

KEY TELEPHONE SYSTEMS
**400D AND MODEL 4000 KEY TELEPHONE UNITS
INSTALLATION AND CONNECTIONS**

1. GENERAL

- 1.01 This practice provides the description of, installation and connections for the 400D type key telephone units manufactured by Stromberg-Carlson, Automatic Electric, ITT Telecommunications and Western Electric. The same line card unit manufactured by San/Bar Electronics is referred to as a Model 4000 line card.
- 1.02 The 400D key telephone unit (KTU) is designed for use with a central office or PBX line circuit unit in the 1A2 key telephone system. The circuitry of the unit employs transistors, miniature and dry-reed relays, capacitors, diodes and resistors.

2. WESTERN ELECTRIC 400D KTU

- 2.01 The Western Electric 400D KTU is an 18 contact plug-in type unit with the circuit components mounted on an epoxy-coated metal board interconnected by printed circuitry on both sides. The plug end of the unit has two slots to locate and properly seat into the mounting receptacle of a 501, 502, 550 and 551 type key service unit, or 583 and 584 type panel, or a 259 type KTU. See Figure 1.
- 2.02 The KTU is equipped with a combination option block and finger grip handle to assist in its insertion or removal and to provide means for changing circuit options.
- 2.03 The KTU provides the means for (or the control of) the following service and operational features in a key telephone system:
 - a. Central office or PBX line pickup and hold.
 - b. Flashing line lamp.
 - c. Winking (or steady) hold lamp indications.
 - d. Individual line time out with optional short or extended release time interval.
 - e. Common audible signal on incoming calls.
 - f. Talking circuit maintained during local power failure.

3. INSTALLATION

- 3.01 Wiring options are listed in Table A. If customer requirements are different from factory furnished options, these options should be changed on the 400D KTU before insertion into the mounting receptacle.
- 3.02 Figure 2 shows the KTU line circuit option block layout. Use 24 gauge bare wire for strapped connections and place in option terminal using long-nose pliers.
- 3.03 When the resistor shunt is required to further reduce the short time out interval (Z option), proceed as follows:

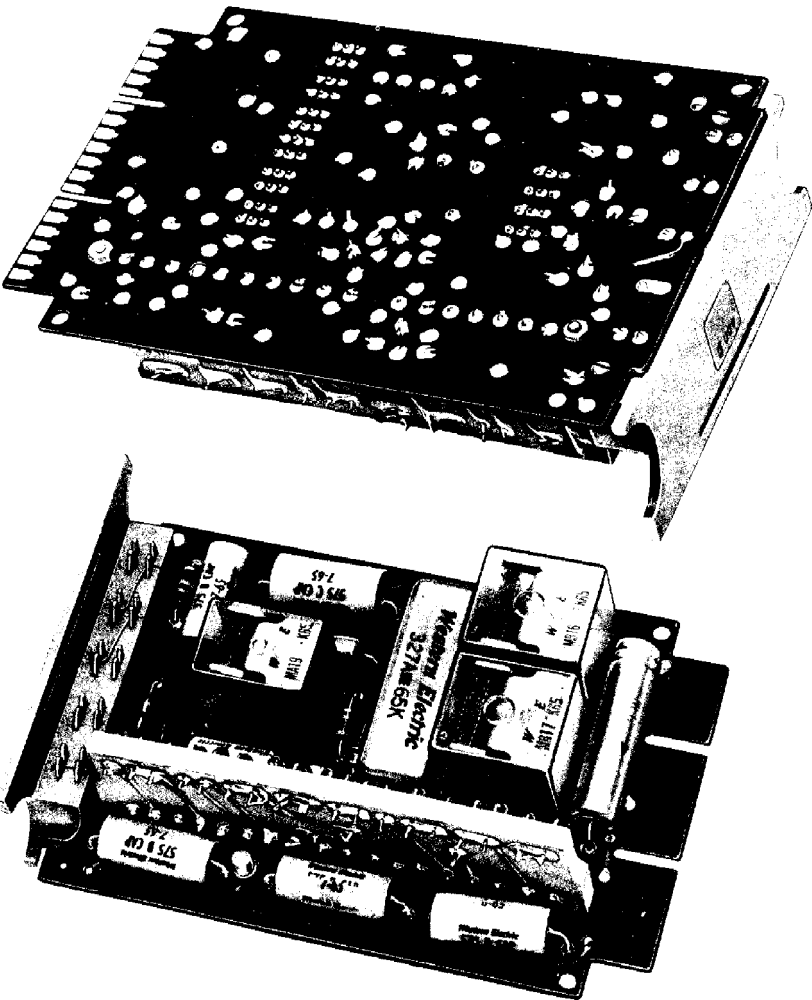


FIGURE 1. 400D Key Telephone Unit

TABLE A
WIRING OPTIONS

FEATURE	OPTION	WIRING	STRAP ON 400D KTU TERMINALS	PROVIDED BY FACTORY†
Time-Out Control	Long Time Delay	*	None	No
	Short Time Delay	(Z)	1 to 2	Yes
	Reduction of Short Time Delay‡	‡	1 to 2 (1st lead) 3 (2nd lead)	No
Visual Hold Signal	Lamp Wink	(Y)	7 to 10	Yes
	Lamp Steady	(X)	7 to 9	No
Audible Signaling	Interrupted Ring	(W)	5 to 8	Yes
	Steady Ring	(T)	6 to 8	No
	Common, With Relay Control	(V)	4 to 8	No
	Common, With Matrix Control	(S)	5 to 8	No

* Long time delay is effective only when the (Z) option strap is removed.

† When changing options, remove factory or existing option.

‡ See Table B.

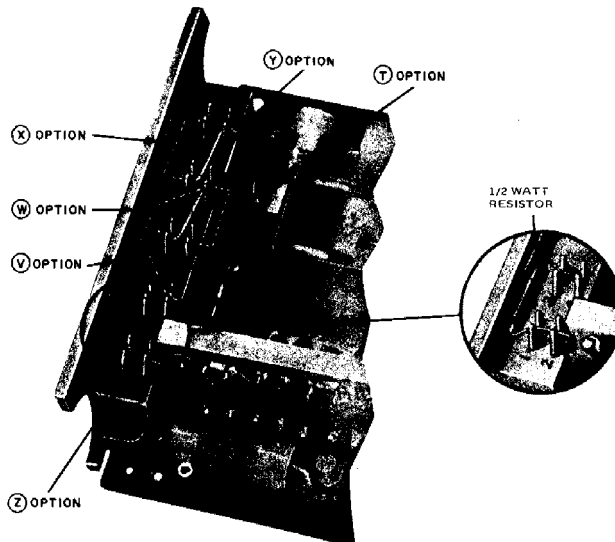


FIGURE 2. 400D KTU Option Block Handle

- a. Determine in seconds the existing short time out interval. Do this by dialing one line from another line at the same station and counting the number of flashes on the called line lamp after hanging up the handset on the calling line. Count one second for each flash of the lamp.
- b. Select a resistor from Table B which will provide the time out interval desired.

NOTE: The resistor selected will reduce the existing time out interval to the fractional value listed in Table B.

TABLE B
RESISTANCE REQUIRED FOR DECREASING SHORT TIME-OUT INTERVAL†

DESIRED FRACTION OF EXISTING TIME-OUT	MEG OHM RESISTOR*	RESISTOR COLOR CODE
3/4	1.50	BROWN-GREEN-GREEN
2/3	.82	GRAY-RED-YELLOW
1/2	.47	YELLOW-VIOLET-YELLOW
1/3	.24	RED-YELLOW-YELLOW
1/4	.16	BROWN-BLUE-YELLOW

* 1/2-watt resistor.

† When the duration of the machine ringing is 1.0 second, the time-out shall not be reduced more than 50% of the original time-out.

- c. Remove the (Z) option strapping.
- d. Connect one lead of the selector resistor to terminal 3 on the option block. Connect the other lead to *both* terminals 1 and 2 (see Figure 2).
- e. Check the modified time out interval by following procedures outlined in a.

3.04 When inserting the KTU, grasp the unit by the finger grip handle and with a vertical rocking motion use sufficient force to seat it fully in its receptacle. *The plug edge of each KTU is treated with a lubricant to assist in the removal from or insertion in its mounting receptacle. DO NOT WIPE OFF LUBRICANT.*

4. CONNECTIONS

4.01 The printed circuit wiring extends to the contacts of the KTU which are on one side of the circuit board along the plug end (see Figure 1). See Table C for lead designations.

5. MAINTENANCE

5.01 When circuit trouble is encountered with a 400D KTU, interchange it with one known to be working properly to determine whether the trouble is in the KTU itself or external to it. If the KTU is proven defective, replace it with a good unit.

NOTE: Exercise care when inserting or removing the KTU to avoid damage to the printed wiring and other circuit components.

5.02 The miniature relays used in the KTU's are factory adjusted. *Field adjustments should not be attempted.* DO NOT remove the relay dust covers.

TABLE C
TERMINAL ASSIGNMENT

TERM. NO.	LEAD DESIG
1	RC
2	LW
3	
4	10V±
5	ST
6	LG
7	LF
8	L
9	R (CO)
10	105V±
11	RN
12	T (STA)
13	R (STA)
14	T (CO)
15	GRD B
16	A
17	BAT. B
18	

- 5.03 Operational sequence charts and a functional schematic drawing are shown in Figures 3 and 4. *During periods when the local DC supply is inoperative, outgoing calls may be originated at any time. Incoming calls to the 400D operate connected line ringers in the usual manner, although common audible signals and all visual signals are inoperative.*

6. SAN/BAR MODEL 4000 LINE CARD

- 6.01 The San/Bar Model 4000 (4000002 B and C) line card is a simplified KTU line circuit unit designed for full compatability with all types of key systems working into either central office or PBX/PABX equipment. All functions and options conform to established operating practices.
- 6.02 The unit comprises a single sided 3-1/2 inches x 4-3/4 inches x 1/16 inch printed circuit board for mounting of the circuit components consisting of relays, reed and telephone type transistors, capacitors, switch, lamp, resistors, handle and U link sockets.

7. SPECIFICATIONS

- 7.01 The basic specifications and features are as follows:

- Voltage DC**—Operates on 22 through 26 volts DC. Voltage transients on the 24 volt power supply will not cause false ringing in.
- Current Consumption**—There is no idle current consumption; in talk or ringing mode only 30 milliamps are required for operation of the B or C relays. In hold operation 60 milliamps are required for operation of the B and C relays; 40 milliamps are required for operation of the check lamp via the momentary switch.
- Ringing Sensitivity**—Guaranteed operation with 65 volts ringing signal.
- Parallel Dialing**—A remote two wire telephone instrument dialing (on the central office side) will not cause false ringing in.
- False Ringing**—Line induced AC voltages will not cause false ringing in.

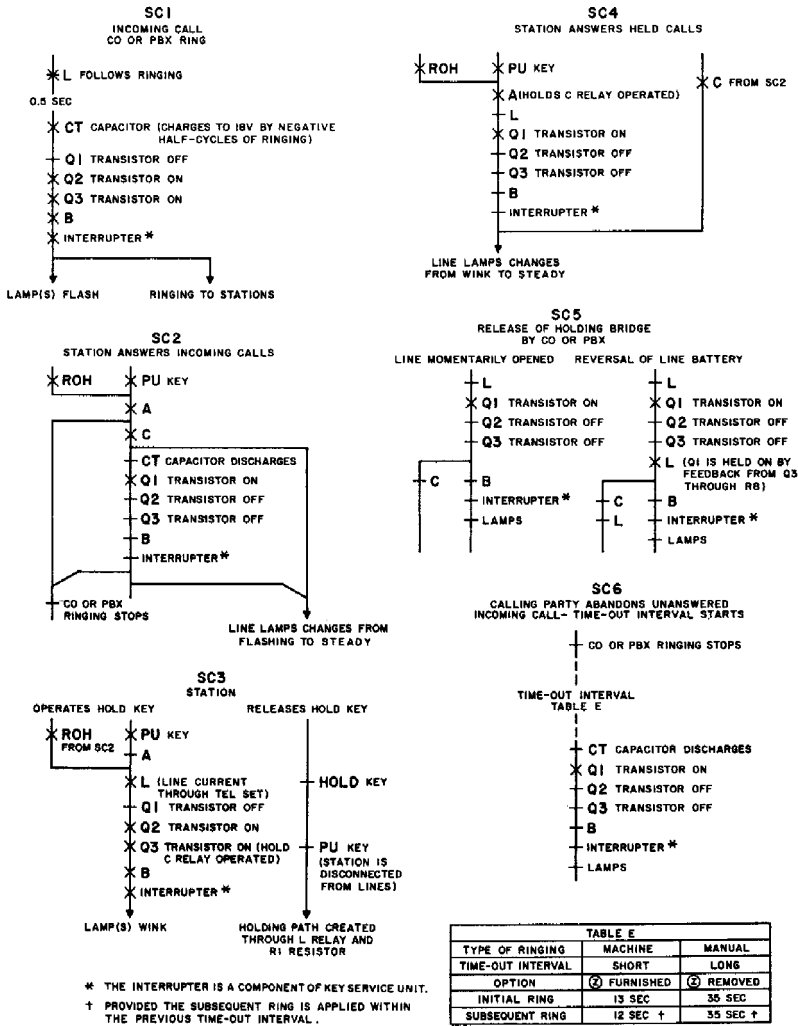


FIGURE 3. Sequence Charts (SC1 to SC6) Showing Operational Sequence of 400D KTU



- f. *Response Time*—Guaranteed 200 milliseconds of ringing signal will trigger the ring in circuitry.
- g. *Line Reversal*—Unit operation is independent of line polarity.
- h. *Ringing Time Out*—Two options are furnished, either 6 or 15 seconds $\pm 20\%$.
- i. *Busy Light*—A 24 volt lamp with series momentary switch is furnished to indicate, on demand, a busy or idle line condition.
- j. *Divided Ringing Option*—The unit includes a two party ringing option by the use of U links and sockets furnished. The unit is factory wired for bridged ringing.
- k. *Hold Function*—Hold function switching time is 30 ± 10 milliseconds.

7.02 Application of the 4000 line card is as follows:

- a. On any existing KTU system as a replacement unit or for additional lines/extensions as required.
- b. In areas where AC line induction is a problem.
- c. If an existing 24 volt KTU power supply is creating operating problems with loading transients.
- d. On PBX use where less than a one second ring-up signal (by key operation) is required.
- e. On PBX and/or Centrex use where transfer and hold problems with KTU operation can arise.
- f. For two party option where it is desirable to have day and night calling discrimination.

NOTE: When the key system is terminated in a PABX with a dial 1 or pushbutton call transfer feature, a false transfer condition resulting in accidental transfer or the loss of a call can occur. When a call is placed on hold, the action of call pickup previously caused a false transfer or false hold condition to occur, i.e., the person picking up the call hears dial tone. The problem is caused during the removal of the handset when picking up a line that has been placed on hold. During the normal removal of the handset, there is approximately a 10 millisecond interval between the time the A lead contacts the tip and ring contacts of the telephone hookswitch make. The 400B line card's hold condition is released upon operation of the A relay. The 400D line card's hold condition is maintained for 50 milliseconds after the A relay operates. This is sufficient delay to prevent a false transfer condition with normal operation. An additional problem has occurred in areas where ground potentials exist. The addition of relay L and the subsequent time delay cause what might be referred to as a buffer. Refer to the circuit descriptions of the 400B and 400D cards to analyze the differences in circuit operation.

8. INSTALLATION

8.01 The 4000 line cards are factory wired for:

- a. Bridged ringing.
- b.  ringing audible option.

- c. (Y) flashing option for the hold condition.
 - d. The six second time out on an abandoned call, which is the (P) option.
- 8.02 To change the ringing from bridged to divided ringing, move the U links to the alternative position for either tip to ground, or ring to ground as required in the sockets on the printed circuit board.
- 8.03 To change all other options it is also necessary to transfer the U links as required.
- 8.04 All sockets are clearly marked and the U link must be bridging the option indicated for the circuit function.

NOTE: Power switch ON or initial line card insertion will cause a ring up transient due to capacitor charge of the circuitry. This is a "one time only" transient and is not a fault condition.

9. MAINTENANCE

- 9.01 The only maintenance feature is the operation of the line light switch; this can be used as a busy condition interrogator. The absence or presence of light will indicate the idle or busy state of the line.
- 9.02 The light switch can also be used as a ring up indicator to check the ringing in and line functions. If the circuit to be tested is dialed via another line or the test handset and the switch button of the line to be tested is held pressed, the lamp will indicate the receipt of incoming ringing because the operation of the RL relay contact will apply negative voltage to the lamp which will light to the ringing cycle timing.
- 9.03 As long as the switch is held pressed, operation of the B relay is prevented and test calls do not ring in until release of the switch button. This action will also effectively prevent service call interference to customer operation.

10. STROMBERG-CARLSON 400D KTU

- 10.01 The SC 400D line card is mechanically and electrically interchangeable with the 400B and 400BMI line cards (see Figure 5). It eliminates power and ground problems inherent in previous line cards and should be used in all 1A2 key systems which terminate on PABX lines where:
- a. False transfer problems occur with dial 1 or pushbutton transfer feature in the PABX.
 - b. Induction or ground potential problems are present.
 - c. There are connections to answering services, electronic PABX equipment, or a manual PBX board.

11. TELECOMMUNICATIONS 400D KTU

- 11.01 The K400(D)962 KTU is mechanically and electrically interchangeable with K400B type units in the K501 and K512 series KSU's. Operationally, the K400D KTU's are fully compatible with K400B KTU's in any 1A2 system installation. (See Figures 6 through 12.) Ring up and hold functions are accomplished by the use of a split winding dry-reed relay. The ringing detector, a combined grounded metallic circuit is not normally subject to false ring of induced foreign potentials. Ringing bridge impedance is approximately equal to one high impedance ringer. A maximum of three ringers may be connected in combination across the line ahead of or behind the K400D KTU. A non A lead type station, dialing ahead of the line circuit, could ring up the circuit falsely if foreign

voltages were present; however, this will not occur unless such voltages are above 35 volts rms. The K400D KTU is normally not affected by induced foreign potentials on the central office line up to approximately 24 volts rms of parallel induction or a cross of 90 volts rms.

- 11.02 An incompatibility problem may occur between 1A2 KTS equipped with 400D KTU's and certain central offices or PBX's. In some cases, a lost call can result when the switching system reswitches an established connection while the key telephone station is on hold. If the reswitching sequence opens the loop for an interval greater than that required to release the 400D KTU hold circuit, a disconnection will occur.
- 11.03 The release time of the 400D KTU can be extended to bridge the open intervals generated by these reswitching sequences by applying the appropriate one of the two following options. See Figure 7.
- 11.04 *Option ZC*—This is a delay hold release for electronic switching and consists of adding a $5\mu f$ capacitor across terminals 2 and 3 of the 400D KTU option block.
- 11.05 *Option ZD*—This is a delay hold release for offices other than electronic and consists of adding a $1\mu f$ capacitor across terminals 2 and 3 of the block.
- 11.06 When the existing (Z) option is provided with ZC or ZD option, the strap between terminals 1 and 2 of the option block should be removed and replaced with one of the capacitor pigtail leads.

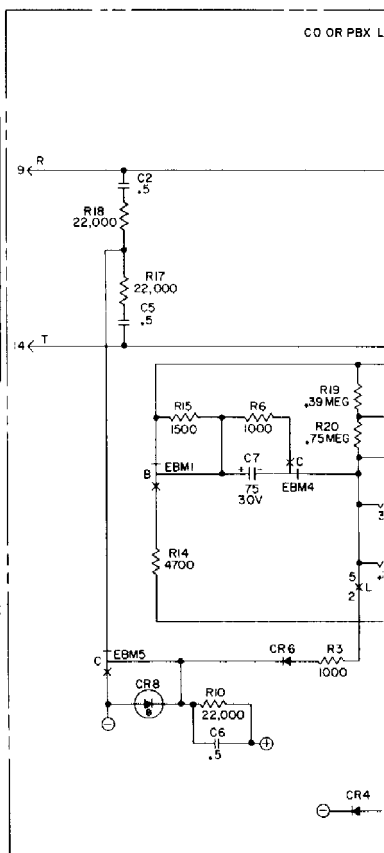
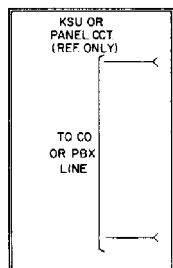
TABLE "A"		
	FEATURE	WIRING OPTION
TIME-OUT	LONG TIME DELAY	-
	SHORT TIME DELAY	Z *
VISUAL HOLD SIGNAL	LAMP WINKING	Y *
	LAMP STEADY	X
AUDIBLE SIGNAL	INTERRUPTED RINGING	W *
	COMMON B CONTROL	V
	STEADY RINGING	T

* FACTORY WIRED

DETACHED CONTACT SYMBOLS
 M MAKE CONTACT
 B BREAK CONTACT
 EBM TRANSFER CONTACT
 EMB MAKE-BEFORE-BREAK
 CONTACT

NOTE:
 FOR NOTES REFER TO SN-428028.

INFORMATION NOTES:
 1- ALL RESISTORS ARE $\pm 5\%$
 UNLESS OTHERWISE INDICATED.
 2- ALL CAPACITORS ARE $\pm 10\%$ 200 VOLTS
 UNLESS OTHERWISE INDICATED.
 3- CURRENT DRAIN 0.06 AMPERES.



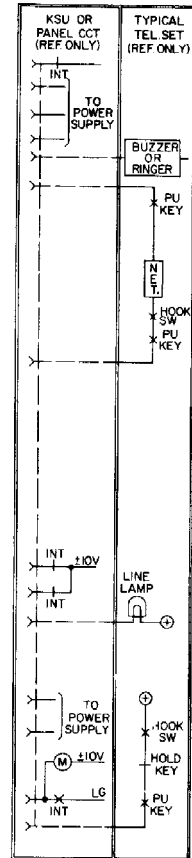
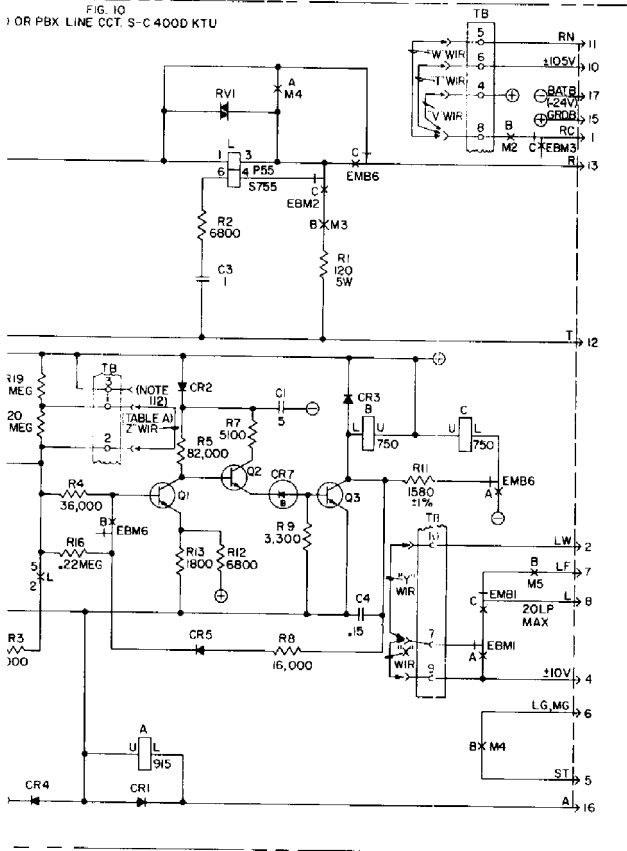


FIG. 10
S-C 400D KTU.

S-428028	SH 12	ISS. NO. 1
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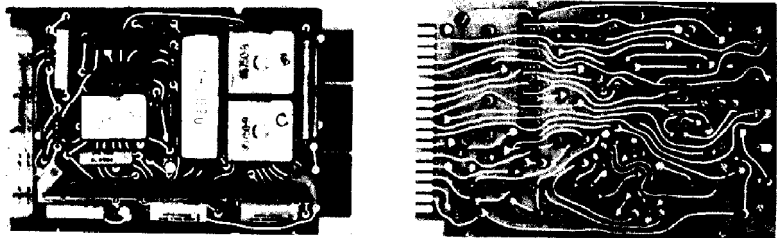


FIGURE 6. K-400D Key Telephone Unit; Component Side (left) and Printed Circuit Side

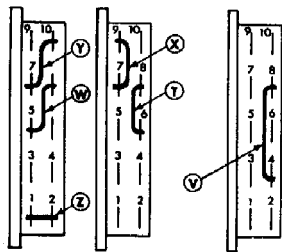


FIGURE 7. K400(D) KTU, Circuit Options

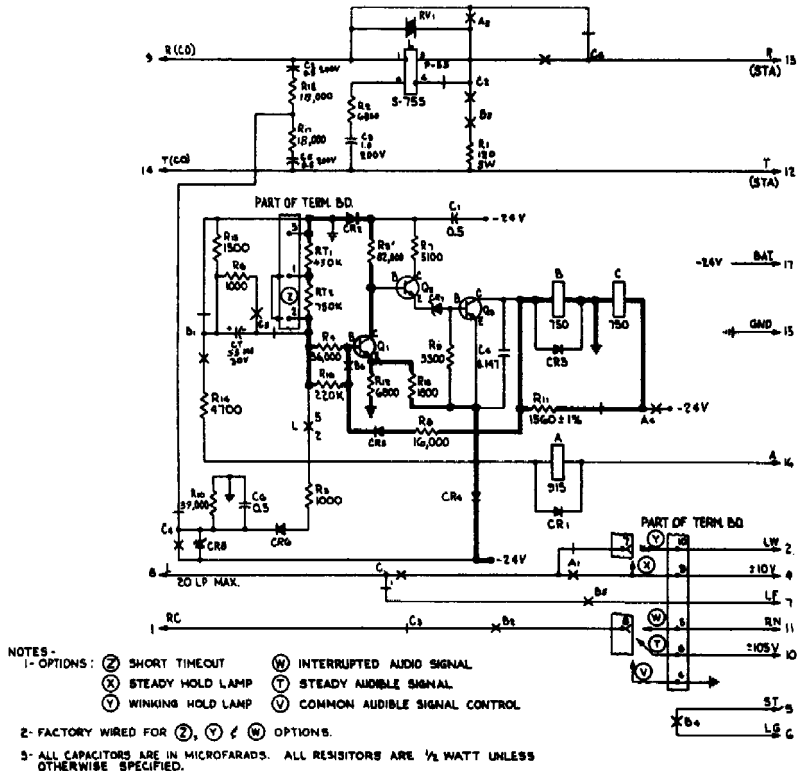


FIGURE 8. K400(D) KTU, Idle Circuit Condition

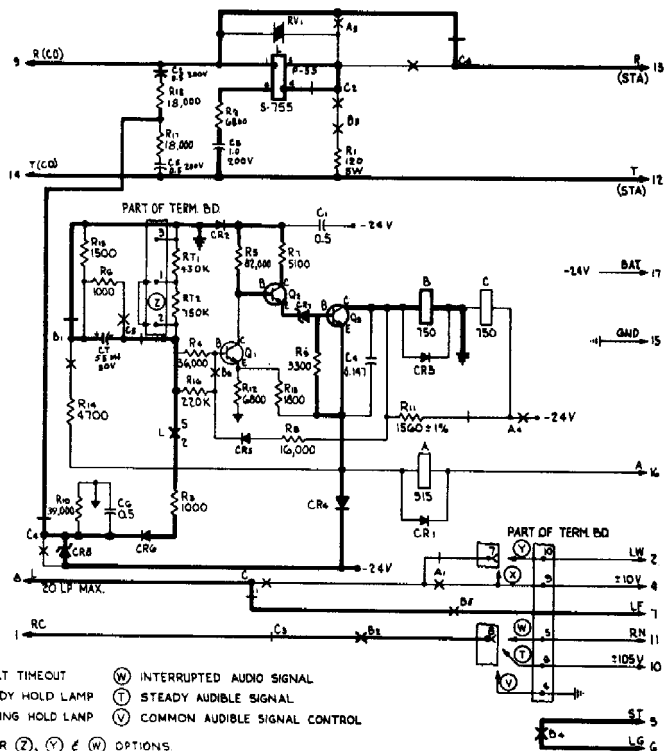


FIGURE 9. K400(D) KTU, Ringing Current Applied



FIGURE 10. K400(D) KTU, Time-Out

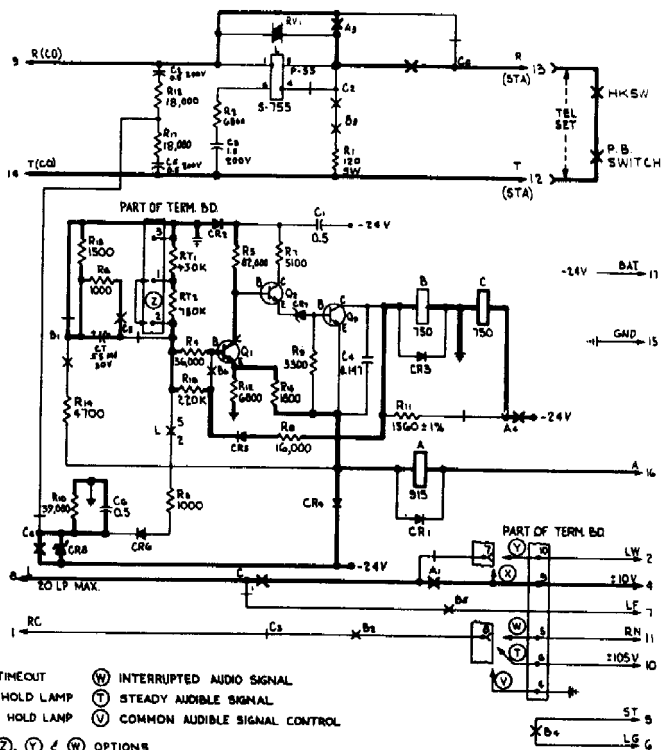


FIGURE 11. K400(D) KTU

