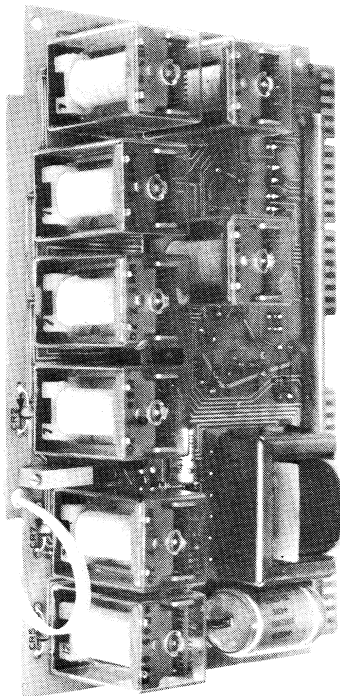


S-C 407B KTU 10-STATION SELECTOR CIRCUIT CARD

IDENTIFICATION, INSTALLATION, CONNECTIONS,
MAINTENANCE, CIRCUIT DESCRIPTION, AND PARTS LIST



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Figure 1. S-C 407B KTU 10-Station Selector Circuit Card

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1. INTRODUCTION

1.01 This section provides identification, installation, connections, maintenance, circuit description, and parts ordering information for the S-C 407B KTU 10-station selector circuit card. This circuit card is used in S-C EM-101 or EM-102 expansion modules.

1.02 This issue updates issue 2 dated June 1974. Paragraph 5.03 has been added and corrections have been made in paragraphs 5.01, 5.02, and 7.02c. These changes are identified by a black line in the margin.

2. RELATED INFORMATION

2.01 A Sales and Instructional Literature Index, which lists the latest publications available from Stromberg-Carlson Corporation, can be obtained from your Stromberg-Carlson sales representative or from Publications Services, Stromberg-Carlson Corporation, 100 Carlson Road, Rochester, New York 14603.

2.02 Sections or publications applicable to the equipment covered in this section, as well as others of particular interest, can be ordered from the Sales and Instructional Literature Index.

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3. IDENTIFICATION

3.01 The S-C 407B circuit card consists of one printed circuit board and miscellaneous transistors, resistors, capacitors, diodes, and relays. The circuit card measures 7-1/2 inches (19.1 cm) high, by 5-5/16 inches (13.5 cm) deep, by 1-7/16 inches (3.7 cm) wide and provides access for up to 10 station codes when used in conjunction with the S-C EM-101 and EM-102 expansion modules.

3.02 The features provided by this circuit are as follows:

- a. Provides talking battery for intercom stations over a common talking path.
- b. Provides single-digit station selection for up to 10 codes.
- c. Provides an adjustable single audible signal to the dialed station over a separate signaling pair.
- d. Provides a means for operating visual busy signals.
- e. Accepts dial pulses at 8 to 12 pulses per second.
- f. When used in conjunction with S-C TONE-DIAL® receiver circuit, will function with pushbutton-dial and rotary-dial telephones.
- g. Allows for a maximum station conductor loop resistance (not including station instrument) of 50 ohms. Up to four stations can be off-hook at one time for conference calls.

4. CONNECTIONS

4.01 There are no connections or strapping to be made on the S-C 407B circuit card itself. Table 1 lists the various options which can be wired on the connecting blocks associated with this KTU when associated with an S-C 1A2 Key Telephone System. For complete wiring information, refer to the applicable S-C 1A2 Key Telephone System publication.

5. INSTALLATION

Caution: Use care when handling printed circuit board to avoid damage to the board or its components. Also, ensure wiring at card receptacle is correct before plugging in circuit board to ensure against electrical damage to card.

5.01 The S-C 407B printed circuit board is used

with the S-C EM-101 and EM-102 expansion modules. The plug end of the circuit board is slotted to prevent improper installation.

5.02 After checking wiring of the module receptacle, insert printed circuit card carefully into the expansion module receptacle using sufficient pressure to ensure proper seating.

5.03 Adjust variable resistor R4 to the desired audible signal time duration (factory adjusted to 1.5 seconds, nominal).

6. MAINTENANCE

6.01 Troubleshooting a suspected S-C 407B KTU is best accomplished by exchanging it with a known good card to isolate the fault.

6.02 It is recommended that field repair or relay adjustment of these cards not be attempted. If adequate repair shop facilities are not available, the card should be sent to Stromberg-Carlson for repair. It is also recommended that a spare S-C 407B circuit card should be available for replacement purposes.

Caution: If component replacement is required, apply heat to the component leads only long enough to unsolder or solder them. Excessive heat will damage printed circuit card components.

6.03 Printed circuit cards are fragile and must never be stored or shipped without adequate protection. For this reason, the packing box used to ship the KTU should be stored for possible future use.

7. CIRCUIT DESCRIPTION (FIG. FO-1)**7.01 Prior to Seizure.**

In the idle condition, -24 volts dc through resistors R4, R5, R6, and R13 cause diode CR1 to break down and conduct. This places a negative voltage on the base of transistor Q2 which turns it on. The base of transistor Q3 is then at a potential close to ground for the purpose of holding transistor Q3 off.

7.02 Seizure.

- a. When a station goes off-hook and accesses the intercom circuit, it causes current to flow through resistors R1 and R2, retard coil L1, and the station loop to the station. This current produces a voltage drop across resistor R2 which forward biases transistor Q1 and turns it on.

b. Transistor Q1 turned on operates relay A. Relay A closes a circuit to the busy-station lamps and connects ground through resistor R16 to the anode of diode CR1 so that it cannot conduct. This removes the forward bias on transistor Q2 and it turns off. Transistor Q2 off permits the -24 volts through resistor R7 to forward bias transistor Q3 and turn it on, operating relay B. Relay B provides -24 volts for the counting relays which operates relay Y3 on ground by way of the CG lead. Relay B also applies ground to lead TTG which enables the TONE-DIAL receiver circuit if provided.

c. Relay Y3 operated completes the following circuit: ground through contacts EBM2 of relay R, contacts EBM3 of relay Y2, contacts EMB6 of relay Y4, contacts EMB6 of relay Y5, contacts EBM3 of operated relay Y3, resistors R10 and R9 to -24 volts (B battery). This current produces a voltage at the junction of resistors R9 and R10 which is below the breakdown voltage of diode CR4 which is then unable to conduct current.

d. The selector is now ready to receive dialed digits (with relays A, B, and Y3 operated).

Table 1. Wiring Options Available with S-C 407B KTU

FEATURE	OPTION	WIRING	EXTERNAL CONNECTIONS		PROVIDED BY FACTORY IN 1A2 KEY SYSTEM
			FROM	TO	
Audible Signaling	Single-Spurt Ringing with Ac Buzzer	Y,J	± 18V	B14	YES
	Single-Spurt Ringing with Dc Buzzer	Y,K	B BAT	B14	NO
	Single-Spurt Ringing with Ringer	Y,M	± 105V	B14	NO
	Interrupted Ringing	X	INTR(RN)	B14	NO
			FLASH LAMP CKT (TC)	B37	NO
	Station Busy Tone	R	TONE CONT.(SS)	B14	NO
Rotary-Dial Station Selection	Rotary-Dial Station Selection	Z	A19	B21	YES
Pushbutton-Dial Station Selection	TONE-DIAL Applique	N	RH CG RS1	B26 B21 A19	NO
Visual Indication (Incoming Inter- com Calls)	Steady Station Lamps	W	TEL SET	B31	YES (lead L)
	Flashing Station Lamps	V	LAMP FLASH CKT (lead LA)	B31	NO

7.03 Single-Digit, Rotary-Dial Station Selection.**a. Station Selection (Table 2).****1. Assume station number zero (0) is being called.**

On release of the calling party's dial, the first break pulse begins the counting chain operation of relays Y1, Y2, Y3, Y4, and Y5.

2. During the break time of the first pulse, relay A releases, completing the operate path to relay Y2 as follows: ground on lead CG, through contacts EBM3 of relay Y1, contacts EBM5 of relay A, the coil of relay Y2 to battery on contacts EBM5 of operated relay B. Relay Y3 holds operated through contacts EBM4 of relay A, EBM1 of relay Y2 and EBM5 of itself to lead CG. At the end of the first pulse, relay A reoperates and releases relay Y3. Relay Y2 remains operated.

3. On the break portion of the second pulse relay A releases, operating relay Y1 through contacts of relays A and Y3. At the end of the second pulse, relay A operates and releases relay Y2. Relay Y1 remains operated.

4. On the break portion of the third pulse, relay A releases and operates relay Y3 through contacts of relay A and Y2. Relay Y4 operates through contacts of relays Y5, Y3, Y1, and Y2 respectively. At the end of the third pulse, relay A reoperates causing relay Y1 to release. Relays Y3 and Y4 remain operated.

5. On the break portion of the fourth pulse, relay A releases and operates relay Y2 through contacts of relays A and Y1. At the end of the fourth pulse, relay A reoperates causing relay Y3 to release. Relays Y2 and Y4 remain operated.

6. On the break portion of the fifth pulse, relay A releases and operates relay Y1 through contacts of relays A and Y3. At the end of the fifth pulse, relay A reoperates causing relay Y2 to release. Relay Y5 operates through contacts of relays Y4, Y3, Y1, and Y2. Relays Y1, Y4, and Y5 remain operated.

7. On the break portion of the sixth pulse, relay A releases and operates relay Y3. At the end of

the sixth pulse, relay A reoperates causing relay Y1 to release. Relays Y3, Y4, and Y5 remain operated.

8. On the break portion of the seventh pulse, relay A releases and operates relay Y2 through contacts of relays A and Y1. At the end of the seventh pulse, relay A reoperates causing relay Y3 to release. Relays Y2, Y4, and Y5 remain operated.

9. On the break portion of the eighth pulse, relay A releases and operates relay Y1 through contacts of relays A and Y3. Relay Y1 operating releases relay Y4. At the end of the eighth pulse, relay A reoperates causing relay Y2 to release. Relays Y1 and Y5 remain operated.

10. On the break portion of the ninth pulse, relay A releases and operates relay Y3 through contacts of relays A and Y2. At the end of the ninth pulse, relay A reoperates causing relay Y1 to release. Relays Y3 and Y5 remain operated.

11. On the break portion of the tenth pulse, relay A releases and operates relay Y2 through contacts of relays A and Y1. At the end of the tenth pulse, relay A reoperates causing relay Y3 to release. Relays Y2 and Y5 remain operated.

12. During pulsing of the dial contacts, relay A operated and released alternately. This action by relay A permits capacitor C1 to charge and discharge in unison with the relay. Capacitor C2 charges as C1 discharges and discharges as C1 charges. The alternate charging of capacitors C1 and C2 during dial pulsing holds relay B operated and shunts relay R.

b. Station Signaling.

1. On completion of the dialed digit, relay A remains operated and ground is removed from the RH lead. This permits capacitor C2 to charge. When the reverse breakdown voltage of zener diode CR4 is reached, it conducts and turns on transistor Q4. Transistor Q4 on, operates relay R.

2. When relay R operates, an audible signal is applied to the buzzer, bell, or ringer of the

Table 2. S-C 407B Relay Sequence of Operation

PULSE NO.	DIAL CONTACT CONDITION		RELAYS							
			A	B	Y1	Y2	Y3	Y4	Y5	R
	PRESEIZURE		↓	↓	↓	↓	↓	↓	↓	↓
	SEIZURE (closed)		↑	↑			↑			
1	OPEN		↓			↑				
1	CLOSED		↑				↓			
2	OPEN		↓		↑					
2	CLOSED		↑			↓				
3	OPEN		↓				↑	↑		
3	CLOSED		↑		↓					
4	OPEN		↓			↑				
4	CLOSED		↑				↓			
5	OPEN		↓		↑				↑	
5	CLOSED		↑			↓				
6	OPEN		↓				↑			
6	CLOSED		↑		↓					
7	OPEN		↓			↑				
7	CLOSED		↑				↓			
8	OPEN		↓		↑			↓		
8	CLOSED		↑			↓				
9	OPEN		↓				↑			
9	CLOSED		↑		↓					
0	OPEN		↓			↑				
0	END		↑				↓			
	STATION SIGNALING	(Start)	↑							↑
		(Stop)	↑	↓	↓	↓	↓	↓	↓	↑
	CONVERSATION		↑							↑
	DISCONNECT		↓							↓

How To Use This Table:

The example used is the dialed digit 3.

1. Use a piece of paper and cover the remaining dial pulse sequences 4 through 0.
2. Note that at the end of the third dial pulse, the table shows that relays A, B, Y3, and Y4 are operated.
3. At the start of station signaling (1.5 seconds duration), relay R operates.
4. When station signaling stops, relays B, Y3, and Y4 release.
5. Relays A and R remain operated during conversation.

selected station by way of contacts of the X (counting) relays. Relay R also removes resistance ground from capacitor C1 permitting it to charge if there is no resistance ground on the TC lead. When the charge on capacitor C1 exceeds the breakdown voltage of zener diode CR1, it conducts and turns on transistor Q2. This applies ground to the base of transistor Q3 to turn it off. Transistor Q3 off releases relay B which removes the audible signal from the station and removes battery from the Y (counting) relays to release them. The selector is now in the talking mode with relay A and relay R operated.

3. The time between the operation of relay R and release of relay B represents the audible signal time (1.5 seconds nominal) for single-spurt ringing. This period is factory adjusted to the nominal period with variable resistor R4.

c. Disconnect.

After the last station disconnects, relay A releases. Relay A releasing, releases relay R. The release of relay R causes the busy lamps to go out and restores the circuit to normal.

7.04 Pushbutton-Dial Station Selection (Fig. FO-1).

a. Station Selection.

1. The receipt of pushbutton-dial digits (optional TONE-DIAL receiver provided) is enabled by the application of ground on the TTG lead from the TONE-DIAL adapter circuit. When a dual-tone multifrequency signal is received by the TONE-DIAL receiver circuit, proper H and L relays will operate.

2. This removes ground from the CG lead to release relay Y3, applies ground on the RH lead to keep relay R from operating, and applies ground to the associated Y leads to operate the proper counting chain relays (Y1, Y2, Y3, Y4, and Y5).

3. When the dual-tone signal is removed, the H and L relays in the TONE-DIAL receiver release. This restores ground to the CG lead to hold the selected Y relays, and restores ground from the Y leads and RH lead to allow relay R to operate.

b. Station Signaling.

Signaling the called station is as given in paragraph 7.03b.

c. Disconnect.

On completion of the conversation, both stations go on-hook. The manner in which the S-C 407B KTU restores to normal is as given in paragraph 7.03c.

8. PARTS LIST

8.01 Individual components for the S-C 407B 10-station selector circuit card can be identified by the following procedure:

- a. Locate the part on figure 2 and obtain the associated part identification reference or item number.
- b. Refer to table 3 and locate the item number of the part to obtain its description and stock number.

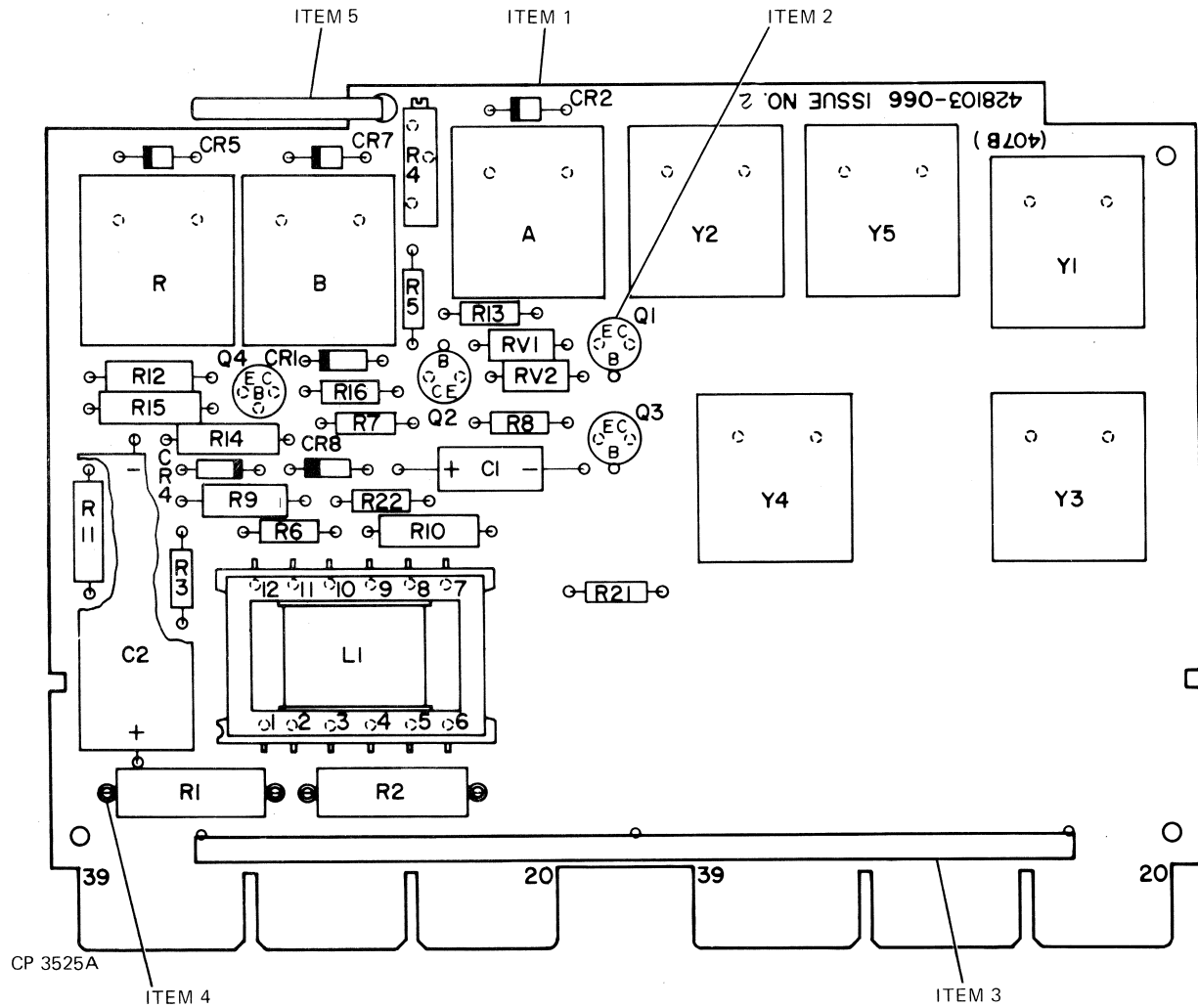
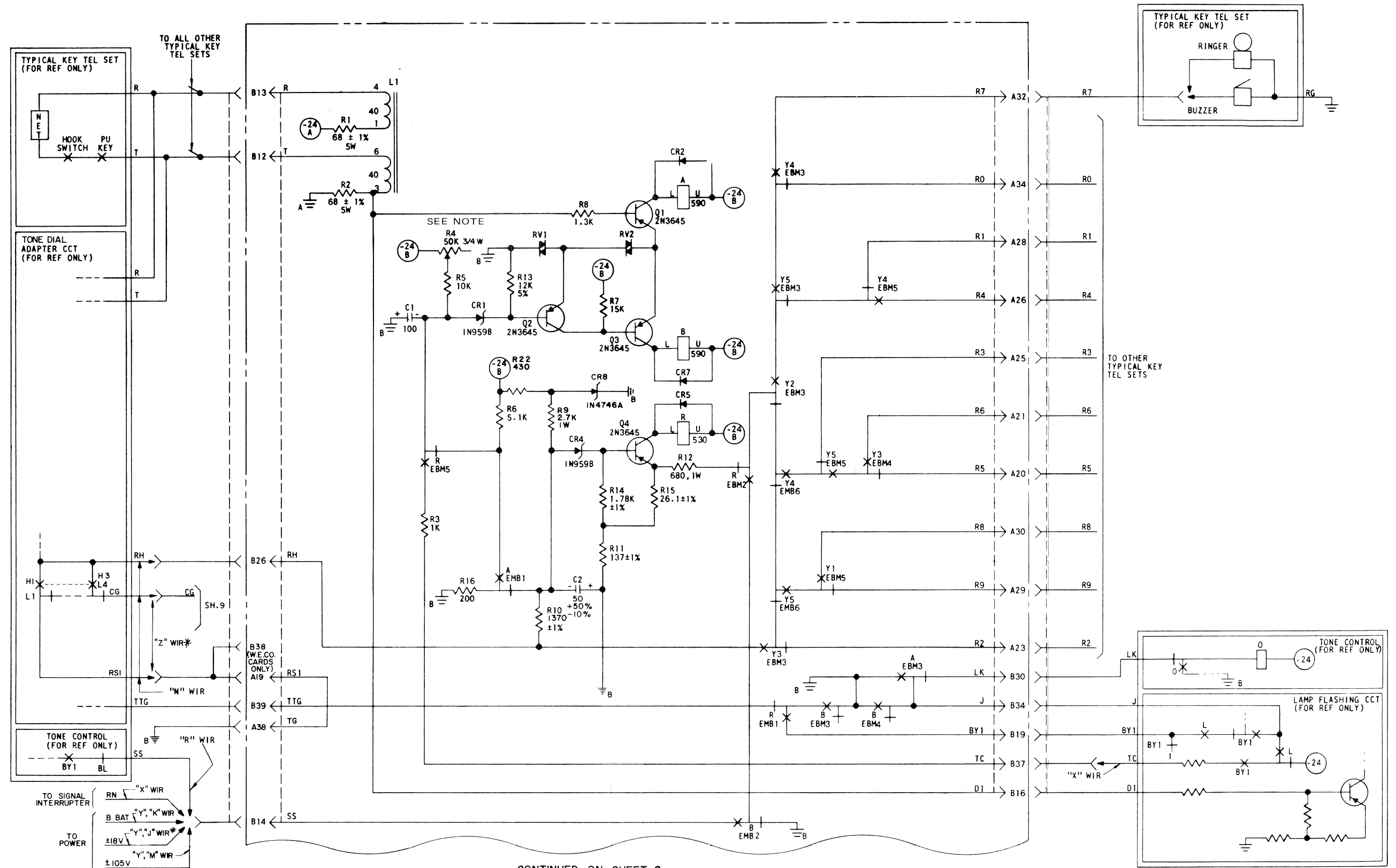


Figure 2. S-C 407B KTU 10-Station Selector Circuit Card (Component Layout)

Table 3. S-C 407B KTU 10-Station Selector Circuit Card, Parts Identification

REFERENCE	DESCRIPTION	STOCK NO.
ITEM 1	Printed Circuit Card Assembly	428103-066
ITEM 2	Transistor Mounting Pad (Transipad)	350002-799
ITEM 3	Stiffner Rib	303506-702
ITEM 4	Stand-off Spacer	300348-925
ITEM 5	Cable Strap, Plastic	540595-101
C1	Capacitor, 100-uf, $\pm 20\%$, 25Vdcw	202928-535
C2	Capacitor, 50-uF, +50%, -10%, 75Vdcw	552272-513
CR1,CR4	Diode, Zener 1N959B	202894-268
CR2,CR5-CR7	Diode, S-C 827	202852-138
CR8	Diode, Zener 1N4746A	202941-058
R	Relay, MB-65	204805-538
A,B,Y1,Y2		
Y3,Y4,Y5	Relay, MB-5	204801-678
R1,R2	Resistor, 680-ohm, 5W, $\pm 1\%$	554531-680
R3	Resistor, 1K-ohm, 1/2W, $\pm 5\%$	554000-102
R4	Resistor, 50K-ohm, 3/4W, $\pm 10\%$	202915-766
R5	Resistor, 10K-ohm, 1/2W, $\pm 5\%$	554000-103
R6	Resistor, 5100-ohm, 1/2W, $\pm 5\%$	554000-512
R7	Resistor, 15K-ohm, 1/2W, $\pm 5\%$	554000-153
R8	Resistor, 1300-ohm, 1/2W, $\pm 5\%$	554000-132
R9	Resistor, 2700-ohm, 1W, $\pm 5\%$	554003-272
R10	Resistor, 1370-ohm, 1/2W, $\pm 1\%$	554020-306
R11	Resistor, 137-ohm, 1/2W, $\pm 1\%$	554020-210
R12	Resistor, 680-ohm, 1W, $\pm 5\%$	554003-681
R13	Resistor, 12K-ohm, 1/2W, $\pm 5\%$	554000-123
R14	Resistor, 1780-ohm, 1/2W, $\pm 1\%$	554020-317
R15	Resistor, 26.1-ohm, 1/2W, $\pm 1\%$	554020-137
R16	Resistor, 200-ohm, 1/2W, $\pm 5\%$	554000-201
R21	Resistor, 20K-ohm, 1/2W, $\pm 5\%$	554000-203
R22	Resistor, 430-ohm, 1/2W, $\pm 5\%$	554000-431
L1	Inductor	202942-661
Q1-Q4	Transistor, 2N3645	202911-737
RV1-RV2	Varistor	202894-019



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Notes:
Resistor R4 is factory adjusted to provide
1.5 seconds \pm 0.2 seconds audible call signal.
*Indicates factory wired option.

Figure FO-1. S-C 407B KTU 10-Station Selector Circuit,
Schematic Diagram (Sheet 1 of 2)

CONTINUED FROM SHEET 1

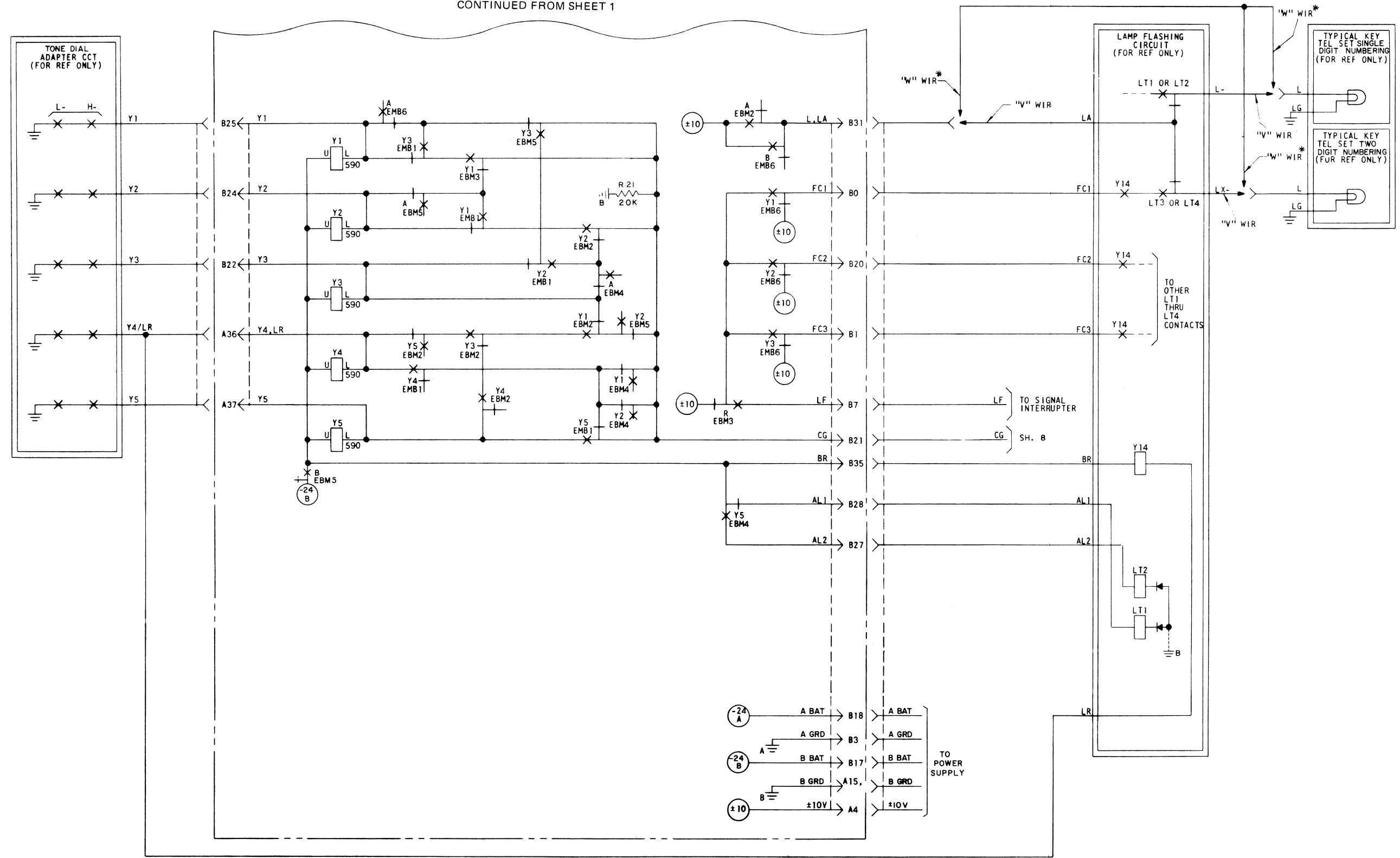


Figure FO-1. S-C 407B KTU 10-Station Selector Circuit, Schematic Diagram (Sheet 2 of 2)