

SERVICE
400-SERIES KEY TELEPHONE UNITS
FOR INTERCOM SERVICES

1. GENERAL

1.01 This section provides schematic information for the 400-series key telephone units (KTUs) which provide talking circuits and control and signaling functions between telephone sets in a 1A2 key telephone system (KTS) (Fig. 1 and 2).

1.02 This section is reissued to:

- Correct Y and Z options for the 478B KTU in Fig. 20
- Add X option for the 478B KTU in Fig. 20
- Add information on the new 494B KTU.

1.03 The following KTUs and their functions are covered in this section:

- 401-Type—Manual Intercom Line Circuit
- 407-Type—Dial Intercom, 10-Code Selector Circuit
- 420A—Long Line Circuit
- 421A—Direct Station Selection (DSS) Circuit or Preset Conference
- 422B—Station Busy Selector Circuit
- 423A—Dial Tone, Busy Tone, and Audible Ringback Tone Circuit for nonmodular panel installations
- 424-Type—Dial Intercom, 19-Code Selector Circuit
- 425-Type—Flashing Lamp Circuit
- 426A—Amplifier, Band Separation, and Limiter Circuit

- 427-Type—Frequency Recognition and Translation Circuit
- 440A (MD)—TOUCH-TONE® Adapter Circuit
- 444-Type—Selector Extender Circuit
- 454-Type—3-Path Access Circuit
- 460-Type—2-Path Access Circuit
- 476A—Dial Tone, Busy Tone, and Audible Ringback Tone Circuit for modular panel installations
- 478B—TOUCH-TONE Adapter Circuit
- 494A—TOUCH-TONE Selector Circuit
- 494B—Rotary and TOUCH-TONE Selector Circuit

1.04 Detailed information on the 626A modular panel (Fig. 3) and its associated KTUs may be found in Section 518-215-421.



The 401-type, 407-type, 424-type, and 494-type KTUs must not be used for multiline conferencing to CO/PBX lines using simultaneous depression of pickup buttons (mashdown conferencing). This can cause damage to the KTUs and violates the Federal Communications Commission (FCC) registration requirements. This restriction does not apply in COM KEY* systems and for 2- and 3-path intercom arrangements (options FW and S) in the 626A modular panel. Add-on

*Trademark of AT&T.

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

conferencing to CO/PBX lines using the 417A KTU is allowed.

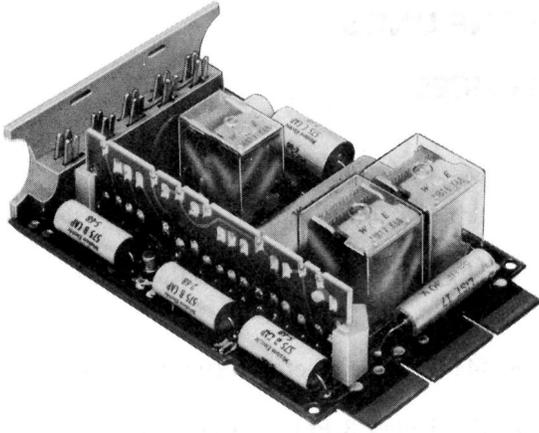


Fig. 1—Typical 4-Inch Key Telephone Unit

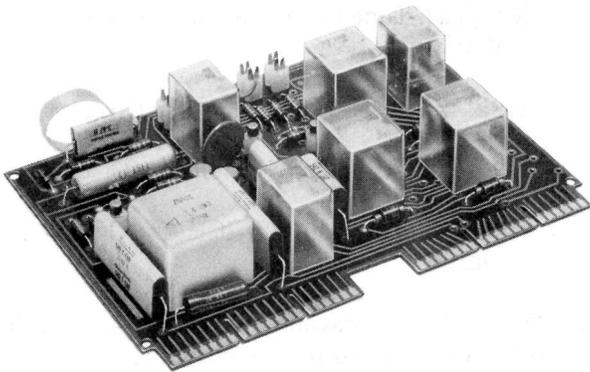


Fig. 2—Typical 8-Inch Key Telephone Unit

1.05 After January 1, 1980, the 401B, 454C, and 460C KTUs must be used when providing their related services. Earlier vintage KTUs may be used for additions and maintenance at grandfathered installations for the life of the units, provided they are not modified.

1.06 Information on line services is covered in Section 518-215-400; auxiliary circuits, Section 518-215-401; and all control circuits including audible signals, Section 518-215-403.

A. Mechanical

1.07 All circuit components on these KTUs are mounted in a plug-in printed wiring board,

one end of which is equipped with contacts. A 4-inch board may have 18, 20, or 40 contacts; an 8-inch board will have 80 contacts (requiring two vertical 40-pin connectors). The circuit boards plug into mating connectors in key service units, panels, or apparatus mountings. Wiring from the connectors will be dedicated or nondedicated leads. Dedicated leads are those that normally appear on the same contacts of all KTUs, such as supply voltages and grounds, and are normally factory wired. Nondedicated leads are those whose designation and function vary and are made available for installer connections. Typical 4- and 8-inch KTUs are shown in Fig. 1 and 2.

B. Electrical

1.08 Functional schematics (Fig. 4 through 21) cover the basic circuitry of each KTU, contacts used, and its relationship to telephone sets, other KTUs, power supplies, and apparatus. Dashed lines are used to simplify the schematics and to indicate intermediate circuitry. If full schematics are required, refer to the SDs listed in paragraph 1.11.

1.09 Voltages required for operation of the KTU, or provided to associated apparatus by the KTU, are shown with their connector pins. Other voltages may appear on the contacts of the mating connector, depending on the mounting arrangement, but not on the KTU.

1.10 The KTUs may require the following power supply voltages and their associated grounds:

- -24 volts (B battery) for control
- -24 volts (A battery) for talking current
- ± 10 volts for visual and audible signals
- ± 105 volts for audible signals.

1.11 This issue of the section is based on the following drawings:

SD-69475-01, Issue 6—401A and 401B KTUs

SD-69567-01, Issue 16—407B (MD) and C, 420A, 422B, 423A and B, 424A (MD), B (MD), and C, 425A (MD) and B, 476A, 494A, and 494B KTUs

SD-69590-01, Issue 3—421A KTU

SD-69595-01, Issue 7—426A, 427B, and C KTUs

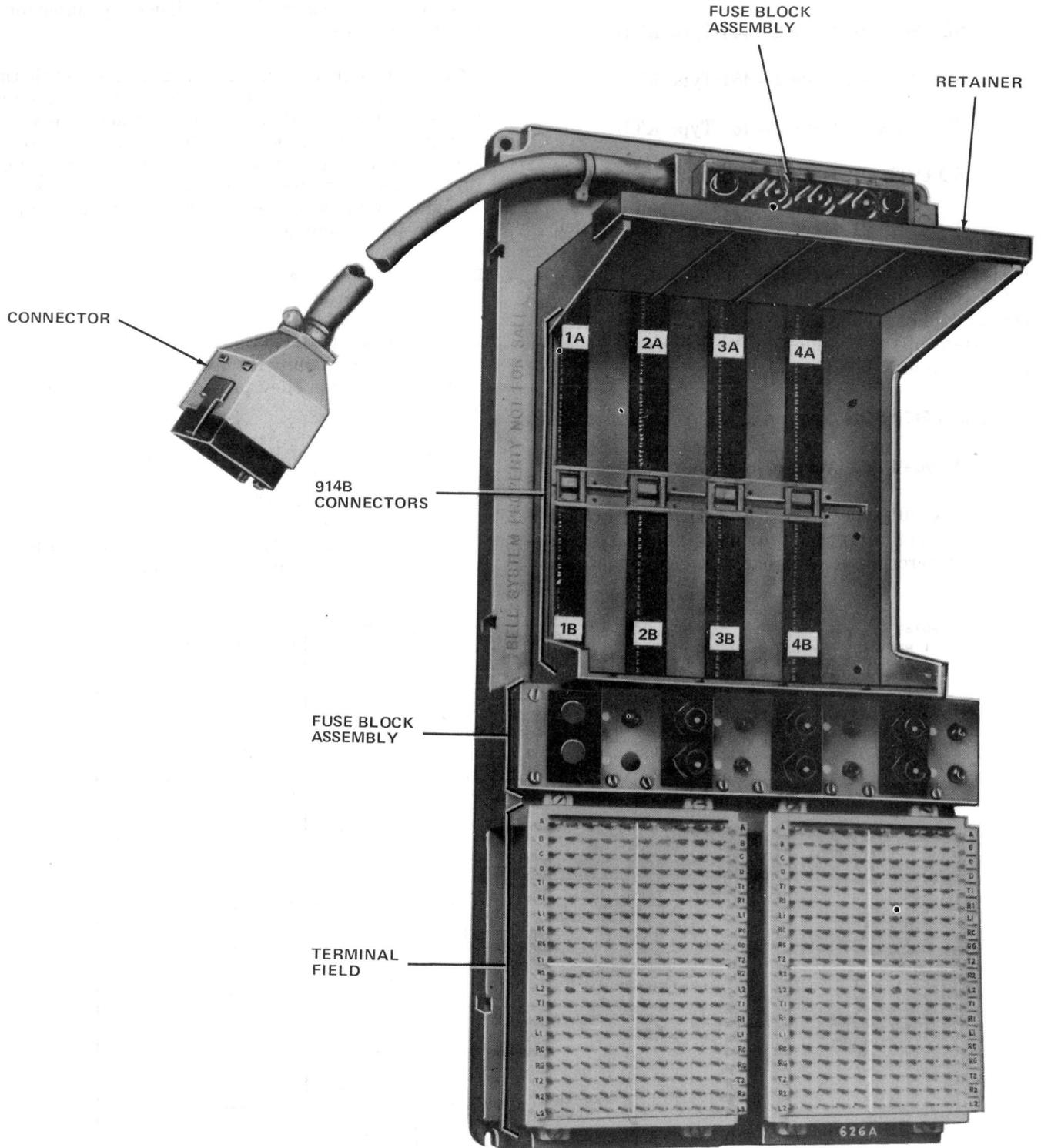


Fig. 3—626A Modular Panel

SD-69906-01, Issue 1—440A (MD) KTU

SD-69653-01, Issue 2—444-Type KTU

SD-69930-01, Issue 1—454-Type KTU

SD-69652-01, Issue 3—460-Type KTU

SD-69931-01, Issue 1—478B KTU

SD-69658-01, Issue 4—626A Modular Panel.

If this section is to be used with equipment or apparatus reflecting later issues of the drawings, reference should be made to the CDs and SDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

A. 401-Type KTUs (Manual Intercom Line Circuit)

2.01 The 401-type KTUs (Fig. 4) are 4-inch, 18-contact units that provide talking battery for manual intercom and control for line busy lamp feature.

ture. Audible signaling between stations is accomplished via separately furnished pushbuttons, buzzers, or bells.

2.02 The A lead of a station associated with the manual intercom circuit provides ground through the operated switchhook contacts to operate a relay on the 401-type KTU. Operation of this relay completes a circuit for the optional busy lamp feature. In addition, the relay provides a spare set of transfer contacts for local engineering use, such as audible signal control.

B. 407B (MD) and 407C KTUs (Dial Intercom, 10-Code Selector Circuit)

2.03 The 407-type KTUs (Fig. 5 and 6) are 8-inch, 80-contact units for use with the dial selective intercom circuits. They provide the following basic operating features:

- Maximum of 10 station codes (0-9)
- Busy lamp at all stations
- Adjustable single spurt signaling (0.5 to 2.5 seconds) by adjusting timing resistor

NOTE:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 18-, 20-, OR 40-PIN CONNECTOR.

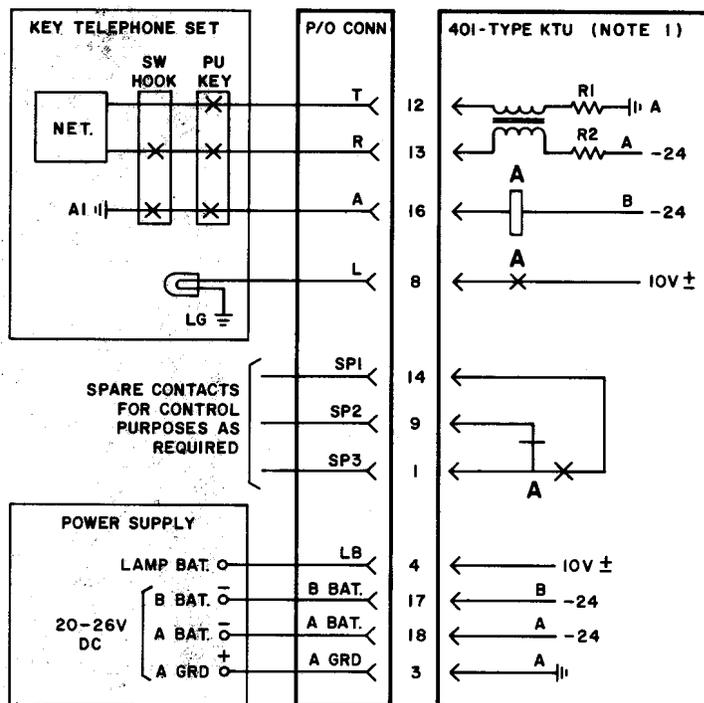


Fig. 4—Condensed Functional Schematic of 401A or 401B KTU (Manual Intercom Line Circuit)

- Rotary dial selection.

The 407C KTU replaces the 407B KTU (MD) on a plug-compatible basis.

C. 420A KTU (Long Line Circuit)

2.04 The 420A KTU (Fig. 7) is a 4-inch, 18-contact unit that provides a circuit for use with off-premise (long line) stations connected to the dial selective intercom line circuit. This KTU extends the loop resistance of the basic selector to 500 ohms. No provision is made for busy lamps at stations connected to this circuit. Mutilation of other station dial pulses is prevented by relay operation. The KTU provides the following operating features:

- Signaling and talking over single pair from off-premise (long line) stations
- Any code may be assigned to off-premise stations
- Ringing can be tripped only during silent intervals

Note: If handset pickup occurs during ringing cycle, ring will be heard in handset receiver.

- Used with rotary or TOUCH-TONE telephone set
- When associated with TOUCH-TONE adapter circuit (426A with 427B or C KTUs, 440A [MD], or 478B KTU) or TOUCH-TONE Selector Circuit (494-type KTU), maximum nonrepeated station conductor loop is 500 ohms or 4-dB insertion loss at 1000 Hz, whichever is limiting.

D. 421A KTU (DSS Circuit or Preset Conference)

2.05 The 421A KTU (Fig. 8 and 9) is a 4-inch, 40-contact unit that can be used as a DSS circuit or a preset conference circuit. The KTU has the following operating features:

- Used with common audible matrix
- Option strapping when used for a preset conference circuit
- Maximum external circuit loop resistance is 120 ohms

- Used to provide DSS in conjunction with 407- or 424-type KTUs.

E. 422B KTU (Station Busy Selector Circuit)

2.06 The 422B KTU (Fig. 10) is a 4-inch, 40-contact unit that provides control of station busy tone for the dial selective intercom line circuit. It also provides control circuits for 10 station codes. When a system consists of 19 station codes, two KTUs are required—one for the units group (single-digit codes, 0-9) and one for the tens group (2-digit codes, X0-X9). This KTU provides the following operating features:

- Determines if called station is off-hook or busy on other line
- Allows line lamps to flash but prevents audible signal at called station when called station is busy on other line
- If the calling station maintains connection and the called station goes from busy to on-hook, the busy signal to the calling station stops and the audible signal (with flashing line lamp) begins at the called station.

F. 423A KTU (Dial Tone, Busy Tone, and Audible Ringback Tone Circuit)

2.07 The 423A KTU (Fig. 11) is a 4-inch, 20-contact unit that provides a variable rate multivibrator to produce dial tone, station busy tone, or audible ringback tone for the dial selective intercom line circuit. To provide busy tone and audible ringback tone, the multivibrator of the 423A KTU is under control of an associated interrupter (ground). For all tone signals, the output of the multivibrator is returned to the originating station over the tip side of the intercom line.

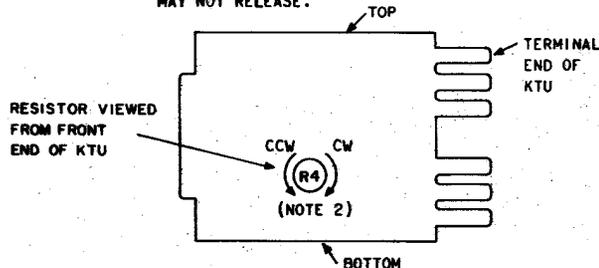
2.08 The 423A KTU has been rerated from MD to AT&T Standard for use in nonmodular panel installations.

Note: The 423B KTU has been recoded to 476A KTU for use in modular panel installations only.

G. 424A (MD), 424B (MD), and 424C KTUs (Dial Intercom, 19-Code Selector Circuit)

2.09 The 424-type KTUs (Fig. 12) are 8-inch, 80-contact units providing the same basic fea-

- NOTES:
1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
 2. RESISTOR R4 CAN BE ADJUSTED TO PROVIDE A VARIABLE TIMING CYCLE FOR THE RELEASE OF RELAY B (SET AT 1.5 SECONDS AT FACTORY). TURN KNURLED WHEEL FULL COUNTERCLOCKWISE FOR 0.5 SECOND TIMEOUT. TURN CLOCKWISE TO MAKE INTERVAL LONGER. AT THE FULL CLOCKWISE POSITION TIMING MAY BE SO LONG THAT B RELAY MAY NOT RELEASE.



3. IF DSS IS REQUIRED, SEE FIG. 8

TABLE:

DIGIT DIALED	COUNTER RELAYS OPERATED AT END OF DIAL PULSE				
	Y1	Y2	Y3	Y4	Y5
1		•			
2	•				
3			•	•	
4		•		•	•
5	•			•	•
6			•	•	•
7		•		•	•
8	•			•	•
9			•	•	•
0		•		•	•

4. 440A(MD) OR 478B KTU MAY BE USED TO PROVIDE "TOUCH-TONE" DIALING IN PLACE OF 426A WITH 427B (SERIES 4) OR C KTUS.

OPTIONS:

Z	WITHOUT	"TOUCH-TONE" DIALING
N	WITH	
E	INTERRUPTED	10V AC BUZZER
X	*	105V 30HZ RINGER
B	SINGLE SPURT	10V AC BUZZER
J		18V AC BUZZER
K		DC BUZZER
M		105V 30HZ RINGER
W	STEADY	LINE LAMPS
H	FLASHING	
R	INTERRUPTED RING WITH STATION BUSY TONE *	USING 423A KTU

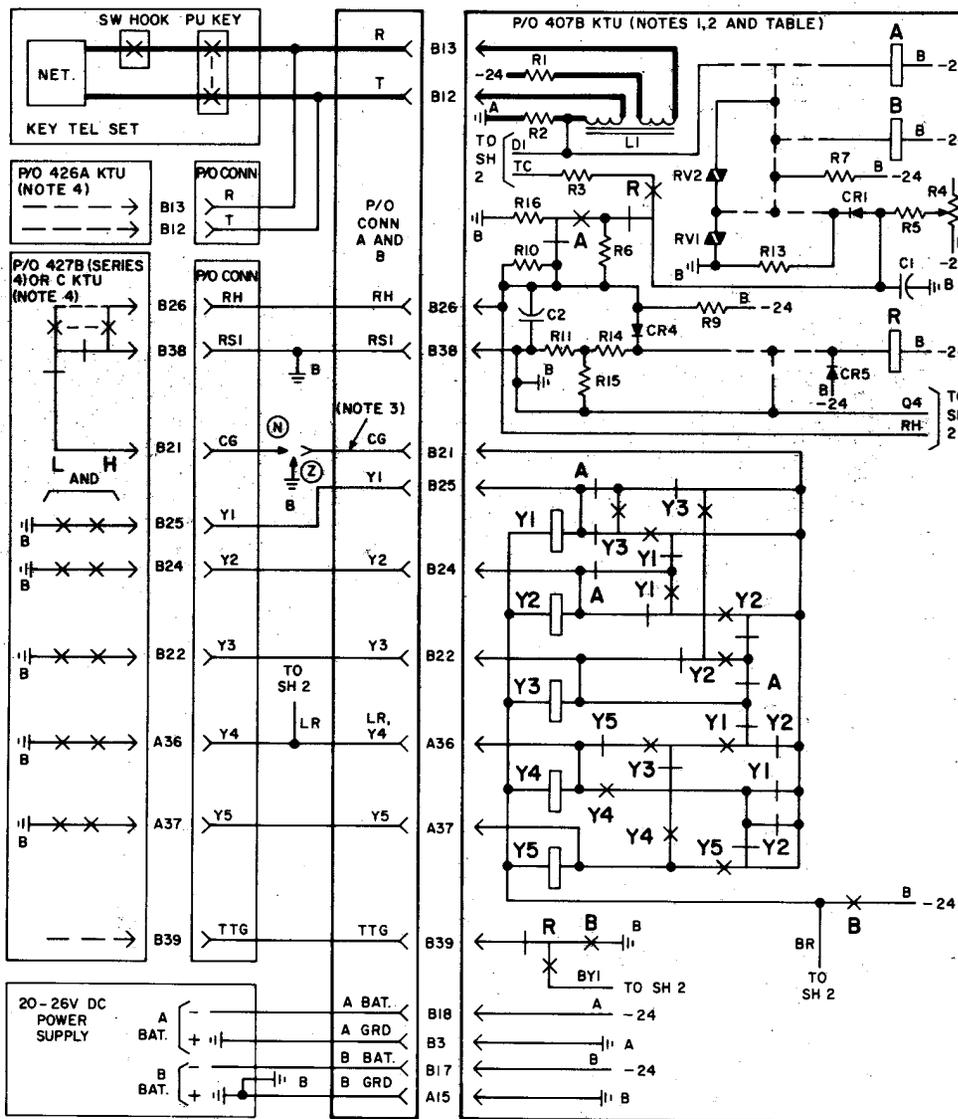


Fig. 5—Condensed Functional Schematic of 407B KTU (MD) (Dial Intercom, 10-Code Selector Circuit) (Sheet 1 of 2)

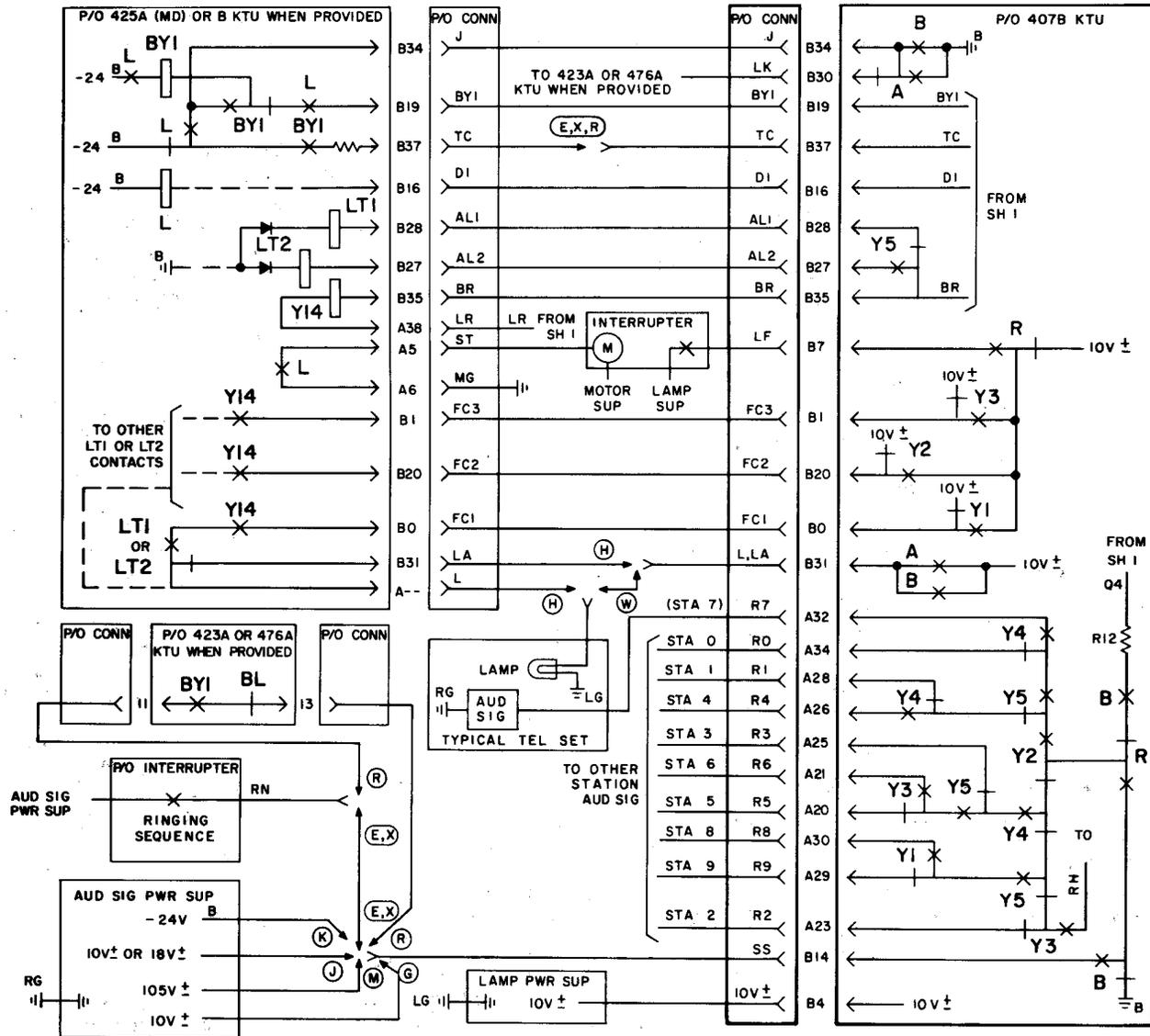
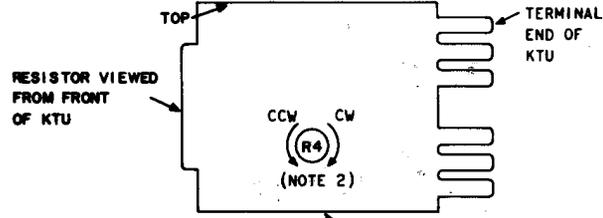


Fig. 5—Condensed Functional Schematic of 407B KTU (MD) (Dial Intercom, 10-Code Selector Circuit) (Sheet 2 of 2)

- NOTES:
1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
 2. RESISTOR R4 CAN BE ADJUSTED TO PROVIDE A VARIABLE TIMING CYCLE FOR THE RELEASE OF RELAY B. A TIMING CYCLE OF 1.5 SEC IS PROVIDED BY THE FACTORY. THE ADJUSTMENT OF R4 IS REVERSED FROM THE 424B KTU. TURN KNURLED WHEEL TO FULL CLOCKWISE POSITION FOR 0.5 SEC TIMEOUT. TURN COUNTERCLOCKWISE FOR TIMEOUT INTERVAL LONGER THAN 1.5 SECONDS.



3. IF DSS IS REQUIRED, SEE FIG. 8

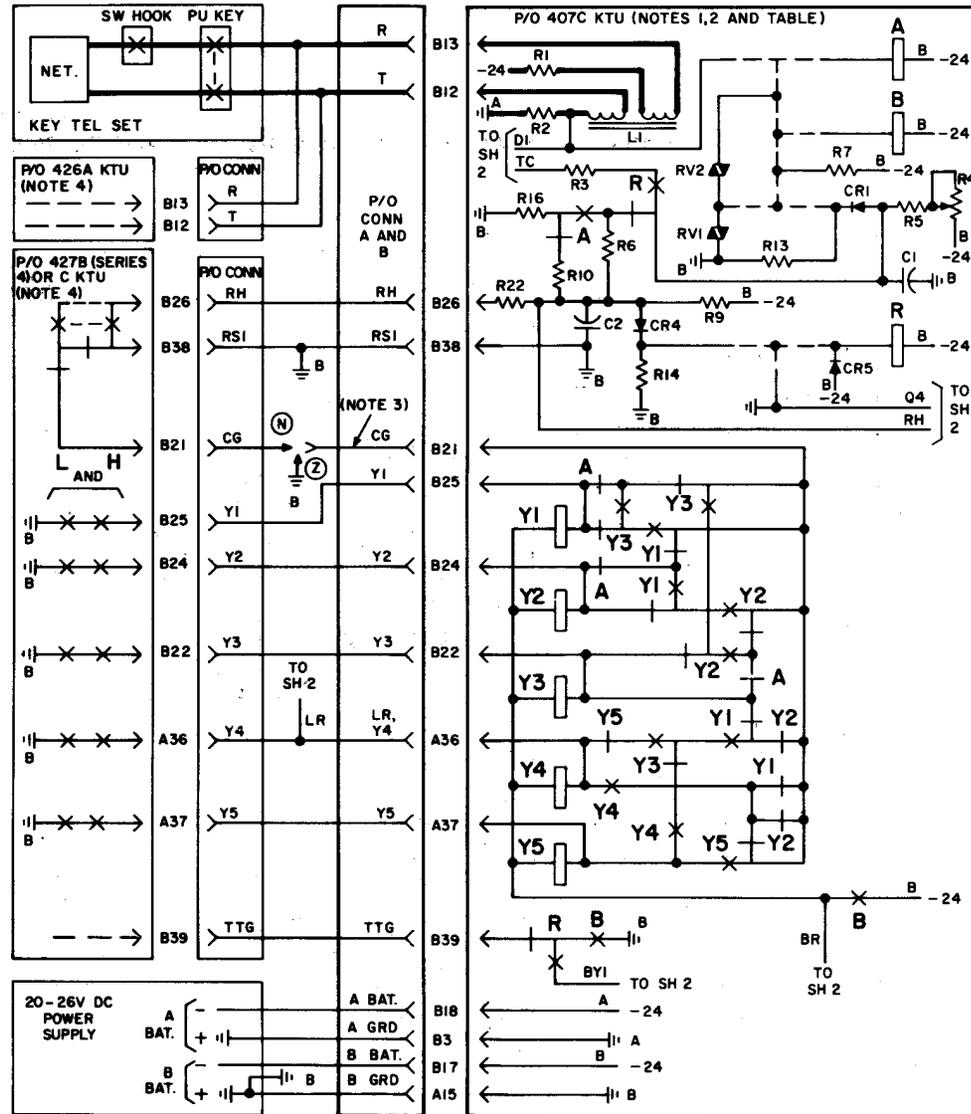
TABLE:

DIGIT DIALED	COUNTER RELAYS OPERATED AT END OF DIAL PULSE				
	Y1	Y2	Y3	Y4	Y5
1		•			
2	•				
3		•	•	•	
4		•		•	•
5	•			•	•
6		•	•	•	•
7		•		•	•
8	•			•	•
9		•		•	•
0		•	•	•	•

4. 440A(MD) OR 478B KTU MAY BE USED TO PROVIDE "TOUCH-TONE" DIALING IN PLACE OF 426A WITH 427B (SERIES 4) OR C KTUS.

OPTIONS:

Z	WITHOUT		"TOUCH-TONE" DIALING
N	WITH		
E	INTERRUPTED	10V AC BUZZER	AUDIBLE SIGNALS
X	*	105V 30HZ RINGER	
Q		10V AC BUZZER	
J	SINGLE SPURT	18V AC BUZZER	
K		DC BUZZER	
M	†	105V 30HZ RINGER	
W	STEADY		LINE LAMPS
H	FLASHING		
R	INTERRUPTED RING WITH *		USING 423A KTU
		STATION BUSY TONE	



- * TO PROVIDE INTERRUPTED RINGING A 425B KTU MUST BE USED.
- † STATION BUSY TONE IS NOT RECOMMENDED FOR USE WITH SINGLE SPURT RINGING

Fig. 6—Condensed Functional Schematic of 407C KTU (Dial Intercom, 10-Code Selector Circuit) (Sheet 1 of 2)

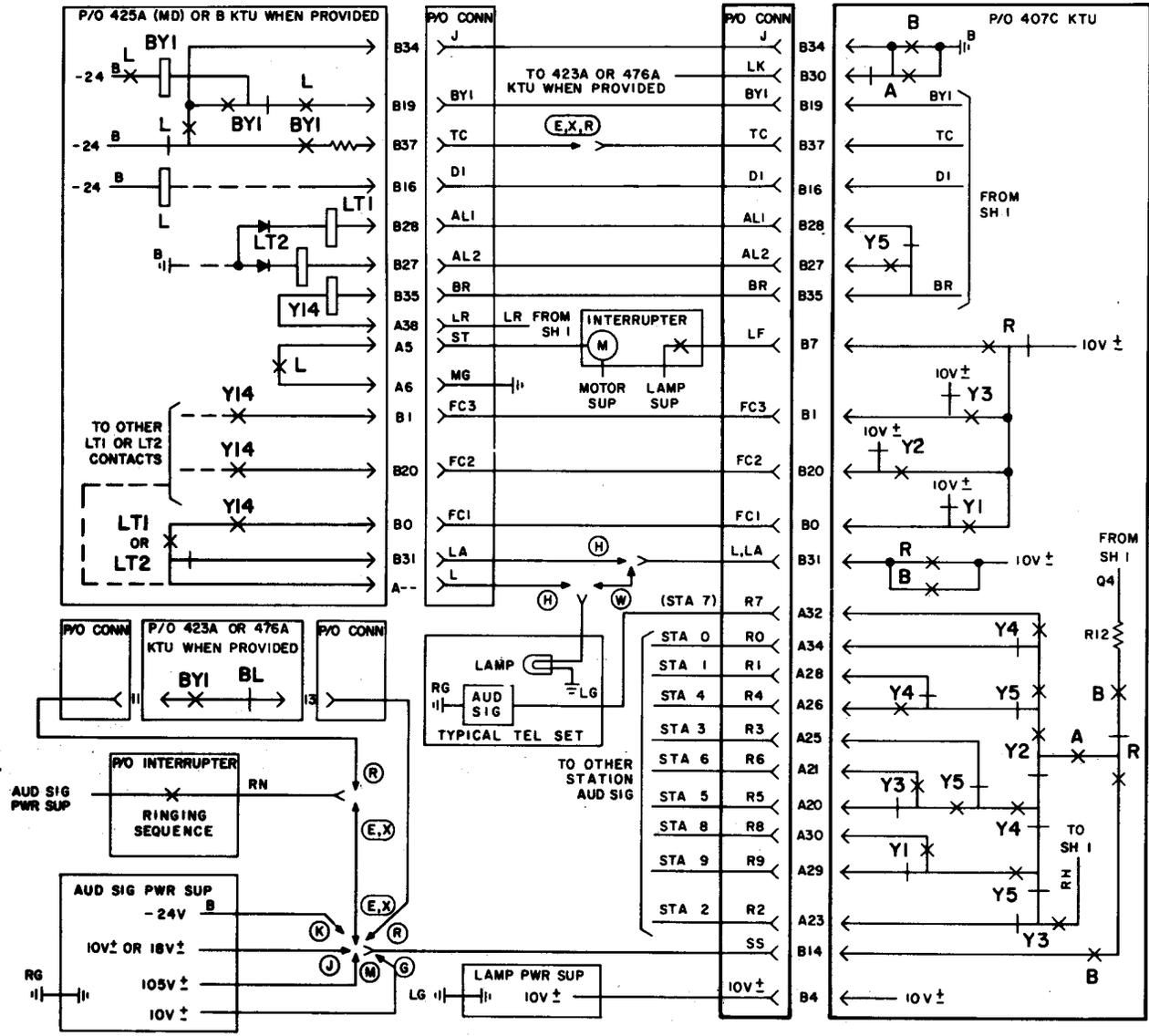


Fig. 6—Condensed Functional Schematic of 407C KTU (Dial Intercom, 10-Code Selector Circuit) (Sheet 2 of 2)

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 18-,20-, OR 40-PIN CONNECTOR.
2. WHEN INTERCOMMUNICATING SYSTEM IS EQUIPPED WITH THE "TOUCH-TONE" ADAPTER (440A[MD] OR 478B OR 426A WITH 427B [SERIES 4] OR CKTUS) PROVIDE A 400J DIODE FOR EACH 420A KTU INSTALLED.
3. MAXIMUM STATION CONDUCTOR LOOP IS 500 OHMS. OFF-PREMISE (LONG LINE) TELEPHONE SET MAY BE EQUIPPED WITH A "TOUCH-TONE" DIAL PROVIDED THE INTERCOMMUNICATING SYSTEM IS SO EQUIPPED.
4. ANY DIGIT MAY BE ASSIGNED TO OFF-PREMISE (LONG LINE) STATION.

OPTIONS:

M	105V±	USED TO OPERATE AUD SIG OF INTERCOM SYSTEM
J	18V±	
K	-24V DC	

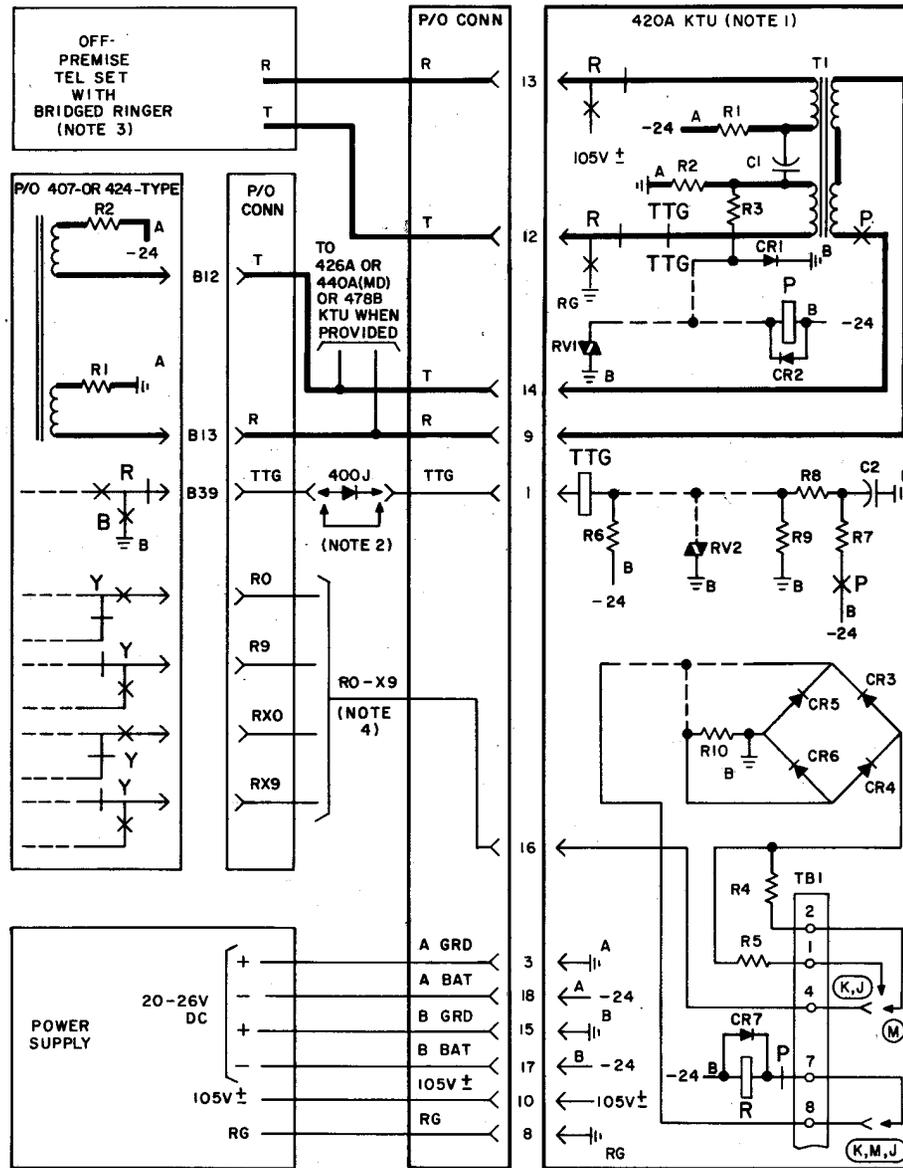


Fig. 7—Condensed Functional Schematic of 420A KTU (Long Line Circuit)

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH A 40-PIN CONNECTOR.
2. PROVIDE A SEPARATE 421A KTU AND SIGNAL KEY FOR EACH STATION CODE TO BE SELECTED.
3. SELECT CODE AND CONNECT LEADS FOR SELECTED CODE AS SHOWN IN VERTICAL COLUMN.
4. IF MORE THAN ONE 421A KTU IS USED FOR DSS, CONNECT AS SHOWN BELOW:

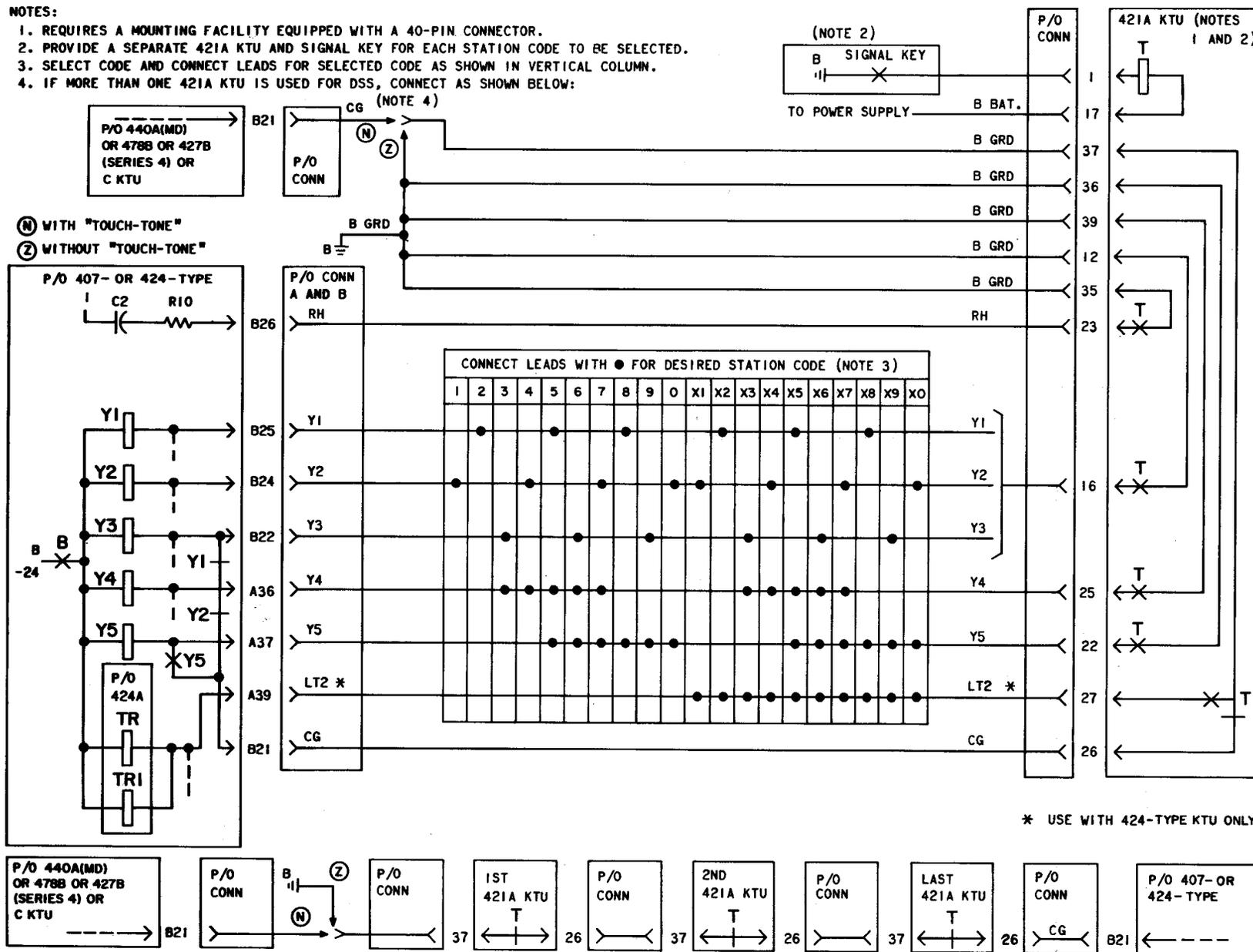


Fig. 8—Condensed Functional Schematic of 421A KTU (Wired for DSS)

NOTES:

1. THE 421A KTU REQUIRES A MOUNTING FACILITY EQUIPPED WITH A 40-PIN CONNECTOR.
2. THE 413A KTU REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 18-, 20-, OR 40-PIN CONNECTOR.
3. PROVIDE THE 413A KTU ONLY WHEN ACCESS TO THE PRESET CONFERENCE IS BY DIAL CODE OR BY DIAL CODE AND DSS. DO NOT PROVIDE THE 413A KTU WHEN ACCESS TO THE PRESET CONFERENCE IS LIMITED TO DSS.
4. REMOVE RINGER CAPACITORS FROM CIRCUIT.
5. WHEN THIS CIRCUIT IS PROVIDED, RINGING VOLTAGE (105V±) MUST BE USED TO OPERATE THE AUDIBLE SIGNALS CONNECTED TO THE DIAL INTERCOM LINE.
6. PROVIDE (W) OPTION AS SHOWN.

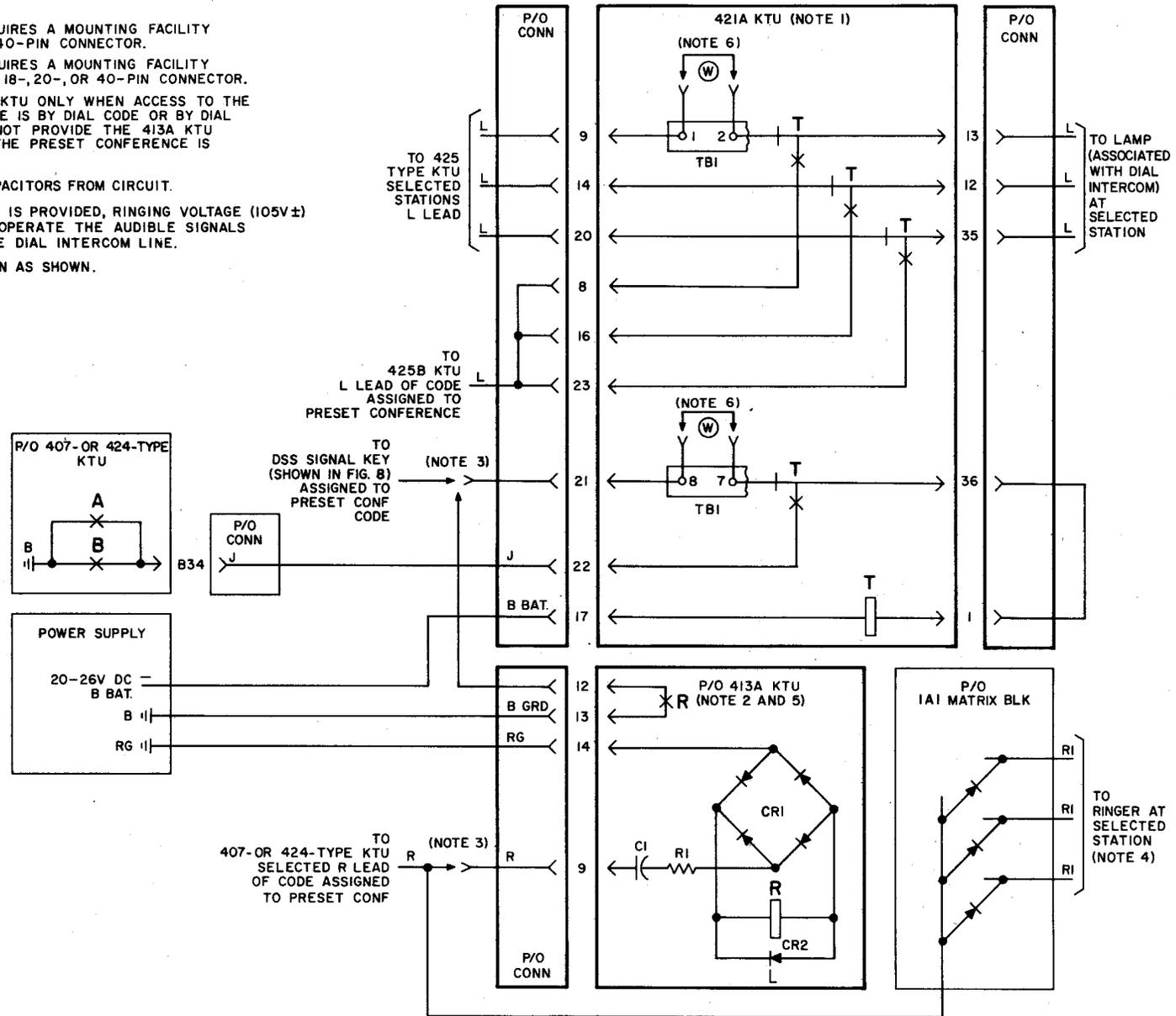


Fig. 9—Condensed Functional Schematic of 421A KTU (Wired for Preset Conference)

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH A 40-PIN CONNECTOR.
2. PROVIDE A SEPARATE 422B KTU FOR UNITS GROUP (1-0, SINGLE DIGIT NOS.) AND FOR THE TENS GROUP (X1-X0, TWO-DIGIT NOS.)
3. PROVIDE AND INSTALL A KS-15724, LI DIODE IN THE TELEPHONE SET. FOR CONNECTION, USE THE STATION BUSY OPTION AS SHOWN IN THE CONNECTION SECTION OF THE TEL SET USED.
4. CONNECT TO J GROUND IF 407-TYPE KTU IS PROVIDED. CONNECT TO LT1 IF ASSOCIATED WITH UNITS GROUP OR TO LT2 IF ASSOCIATED WITH TENS GROUP.
5. REMOVE STRAP AND INSTALL 44IJ DIODE, PROCURE DIODE LOCALLY.

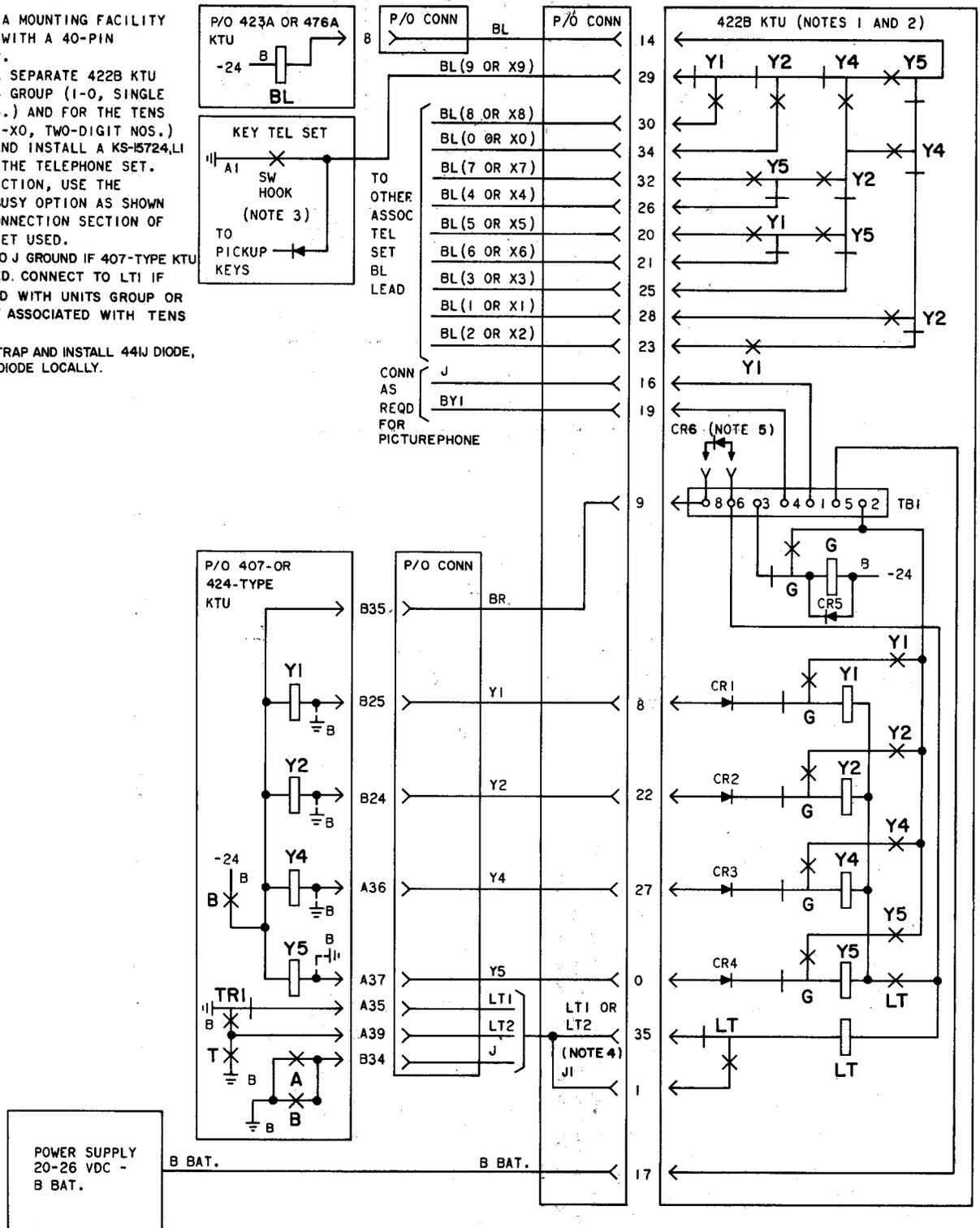
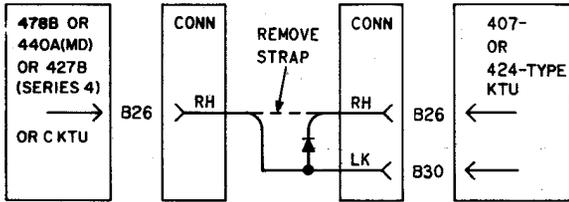


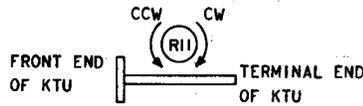
Fig. 10— Condensed Functional Schematic of 422B KTU (Station Busy Selector Circuit)

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH A 20- OR 40-PIN CONNECTOR.
2. WHEN ADDING DIAL TONE (T OPTION) TO A SYSTEM EQUIPPED FOR "TOUCH-TONE" (440A [MD] OR 478B OR 426A WITH 427B [SERIES 4] OR C KTUS) A 400J DIODE MUST BE INSERTED BETWEEN THE "RH" AND "LK" LEADS ON THE 407- OR 424-TYPE KTU. REWIRE AS FOLLOWS:



3. TURN KNURLED WHEEL TO FULL CLOCKWISE POSITION FOR MINIMUM DIAL TONE VOLUME AND TO FULL COUNTERCLOCKWISE POSITION FOR MAXIMUM DIAL TONE VOLUME.



OPTIONS:

R	STATION BUSY TONE WITH INTERRUPTED AUDIBLE SIGNAL
S	AUDIBLE RINGBACK
T	DIAL TONE

*-FACTORY PROVIDED

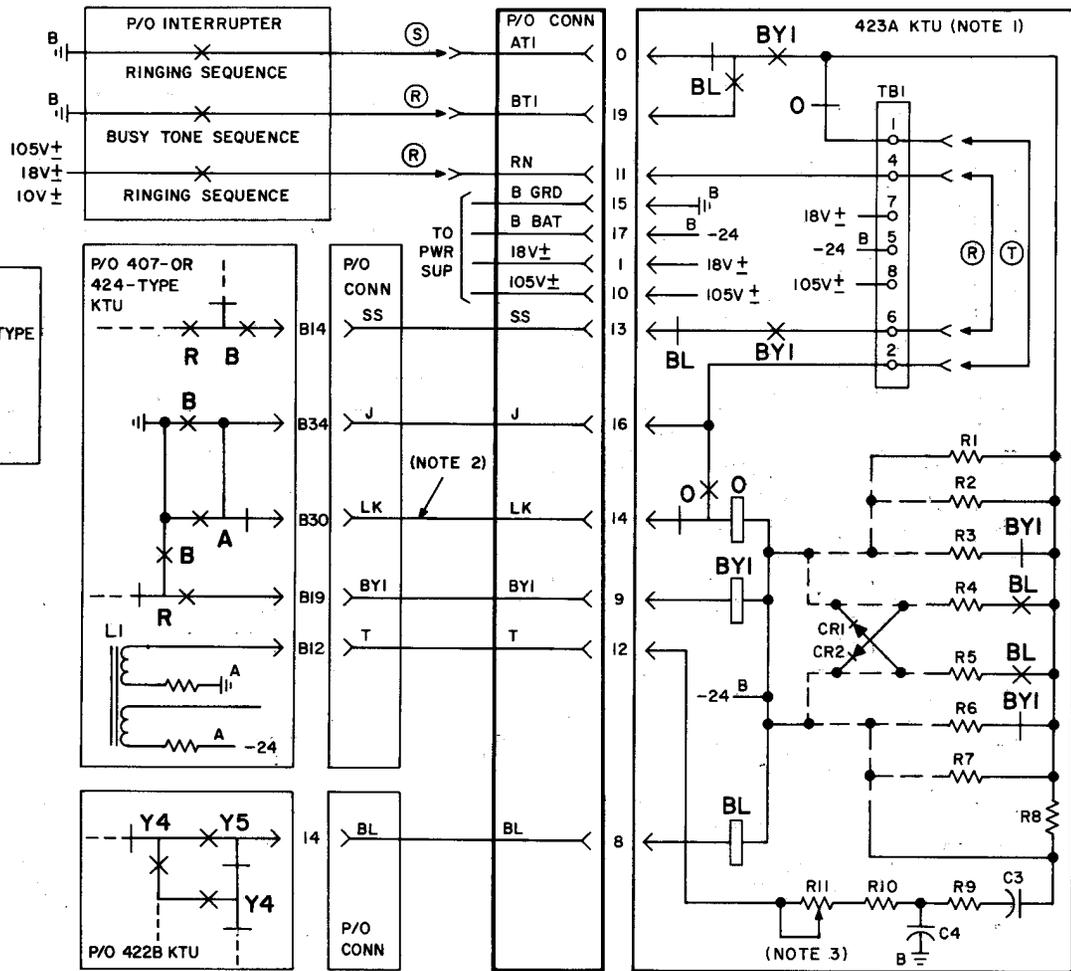


Fig. 11—Condensed Functional Schematic of 423A KTU (Dial Tone, Busy Tone, and Audible Ringback Tone)

tures as the 407C KTU but have a capacity of 19 station codes. These KTUs provide the following:

- Rotary dial selection
- Nineteen dial codes (nine single digit and ten 2-digit).

Note: The first digit of a 2-digit code is not available as a station code.



A 424A (MD), B (MD), or C KTU can be used in a 1A2 KTS, but a 424A KTU (MD) is not to be used in place of a 424B (MD) or C KTU in the 7A or 14A Communication System. Of the 424-type KTUs, only the 424C KTU can be used with the 21A System. The 424C KTU provides a number of circuit improvements over the 424A KTU (MD) and 424B KTU (MD), such as greater tolerance to rapid TOUCH-TONE dialing and elimination of speaker clicks in COM KEY installations. Replace earlier 424-type KTUs with a 424C KTU only when customer complaints warrant.

H. 425A (MD) and 425B KTUs (Flashing Lamp Circuit)

2.10 The 425-type KTUs (Fig. 13) are 8-inch, 80-contact units that provide the control circuits for flashing lamps for up to 19 station codes in the dial selective intercom circuit. These KTUs provide the following operating features:

- Incoming call flashing lamp signal to called station
- Busy lamp signals to all other stations
- Optional interrupted ringing
- Detects when called station answers; stops interrupted ringing and flashing lamp signal.

I. 426A KTU (Amplifier, Band Separation, and Limiter Circuit)

2.11 The 426A KTU (Fig. 14) is an 8-inch, 80-contact unit comprising half of the TOUCH-TONE adapter circuit. It is used in conjunc-

tion with a 427-type KTU for TOUCH-TONE dial station selection in the 1A2 KTS dial selective intercommunicating circuit. The 426A amplifies and separates TOUCH-TONE signals into high and low frequencies for use as inputs for the 427-type KTUs. It also provides protection against false operation caused by speech or noise frequency components.

J. 427B (Series 4) and 427C KTUs (Frequency Recognition and Translation Circuit)

2.12 The 427B (Series 4) and 427C KTUs (Fig. 14) are 8-inch, 80-contact units comprising the second half of the TOUCH-TONE adapter circuit. These KTUs receive separated TOUCH-TONE frequencies from the 426A KTU and translate them into relay operations. The relay operations, in turn, energize relays in the basic selector circuit to signal the selected station.

K. 440A KTU (MD) (TOUCH-TONE Adapter Circuit)

2.13 The 440A KTU (MD) (Fig. 15) is an 8-inch, 80-contact unit consisting of two printed circuit boards permanently fastened together and requiring a single upper and lower connector. The circuitry and function are the same as that of the 426A and 427C KTUs, but are not electrically interchangeable in some mounting arrangements since the 426A and 427C KTUs each require an upper and lower connector. The 440A KTU (MD) is replaced by the 478B KTU.

L. 444-Type KTU (Selector Extender Circuit)

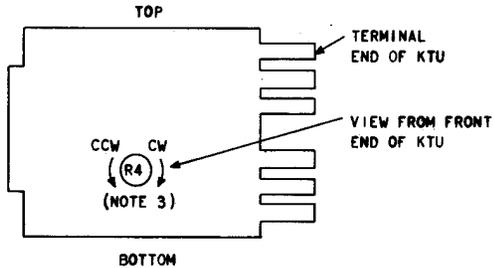
2.14 The 444-type KTU (Fig. 16) is an 8-inch, 80-contact unit which expands the 19 codes of the 424-type KTU (19-code selector circuit) to a total of 37 codes. The 444B KTU is the same as the 444A except two option plugs have been added which have application only in the 21A Communication System. In other systems, the 444B KTU should be used as supplied from the factory, ie, with the option plugs in positions 2-3 and 5-6. When using the 444-type KTU, two more transfer digits are factory assigned and these digits may not be used as station codes. Digits 2 and 3 are used as the second and third transfer digits.

M. 454-Type KTU (3-Path Intercom Access Circuit)

2.15 The 454-type KTU (Fig. 17) is an 8-inch unit that contains three separate intercom paths.

NOTES:

- REQUIRES A MOUNTING FACILITY EQUIPPED WITH TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
- ANY SELECTED R LEAD (R1-R0) MAY BE ASSIGNED AS THE INITIAL DIGIT OF A 2-DIGIT CODE. THE R LEAD SO ASSIGNED MAY NOT BE USED FOR A STATION CODE.
- RESISTOR R4 CAN BE ADJUSTED TO VARY THE RELEASE TIME OF RELAY B (FACTORY SET AT 1.5 SECONDS ON ALL CODES) AS FOLLOWS:
 424A AND 424B-TURN KNURLED WHEEL FULL COUNTERCLOCKWISE (CCW) FOR 0.5 SECOND TIMEOUT. TURN CLOCKWISE (CW) FOR INTERVAL LONGER THAN 1.5 SECONDS. AT FULL CW POSITION CYCLE MAY BE VERY LONG AND B RELAY MAY NOT RELEASE.
 424C-ADJUSTMENT OF R4 IS REVERSED ON 424C FROM 424A/B. TURN WHEEL FULL CW FOR 0.5 SECOND TIMEOUT. TURN CCW FOR TIMING LONGER THAN 1.5 SECONDS.



- CONNECT LT1 TO 422B KTU ASSOCIATED WITH UNITS GROUP AND CONNECT LT2 TO 422B KTU ASSOCIATED WITH TENS GROUP.
- IF DSS IS REQUIRED, SEE FIG. 8.
- 440A(MD) OR 478B KTU MAY BE USED TO PROVIDE TOUCH DIALING IN PLACE OF 426A WITH 427B (SERIES 4) OR C KTUS.

OPTIONS:

Z	WITHOUT	"TOUCH-TONE" DIALING
N	WITH	
E	INTERRUPTED	10V AC BUZZER
X	*	105V 30 HZ RINGER
R	INTERRUPTED RING WITH STATION BUSY TONE *	USING 423A KTU
G		10V AC BUZZER
J	SINGLE	18V AC BUZZER
K	SPURT	DC BUZZER
M		105V 30 HZ RINGER
W	STEADY	LINE LAMPS
V	FLASHING	

* TO PROVIDE INTERRUPTED RINGING A 425B KTU MUST BE USED.
 † STATION BUSY TONE IS NOT RECOMMENDED FOR USE WITH SINGLE SPURT RINGING.

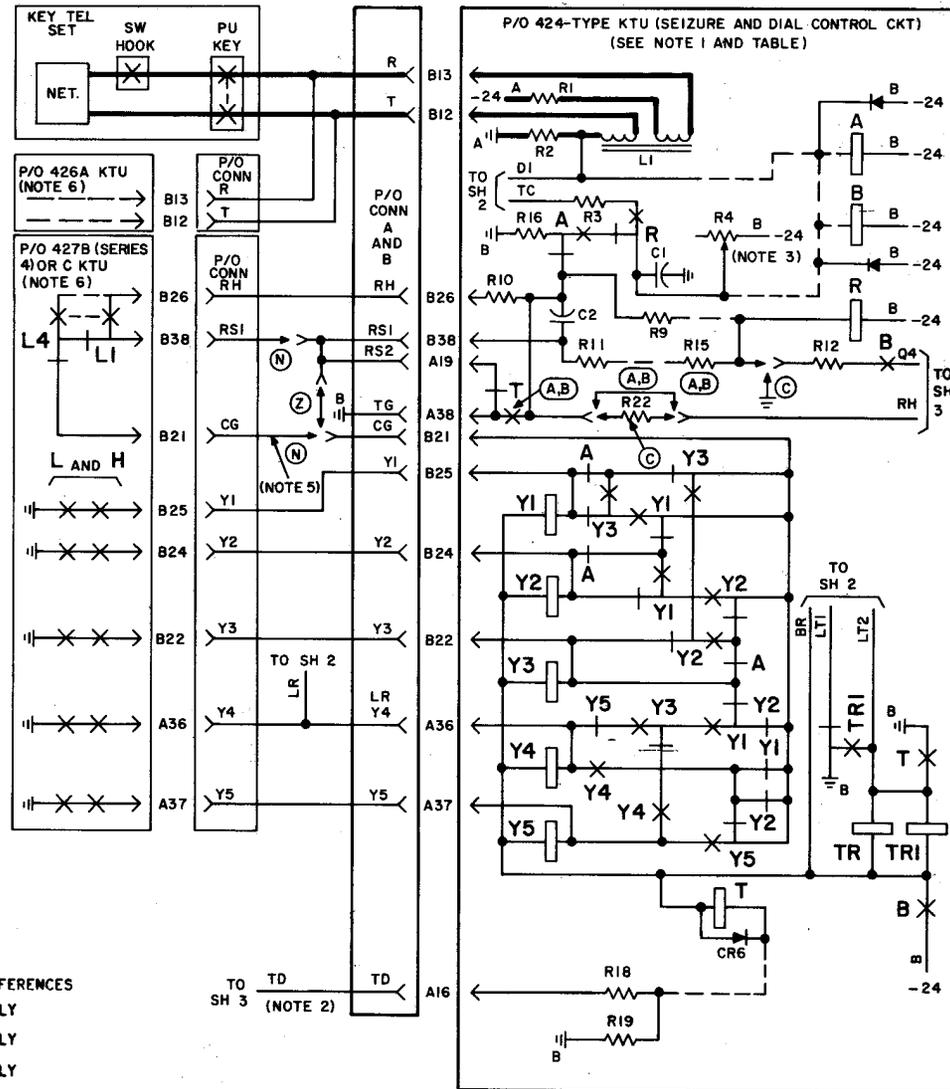


Fig. 12—Condensed Functional Schematic of 424-Type KTU (Dial Intercom, 19-Code Selector Circuit) (Sheet 1 of 3)

TABLE

DIGIT DIALED	COUNTER RELAYS OPERATED AT END OF DIAL PULSE						
	Y1	Y2	Y3	Y4	Y5	TR	TRI
1							
2	•						
3			•	•			
4		•					
5	•			•	•		
6			•	•	•		
7		•		•	•		
8	•			•	•		
9			•	•	•		
0		•			•		
X1		•				•	•
X2	•						•
X3			•	•		•	•
X4		•				•	•
X5	•			•	•	•	•
X6			•	•	•	•	•
X7		•		•	•	•	•
X8	•			•	•	•	•
X9			•	•	•	•	•
X0		•				•	•

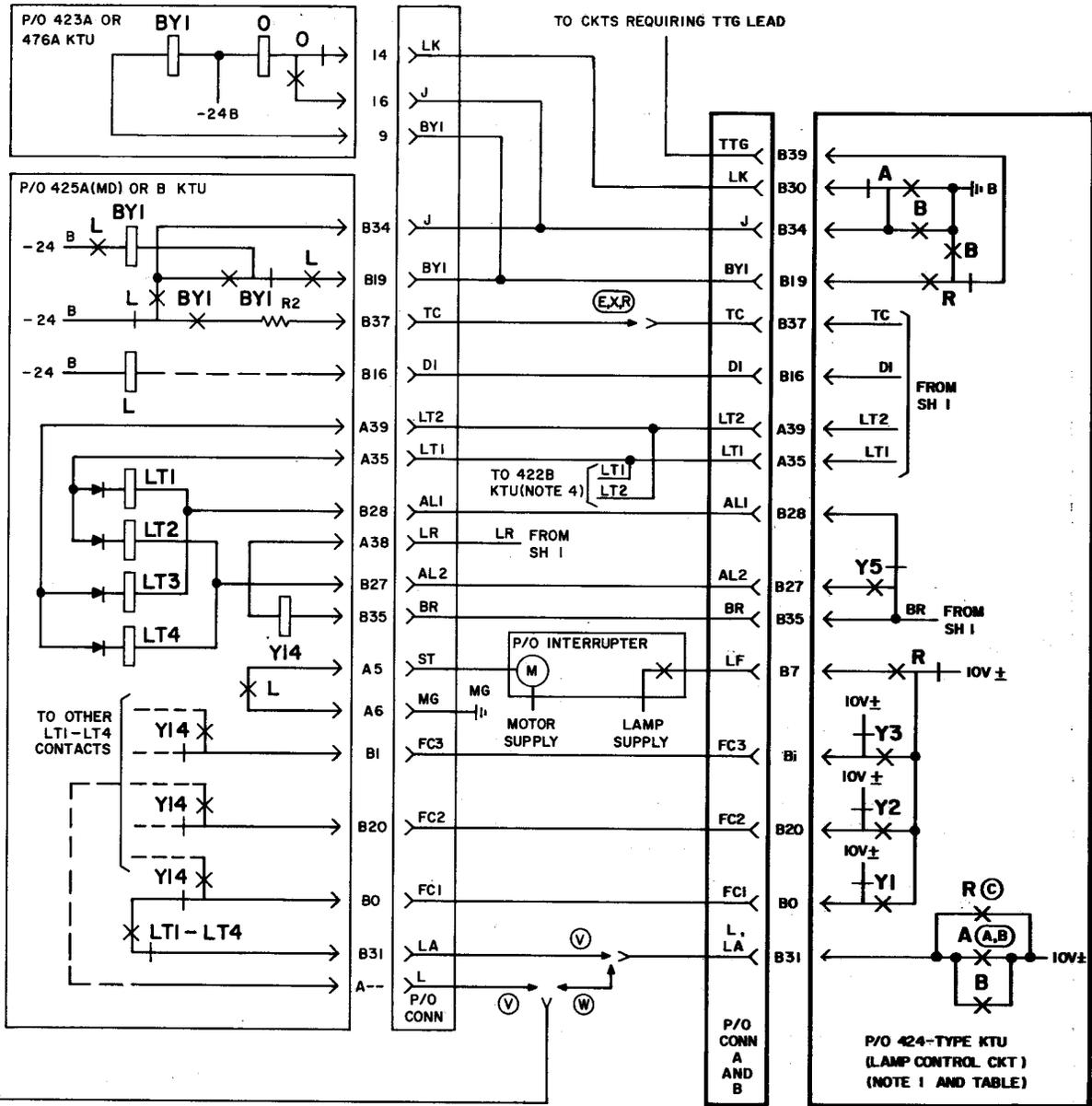
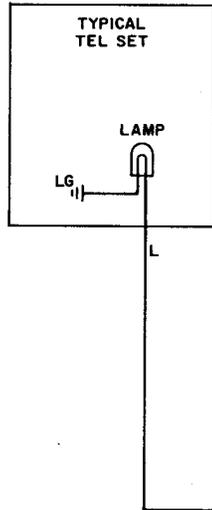


Fig. 12—Condensed Functional Schematic of 424-Type KTU (Dial Intercom, 19-Code Selector Circuit) (Sheet 2 of 3)

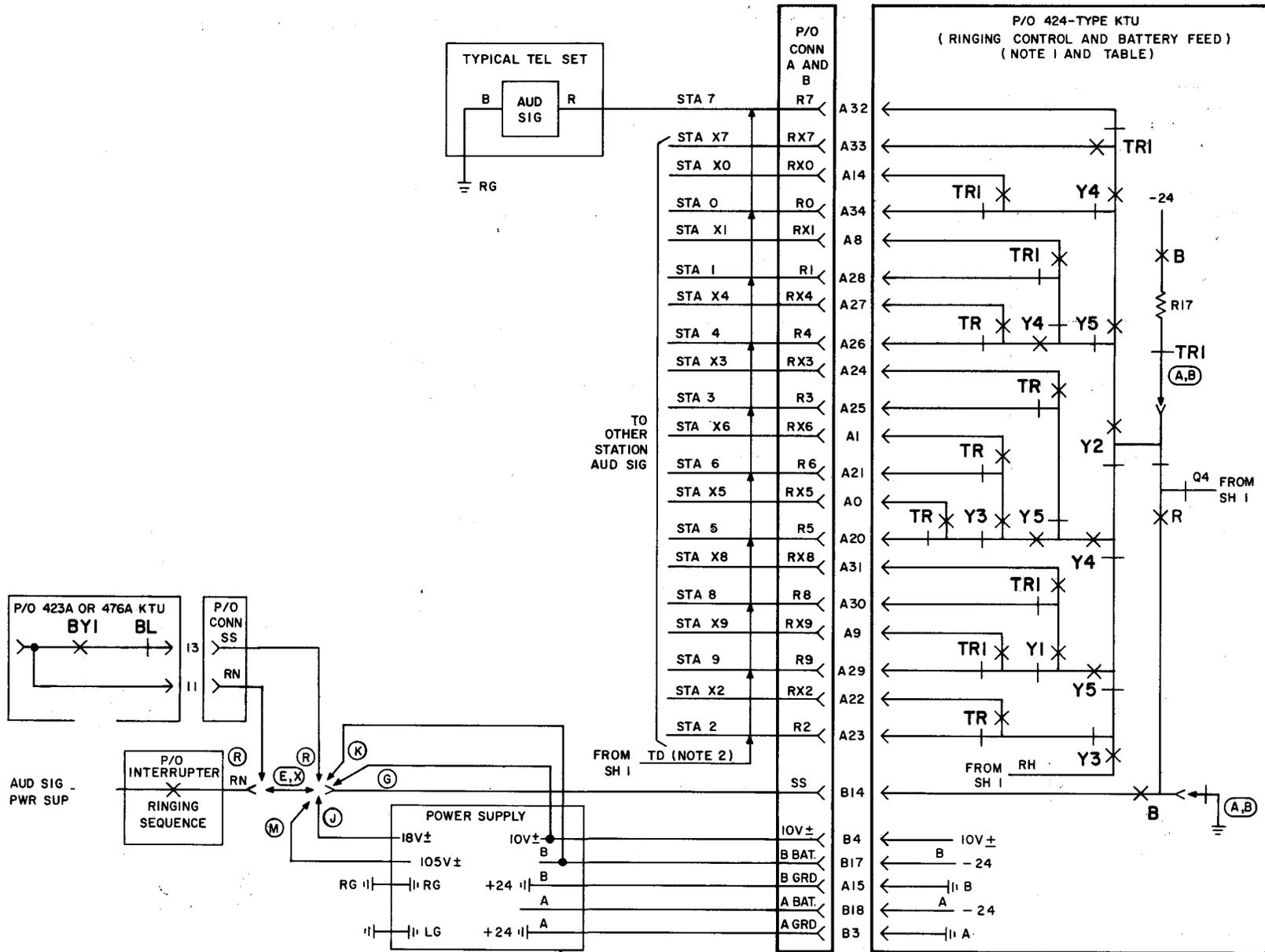


Fig. 12—Condensed Functional Schematic of 424-Type KTU (Dial Intercom, 19-Code Selector Circuit) (Sheet 3 of 3)

Path selection is based on operation of an associated intercom button on the key telephone sets. The 454-type KTU also provides dial tone, seizes the code selector, and provides flashing lamp signal during selection and steady lamp during busy mode.

N. 460-Type KTU (2-Path Intercom Access Circuit)

2.16 The 460-type KTU (Fig. 18) is an 8-inch unit that contains two separate intercom paths. Path selection is based on operation of the associated intercom button on the key telephone sets. The unit also provides dial tone, seizes the selector, and provides a flashing lamp signal during selection and a steady lamp during the busy mode. Control circuitry permits only one intercom path to seize the selector at a time.

O. 476A KTU (Dial Tone, Busy Tone, and Audible Ringback Tone Circuit)

2.17 The 476A KTU (Fig. 19) is a 4-inch, 20-contact unit that provides a variable rate multivibrator to produce dial tone, station busy tone, or audible ringback tone for the dial selective intercom line circuit in modular panel installations. To provide busy tone and audible ringback tone, the multivibrator is controlled by the RN and lamp flash leads. For all tone signals, the output of the multivibrator is returned to the originating station over the tip side of the intercom line.

2.18 The 476A KTU provides the following features:

- Eliminates externally wired interrupter or relay
- Uses existing RN and LF leads for control.



The 476A KTU should be used in modular panel installations only.

P. 478B KTU (TOUCH-TONE Adapter Circuit)

2.19 The 478B KTU (Fig. 20) is an 8-inch, 80-contact solid state unit which provides the same functions as the 440A KTU (MD). It will work with all 407- and 424-type selector circuits. The 478B KTU requires both A and B grounds; provisions are made by means of either a wiring kit or an option

plug for installing the necessary grounds when they are not present in the mounting arrangement. The 478B KTU is directly interchangeable with the 440A KTU (MD) when the connectors have A and B grounds.

Q. 494A KTU (TOUCH-TONE Selector Circuit)

2.20 The 494A KTU (Fig. 21) provides basic TOUCH-TONE intercom features in a single 8-inch, 80-contact, solid-state unit. It utilizes the same mounting slot in 1A2 key service units and panels as 407- and 424-type KTUs, or the 702B panel only in COM KEY 2152. The 494A KTU provides:

- TOUCH-TONE dial selection of up to 19 station codes, including 0, 2 through 9, and 10 through 19.
- Single-spurt signaling using 10-volts ac buzzers or -24 volts dc signaling devices. Signaling duration is nonadjustable and preset at nominal 1.5 seconds duration.
- ♦Intercom dial tone.♦
- Control for intercom line busy lamps.
- Capability for expansion to 37 codes, 55 codes, and multipath intercom (COM KEY and 626A modular panel) arrangements with the 444-, 454-, and 460-type KTUs.



Deluxe intercom features, including flashing lamps at called stations, audible ringback and busy tone, cannot be provided.

2.21 Lead connections are the same as for the 424C KTU except that an additional pair of tip and ring contacts are available for use in COM KEY 2152.

2.22 The initial digit 1 is always treated as the first digit of a 2-digit code; therefore, no strapping of a transfer digit is required for basic 19-code selector operation. Digits 2, 3, 4, and/or 5 may be used as transfer digits when operation is extended to 37 or 55 codes using the 444-type KTU (selector extender).

Note: Once selected, the first digit of a 2-digit code is not available as a single-digit station code.

2.23 Screw switches S1 and S2 must be in the open position to disconnect the internal battery

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
2. THE 425A (MD) AND B KTUS ARE THE ONLY KTUS TO PROVIDE INTERRUPTER START CONTROL FOR ALL FUNCTIONS OF THE IA2 DIAL INTERCOMMUNICATING SYSTEM.

OPTIONS:

X	INTERRUPTED 105V AC RINGER	
V	FLASHING LAMPS	USING 424-TYPE KTU
H		USING 407-TYPE KTU
R	INTERRUPTED RING WITH STATION BUSY TONE	USING 423A KTU

TABLE:

STA LAMP LEAD*	RELAYS OPERATED AT END OF PULSE TRAIN									
	407 OR 424					425A OR B				
	Y1	Y2	Y3	Y4	Y5	LT1	LT2	LT3	LT4	Y14
L1										
L2	•									
L3			•	•						
L4		•	•	•						
L5	•									
L6		•	•	•						
L7		•	•	•						
L8	•									
L9			•	•						
L0		•								
LX1		•								
LX2	•									
LX3			•	•						
LX4		•	•	•						
LX5	•									
LX6		•	•	•						
LX7		•	•	•						
LX8	•									
LX9			•	•						
LX0		•								

407-TYPE

424-TYPE

* NUMBER DESIGNATES STATION ASSIGNMENT. X IS FIRST DIGIT OF TWO-DIGIT CODE, WHICH CAN BE ANY DIGIT 1-0. DIGIT 0 ASSIGNED, CANNOT BE A SINGLE DIGIT STATION CODE.

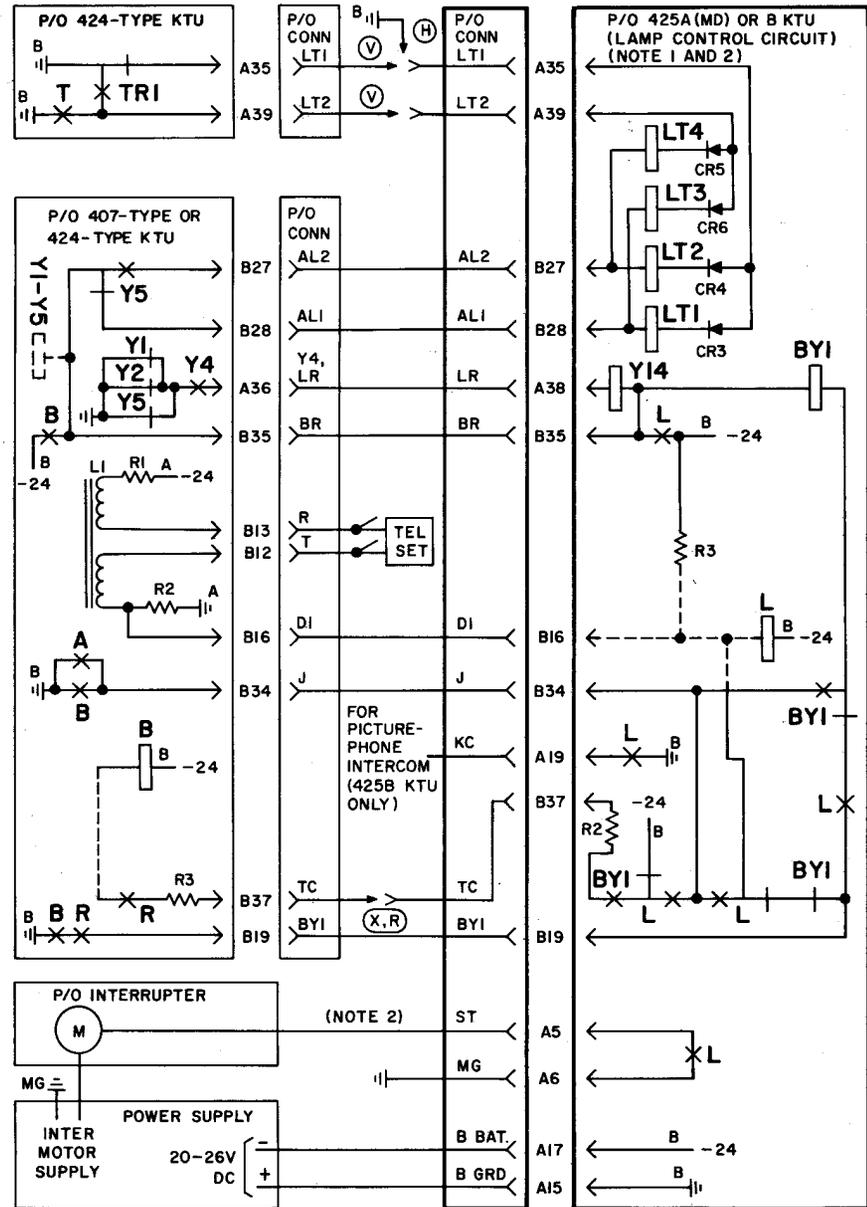


Fig. 13—Condensed Functional Schematic of 425A (MD) and 425B KTUs (Flashing Lamp Circuit) (Sheet 1 of 2)

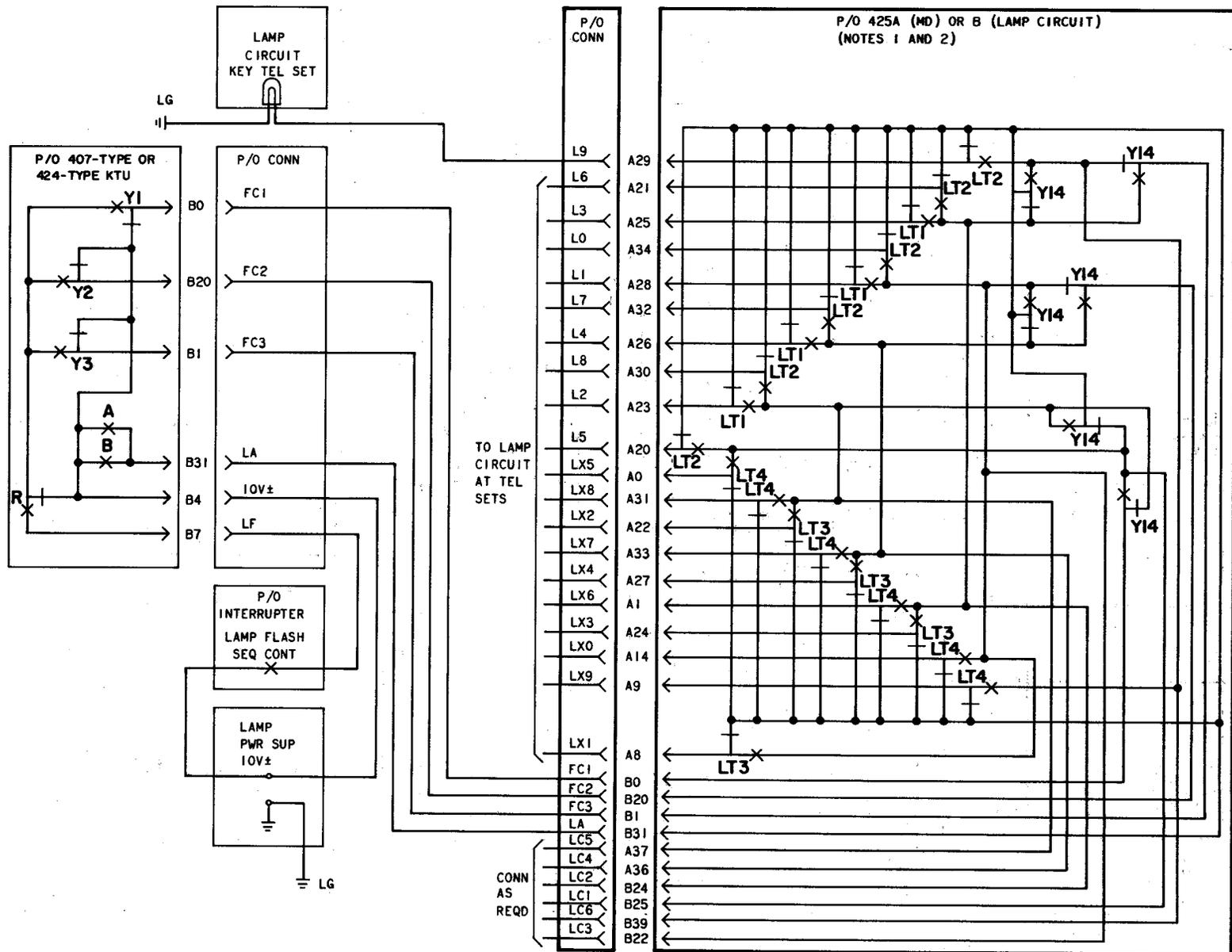


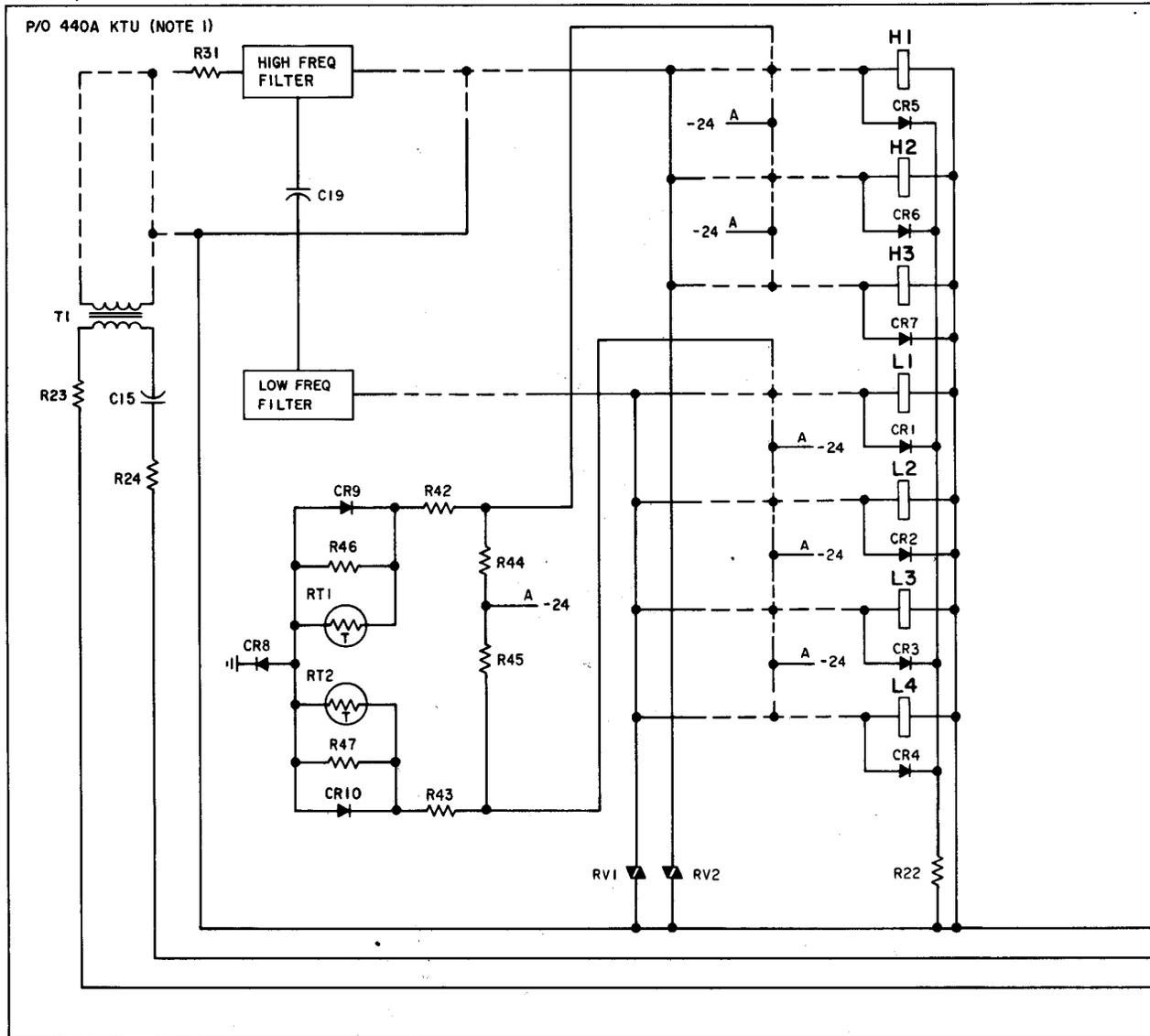
Fig. 13—Condensed Functional Schematic of 425A (MD) and 425B KTUs (Flashing Lamp Circuit) (Sheet 2 of 2)

DIGIT DIALED †	1	2	3	4	5	6	7	8	9	0
HIGH AND LOW FREQ GENERATED BY TT DIAL	1209 697	1336 697	1477 697	1209 770	1336 770	1477 770	1209 852	1336 852	1447 852	1336 941
RELAYS OPERATED IN 427B, SERIES 4 OR 427C KTU	H1,L1	H2,L1	H3,L1	H1,L2	H2,L2	H3,L2	H1,L3	H2,L3	H3,L3	H2,L4
CTR RELAYS OPRD IN 407-TYPE OR 424-TYPE	Y2	Y1	Y3,Y4	Y2,Y4	Y1,Y4,Y5	Y3,Y4,Y5	Y2,Y4,Y5	Y1,Y5	Y3,Y5	Y2,Y5

NOTES:

1. EACH 426A AND 427B, SERIES 4 OR 427C KTU REQUIRES TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
 2. T WIRING MUST BE FURNISHED ON A SYSTEM EQUIPPED WITH DIAL TONE USING A 423A KTU. DIODE IS A 400J AND MUST BE PROVIDED LOCALLY. DIODE IS NOT REQUIRED IF DIAL TONE IS PROVIDED BY A 423B KTU.
 3. GROUND IS PROVIDED DIRECTLY TO THE RSI LEAD WHEN THE 407-TYPE KTU IS USED AND THROUGH A T RELAY CONTACT WHEN THE 424-TYPE KTU IS USED.
 4. WHEN THE 427B, SERIES 4 OR 427C IS ADDED TO AN EXISTING SYSTEM REMOVE GROUND FROM B21 OF THE 407B KTU OR REMOVE STRAP FROM B21 TO A19 OF THE 424A KTU.
 5. WHEN ADDING THE 426A AND 427B, SERIES 4 OR 427C KTU'S TO AN EXISTING SYSTEM EQUIPPED WITH A 420A KTU, A DIODE MUST BE INSTALLED IN THE TTG LEAD CONNECTING TO THE 420A KTU. SEE FIGURE 6.
 6. IF DSS IS REQUIRED, SEE FIG. 8.
- † SINGLE-DIGIT CODE OR 1ST OR 2ND DIGIT OF TWO-DIGIT CODE.

Fig. 14—Condensed Functional Schematic of 426A KTU (Amplifier, Band Separation, and Limiter Circuit) and 427B (Series 4) or 427C KTU (Frequency Recognition and Translation Circuit) (Sheet 2 of 2)



DIGIT DIALED *	1	2	3	4	5	6	7	8	9	0
HIGH AND LOW FREQ GENERATED BY TT DIAL	1209 697	1336 697	1477 697	1209 770	1336 770	1477 770	1209 852	1336 852	1477 852	1336 941
RELAYS OPRD IN 440 A KTU	H1,L1	H2,L1	H3,L1	H1,L2	H2,L2	H3,L2	H1,L3	H2,L3	H3,L3	H2,L4
CTR RELAYS OPRD IN 407B OR 424A	Y2	Y1	Y3,Y4	Y2,Y4	Y1,Y4,Y5	Y3,Y4,Y5	Y2,Y4,Y5	Y1,Y5	Y3,Y5	Y2,Y5

NOTES:

- REQUIRES A MOUNTING FACILITY EQUIPPED WITH A 80-PIN CONNECTOR.
- WHEN THE 440A KTU IS ADDED TO AN EXISTING SYSTEM REMOVE GROUND FROM B21 OF THE 407-TYPE KTU OR REMOVE STRAP FROM B21 TO A19 OF THE 424-TYPE KTU.
- GROUND IS PROVIDED DIRECTLY TO THE RS1 LEAD WHEN THE 407B-TYPE KTU IS USED AND THROUGH A T RELAY CONTACT WHEN THE 424A-TYPE KTU IS USED.
- T WIRING MUST BE FURNISHED ON A SYSTEM EQUIPPED WITH DIAL TONE. DIODE IS A 400J AND MUST BE PROVIDED LOCALLY.
- WHEN ADDING THE 440A KTU TO AN EXISTING SYSTEM EQUIPPED WITH A 420A KTU, A DIODE MUST BE INSTALLED IN THE TTG LEAD CONNECTING TO THE 420A KTU. SEE FIGURE 7.

* SINGLE-DIGIT CODE OR 1ST OR 2ND DIGIT OF TWO-DIGIT CODE.

Fig. 15—Condensed Functional Schematic of 440A KTU (MD) (TOUCH-TONE Adapter Circuit) (Sheet 1 of 2)

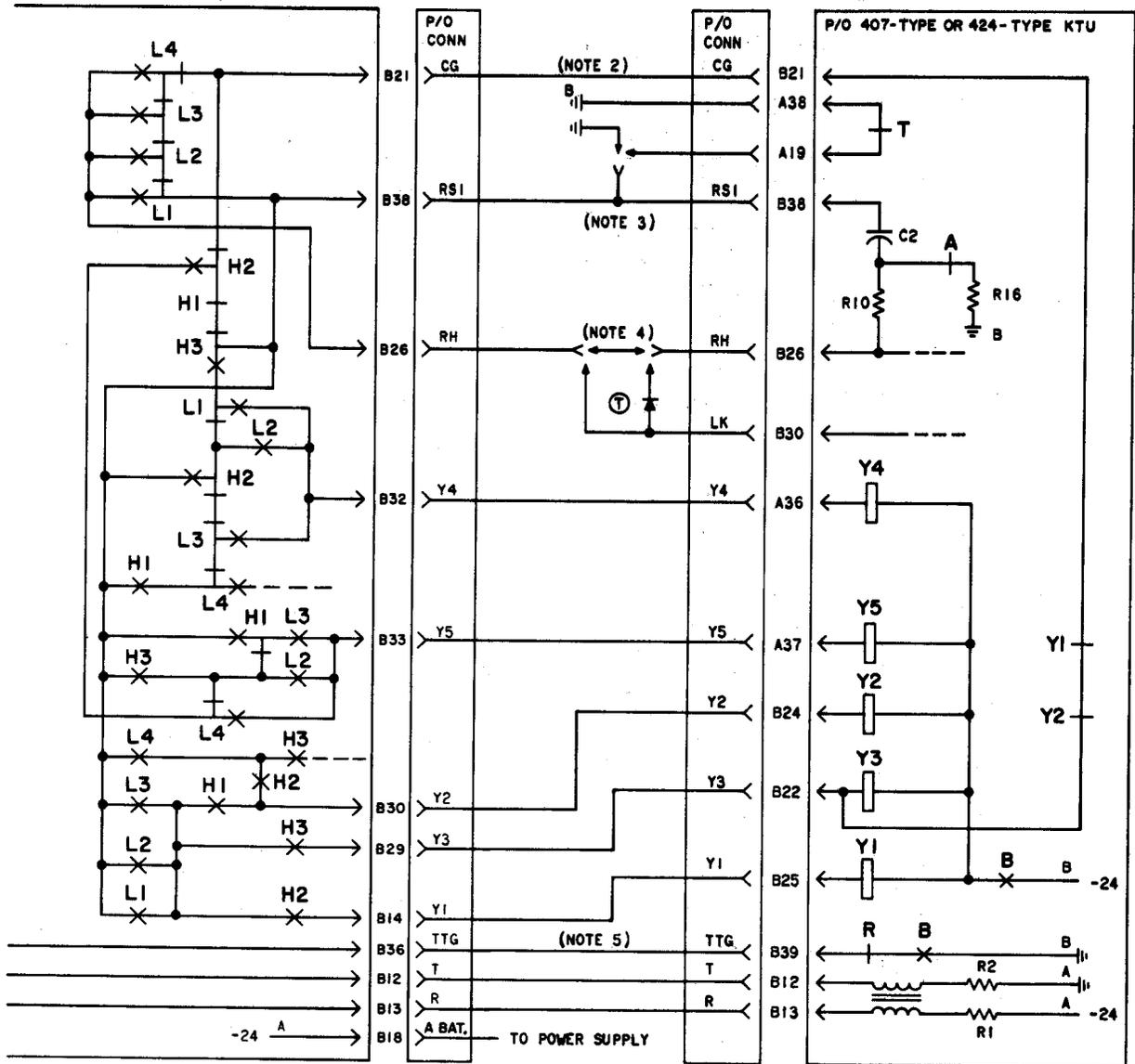


Fig. 15—Condensed Functional Schematic of 440A KTU (MD) (TOUCH-TONE Adapter Circuit) (Sheet 2 of 2)

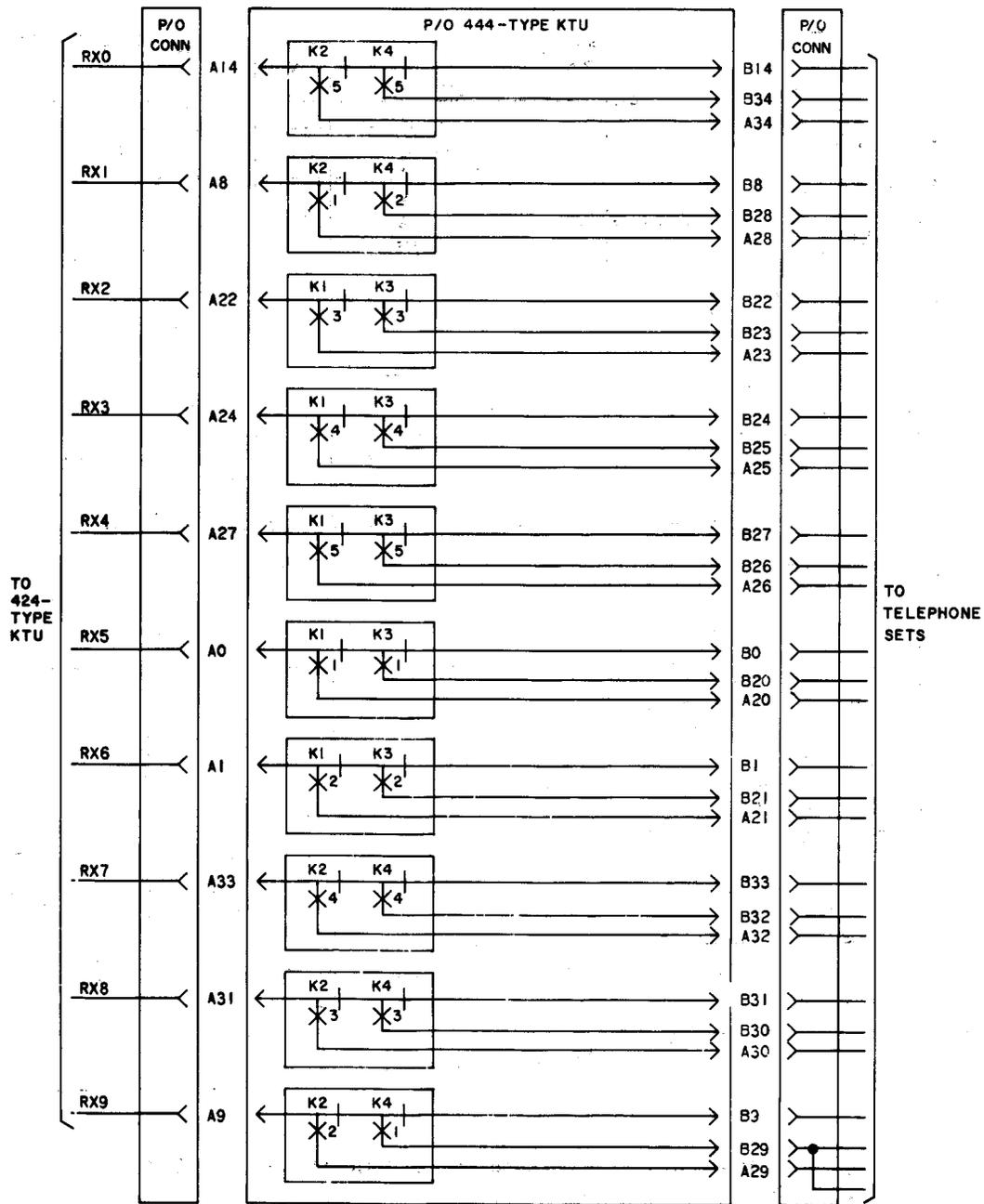


Fig. 16—Condensed Functional Schematic of 444-Type KTU (Selector Extender Circuit)
(Sheet 1 of 2)

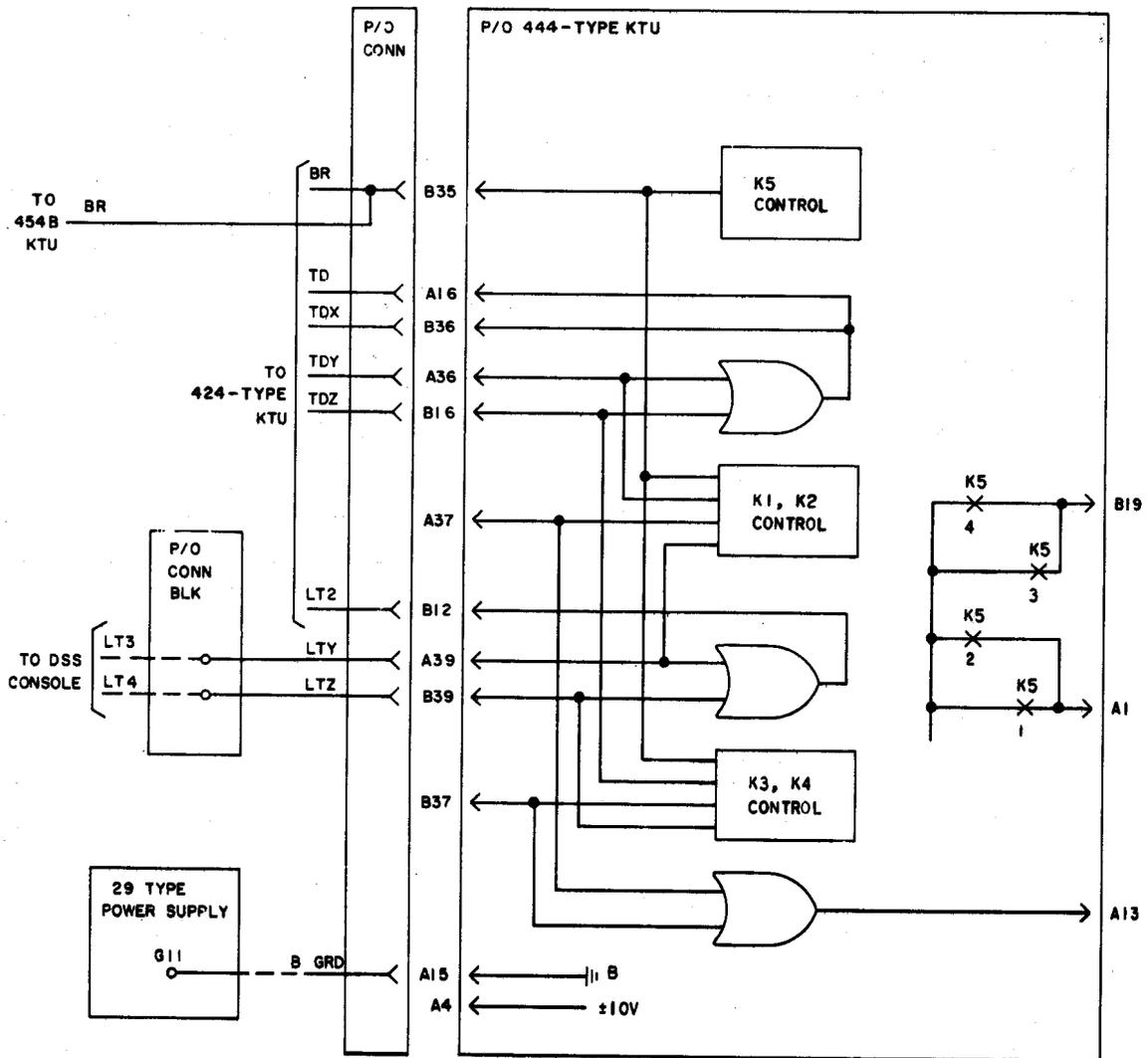


Fig. 16—Condensed Functional Schematic of 444-Type KTU (Selector Extender Circuit)
(Sheet 2 of 2)

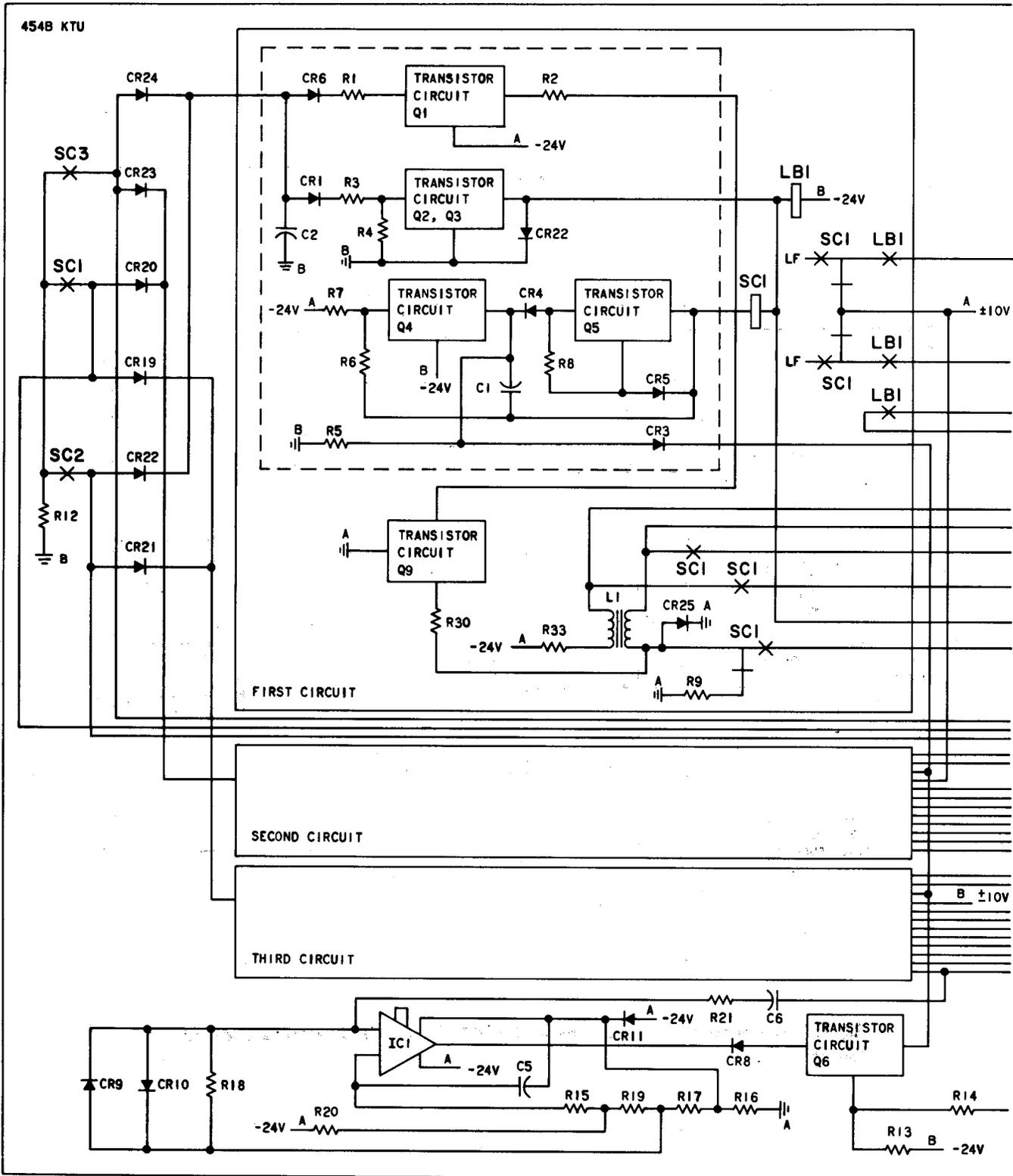


Fig. 17—Condensed Functional Schematic of 454-Type KTU (3-Path Intercom Access Circuit) (Sheet 1 of 2)

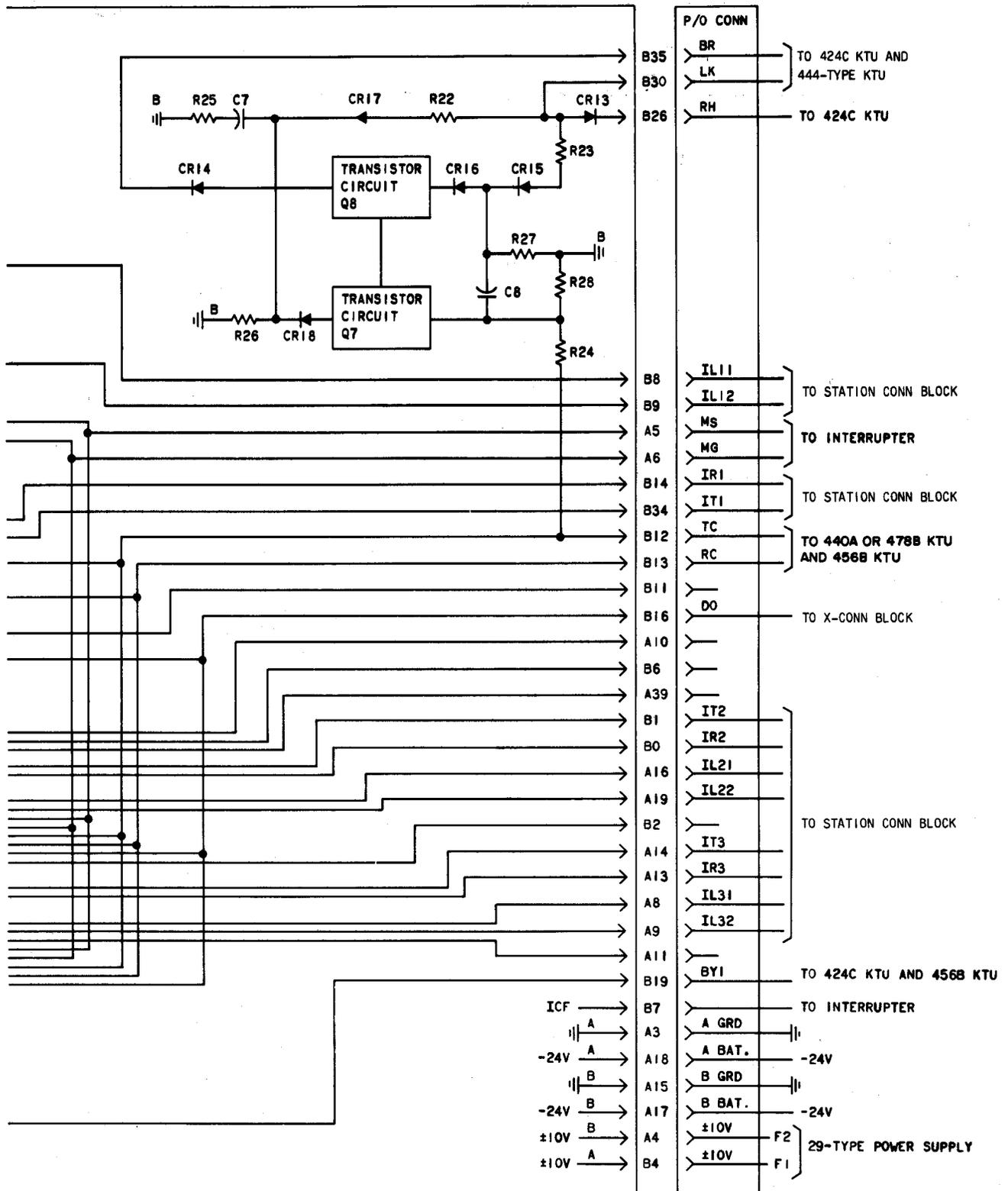


Fig. 17—Condensed Functional Schematic of 454-Type KTU (3-Path Intercom Access Circuit) (Sheet 2 of 2)

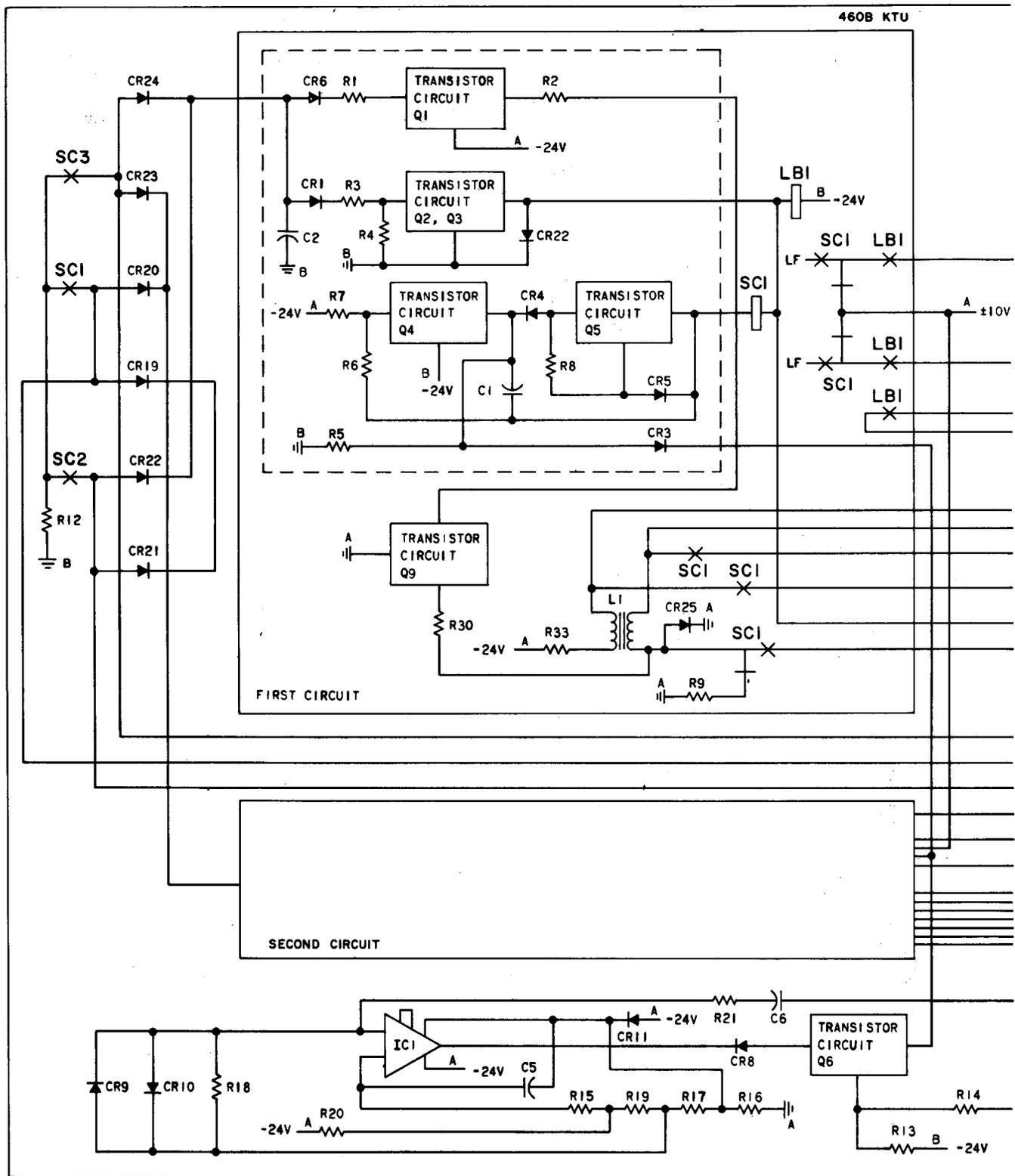


Fig. 18—Condensed Functional Schematic of 460-Type KTU (2-Path Intercom Access Circuit) (Sheet 1 of 2)

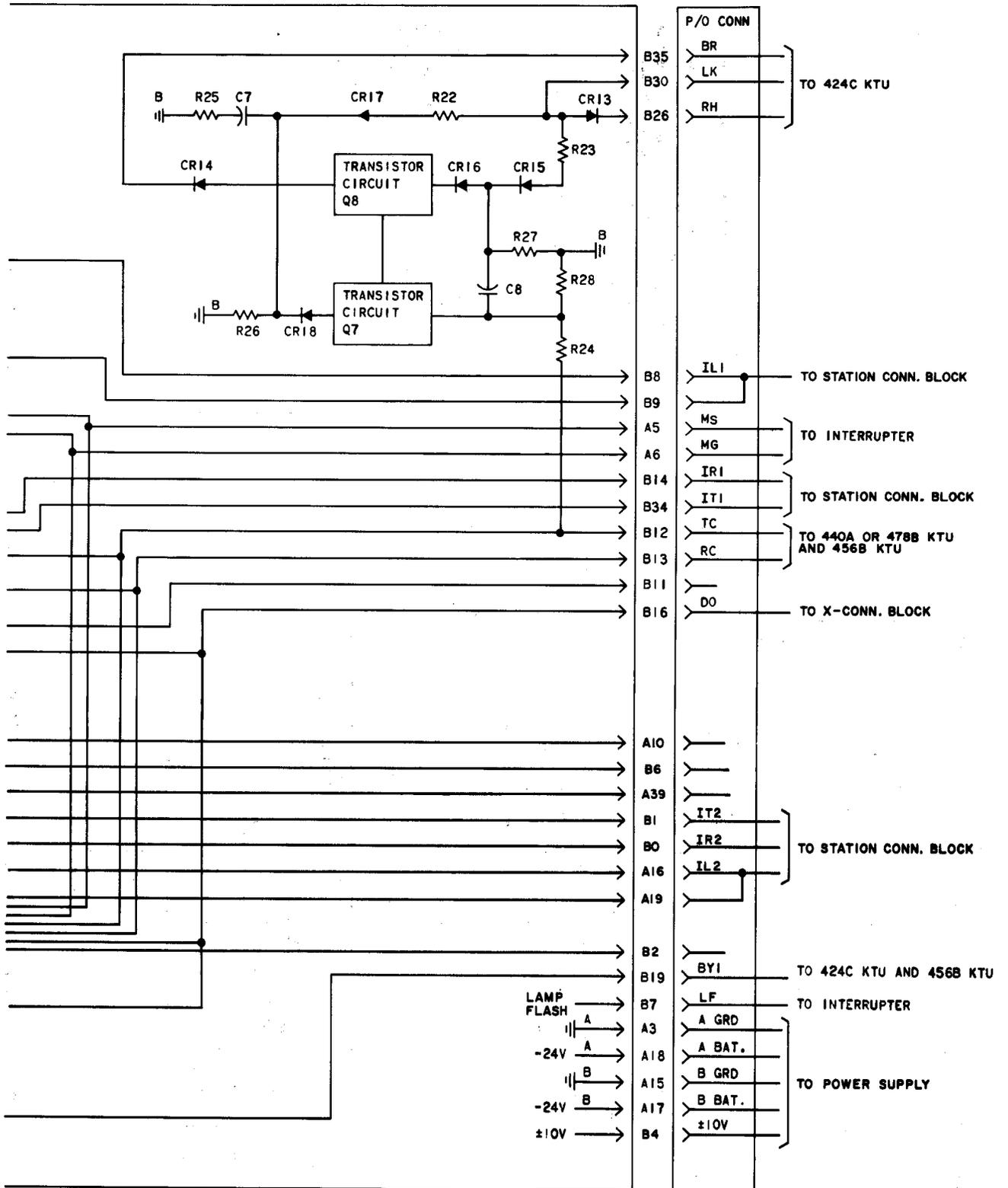
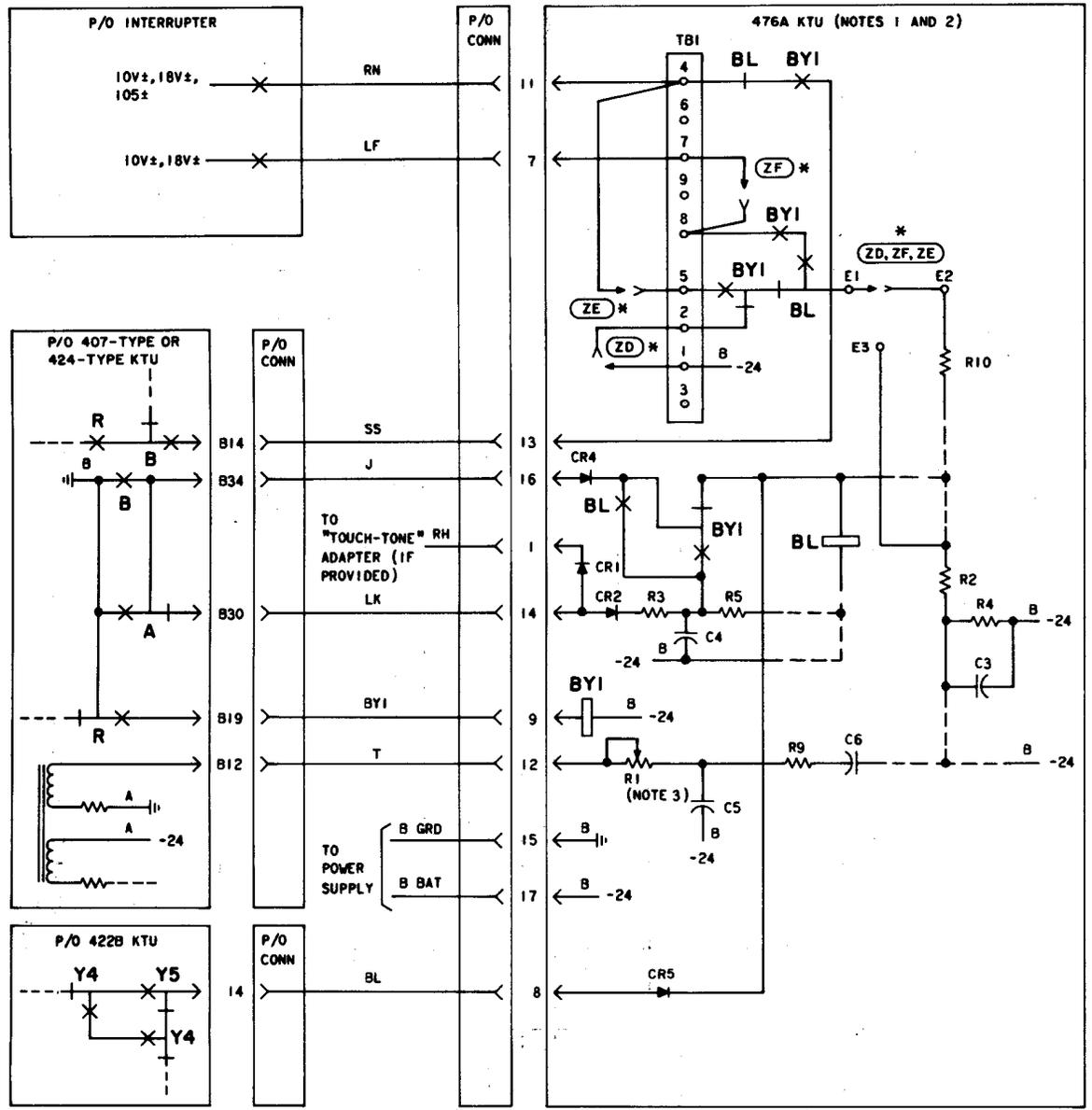
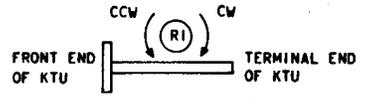


Fig. 18—Condensed Functional Schematic of 460-Type KTU (2-Path Intercom Access Circuit) (Sheet 2 of 2)



- NOTES:
1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH 20 OR 40 PINS.
 2. THE 476A KTU CAN ONLY BE USED IN MODULAR PANEL INSTALLATIONS.
 3. TURN KNURLED WHEEL TO FULL CLOCKWISE POSITION FOR MINIMUM DIAL TONE VOLUME AND TO FULL COUNTERCLOCKWISE POSITION FOR MAXIMUM DIAL TONE VOLUME.

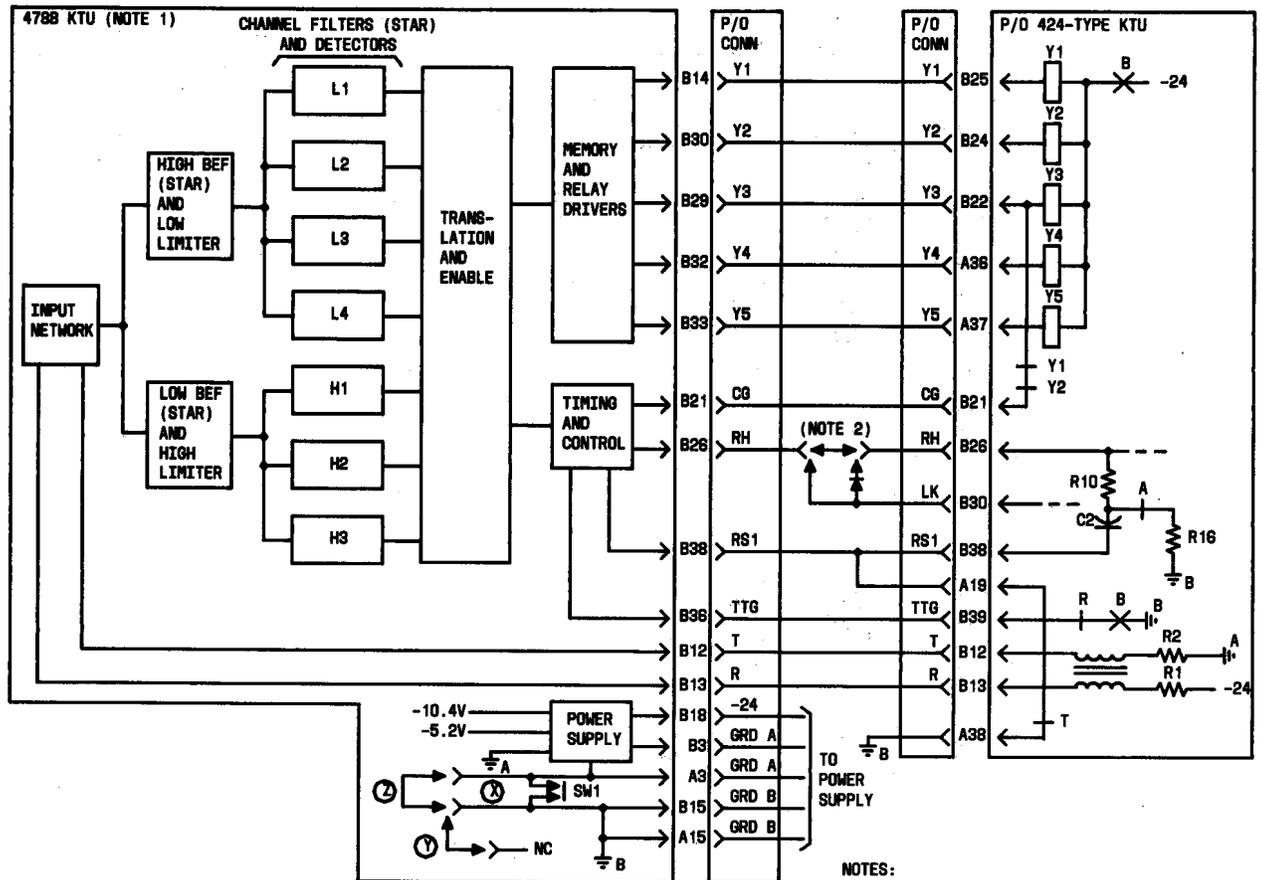


OPTIONS:

APPLICATION	"E" TERMINAL STRAPPING	OPTION	
		DIAL TONE	ZD *
AC OR NEGATIVE VOLTAGE CONTROL	E1 TO E2 *	STATION BUSY TONE	ZF *
		AUDIBLE RINGBACK	ZE *

* FACTORY PROVIDED STRAPPING

Fig. 19—Condensed Functional Schematic of 476A KTU (Dial Tone, Busy Tone, and Audible Ringback Tone)



NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 80-PIN CONNECTOR.
2. DIODE (400J, LOCALLY PROVIDED) MUST BE FURNISHED IN SYSTEM EQUIPPED WITH DIAL TONE.
3. CONNECTORS J13 AND J14 OF 570A KSU AND J21 AND J22 OF 580A KSU MUST EACH HAVE A GRD ON PIN 3 AND B GRD ON PIN 15. IF NOT FACTORY WIRED IN KSU, INSTALL LEAD ASSEMBLY SHIPPED WITH 478B KTU. IN 570A, RUN A GRD FROM J10-3 AND B GRD FROM J10-37. IN 580A, RUN A GRD FROM J18-3 AND B GRD FROM J23-15.

* D180720 KIT OF PARTS REQUIRED ON UNITS PRIOR TO SERIAL NO. 16390

† D180720 KIT OF PARTS REQUIRED ON UNITS PRIOR TO SERIAL NO. 6183

OPTIONS:

USAGE	OPTION (MD)	OPTION (X) (SW1 SCREW) SWITCH
570A, B KSU	Y	OPEN
580A, B KSU	Y	OPEN
626A PANEL	Y	OPEN
642A PANEL	Y	OPEN
4A - ACD	Y	OPEN
69E, F APP MOUNTING	Y	OPEN
702A, B PANEL	Y	OPEN
641A PANEL	Z	CLOSED

478B KTU USABILITY IN COM KEY SYSTEMS

	718 E/W		1434 E/W		2152 E/W	
570A	570B	580A	580B	702A	702B	
YES*	YES	YES†	YES	YES	YES	

Fig. 20—Condensed Functional Schematic of 478B KTU (TOUCH-TONE Adapter Circuit)

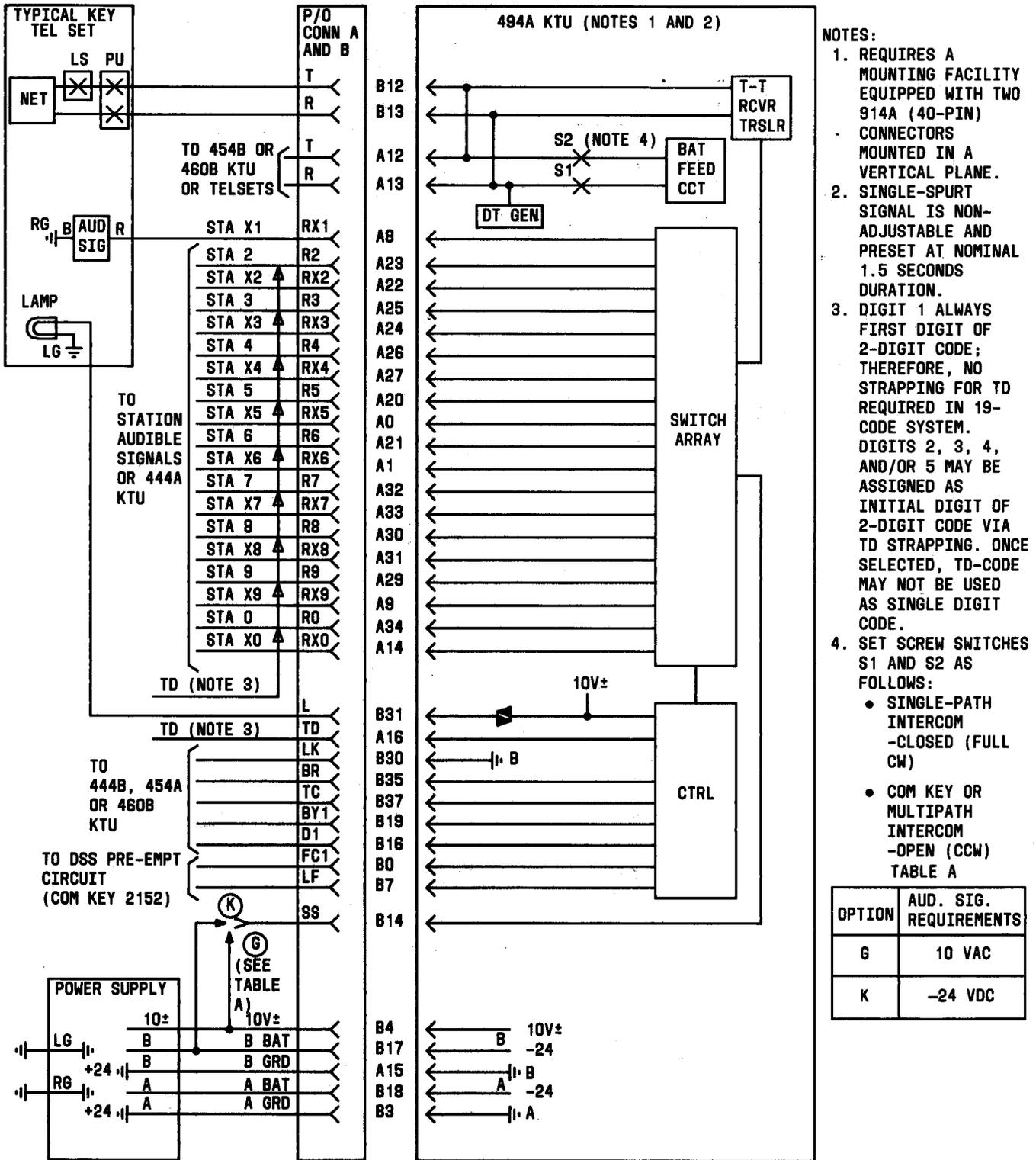


Fig. 21—Condensed Functional Schematic of 494A KTU (TOUCH-TONE 19-Code Selector Circuit) (Sheet 1 of 3)

TABLE B
494A KTU USABILITY IN
1A2 KEY SYSTEMS

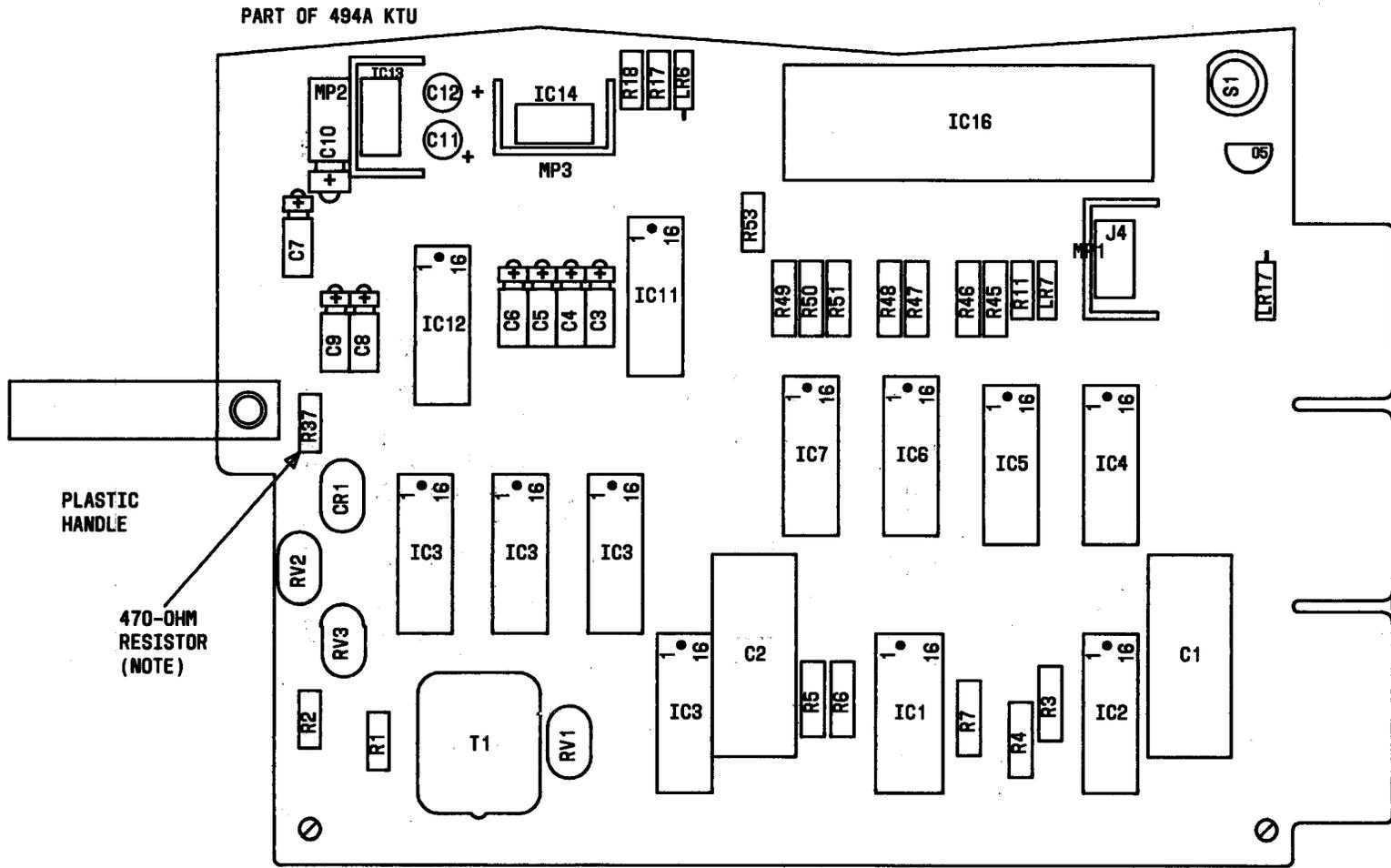
MOUNTING APPARATUS OR PANEL		
APPARATUS MOUNTING	69G	YES
	110A	YES
KEY SERVICE UNIT	513-, 515-	YES
	593-TYPE	YES
PANEL	601A	YES
	602A	NO
MODULAR PANEL	626A	YES
	641A	YES
KEY SERVICE PANEL	630-TYPE	YES

494A KTU USABILITY IN
COM KEY SYSTEMS

718 E/W		1434 E/W		2152 E/W	
570A	570B	580A	580B	702A	702B
NO	NO*	NO	NO*	NO	YES

* IF COM KEY 718/1434 SYSTEM IS NOT EQUIPPED
WITH A DSS CONSOLE A 494A COULD BE USED.

Fig. 21—Condensed Functional Schematic of 494A KTU (TOUCH-TONE 19-Code
Selector Circuit) (Sheet 2 of 3)



NOTE:

IF IT IS NECESSARY TO ELIMINATE DIAL TONE IN OTHER THAN COMKEY SYSTEMS, THE 470 OHM (YELLOW-VIOLET-BROWN) RESISTOR NEXT TO THE HANDLE MUST BE CLIPPED OFF THE CIRCUIT BOARD

Fig. 21—Condensed Functional Schematic of 494A KTU (TOUCH-TONE 19-Code Selector Circuit) (Sheet 3 of 3)

feed circuit for button-per-path intercom arrangements, eg, COM KEY, or 626A modular panel (option FW or S). Single path 1A2 intercoms require S1 and S2 switches be closed.

Warning: Failure to open S1 and S2 switches in button-per-path arrangements may cause damage to 494A KTU.

R. 494B KTU (Rotary and TOUCH-TONE Selector Circuit)

2.24 The 494B KTU (Fig. 22) provides basic rotary and/or TOUCH-TONE intercom features in a single 8-inch, 80-contact, solid-state unit. It utilizes the same mounting slot in 1A2 key service units (KSUs) and panels as 407- and 424-type KTUs or the 702B panel in COM KEY 2152. The 494B KTU can also be used in COM KEY 718 (570B KSU) and COM KEY 1434 (580B KSU). The 494B KTU provides:

- Rotary or TOUCH-TONE or mixed rotary or TOUCH-TONE dial selection of up to 19 station codes (nine single digit and ten 2-digit). The first digit of a 2-digit code is not available as a station code.
- Single-spurt signaling for use with 10-volt ac buzzers or -24 volts dc signaling devices. Signaling duration is nonadjustable and preset at nominal 1.5 seconds duration.
- Compatibility for expansion to 37 codes, 55 codes, and multipath intercom (COM KEY and 626A modular panel) arrangements with 444A-, 454-, and 460-type KTUs.
- Control of intercom line busy lamps.
- Compatibility with 6A1 and 7A1 DSS console via optional 120A circuit module.

◆Deluxe intercom cannot be provided because the 494B KTU is not compatible with the 423A or 476A KTUs (dial tone, station busy, and ringback) and the 425-type KTUs (flashing lamp).

2.25 ◆The optional 120A circuit module (CM) is required when the 494B KTU is used with COM KEY installations that are equipped with 6A1 or 7A1 DSS consoles. A connector is provided on the 494B KTU to accept the 120A CM. The connector is factory equipped with a jumper plug that must be in place when the 120A CM is not used.

2.26 ◆Lead connections are the same as the 424C KTU except that an additional pair of tip and ring contacts are available for use in COM KEY systems.

2.27 ◆Any digit may be assigned as the initial digit of a 2-digit code by strapping the digit as a transfer digit. Any additional digits may be used as transfer digits when operation is extended to 37 or 55 codes using the 444-type KTU (selector extender).

Note: Once selected, the first digit of a 2-digit code is not available as a single-digit station code.

2.28 ◆Audible signaling voltage is restricted to 10-volts ac and -24 volts dc at 120 mA maximum by integrated circuit switches used on the 494B KTU. This capacity includes voice and tone signaling which uses ac superimposed on -24 volts dc. Because of the voltage drop across the switches, the acoustic output of buzzers on long loops may not be adequate. In such cases, the audible signaling leads can be paralleled with spare conductors in the station cables to reduce voltage drop.

2.29 ◆Screw switches S1 and S2 on the 494B KTU must be in the open position to disconnect the internal battery feed circuit for button-per-path intercom arrangements, eg, COM KEY or 626A modular panel (option FW or S). Single-path 1A2 intercoms require S1 and S2 switches be closed.

Warning: Failure to open S1 and S2 switches in button-per-path arrangements may cause damage to 494B KTU.

S. 626A PANEL

2.30 The 626A panel measures 8-1/2 inches wide, 18-1/2 inches high, and 6 inches deep. It is equipped with eight 914B connectors paired vertically to accept 4- or 8-inch KTUs. The 626A panel is designed for use with the 1A2 KTS. It serves as a means for providing a number of button-per-path type dial intercoms. The 626A panel can accommodate intercom configurations of 1, 2, or 3 paths with capacities of 19 or 37 stations. Intercom paths are selected by operation of the associated button on KTSs. Rotary and/or TOUCH-TONE dialing can be provided. Lead terminations are provided in a quick-connect field to facilitate connecting optional features and for connecting to station blocks of a 1A2 KTS cross-connect field.

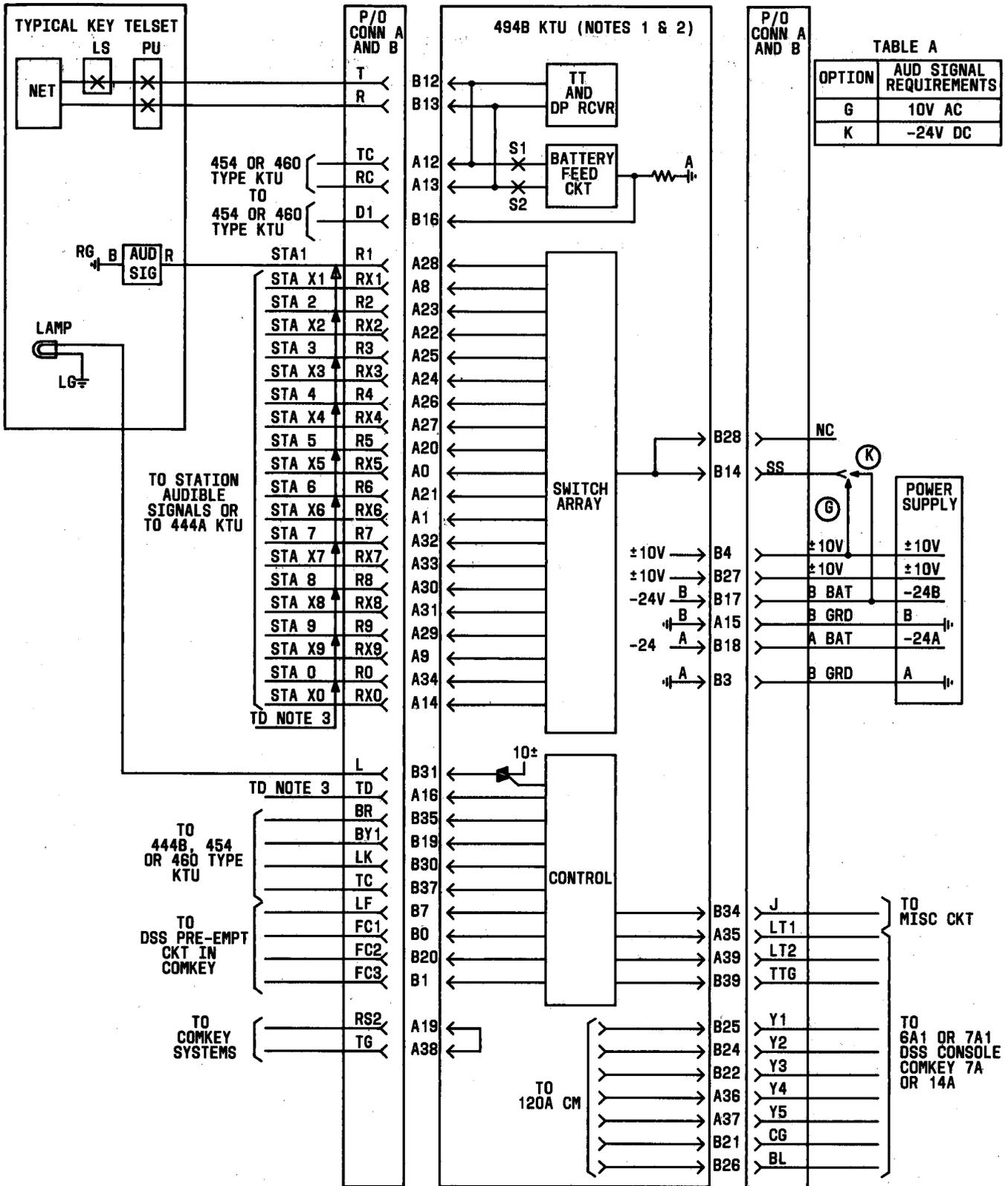


Fig. 22—Condensed Functional Schematic of 494B KTU (Rotary and TOUCH-TONE 19-Code Selector Circuit) (Sheet 1 of 2)

TABLE B
494B KTU USABILITY

MOUNTING APPARATUS OR PANEL					
COM KEY	718 (7A)		YES*		
	1434 (14A)		YES*		
	2152 (21A)	PANEL			
		702	A	NO	
B	YES				
APPARATUS MOUNTING	69G		YES		
	110A		YES		
KEY SERVICE UNIT	513-, 515		YES		
	593-TYPE		YES		
PANEL	601A		YES		
	602A		NO		
MODULAR PANEL	626A		YES		
	641A		YES		
KEY SERVICE PANEL	630-TYPE		YES		

* 120A CIRCUIT MODULE IS REQUIRED IF
DSS CONSOLES ARE PROVIDED

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH TWO 914A (40-PIN) CONNECTORS MOUNTED IN A VERTICAL PLANE.
2. SINGLE-SPURT SIGNAL IS NON-ADJUSTABLE AND PRESET AT NOMINAL 1.5 SECONDS DURATION.
3. ANY DIGIT MAY BE ASSIGNED AS THE INITIAL DIGIT OF A TWO DIGIT CODE BY STRAPPING IT TO THE TD LEAD. THE DIGIT SO ASSIGNED MAY NOT BE USED FOR A STATION CODE.
4. SET SCREW SWITCHES S1 AND S2 AS FOLLOWS:
 - SINGLE-PATH INTERCOM - CLOSED (FULL CW)
 - COM KEY OR MULTIPATH INTERCOM - OPEN (CCW)

Fig. 22—Condensed Functional Schematic of 494B KTU (Rotary and TOUCH-TONE 19-Code Selector Circuit) (Sheet 2 of 2)