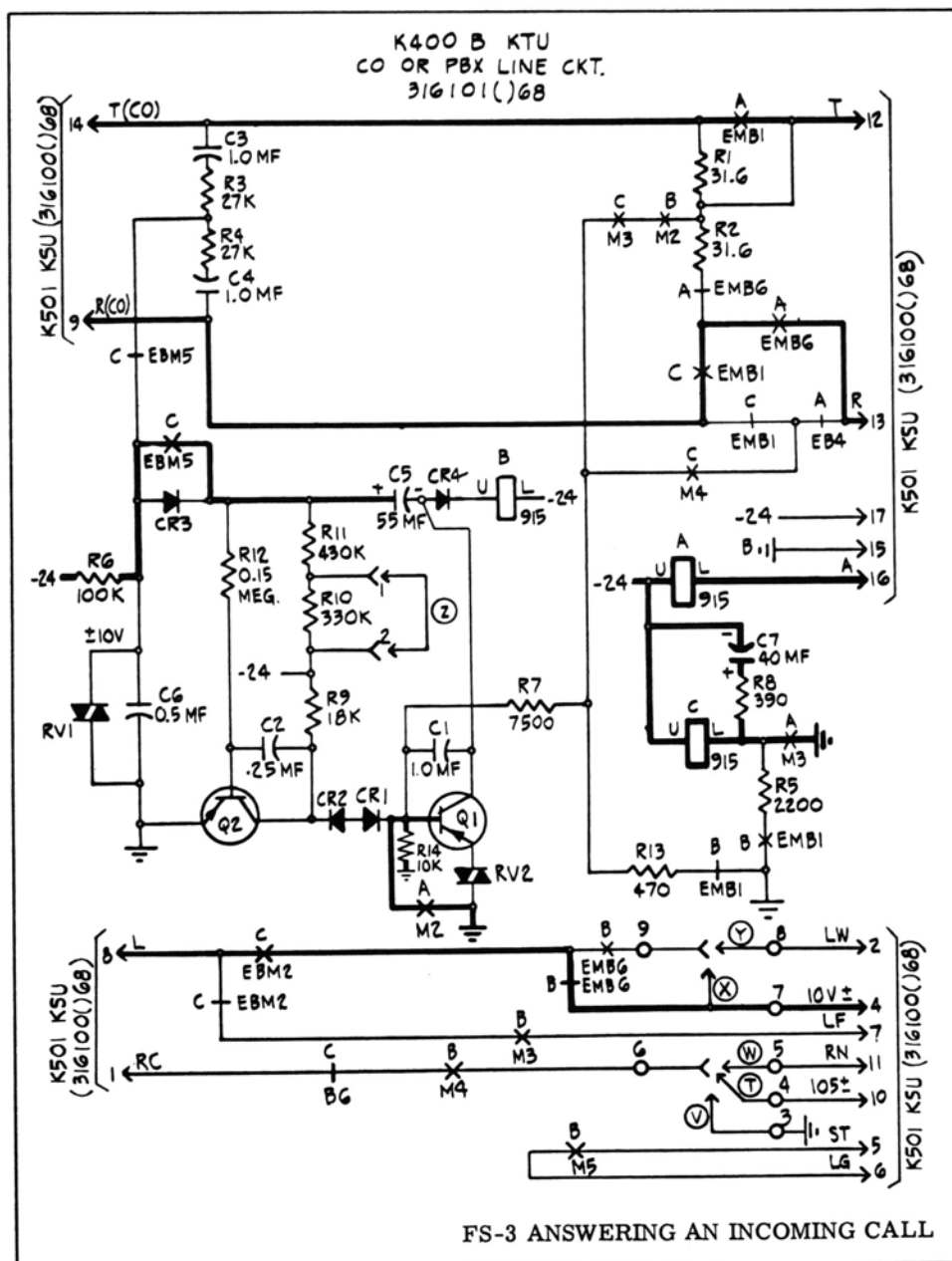
SECTION 3

6.1.2 Answering an Incoming Call

An incoming call is answered by operating the pickup key associated with the line being rung and removing the handset from its mounting. Operation of the set switch connects ground through the pickup key to the "A" lead operating relay A. Relay A operated: prepares the talking path to the CO or PBX through its contacts EMB1 and EMB6; connects ground to the base circuit of transistor Q1 through its contacts M2, causing Q1 to turn off and release relay B and connects ground to the winding of relay C causing it to operate. Relay C operated: completes the talking path through its contacts EMB1; connects the lamp lead through its contacts EBM2 and contacts EBM6 of relay B to the lamp supply for visual signaling; opens the "RC" lead through its contacts B6 to discontinue local audible signaling and provides a discharge circuit for capacitor C5 by connecting the positive lead through its contacts EBM5 to the negative voltage, through resistor R6. (See FS-3).

6.2 Outgoing Call

The procedure for making an outgoing call is the same as that for answering an incoming call except that transistor Q1 will already be in a nonconducting state and relay B will be in the unoperated position.



6.3 Holding

On an answered incoming call or a completed outgoing call, relays A and C are operated. The connection may be placed on "hold" by operating the hold key in a telephone set that is associated with the line to be held. The operated hold key contact opens ground from the "A" lead, causing relay A to release. Relay A released: connects the holding bridge (resistors R1 and R2) across the line through the opening of its contacts EMB1, the back contacts EMB6 and operated contacts EMB1 of relay C; connects the station "R" lead to the base circuit of transistor Q1 through its contacts EB4, contacts M4 of relay C and resistor R7; opens ground from the base lead of transistor Q1 and removes ground from the "L" terminal of Relay C. Relay C is slow to release as a result of the R-C circuit (capacitor C7 and resistor R8) shunted across its winding. A negative voltage existing between resistors R1 and R2 supplies base current through the station shunt to the transistor Q1. The transistor will conduct and relay B will operate. Relay B operated; provides a hold path through its contacts EMB1 for relay C; connects the "LG" lead through its contacts M5, to the "ST" lead to start or continue the signal interrupter operation; connects the "L" lead through its contacts EBM6 and contacts EBM2 of relay C to the "LW" lead (Y option) or to the lamp supply (X option) for visual signaling, and connects the base circuit of transistor Q1, through its contacts M2 and contacts M3 of relay C to the center of the holding bridge (R1 and R2). Release of the hold key will permit the pickup key associated with the held line to disengage and disconnect the telephone circuit from the line. The circuit will remain in this condition until a station connects to the line or the line is opened. (See FS-4).

6.3.1 Release of the Holding Bridge by a Station

Any station of the key telephone system that seizes the line by operating the associated pick-up key, with its handset off hook, will cause relay A to operate over its grounded "A" lead. Relay A operated removes the holding bridge from the line, connects the stations "T" and "R" leads to the line and connects ground to the winding of relay C and to the base of transistor Q1. The circuit is thus restored to a busy condition as described in 6.2.

6.3.2 Release of the Holding Bridge from the CO or PBX

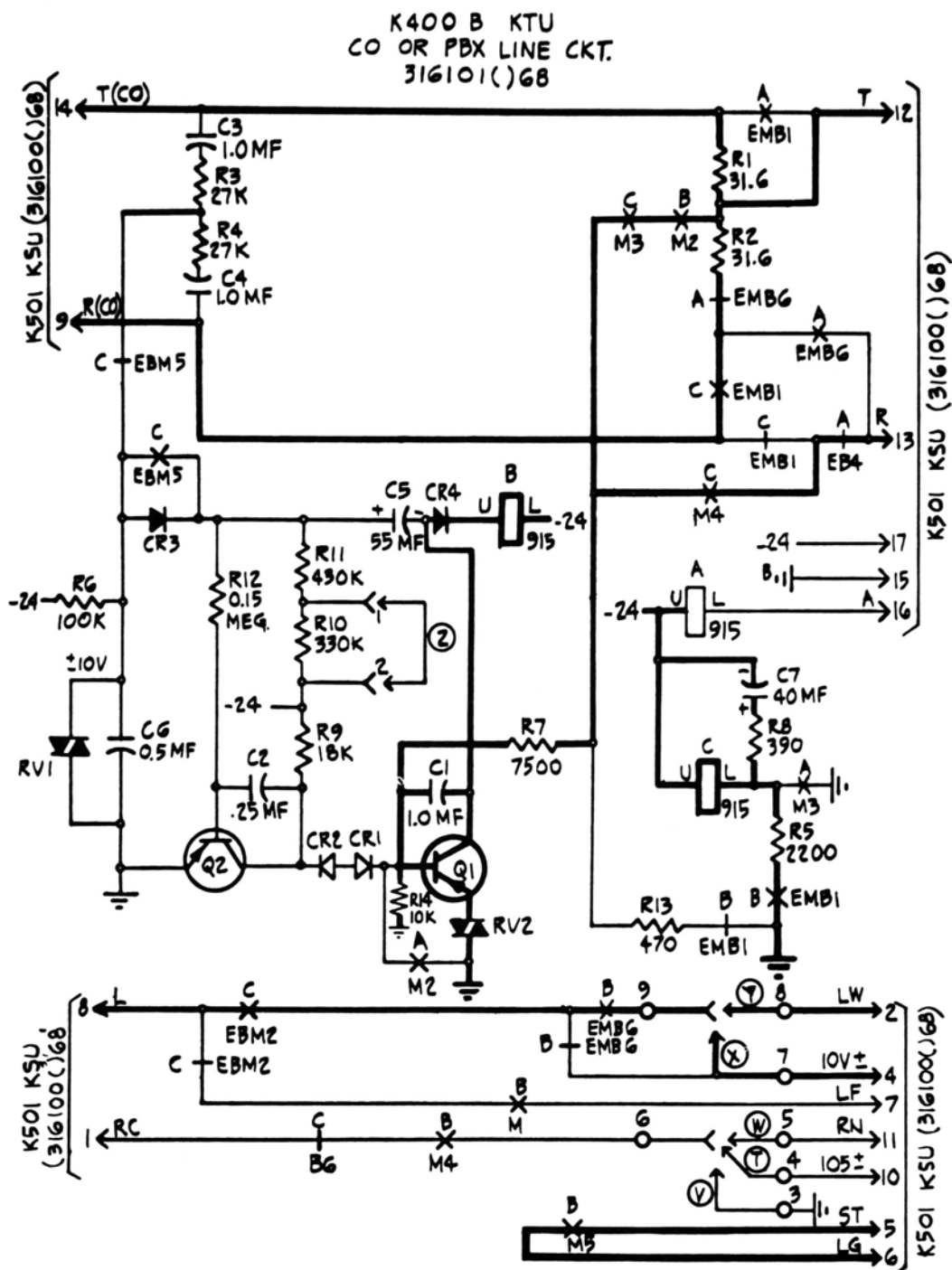
A permanent signal, caused by the hold circuit not being released by a station, can be released from the CO or PBX by opening the line momentarily to remove the negative bias from the base circuit of transistor Q1. This will cause the circuit to return to the idle circuit condition.

6.4 Disconnection

Ground will be removed from the "A" lead when the station disconnects from the line causing relay A to release. The release of relay A opens the holding circuit of relay C causing it to release. The circuit is returned to an idle condition in this manner.

6.5 Operation With Local Power Failure

Outgoing calls can be originated during periods when the local dc supply is inoperative. The station is connected to the line by contacts EB4 of relay A and contacts EMB1 of relay C when the handset is removed from the telephone. Resistor R1 is in series with the station during power failure operation but does not affect the talking circuit. Incoming calls can be signaled by the bridged line ringers in the usual manner. Common audible and separate audible signals will be inoperative since relay B cannot operate.



FS-4 HOLDING A CALL

6.6 Common Audible Signaling

6.6.1 Without Auxiliary Relay Equipment

Common audible signaling may be obtained using options "T" or "W" (K400B KTU, 316101 ()68) by strapping the "R1" terminals on connecting block B (K501 KSU, 316100()68) of stations to be associated with the feature and terminating the strapping to the common audible signal. When this arrangement is utilized, station audible signals if required, must be bridged in the telephone set.

6.6.2 With Auxiliary Relay Equipment

Common audible signaling may be obtained using option V (K400B KTU, 316101()68) and Common Audible Relay Auxiliary Control Circuit (K227A KTU, 316103()68). In this arrangement all "CA" terminals, on connecting block B (K501 KSU, 316100()68) associated with the common audible feature are strapped together and terminated on the K227A KTU, 316103()68. The operation of relay B (K400B KTU, 316100()68) will connect ground through its contacts M4 to operate relay MS (K227A KTU, 316103()68). Relay MS operated, connects either interrupted (Option W) or steady (Option T) ring battery to operate the common audible signal. When this arrangement is utilized, station audible signals if required for stations associated with this feature, must be bridged in the telephone set. Audible signals for stations not associated with this feature may be either bridged at the station telephone or connected to associated R1 terminals on connecting block B (K501 KSU, 316100()68) with options "T" or "W".

7. MANUAL INTERCOMMUNICATING (CIRCUIT 316102 ()68)

Manual intercommunicating line circuit cards can be installed in any of the line connectors of the K501 KSU (316100()68). When a pickup key (associated with one of these lines) is operated and the handset is removed from the telephone, the station is connected to talking battery through the windings of inductor BF and resistors R1 and R2. The resistors serve as current-limiting devices to protect the inductor from excessive current under trouble conditions. Ground is connected to the "A" lead at the telephone set when the set is connected to the line. The grounded "A" lead causes relay A to operate. Contacts EBM2 of the A relay connect the lamp supply to the "L" lead for visual indications of busy conditions. The desired station is manually signaled on equipment separately provided. The called station is connected to talking battery in the same manner as the calling station.

8. SIGNAL INTERRUPTER (CIRCUIT 316100 ()68)

8.1 Operation

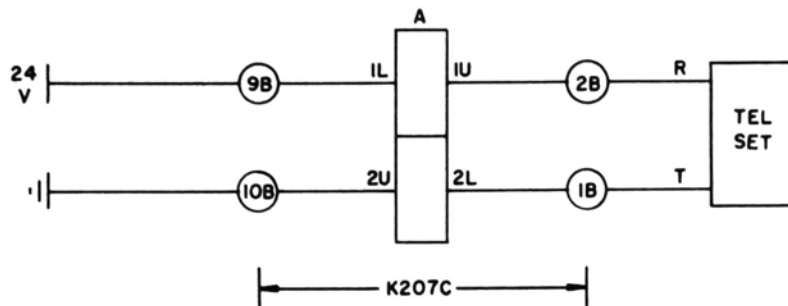
The operation of the B relay of the line circuit connects ground to the "ST" lead. This lead is connected to the motor of the signal interrupter, completing a circuit which causes the motor to start. The motor drives a cam arrangement which operates a group of contacts at different intervals. This provides the necessary interrupted supplies to flash and wink lamps and interrupted ringing for common and separate audible signals. The "LG" lead, connected to the motor control contact, causes the interrupter to continue operating after ground is removed from the "ST" lead. This positions the cam in the home position, at which time the control contact is opened by the cam causing the motor to stop.

SECTION 3

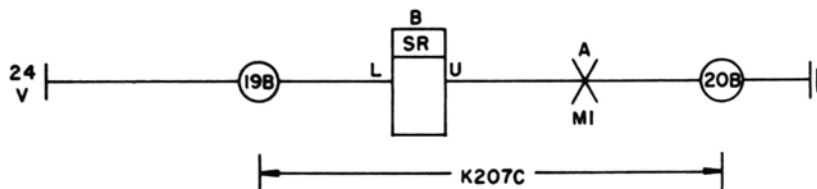
9. DIAL INTERCOMMUNICATING CIRCUIT (CIRCUIT 316104 () 68)

9.1 Line Seizure

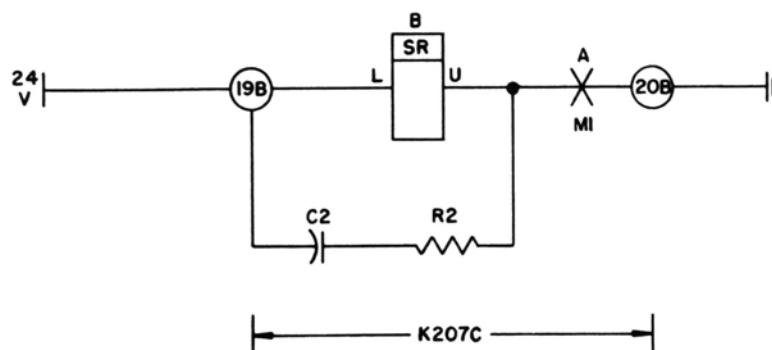
When an intercom call is to be made, the line is seized by operating the pickup key and lifting the handset. This connects the telephone transmission circuit in series with relay (A) and causes it to operate:



The (A) relay in operation, operates relay (B),

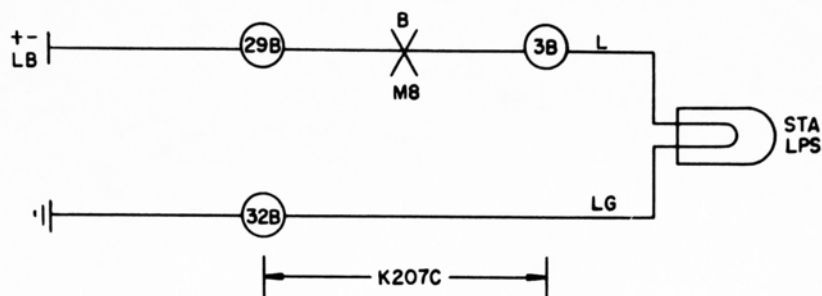


The (A) relay in operation and under control of its contacts M1 also connects the time constant components (R2) and C2 between battery and ground, allowing (C2) to charge so that its charge will assist in holding slow releases relay (B) operated during the dial pulsing period.



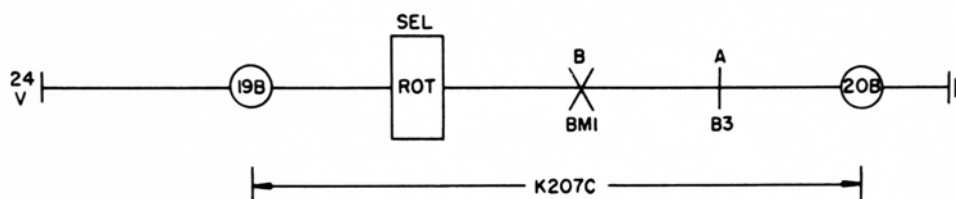
Relay (B) operated:

- Prepares the circuit for stepping the selector in response to dial pulses (through contacts EBM).
- Closes a circuit to light the line lamps (if provided) steadily at all associated stations as a line busy indication,
- Prepares a circuit to connect ring generator or battery to the station audible signal (thru contact M6).

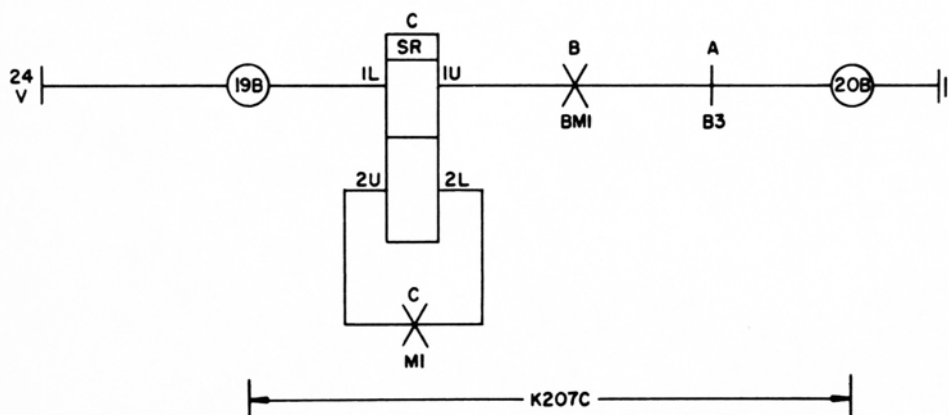


9.2 Station Selection and Signaling

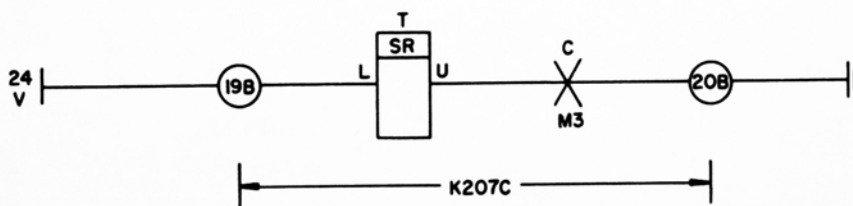
Stations are selected by dialing single digit codes. As the digit is dialed the circuit of the (A) relay is intermittently opened and closed causing the (A) relay to release and reoperate in unison with dial pulses. The slow releasing relay (B) remains operated during pulsing. For the portion of the pulses during which the (A) relay is released, ground is connected under control of contacts BM1 relay (B) to operate the selector stepping magnet, and successive pulses advance the selector in steps corresponding to the number of pulses.



Slow releasing relay (C) also operates on the first dial pulse and remains operated for the duration of the pulse train. The shorted winding constitutes a copper sleeve to make the relay "SR".



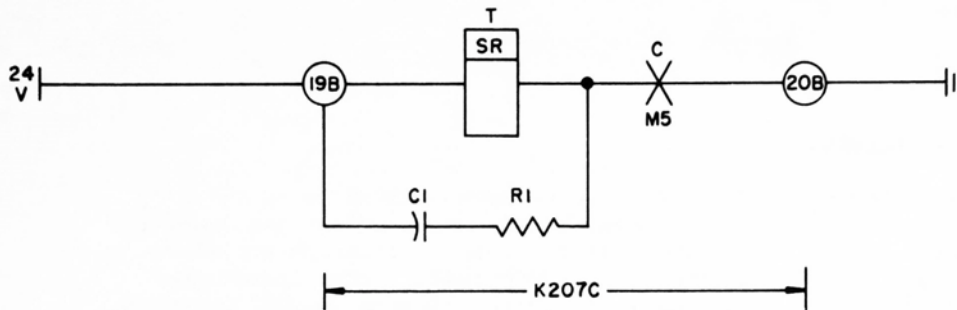
Relay (C) operated, connects ground under control of its contacts M3 to operate slow release relay (T).



SECTION 3

Relay (T) operated,

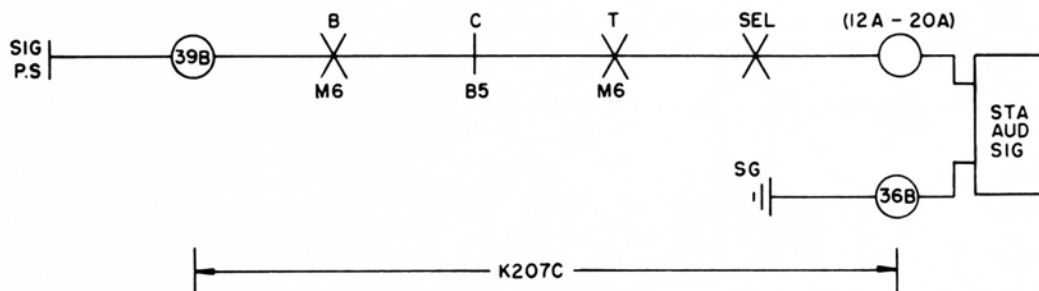
- a. Under control of its contacts M5 connects the time constant components R1 and C1 between battery and ground, allowing C1 to charge so that its charge will hold re-relay (T) operated for approximately 1-1/2 seconds (the duration of the audible signal).



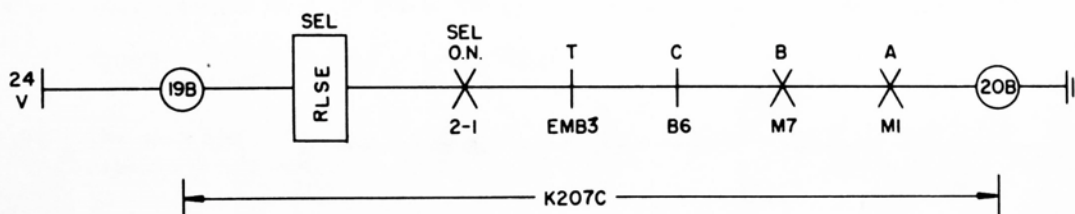
- b. Prepares a circuit under control of its M6 contacts to connect signaling power supply to the station audible signal.

At the conclusion of the pulses, relay (A) is reoperated, opening the ground to the (C) relay, under control of relay (B) contacts BM1 and allowing relay (C) to release.

The release of relay (C) connects signaling power supply under control of relay (B) contacts M6, relay (C) contacts B5, relay (T) contacts M6 and the lower bank of selector, to operate the audible signal at the station called.

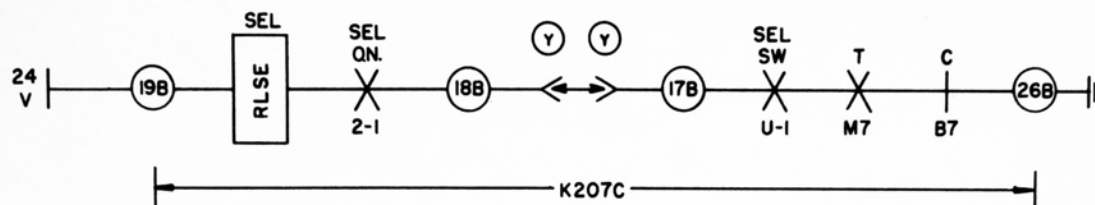


At the end of the audible signaling period, signaling is stopped by the release of relay (T). Relay (T) released connects ground under control of relay (A) contacts M1, relay (B) contacts M7, relay (C) contacts B6, relay (T) contacts EMB3 selector ON switch contacts 1-2 to the selector release magnet, operating it and allowing the selector to return to normal.



9.3 Release of Preliminary Pulse

When the digit one is dialed initially or operates the selector due to handset fumbling on pickup, ground under control of selector ON contacts 2-1, selector position 1 of upper bank, contacts M7 of relay (T) and contacts B7 of relay (C) is connected to the selector release magnet to cause the selector to release and restore to normal.



9.4 Talking

Relays (A) and (B) have previously been operated. When the called station picks up in answer to the signal, a talking connection is established between the calling and the called station. Talking battery for both stations is supplied through the windings of relay (A).

9.5 Disconnection

After both stations disconnect, relay (A) releases and in return releases relay (B). The release of relay (B).

- a. Extinguishes the busy lamps (if provided).

FIG. 1

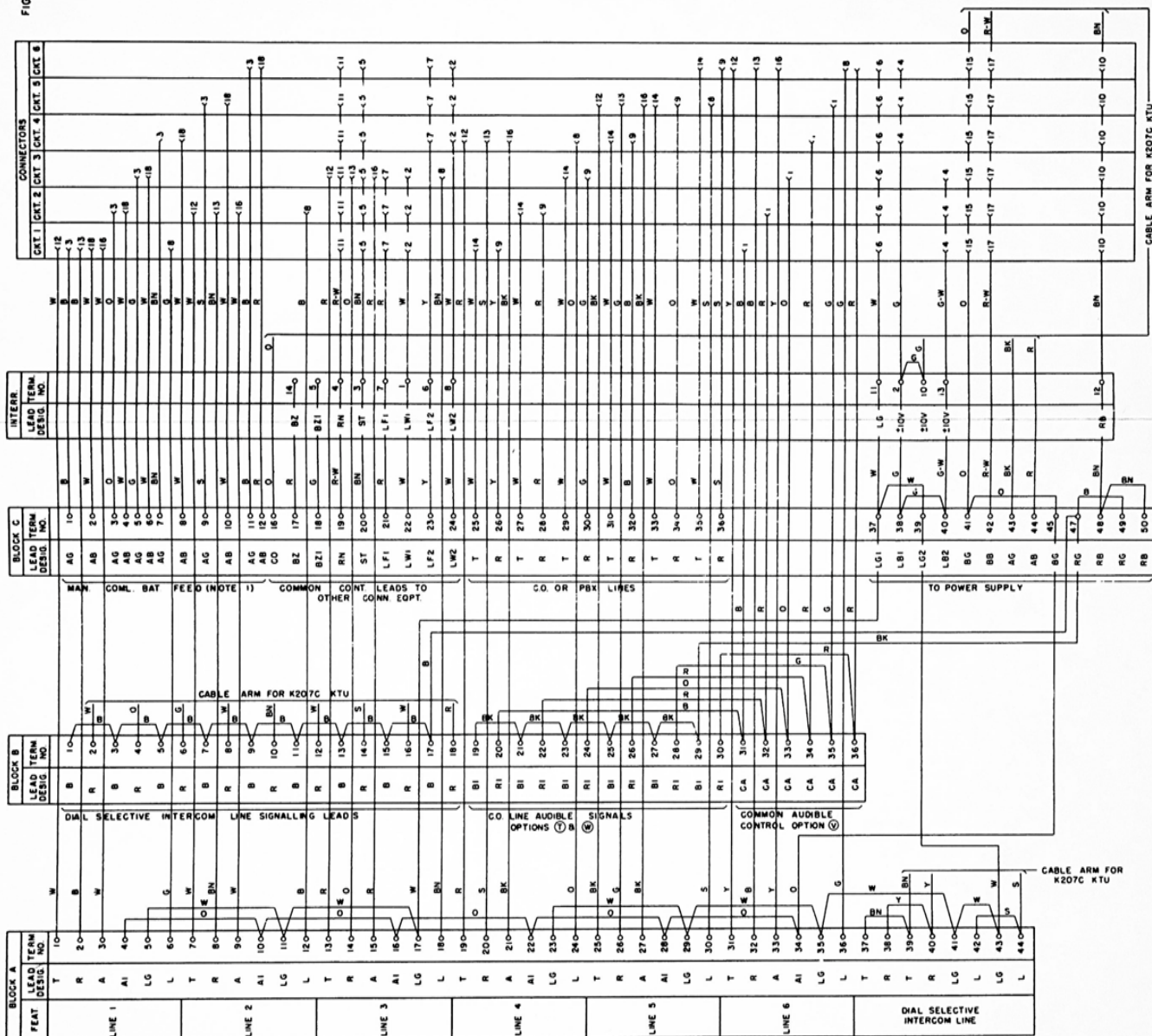
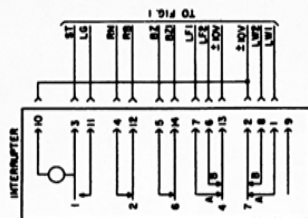


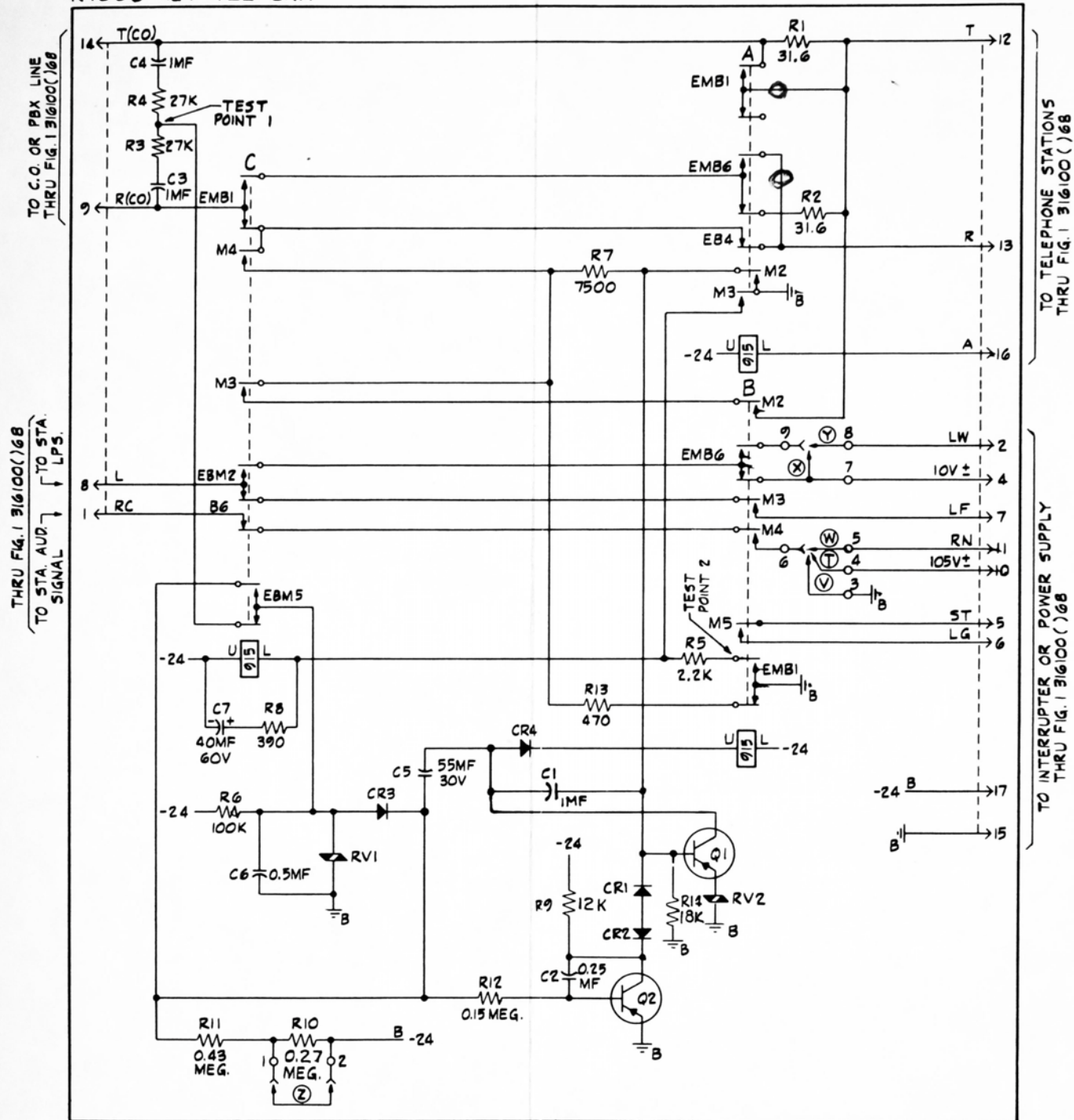
FIG. 2



NOTES:
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K501 KEY SERVICE UNIT WIRING DIAGRAM

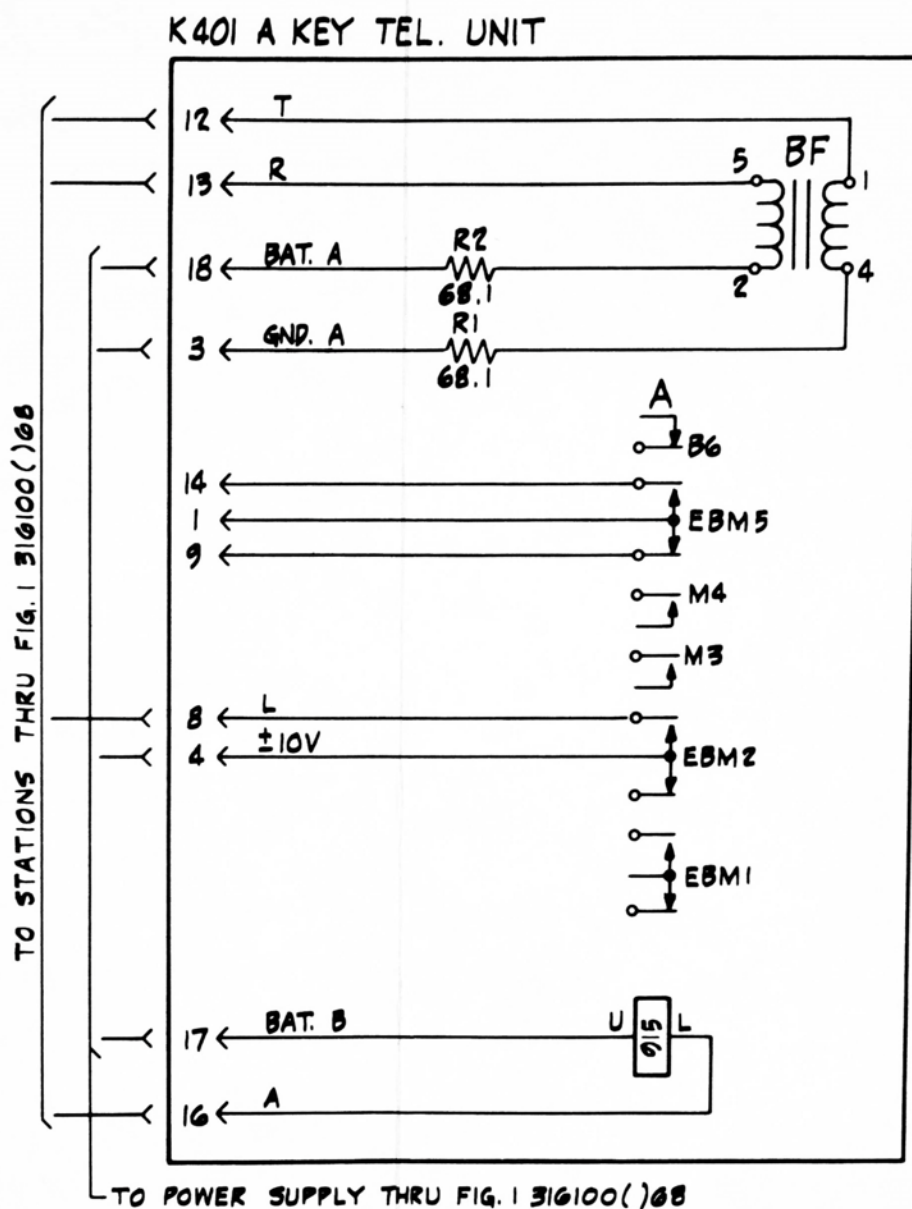
K400B KEY TEL UNIT



NOTES:

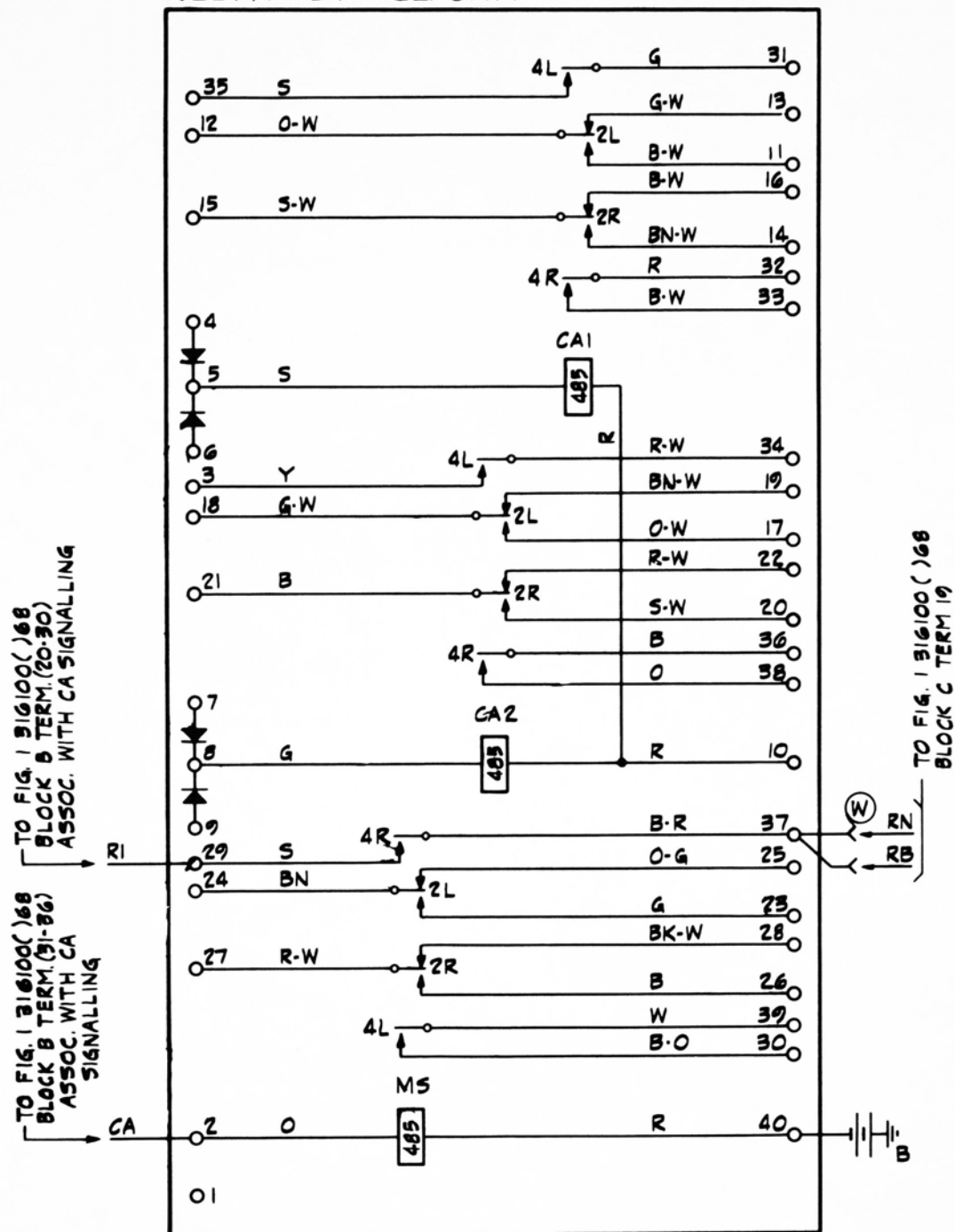
1. OPTIONS - (Z) SHORT TIMEOUT (W) INTERRUPTED AUDIBLE SIGNAL
(X) STEADY HOLD LAMP (T) STEADY AUDIBLE SIGNAL
(Y) WINKING HOLD LAMP (V) COMMON AUDIBLE SIGNAL CONTROL
2. FACTORY WIRED FOR (Z), (Y), & (W) OPTIONS.
3. FOR CKT DESCRIPTION, REFER TO DWG. 316100()77.

C.O. OR PBX LINE CIRCUIT
K400B KEY TEL. UNIT



MANUAL INTERCOM CIRCUIT
K401A KEY TEL. UNIT

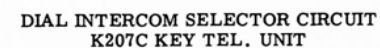
K227A KEY TEL. UNIT



NOTES:

1. THIS CIRCUIT IS NOT PROVIDED WITH K501 K5U. IT MUST BE ADDED BY INSTALLER WHEN REQUIRED.

COMMON AUDIBLE RELAY
AUXILIARY CONTROL CIRCUIT
K227A KEY TEL. UNIT



MAINTENANCE

1. GENERAL

The Key Telephone Units utilized as modular components of the K501 Key Service Unit (KSU) have been designed to provide a high grade of service to the subscriber, thus reducing maintenance effort to a minimum. It is the purpose of this section to provide maintenance personnel with information and aids that are useful in the upkeep of the Key Service Units to a state of the highest performance efficiency.

1.1 Periodic Preventive Maintenance

The frequency of this type of maintenance is determined by the local operating company and is influenced by the environmental conditions surrounding the location of the switching apparatus for the Key Service Units on the subscriber's premises.

Essential factors involved in preventive maintenance are:

- a. A visual inspection to determine that wiring is properly dressed and that terminal screws have not become loosened, and that conductors terminated on connecting blocks have not become broken.
- b. Inspection of power supply fuses.
- c. The removal of any accumulated dust or dirt that might affect component operation. This probability is very slight since all of the KTU's are protected by an overall apparatus cabinet cover. The use of a small portable vacuum cleaner should prove useful in the removal of dust.
- d. Lubrication - The only moving part requiring lubrication is the selector in the K207C KTU which requires the application of a few drops of high grade light machine or clock oil applied on the top of the arm assembly immediately underneath the retaining collar. The frequency of this operation should be such that it occurs at least every six months.
- e. Cleaning - If an inspection of the selector reveals that some tarnishing or collection of dirt on the segment contacts of the selector has occurred, cleaning with an approved liquid contact cleaner such as John B. Moore, Solvent M-3 (Frigisol), applied with a brush or cloth is recommended.

1.2 "On the Site" Trouble Shooting and Repairs

Systematic and regular preventive maintenance schedules should substantially reduce this type of maintenance to the following phases:

- a. A visual inspection to determine possible sources of trouble such as broken wires, loose connections and burned out fuses. In many cases thoroughness in this endeavor will greatly expedite the restoration of normal service to the subscriber.
- b. A system checkout and analysis as outlined in Section 2, may pinpoint the localization of trouble.
- c. A closer analysis of the Key Telephone Unit may be performed with the aid of a Volt-Ohmmeter or other visual or audible trouble shooting device, once the trouble has been localized to a particular KTU.
- d. If tests reveal that some part or component on the K400B or K401A KTU is defective, the entire printed circuit card should be replaced by one that is in good condition and the defective card returned to the shop.

Normally, complete relay replacements are not made in field repairs since it has been determined that it is more economical to change out the KTU having the defective relay. However, if a 4000 type relay coil on the K227A KTU is found to be defective, a replacement coil may be installed "on the job". The armature gap may require slight readjustment; therefore, the gap should be checked (see par. 4.0) and the necessary readjustment made.

If, in the course of the investigation, defective parts such as capacitors, resistors, rectifiers (diodes) etc. are found, they may readily be replaced on the K207C or K227A KTU's by removing the terminal panel assembly on the rear of the KTU, permitting access to the faulty component.

1.3 Shop Maintenance

Shop Maintenance is that phase of the maintenance and service program that is related to the major repairs and servicing of KTU's that are not normally performed in the field. Involved here is the replacement and adjustment of complete relays, selectors etc. on the K207C and K227A KTU's only. In order to promote efficient shop maintenance, an adequate supply of replacement KTU's should be on hand to prevent interruption of subscriber's services. In addition, spare parts may be required to be available on a determined quantity level. See Table 4.2 for list of replacement parts.

It is recommended that defective K400B and K401A KTU's be returned to ITT Telecom for repair and return in any case where the operating company does not have skilled personnel trained in printed circuit repair techniques and the necessary "desoldering" devices required for replacement of components. In the event such skills and devices are accessible,

SECTION 4

replacement parts are listed elsewhere in this section for this purpose. It should be noted that there are no adjustments required for the miniature relays on the printed circuit cards and the plastic covers for these relays should not be removed.

2. MAINTENANCE AIDS

In order to provide thorough and efficient maintenance of the KSU's, the serviceman should have a thorough and workable knowledge of all the circuits involved in the three arrangements and the optional features of the system. This data is included in the manual and is located as follows:

Functional Schematics, Sect. 3
Circuit Schematics, Sect. 3

In addition to the above technical data, the following data pertinent to maintenance is included in the manual and is located as follows:

Relay Adjustment Data, Sect. 4
Replacement Parts Lists, Sect. 4

3. MAINTENANCE TOOLS AND TEST EQUIPMENT

To perform the various adjustments on ITT Telecom 4000 Type and Wire Spring relays, and, in general, to keep the KSU's in proper operating condition, it is necessary to provide the proper maintenance tools and test equipment. As a rule, those who are to maintain the equipment normally possess many of the tools required. The following "specialized" tools are available by ordering through the local ITT Telecom Regional Office or Manufacturers' Representative:

TOOL NUMBER	DESCRIPTION	USE
104()770	Spring Adjuster	4000 Type Relays
105()770	Spring Adjuster	4000 Type Relays
106()770	Spring Adjuster	4000 Type Relays
124()770	Gauge Set	4000 Type Relays
128()770	50 - 0 - 50 Gram Gauge	4000 Type Relays
131()770	Armature Adjuster	4000 Type Relays

Test equipment would normally be limited to a continuity buzzer, volt-ohmmeter and a Current Flow Test Set.

4. RELAY MAINTENANCE

Proper relay maintenance is essential to continued good performance of the switching circuits utilized in the K207 & K227A Key telephone units of the K501 KSU. This maintenance can be divided into three important phases, namely:

1. Periodical Inspection
2. Cleaning

3. Adjustment or Replacement

Each phase is briefly discussed to provide useful information in the performance of these services.

4.1 Periodic Inspection

Properly protected relays generally need little inspection, either visual or by means of gauges, as it is believed that regular routine tests will disclose abnormal relay troubles. However, it is known that dirt and dust are the natural enemies of proper and continued relay performance. Therefore, in such environmental conditions, periodic inspections may be warranted.

4.2 Cleaning

If, due to relay failure or as a result of a periodic inspection, a relay is found to be dirty, it should be properly cleaned. Superficial dust or dirt should be removed by means of a suitable soft brush and collected by means of a linen cloth or a small portable vacuum cleaner. Adjacent relays or other apparatus should be adequately protected.

The contacts should be cleaned with a "camel hair" brush and then slightly burnished with a small piece of "bond" paper. Care should be taken to not bend, distort or damage the springs. No cleaning agent is required for relays.

4.3 Adjustment or Replacement

Two types of relays are used in these key telephone units.

1. 4000 Type Relays (e.g. AA4002(S6)Z)
(K227A KTU)
2. Wire Spring Relays (e.g. 95084-11)
(K207C KTU)

If, during an inspection, a relay is found to have defective or badly bent contact springs, no attempt should be made to straighten same. The relay should be replaced in its entirety.

4.3.1 Adjustment of 4000 Type Relays

Detailed information for routine servicing, adjusting and maintenance of 4000 type relays is thoroughly covered in the following General Information Specifications:

GIS-1000 General Information
GIS-1001 Standard Adjustment

These specifications may be obtained through the nearest ITT Telecom Regional Office or Manufacturers' Representative.

4.3.2 Adjustment of Wire Spring Relays

Wire Spring Relays, due to their unique construction, normally require no adjustment in the field. Since each group of contact springs are fac-

tory pretensioned and will normally retain these characteristics throughout its lifetime, no attempt should be made to apply readjustment to these items.

Should a spring, or set of springs, become damaged or distorted, the entire relay should be replaced and the defective relay returned to the factory through ITT Telecom Regional Offices. In the event that a contact spring has been crossed with another through misuse or mishandling of the relay with the cover removed, it may be replaced by the use of an orange stick. Insert the orange stick under the contact spring and move the spring away from the stationary spring allowing the spring to fall into its proper position in plastic spring comb. Note: In replacing a make spring, it may be necessary to temporarily remove the fixing spring from the contact cover. When misplaced springs are restored to their proper position, the fixing spring should be reinstalled and followed by the cover.

4.4 Relay Adjustment Data

Table 4-1 provides mechanical and electrical relay adjustment characteristics, as well as coil resistance values for the 4000 type relays. The relays are designated by circuit reference and schematic diagram figure number. (See Section 3). Complete

relay part numbers or code numbers are provided in the parts list.

TABLE 4-1
RELAY CHARACTERISTICS

KTU NO. - K227A

CIRCUIT DESIGNATION - MS, CA1 & CA2

COIL RESISTANCE - 485 Ohms

CONTACT PRESSURE - 35 Grams

ARMATURE TRAVEL - .026 In.

OPERATE

Test - .0253 Amp.

Readjust - .0242 Amp.

NON-OPERATE

Test - .0122 Amp.

Readjust - .0128 Amp.

5. SPARE PARTS LIST

Available replacement parts for K1A2 Key Telephone System components are listed in Table 4-2.

TABLE 4-2
REPLACEMENT PARTS LIST

UNIT NUMBER	COMPONENT	PART NUMBER	REMARKS
K501 KSU	Cable Block	86425	Used in pairs
	Connecting Block	95634	Block "A"
	Connecting Block	95743	Block "B" & "C"
	Cable Hook	86423	
	Receptacle	95827	Gate Lock
	Designation Strip	95647-3	
	Connector	95744	Printed Circuit Cards
	Connector	95745	Interrupter
	Card Retainer	86419	
	Interrupter	95742	
	Cover	86434	
	THM Screw	69817	Conn. Block Mtg.
	RHM Screw	58713	95744 Conn. Mtg.
	RHM Screw	56233	Cable Hook Mtg.
	Hex Nut	66435	95744 Conn. Mtg.
	RHM Screw	54855	95745 Conn. Mtg.
	RHM Screw	68959	Cable Block Mtg.
	Stud	79593	Cover Locking
	Retaining Ring	79680	Cover Stud
	RHM Screw	86855	Card Retainer

TABLE 4-2 (Cont.)

UNIT NUMBER	COMPONENT	PART NUMBER	REMARKS
K400B KTU	Card Frame	86854-1	
	Resistor	95747-1	R1 & R2
	Resistor	62948-57	R3 & R4
	Resistor	62948-104	R5
	Resistor	62948-99	R6
	Resistor	62948-130	R7
	Resistor	62948-79	R8
	Resistor	62948-90	R9
	Resistor	62948-103	R10
	Resistor	62948-132	R11
	Resistor	62948-101	R12
	Resistor	62948-110	R13
	Resistor	62948-91	R14
	Diode	95754-1	CR1
	Diode	95552-1	CR2
	Diode	95332-1	CR3 & CR4
	Varistor	95748-1	RV1
	Varistor	95655-1	RV2
	Transistor Spacer	95749-1	
	Transistor	81740-3	Q1
	Transistor	95756-1	Q2
	Capacitor	95544-5	C1, C3 & C4
	Capacitor	95544-3	C2
	Capacitor	95751-1	C5
	Capacitor	95544-4	C6
	Capacitor	95751-2	C7
	Relay	95750-1	B
	Relay	95750-2	C
	Relay	95750-3	A
K401A KTU	Card Frame	86854-1	
	Inductor	95752-1	
	Resistor	95747-2	R1, R2
	Relay	95750-2	A
K207C KTU	Wire Spring Relay	95084-11	A
	Wire Spring Relay	95084-12	C
	Wire Spring Relay	95084-13	B, T
	Capacitor	79700-6	C1, C2
	Resistor	71661-3	R1
	Resistor	64342-13	R2
	Network	79678	N
	Selector	79677-3	SEL
	Term. Mtg. Assy.	82398-2	
	Terminal Screw	70286	
	Mounting Screw	79400-2	
K227A KTU	Relay CA1, CA2, MS	AA4042(S6)7	Adjust per 210514()106 Fig. 22
	Rectifier C2, C3, C4, C5	83777-2	Commercial 1N2070
	Terminal Mtg. Assy.	79631	
	Terminal Screw	70286	
	Mounting Screw	79400-2	

QUANTITY

PART NO.

DWG. NO.

DESCRIPTION

Item No.	Particulars	Amount
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[illegible]

SECTION 5 ADDITIONAL INFORMATION

WIRING CHART FOR ADDITION OF A K216A KTU TO K501 KSU with K207C KTU.

Following are installer wiring instructions for the addition of a K216A Key Telephone Unit to any K501 Key Service Unit previously equipped with a K207C KTU for a nine (9) station Dial Intercom Circuit. The addition of the K216A KTU permits the expansion of the number of dial intercom stations to a maximum of eighteen (18).

K-50109 KSU

On K207C remove strap between terminals 17B and 18B

Remove the following leads from the K207C KTU and rewire them on the K216A KTU

FROM K207C	TO K216A	LEAD DESIGNATION
12A	22	R(22) (Was R(2))
13A	13	R(3)
14A	14	R(4)
15A	15	R(5)
16A	16	R(6)
17A	17	R(7)
18A	18	R(8)
19A	19	R(9)
20A	20	R(0)

Wire the K216A as Follows:

TERM NO.	LEAD DESIGNATION	TO
1	R(1)	K207C-11A
2	R(2)	K207C-12A
3	R(3)	K207C-13A
4	R(4)	K207C-14A
5	R(5)	K207C-15A
6	R(6)	K207C-16A
7	R(7)	K207C-17A
8	R(8)	K207C-18A
9	R(9)	K207C-19A
10	R(0)	K207C-20A
21	R(21)	Block B, Clip 1 Term 38
23	R(23)	" " " " " 40
24	R(24)	" " " " " 42
25	R(25)	" " " " " 44
26	R(26)	" " " " " 46
27	R(27)	" " " " " 48
28	R(28)	" " " " " 50
29	R(29)	Block A, Clip 6 Term 46
30	R(20)	" " " " " 48
31	RL	K207C-15B
32	ON	" 16B
33	SW2	" 2A
34	WI	" 17B
35	W	" 18B
36	J	" 5B
37	STRAP	K216A-38
39	STRAP	K216A-40
	"B" Batt.	K207C-19B

Connect the following "B" leads to RG. Loop wires through clip without cutting. All "B" leads will be common to RG.

FROM	LEAD DESIGNATION	TO
*RG	B(21)	Block B, Clip 1 Term 37
B(21)	B(23)	" " " " " 39
B(23)	B(24)	" " " " " 41
B(24)	B(25)	" " " " " 43
B(25)	B(26)	" " " " " 45
B(26)	B(27)	" " " " " 47
B(27)	B(28)	" " " " " 49
B(28)	B(29)	Block A, Clip 6 Term 45
B(29)	B(20)	" " " " " 47

*Block C, Clip 3, Term 49

THE K107A TELEPHONE LOUDSPEAKER

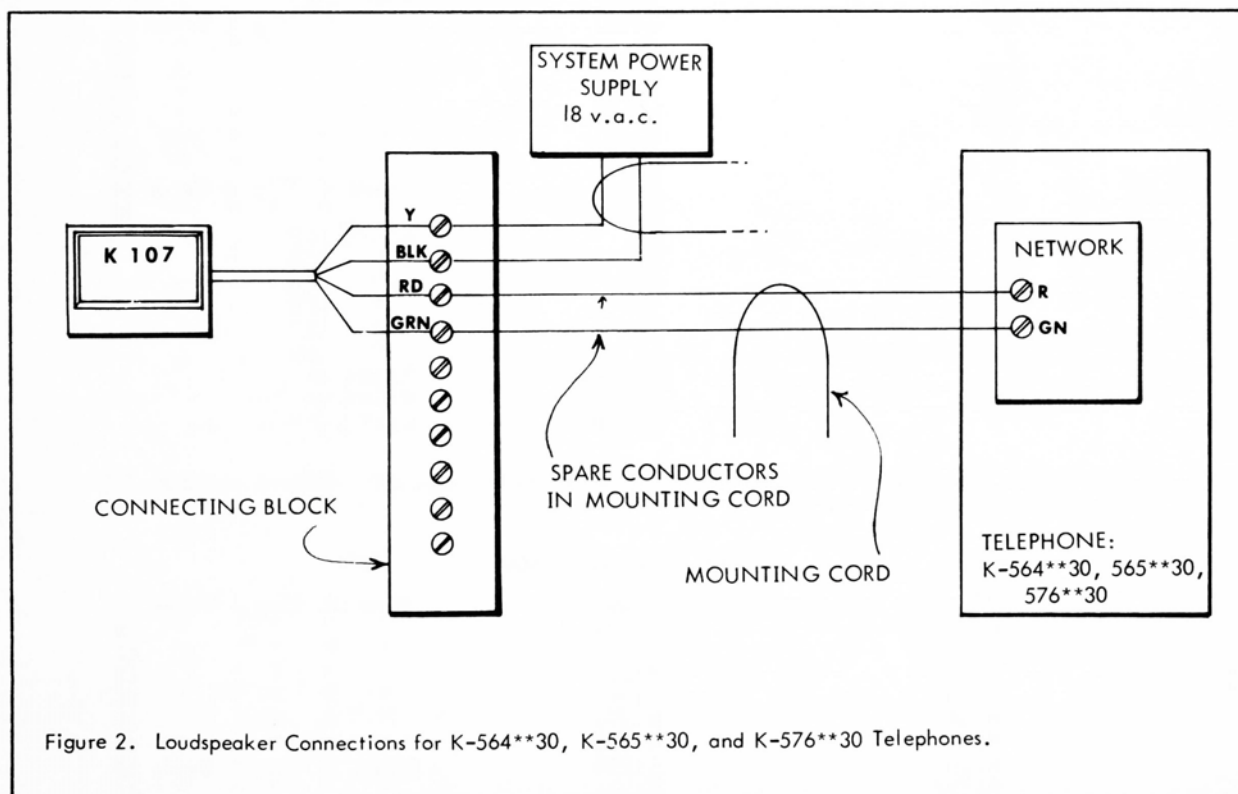
Figure 1. K-107(A) Telephone Loudspeaker

The K-107A loudspeaker is designed for use with a standard telephone set, permitting a group of people to overhear both sides of a telephone conversation. A combination volume control and on-off switch is provided on the front panel. The loudspeaker is encased in a plastic housing available in color and equipped with a 4-conductor 9-foot cord also in color (See Table I). An external power supply of 18 to 22 volts AC or DC is required. Height, 4 inches; width, 5 5/8 inches; depth, 3 3/4 inches.



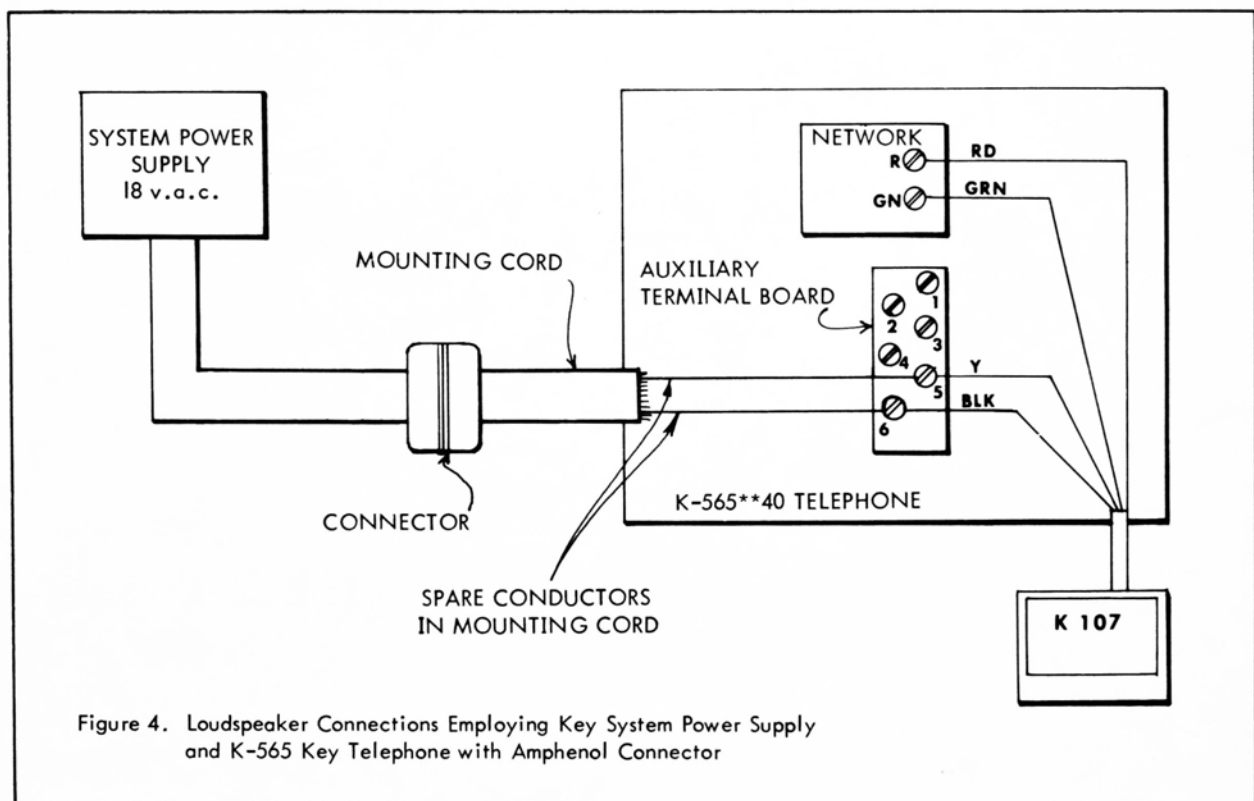
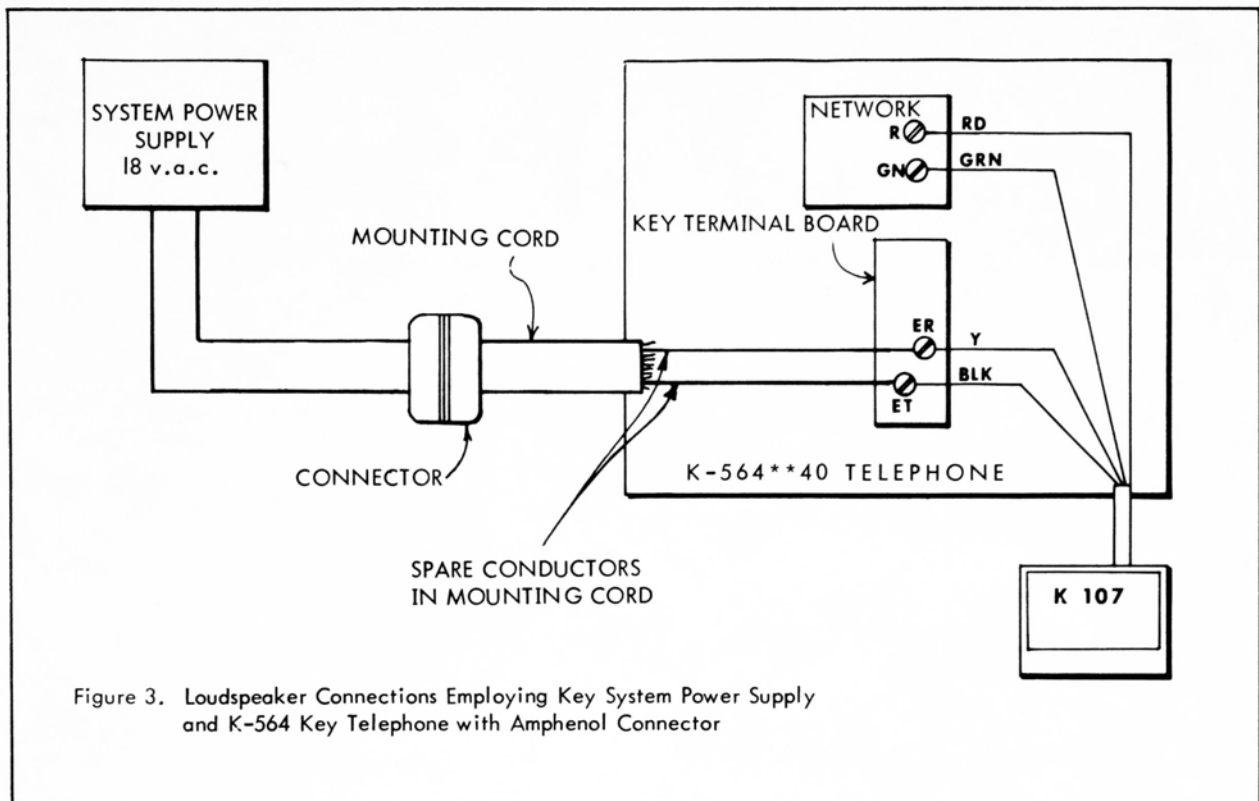
TABLE I. LOUDSPEAKERS AND CORDS IN COLOR

COLOR	LOUDSPEAKER	LOUDSPEAKER CORD	3-CONDUCTOR CORD	6-CONDUCTOR CORD
Green	10705(A)319	305405(25)650	303105(06)650	304405(14)650
Ivory	10709(A)319	305409(25)650	303109(06)650	304409(14)650
Light Beige	10713(A)319	305413(25)650	303113(06)650	304413(14)650
Light Gray	10714(A)319	305414(25)650	303114(06)650	304414(14)650
White	10715(A)319	305415(25)650	303115(06)650	304415(14)650



** Substitute Color Code Number (See Table I)

THE K107 A TELEPHONE LOUDSPEAKER



** Substitute Color Code Number (See Table I)

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