KEY TELEPHONE UNITS
(SB4000F LINE CARD, ISSUE 6)

1. GENERAL

1.01 This section provides circuit description, installation and basic testing information for the SAN/BAR 4000F Line Card.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The SAN/BAR 4000F Line Card (Exhibit 1) is a simplified KTU line circuit designed for full compatibility with all types of key telephone systems working in conjunction with central office or PBX/PABX equipment. The SB4000F is also compatible with ComKey music-on-hold.

2. SPECIFICATION

2.01 Electrical Characteristics - Model 4000F Issue 6

(a) Source Voltage operates at 20V to 30V DC.
(b) Operating Environment: Temperature from 0°C to 50°C. Humidity to 90%.
(c) Current Consumption: Less than 1MA idle current consumption. Maximum current consumption is 85MA.
(d) Loop Current: 20MA (minimum)
(e) Ringing Voltage: 46VAC nominal ringing signal, insuring operation with a 1300 ohm loop and three bridged ringers.
(f) A-Lead Impedence: 900 ohms capable of sourcing 25MA DC current for powering special relays (e.g., operator busy lamps).
(g) Ringing Time-Out: Two options are furnished either 6 or 15 sec. (See Paragraph 5.02).
(h) False Dial-1 Protection: A 200 MS delay circuit protects against false dial-1 commonly occurring during the hold-to-answer transition.
(i) Ringing Option: The unit provides optional STC remote ringing by moving a buswire strap on the card. The unit is factory set for bridge ringing.
(j) Parallel Dialing: A remote two wire telephone instrument dialing (on the central office side) will not cause false ringing-in.
(k) Line Reversal: Unit operation is independent of line polarity.
(l) Busy Light: A light emitting diode is provided to indicate a busy line condition.
(m) A-Lead Noise Immunity: Protects against induced 60Hz noise up to 30VAC.
(n) T,R Isolation: Complete isolation offers 2000V lightning protection and immunity to induced 60Hz longitudinal noise.
(o) Delayed Hold Release: A delayed drop from hold option is provided for 50 msec and 500 msec. nominally. The option is strappable by U-Link. (See Paragraph 5.02).
(p) Comkey: Line circuitry is designed to allow compatibility with Comkey music-on-hold installations.

2.02 Physical Characteristics

(a) Dimensions: 5-5/16"x3½"x1-5/16".
(b) Weight: 6-2/3 oz. approximately.
(c) Key location: Card must be keyed with slots between pins 5 and 6, and between pins 12 and 13.

(d) Contact Material: Rhodium plating over nickel (improves contact tarnishing over gold plating).

3. INSPECTION

3.01 Inspect the unit thoroughly, as soon as possible after delivery. If any part of the unit has been damaged in transit, report the extent of damage to the transportation company immediately. If the unit is to be stored for some time before installation, make an operational check at once. The purpose of this check is to make sure that the unit is in proper working order as received from the factory. If the check indicates satisfactory performance, the unit may be stored for the future installation. If the system is to be installed at once, make an operational check after the installation is completed.

4. MOUNTING

4.01 SAN/BAR 4000F line card is the same physical size and has the same type keying and lock capability as the standard WE400 line card and will mount in any standard mounting shelf, including those employing front card edge locking devices.

5. INSTALLER CONNECTIONS

5.01 The SAN/BAR 4000F has all pin assignments compatible with shelf wiring for 1A2 type line cards.

5.02 Strap Options: The SAN/BAR line card has the following strap options provided: (See Exhibit 2)

(a) Ringing (J1):
Bridged: "BR" (factory set)
STC: "RR"

(b) Delayed Hold Release (J7):
500 msec.: "HC" (factory set)
50 msec.: "HD"

(c) Time-out (J3):
6 sec.: "P" (factory set)
15 sec.: "Z"

(d) Local Ringing (J4, J5)
Interrupted: "W" (factory set)
Steady: "T"
Common Audible: "V"

(e) Hold Lamp Flash (J6):
Wink: "Y" (factory set)
Steady: "X"

5.03 In areas of high thunderstorm activity, the following information is offered: Continued and extensive test of line card failure due to lightning damage indicates that the best protection is to have a separate earth ground (water pipe) for the KTU power supply and not to use an adjacent or easily available AC circuit ground for this purpose.

6. CIRCUIT DESCRIPTION (See Schematic as shown in Exhibit 3)

6.01 Incoming Call: An incoming call will apply ringing voltage to the T,R (C.O.). This signal is rectified in the bridged CR1-CR4 to operate relay K3 through coil R. The K3 contact closes and applies a positive potential to the base of Q1 through R5 and R8. Q1 in turn conducts to energize relay K1. Contacts K1-A through K1-F operate providing the following functions:

(a) Connects line card pin 5 and 6 (ST and LG) to start the interrupter.
(b) Connects lamp flash (pin 7) to lamp (pin 8) and line button on tel. set flashes.
(c) Connects ring control voltage (pin 1) via pin 11 to bell/buzzer in tel. set.

6.02 Abandoned Call: If the incoming ringing ceases due to the caller hang up, Resistor R3 and R4, determine the 6 sec. and 15 sec. time-out charge of C3 and the hold over time before relay K1 releases.

6.03 Call Answered: When the telephone receiver is off-hook and the calling line button is depressed, a ground is applied to the "A" lead. Removal of the receiver also terminates the T,R (STA) leads. The resulting loop current will trip the incoming ringing. Ground potential at "A" causes Q4, Q5, and Q2 to saturate. With Q2 saturated, a positive potential is applied to the base of Q1 through R11 & CR6 and R8. Q1 becomes non-conductive releasing relay K1. Q2 also applied a positive potential to the base of Q3 through R11 and R7 causing Q3 to saturate. Relay K2 will energize due to the ground applied through CR5 to K2 coil. Relay contacts K2-A through K2-F operate providing the following functions:

(a) Applies an alternate ground to the coil of the K2 relay to hold it if "A" lead is removed from ground in the hold condition.
(b) Connects inpart hold resistor R2 across the T,R for hold condition when the K1 relay operates.
(c) Removes the short condition from K3 (L winding) and loop current energizes L winding, thus operating relay K3 and the K3 contact closes.
(d) Breaks ringing control voltage from the bell/buzzer circuit.
(e) Breaks lamp flash.
(f) Gives lamp steady state.

The telephone circuit is now established, and a telephone conversation effected. The line button lamp will be steadily illuminated until the subscriber goes off the line. Light emitting diode LED 1 lights.

6.04 Hold Condition: Depression of the HOLD button causes the ground from the "A" lead to be removed. Q3 will remain saturated since the K3 contact has closed, thus maintaining K2 energized. With Q3 saturated, Q1 will again become conductive reoperating relay K1. Operation of both relays K1 and K2 provides the following functions:

(a) Terminates the T and R leads in the hold condition via the resistor R2 which will hold the relay K3 by the loop current.
(b) Re-operate the interrupter motor.
(c) Connect the lamp wink to the lamp output. Light emitting diode LED1 will remain lit.

6.05 Retrieval from Hold Condition: This is effected by depression of the line button which applies ground to the "A" lead to make Q1 non-conductive. Relay K1 de-energizes, returning to the Answer Condition. In the majority of telephone exchange areas, when an outgoing call is placed into the hold condition, it will so remain until released by the re-operation of the associated line button in the keyset. However, in those telephone office areas where "Force Release" or "Called Party Release" equipment is installed, a line disconnect condition may be given to the circuit which will release the K3 relay from the "L" winding and return the unit to the idle state.

6.06 Delayed Hold Release: A strap option is provided by U-Link on the card allowing additional delay in the release of the HOLD circuit. Certain central offices such as ESS No. 1 open the loop for diagnostic purposes for up to 500 msec. This strap option protects against false drop from HOLD under these circumstances. When the loop is opened, K3 releases. The K3 contact

opens, however Q3 will remain conductive for the required delay period. During HOLD, the K1 contact connected C8 through R22 and R23 to the base of Q3. Therefore Q3 remains saturated until C8 discharges. A 50 msec. delay is established when so strapped by the added discharge path of R21 (required for #5 Crossbar offices).

6.07 Dial-1 Transfer: Central offices that have Dial-1 transfer capability may experience difficulty due to a momentary open in the loop during the HOLD to ANSWER transition. This open may cause a false Dial-1 transfer. To guard against this possibility a 200 msec. delay has been provided in removal of the hold resistor. When returning to the ANSWER condition ground is reapplied to the "A" lead. However, Q5 does not saturate immediately due to a delay caused by C7. R19 had been removed by the K2 contact thus eliminating the otherwise fast operation of Q1. Since Q1 operation is delayed, so is the release of relay K1. Therefore insuring sufficient time has elapsed for the telephone network to terminate the loop before removing the HOLD resistor.

6.08 Outgoing Calls: A subscriber can place an outgoing call by depressing the appropriate line button and removing his telephone receiver to an off-hook condition. Relay K3 energizes. The relay K2 will be energized by the application of ground potential to the "A" lead. No ringing occurs at the telephone unit. For outgoing calls, as with incoming calls, the line button lamp will be controlled simultaneously and will go off when the subscriber is off line and the line card circuit is permitted to be restored to an idle condition.

6.09 Comkey: Comkey music-on-hold allows the music source to be applied during the HOLD condition across the K3-L coil impedence in the Ring conductor (Pins 9 to 13). The bypass capacitor C2 is removed from across the coil by the K1 contact during the HOLD condition.

7. TESTING

7.01 If trouble is encountered with the operation of the 4000F line card, check that all installer connections and strappings have been properly made. Make certain that the 4000F unit is making good connection with the mounting assembly card connector, snap the 4000F in and out several times.

7.02 If another known working unit is available, interchange cards to verify that the card is malfunctioning or that the problem is in the system wiring.

7.03 Field repairs involving replacement of components within a module are not recommended. All SAN/BAR products are warranted for 2 years from the date of purchase.

8. ORDERING GUIDE

8.01 The CO/PBX line circuit may be ordered as follows: (Quan.) Unit, Telephone Key, SB4000F Issue-6.

EXHIBIT 1

SAN/BAR 4000F LINE CARD

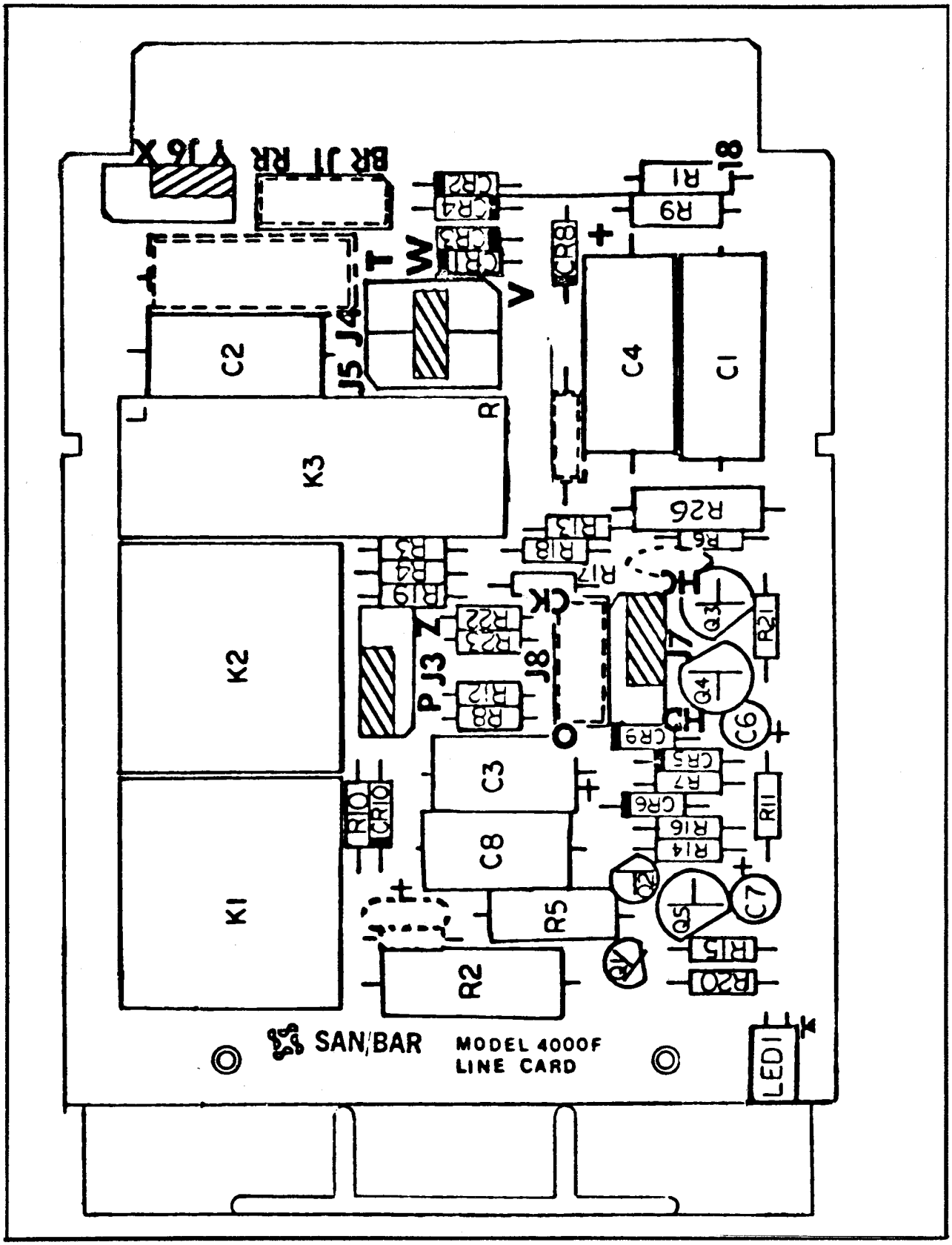


EXHIBIT 2

STRAP OPTIONS

OPTIONS

OPT.	FEATURES		
Z	TIME OUT	Long Time Delay (Approx. 15 Seconds)	
P		Short Time Delay (Approx. 6 Seconds)	
Y	VISUAL HOLD CKT.	Lamp Wink	
X		Lamp Steady	
W	AUDIBLE SIGNAL	Interrupted Ring	
T		Steady Ring	
S		Common With Diode Matrix Control	
V		Common With Relay Control	
HD	DELAYED HOLD RELEASE	Release Of Holding Bridge From CO or PBX By Line Current Opens	50 MS
HC			500 MS

NOTES:
1. REQUIRES A MOUNTING FACILITY REQUIPPED WITH AN 18-, 20-, OR 40-PIN CONNECTOR.
2. THE STATUS OF THE RELAYS FOR ALL FUNCTIONS OF THE KTU ARE AS FOLLOWS:

RELAY	FUNCTION		
	INC RING CYCLE	ANS OR INIT CALL	HOLD
K1	O	R	O
K2	R	O	O
K3	O	O	O

R = Released

O = Operate

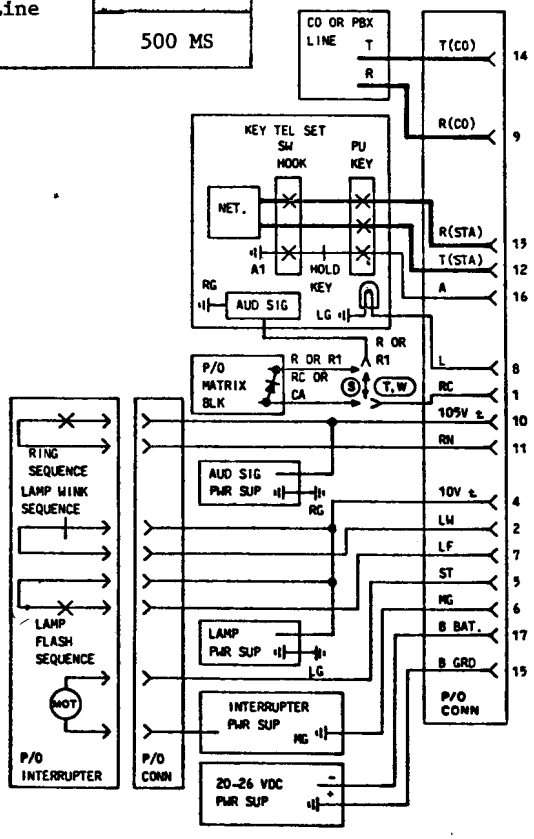
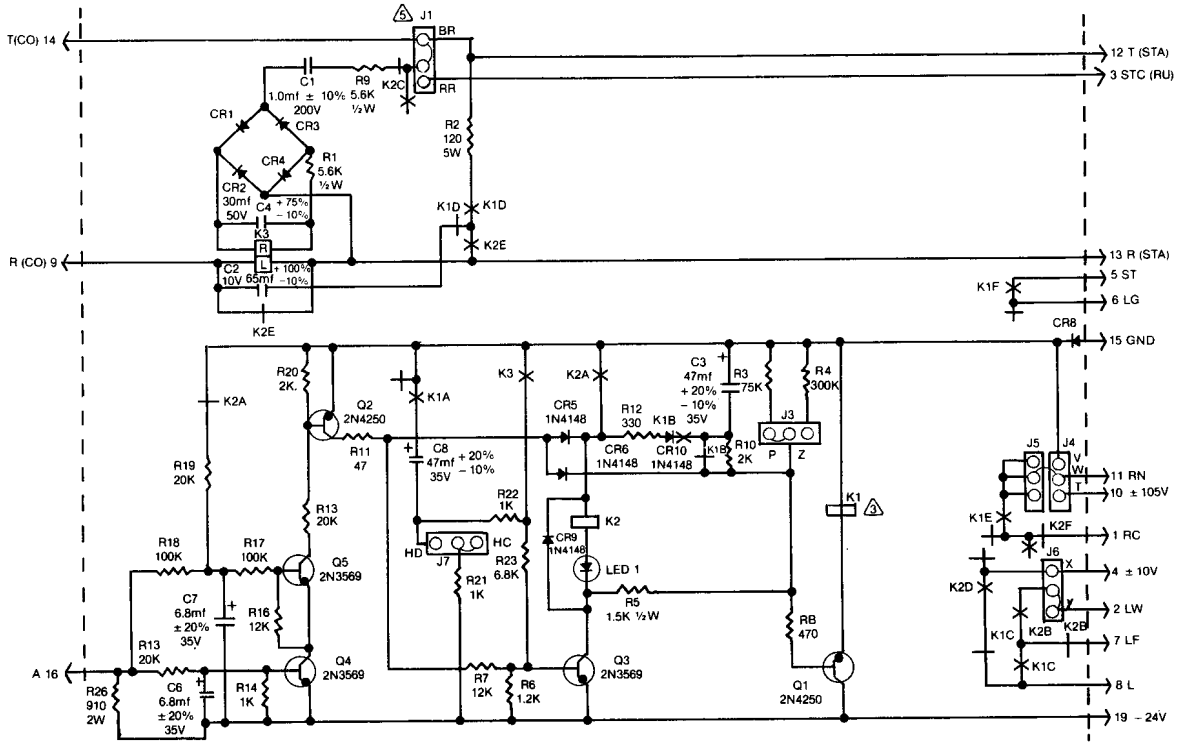


EXHIBIT 3

CIRCUIT DESCRIPTION



⑤ J1 USES BUSS WIRE INSTEAD OF U-LINK.
BUSS WIRE MAY BE CHANGED TO OBTAIN STC OPTION (RR).

NOTE: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE IN OHMS, ±5%, ¼W.
2. DIODES ARE 1N4002.
③ 3. SELECTED FOR 3-5 MA DROPOUT.

OPTION	OPTION PLUG	FACTORY PROVIDED
Z	J3	
P	J3	✓
Y	J6	✓
X	J6	
W	J4 & J5	✓
T	J4 & J5	
V	J4 & J5	
HD	J7	
HC	J7	✓