SYSTEM PRACTICE 86046

TCX-128

Description and Installation Manual

Issue 2-2 January 17, 1985

This manual should be read in its entirety before attempting to install or program the system.

This manual has been developed by TIE/communications, Inc. It is intended for the use of its customers and service personnel.

Any comments or suggestions for improving this manual would be appreciated. Forward your remarks to:

TIE/communications, Inc.
5 Research Drive
Shelton, CT 06484

Attention: Manager, Technical Publications

Form 0006 April 1983

Printed in U.S.A.

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The information in this manual is subject to change. While every effort has been made to eliminate errors, the company disclaims liability for difficulties arising from interpretation of the information contained herein.

Form 0006 April 1983

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REVISION CONTROL

REVISION	DATE	CHANGE
1-0	1 MAR 83	Original Issue, major revisions to all sections of previously released draft 0-8 dated 12/9/82. Grammatical corrections throughout document. Section 2: Updated features. Section 3: Added Option Configuration Worksheet, Ordering Guidelines, and Configuration information. Section 4: Upgraded instructions and program. Section 5: Added installation checklists and specific layout requirements. Section 6: Added paragraph "Program Changes." Section 7: Moved Software Configuration from Section 7 to Section 3. Section 8: Added new section - Maintenance. Section 9: Added new section - Optional Equipment.
2-0	30 DEC 83	This issue has been rewritten for software version BT-15 X10, which requires a Series 03, 05, or later B-CPU-B PCB. All references to earlier version CPUs have been removed. Off-Premises Extension, Loud Ringer Board and Real Time Clock Daughter Board supplements have been included.
2-1	13 APR 84	Section 1: Handsfree option added to description of Multibutton Key Telephone. Definition of Attendant's telephone revised. Section 2: Meritor telephone key cap colors corrected. All tone and flash pattern charts redrawn. Minor corrections to the following features: Intercom, LCR, LCR Bypass, Message Waiting, Monitor, Central Office Call, Outgoing, Do-Not-Disturb and Handsfree Transfer. Section 3: Table 3-1 and associated text reworked. Block requirements clarified. Appropriate System Options included on Table 3-5. Section 4: Station Features programming menu added. External output programming clarified (default values entered into bit graph). Section 5: Installation flowchart reworked. Drawing on punchdown operation removed. Power supply drawing added. Real Time Clock Daughter Board deleted. Tone Generator strapping corrected. Text on Connecting Telco Lines moved to correspond to installation requirements. Section 6: No changes. Section 7: Slot assignments for CPU (Table 7-1) corrected. Section 8: No changes. Section 9: Table 9-1 and 9-2 corrected.
2-2	17 JAN 85	Corrected Table 3-6 and Office Code Types description on page 4-8.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
TABLE OF CONTENTS

SECTION 1 **General Description**

The GENERAL DESCRIPTION Section provides basic information about the TCX-128 Computerized Branch Exchange. It summarizes the various components of a system, available extension instruments, specifications, site requirements, and Federal Communications Commission/telephone company requirements.

CONTENTS **PAGE**

SECTION 2 **Features**

The FEATURES Section provides descriptions of extension instruments, their key layouts and operational capabilities, and detailed information on each of the features available on the TCX-128 Computerized Branch Exchange.

CONTENTS **PAGE**

SECTION 3 **System Configuration**

The SYSTEM CONFIGURATION Section provides information to help meet the particular needs of the customer. The Option Configuration Worksheets are used to gather system and extension data for ordering equipment and completing the Program Record Forms needed for programming.

CONTENTS **PAGE**

SECTION 4 **Program Record Form**

The PROGRAM RECORD FORM PREPARATION Section provides instructions for changing the information gathered on the Option Configuration Worksheets into programming data.

CONTENTS **PAGE**

SECTION 5 Installation

The INSTALLATION Section provides detailed procedures for installing the component parts of the system.

CONTENTS PAGE

SECTION 6 Programming

The PROGRAMMING Section describes the programming procedures for the system.

CONTENTS PAGE

SECTION 7 Operational Test and Fault Location

The OPERATIONAL TEST and FAULT LOCATION Section contains the information and instructions to test the system.

CONTENTS PAGE

SECTION 8 Maintenance

The MAINTENANCE Section contains information for maintaining the system.

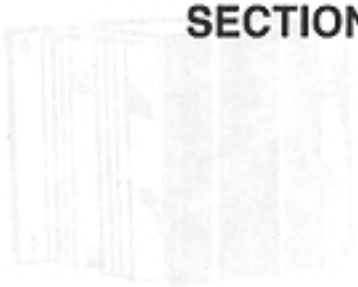
CONTENTS PAGE

SECTION 9 **Optional Equipment**

The OPTIONAL EQUIPMENT Section provides information on the equipment, accessories and customer-supplied equipment used with the system.

CONTENTS **PAGE**

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 1, GENERAL DESCRIPTION



1. INTRODUCTION

1.01 The GENERAL DESCRIPTION SECTION provides basic information pertaining to the TCX-128 Computerized Branch Exchange. It summarizes the various components of the system, available extension instruments, system specifications, site requirements, and Federal Communications Commission/telephone company requirements.

1.02 Major revisions to this section included the addition of the Handsfree option to the description of the Multibutton Key Telephone. The definition of the Attendant's telephone was revised.

2. SYSTEM DESCRIPTION

2.01 The TCX-128 uses a Z80 micoprocessor for the main operating program and additional processors for traffic control and status reporters to allow task sharing between the Central Processing Unit (CPU) and Station Printed Circuit Boards (PCBs). The system employs space division audio switching (to physically separate talkpaths) with time division data distribution for stored program control over a common bus. This technology is generally found only in large Private Branch Exchanges (PBXs). The TCX-128 has a maximum capacity of 128 extensions and 32 Central Office (CO) lines.

KEY SERVICE UNIT

2.02 The TCX-128 Key Service Unit (KSU) is a wall-mounted, convection-cooled device equipped with replaceable Printed Circuit Boards (PCBs). The primary KSU Cabinet (Figure 1-1) can accommodate up to 64 extensions and 24 CO telephone lines. This KSU provides 32 links (talkpaths) of which 20 are reserved for CO lines, 10 are available for either CO or Intercom (ICM) calls and 2 are reserved exclusively for Paging and Background Music.

2.03 When more than 64 extensions are needed or more than 24 CO lines are required, an expansion cabinet (Figure 1-1) must be added to the system. This expansion cabinet can accommodate an additional 64 extensions and 8 CO lines. The expansion cabinet does not increase the number of links in the system.

2.04 A detailed traffic study should be performed when more than 24 CO lines are included in a system. This will enable the user to determine that sufficient intercom links are available.

POWER SUPPLY UNIT

2.05 The Power Supply (Figure 1-2), contained in a separate unit, supplies DC voltages to the system.

EXTENSION INSTRUMENTS

2.06 The TCX-128 Telephone System uses the following extension instruments: Multibutton Key Telephone, Display Multibutton Key Telephone, Attendant Multibutton Key Telephone, Attendant Display Multibutton Key Telephone, Four-Button Key Telephone and any standard 2500 type single line telephone (with special electronic ringer). Detailed descriptions of these telephones and their use can be found in SECTION 2, FEATURES.

2.07 Key telephones contain a speaker to accommodate tone signaling and ICM voice announcements. The system transmits various tone signals that enable the user to distinguish among CO, ICM, and paging calls.

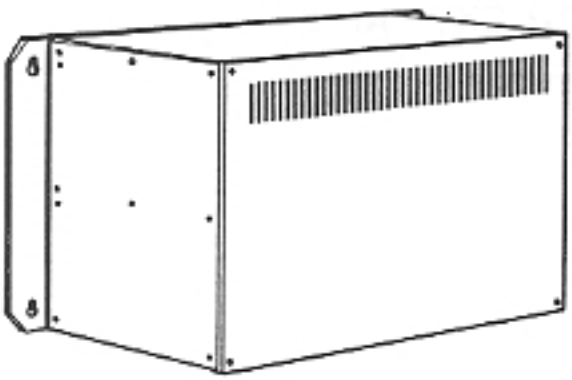


Figure 1-1 KEY SERVICE UNIT (KSU) OR EXPANSION CABINET, TCX-128

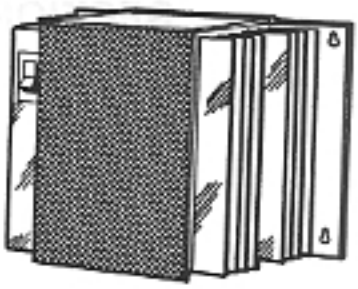


Figure 1-2 POWER SUPPLY, TCX-128

2.08 All of the standard telephones used with the TCX-128 have Dual Tone Multifrequency (DTMF) pushbutton dials. The DTMF tones for display telephones are generated on the Tone Generator PCB. Tone signals can be converted by the TCX-128 to accommodate CO exchanges that only accept pulse signals. This tone-to-pulse conversion is programmed on a per line basis. An outpulse line reverts to DTMF after a programmable period of time for data entries as required by MCI, Computer Network, etc.

MULTIBUTTON KEY TELEPHONE

2.09 The Multibutton Key Telephone provides rapid access to all extension features available in the system. This telephone is available in two configurations (Figures 1-3 and 1-4). Each configuration is available with or without a speakerphone for Handsfree operation. Detailed descriptions of these features are contained in SECTION 2, of this manual.

DISPLAY MULTIBUTTON KEY TELEPHONE

2.10 The Display Multibutton Key Telephone (Figures 1-5 and 1-6) provides rapid access to all extension features available in the system and display features including Time / Date Display, Number Dialed Display and displays of other call status messages.

ATTENDANT MULTIBUTTON KEY TELEPHONE

2.11 The Attendant Multibutton Key Telephone is the same as the Multibutton Key Telephone but has several unique programmed features including Automatic Hold, Handsfree Transfer, Barge-In, and Voice Transfer. The system is capable of providing up to six attendant positions, each of which can be used with a Direct Station Selection (DSS) console.

ATTENDANT DISPLAY MULTIBUTTON KEY TELEPHONE

2.12 The Attendant Display Multibutton Key Telephone is the same as the Display Multibutton Key Telephone and has several unique programmed features including Automatic Hold, Handsfree Transfer, Barge-In and Voice Transfer. The Attendant Display Multibutton Key Telephones are shown with the DSS console in Figures 1-7 and 1-8.

DIRECT STATION SELECTION (DSS) CONSOLE

2.13 The DSS console provides the attendant with single key access to the extensions and serves as a Busy Lamp Field for the system. Each TCX-128 system can support up to six DSS consoles. Each DSS console requires one extension position. The DSS console is shown with the Attendant Display Multibutton Key Telephones in Figures 1-7 and 1-8.

Figure 1-3 MULTIBUTTON KEY TELEPHONE (ULTRACOM), TCX-128

Figure 1-4 MULTIBUTTON KEY TELEPHONE (MERITOR), TCX-128

Figure 1-5 DISPLAY MULTIBUTTON KEY TELEPHONE (ULTRACOM), TCX-128

Figure 1-6 DISPLAY MULTIBUTTON KEY TELEPHONE (MERITOR), TCX-128

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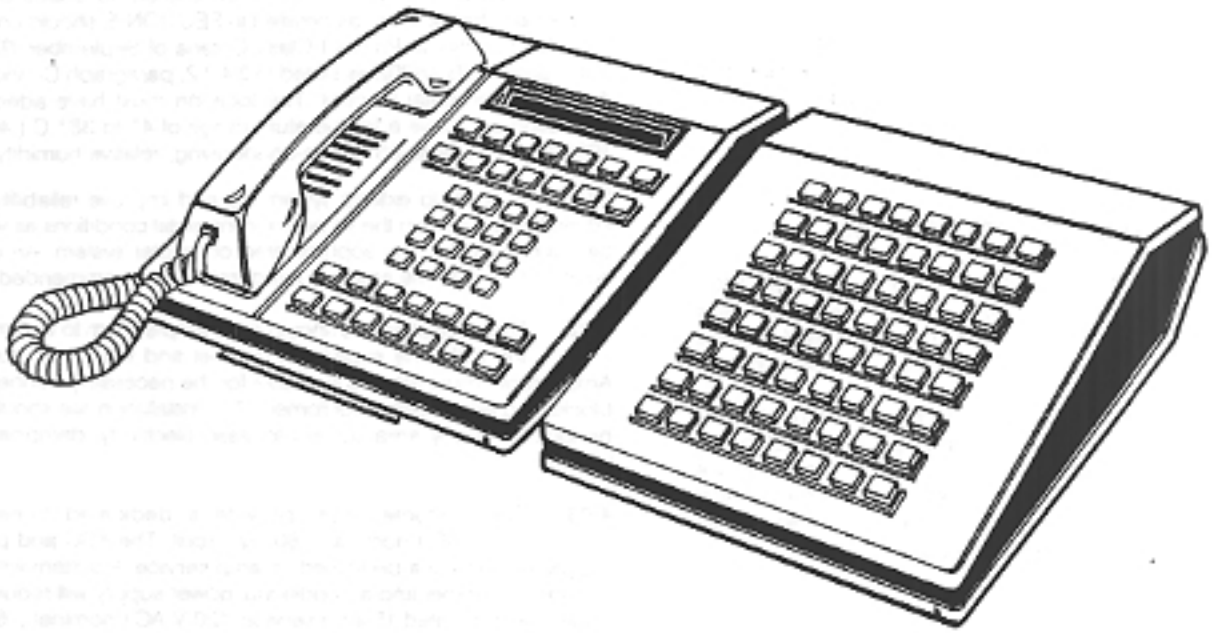


Figure 1-7 ATTENDANT DISPLAY MULTIBUTTON KEY TELEPHONE (ULTRACOM), SHOWN WITH DSS CONSOLE

Figure 1-8 ATTENDANT DISPLAY MULTIBUTTON KEY TELEPHONE (MERITOR), SHOWN WITH DSS CONSOLE

FOUR-BUTTON KEY TELEPHONE

2.14 The Four-Button Key Telephone (Figure 1-9) is used where direct access to all features is not required. The four buttons provide single access to the most commonly used features: Hold / Transfer, Monitor, Message Waiting / Callback, and Conference / Pick Up. Many other system features are available by dialing access codes. These features are described in SECTION 2 of this manual.

2500 TYPE SINGLE LINE TELEPHONE

2.15 A standard 2500 type single line telephone (Figure 1-10) can be used with the TCX-128 system. The telephone is connected to the ICM circuit whenever the handset is lifted. Outside lines and certain features are available by dialing access codes.

2.16 A special single line PCB must be installed in the KSU for 2500 type single line telephones. Single line (2500 type) telephones must be equipped with a special tone ringing device (TIE P/N 86185). The tone ringing device also allows the optional installation of an external ringer and faceplate with Hold button. Single line telephones do not use standard 90V ringers.

3. SPECIFICATIONS

3.01 Refer to Table 1-1 for technical specifications pertaining to the TCX-123B Computerized Branch Exchange.

4. SITE REQUIREMENTS

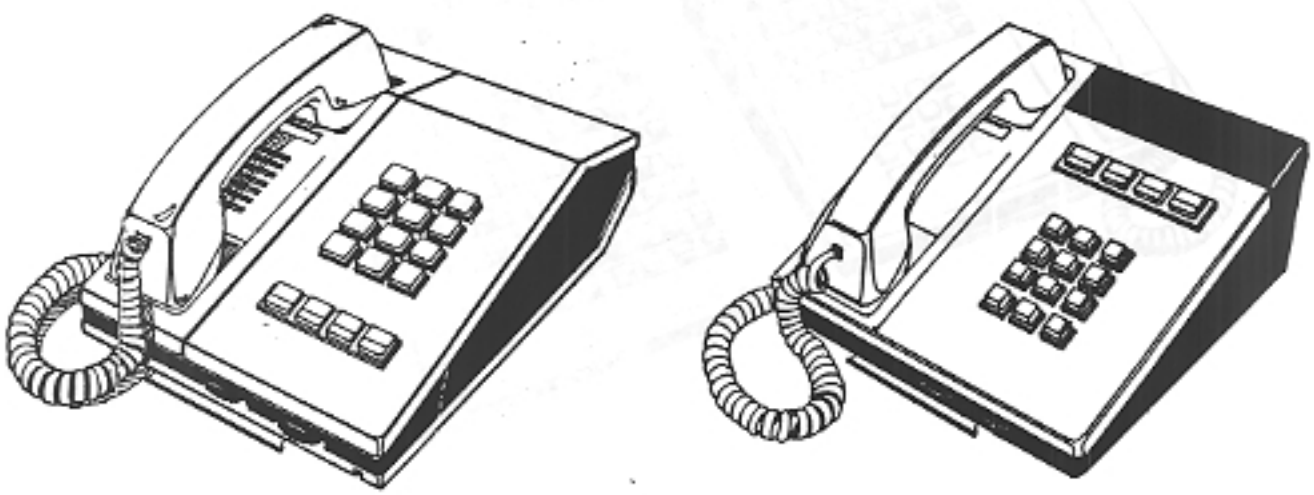
4.01 The TCX-128 KSU should be installed in a clean, dry, and secure location that is not accessible to unauthorized personnel. This location, as detailed in SECTION 5, should comply with Bell Functional Product Class Criteria of September 1978, in publication PUB 48002 as stated in 3.4.3.2, paragraph C---Indoors With Environmental Control. The location must have adequate ventilation and have a temperature range of 4° to 38° C (40° to 100° F) with 5% to 95% non-condensing, relative humidity.

NOTE: In order to extend system life and improve reliability it is advisable to maintain the same environmental conditions as would be maintained for any sophisticated computer system. An even, consistent, moderate ambient temperature is recommended.

4.02 The installation site should have ample room to wall-mount the KSU, the expansion cabinet and the power supply. Ample room must also be available for the necessary connecting blocks and any ancillary equipment. The installation site should not be located in any area subject to static electricity, dampness or vibration.

4.03 The customer must provide a dedicated three-wire 120 V AC (nominal), 60 Hz circuit. The KSU and power supply will require a dedicated 15 amp service. A system with the expansion cabinet and an additional power supply will require an additional dedicated 15 amp service, 120 V AC (nominal), 60 Hz circuit. A separate earth ground is required in addition to the third-wire ground on the AC circuit.

CAUTION: THE EQUIPMENT GENERATES AND IS SUSCEPTIBLE TO RADIO FREQUENCY ENERGY. REFER TO SECTION 5 FOR DETAILS.



ULTRACOM MERITOR

Figure 1-9 FOUR-BUTTON KEY TELEPHONE, TCX-128

Table 1-1 TCX-128 SPECIFICATIONS (1 of 2)

GENERAL SPECIFICATIONS

System Capacity:

	KSU	WITH EXP. CABINET
CO/PBX Lines	24	32
Extensions	64	128
Intercom Paths	10	10
System Talk Paths	32	32
Private Lines	24	32
Hotlines	32 programmable	64 programmable
DSS Intercom Keys	14 *	14 *
Attendant Consoles	6 DSS	6 DSS
Paging Zones	8 **	8

* programmable/extension (multibutton only) first 50 extensions
** with two Tone Generator PCBs.

ELECTRICAL SPECIFICATIONS

Power Requirements:

1 KSU & Power Supply:
Input: 95 - 130 V AC, 6.2 AMPS at 120 V AC, 51 - 60 Hz, single phase.
Output: +24 V, −24 V, +5 V

1 Expansion Cabinet & Power Supply:
Input: 95 - 130 V AC, 6.2 AMPS at 120 V AC, 51 - 60 Hz, single phase.
Output: +24 V, −24 V, +5 V

Power Dissipation:

1 KSU & Power Supply: 1150 BTUs/hr. *
1 Expansion Cabinet & Power Supply: 1150 BTUs/hr. *

Each Telephone: 8.9 BTUs/hr.
* Assuming nominal 120 V AC input and fully loaded system.

Fusing:

Power Supply:
Input AC Fuse, 10 AMPS, Slow Blow

KSU:
F1, 15 AMPS
F2, 15 AMPS

Switching Principle:

Solid state, space-division matrix with stored program control.

Cable Requirements:

Four conductor station wire, non-twisted, 24 gauge. Maximum cable run up to 800 feet for display telephones, 2000 feet for keysets, and 10,000 feet for 2500 type single line sets.

T2009F
April 1984

Table 1-1 TCX-128 SPECIFICATIONS (2 of 2)

ELECTRICAL SPECIFICATIONS (cont.)

External Relay Contacts:

SPST NO.:
Maximum Power: 50 VA
Maximum Current: 1 A
Maximum Voltage: 125 V AC or 150 V DC
Programmable to close on Night Ring and/or Page.

Background Music:

Input Impedance: 22 K OHM
Input Level: −25 dBV
Maximum Input: 0.5 VRMS

Music-On-Hold:

Input Impedance: 22 K OHM
Input Level: −25 dBV
Maximum Input: 0.5 VRMS

External Paging:

Output Impedance: 600 OHM
Output Level: 20 dBM/600 OHM nominal
Maximum Output: 6 VRMS

MECHANCIAL SPECIFICATIONS

Dimensions and Weights:

KSU:	27¼" W	x	17" H	x	13" D	55 lbs.
	69cm	x	43cm	x	33cm	25 kg.
Power Supply:	14" W	x	14.5" H	x	6" D	40.5 lbs.
	35cm	x	37cm	x	15cm	18.5 kg.

ENVIRONMENTAL SPECIFICATIONS

Environmental Operating Conditions:

Temperature: 4°-38° C (40°-100° F)
Humidity: 5-95% relative, non-condensing
(Reference Bell Functional Product Class Criteria of September 1978 publication PUB 48002)

T2009F
April 1984

Figure 1-10 2500 TYPE SINGLE LINE TELEPHONE, TCX-128

5. FCC AND TELCO REQUIREMENTS

5.01 Rules and regulations for the operation and installation of telephone equipment have been established by the Federal Communications Commission (FCC). These rules legalize the use of privately-owned telephones. According to Part 68 (Connection of Terminal Equipment to the Telephone Network) and its amendments, several actions are required before and during installation of customer-provided telephone equipment. These actions are described in the following paragraphs.

NOTIFICATION TO TELCO

5.02 As owner of this telephone system, you must give the following information to the operating telephone company before connecting or disconnecting the system:

1. Sufficient notice of your intention to use privately owned telephone equipment.
2. The particular lines to be used (telephone numbers xxx-xxxx through xxx-xxxx).
3. Model: **TCX-128**
   FCC Reg. Number: **BJ286G-68925-MF-E**
   Ringer Equivalence: **2.6B**
   Registered Jack: **RJ-2IX**

CONNECTION TO TELCO LINES

5.03 Connection of this system to telephone company lines must be made with FCC approved plugs and jacks.

INSTALLATION CLASSES

5.04 Classes for installation are available through TIE/communications, Inc. and its Regional Offices.

INCIDENCE OF HARM

5.05 When a problem exists, the customer shall disconnect the registered equipment from the telephone line to determine if the registered equipment is malfunctioning, and that if the registered equipment is malfunctioning, the use of such equipment shall be discontinued until the problem has been corrected.

5.06 When practical, the telephone company must notify the customer that service may be temporarily discontinued if customer-provided equipment is causing harm to the telephone network. The telephone company must attempt to inform the customer that service is to be discontinued before discontinuance of service. The telephone company must also provide customers with an opportunity to correct the problem and must advise the customers of their right to bring complaint procedures before the FCC.

HEARING AID COMPATIBILITY

5.07 FCC rules prohibit the use of non-hearing aid-compatible telephones in the following locations:

(a) Any public or semipublic location where coin-operated or credit card telephones may be found.

(b) Elevators, highways, and tunnels (automobile, subway, railroad, or pedestrian) where a person with impaired hearing might be isolated in an emergency.

(c) Places where telephones are specifically installed to alert emergency authorities such as fire, police, or medical assistance personnel.

(d) Hospital rooms, residential health care facilities, convalescent homes, and prisons, specifically where telephones are used for signaling life-threatening or emergency situations if alternative signaling methods are not available.

(e) Workstations for hearing impaired personnel.

(f) Hotel, motel, apartment lobbies; in stores where telephones are used by patrons to order merchandise; in public transportation terminals where telephones are used to call taxis, or to reserve lodging or rental automobiles.

(g) Hotel and motel rooms. (At least ten percent of the rooms must contain hearing aid-compatible telephones; or contain jacks for plug-in hearing aid-compatible telephones which will be provided to hearing impaired customers upon request.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 2, FEATURES

1. INTRODUCTION

1.01 The FEATURES Section provides information on the extension and system features of the TCX-128 Computerized Branch Exchange. Features are defined by their use. Descriptions of extension instruments and their key layouts and operational capabilities are also provided.

1.02 Major revisions to this section included corrections to the MERITOR key cap colors. All tone and flash pattern charts were redrawn. Minor corrections were made to the following features: Intercom, LCR, LCR Bypass, Message Waiting, Monitor, Central Office Call Outgoing, Do-Not-Disturb and Handsfree Transfer.

2. EXTENSION INSTRUMENTS

2.01 The extension instruments used with the TCX-128 system are: the Multibutton Key Telephone, the Display Multibutton Key Telephone, the Four-Button Key Telephone and the 2500 type single line telephone. The Attendant Telephone may be either the Multibutton Key or the Display Multibutton Key Telephone. All key telephones contain a speaker for tone signaling and handsfree Intercom (ICM) announcements. Visual and audible signals provide various tone and flash patterns that distinguish outside Central Office (CO), ICM and paging calls. Only audible signals are available on single line telephones. The flash and tone patterns are graphically presented in Figures 2-1, 2-2 and 2-3.

2.02 All standard telephones have Dual Tone Multifrequency (DTMF) pushbutton dials. The DTMF tones for the display telephones are generated on the tone PCB. Tone signals from all telephones can be converted to pulse signals to accommodate CO exchanges that only accept pulse signals. This tone-to-pulse conversion is programmed on a per-line basis. The signals revert to DTMF after a programmable period of time for Special Telephone Services such as MCI, Computer Network, etc.

MULTIBUTTON KEY TELEPHONE

2.03 The Multibutton Key Telephone is the primary extension instrument for the TCX-128 system. This telephone is available in two configurations, the Ultracom and the Meritor (Figures 2-4 and 2-5). Additionally, there are two models of Multibutton Key Telephones available. One model has a built-in speakerphone which allows Handsfree CO as well as Intercom calls. The other model does not have a built-in speakerphone; the Monitor feature replaces the Handsfree feature for CO calls.

2.04 The Ultracom Multibutton Key Telephone key layout as shown in Figure 2-4 is divided into three sections. The top section contains two rows of keys which provide access to incoming and outgoing CO lines. Incoming CO line keys 1-5 are yellow; and outgoing CO line keys 8-13 are green. These keys may also be programmed for bin storage of frequently called extension numbers. The middle section contains the dial pad. The bottom section contains two rows of dedicated feature keys which provide access to extension and system features and special functions.

2.05 The key layout of the Meritor Multibutton Key Telephone (Figure 2-5) is divided into two sections. The top section contains incoming and outgoing CO line keys and feature keys. The bottom section contains the dialpad and, on display telephones, volume control, SAVE, and REDIAL keys. Incoming CO lines 1-5 are brown; outgoing CO lines 8-13 are blue; and the HOLD key is red.

DISPLAY MULTIBUTTON KEY TELEPHONE

2.06 The Display Multibutton Key Telephone (Figures 2-4 and 2-5) functions similarly to the standard Multibutton Key Telephone, described above, and also provides display features. (Refer to Table 2-1 for a complete list of display messages.)

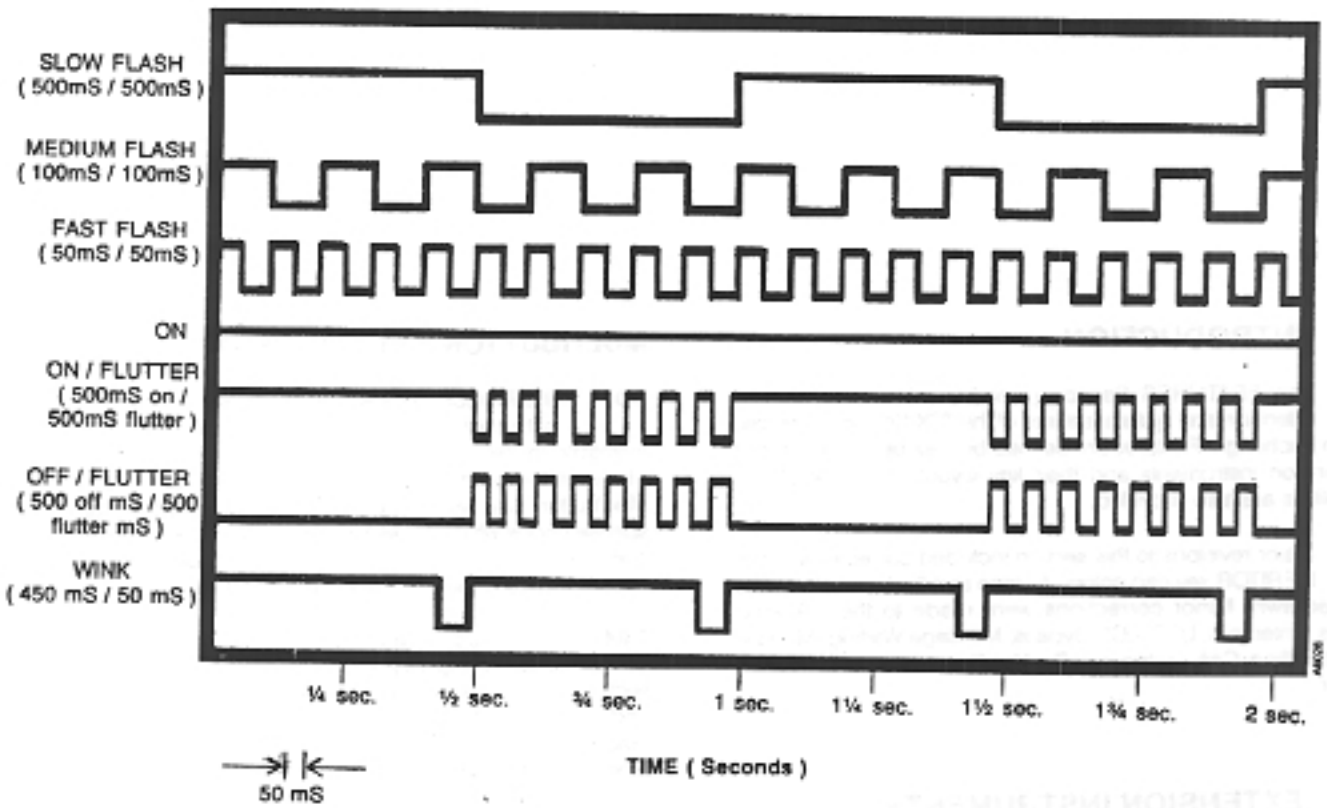


Figure 2-1 FLASH PATTERNS, TCX-128

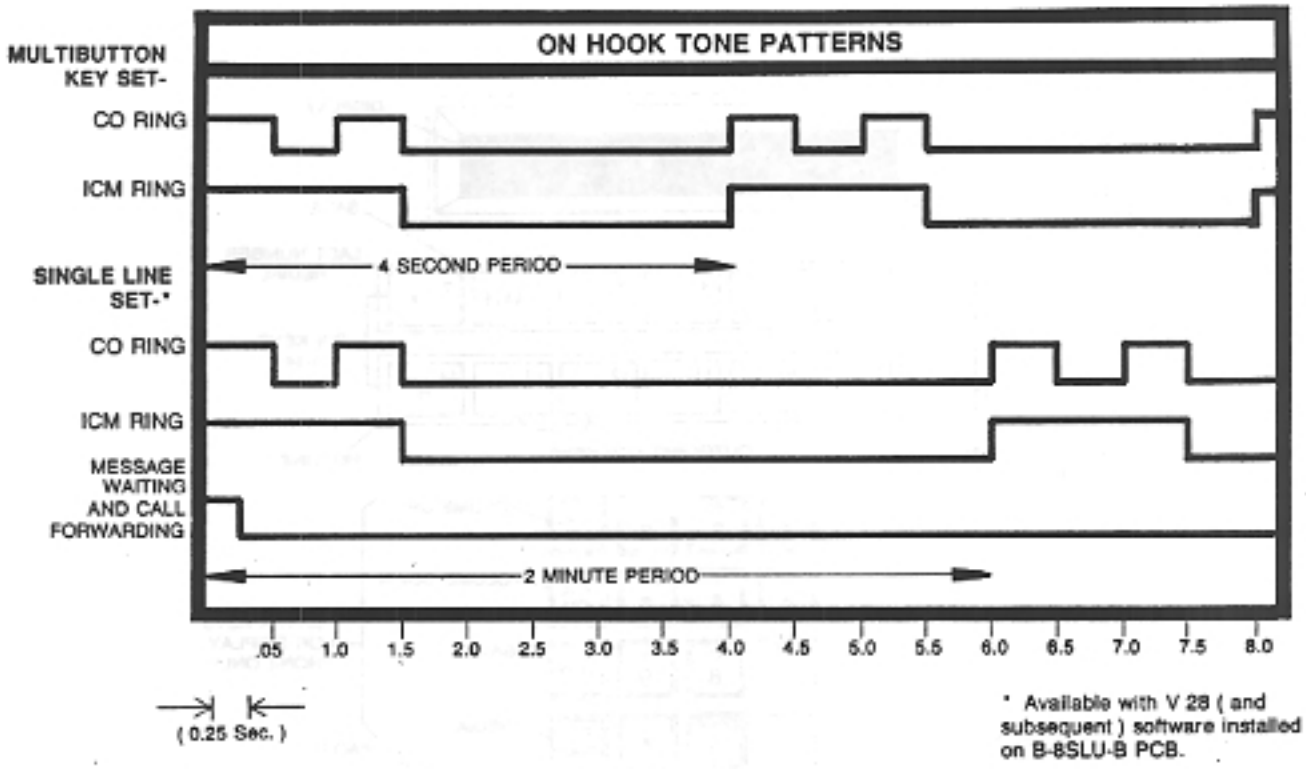


Figure 2-2 ON HOOK TONE PATTERNS, TCX-128

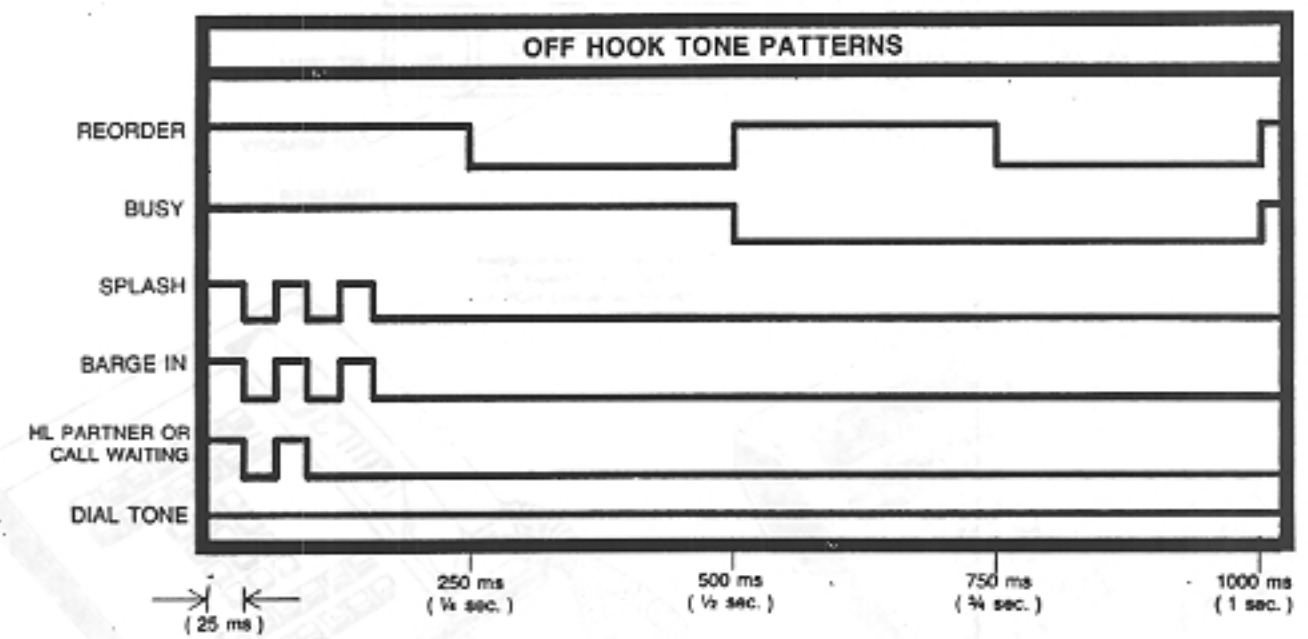


Figure 2-3 OFF HOOK TONE PATTERNS, TCX-128

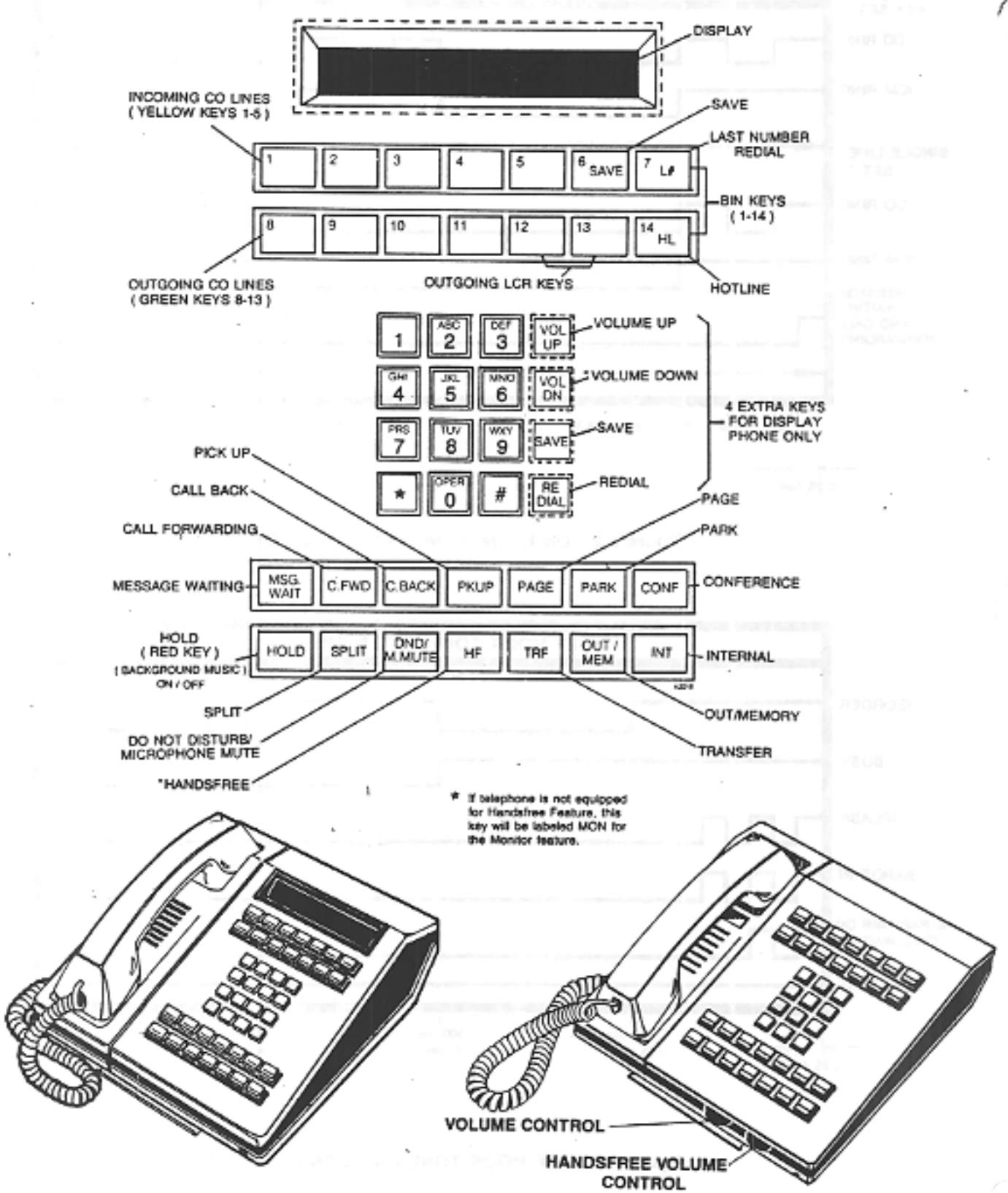


Figure 2-4 KEY LAYOUT, MULTIBUTTON KEY TELEPHONE (ULTRACOM), TCX-128

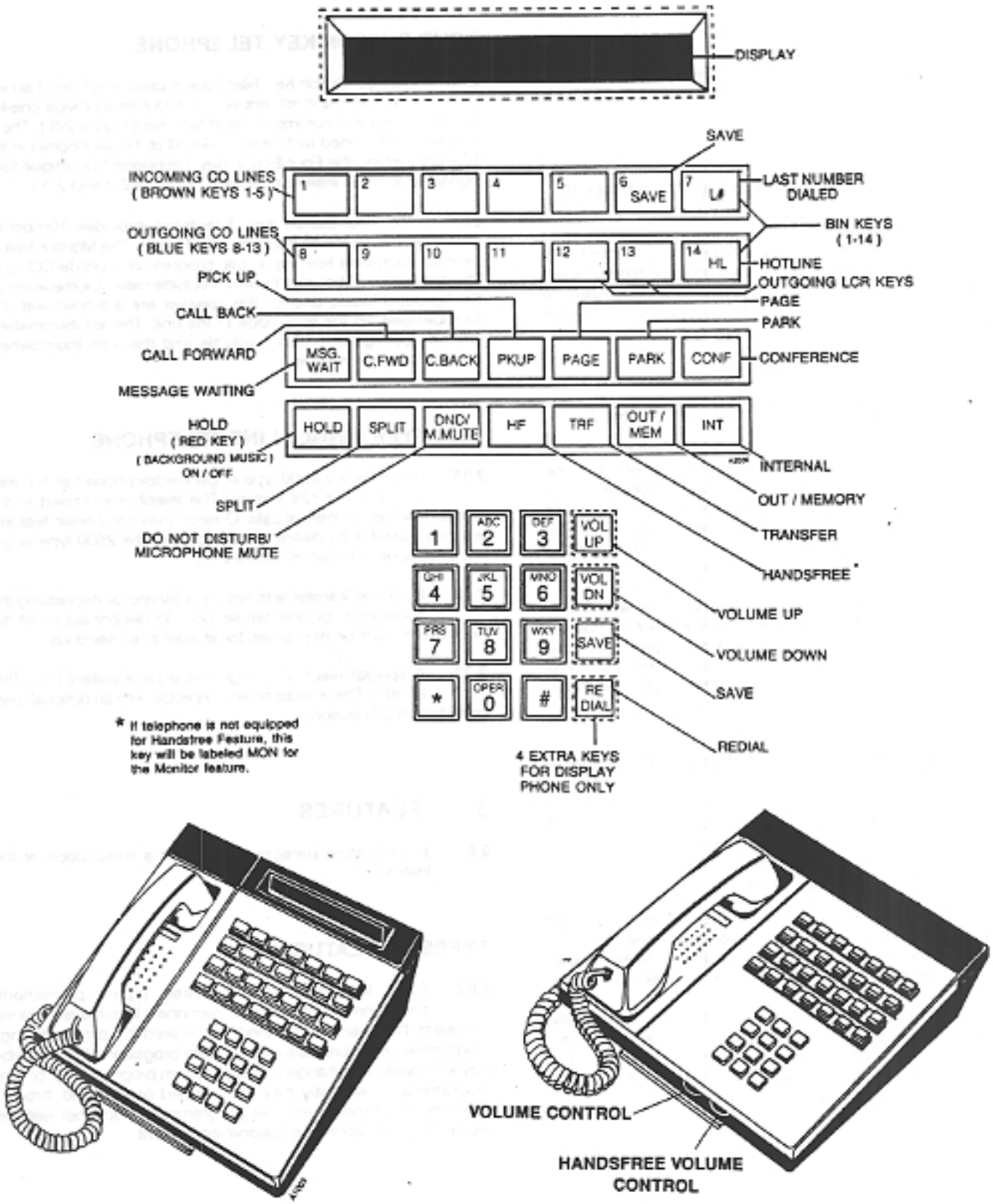


Figure 2-5 KEY LAYOUT, MULTIBUTTON KEY TELEPHONE (MERITOR), TCX-128

2.07 All further reference in this manual to the Multibutton Key Telephone shall be taken to mean the Multibutton Key Telephone and the Display Multibutton Key Telephone. When display features are referenced it shall be assumed that they are available only with the display telephone.

ATTENDANT MULTIBUTTON KEY TELEPHONE

2.08 The Attendant Multibutton Key Telephone is the same as the standard Multibutton Key Telephone and is additionally programmed for several unique features to provide more efficient call processing. These features include Automatic Hold, Alternate Attendant Station, Handsfree Transfer, Release and Voice Transfer (see key layout, Figures 2-6 and 2-7).

ATTENDANT DISPLAY MULTIBUTTON KEY TELEPHONE

2.09 The Attendant Display Multibutton Key Telephone is the same as the Display Multibutton Key Telephone and is additionally programmed for several unique features to provide more efficient call processing. These features include Automatic Hold, Alternate Attendant Station, Handsfree Transfer, Release and Voice Transfer (see key layout, Figures 2-6 and 2-7).

2.10 All further references in this manual to the attendant's telephone will be taken to mean the Attendant Multibutton Key Telephone and Attendant Display Multibutton Key Telephone with the DSS console. When display features are referenced, it shall be assumed that they are available only with the display telephone.

DIRECT STATION SELECTION (DSS) CONSOLE

2.11 A Direct Station Selection (DSS) console is used with the attendant telephones to provide direct access to all extensions in the system. Used in conjunction with the attendant telephone, the DSS console allows direct transfer of calls to the appropriate extension by using a single key.

The lower right key on the DSS console is a SHIFT key. When the SHIFT key is flashing the DSS selection keys change from extensions 301 through 363 to 401 through 463. (See key layout, Figure 2-8). Extensions 464 and 465 must be accessed by dialing.

2.12 The LEDs associated with the DSS keys provide a Busy Lamp Field (BLF) for all extensions in the system. When an extension is busy the LED associated with that extension is lit steadily. When an extension is in the Do-Not-Disturb (DND) mode the LED associated with that extension flashes.

FOUR BUTTON KEY TELEPHONE

2.13 The Four-Button Key Telephone is used when direct access to all features is not required. The four keys provide one-key access to the most commonly used features (Figure 2-9). These keys are color coded by function. Like all of the telephones in the TCX-128 system, the Four-Button Key Telephone has unique tone signals to assist in feature operation (Figures 2-2 and 2-3).

2.14 The Four-Button Key Telephone provides Handsfree answer-back on Intercom (ICM) calls. The Monitor feature permits Handsfree listening to call progress on outside CO calls. The handset must be used to talk on outside calls. Volume levels for Background Music and for the speaker are adjusted with the thumbwheels on the front edge of the unit. The left thumbwheel controls Background Music volume and the right thumbwheel controls speaker volume.

2500 TYPE SINGLE LINE TELEPHONE

2.15 Any standard 2500 type single line telephone can be used with the TCX-128 system. The telephone is used in the normal manner for internal calls. Outside lines and certain features are only available by dialing access codes. The 2500 type single line telephone is shown in Figure 2-10.

2.16 Hold and Transfer features are activated by depressing the hookswitch for one-half second. To disconnect a call the hookswitch must be depressed for at least three seconds.

2.17 A special electronic ringer must be installed (TIE P/N 86185). This installation is compatible with an optional, user provided HOLD button.

3. FEATURES

3.01 Each feature paragraph contains a description of the feature.

TYPES OF FEATURES

3.02 Each feature is one of three types: permanent, programmable or optional. Permanent features are intrinsic to system hardware and cannot be altered by programming. Programmable features are either system programmable, whereby they are enabled or changed through system programming, or user programmable, whereby they are enabled or changed through extension or attendant console programming. Optional features require the installation of additional equipment.

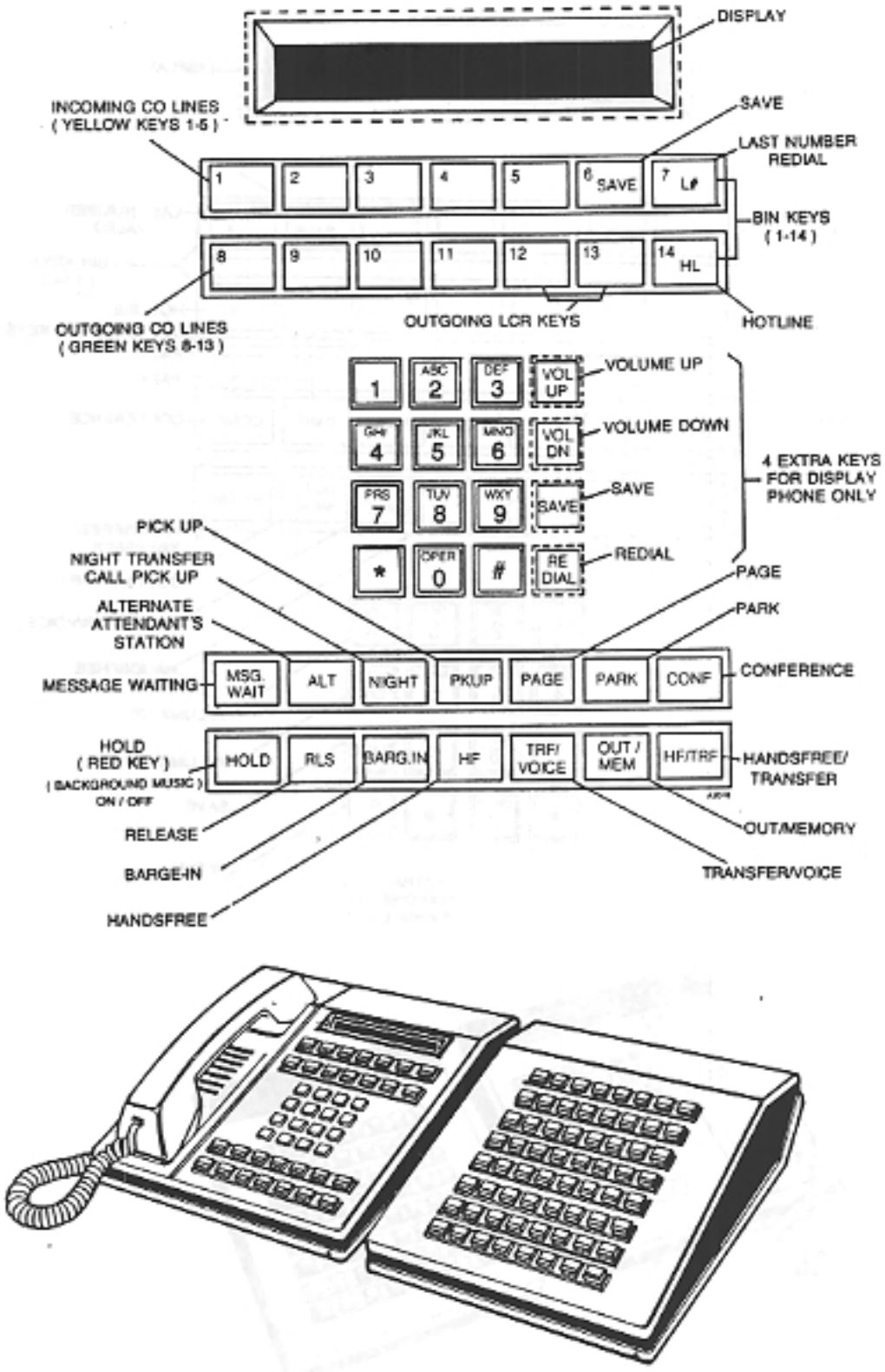


Figure 2-6 KEY LAYOUT, ATTENDANT MULTIBUTTON KEY TELEPHONE (ULTRACOM), SHOWN WITH DSS CONSOLE

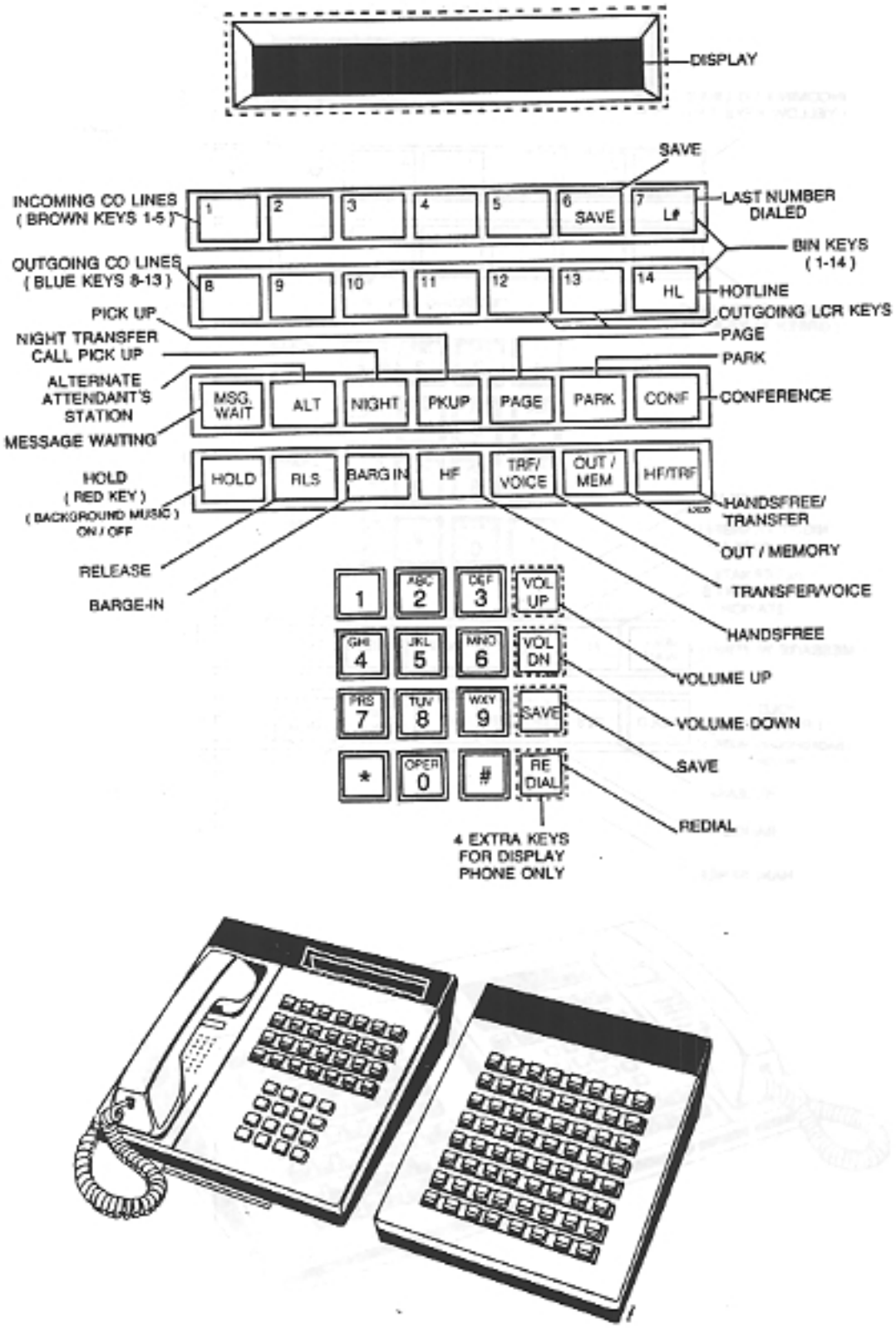


Figure 2-7 KEY LAYOUT, ATTENDANT MULTIBUTTON KEY TELEPHONE (MERITOR), SHOWN WITH DSS CONSOLE

Table 2-1 DISPLAY MESSAGES, TCX-128

DISPLAY MESSAGE	DEFINITION
WED JAN 13 12-04P	Day of Week / Month / Date / Time This display is shown constantly when telephone is idle.
LINE XX	When selecting an outgoing line or answering an incoming Direct Inward Line, the line number will appear in "XX".[1]
MSG FROM EXT YYY	Displayed once every 2 minutes with audible tone when someone has left a message waiting at your telephone.[2]
EXTENSION YYY	Display of the extension you have called on the Intercom.
EXT YYY CALLING	Shows which extension is calling you on the Intercom. This information is displayed in the Handsfree or Intercom Ring mode of operation.
FORWARD TO YYY	This message is displayed once every 2 minutes with audible tone when you have call forwarded your telephone.
YYY BUSY	Displayed when you have called a busy extension on the Intercom. A busy tone will also be heard.
RECALL FROM XXX	If a call is transferred to another extension and not picked up or is recalled to the operator because of a HOLD timeout from another extension to a display telephone, the display will say RECALL FROM XXX. This message will not appear, however, on a HOLD timeout from that telephone itself.
CALL BACK ST YYY	This message is displayed constantly for 30 seconds along with Intercom ringing. If the handset is picked up, the displayed message clears. Tells the user that the extension they left a callback on has become idle. Intercom path is automatically connected by picking up the handset.
CALL BACK CO XX	Displayed continually for 15 seconds along with ring or until the extension user picks up handset. The message remains for six seconds or until the first digits are entered. This tells the user that a line which they had queued on has become idle. The line is automatically connected when going off hook and appears busy to all other extensions to prevent access during your recall.
YYY NOT EXIST	Displayed when attempting to dial invalid or defective extension on the Intercom.
PICK UP FROM YYY	Displayed when a call is answered on the Pick Up key. This extension number shows which telephone the call was for and allows you to answer accordingly. This display is also present when using Directed Call Pick Up.
CO TO ORBIT ZZ	Shows which orbit was selected when transferring a CO call to a general parking orbit.[3]
CO FROM ORBIT ZZ	Shows which orbit was dialed when retrieving a call from a parking orbit.
YYY DND	Displayed when calling an extension which is in the Do-Not-Disturb mode. Re-order tone is also heard.
PROGRAM MEMORY	Displayed when OUT/MEM key is pressed to inform the user that they are programming CO speed dial or extension DSS keys.
NUMBER TO BIN WW	Displayed after pressing OUT/MEM key and one of the first 14 storage location keys. The digits entered via the dial pad are shown at the time the entry is made. This display is used for CO number storage and extension DSS programming mode.[4]
PROGRAM COMPLETE	Displayed after dial entry is completed and the selected storage location key is pressed a second time to complete the programming sequence.
COST $VV.VV	With rate chip installed in system, the cost of the call will be displayed for outgoing calls.[5]
DIGITS DISPLAYED	Digits displayed as entered when placing outside call.
TOLL RESTRICTED	Appears when attempting to dial a restricted number.

[1]XX = 01 - 32.
[2]YYY = Extension 301 - 363.
401 - 465 (found in Expansion Cabinet).
[3]ZZ = Park Orbit 50 - 59.
[4]WW = Speed dial DSS station storage Bin 1 - 14.
[5]VV.VV = Running total of call in dollars and cents.

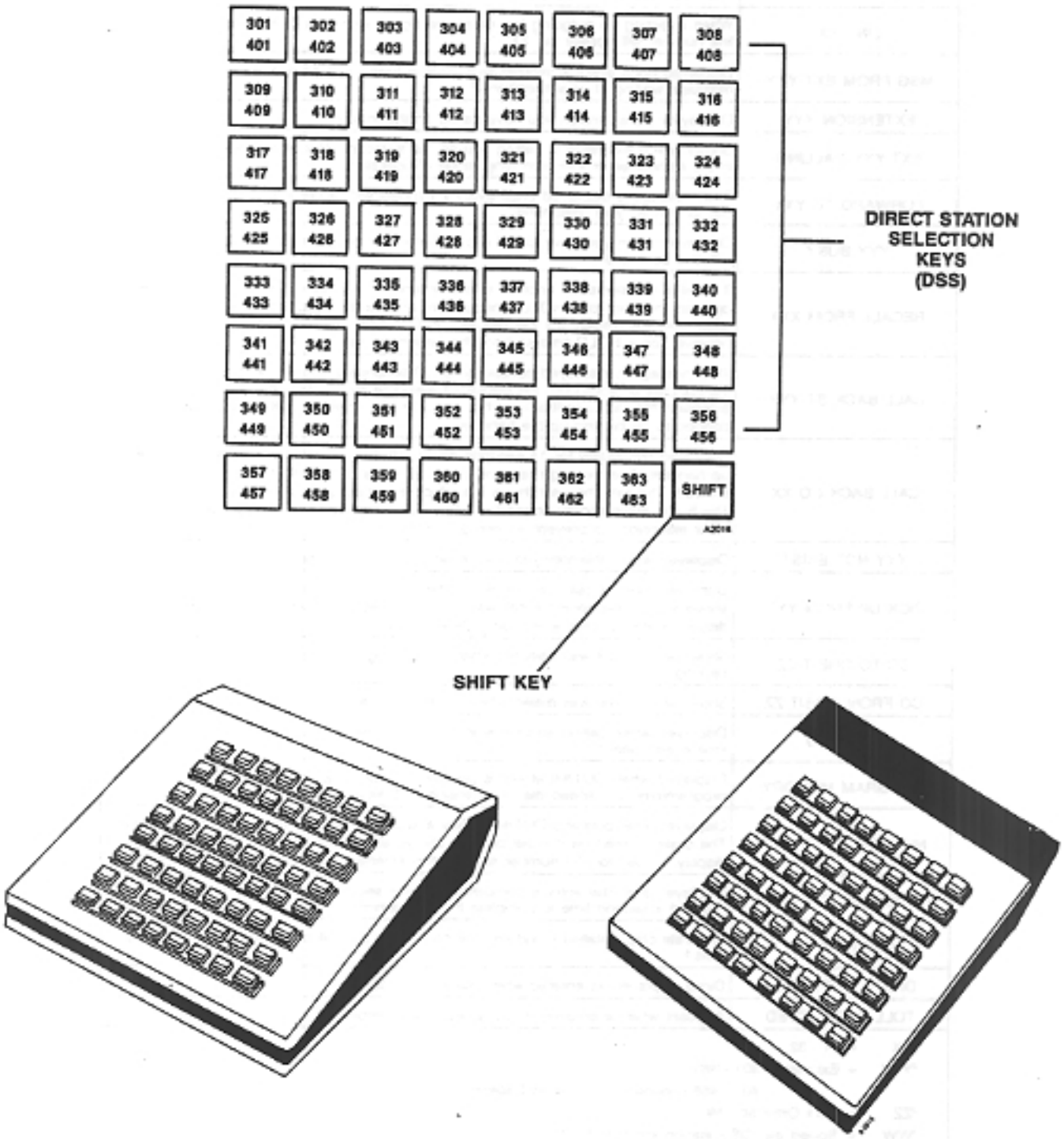


Figure 2-8 KEY LAYOUT, DIRECT STATION SELECTION (DSS) CONSOLE

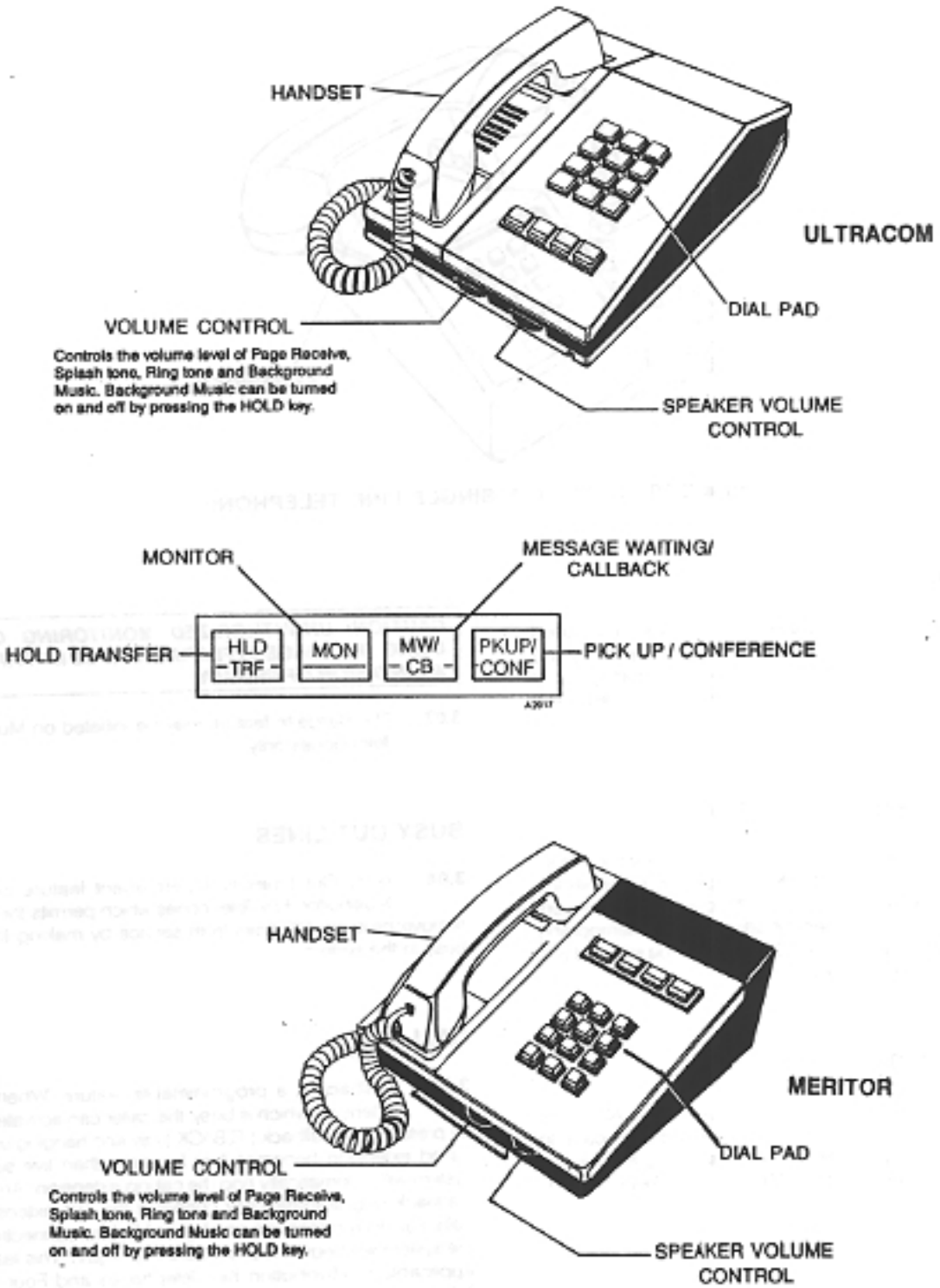


Figure 2-9 KEY LAYOUT, FOUR-BUTTON KEY TELEPHONES, TCX-128

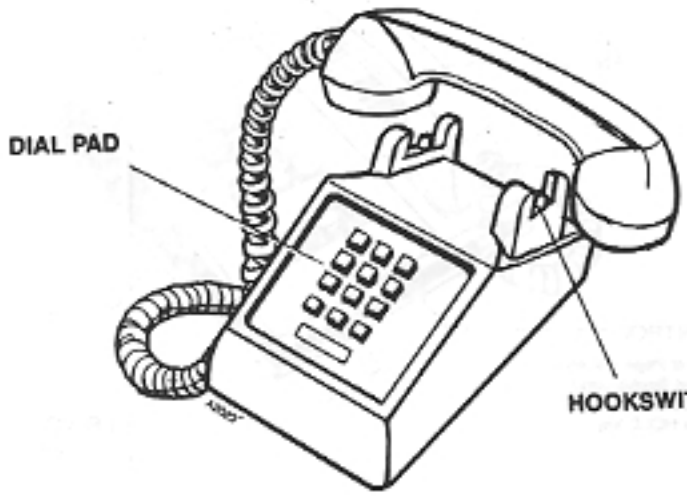


Figure 2-10 2500 TYPE SINGLE LINE TELEPHONE

ACCOUNT CODE

3.03 If the system has been installed with a customer supplied printer, a record of all calls may be kept by assigning account codes of up to nine digits. Account codes are assigned at the telephone from which the call is being placed. This feature is available from all telephones on the system.

ALTERNATE ATTENDANT STATION

3.04 The Alternate Attendant Station is a programmable feature of the Attendant Multibutton Key Telephone. It permits the primary console attendant to direct all calls to another extension. This feature is generally used when the attendant must temporarily leave the console. Alternate Attendant Stations must be selected and programmed at the time of installation.

AUTOMATIC HOLD

3.05 Automatic Hold is a permanent feature of the Attendant Multibutton Key Telephone. It allows the attendant to automatically place an outside call on hold by pressing another line key, the Voice Transfer key (VOICE / TRF) or Page key (PAGE).

BARGE-IN

3.06 Barge-In is a system programmable feature that permits designated extensions to override the system privacy lockout on other specified extensions. When this feature is invoked, the conversation in progress receives three splash tones followed by a delay, and then the voice of the extension user who is barging in. Extensions can be programmed individually to block Barge-In. Unless the call is terminated, only the party initiating the Barge-In can release the Barge-In status.

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE-IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

3.07 The Barge-In feature may be initiated on Multibutton Key Telephones only.

BUSY OUT LINES

3.08 Busy Out Lines is a permanent feature on Attendant Multibutton Key Telephones which permits the attendant to remove problem CO lines from service by making them appear busy to the system.

CALLBACK

3.09 Callback is a programmable feature. When calling an extension which is busy, the caller can activate this feature by pressing the Callback (C.BACK) key and hanging up. When the called extension becomes free for more than five seconds, the system will automatically ring the calling extension. Answering the Callback ring automatically connects the two extensions. If the called extension receives another call before connection is made, the system will begin the procedure over again. This feature is only applicable to Multibutton Key Telephones and Four-Button Key Telephones.

CALL FORWARD CANCEL

3.10 Call Forward Cancel is a permanent feature of the Attendant Multibutton Key Telephone. It allows the attendant to cancel all Call Forwarding conditions throughout the system.

CALL FORWARDING

3.11 Call Forwarding is a programmable feature used to transfer all incoming CO or ICM calls for one extension to another extension in the system. Internal calls can be forwarded through up to four extensions before reaching the desired extension. The forwarded call cannot be sent back to the extension at which it originated. The attendant can cancel all Call Forwarding conditions in the system. Call Forwarding is only applicable to Multibutton Key Telephones.

CALL WAITING, CO CALL

3.12 Call Waiting, CO call is a system programmable feature which provides a busy extension with an audible and visual indication that a CO or attendant call is waiting to be answered. The busy extension will receive a double beep and the appropriate CO line key will flash. To be connected to the waiting call, the user must press the CO line key. The entire system may be programmed to allow or disallow CO Call Waiting signals. However, if CO Call Waiting signaling is allowed on a system wide basis it may still be disallowed on an extension-by-extension basis. All programming for this feature is done during installation.

CENTRAL OFFICE CALL, INCOMING

3.13 Central Office Call, Incoming is a system programmable feature. Incoming calls can be answered from any extension programmed to receive calls. Incoming CO calls provide a distinctive tone signal at the extension. This feature is available on all system telephones. Multibutton Key Telephones will also display a distinctive flash rate on the line key associated with the incoming call. For Multibutton Key Telephones with the Handsfree feature, the speaker and microphone inside the telephone may be used instead of the handset on outside as well as ICM calls.

CENTRAL OFFICE CALL, OUTGOING

3.14 Outside calls can be initiated from any extension provided that the extension's Class of Service (COS) does not restrict the outgoing call. This is a system programmable feature.

3.15 When LCR is installed, Multibutton Key Telephone keys 12 and 13 will access LCR. Keys 8, 9, 10 and 11 access Line Groups as programmed, if allowed. Multibutton phones may dial access specific groups not available on keys 8, 9, 10 and 11. Four-Button Key Telephones and 2500 type single line telephones cannot access a specific line group. With LCR installed dialing "9" automatically accesses the least costly route.

CLASS OF SERVICE

Refer to TOLL RESTRICTION.

CONFERENCE CALL

3.16 Conference Call is a permanent feature that permits a three way telephone conversation. There are two types of Conference Call features: ***Add-On Conference*** and ***Line Conference.***

Add-On Conference

3.17 Add-On Conference permits the addition of a second internal party to an existing outside call. The second internal party may be using any one of the telephones used in the TCX-128 system. However, the 2500 type single line telephone may not be used to initiate conference calls.

Line Conference

3.18 Line Conference allows one internal party to conference with two outside lines. This feature is available on all telephones except for 2500 type single line telephones.

3.19 Not Used.

DATE AND TIME

3.20 The Date and Time feature is used by the system for SMDR and display telephone presentations. This data can be entered at the attendant's extension. Data entered includes the hour, minutes past the hour, month, day of the month and year. The presentation also includes the day of the week.

DIRECT INWARD LINE

3.21 The Direct Inward Line (DIL) feature permits an incoming call to be directly connected to a specific extension or group of extensions without going through the attendant. This direct connection applies to incoming calls; however, depending on system programming, extensions may have access to a DIL for outgoing calls also. This feature applies to all telephones on the system and does not affect normal operation of the telephone.

DIRECT INWARD LINES SPLIT TONE SIGNALING

3.22 Direct Inward Lines Split Tone Signaling is a system programmable feature that permits CO tone signaling assignments for extensions. Any combination of CO lines can directly signal each individual extension as Direct Inward Lines without the attendant.

DIRECT LINE ACCESS

3.23 Direct Line Access is a permanent feature of the Attendant Multibutton Key Telephone that permits the attendant to select a specific CO line for an outside call. The attendant can override Least Cost Routing (see Least Cost Routing description below) using this feature.

DIRECTED CALL PICK UP

3.24 Directed Call Pick up is a permanent feature that permits a transferred CO call to be answered on an extension near the extension to which the call is being transferred. The call can be answered on any nearby key or 2500 type single line telephone. If the call is unanswered, it will automatically revert to the attendant.

DO-NOT-DISTURB

3.25 Do-Not-Disturb (DND) is a system programmable feature that blocks all incoming internal calls and paging signals to an extension. Callers attempting to reach an extension that has invoked DND will receive a busy tone. Only the attendant can override DND. Only Multibutton Key Telephones can be placed in the DND mode. When an extension is in the DND mode the DSS console will have a flashing LED for that extension.

DO-NOT-DISTURB OVERRIDE

3.26 This feature can only be initiated at an Attendant Multibutton Key Telephone or by a Hotline partner. The attendant is able to make a voice announcement to any extension that is in the DND mode. When the extension is busy the attendant uses the Barge-In feature instead.

EXCLUSIVE HOLD

3.27 Exclusive Hold is a permanent feature for placing a call in a temporary waiting condition. The call can be accessed only by the extension which placed the call on hold. A distinctive flash pattern appears on the CO line key at the extension. If the call is left on hold longer than the programmed period, the call will ring again at the extension (refer to the Hold Recall feature described below).

3.28 At Attendant Multibutton Key Telephones calls can be placed on hold by two methods: Manual and Automatic. Manual Hold is initiated by pressing the HOLD key. Automatic Hold is initiated by pressing another line key, the Voice Transfer (VOICE / TRF) key or Page key.

GROUP PICK UP

3.29 Group Pick Up is a system programmable feature. It permits an incoming CO line call to be answered from any extension within a selected pickup group. Up to 64 pickup groups can be established in the system. However, each extension can belong to only one group. Each extension in a pickup group may be individually programmed to receive ringing for a call directed to its group.

HANDSFREE

3.30 The Handsfree feature allows use of the speakerphone (speaker and microphone) inside the telephone instead of the handset. This is an optional feature available only to Multibutton Key Telephones. Telephones equipped with this feature provide full Handsfree communication (Handsfree transmitting and receiving) on all CO and ICM calls.

HANDSFREE ANSWERBACK

3.31 The Handsfree Answerback feature is a permanet feature for all Four-Button Key Telephones and for Multibutton Key Telephones which are not equipped with the optional Handsfree feature. The Handsfree Answerback feature allows the user to respond handsfree to voice announced ICM calls.

HANDSFREE TRANSFER

3.32 Central Office calls may be transferred Handsfree from the attendant to another extension providing that the extension initiating the transfer is equipped with the Handsfree feature.

HOLD RECALL

3.33 Hold Recall is a programmable feature that prevents CO calls from being left on hold and forgotten. After a programmed period of time the system automatically resignals the extension that placed the call on hold. If the call is not answered it will revert to the attendant extension. If the attendant extension is a display telephone, the display will inform the attendant of which extension has left the call unanswered. The Hold Recall feature is automatic on all telephones used in the system.

HOTLINE

3.34 Hotline is a system programmable feature that directly connects two extensions for fast efficient communication and call transfer. By using just the Hotline (HL) Key, incoming calls are automatically put on hold and a Handsfree conversation is established between the Hotline partners. The HL key also provides a busy status indication for a HL partner whenever its partner extension is in use. This feature is only available on Multibutton Key Telephones.

3.35 Each Hotline arrangement uses one intercom link when in use. Each extension may be programmed for only one outgoing Hotline but may have more than one incoming Hotline. To screen calls for the other partner, the partner answering the calls must have the higher extension number of the Hotline pair.

3.36 A call transferred to the Hotline partner via the HL key will revert to the attendant if not answered after a programmed period of time. If the partner to whom the call is being transferred has invoked the Do-Not-Disturb feature, the Hotline partner transferring the call will receive a busy tone.

NOTE: If the Hotline partner is on a call, his or her HL key will light. The other Hotline partner can press the HL key to send a call waiting signal (2 beeps). The HL key will flash rapidly. Upon hearing the call waiting signal and seeing the flashing key, the partner may place the first call on hold and respond to the HL call by pressing the flashing HL key. If the partner hangs up from the first call without pressing the HL key, the partners will be connected to each other handsfree.

INTERCOM

3.37 Intercom (ICM) is a system programmable feature. Intercom (internal) calls can be initiated from any extension in the system. If the extension being called is a key telephone, the called party can respond Handsfree. If the called party has a 2500 type single line telephone the handset must be lifted for response.

3.38 Key telephones provide the option of sending either an ICM tone or voice announcements to other key telephones which may respond Handsfree or by lifting the handset. However, if the called extension is a single line telephone, the tone will be received regardless of whether the ICM call was initiated at a single line or key telephone.

Direct Station Selection

3.39 For rapid ICM calling, the fourteen keys located in the top section of the Multibutton Key Telephones may be programmed for bin storage of up to fourteen frequently called extensions. Keys so programmed will function as Direct Station Selection (DSS) keys, allowing quick access to called extensions. When using these programmed DSS keys, the initiating extension will send a voice announcement. A tone will be received only if the called extension is programmed for Intercom Voice Announce Disable. Attendant Multibutton Key Telephones being used without a DSS console initiate rapid ICM calling by using the above mentioned DSS bin keys.

INTERCOM VOICE ANNOUNCE DISABLE

3.40 Intercom Voice Announcements may be disabled on a system-wide or extension by extension basis. During system programming Voice Announce may be disabled so that all Intercom calls are signaled by a distinctive ring tone at all called extensions. Voice announcements will not be permitted. If Intercom Voice Announce Disable has not been programmed on a system-wide basis, each extension may be programmed on an individual basis by the user to disable voice announcements. Extensions so programmed will receive tone signaling for all ICM calls. This feature is available on key telephones only.

LAST NUMBER REDIAL

3.41 Last Number Redial is a permanent feature available to all extensions capable of placing outside calls. This feature stores the last dialed CO line telephone number to be automatically redialed at a later time. The number is held in memory regardless of whether the call was answered, not answered or busy.

LEAST COST ROUTING (LCR)

3.42 Least Cost Routing is an optional feature which automatically evaluates as many as 10 different rate structures and selects the least costly route for a call.

3.43 If Least Cost Routing (LCR) is installed in the system, outgoing keys 12 and 13 are outgoing LCR keys. Outgoing keys 8-11 are available for direct access to up to 4 different outgoing CO line groups. If LCR is not installed, outgoing CO line keys 8-13 are available for direct access to up to 6 different outgoing CO line groups. Outgoing CO lines may be divided into as many as 10 groups. If allowed by system programming, these may be accessed by dialing 9 and the appropriate line group number (0-9).

NOTE: If LCR is accessed by pressing outgoing CO line keys 12 and 13, the SMDR and cost display will show the actual cost of the call. If in addition to LCR, the user's telephone is programmed for Direct Line Access, the user may directly select a line and dial a toll call via an Other Common Carrier (OCC). If direct selection is made, the SMDR and cost display will show the local number that was dialed to access the OCC, rather than the actual cost.

LCR BYPASS

3.44 LCR Bypass is a programmable feature which allows the LCR to bypass a three digit exchange by defaulting to Class of Service 1. This may be necessary for new area codes and should be used only on a temporary basis until a new rate chip is installed. The LCR Bypass feature may be initiated on attendant telephones only.

LINE QUEUING

3.45 Line Queuing is a permanent system feature. It permits an extension to queue (wait in line) for an outside line when all lines are busy and to be signaled when a line is available. Any number of extensions can queue on any one line group. The system automatically signals the extensions, in order, when a line is available, by ringing the extension and illuminating the CO line key. If the line is not accessed within 12 seconds after it becomes available, the line then passes to the next extension in the queue. If an extension is busy when the line becomes available, the line is passed to the next extension in the queue. This feature is only available to Multibutton Key Telephones and Four-Button Key Telephones.

MESSAGE WAITING

3.46 This feature is used to leave a Message Waiting indication (flashing MSG.WAIT key [1] and short beep at programmed intervals) at a called extension that is not answered or busy. Each extension can leave any number of Message Waiting indications in the system. Several Message Waiting signals can be left at Multibutton Key Telephones, and Four-Button Key Telephones. Up to four messages may be left at display telephones, at which the calling extension number is displayed.

[1] On Four-Button Key Telephones the Message Waiting indication is a flashing HLD / TRF key and a short beep at programmed intervals.

3.47 To respond to a Message Waiting indication, pressing the flashing MSG.WAIT key while off hook will automatically signal the extension which left the Message Waiting indication. If more than one Message Waiting indication has been left, response to each may be made, in turn, through this procedure.

MICROPHONE CUTOFF

3.48 This feature provides privacy at a key telephone by disabling the transmitter portion of the speakerphone while the extension is in an idle state. This prevents a party calling the extension Handsfree from overhearing conversations in the vicinity of the called extension.

MICROPHONE MUTE

3.49 Microphone Mute is a permanent feature on all Multibutton Key Telephones. When the Microphone Mute (DND / M.MUTE) key is pressed during a handsfree conversation the microphone portion of the speakerphone is disabled, preventing the other party from hearing what is being said at the extension.

MONITOR

3.50 The Monitor feature is a permanent feature for all Four-Button Key Telephones and for Multibutton Key Telephones without a built in speakerphone. The Monitor feature allows the user to dial an outside call without lifting the handset. It also allows the user to monitor the outside call while waiting for the called party to take the call off hold. To talk on an outside call the handset must be used. This feature also allows the user to receive voice announced ICM calls and to reply Handsfree.

MUSIC ON HOLD / BACKGROUND MUSIC

3.51 Music On Hold (MOH) and / or Background Music (BGM) can be connected to the system. MOH provides music to CO lines when they are placed on hold. No action is required on the part of the extension user. The speaker on the key telephones can be used to provide BGM if the music source is installed and the system is programmed for the optional music source. Background Music is turned on and off at each extension by the extension user. When the telephone is in use BGM is automatically turned off. Background Music is not available on 2500 type single line telephones.

OPEN LOOP TIMED FLASH

3.52 Open Loop Timed Flash is a programmable feature that provides a new dial tone without losing control of the line. This feature is only applicable to the Multibutton Key Telephones.

PAGING

3.53 Paging is a system programmable feature. There are two types of Paging: ***All Call Paging*** and ***Zone Paging.***

All Call Paging

3.54 All Call Paging is broadcast over all extensions in the system except those extensions programmed not to receive page announcements. All Call Paging may be initiated from any of the telephones in the system. A volume control located on key telephones regulates the page level from the speaker. Optional external amplifiers and speakers can also be connected to each zone for page broadcasts.

Zone Paging

3.55 Zone Paging provides paging to up to eight groups of extensions. Multibutton telephones may receive paging via the speakerphone. Extensions are grouped into paging zones during installation.

3.56 The following shows the access codes associated with each zone. Paging zones are programmable on an extension-by-extension basis.

ZONE	ACCESS CODE
1	61
2	62
3	63
4	64
5	65
6	66
7	67
8	68

NOTE: There are four zones per Tone Generator PCB.

PARK

3.57 You can park an outside call, page a third person and have that person pick up the parked call from any extension in the system. There are two types of parking orbits: ***General Park Orbit*** and ***Personal Park Orbit.*** This is a permanent feature on all telephones used in the TCX-128 system.

General Park Orbit

3.58 General Park Orbit provides access to parked calls from any extension in the system. A call is retrieved from a General Park Orbit by dialing designated codes.

Personal Park Orbit

3.59 Personal Park Orbit provides access to calls that are parked at a particular extension. These calls can be answered at any other extension by dialing the extension number of the extension where the call is parked.

PRIVATE LINE

3.60 The Private Line feature allows a Central Office (CO) line to be reserved for a specific extension or group of extensions. All incoming or outgoing calls are handled at the extensions programmed for the Private Line. Each Multibutton Key Telephone can have one Private Line. Every Private Line requires one CO line circuit in the Key Service Unit (KSU). A Private Line assigned to an extension will always be accessed by the fifth incoming line button on the telephone. Multiple telephones may have the same Private Line. Four-Button Key Telephones and 2500 type single line telephones cannot be assigned Private Lines. Private lines are not normally programmed for Universal Night Answer. When the system is placed in the Universal Night Answer mode, Private Lines will ring only at the extensions for which they have been reserved, or where CO Audible has been assigned.

RELEASE

3.61 The Release feature is a permanent feature that permits the attendant to disconnect an outside or ICM call without replacing the handset.

SAVE

3.62 The Save feature stores a specific telephone number for automatic dialing at a later time. The number remains saved until another number is stored in its place. This feature is only available on Multibutton Key Telephones.

SMDR

3.63 The Station Message Detail Recording data (SMDR) is a feature which permits the recording of call data such as date and time made, duration, extension called from, line used, telephone number dialed, charge [1] and account codes. This data enables a customer to manage the operation of a TCX-128 Key Telephone System more efficiently and economically. The system can store 24 lines of information before printing. Detailed information on the SMDR printer, including a sample printout, is provided in Section 9, OPTIONAL EQUIPMENT.

[1] Cost will be shown on SMDR printout and displayed only if the Rate Chip is installed.

SPEED DIAL

3.64 Speed Dial is a programmable feature that permits automatic dialing of stored CO line telephone numbers. There are two types of Speed Dial: ***Extension Speed Dial*** and ***System Speed Dial.*** Class of Service and Toll Restriction programming can deny or limit Speed Dial for a particular extension.

Extension Speed Dial

3.65 Extension Speed Dial is available only to the first 50 extensions. On Multibutton Key Telephones the top 14 keys (incoming and outgoing CO line keys) can also be used as bin storage locations. Each extension can be programmed individually, with each bin storing one telephone number of up to 16 digits. Bins can be chained together to accommodate numbers greater than 16 digits.

3.66 On Four-Button Key Telephones and 2500 type single line telephones up to ten frequently dialed numbers may be stored for each extension.

System Speed Dial

3.67 Up to 100 frequently dialed numbers can be programmed into system memory and are available to every extension in the system unless limited by Class of Service or Toll Restriction. Only the attendant can program or change System Speed Dial numbers.

3.68 Up to four bins may be chained together. These four bins may all be system bins or may be system bins and extension bins. If system bins are combined with extension bins, the first bin must be a system bin. Special numbers and security codes (e.g., MCI access, security codes), which will be used in conjunction with a manually dialed number, may also be stored.

SYSTEM SPEED DIAL DIRECTIVES

3.69 The attendant can enter Special System Speed Dial Directives with the number stored in the system bin during System Speed Dial programming.

Directive *

3.70 Storing a * enters a 6-second pause at the point where it is encountered. The * is also used to indicate a chaining sequence.

Directive *1

3.71 Each system speed dial bin can store up to 16 digits, including digits used for directives. The directive *1 entered at the end of the bin (or after 14 digits have been entered) increases bin storage. This tells the system to jump to the next storage bin, increasing the size of the bin by 16 digits. The system will treat this as one bin. The second bin should not be accessed independently.

Directive *2*

3.72 The directive *2* is used at the end of a system bin which is to be used in conjunction with a station bin. The *2* directive tells the system to wait for the next bin to be entered by key telephones if not already known to the system. This directive also puts key telephones into the memory dial mode, enabling the bin keys for 6 seconds. This does not affect chaining for 4-Button Key Telephones or 2500-type telephones.

Directive *3

3.73 The directive *3, entered at the beginning of a bin, turns the display on display telephones off and turns off the SMDR until the next bin is entered. It is used when entering access codes, security codes, etc. Toll restriction is applied to the numbers which are entered after the SMDR is turned back on (i.e., at the beginning of the next bin). If the directive *1 is used to increase the storage capacity of a system speed dial bin, the *3 directive should be repeated after the *1 directive is used.

3.74 If the first bin accessed is one of the ten identified during Line Service Type programming as an OCC dial up system bin, the system will turn off the display and the printer automatically.

Directive *4

3.75 The directive *4 applies station speed dial restrictions instead of system speed dial restrictions to the call. The directive *4 may be entered either at the beginning or at the end of the bin.

Directive *5

3.76 The directive *5 is entered into a bin to cause toll restriction to be abandoned for the call being made. Any COS, including COS 05, can dial this number. It may be placed either at the beginning or at the end of the number in the bin.

Directive *6

3.77 Directive *6 is a special instruction which suppresses the digit 1 if it appears in the next bin. If the user is in an area which requires a leading 1 for calls, and an OCC service is used to an area where leading 1 is not used, the 1 will be stripped if it appears as the first digit in the next bin. This directive is placed at the end of an account code or security code.

SPLIT

3.78 Split is a permanent feature that allows an extension user to place a call on hold and answer a second incoming call. Using the Split feature the user can alternate between the two calls. This feature may be accessed on all telephones used in the TCX-128 system.

TENANT SERVICE

3.79 Tenant Service is a permanent feature. It allows up to six customers (tenants) to share a TCX-128 telephone system. Each tenant group may have dedicated CO lines, a separate attendant console, and extensions. Only the CO lines assigned to a tenant are available to that tenant for incoming and outgoing calls. All extensions except 464 and 465 in the system appear on all the Direct Station Selection (DSS) consoles at the attendants' stations. Therefore, the DSS console functions as a Busy Lamp Field (BLF) for the extensions in the system regardless of tenant group. Internal calls can be made among the different tenant groups. The TCX-128 provides zone or All Call paging. All Call pages will be broadcast to all extensions, except those programmed not to receive pages regardless of tenant group. Paging zones may be assigned to tenants. Night Ringing cannot be assigned to individual attendants.

TOLL RESTRICTION

3.80 Toll Restriction is a programmable feature that prohibits selected extensions from placing unauthorized long distance (toll) calls. Extensions can be restricted to internal calls, local calls, Speed Dial, or selected area codes depending on the Class of Service designated for that line and / or extension.

TRANSFER

3.81 Transfer is a permanent feature for transferring an established outside CO call from one extension to another extension. The call may be transferred unscreened (unannounced) screened (announced). While the CO call is being transferred, the appropriate line key flutters at half second intervals. For an unannounced transfer, the fluttering line key appears only at the extension receiving the transfer. Three splash tones are heard by both the transferring and receiving extensions. Unanswered transfer calls return to the extension that transferred the call. If the call is not answered after a programmed period of time, it will revert to the attendant extension. If the attendant extension is a display telephone it will display the extension number from which the call has been returned.

3.82 The attendant can transfer calls to any extension in the system using the Direct Station Selection (DSS) console. Each DSS key is used for two extension numbers. When the SHIFT key on the console is not flashing, the DSS keys represent extensions 301 363. When the SHIFT key is flashing, the DSS keys represent extensions 401-463. Extensions 464 and 465 must be dialed.

Transfer, Call Waiting (Camp-On)

3.83 The Call Waiting Transfer feature allows transferring a CO call to a busy extension. The busy extension receives a Call Waiting (Camp-On) tone and the appropriate CO line key will flash. A double splash tone is heard by both the transferring and receiving extension.

3.84 The extension receiving the transfer can either put the first call on hold to answer the second call (Split) or terminate the first call. When the extension becomes idle from terminating the first call, the waiting call will ring at the extension.

3.85 Extensions may be programmed individually during system programming to enable or disable the ability to send and / or receive Call Waiting (Camp-On) signals.

Transfer, Handsfree

Refer to HANDSFREE TRANSFER.

UNIVERSAL NIGHT ANSWER

3.86 The NIGHT key on the Attendant Multibutton Key Telephone is used during off hours to put the system in the Universal Night Answer (UNA) mode. In this mode telephones and optional external page systems, so programmed during installation, can receive indications of incoming calls. The ability to put the system into the UNA mode is available at the attendant's extension only.

3.87 Multibutton Key Telephones may be programmed for Night Ringing. This Night Ringing may be temporarily disabled on an individual Multibutton Key Telephone by activating the Do-Not- Disturb feature on that telephone.

3.88 Four-Button Key Telephones and 2500 type single line telephones can answer Night Ringing heard over the paging system by lifting the handset and dialing "69". When more than one incoming CO line is ringing while the system is in the Universal Night Answer mode, these telephones will automatically access the first incoming call.

NOTE: The incoming CO lines which will ring at all extensions in the Universal Night Answer mode are programmed individually. This allows special lines, such as Direct Inward Lines (DILs) or Private Lines to ring only at selected extensions as they do when the system is in the normal daytime mode. These special lines will not ring over the paging circuit.

VOLUME CONTROL

3.89 The volume controls are used to adjust volume levels of page receive, splash tones, ring tones, BGM and the Handsfree speaker. Key telephones without display have volume controls on the lower front edge. The left thumbwheel controls the volume level of page receive, splash tones, ring tones and BGM. The right thumbwheel controls the volume level of the Handsfree speaker.

3.90 All volume levels on the display key telephones are controlled by the Volume Up (VOL UP) and Volume Down (VOL DN) keys located next to the dialpad.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 3, SYSTEM CONFIGURATION

1. INTRODUCTION

1.01 The SYSTEM CONFIGURATION Section provides information to help meet the particular needs of the customer. The Option Configuration Worksheets (OCWs) are used to gather system and extension data for ordering equipment and completing the Program Record Forms (PRFs) in Section 4.

1.02 Major revisions to this section included reworking Table 3-1 and the text associated with it. Block requirements were clarified. The appropriate System Options were included on Table 3-5.

2. DESCRIPTION OF COMPONENTS

2.01 The following paragraphs describe the component parts of a TCX-128 system: Key Service Unit (KSU) and Expansion Cabinet, Power Supply, Printed Circuit Boards (PCBs) and Extension Instruments.

KEY SERVICE UNIT

2.02 The KSU houses the PCBs for the system. The KSU accommodates up to 64 extensions and 24 Central Office (CO) lines. The KSU also provides 32 talkpaths, 20 of which are reserved for CO lines, 10 are available for additional CO lines or Intercom calls (ICM) and two are reserved exclusively for Paging and Background Music (BGM).

EXPANSION CABINET

2.03 The Expansion Cabinet is installed when more than 64 extensions or more than 24 CO lines are required. The Expansion Cabinet accommodates an additional 64 extensions and 8 CO lines. A system with a KSU and Expansion Cabinet provides a maximum system capacity of 128 extensions and 32 CO lines. The Expansion Cabinet does not increase the number of talkpaths in the system.

POWER SUPPLIES

2.04 The KSU and Expansion Cabinet each require a separate power supply. A surge protector should be installed for each power supply.

PRINTED CIRCUIT BOARDS

Central Processing Unit PCB

2.05 One Central Processing Unit (B-CPU-B) PCB is required. This PCB, which contains system clocks and operating programs, is the control center for the system.

Tone Generator PCB

2.06 The Tone Generator (B-TGU) PCB generates the various tone signals for the TCX-128 system. Up to two Tone Generator PCBs can be installed in the system. If an expansion cabinet is installed, a second Tone Generator PCB or an Auxiliary PCB is required. Each Tone Generator PCB contains four paging zone circuits; two relays (external ringing or paging); and volume controls for page, BGM, and Music-On-Hold (MOH). Each Tone Generator PCB also contains two Dual Tone Multi-Frequency (DTMF) receivers and two DTMF generators. Two additional DTMF receivers can be added by installing daughter boards on each Tone Generator PCB.

CO Line PCB

2.07 Each CO Line PCB (B-4COU-A) contains the necessary circuitry for connecting four CO lines to the system. The KSU has space for up to six CO Line PCBs (24 lines) and the Expansion Cabinet can hold two additional CO Line PCBs (8 lines). This PCB contains ring detectors, conference circuits, loop relay for open loop flashes, and MOH circuitry for the four line circuits.

Station PCB

2.08 The Station PCB (B-8SCU-C) contains circuits for up to eight key telephones. Each PCB contains the required power and receive / transmit circuits for the extensions; cross-points for ICM, CO, and conference calls; a programmable Read Only Memory (ROM); and overload protection circuits for extensions. The protection circuit disables a malfunctioning extension so the rest of the system can continue to operate normally. When the problem is corrected, the extension is automatically reconnected to the system. The KSU has space for up to eight Station PCBs (64 extensions) and the Expansion Cabinet can hold eight additional Station PCBs (64 extensions).

Single Line PCB

2.09 The Single Line (B-8SLU-B) PCB contains circuits for up to eight Single Line (2500 type) telephones. It requires one Station PCB slot in the KSU and cannot be used for any key telephone.

Buffer PCB

2.10 The Buffer (B-BUF-A) PCB is required in every system that uses an Expansion Cabinet. It is inserted into the Expansion Cabinet and passes the control data to the CO Line PCBs and Station PCBs installed in the Expansion Cabinet.

Auxiliary PCB

2.11 The Auxiliary (B-AUX-A) PCB is required in a system equipped with a Rate Chip or Least Cost Routing. The Auxiliary PCB replaces one of the Tone Generator PCBs in the KSU. This PCB contains three DTMF generators, but no DTMF receivers.

EXTENSION INSTRUMENTS

Multibutton Key Telephone

2.12 The Multibutton Key Telephone is the primary extension instrument and is available in two key configurations, the Meritor and the Ultracom, with or without display. Telephones without displays can be purchased with or without the Handsfree feature.

DSS Console

2.13 A Direct Station Selection (DSS) Console is used with the Attendant's Multibutton Key Telephone to provide direct access to the extensions in the system. The DSS console is available in two models, the Meritor and the Ultracom.

4-Button Key Telephone

2.14 The proprietary 4-Button Key Telephone is used when direct access to all the features is not required. The 4-Button Key Telephone is available in two models, the Meritor and the Ultracom.

Single Line Telephone

2.15 A standard single line (2500 type) telephone can be used but requires an optional (B-8SLU-B) PCB and the telephone must be equipped with a tone signaling device.

3. COLLECTION OF DATA

3.01 Tables 3-1 through 3-6 provide sufficient information to order the required hardware and to complete the Program Record Forms (PRFs) in Section 4.

LINE OPTIONS

Outside Lines, Column 1

3.02 The TCX-128 accommodates up to 32 outside lines. If more than 24 lines are needed an Expansion Cabinet will be required. Table 3-1 identifies the lines available.

Telephone Number, Column 2

3.03 Indicate on Table 3-1 the telephone number assigned to each line, if appropriate.

Type Of Service, Column 3

3.04 Up to ten services can be accommodated including Local, Direct Distance Dialing (DDD), Wide Area Telephone Service (WATS), Foreign Exchange (FX), and other common carriers (SPRINT, MCI). Indicate on Table 3-1 the type of service for each line.

Tone / Pulse, Column 4

3.05 Indicate on Table 3-1 which lines are pulse. Pulse lines are often referred to as rotary. Indicate which lines are tone. Most installations use tone signals.

Incoming Only, Column 5

3.06 Indicate on Table 3-1 which lines should be designated for incoming calls only. These lines cannot be accessed to make an outgoing call.

Behind a PBX, Column 6

3.07 Indicate on Table 3-1 which lines are installed behind a Private Branch Exchange (PBX).

Toll Free, Column 7

3.08 Indicate on Table 3-1 which lines are toll free. Toll free lines are not subject to extension toll restrictions.

Universal Night Answer, Column 8

3.09 Indicate on Table 3-1 which lines should be placed in a Universal Night Answer (UNA) group. Lines in UNA groups ring at programmed extensions when the system is placed in the night mode.

Private Line, Column 9

3.10 Indicate on Table 3-1 if the line is to be a private line.

EXTENSION OPTIONS

Name, Column 1

3.11 Insert the person's name who will be using the extension. It is often easier to associate feature requirements with a person rather than an extension number. On Table 3-2, indicate next to the person's name if they are an operator or alternate operator.

Extension, Column 2

3.12 The assigned extension number by default programming is shown in column 2 of Table 3-2.

Type Of Phone, Column 3

3.13 On Table 3-2, note the type of telephone to be installed at a particular extension. The types available are: Multibutton Key Telephone, DSS Console, Four-Button Key Telephone and a 2500 Type Single Line Telephone. Make sure that all telephones in a group (separated by bold horizontal lines) are either key telephones or single-line (2500 type) telephones. If the extension is to be wall mounted, then put a check in the column labeled "WALL MTG". The key telephones require a special wall mounted style.

Hotline, Column 4

3.14 If an extension is to have a Hotline, then the number for the Hotline partner must be entered in column 4 of Table 3-2.

Class Of Service, Column 5

3.15 Class Of Service (COS) refers to the restrictions placed on a particular extension. Enter on Table 3-2 (column 5) the COS for each extension:

00 = Unrestricted. Permitted to dial system speed dial numbers and all area codes.
01 = Permitted to dial 7-digit numbers, '1' + 7-digit numbers, system speed dial numbers and allowed area codes.
02 = Permitted to dial 7-digit numbers, '1' + 7-digit numbers, and allowed area codes.
03 = Permitted to dial 7-digit numbers, system speed dial numbers and allowed area codes.
04 = Permitted to dial 7-digit numbers and allowed area codes.
05 = Permitted to dial system speed dial numbers.

All Page, Column 6

3.16 Indicate in Table 3-2 whether or not the extension will receive All Paging. Only key telephones have the option to receive paging.

Barge-In, Column 7

3.17 Indicate on Table 3-2 which extensions can interrupt other conversations in progress. Only Multibutton Key Telephones can have this feature.

Block Barge-In, Column 8

3.18 Indicate on Table 3-2 which extension cannot be interrupted by Barge-In.

Night Ring, Column 9

3.19 Indicate in Table 3-2 which extensions will receive ring tones from outside lines when the Attendant puts the system into the night mode. When an extension is assigned Night Ringing, it will receive ringing for all lines that are programmed to ring into the system.

DIL Off Hook, Column 10

3.20 Indicate in Table 3-2 if the extension should receive camp on tones while off hook.

Dial CO Group, Column 11

3.21 Indicate in Table 3-2 if the extension should be able to access lines in a group not assigned to the keys on the telephone by dialing 9 + the group number.

Call Wait Originate, Column 12

3.22 Indicate in Table 3-2 if the extension should send Call Wait (Camp-On) tones when transferring a CO line call to a busy extension.

Call Wait Receive, Column 13

3.23 Indicate in Table 3-2 if the extension should receive Call Wait (Camp-On) tones when it is busy and another extension transfers a CO line call to it.

Page Zone Received, Column 14

3.24 Indicate in Table 3-2 which page zone (1-8) the extension should be assigned to.

Pick Up Group, Column 15

3.25 Indicate in Table 3-2 which group this extension should be assigned to answer calls coming into that group. Up to 64 groups can be defined in a system since two extensions can form a group. Normally Pick Up Groups are defined by department function (i.e., accounting, engineering, etc.).

Private Line, Column 16

3.26 Enter the line number (Table 3-2, column 16) if the extension is to have a Private Line. Keep in mind that a Private Line requires a CO line circuit in the KSU and must be counted in the total number of CO lines in the system. A particular CO line may be designated as a Private Line for any number of extensions; however, an extension can have only one Private Line.

CO Audible

3.27 Indicate on Table 3-3 which lines each extension will receive audible for.

CO Access

3.28 Indicate on Table 3-4 which lines each extension will be able to access.

SYSTEM OPTIONS

3.29 The System Option Configuration Worksheet (Table 3-5) contains the necessary information to determine the options required for the system.

4. ORDER REQUIREMENTS

4.01 Use the following guide to determine overall equipment requirements for installation.

MAJOR COMPONENTS

(a) One KSU is required in a system. The KSU accommodates 24 CO lines and 64 extensions. If more than 24 CO lines and or 64 extensions are needed, an Expansion Cabinet must be installed. Indicate on Table 3-6 if an Expansion Cabinet is needed.

(b) The KSU and Expansion Cabinet each requires its own power supply. Indicate if 1 or 2 power supplies are needed on Table 3-6.

PRINTED CIRCUIT BOARDS

(c) Indicate on Table 3-6 the number of each PCB required.

EXTENSION INSTRUMENTS

(d) Indicate on Table 3-6 how many of each extension instrument are needed. Each extension in the system can have one of the following instruments: Multibutton Key Telephone, Display Multibutton Key Telephone, 4-Button and 2500 type single line telephones or a DSS console.

INSTALLATION EQUIPMENT

(e) For each 12 CO lines in a system the telephone company installs an RJ21X not more than 25 feet from the KSU. Use Table 3-1, indicating how many lines are installed, to determine how many RJ21X connectors should be ordered from the telephone company and enter on Table 3-6:
1-12 lines installed require 1 RJ21X connector.
1-24 lines installed require 2 RJ21X connectors
1-32 lines installed require 3 RJ21X connectors

(f) 66M1-50 connecting blocks are used for extension and optional equipment connections. Use the following chart, indicating how the stations are distributed in the system, to determine how many 66M1-50 blocks are needed and enter on Table 3-6:

PORT	BLOCK
01-04	B1
05-16	B2
17-28	B3
29-40	B4
41-52	B5
53-64	B6
65-76	B7
77-88	B8
89-100	B9
101-112	B10
113-124	B11
125-128	B12

(g) A 625A, 625F (4-wire) or equivalent modular station jack with screw type terminals is used to connect each extension instrument. Indicate on Table 3-6 how many modular jacks are needed.

(h) A tone signaling device is required for each 2500 type telephone installed. Indicate on Table 3-6 how may tone devices are needed.

WIRING

(i) For each RJ21X installed in a system a 25-pair cable, with type 57 connectors, female on one end and male on the other, is needed. These cables should be long enough for connecting the telco jacks to the KSU and Expansion Cabinet, but not longer than 25 feet. Indicate on Table 3-6 how many cables are needed for connecting to telco lines.

(j) For each 66M1-50 block installed in a system a 25-pair cable, with type 57 connectors, female on one end, is needed. Indicate on Table 3-6 how many cables are needed for connecting KSU and Expansion Cabinet to the 66M1-50 blocks.

(k) Standard quad station cable is used to connect the 66M1-50 blocks to the modular jacks. Indicate on Table 3-6 how much station cable is needed.

(l) A 4-wire modular line cord is used to connect each extension instrument to the station jack. Indicate on Table 3-6 how many modular line cords are needed.

OPTIONAL EQUIPMENT

(m) A powerline surge protector should be installed for each power supply. These protectors should be self-contained 3-prong grounded receptacles with 15-amp capacity. Indicate on Table 3-6 if 1 or 2 surge protectors are needed.

(n) Table 3-2 shows those telephones that require wall mounting. Key telephones that are wall mounted require a special wall mounting bracket and single line telephones (2500 type) are available in a wall-mounted style. Indicate on Table 3-6 the number of wall-mounting kits needed.

Table 3-1 OPTION CONFIGURATION WORKSHEET, LINES, TCX-128

1	2	3	4	5	6	7	8	9
	TELEPHONE NUMBER	TYPE OF SERVICE	TONE/PULSE	IN ONLY	PBX	TOLLF	UNA	PRIVATE LINE
Line 1								
Line 2								
Line 3								
Line 4								
Line 5								
Line 6								
Line 7								
Line 8								
Line 9								
Line 10								
Line 11								
Line 12								
Line 13								
Line 14								
Line 15								
Line 16								
Line 17								
Line 18								
Line 19								
Line 20								
Line 21								
Line 22								
Line 23								
Line 24								
Line 25								
Line 26								
Line 27								
Line 28								
Line 29								
Line 30								
Line 31								
Line 32								

T4041A

Table 3-2 OPTION CONFIGURATION WORKSHEET, EXTENSION, TCX-128 (1 of 4)

1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16
NAME	EXT.	PHONE TYPE	WALL MTG	HOTLINE	CLASS OF SERVICE	ALL PAGE	BARGE-IN	BLOCK BARGE-IN	NIGHT RING	DIL OFF-HOOK	DIAL CO GROUP	C.WAIT ORIG.	C.WAIT REC'D	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
	301															
	302															
	303															
	304															
	305															
	306															
	307															
	308															
	309															
	310															
	311	KEY		310												
	312															
	313															
	314															
	315															
	316															
	317															
	318															
	319															
	320															
	321															
	322															
	323															
	324															
	325															
	326	KEY		313												
	327															
	328															
	329															
	330															
	331															
	332															

Table 3-2 OPTION CONFIGURATION WORKSHEET, EXTENSION, TCX-128 (2 of 4)

1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16
NAME	EXT.	PHONE TYPE	WALL MTG	HOTLINE	CLASS OF SERVICE	ALL PAGE	BARGE-IN	BLOCK BARGE-IN	NIGHT RING	DIL OFF-HOOK	DIAL CO GROUP	C.WAIT ORIG.	C.WAIT REC'D	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
	333															
	334															
	335															
	336															
	337															
	338															
	339															
	340															
	341															
	342															
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	356															
	357															
	358															
	359															
	360															
	361															
	362															
	363															
	401			313												

Table 3-2 OPTION CONFIGURATION WORKSHEET, EXTENSION, TCX-128 (3 of 4)

1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16
NAME	EXT.	PHONE TYPE	WALL MTG	HOTLINE	CLASS OF SERVICE	ALL PAGE	BARGE-IN	BLOCK BARGE-IN	NIGHT RING	DIL OFF-HOOK	DIAL CO GROUP	C.WAIT ORIG.	C.WAIT REC'D	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
	402															
	403															
	404															
	405															
	406															
	407															
	408															
	409															
	410															
	411															
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	425															
	426															
	427															
	428															
	429															
	430															
	431															
	432															
	433															

Table 3-2 OPTION CONFIGURATION WORKSHEET, EXTENSION, TCX-128 (4 of 4)

1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16
NAME	EXT.	PHONE TYPE	WALL MTG	HOTLINE	CLASS OF SERVICE	ALL PAGE	BARGE-IN	BLOCK BARGE-IN	NIGHT RING	DIL OFF-HOOK	DIAL CO GROUP	C.WAIT ORIG.	C.WAIT REC'D	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
	434															
	435															
	436															
	437															
	438															
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	462															
	463															
	464															
	465															

Table 3-3 OPTION CONFIGURATION WORKSHEET, CO AUDIBLE, TCX-128 (Page 1 of 2)

PORT	STATION	NAME	KSU CO LINES																													
			32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
001	301																																	
002	302																																	
003	303																																	
004	304																																	
005	305																																	
006	306																																	
007	307																																	
009	308																																	
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011	311																																	
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019	319																																	
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021	321																																	
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023	323																																	
024	324																																	
025	325																																	
026	326																																	
027	327																																	
028	328																																	
029	329																																	
030	330																																	
031	331																																	
032	332																																	
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042	342																																	
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060	360																																	
061	361																																	
062	362																																	
063	363																																	
064	401																																	

Table 3-3 OPTION CONFIGURATION WORKSHEET, CO AUDIBLE, TCX-128 (Page 2 of 2)

PORT	STATION	NAME	EXPANSION CABINET CO LINES																													
			32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
065	402																																	
066	403																																	
067	404																																	
068	405																																	
069	406																																	
070	407																																	
071	408																																	
072	409																																	
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076	413																																	
077	414																																	
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081	418																																	
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088	425																																	
089	426																																	
090	427																																	
091	428																																	
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093	430																																	
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126	463																																	
127	464																																	
128	465																																	

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Table 3-4 OPTION CONFIGURATION WORKSHEET, CO ACCESS, TCX-128 (Page 1 of 2)

PORT	STATION	NAME	KSU CO LINES 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
001	301		
002	302		
003	303		
004	304		
005	305		
006	306		
007	307		
008	308		
009	309		
010	310		
011	311		
012	312		
013	313		
014	314		
015	315		
016	316		
017	317		
018	318		
019	319		
020	320		
021	321		
022	322		
023	323		
024	324		
025	325		
026	326		
027	327		
028	328		
029	329		
030	330		
031	331		
032	332		
033	333		
034	334		
035	335		
036	336		
037	337		
038	338		
039	339		
040	340		
041	341		
042	342		
043	343		
044	344		
045	345		
046	346		
047	347		
048	348		
049	349		
050	350		
051	351		
052	352		
053	353		
054	354		
055	355		
056	356		
057	357		
058	358		
059	359		
060	360		
061	361		
062	362		
063	363		
064	401		

Table 3-4 OPTION CONFIGURATION WORKSHEET, CO ACCESS, TCX-128 (Page 2 of 2)

PORT	STATION	NAME	EXPANSION CABINET CO LINES																													
			32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
065	402																																	
066	403																																	
067	404																																	
068	405																																	
069	406																																	
070	407																																	
071	408																																	
072	409																																	
073	410																																	
074	411																																	
075	412																																	
076	413																																	
077	414																																	
078	415																																	
079	416																																	
080	417																																	
081	418																																	
082	419																																	
083	420																																	
084	421																																	
085	422																																	
086	423																																	
087	424																																	
088	425																																	
089	426																																	
090	427																																	
091	428																																	
092	429																																	
093	430																																	
094	431																																	
095	432																																	
096	433																																	
097	434																																	
098	435																																	
099	436																																	
100	437																																	
101	438																																	
102	439																																	
103	440																																	
104	441																																	
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114	451																																	
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118	455																																	
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120	457																																	
121	458																																	
122	459																																	
123	460																																	
124	461																																	
125	462																																	
126	463																																	
127	464																																	
128	465																																	

Table 3-5 OPTION CONFIGURATION WORKSHEET, SYSTEM, TCX-128 (Page 1 of 2)

STATIONS	Up to 128 extensions can be accommodated. Indicate how many stations are needed (1-128).	_____
Operators:	Up to 6 operators can be accommodated. Using Table 3-2, indicate the station number of the operator(s).	OPR 1 _____ OPR 2 _____ OPR 3 _____ OPR 4 _____ OPR 5 _____ OPR 6 _____
DSS Consoles:	Each DSS console requires one station position. Using Table 3-2, indicate the station number for the DSS console(s).	DSS 1 _____ DSS 2 _____ DSS 3 _____ DSS 4 _____ DSS 5 _____ DSS 6 _____
Alternate Operators:	Alternate operators can be assigned so that calls are automatically transferred to that station when the operators station is unattended. Indicate the alternate operators station number(s).	ALT 1 _____ ALT 2 _____ ALT 3 _____ ALT 4 _____ ALT 5 _____ ALT 6 _____
TIMERS	The following timers are preset. Indicate the times needed if the customers requirements differ from the preset times.	
Hold Recall:	is the time, usually one minute, to elapse before a call left on Hold returns to the station that placed the call on Hold.	_____
Orbit Recall:	is the time, usually one minute, to elapse before a call placed in orbit returns to the station that placed the call in orbit.	_____
Pause Time-Out:	is the pause, usually 6 seconds, before the system continues dialing out speed dial numbers.	_____
Flash:	is the time, usually 1 second, for the momentary interruption of loop current when flashing a line key to obtain a new dialtone.	_____
Dial Tone Time-Out:	is the delay, usually 2 seconds, before dialtone is received.	_____
SMDR:	is the time, usually 30 seconds, the system should wait before recording a call.	_____
Trans Recall:	is the elapsed time, usually 2 minutes before an unanswered transferred call recalls the transferring station.	_____
LEAST COST ROUTING (LCR)	When LCR is installed the system automatically evaluates a Direct Dialing (DDD) call and selects the least expensive routing for that call. Indicate if LCR is required.	_____

T20r5

Table 3-5 OPTION CONFIGURATION WORKSHEET, SYSTEM, TCX-128 (Page 2 of 2)

RELAYS

There are 4 relay contacts that can be programmed to close when the system:

(a) is in the night ring mode
(b) receives an all page signal
(c) receives any paging signal
(d) receives a night ring signal
(e) receives a zone page signal

These relays can be used to activate optional equipment such as buzzers and Loud Ring devices. Indicate which mode (a-e) will activate each relay.

Relay 1 ____
Relay 2 ____
Relay 3 ____
Relay 4 ____

EXTERNAL OUTPUTS

There are 8 external outputs which may be programmed for the output of Night Ring, All Call Paging and Background Music (BGM) to external paging equipment, such as amplifiers. The audio for external outputs is derived from unused station ports. Indicate if Night Ring, Paging and / or BGM should be broadcast over external paging equipment and the unused station port for each external output.

Keep in mind that each station port required for external audio reduces the number of stations available in the system. Therefore, if all 8 external outputs are needed, 8 audio ports would be required, reducing the number of stations available in the system to 120.

	NIGHT RING	PAGING	BGM	PORT
Output 1	____	____	____	____
Output 2	____	____	____	____
Output 3	____	____	____	____
Output 4	____	____	____	____
Output 5	____	____	____	____
Output 6	____	____	____	____
Output 7	____	____	____	____
Output 8	____	____	____	____

MUSIC-ON-HOLD (MOH) BACKGROUND MUSIC (BGM)

MOH and BGM require a customer-supplied music source. Indicate if MOH is needed and if BGM and MOH will use the same source. ____ ____

STATION DETAIL RECORDING (SMDR)

SMDR provides a record of calls and requires a customer-supplied printer. Indicate if SMDR is needed. ____

Options for SMDR:

Indicate if a printout should be supplied for the following calls:

(a) local 7-digit numbers ____
(b) 1 + 7-digit numbers ____
(c) long distance numbers ____
(d) all calls beginning with 0 ____
(e) first and last speed dial bin numbers ____

SYSTEM OPTIONS

(a) Indicate if a call should be placed on the least costly line even if that line is one the station user placing the call has been denied access. ____

(b) All Intercom (ICM) calls can be ringing only or voice announced with a ringing option. Initially when the system is installed, ICM calls are voice announced with ringing option. Indicate if ICM calls should be ring only. ____

(c) Indicate if all stations in the system should be limited to 16 digits on a dialed telephone number. ____

(d) Indicate if a beep tone should signal a station user in the Call Forwarding mode that a message is waiting. ____

Table 3-6 ORDER CHART, TCX-128

ITEM	PART NUMBER	DESCRIPTION	NUMBER NEEDED
		MAJOR COMPONENTS	
B-KSU-C	86003	Key Console Unit	1
B-EXP-A	86016	Expansion Cabinet	___
B-PSU-A	86005A	Power Supply	___
		PRINTED CIRCUIT BOARDS	
B-CPU-B	86037	Central Processing Unit, 1 required	1
B-TGU-B	86033	Tone Generator, 1 required (2 max.) 2 required if expansion cabinet is installed	___
B-4COU-A	86010	CO Line, 1 required for every 4 CO Lines	___
B-8SCU-C	86023	Station, 1 required for every 8 extensions	___
B-8SLU-B	86027	Station, Optional for up to 8 single line extensions, takes B-8SCU-C slot	___
B-BUF-A	86017	Buffer, 1 required if expansion cabinet is installed	___
B-AUX-A	86046	Auxiliary	___
	86047 (with rate chip)	1 optional, takes one B-TGU-B slot	
	86019	DTMF Receiver Daughter PCB, 2 optional installed in B-TGU-B	___

		LOW/MED OUTGOING TRAFFIC	HEAVY OUTGOING TRAFFIC
NUMBER OF EXTENSIONS	NUMBER OF CO LINES	DTMF RECEIVERS REQUIRED	DTMF RECEIVERS REQUIRED
20	8	2	3
40	12	3	4
80	24	4	6
128	32	6	8

ITEM	PART NUMBER	DESCRIPTION	NUMBER NEEDED
		EXTENSION INSTRUMENTS	
		Multibutton Key	
	86072	Meritor	___
	86070	Meritor with handsfree	___
	86082	Ultracom	___
	86080	Ultracom with handsfree	___
		Display Key	
	86073	Meritor	___
	86063	Ultracom	___
		4-Button Key	
	86071	Meritor	___
	86061	Ultracom	___
		2500 Type Single Line	___
		DSS Console	
	86075	Meritor	___
	86065	Ultracom	___
		INSTALLATION EQUIPMENT	
		RJ21X from Telco	___
		66M1-50 Connecting Blocks	___
		Modular Station Jacks	___
	86185	Tone devices for 2500 type telephones	___
		WIRING	
		25 pair cable for telco connection	___
		25 pair cable for station block connections	___
		Standard quad station cable	___
		4-wire modular line cords	___
		OPTIONAL EQUIPMENT	
		Surge Protector	___
		Wall Mounting Kits for:	___
		Multibutton Key	
	86076	Meritor	___
	86066	Ultracom	___
		Single Line	
	86077	Meritor	___
	86062	Ultracom	___

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 4, PROGRAM RECORD FORM PREPARATION

1. INTRODUCTION

1.01 The PROGRAM RECORD FORM PREPARATION section provides instructions for changing the information gathered on the Option Configuration Worksheets (SECTION 3) into programming data. The information on the Option Configuration Worksheets (OCWs) is generally filled out by sales or customer representatives to reflect those features desired by the customer. The information on the OCWs is converted into codes and entered on the 'Program Entry' column of the Program Record Forms (PRFs). The PRFs at the end of this section must be completed and should be retained as a job record.

1.02 Major revisions to this section included the addition of the Station Features programming menu. External output programming was clarified and the default values were entered into the external output bit graph.

1.03 The "Default Entry" column in the instructions and on the PRFs represents the program that exists upon initialization. Whenever the system is initialized, all programming entries are erased and returned to the default entries.

1.04 Program only those options that require a change from the default entries. Some entries require converting from binary to hexadecimal numbers. The general procedure is as follows:

- *Determine the binary number (0000 0000 to 1111 1111) required for the feature by placing a 1 in the appropriate columns and a 0 in each of the remaining columns on the bit graphs provided.*
- *Use the Binary to Hexadecimal Conversion Chart (Table 4-1) to convert binary numbers to hexadecimal numbers.*
- *Enter the hexadecimal number in the "Program Entry" column on the Program Record Form.*

1.05 Program Record Form Instructions (Table 4-2 and 4-3) include system prompts and default entries. Use the instruction tables to complete the System and Extension PRFs.

1.06 Following are two menus which appear during programming. The first menu is the System Configuration Menu. The second menu is the System Commands Menu.

TCX-128 SYSTEM CONFIGURATION PROGRAM

'E'-STATIONS FEATURES
'S'-SYSTEM FEATURES
'I'- SYSTEM INITIALIZATION
'Q'-EXIT PROGRAMMING MODE
'D'-DISPLAY SYSTEM STATUS

SYSTEM COMMANDS

'T'-TIME OF DAY
'D'-DATE
'O'-OPERATORS & DSS
'M'-TIMERS
'L'-LEAST COST ROUTING
'R'-RELAYS CONTROL
'G'-CO GROUPS
'P'-CO TYPE
'A'-OFFICE CODE TYPES
'K'-COS ALLOWED AREA CODES
'E'-EXTERNAL OUTPUTS
'N'-OUT KEY GROUPS
'F'-SYSTEM OPTIONS
'?'-COMMAND LIST

1.07 Following are the prompts which appear during programming Station Features.

PROGRAMMING STATION.....
PORT NUMBER.....
TYPE OF PHONE.....KEY
HOT-LINE KEY.....
CLASS OF SERVICE.....00
CO AUDIBLE [01..08] IS.....FF
CO AUDIBLE [09..16] IS.....FF
CO AUDIBLE [17..24] IS.....FF
CO AUDIBLE [25..32] IS.....FF
CO ACCESS [01..08] IS.....FF
CO ACCESS [09..16] IS.....FF
CO ACCESS [17..24] IS.....FF
CO ACCESS [25..32] IS.....FF
RECEIVE ALL-PAGE.....YES
BARGE IN ENABLED.....NO
BLOCK BARGE ENABLED.....NO
NIGHT RING ENABLED.....YES
DIL OFF HOOK SIGNAL.....NO
DIAL C.O. GROUP.....NO
CAMP-ON ORIGINATE.....YES
CAMP-ON RECEIVE.....YES
PAGE ZONE RECEIVED.....
PICK UP GROUP IS.....00
PRIVATE LINE IS.....NONE

Table 4-1 BINARY TO HEXADECIMAL CONVERSION CHART

TO CONVERT	ENTER	TO CONVERT	ENTER	TO CONVERT	ENTER	TO CONVERT	ENTER
0000 0000	00	0100 0000	40	1000 0000	80	1100 0000	C0
0000 0001	01	0100 0001	41	1000 0001	81	1100 0001	C1
0000 0010	02	0100 0010	42	1000 0010	82	1100 0010	C2
0000 0011	03	0100 0011	43	1000 0011	83	1100 0011	C3
0000 0100	04	0100 0100	44	1000 0100	84	1100 0100	C4
0000 0101	05	0100 0101	45	1000 0101	85	1100 0101	C5
0000 0110	06	0100 0110	46	1000 0110	86	1100 0110	C6
0000 0111	07	0100 0111	47	1000 0111	87	1100 0111	C7
0000 1000	08	0100 1000	48	1000 1000	88	1100 1000	C8
0000 1001	09	0100 1001	49	1000 1001	89	1100 1001	C9
0000 1010	0A	0100 1010	4A	1000 1010	8A	1100 1010	CA
0000 1011	0B	0100 1011	4B	1000 1011	8B	1100 1011	CB
0000 1100	0C	0100 1100	4C	1000 1100	8C	1100 1100	CC
0000 1101	0D	0100 1101	4D	1000 1101	8D	1100 1101	CD
0000 1110	0E	0100 1110	4E	1000 1110	8E	1100 1110	CE
0000 1111	0F	0100 1111	4F	1000 1111	8F	1100 1111	CF
0001 0000	10	0101 0000	50	1001 0000	90	1101 0000	D0
0001 0001	11	0101 0001	51	1001 0001	91	1101 0001	D1
0001 0010	12	0101 0010	52	1001 0010	92	1101 0010	D2
0001 0011	13	0101 0011	53	1001 0011	93	1101 0011	D3
0001 0100	14	0101 0100	54	1001 0100	94	1101 0100	D4
0001 0101	15	0101 0101	55	1001 0101	95	1101 0101	D5
0001 0110	16	0101 0110	56	1001 0110	96	1101 0110	D6
0001 0111	17	0101 0111	57	1001 0111	97	1101 0111	D7
0001 1000	18	0101 1000	58	1001 1000	98	1101 1000	D8
0001 1001	19	0101 1001	59	1001 1001	99	1101 1001	D9
0001 1010	1A	0101 1010	5A	1001 1010	9A	1101 1010	DA
0001 1011	1B	0101 1011	5B	1001 1011	9B	1101 1011	DB
0001 1100	1C	0101 1100	5C	1001 1100	9C	1101 1100	DC
0001 1101	1D	0101 1101	5D	1001 1101	9D	1101 1101	DD
0001 1110	1E	0101 1110	5E	1001 1110	9E	1101 1110	DE
0001 1111	1F	0101 1111	5F	1001 1111	9F	1101 1111	DF
0010 0000	20	0110 0000	60	1010 0000	A0	1110 0000	E0
0010 0001	21	0110 0001	61	1010 0001	A1	1110 0001	E1
0010 0010	22	0110 0010	62	1010 0010	A2	1110 0010	E2
0010 0011	23	0110 0011	63	1010 0011	A3	1110 0011	E3
0010 0100	24	0110 0100	64	1010 0100	A4	1110 0100	E4
0010 0101	25	0110 0101	65	1010 0101	A5	1110 0101	E5
0010 0110	26	0110 0110	66	1010 0110	A6	1110 0110	E6
0010 0111	27	0110 0111	67	1010 0111	A7	1110 0111	E7
0010 1000	28	0110 1000	68	1010 1000	A8	1110 1000	E8
0010 1001	29	0110 1001	69	1010 1001	A9	1110 1001	E9
0010 1010	2A	0110 1010	6A	1010 1010	AA	1110 1010	EA
0010 1011	2B	0110 1011	6B	1010 1011	AB	1110 1011	EB
0010 1100	2C	0110 1100	6C	1010 1100	AC	1110 1100	EC
0010 1101	2D	0110 1101	6D	1010 1101	AD	1110 1101	ED
0010 1110	2E	0110 1110	6E	1010 1110	AE	1110 1110	EE
0010 1111	2F	0110 1111	6F	1010 1111	AF	1110 1111	EF
0011 0000	30	0111 0000	70	1011 0000	B0	1111 0000	F0
0011 0001	31	0111 0001	71	1011 0001	B1	1111 0001	F1
0011 0010	32	0111 0010	72	1011 0010	B2	1111 0010	F2
0011 0011	33	0111 0011	73	1011 0011	B3	1111 0011	F3
0011 0100	34	0111 0100	74	1011 0100	B4	1111 0100	F4
0011 0101	35	0111 0101	75	1011 0101	B5	1111 0101	F5
0011 0110	36	0111 0110	76	1011 0110	B6	1111 0110	F6
0011 0111	37	0111 0111	77	1011 0111	B7	1111 0111	F7
0011 1000	38	0111 1000	78	1011 1000	B8	1111 1000	F8
0011 1001	39	0111 1001	79	1011 1001	B9	1111 1001	F9
0011 1010	3A	0111 1010	7A	1011 1010	BA	1111 1010	FA
0011 1011	3B	0111 1011	7B	1011 1011	BB	1111 1011	FB
0011 1100	3C	0111 1100	7C	1011 1100	BC	1111 1100	FC
0011 1101	3D	0111 1101	7D	1011 1101	BD	1111 1101	FD
0011 1110	3E	0111 1110	7E	1011 1110	BE	1111 1110	FE
0011 1111	3F	0111 1111	7F	1011 1111	BF	1111 1111	FF

T-4028

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 1 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
Operators and DSS		
OPERATOR 1 IS	301	Enter on Table 4-4 the 3-digit operator extension number (301-363, 401-465). Default program assigns operator to extension 301.
DSS OPERATOR 1 IS	NONE	Enter on Table 4-4 the 3-digit DSS extension number. Leave NONE if no DSS is used.
ALTERNATE OPERATOR 1 IS	NONE	Enter on Table 4-4 the 3-digit alternate operator extension number. Leave NONE if no alternate operator is assigned.
OPERATOR 2 IS DSS OPERATOR 2 IS ALTERNATE OPERATOR 2 IS	NONE NONE NONE	(Enter on Table 4-4 information as above if the system has 2 operators)
OPERATOR 3 IS DSS OPERATOR 3 IS ALTERNATE OPERATOR 3 IS	NONE NONE NONE	(Enter on Table 4-4 information as above if the system has 3 operators)
OPERATOR 4 IS DSS OPERATOR 4 IS ALTERNATE OPERATOR 4 IS	NONE NONE NONE	(Enter on Table 4-4 information as above if the system has 4 operators)
OPERATOR 5 IS DSS OPERATOR 5 IS ALTERNATE OPERATOR 5 IS	NONE NONE NONE	(Enter on Table 4-4 information as above if the system has 5 operators)
OPERATOR 6 IS DSS OPERATOR 6 IS ALTERNATE OPERATOR 6 IS	NONE NONE NONE	(Enter on Table 4-4 information as above if the system has 6 operators)
Timers		
HOLD RECALL TIMER (SEC)	060	Enter on Table 4-4 the time in seconds to elapse before a call left on Hold returns to the extension that placed the call on Hold. The call will return to the operator if not answered 60 sec. after recall.
ORBIT RECALL TIMER (SEC)	060	Enter on Table 4-4 the time in seconds to elapse before a call placed in orbit returns to the station that placed the call in orbit. The call will return to the operator if not answered in 60 sec. after recall.
PAUSE TIME-OUT (SEC)	006	Enter on Table 4-4 the pause in seconds before the system begins dialing out speed dial numbers.
FLASH TIMER (N*50MSEC)	020	Enter on Table 4-4 the time in multiples of 50 milliseconds for the momentary interruption of loop current when flashing a line key to obtain a new dial tone.
DIAL TONE TIME-OUT (SEC)	002	Enter on Table 4-4 the delay in seconds before diallone is received. For speed dial this will ensure transmission of the first digit. It will also prevent a toll restricted telephone from defeating restriction by dialing a local number before CO diallone is received.
SMDR TIMER (SEC)	030	Enter on Table 4-4 the time in seconds the system should wait before recording (printing) a call.
TRANS RECALL (SEC)	120	Enter on Table 4-4 the elapsed time in seconds an unanswered transferred call recalls the transferring extension. If unanswered, call will return to the operator after this period of time.

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 2 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
Least Cost Routing		
LCR ENABLED	NO	Enter on Table 4-4 'Y' for Yes or 'N' for No to program the rate chip for LCR. Even if LCR is not installed but a rate chip is used for cost display, enable LCR and program the line groups.
LCR SERVICE # 01		
LINE GROUP	77	Enter on Table 4-4 the line group number (01-10) which contains the CO lines for the LCR service group being programmed. All CO lines in a service group must be the same type. Service #01 is always used for DDD lines. The line group number must match line group assignments that are programmed under 'CO Groups.'
OCC DIALUP SYS BIN	00	If the lines in the service being programmed are dial-up OCC lines such as MCI or SPRINT, enter on Table 4-4 the number of the system bin containing the access and security codes required to dial the OCC.
FX SERVICE/OTHER..1/0	00	Enter on Table 4-4 a '1' if LCR Service is an FX line. Enter '0' if LCR Service is not an FX line.
LCR SERVICE # 02		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 03		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 04		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 05		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 06		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 07		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 08		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 09		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	
LCR SERVICE # 10		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER..1/0	00	

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 3 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
Relays Control		
RELAY #1 CONTROL	00	For each relay, place a "1" on the bit graph below to enable the appropriate function and a "0" below the other bits. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-4. The functions are as follows: BIT 7: NIGHT (Continuous) Place a '1' below BIT 7 for the relay to close for a night ringing condition. BIT 6: ALL-P (All Page) Place a '1' below BIT 6 for the relay to close for an All Page signal only. BIT 5: ANY-P (Any Page) Place a '1' below BIT 5 for the relay to close for any paging signal, All Call and Zone Page. BIT 4: NOT USED Place a '0' below BIT 4 BIT 3: NOT USED Place a '0' below BIT 3. BIT 2: NRNGR (Night Ring, Interrupted) Place a '1' below BIT 2 for the relay to close following the night ringing signal. BIT 1: ZPAGE (Zone Page) Place a '1' below BIT 1 for the relay to close for any zone paging signal, but not All Call Page. BIT 0: RINGR (Ringer Test) Place a '1' below BIT 0 to test output for the relay. Ringing is on continuously. ***NOTE:*** Only one of these functions is normally enabled.
RELAY #2 CONTROL	00	Enter on Table 4-4 information as above if a second relay is used.
RELAY #3 CONTROL	00	Enter on Table 4-4 information as above if a third relay is used.
RELAY #4 CONTROL	00	Enter on Table 4-4 information as above if a fourth relay is used.

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	NIGHT	ALL-P	ANY-P			NRNGR	ZPAGE	RINGR	HEX
RELAY #1									
RELAY #2									
RELAY #3									
RELAY #4									

1-4042

4042 I

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 4 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
CO Groups		
LINE 01 GROUP IS	01	Enter on Table 4-4, the number of the outgoing CO line group, (01-10) and 77 for unused lines. Any number of lines can be assigned to a CO line group. The lines must be assigned to groups as programmed for Least Cost Routing. CO lines default into 3 groups as follows: Lines 1-8 default to group 1, Lines 9-16 default to group 2 and lines 17-24 default to group 3. Lines 25-32 default to 77 or unused lines.
LINE 02 GROUP IS	01	
LINE 03 GROUP IS	01	
LINE 04 GROUP IS	01	
LINE 05 GROUP IS	01	
LINE 06 GROUP IS	01	
LINE 07 GROUP IS	01	
LINE 08 GROUP IS	01	
LINE 09 GROUP IS	02	
LINE 10 GROUP IS	02	
LINE 11 GROUP IS	02	
LINE 12 GROUP IS	02	
LINE 13 GROUP IS	02	
LINE 14 GROUP IS	02	
LINE 15 GROUP IS	02	
LINE 16 GROUP IS	02	
LINE 17 GROUP IS	03	
LINE 18 GROUP IS	03	
LINE 19 GROUP IS	03	
LINE 20 GROUP IS	03	
LINE 21 GROUP IS	03	
LINE 22 GROUP IS	03	
LINE 23 GROUP IS	03	
LINE 24 GROUP IS	03	
LINE 25 GROUP IS	77	
LINE 26 GROUP IS	77	
LINE 27 GROUP IS	77	
LINE 28 GROUP IS	77	
LINE 29 GROUP IS	77	
LINE 30 GROUP IS	77	
LINE 31 GROUP IS	77	
LINE 32 GROUP IS	77	
CO Type		
LINE 01 TYPE IS	01	To determine the type for each line, on the bit graph below place a '1' below the appropriate option and a '0' below the other bits. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-4. The available options are: BIT 7: IN Incoming line. Cannot be accessed by outgoing groups. BIT 6: PBX Indicates line is behind a PBX. BIT 5: P/T Pulse/Tone. Lines are initialized as tone lines. To enter OUTPULSE, place a 1 in bit 5. BIT 4: NOT USED Place a '0' below bit 4.
LINE 02 TYPE IS	01	
LINE 03 TYPE IS	01	
LINE 04 TYPE IS	01	
LINE 05 TYPE IS	01	
LINE 06 TYPE IS	01	
LINE 07 TYPE IS	01	
LINE 08 TYPE IS	01	
LINE 09 TYPE IS	01	
LINE 10 TYPE IS	01	
LINE 11 TYPE IS	01	
LINE 12 TYPE IS	01	
LINE 13 TYPE IS	01	
LINE 14 TYPE IS	01	
LINE 15 TYPE IS	01	
LINE 16 TYPE IS	01	
LINE 17 TYPE IS	01	
LINE 18 TYPE IS	01	
LINE 19 TYPE IS	01	
LINE 20 TYPE IS	01	

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 5 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
LINE 21 TYPE IS LINE 22 TYPE IS LINE 23 TYPE IS LINE 24 TYPE IS LINE 25 TYPE IS LINE 26 TYPE IS LINE 27 TYPE IS LINE 28 TYPE IS LINE 29 TYPE IS LINE 30 TYPE IS LINE 31 TYPE IS LINE 32 TYPE IS	01 01 01 01 01 01 01 01 01 01 01 01	BIT 3: NOT USED Place a '0' below Bit 3. BIT 2: NOT USED Place a '0' below Bit 2, Not used. BIT 1: TOLLF Tollfree line. When this is enabled, the program ignores any extension toll restriction programmed. BIT 0: UNA Universal Night Answer. When this is enabled, the CO line is placed into the Universal Night Answer group. The line will ring at all extensions programmed to receive night ringing.

BIT NUMBER	7	6	5	4	3	2	1	0	
TYPE	IN	PBX	P/T				TOLLF	UNA	HEX
LINE 01									
LINE 02									
LINE 03									
LINE 04									
LINE 05									
LINE 06									
LINE 07									
LINE 08									
LINE 09									
LINE 10									
LINE 11									
LINE 12									
LINE 13									
LINE 14									
LINE 15									
LINE 16									
LINE 17									
LINE 18									
LINE 19									
LINE 20									
LINE 21									
LINE 22									
LINE 23									
LINE 24									
LINE 25									
LINE 26									
LINE 27									
LINE 28									
LINE 29									
LINE 30									
LINE 31									
LINE 32									

T4042A

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 6 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
Office Code Types		Area codes and office exchange codes in the United States are numbers between 200 and 999. To complete Table 4-5: Define all exchanges as type 03. This identifies them as local numbes to the system. Area codes should be identified as 00. In certain areas, primarily large cities, there will be local exchanges which will have the same 3-digits as area codes. Identify these as type 01. The system will treat them as local numbers unless when dialed they are preceded by a '1'. In addition, codes 100-199 must be identified as 01. Any special codes such as 911, 1911, 411, 1411, 811, etc. should be identified as type 02. 04 is a special code which is only used in Puerto Rico. You should not identify any codes as 04.
COS Allowed Area Codes		For each area code place a '1' below each COS on Table 4-6 which should be allowed to dial that area code and a 0 below each class of service denied access to that area code group. Convert the resulting binary number to HEX using Table 4-1. There are 6 Classes of Service for the TCX-128B as follows: 0 = Unrestricted. Permitted to dial all system speed dial numbers and all area codes. This is the only class of service permitted to dial (telco) operator ('0') calls. 1 = Permitted to dial 7-digit and '1' + 7-digit bers, all system speed dial numbers and allowed area codes. 2 = Permitted to dial all 7-digit numbers, "1" + 7-digit numbers and allowed area codes. 3 = Permitted to dial 7-digit numbers (no prefix local numbers), all system speed dial numbers and allowed area codes. 4 = Permitted to dial 7-digit numbers (no prefix local numbers), and allowed area codes. 5 = Permitted to dial all system speed dial numbers. **NOTE:** All classes of service except 5 will be allowed to dial the special service numbers such as 911 (emergency assistance in some areas), 411 (directory assistance), etc. COS 5 cannot access these numbers unless they are programmed as system speed dial numbers.

T4015-1
January 1985-1

4-8

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 7 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
External Outputs		
OUTPUT.01 CONTROL IS	20	This program controls the output of night ringing, Background Music (BGM) and All-Call paging and the corresponding zone page to each of 8 external audio outputs. On the bit graph below place a 1 below each of the options which should be enabled for each of the outputs. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-4. ***NOTE:*** The programmed parameters of each External Output are transferred to the corresponding Alternate Audio Port, when programmed. The actual External Outputs are not used; however, they must be programmed to enable the corresponding Alternate Audio Port. The default value of 20 enables paging but disables night ringing and background music. Paging should be enabled even if external paging amplifiers are not connected to avoid volume fluctuations in the system. BIT 7: NIGHT Place a '1' below BIT 7 to send a night ring audio to the output. BIT 6: BGM Place a '1' below BIT 6 to send BGM audio to the output. BIT 5: PAGE Place a '1' below BIT 5 to send paging audio to the output. BIT 4: NOT USED. No change required from default setting. BIT 3: NOT USED. No change required from default setting. BIT 2: PG-DZ. No change requried from default setting. BIT 1: ON No change requried from default setting. BIT 0: C-OFF No change requried from default setting. ***NOTE:*** BIT 5 should be enabled even if external paging amplifiers are not connected to avoid fluctuations in the system.
ALTERNATE AUDIO PORT IS	NONE	Alternate audio ports are used for external outputs. Enter on Table 4-4 the number of the port (001-128). The station port must be on a B-8SCU-C PCB and the port cannot support a telephone. ***NOTE:*** Do not program the same port to more than one zone.
OUTPUT.02..CONTROL IS ALTERNATE AUDIO PORT IS OUTPUT.03..CONTROL IS ALTERNATE AUDIO PORT IS	20 NONE 20 NONE	(Enter on Table 4-4 information as above for each of the external outputs).

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 8 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
OUTPUT 04 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 05 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 06 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 07 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 08 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	NIGHT	BGM	PAGE			PG-D2	ON	C-OFF	HEX
OUTPUT 01				0	0	0	0	0	
OUTPUT 02				0	0	0	0	0	
OUTPUT 03				0	0	0	0	0	
OUTPUT 04				0	0	0	0	0	
OUTPUT 05				0	0	0	0	0	
OUTPUT 06				0	0	0	0	0	
OUTPUT 07				0	0	0	0	0	
OUTPUT 08				0	0	0	0	0	

1-4040

Out Key Groups		
OUT_KEY # 01 SELECT GROUP #	01	The outgoing keys format program tells the system which group(s) of CO lines the 6 outgoing CO line keys on multibutton telephones will access. If LCR is installed, keys 5 and 6 should be programmed into a group which does not contain any active CO lines if possible. Enter on Table 4-4 the CO group number (01-10) for each key.
OUT_KEY # 02 SELECT GROUP #	01	
OUT_KEY # 03 SELECT GROUP #	02	
OUT_KEY # 04 SELECT GROUP #	02	
OUT_KEY # 05 SELECT GROUP #	03	
OUT_KEY # 06 SELECT GROUP #	03	
System Options		The system options program is used for modifications. Enter on Table 4-4 'Y' to enable or 'N' to disable each option.
ENTER OPTION #..__1 OPTION ENABLED...01...	YES	BYPASS CO ACCESS FOR LCR SEARCH This option is enabled by the default program. If a call is made from a toll restricted telephone, LCR will route the call the cheapest way even if that route is on a line to which that extension does not normally have access. This override has no effect on directly-selected line calls. Option is ignored if LCR is not installed.
ENTER OPTION #.__ OPTION ENABLED...02...	YES	MOH ENABLED This option is enabled by the default program. Even if Music-On-Hold is not desired, do not disable this option.
ENTER OPTION #.__ OPTION ENABLED...03...	YES	CONF KEY TO MOVE UP GREEN LED This option is enabled by the default program. If each outgoing CO line key has been programmed for a different line group, this option allows the user to make a conference call using two lines in the same line group.

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 9 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
ENTER OPTION #.__ OPTION ENABLED..04...	NO	DISTINCTIVE CO RING FOR 2500 SLI This option is disabled by the default program. If the updated software V28 or subsequent is installed on the B-8SLU-B PCB, distinctive tones are available on 2500 type telephones. Enable the option if distinctive ringing is desired.
ENTER OPTION #.__ OPTION ENABLED..05...	YES	AUTO DISCONNECT BAD TRUNK If the system detects a momentary break in loop current during the loop seizure process (within 2 seconds of seizing the line), the system will assume a bad trunk and jump to the next line group. If the CO is within specification, these breaks should not occur. However, the system may be programmed to ignore these interruptions by disabling this Option.
ENTER OPTION #.__ OPTION ENABLED..06...	NO	FORCED RINGDOWN INT CALLS This option is disabled by the default program. If desired, all intercom calls may be forced to ring down by enabling this option.
ENTER OPTION #.__ OPTION ENABLED..07...	YES	FULL SPEED DTMF (60 ON 60 OFF) The DTMF tone time may be either 60m. sec. on/60m. sec. off (full speed) or 120m. sec. on/120m. sec. off (half speed). The default value is 60/60. To select half speed DTMF signaling disable this Option.
ENTER OPTION #.__ OPTION ENABLED..08...	NO	IGNORE CO TERMINATION ON HELD LINE If the system detects that the CO line connection has been broken while a call is on hold, (second party release), the system will drop the call. If the system should ignore a second party release, enable this option.
ENTER OPTION #.__ OPTION ENABLED..09...	YES	LINK 0 DEDICATED FOR RING This option is enabled by the default program. A link is exclusively dedicated to incoming CO line ringing signals.
ENTER OPTION #.__ OPTION ENABLED..10...	YES	TOLL RESTRICTION IN CASE OF NO DIGITS ENTRIES This option is enabled by the default program. When enabled, the toll restriction program will cause the call to be dropped if no digits are dialed after 6 seconds.
ENTER OPTION #.__ OPTION ENABLED..11...	YES	SMDR FOR 1 + 7-DIGITS This option is enabled by the default program. If an SMDR printout is desired for these numbers, enable this option.
ENTER OPTION #.__ OPTION ENABLED..12...	NO	TOLL RESTRICT INSUFFICIENT DIGITS FOR EXCHANGE TYPE This option is disabled by the default program. If enabled, the toll restriction program will cause a call to be dropped if insufficient digits are dialed for the exchange type.

Table 4-2 PROGRAM RECORD FORM INSTRUCTIONS, SYSTEM, TCX-128 (Page 10 of 10)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
ENTER OPTION #..__ OPTION ENABLED...13...	YES	SMDR FOR LONG DISTANCE CALLS This option is enabled by the default program. If an SMDR printout is desired for long distance calls, enable this Option.
ENTER OPTION #..__ OPTION ENABLED...14...	NO	16 DIGIT LIMIT ON MEMORY DIAL This option is disabled by the default program. If enabled, this option limits any telephone in the system to 16 digits on a manually dialed number.
ENTER OPTION #..__ OPTION ENABLED...15...	YES	SMDR FOR LEADING O CALLS This option is enabled by the default program. If an SMDR printout is desired for all calls which begin with O, enable this Option.
ENTER OPTION #..__ OPTION ENABLED...16...	NO	SMDR INCLUDES SPEED DIAL BIN NUMBERS This option is disabled by the default program. If enabled, the SMDR printout will show the first and last (if any) speed dial bin numbers to place a call. This option may be useful for OCC use.
ENTER OPTION #..__ OPTION ENABLED...17...	YES	SMDR FOR LOCAL 7-DIGIT CALLS This option is enabled by the default program. If an SMDR printout is desired for all local 7-digit calls, enable this option.
ENTER OPTION #..__ OPTION ENABLED...18...	NO	Not presently used.
ENTER OPTION #..__ OPTION ENABLED...19...	YES	MSG.WAIT/CALL FORWARD BEEP This option is enabled by the default program. If enabled, this option sends a beep tone at two minute intervals to any extension which has been placed in the Call Forwarding mode or which has messages waiting. If disabled, no beep tones are heard.

Table 4-3 PROGRAM RECORD FORM INSTRUCTIONS, EXTENSION, TCX-128 (Page 1 of 3)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
PORT NUMBER		Table 4-7 shows the default port number to which the extension is to be assigned. ***NOTE:*** Extension 301 is assigned to port 01 by the default program. If port assignments are changed, the installer must make sure that two extensions are not inadvertently assigned to the same port.
TYPE OF PHONE	KEY	Enter on Table 4-7 the type of phone to be installed at this extension. The options are: KEY = Multibutton Key Telephone DSS = Direct Station Selection Console SLI = 4-Button Key Telephone 500 = 2500-Type Telephone
HOT-LINE KEY		Enter on Table 4-7 the 3-digit extension number for the hotline pair this extension is to be hotlined to, if any. For example, if extension 309 and extension 312 are to be hotline partners, enter 312 when programming extension 309 and enter 309 when programming extension 312.
CLASS OF SERVICE	00	Enter on Table 4-7, 2-digits (00-05) indicating the class of service for the extension. 00 = Unrestricted. Permitted to dial all system speed dial numbers and all area codes. 01 = Permitted to dial 7-digit and 1 + 7-digit numbers, all system speed dial numbers and allowed area codes. 02 = Permitted to dial 7-digit numbers and 1 + 7-digit numbers and allowed area codes. 03 = Permitted to dial 7-digit numbers, all system speed dial numbers and allowed area codes. 04 = Permitted to dial 7-digit numbers, and allowed area codes. 05 = Permitted to dial all system speed dial numbers. ***NOTE:*** This program, in conjunction with the toll restriction table, can be used to allow extensions with class of service 00 to 04 to access special services such as 911, 411, etc. Class of service 05 cannot access special service numbers unless these numbers are programmed as system speed dial numbers.
CO AUDIBLE [01..08] IS		To provide CO audible at this extension for CO lines 1-8, on the CO Audible Bit Graph place a 1 below each of the lines which should receive CO audible. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO AUDIBLE [09..16] IS		To provide CO audible at this extension for CO lines 9-16, on the CO Audible Bit Graph place a 1 below each of the lines which should receive CO audible. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.

Table 4-3 PROGRAM RECORD FORM INSTRUCTIONS, EXTENSION, TCX-128 (Page 2 of 3)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
CO AUDIBLE [17..24] IS		To provide CO audible at this extension for CO lines 17-24, on the CO Audible Bit Graph place a 1 below each of the lines which should receive CO audible. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO AUDIBLE [25..32] IS		To provide CO audible at this extension for CO lines 25-32, on the CO Audible Bit Graph place a 1 below each of the lines which should receive CO audible. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO ACCESS [01..08] IS	FF	To provide CO access at this extension for CO lines 1-8, on the CO Access Bit Graph place a 1 below each of the lines which should receive CO access. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO ACCESS [09..16] IS	FF	To provide CO access at this extension for CO lines 9-16, on the CO Access Bit Graph place a 1 below each of the lines which should receive CO access. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO ACCESS [17..24] IS	FF	To provide CO access at this extension for CO lines 17-24, on the CO Access Bit Graph place a 1 below each of the lines which should receive CO access. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
CO ACCESS [25..32] IS	FF	To provide CO access at this extension for CO lines 25-32, on the CO Access Bit Graph each of the lines which should receive CO access. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
RECEIVE ALL PAGE	YES	Enter on Table 4-7 'Y' for yes and 'N' for no as to whether All-Page announcements are to be received at the extension being programmed.
BARGE IN ENABLED	NO	Enter on Table 4-7 'Y' for yes and 'N' for no as to whether the extension being programmed should be able to barge in on other extensions.
BLOCK BARGE ENABLED	NO	Enter on Table 4-7 'Y' for yes and 'N' for no as to whether other extensions should be able to barge in on the extension being programmed.
NIGHT RING ENABLED	YES	Enter on Table 4-7 'Y' for yes and 'N' for no if the extension being programmed should receive night ringing signals.
DIL OFF HOOK SIGNAL	NO	Enter on Table 4-7 'Y' for yes and 'N' for no if the extension being programmed should receive camp on tones while off hook, indicating an incoming DIL call (Call Waiting CO Calls).
DIAL C.O. GROUP	NO	Enter on Table 4-7 'Y' for yes and 'N' for no if the extension being programmed should be able to access a specific CO line group by dialing 9 + the group number. The default value (NO) limits the extension accessing CO line groups with the outgoing CO line keys on the phone.

Table 4-3 PROGRAM RECORD FORM INSTRUCTIONS, EXTENSION, TCX-128 (Page 3 of 3)

FIELD DESCRIPTION	DEFAULT ENTRY	INSTRUCTIONS
CAMP-ON ORIGNATE	YES	Enter on Table 4-7 'Y' for yes and 'N' for no if the extension being programmed should send call wait tones when transferring a CO line call to a busy extension (Call Waiting Transfer).
CAMP-ON RECEIVE	YES	Enter on Table 4-7 'Y' for yes and 'N' for no if the extension being programmed should receive call wait tones when it is busy and another extension transfers a CO line call to it (Call Waiting Transfer).
PAGE ZONE RECEIVED		The default entry for Page Zone Receive is as follows: Extension 301-316 are in Zone 1, Extensions 317-332 are in Zone 2, Extensions 333-348 are in Zone 3 and Extensions 349-401 are in Zone 4, Extensions 402-417 are in Zone 5, Extensions 418-433 are in Zone 6, Extensions 434-449 are in Zone 7, Extensions 450-465 are in Zone 8. To provide zone page announcements at the extension being programmed, on the Page Zone Receive Bit Graph place a '1' below each whose signals should be received by this extension. Convert the resulting binary number to HEX using Table 4-1 and enter on Table 4-7.
PICK UP GROUP IS	00	A maximum of 64 pick-up groups can be configured. When a call is received at an extension within a pick-up group, it can be picked up at any extension within the group. Any number of extensions can be assigned to a pick-up group, but each extension can only be in one pick-up group. Enter on Table 4-7 the pick-up group number to which the extension being programmed is assigned (00-64).
PRIVATE LINE IS	NONE	If the extention being programmed is to have a private line, enter on Table 4-7 the CO line number. More than one extension can be assigned the same private line. If desired, another extension may be given CO audible for the private line. This will allow inward CO access only. The extension with CO audible may answer incoming calls on the private line, but may not access the line for outgoing calls.

CO AUDIBLE - LINES 01-08, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
STA 319									
STA 320									
STA 321									
STA 322									
STA 323									
STA 324									
STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

I 40420

CO AUDIBLE - LINES 01-08, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
STA 344									
STA 345									
STA 346									
STA 347									
STA 348									
STA 349									
STA 350									
STA 351									
STA 352									
STA 353									
STA 354									
STA 355									
STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

T-4042D

CO AUDIBLE - LINES 01-08, TCX-128 (Page 3 of 4)

BIT NUMBER / CO LINES	7 / 08	6 / 07	5 / 06	4 / 05	3 / 04	2 / 03	1 / 02	0 / 01	HEX
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
STA 413									
STA 414									
STA 415									
STA 416									
STA 417									
STA 418									
STA 419									
STA 420									
STA 421									
STA 422									
STA 423									
STA 424									
STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

T 43420

CO AUDIBLE - LINES 01-08, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
STA 443									
STA 444									
STA 445									
STA 446									
STA 447									
STA 448									
STA 449									
STA 450									
STA 451									
STA 452									
STA 453									
STA 454									
STA 455									
STA 456									
STA 457									
STA 458									
STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

T-40420

CO AUDIBLE - LINES 09-16, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
STA 319									
STA 320									
STA 321									
STA 322									
STA 323									
STA 324									
STA 325							1		02
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331								1	01
STA 332									

I 4042D

CO AUDIBLE - LINES 09-16, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
STA 344									
STA 345									
STA 346									
STA 347									
STA 348									
STA 349									
STA 350									
STA 351									
STA 352									
STA 353									
STA 354									
STA 355									
STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

140420

CO AUDIBLE - LINES 09-16, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
STA 413									
STA 414									
STA 415									
STA 416									
STA 417									
STA 418									
STA 419									
STA 420									
STA 421									
STA 422									
STA 423									
STA 424									
STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

T-4640

CO AUDIBLE - LINES 09-16, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
STA 443									
STA 444									
STA 445									
STA 446									
STA 447									
STA 448									
STA 449									
STA 450									
STA 451									
STA 452									
STA 453									
STA 454									
STA 455									
STA 456									
STA 457									
STA 458									
STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

T-4042D

CO AUDIBLE - LINES 17-24, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 301					1			1	
STA 302									
STA 303									
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STA 331									
STA 332									

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CO AUDIBLE - LINES 17-24, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 333									
STA 334									
STA 335									
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STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

1-4020

CO AUDIBLE - LINES 17-24, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 402									
STA 403									
STA 404									
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STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

T-4042D

CO AUDIBLE - LINES 17-24, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 434									
STA 435									
STA 436									
STA 437									
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STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

1-4042D

CO AUDIBLE - LINES 25-32, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 301									
STA 302									
STA 303									
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STA 331									
STA 332									

T-4042D

CO AUDIBLE - LINES 25-32, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 333									
STA 334									
STA 335									
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STA 363									
STA 401									

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CO AUDIBLE - LINES 25-32, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 402									
STA 403									
STA 404									
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STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

14942

CO AUDIBLE - LINES 25-32, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 434									
STA 435									
STA 436									
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STA 464									
STA 465									

T-40420

CO ACCESS - LINES 01-08, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 301									
STA 302									
STA 303									
STA 304									
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STA 328									
STA 329									
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STA 331									
STA 332									

T-40420

CO ACCESS - LINES 01-08, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
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STA 340									
STA 341									
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STA 359									
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STA 361									
STA 362									
STA 363									
STA 401									

14340D

CO ACCESS - LINES 01-08, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 402									
STA 403									
STA 404									
STA 405									
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STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

T-4042D

CO ACCESS - LINES 01-08, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
STA 434									
STA 435									
STA 436									
STA 437									
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STA 464									
STA 465									

T-4042D

CO ACCESS - LINES 09-16, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
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STA 308									
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STA 331									
STA 332									

I 4042D

CO ACCESS - LINES 09-16, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
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STA 340									
STA 341									
STA 342									
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STA 362									
STA 363									
STA 401									

1-4640D

CO ACCESS - LINES 09-16, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 402									
STA 403									
STA 404									
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STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

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CO ACCESS - LINES 09-16, TCX-128 (Page 4 of 4)

SIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
STA 434									
STA 435									
STA 436									
STA 437									
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STA 463									
STA 464									
STA 465									

F-40420

CO ACCESS - LINES 17-24, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 301									
STA 302									
STA 303									
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STA 331									
STA 332									

1-40420

CO ACCESS - LINES 17-24, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 333									
STA 334									
STA 335									
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STA 363									
STA 401									

T-4042D

CO ACCESS - LINES 17-24, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 402									
STA 403									
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CO ACCESS - LINES 17-24, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
STA 434									
STA 435									
STA 436									
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STA 465									

T-4042D

CO ACCESS - LINES 25-32, TCX-128 (Page 1 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 301									
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1-4042D

CO ACCESS - LINES 25-32, TCX-128 (Page 2 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 333									
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CO ACCESS - LINES 25-32, TCX-128 (Page 3 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 402									
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CO ACCESS - LINES 25-32, TCX-128 (Page 4 of 4)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
STA 434									
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PAGE ZONE RECEIVE (Page 1 of 2)

STATION NUMBER	7 ZONE 8	6 ZONE 7	5 ZONE 6	4 ZONE 5	3 ZONE 4	2 ZONE 3	1 ZONE 2	0 ZONE 1	HEX
301									
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331									
332									

STATION NUMBER	7 ZONE 8	6 ZONE 7	5 ZONE 6	4 ZONE 5	3 ZONE 4	2 ZONE 3	1 ZONE 2	0 ZONE 1	HEX
333									
334									
335									
336									
337									
338									
339									
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401									

T-4042F

PAGE ZONE RECEIVE (Page 2 of 2)

STATION NUMBER	7 ZONE 8	6 ZONE 7	5 ZONE 6	4 ZONE 5	3 ZONE 4	2 ZONE 3	1 ZONE 2	0 ZONE 1	HEX	STATION NUMBER	7 ZONE 8	6 ZONE 7	5 ZONE 6	4 ZONE 5	3 ZONE 4	2 ZONE 3	1 ZONE 2	0 ZONE 1	HEX
402										434									
403										435									
404										436									
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432										464									
433										465									

1-4042F

Table 4-4 PROGRAM RECORD FORM, SYSTEM, TCX-128 (Page 1 of 2)

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
Operators & DSS		
OPERATOR 1 IS	301	
DSS OPERATOR 1 IS	NONE	
ALTERNATE OPERATOR 1 IS	NONE	
OPERATOR 2 IS	NONE	
DSS OPERATOR 2 IS	NONE	
ALTERNATE OPERATOR 2 IS	NONE	
OPERATOR 3 IS	NONE	
DSS OPERATOR 3 IS	NONE	
ALTERNATE OPERATOR 3 IS	NONE	
OPERATOR 4 IS	NONE	
DSS OPERATOR 4 IS	NONE	
ALTERNATE OPERATOR 4 IS	NONE	
OPERATOR 5 IS	NONE	
DSS OPERATOR 5 IS	NONE	
ALTERNATE OPERATOR 5 IS	NONE	
OPERATOR 6 IS	NONE	
DSS OPERATOR 6 IS	NONE	
ALTERNATE OPERATOR 6 IS	NONE	
Timers		
HOLD RECALL TIMER (SEC)	060	
ORBIT RECALL TIMER (SEC)	060	
PAUSE TIME-OUT (SEC)	006	
FLASH TIMER (N*50MSEC)	020	
DIAL TONE TIME-OUT (SEC)	002	
SMDR TIMER (SEC)	030	
TRANS RECALL (SEC)	120	60
Least Cost Routing		
LCR ENABLED	NO	
LCR SERVICE #01		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #02		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #03		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #04		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #05		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #06		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
LCR SERVICE #07		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #08		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #09		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
LCR SERVICE #10		
LINE GROUP	77	
OCC DIALUP SYS BIN	00	
FX SERVICE/OTHER 1/0	00	
Relays Control		
RELAY #1 CONTROL	00	
RELAY #2 CONTROL	00	
RELAY #3 CONTROL	00	
RELAY #4 CONTROL	00	
CO Groups		
LINE 01 GROUP IS	01	
LINE 02 GROUP IS	01	
LINE 03 GROUP IS	01	
LINE 04 GROUP IS	01	
LINE 05 GROUP IS	01	
LINE 06 GROUP IS	01	
LINE 07 GROUP IS	01	
LINE 08 GROUP IS	01	
LINE 09 GROUP IS	02	
LINE 10 GROUP IS	02	
LINE 11 GROUP IS	02	
LINE 12 GROUP IS	02	
LINE 13 GROUP IS	02	
LINE 14 GROUP IS	02	
LINE 15 GROUP IS	02	
LINE 16 GROUP IS	02	
LINE 17 GROUP IS	03	
LINE 18 GROUP IS	03	
LINE 19 GROUP IS	03	
LINE 20 GROUP IS	03	
LINE 21 GROUP IS	03	
LINE 22 GROUP IS	03	
LINE 23 GROUP IS	03	
LINE 24 GROUP IS	03	
LINE 25 GROUP IS	77	
LINE 26 GROUP IS	77	
LINE 27 GROUP IS	77	
LINE 28 GROUP IS	77	
LINE 29 GROUP IS	77	
LINE 30 GROUP IS	77	
LINE 31 GROUP IS	77	
LINE 32 GROUP IS	77	

Table 4-4 PROGRAM RECORD FORM, SYSTEM, TCX-128 (Page 2 of 2)

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
CO Type		
LINE 01 TYPE IS	01	
LINE 02 TYPE IS	01	
LINE 03 TYPE IS	01	
LINE 04 TYPE IS	01	
LINE 05 TYPE IS	01	
LINE 06 TYPE IS	01	
LINE 07 TYPE IS	01	
LINE 08 TYPE IS	01	
LINE 09 TYPE IS	01	
LINE 10 TYPE IS	01	
LINE 11 TYPE IS	01	
LINE 12 TYPE IS	01	
LINE 13 TYPE IS	01	
LINE 14 TYPE IS	01	
LINE 15 TYPE IS	01	
LINE 16 TYPE IS	01	
LINE 17 TYPE IS	01	
LINE 18 TYPE IS	01	
LINE 19 TYPE IS	01	
LINE 20 TYPE IS	01	
LINE 21 TYPE IS	01	
LINE 22 TYPE IS	01	
LINE 23 TYPE IS	01	
LINE 24 TYPE IS	01	
LINE 25 TYPE IS	01	
LINE 26 TYPE IS	01	
LINE 26 TYPE IS	01	
LINE 27 TYPE IS	01	
LINE 28 TYPE IS	01	
LINE 29 TYPE IS	01	
LINE 30 TYPE IS	01	
LINE 31 TYPE IS	01	
LINE 32 TYPE IS	01	
External Outputs		
OUTPUT 01 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 02 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 03 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 04 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 05 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 06 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 07 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 08 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
Out Key Groups		
OUT KEY #1 SELECT GROUP #	01	
OUT KEY #2 SELECT GROUP #	01	
OUT KEY #3 SELECT GROUP #	02	
OUT KEY #4 SELECT GROUP #	02	
OUT KEY #5 SELECT GROUP #	03	
OUT KEY #6 SELECT GROUP #	03	
System Options		
ENTER OPTION #		
OPTION ENABLED 01	YES	
ENTER OPTION #		
OPTION ENABLED 02	YES	
ENTER OPTION #		
OPTION ENABLED 03	YES	
ENTER OPTION #		
OPTION ENABLED 04	NO	
ENTER OPTION #		
OPTION ENABLED 05	YES	
ENTER OPTION #		
OPTION ENABLED 06	NO	
ENTER OPTION #		
OPTION ENABLED 07	YES	
ENTER OPTION #		
OPTION ENABLED 08	NO	
ENTER OPTION #		
OPTION ENABLED 09	YES	
ENTER OPTION #		
OPTION ENABLED 10	YES	
ENTER OPTION #		
OPTION ENABLED 11	YES	
ENTER OPTION #		
OPTION ENABLED 12	NO	
ENTER OPTION #		
OPTION ENABLED 13	YES	
ENTER OPTION #		
OPTION ENABLED 14	NO	
ENTER OPTION #		
OPTION ENABLED 15	YES	
ENTER OPTION #		
OPTION ENABLED 16	NO	
ENTER OPTION #		
OPTION ENABLED 17	YES	
ENTER OPTION #		
OPTION ENABLED 18	NO	
ENTER OPTION #		
OPTION ENABLED 19	YES	

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 1 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
100						150						200					
101						151						201					
102						152						202					
103						153						203					
104						154						204					
105						155						205					
106						156						206					
107						157						207					
108						158						208					
109						159						209					
110						160						210					
111						161						211					
112						162						212					
113						163						213					
114						164						214					
115						165						215					
116						166						216					
117						167						217					
118						168						218					
119						169						219					
120						170						220					
121						171						221					
122						172						222					
123						173						223					
124						174						224					
125						175						225					
126						176						226					
127						177						227					
128						178						228					
129						179						229					
130						180						230					
131						181						231					
132						182						232					
133						183						233					
134						184						234					
135						185						235					
136						186						236					
137						187						237					
138						188						238					
139						189						239					
140						190						240					
141						191						241					
142						192						242					
143						193						243					
144						194						244					
145						195						245					
146						196						246					
147						197						247					
148						198						248					
149						199						249					

T4041

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 2 of 6)

3-DIGIT EXCHANGE	OFFICE CODE TYPE					3-DIGIT EXCHANGE	OFFICE CODE TYPE					3-DIGIT EXCHANGE	OFFICE CODE TYPE				
	00	01	02	03	04		00	01	02	03	04		00	01	02	03	04
250						300						350					
251						301						351					
252						302						352					
253						303						353					
254						304						354					
255						305						355					
256						306						356					
257						307						357					
258						308						358					
259						309						359					
260						310						360					
261						311						361					
262						312						362					
263						313						363					
264						314						364					
265						315						365					
266						316						366					
267						317						367					
268						318						368					
269						319						369					
270						320						370					
271						321						371					
272						322						372					
273						323						373					
274						324						374					
275						325						375					
276						326						376					
277						327						377					
278						328						378					
279						329						379					
280						330						380					
281						331						381					
282						332						382					
283						333						383					
284						334						384					
285						335						385					
286						336						386					
287						337						387					
288						338						388					
289						339						389					
290						340						390					
291						341						391					
292						342						392					
293						343						393					
294						344						394					
295						345						395					
296						346						396					
297						347						397					
298						348						398					
299						349						399					

T4041

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 3 of 6)

3-DIGIT EXCHANGE	OFFICE CODE TYPE					3-DIGIT EXCHANGE	OFFICE CODE TYPE					3-DIGIT EXCHANGE	OFFICE CODE TYPE				
	00	01	02	03	04		00	01	02	03	04		00	01	02	03	04
400						450						500					
401						451						501					
402						452						502					
403						453						503					
404						454						504					
405						455						505					
406						456						506					
407						457						507					
408						458						508					
409						459						509					
410						460						510					
411						461						241					
412						462						512					
413						463						513					
414						464						514					
415						465						515					
416						466						516					
417						467						517					
418						468						518					
419						469						519					
420						470						520					
421						471						521					
422						472						552					
423						473						523					
424						474						524					
425						475						525					
426						476						526					
427						477						527					
428						478						528					
429						479						529					
430						480						530					
431						481						531					
432						482						532					
433						483						533					
434						484						534					
435						485						535					
436						486						536					
437						487						537					
438						488						538					
439						489						539					
440						490						540					
441						491						541					
442						492						542					
443						493						543					
444						494						544					
445						495						545					
446						496						546					
447						497						547					
448						498						548					
449						499						549					

T4041

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 4 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
550						600						650					
551						601						651					
552						602						652					
553						603						653					
554						604						654					
555						605						655					
556						606						656					
557						607						657					
558						608						658					
559						609						659					
560						610						660					
561						611						661					
562						612						662					
563						613						663					
564						614						664					
565						615						665					
566						616						666					
567						617						667					
568						618						668					
569						619						669					
570						620						670					
571						621						671					
572						622						672					
573						623						673					
574						624						674					
575						625						675					
576						626						676					
577						627						677					
578						628						678					
579						629						679					
580						630						680					
581						631						681					
582						632						682					
583						633						683					
584						634						684					
585						635						685					
586						636						686					
587						637						687					
588						638						688					
589						639						689					
590						640						690					
591						641						691					
592						642						692					
593						643						693					
594						644						694					
595						645						695					
596						646						696					
597						647						697					
598						648						698					
599						649						699					

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 5 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
700						750						800					
701						751						801					
702						752						802					
703						753						803					
704						754						804					
705						755						805					
706						756						806					
707						757						807					
708						758						808					
709						759						809					
710						760						810					
711						761						811					
712						762						812					
713						763						813					
714						764						814					
715						765						815					
716						766						816					
717						767						817					
718						768						818					
719						769						819					
720						770						820					
721						771						821					
722						772						882					
723						773						823					
724						774						824					
725						775						825					
726						776						826					
727						777						827					
728						778						828					
729						779						829					
730						780						830					
731						781						831					
732						782						832					
733						783						833					
734						784						834					
735						785						835					
736						786						836					
737						787						837					
738						788						838					
739						789						839					
740						790						840					
741						791						841					
742						792						842					
743						793						843					
744						794						844					
745						795						845					
746						796						846					
747						797						847					
748						798						848					
749						799						849					

T4041

Table 4-5 OFFICE CODE TYPE, TCX-128 (Page 6 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
850						900						950					
851						901						951					
852						902						952					
853						903						953					
854						904						954					
855						905						955					
856						906						956					
857						907						957					
858						908						958					
859						909						959					
860						910						960					
861						911						961					
862						912						962					
863						913						963					
864						914						964					
865						915						965					
866						916						966					
867						917						967					
868						918						968					
869						919						969					
870						920						970					
871						921						971					
872						922						972					
873						923						973					
874						924						974					
875						925						975					
876						926						976					
877						927						977					
878						928						978					
879						929						979					
880						930						980					
881						931						981					
882						932						982					
883						933						983					
884						934						984					
885						935						985					
886						936						986					
887						937						987					
888						938						988					
889						939						989					
890						940						990					
891						941						991					
892						942						992					
893						943						993					
894						944						994					
895						945						995					
896						946						996					
897						947						997					
898						948						998					
899						949						999					

T1041

Table 4-6 ALLOWED COS FOR OFFICE CODE (Page 1 of 4)

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 200									
AREA CODE 201									
AREA CODE 202									
AREA CODE 203									
AREA CODE 204									
AREA CODE 205									
AREA CODE 206									
AREA CODE 207									
AREA CODE 208									
AREA CODE 209									
AREA CODE 210									
AREA CODE 211									
AREA CODE 212									
AREA CODE 213									
AREA CODE 214									
AREA CODE 215									
AREA CODE 216									
AREA CODE 217									
AREA CODE 218									
AREA CODE 219									

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 300									
AREA CODE 301									
AREA CODE 302									
AREA CODE 303									
AREA CODE 304									
AREA CODE 305									
AREA CODE 306									
AREA CODE 307									
AREA CODE 308									
AREA CODE 309									
AREA CODE 310									
AREA CODE 311									
AREA CODE 312									
AREA CODE 313									
AREA CODE 314									
AREA CODE 315									
AREA CODE 316									
AREA CODE 317									
AREA CODE 318									
AREA CODE 319									

1-40428

Table 4-6 ALLOWED COS FOR OFFICE CODE (Page 2 of 4)

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 400									
AREA CODE 401									
AREA CODE 402									
AREA CODE 403									
AREA CODE 404									
AREA CODE 405									
AREA CODE 406									
AREA CODE 407									
AREA CODE 408									
AREA CODE 409									
AREA CODE 410									
AREA CODE 411									
AREA CODE 412									
AREA CODE 413									
AREA CODE 414									
AREA CODE 415									
AREA CODE 416									
AREA CODE 417									
AREA CODE 418									
AREA CODE 419									

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 500									
AREA CODE 501									
AREA CODE 502									
AREA CODE 503									
AREA CODE 504									
AREA CODE 505									
AREA CODE 506									
AREA CODE 507									
AREA CODE 508									
AREA CODE 509									
AREA CODE 510									
AREA CODE 511									
AREA CODE 512									
AREA CODE 513									
AREA CODE 514									
AREA CODE 515									
AREA CODE 516									
AREA CODE 517									
AREA CODE 518									
AREA CODE 519									

1-40429

Table 4-6 ALLOWED COS FOR OFFICE CODE (Page 3 of 4)

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 600									
AREA CODE 601									
AREA CODE 602									
AREA CODE 603									
AREA CODE 604									
AREA CODE 605									
AREA CODE 606									
AREA CODE 607									
AREA CODE 608									
AREA CODE 609									
AREA CODE 610									
AREA CODE 611									
AREA CODE 612									
AREA CODE 613									
AREA CODE 614									
AREA CODE 615									
AREA CODE 616									
AREA CODE 617									
AREA CODE 618									
AREA CODE 619									

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 700									
AREA CODE 701									
AREA CODE 702									
AREA CODE 703									
AREA CODE 704									
AREA CODE 705									
AREA CODE 706									
AREA CODE 707									
AREA CODE 708									
AREA CODE 709									
AREA CODE 710									
AREA CODE 711									
AREA CODE 712									
AREA CODE 713									
AREA CODE 714									
AREA CODE 715									
AREA CODE 716									
AREA CODE 717									
AREA CODE 718									
AREA CODE 719									

T 40425

Table 4-6 ALLOWED COS FOR OFFICE CODE (Page 4 of 4)

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 200									
AREA CODE 801									
AREA CODE 802									
AREA CODE 803									
AREA CODE 804									
AREA CODE 805									
AREA CODE 806									
AREA CODE 807									
AREA CODE 808									
AREA CODE 809									
AREA CODE 810									
AREA CODE 811									
AREA CODE 812									
AREA CODE 813									
AREA CODE 814									
AREA CODE 815									
AREA CODE 816									
AREA CODE 817									
AREA CODE 818									
AREA CODE 819									

BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
AREA CODE 900									
AREA CODE 901									
AREA CODE 902									
AREA CODE 903									
AREA CODE 904									
AREA CODE 905									
AREA CODE 906									
AREA CODE 907									
AREA CODE 908									
AREA CODE 909									
AREA CODE 910									
AREA CODE 911									
AREA CODE 912									
AREA CODE 913									
AREA CODE 914									
AREA CODE 915									
AREA CODE 916									
AREA CODE 917									
AREA CODE 918									
AREA CODE 919									

T 40429

Table 4-7 PROGRAM RECORD FORM, EXTENSIONS, TCX-128 (Page 1 of 4)

STA. NO.	PORT NO.	TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8	CO AUD 9-16	CO AUD 17-24	CO AUD 25-32	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE-IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP-ON ORIG.	CAMP-ON RECEIVE	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
INITIALIZED		KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
301	001																						
302	002																						
303	003																						
304	004																						
305	005																						
306	006	KEY	313	00	00	—	—	00	FF	FF	7F	00	YES	NO	NO	NO	NO	NO	YES	YES	00	00	NONE
307	007																						
308	008																						
309	009																						
310	010																						
311	011	KEY	310	00	FF	FF	FF	00	FF	FF	3F	00	NO	NO	NO	YES	NO	NO	YES	YES	00	01	NONE
312	012																						
313	013																						
314	014																						
315	015																						
316	016																						
317	017																						
318	018																						
319	019																						
320	020																						
321	021																						
322	022																						
323	023																						
324	024																						
325	025																						10
326	026	KEY	313	00	00	—	—	00	FF	FF	7F	00	NO	NO	NO	YES	NO	NO	YES	YES	00	01	NONE
327	027																						
328	028																						
329	029																						
330	030																						
331	031																						9
332	032																						

T5610A

Table 4-7 PROGRAM RECORD FORM, EXTENSIONS, TCX-128 (Page 2 of 4)

STA. NO.	PORT NO.	TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8	CO AUD 9-16	CO AUD 17-24	CO AUD 25-32	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE-IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP-ON ORIG.	CAMP-ON RECEIVE	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
INITIALIZED		KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
333	033																						
334	034																						
335	035																						
336	036																						
337	037																						
338	038																						
339	039																						
340	040																						
341	041																						
342	042																						
343	043																						
344	044																						
345	045																						
346	046																						
347	047																						
348	048																						
349	049																						
350	050																						
351	051																						
352	052																						
353	053																						
354	054																						
355	055																						
356	056																						
357	057																						
358	058																						
359	059																						
360	060																						
361	061																						
362	062																						
363	063																						
401	064																						

Table 4-7 PROGRAM RECORD FORM, EXTENSIONS, TCX-128 (Page 3 of 4)

STA. NO.	PORT NO.	TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8	CO AUD 9-16	CO AUD 17-24	CO AUD 25-32	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE-IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	OIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP-ON ORIG.	CAMP-ON RECEIVE	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
UNINITIALIZED		KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
402	065																						
403	066																						
404	067																						
405	068																						
406	069																						
407	070																						
408	071																						
409	072																						
410	073																						
411	074																						
412	075																						
413	076																						
414	077																						
415	078																						
416	079																						
417	080																						
418	081																						
419	082																						
209	083																						
421	084																						
422	085																						
423	086																						
424	087																						
425	088																						
426	089																						
427	090																						
428	091																						
429	092																						
430	093																						
431	094																						
432	095																						
433	096																						

T5013A

Table 4-7 PROGRAM RECORD FORM, EXTENSIONS, TCX-128 (Page 4 of 4)

STA. NO.	PORT NO.	TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8	CO AUD 9-16	CO AUD 17-24	CO AUD 25-32	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE-IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP-ON ORIG.	CAMP-ON RECEIVE	PAGE ZONE REC'D	PICK-UP GROUP	PRIVATE LINE
INITIALIZED		KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
434	097																						
435	098																						
436	099																						
437	100																						
438	101																						
439	102																						
440	103																						
441	104																						
442	105																						
443	106																						
444	107																						
445	108																						
446	109																						
447	110																						
448	111																						
449	112																						
450	113																						
451	114																						
252	115																						
453	116																						
454	117																						
455	118																						
456	119																						
457	120																						
458	121																						
459	122																						
460	123																						
461	124																						
462	125																						
463	126																						
464	127																						
465	128																						

T5013A

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 5, INSTALLATION

1. INTRODUCTION

1.01 The INSTALLATION Section provides detailed procedures for installing the component parts of a TCX-128 Computerized Branch Exchange. Read and understand this entire section before proceeding. Installation of optional equipment is presented in Section 9 of this manual. Operational tests are covered in Section 7.

1.02 Major revisions to this section included the reworking of the Installation Flowchart. The drawing on punchdown operation was removed and a power supply drawing was added. All references to the Real Time Clock Daughter Board were deleted.

2. PREPARATION

2.01 The area for mounting the Key Service Unit (KSU) and related control equipment should be clean, dry, temperature controlled, and accessible only to authorized personnel. The site should be away from static electricity (dry copiers), caustic chemicals and heavy machinery. There should be ample room to mount and maintain the equipment (Figure 5-1).

2.02 There must be a dedicated 120 V AC (nominal) 15 AMP circuit for each power supply that is being installed. The outlet should be a NEMA 5-15R receptacle and must be within 9 feet (2.7m) of the power supply location. A three-prong to two-prong adapter should not be used.

2.03 An earth ground must be provided within 25 feet (7.6m) of the installation. The third wire of the AC line cord is not an acceptable earth ground. In most installations, a cold water pipe that is metallic throughout (including all joints and sections) will provide a good earth ground.

2.04 The operating telephone company must be notified of the proposed cut-over date and supplied with the information outlined in Section 1 of this manual. Be sure that the RJ21X connector(s) is located within 25 feet (7.6m) of the KSU location.

SITE SUMMARY CHECK

- *Location acceptable (para. 2.01).*
- *AC line(s) installed (para. 2.02).*
- *Provisions for ground (para. 2.03).*
- *Telco notified (para. 2.04).*
- *Telco lines available (para. 2.04).*

Tools And Test Equipment

2.05 The following tools are required:

(a) Drill for mounting equipment on backboard
(b) Screwdrivers (Straight and Philips)
(c) Punchdown tool for cross-connecting wires
(d) Wire stripper for wiring modular jacks
(e) Wrist ground strap for removing and inserting PCBs
(f) Needle-nose pliers for strapping PCBs
(g) Digital voltmeter with a high input impedance and known accuracy of ± 1% for testing
(h) User-provided RS-232C compatible programming terminal.

Equipment Requirements

2.06 The telephone equipment should be unpacked and the equipment received compared to the packing list to insure all components are on site. Check for any physical damage. Verify the number and types of extension instruments for the installation. Call the supplier in the event of damaged or missing equipment.

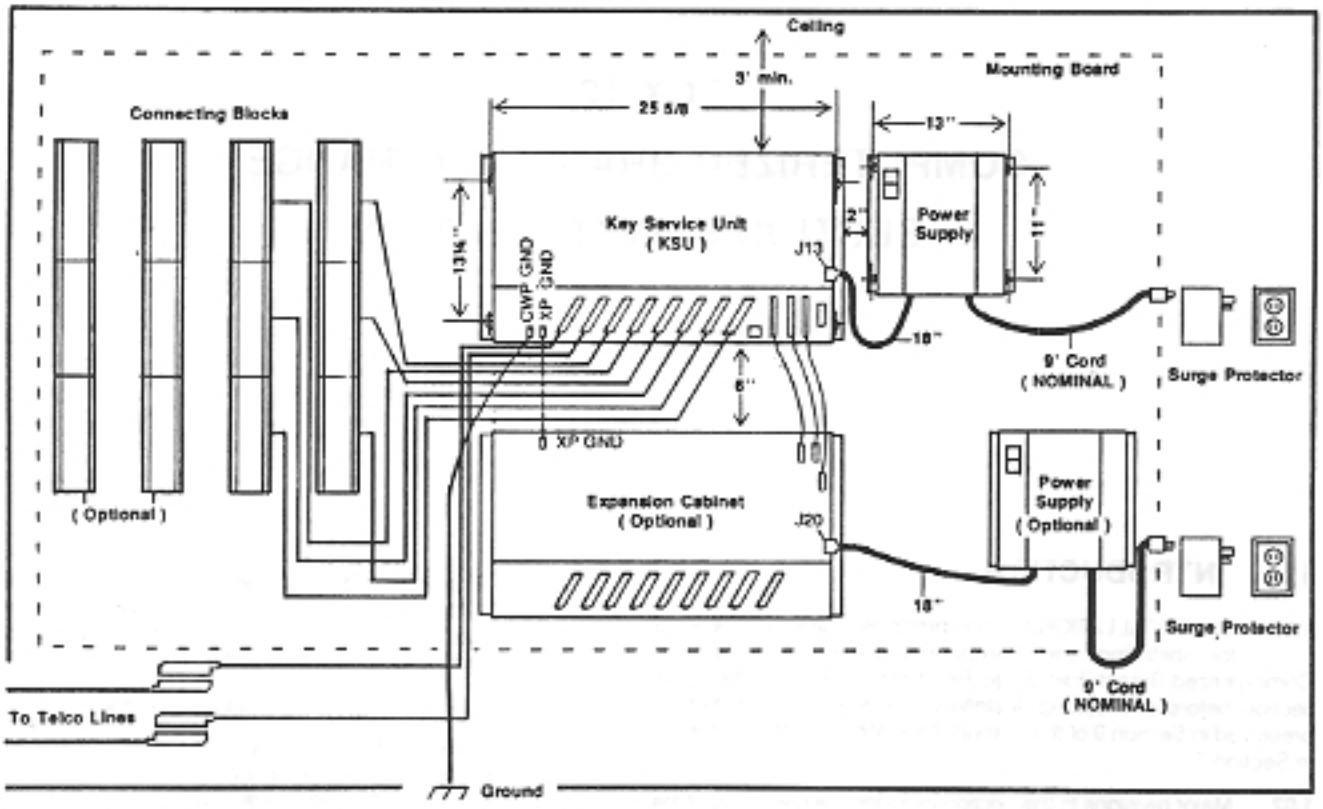

Figure 5-1 INSTALLATION LAYOUT, TCX-128

2.07 The following hardware and cables are required:

(a) 4' × 8' sheet of ¾" exterior grade plywood for a backboard and appropriate fasteners to mount.
(b) A Powerline Surge Protector for each power supply installed. The surge protector must be a 3 prong grounded receptacle with 15-amp capacity.
(c) 66M1-50 connecting blocks with bridging clips to cross connect station cable.
(d) Stranded 14 AWG insulated copper wire and grounding clamp.
(e) 25-pair cables with type 57 female connectors on one end for joining each 66M1-50 connecting block to the KSU and Expansion Cabinet.
(f) Standard quad station cable.
(g) 625A, 625F or equivalent, modular station jacks with screw type terminals.
(h) 25-pair cables with type 57 connectors, female on one end and male on the other end for telco connection.
(i) 4-wire modular line cords.

2.08 Verify that the following documents are complete and on the premises:

(a) Building plan with extensions marked as to location and type of telephone instrument.
(b) Option Configuration Worksheets (Section 3) detailing equipment requirements.
(c) Program Record Forms (Section 4) with all programming information completed.

EQUIPMENT SUMMARY CHECK

- *Tools & test equipment present (para. 2.05).*
- *Equipment present (para. 2.06).*
- *Hardware present (para. 2.07).*
- *Necessary documents on site (para. 2.08).*

3. INSTALLATION

3.01 Procedures for installation (Table 5-1) are divided into six parts: ***Backboard Mounting, Power Supplies, KSU and Expansion Cabinet Installation, Station Cabling, Inserting PCBs*** and ***Connecting To Telco Lines.***

WARNING: ALTERATIONS OR MODIFICATIONS OF THIS EQUIPMENT NOT EXPRESSLY SHOWN IN THIS MANUAL ARE PROHIBITED.

Mount Backboard

3.02 The area for the plywood backboard should be at a convenient working height and within 25 feet (7.6m) of the telco RJ21X connector and within 9 feet (2.7m) of the dedicated AC receptacles.

3.03 Attach the plywood backboard with appropriate fasteners and mark the equipment layout on the board (Figure 5-1).

3.04 Install a surge protector at the dedicated AC receptacle(s) to minimize the effects from high static voltages, low level transients and ripple effects. The protector should be self contained 3-prong grounded receptacle with 15-amp capacity. Connect this unit according to manufacturer's instructions.

BACKBOARD INSTALLATION CHECK

- *Mount backboard and mark equipment layout (para. 3.03).*
- *Install surge protector (para. 3.04).*

Power Supplies Installation

3.05 Mount the power supply or supplies on the backboard in the proper location (Figure 5-1). The power supply (Figure 5-2) is convection cooled and must be installed with the cables at the bottom of the unit. Table 5-2 shows electrical specifications. If two power supplies are installed, they should be staggered as much as possible to prevent overheating. The upper unit must be at least 3 feet (0.9m) from the ceiling.

WARNING: IF THE TOP POWER SUPPLY IS MOUNTED CLOSER THAN 3 FEET (0.9m) TO THE CEILING, IT CAN OVERHEAT.

To mount power supplies:

- *Mark four points on the backboard for each power supply that correspond to the dimensions between the mounting hole centers (Figure 5-1).*
- *Drill pilot holes at these points and insert suitable fasteners having a ¼ inch shank diameter.*
- *Screw in fasteners until the clearance between the fastener head and the mounting surface is ¼ inch.*
- *Mount each power supply on the four fasteners, tighten each fastener until the power supplies are securely attached to the mounting surface.*

WARNING: STAGGER POWER SUPPLIES AS MUCH AS POSSIBLE TO PREVENT OVERHEATING.

3.06 Some local codes require that the power supplies be permanently wired rather than plugged into a dedicated AC receptacle. If permanent wiring is required, follow the instructions on the tag of the power supply and consult local and national codes.

WARNING: DISCONNECT POWER SUPPLY FROM AC POWER SOURCE BEFORE MAKING ANY CHANGES TO WIRING.

KSU And Expansion Cabinet Installation

3.07 Mount the KSU and Expansion Cabinet on the backboard to the left of the power supplies (Figure 5-1). The KSU should be within 2 inches (5.1cm) of its power supply. The Expansion Cabinet is mounted within 6 inches (15.4cm) directly below the KSU. The lower power supply should be as far to the right of the Expansion Cabinet as the 18 inch DC power cable will allow without tensioning cable.

To mount the KSU and Expansion Cabinet:

- *Mark four points on the backboard for the each cabinet that correspond to the dimensions between the mounting hole centers (Figure 5-1).*
- *Drill pilot holes at these points and insert suitable fasteners having a ¼ inch shank diameter.*
- *Screw in fasteners until the clearance between the fastener head and the mounting surface is ¼ inch.*
- *Mount each cabinet on the four fasteners, tighten each fastener until the cabinet is securely attached to the mounting surface.*

CAUTION: DO NOT INSTALL PCBS AT THIS POINT.

3.08 Connect the power supply to the KSU by plugging the shorter cable on the power supply into the connector on the right side of the KSU. If an Expansion Cabinet is installed, plug the shorter cable on the optional power supply into the connector on the right side of the Expansion Cabinet.

CAUTION: DO NOT ALTER CABLE WHICH CONNECTS POWER SUPPLY TO THE KSU. ALTERING CABLE WILL CHANGE LEAD RESISTANCE.

Station Connecting Blocks

3.09 Connecting blocks are used to cross-connect station cable. The number of blocks is dependent on the number of extensions to be included in the system. See Table 3-3. Mount the 66M1-50 connecting blocks to the left of the KSU (Figure 5-1).

3.10 Using 25-pair cables with a female connector on one end, insert the connector into each station plug on the KSU and Expansion Cabinet. The station plugs are labeled P3 through P8 on the KSU (Figure 5-3) and P4 through P9 on the Expansion Cabinet (Figure 5-4). Punchdown the cables according to Tables 5-3 and 5-4.

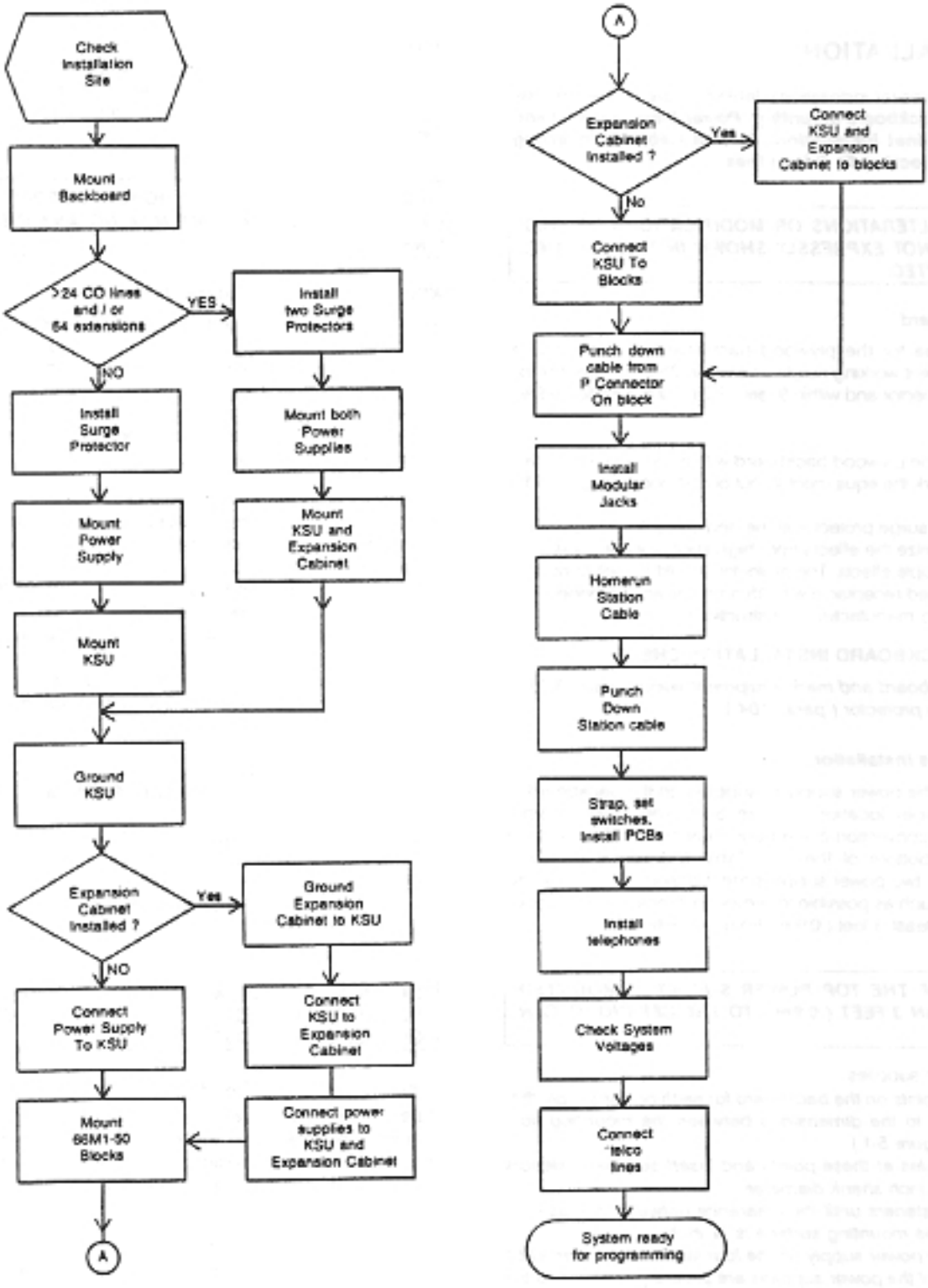

Table 5-1 INSTALLATION PROCEDURES FLOWCHART, TCX-128

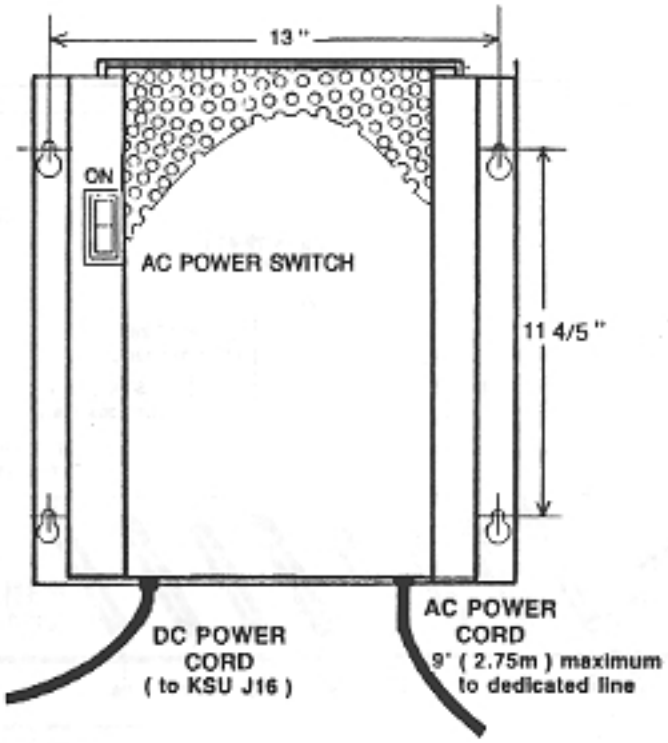

Figure 5-2 POWER SUPPLY, B-PSU-A

Table 5-2 ELECTRICAL SPECIFICATIONS, POWER SUPPLY, TCX-128

VOLTAGE LIMITS	MAXIMUM CURRENT	FUSE NUMBER	FUSE RATING	RIPPLE (P-P)
Digital Power * †		* * Protected in power supply.		
+ 5.0 to + 5.5 V DC	11.0 A	* *		5 mV
Station Power †				
− 24.3 to − 25.0 V DC	8.0 A	F1	15.0 A	25mV
+ 24.3 to + 25.0 V DC	9.0 A	F3	15.0 A	

* Digital power circuits are protected from voltages over 6.2 ± 0.4 V.

† All power supply outputs are current-limited.

INPUT VOLTAGE REQUIREMENT:	**95-130 V AC (115 V AC nominal) 59-61 Hz, Single phase.**
INPUT AC FUSE RATING	**10 A Slow Blow**

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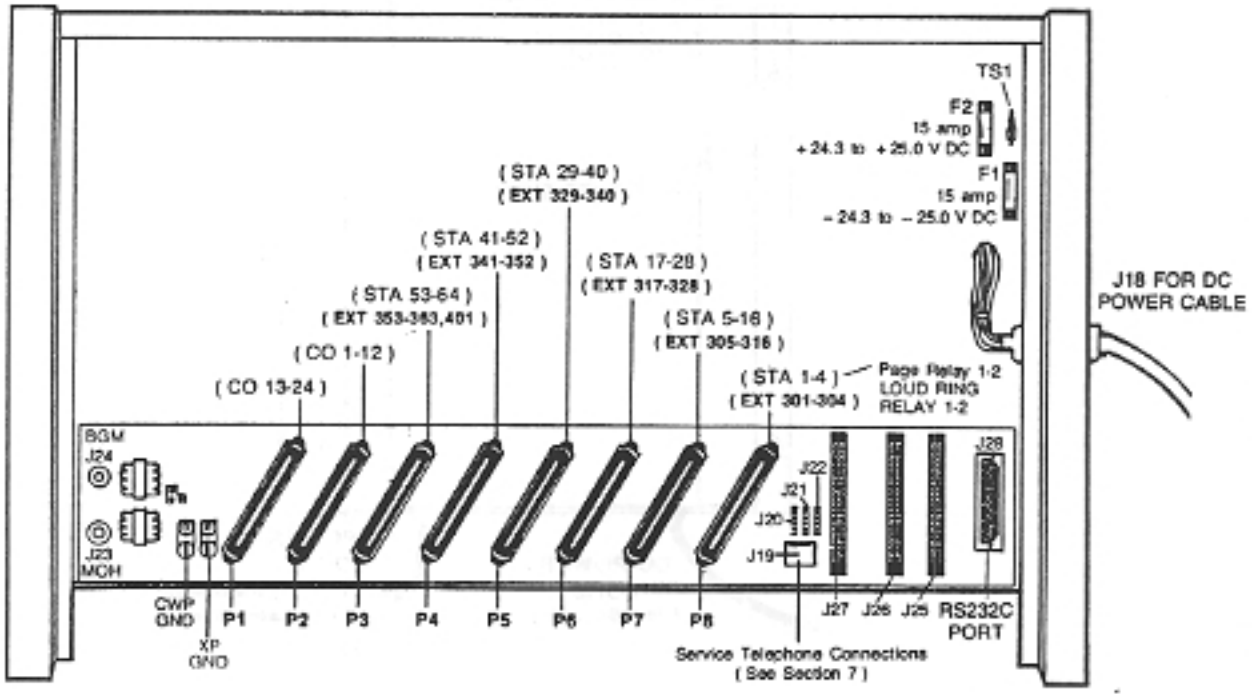


Figure 5-3 CONNECTOR PLUGS, KSU, TCX-128

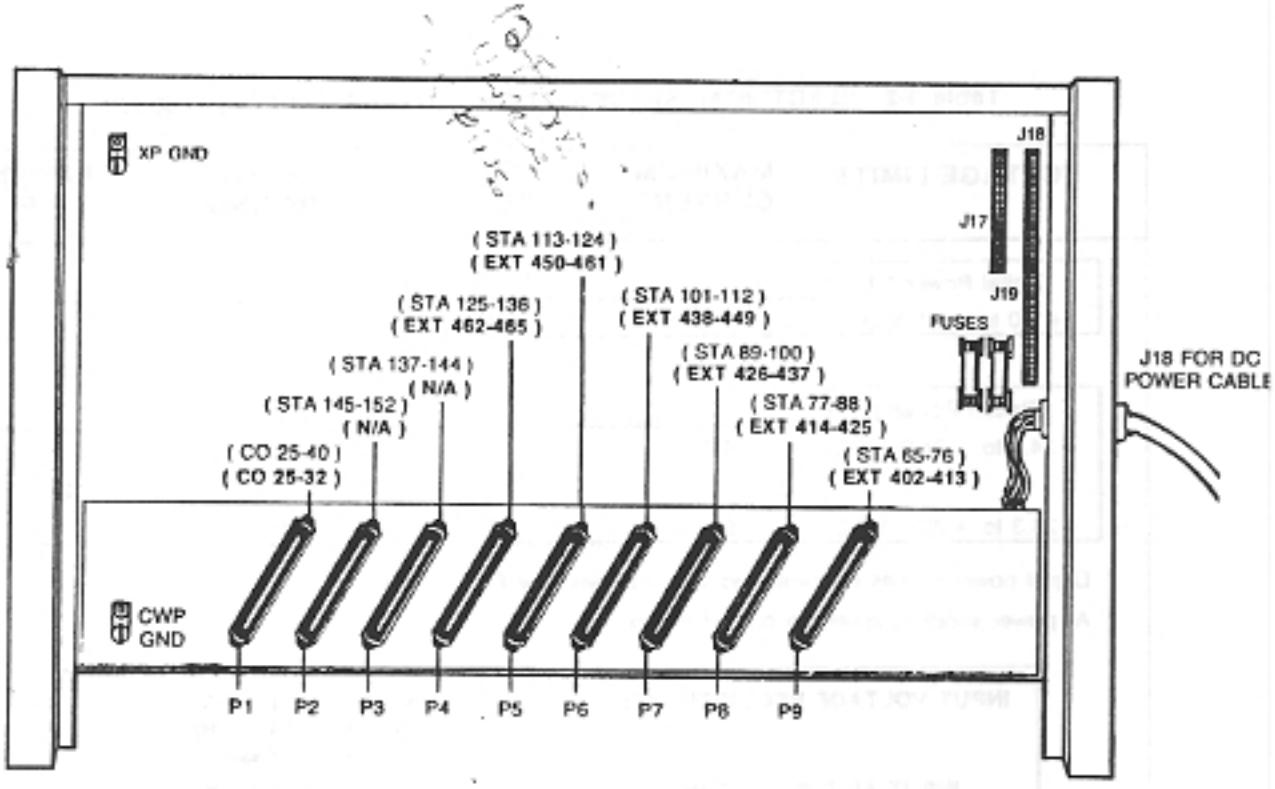


Figure 5-4 CONNECTOR PLUGS, EXPANSION CABINET, TCX-128

Table 5-3 BLOCK CONNECTIONS, KSU, TCX-128

25 Pair Cable		66M1-50	Block B6	Block B5	Block B4	Block B3	Block B2	Block B1
Conn Pin	Color Code	Block Term.	Connector P3	Connector P4	Connector P5	Connector P6	Connector P7	Connector P8
26	WHT-BLU	1	AT	AT	AT	AT	AT	
1	BLU-WHT	2	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
27	WHT-ORN	3	BT 353	BT 341	BT 329	BT 317	BT 305	
2	ORN-WHT	4	BR	BR	BR	BR	BR	
28	WHT-GRN	5	AT	AT	AT	AT	AT	
3	GRN-WHT	6	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
29	WHT-BRN	7	BT 354	BT 342	BT 330	BT 318	BT 306	
4	BRN-WHT	8	BR	BR	BR	BR	BR	
30	WHT-SLT	9	AT	AT	AT	AT	AT	
5	SLT-WHT	10	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
31	RED-BLU	11	BT 355	BT 343	BT 331	BT 319	BT 307	
6	BLU-RED	12	BR	BR	BR	BR	BR	
32	RED-ORN	13	AT	AT	AT	AT	AT	
7	ORN-RED	14	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
33	RED-GRN	15	BT 356	BT 344	BT 332	BT 320	BT 308	
8	GRN-RED	16	BR	BR	BR	BR	BR	
34	RED-BRN	17	AT	AT	AT	AT	AT	1S1 PG Relay #1
9	BRN-RED	18	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
35	RED-SLT	19	BT 357	BT 345	BT 333	BT 321	BT 309	2S1 PG Relay #3
10	SLT-RED	20	BR	BR	BR	BR	BR	
36	BLK-BLU	21	AT	AT	AT	AT	AT	3S1 LD Ring #3
11	BLU-BLK	22	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
37	BLK-ORN	23	BT 358	BT 346	BT 334	BT 322	BT 310	4S1 LD Ring #4
12	ORN-BLK	24	BR	BR	BR	BR	BR	
38	BLK-GRN	25	AT	AT	AT	AT	AT	
13	GRN-BLK	26	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
39	BLK-BRN	27	BT 359	BT 347	BT 335	BT 323	BT 311	
14	BRN-BLK	28	BR	BR	BR	BR	BR	
40	BLK-SLT	29	AT	AT	AT	AT	AT	
15	SLT-BLK	30	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	
41	YEL-BLU	31	BT 360	BT 348	BT 336	BT 324	BT 312	
16	BLU-YEL	32	BR	BR	BR	BR	BR	
42	YEL-ORN	33	AT	AT	AT	AT	AT	AT
17	ORN-YEL	34	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
43	YEL-GRN	35	BT 361	BT 349	BT 337	BT 325	BT 313	BT 301
18	GRN-YEL	36	BR	BR	BR	BR	BR	BR
44	YEL-BRN	37	AT	AT	AT	AT	AT	AT
19	BRN-YEL	38	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
45	YEL-SLT	39	BT 362	BT 350	BT 338	BT 326	BT 314	BT 302
20	SLT-YEL	40	BR	BR	BR	BR	BR	BR
46	VIO-BLU	41	AT	AT	AT	AT	AT	AT
21	BLU-VIO	42	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
47	VIO-ORN	43	BT 363	BT 351	BT 339	BT 326	BT 315	BT 303
22	ORN-VIO	44	BR	BR	BR	BR	BR	BR
48	VIO-GRN	45	AT	AT	AT	AT	AT	AT
23	GRN-VIO	46	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
49	VIO-BRN	47	BT 401	BT 352	BT 340	BT 328	BT 316	BT 304
24	BRN-VIO	48	BR	BR	BR	BR	BR	BR
50	VIO-SLT	49						
25	SLT-VIO	50						

Table 5-4 BLOCK CONNECTIONS, EXPANSION CABINET, TCX-128

25 Pair Cable		66M1-50	Block B12	Block B11	Block B10	Block B9	Block B8	Block B7
Conn Pin	Color Code	Block Term.	Connector P4	Connector P5	Connector P6	Connector P7	Connector P8	Connector P9
26	WHT-BLU	1	AT	AT	AT	AT	AT	AT
1	BLU-WHT	2	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
27	WHT-ORN	3	BT 462	BT 450	BT 438	BT 426	BT 414	BT 402
2	ORN-WHT	4	BR	BR	BR	BR	BR	BR
28	WHT-GRN	5	AT	AT	AT	AT	AT	AT
3	GRN-WHT	6	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
29	WHT-BRN	7	BT 463	BT 451	BT 439	BT 427	BT 415	BT 403
4	BRN-WHT	8	BR	BR	BR	BR	BR	BR
30	WHT-SLT	9	AT	AT	AT	AT	AT	AT
5	SLT-WHT	10	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
31	RED-BLU	11	BT 464	BT 452	BT 440	BT 428	BT 416	BT 404
6	BLU-RED	12	BR	BR	BR	BR	BR	BR
32	RED-ORN	13	AT	AT	AT	AT	AT	AT
7	ORN-RED	14	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
33	RED-GRN	15	BT 465	BT 453	BT 441	BT 429	BT 417	BT 405
8	GRN-RED	16	BR	BR	BR	BR	BR	BR
34	RED-BRN	17		AT	AT	AT	AT	AT
9	BRN-RED	18		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
35	RED-SLT	19		BT 454	BT 442	BT 430	BT 418	BT 406
10	SLT-RED	20		BR	BR	BR	BR	BR
36	BLK-BLU	21		AT	AT	AT	AT	AT
11	BLU-BLK	22		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
37	BLK-ORN	23		BT 455	BT 443	BT 431	BT 413	BT 407
12	ORN-BLK	24		BR	BR	BR	BR	BR
38	BLK-GRN	25		AT	AT	AT	AT	AT
13	GRN-BLK	26		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
39	BLK-BRN	27		BT 456	BT 444	BT 432	BT 420	BT 408
14	BRN-BLK	28		BR	BR	BR	BR	BR
40	BLK-SLT	29		AT	AT	AT	AT	AT
15	SLT-BLK	30		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
41	YEL-BLU	31		BT 457	BT 445	BT 433	BT 421	BT 409
16	BLU-YEL	32		BR	BR	BR	BR	BR
42	YEL-ORN	33		AT	AT	AT	AT	AT
17	ORN-YEL	34		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
43	YEL-GRN	35		BT 458	BT 446	BT 434	BT 422	BT 410
18	GRN-YEL	36		BR	BR	BR	BR	BR
44	YEL-BRN	37		AT	AT	AT	AT	AT
19	BRN-YEL	38		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
45	YEL-SLT	39		BT 459	BT 447	BT 435	BT 423	BT 411
20	SLT-YEL	40		BR	BR	BR	BR	BR
46	VIO-BLU	41		AT	AT	AT	AT	AT
21	BLU-VIO	42		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
47	VIO-ORN	43		BT 460	BT 448	BT 436	BT 424	BT 412
22	ORN-VIO	44		BR	BR	BR	BR	BR
48	VIO-GRN	45		AT	AT	AT	AT	AT
23	GRN-VIO	46		AR EXT.	AR EXT.	AR EXT.	AR EXT.	AR EXT.
49	VIO-BRN	47		BT 461	BT 449	BT 437	BT 425	BT 413
24	BRN-VIO	48		BR	BR	BR	BR	BR
50	VIO-SLT	49						
25	SLT-VIO	50						

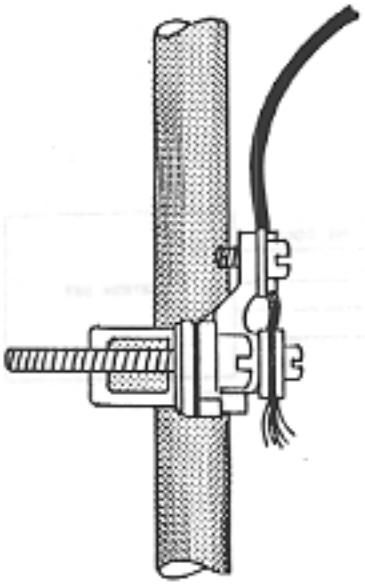


Figure 5-5 GROUNDING TO COLD WATER PIPE

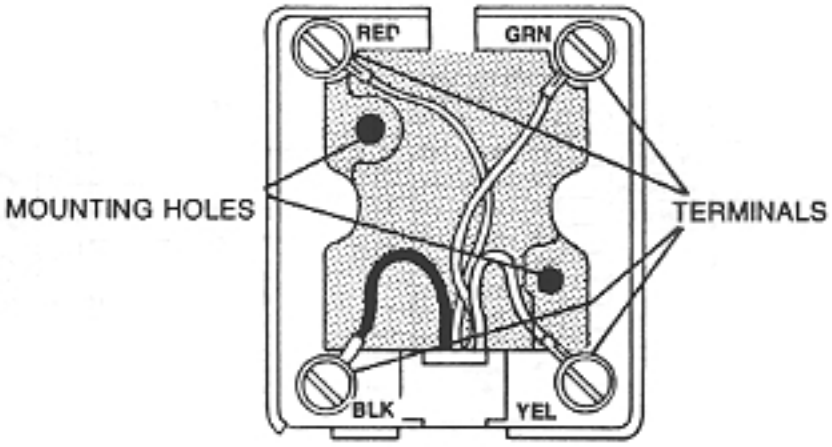


Figure 5-6 4-WIRE MODULAR STATION JACK

Grounding

3.11 Ground the KSU by connecting one end of a stranded 14 AWG, or heavier, insulated copper wire to the CWP grounding lug on the KSU backplane (Figures 5-1 and 5-3). Use a grounding clamp on a cold water pipe or other known ground for the other end of the wire (Figure 5-5). The ground wire should be as short as possible.

3.12 Ground the Expansion Cabinet by connecting the XP GND lug on the KSU (Figures 5-1 and 5-3) to the XP GND lug on the Expansion Cabinet (Figures 5-1 and 5-4).

KSU to Expansion Cabinet Connections

3.13 Three ribbon cables are shipped with the expansion cabinet to interconnect the two cabinets. The cables are attached as follows (Figures 5-3 and 5-4):

KSU		Expansion Cabinet
J25	to	J19
J26	to	J18
J27	to	J17

NOTE: The longest ribbon cable should be used to connect J25 to J19.

EQUIPMENT MOUNTING CHECK

- *Mount power supply or supplies (para. 3.05 and 3.06).*
- *Mount KSU and Expansion Cabinet (para. 3.07).*
- *Connect power supplies to KSU and Expansion Cabinet (para. 3.08)*
- *Mount and punchdown connecting blocks (para. 3.09 and 3.10).*
- *Ground KSU (para. 3.11).*
- *Ground Expansion Cabinet (para. 3.12).*
- *Interconnect KSU and Expansion Cabinet (para. 3.13).*

4. STATION CABLING

4.01 Use standard quad station cable from the connecting blocks to the modular jacks. The station cable is terminated at the extension location in a 625A or 625F (4-wire) modular jack, or equivalent with screw-type terminals. Connect the GRN, RED, BLK and YEL conductors of the cable to the matching color terminals on the modular jack (Figure 5-6).

4.02 All station cable, including cable to the DSS console, must be home run and not exceed 2000 feet for Multi-Button Key Telephones and Four-Button Key Telephones, 800 feet for display telephones, and 10,000 feet for 2500 type single line sets. Quad cable should be routed away from electrical motors and flourescent lights, and should not be run through conduits containing AC supply cable.

CAUTION: QUAD CABLE SHOULD BE ROUTED AWAY FROM ANY ELECTRO-MAGNETIC INTERFERENCE SOURCES SUCH AS ELECTRICAL MOTORS AND FLOURESCENT LIGHTS. ALL CABLE RUNS SHOULD BE AT LEAST 2 INCHES (50.8mm) FROM CONDUCTORS OF ANY ELECTRICAL LIGHT OR POWER CIRCUIT OR CLASS 1 CIRCUITS. REFERENCE NATIONAL ELECTRICAL CODE, ARTICLE 800-COMMUNICATION CIRCUITS.

CAUTION: OPERATION OF THIS EQUIPMENT OUTSIDE OF THESE LIMITS WILL DECREASE ITS EXPECTED RELIABILITY AND WILL VOID ANY APPLICABLE WARRANTY.

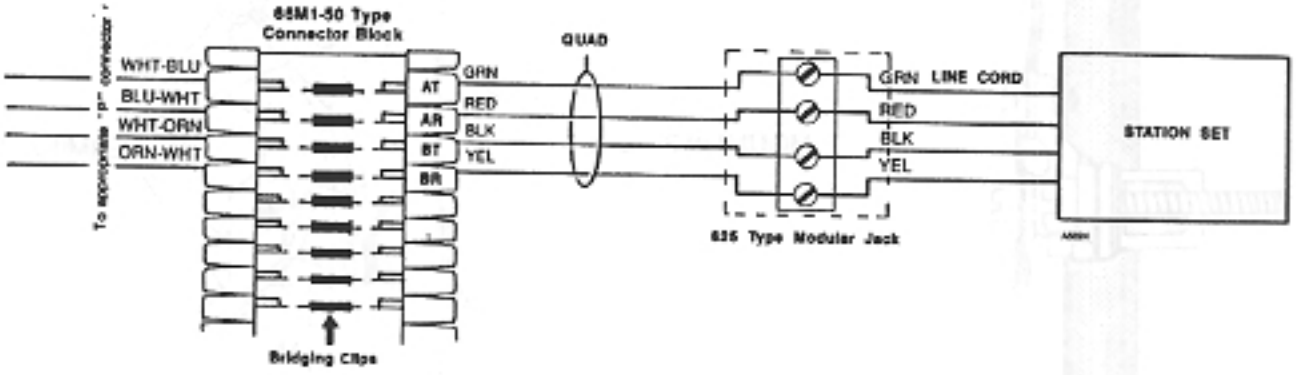


Figure 5-7 TYPICAL STATION CABLING

4.03 Punchdown each station cable at the connecting blocks (Figure 5-7) according to Tables 5-3 and 5-4 as follows:

COLOR	FUNCTION	DESIGNATION
GRN	Data/power –	AT
RED	Data/power +	AR
BLK	Audio –	BT
YEL	Audio +	BR

SYSTEM CABLING CHECK

- *Terminate cable in modular jack at extension location (para 4.01).*
- *Home run all station cable (para. 4.02).*
- *Punchdown cable at connecting blocks (para. 4.03).*

5. INSTALLATION CHECK

5.01 Verify that the installation is in accordance with this manual and Table 5-5.

NOTE: The fuses on the PCBs should not be changed in the field. Open fuse data on the PCB fuses is provided for troubleshooting purposes only. If a defective fuse is found, the PCB should be replaced.

6. INSTALLING PCBs

6.01 The Printed Circuit Board (PCB) assemblies contain devices which are sensitive to damage from static electricity. The next several paragraphs highlight safe handling techniques for static sensitive equipment.

WARNING: WHEN INSTALLING, REMOVING OR MAINTAINING PCBS USE THE PROPER PRECAUTIONS TO GUARD AGAINST STATIC DAMAGE.

6.02 All static-sensitive PCBs are shipped in static-free black velostat bags. Protect the PCBs while handling.

6.03 To minimize static charges, first discharge any accumulated body static by touching a grounded object and then attach a wrist ground strap to the CWP GND lug on the KSU (Figure 5-8). Keep foot movement to a minimum to prevent a charge build-up.

6.04 Any surface or item that is not at ground potential should not come in contact with static-sensitive PCBs.

STATIC CHECK

- *Read static precautions (para. 6.01 through 6.04).*

Table 5-5 INSTALLATION CHECKLIST, TCX-128

INSTALLATION REQUIREMENTS	VERIFICATION
MOUNTING SURFACE	Check that exterior-grade plywood is used as the backboard on damp mounting surfaces.
AC LINE	Check that AC line is dedicated exclusively to the system. If an Expansion Cabinet is installed, it must have its own dedicated AC line.
THE SERVICE ENTRANCE PANEL	Check that circuit breaker switch is equipped with a lock-clip to Entrance Panel to prevent accidental shut-down.
POWER OUTLET	Check that input power line has the capacity to deliver 15 amperes (RMS).
SURGE PROTECTION	Check that Surge Protector is installed on input Power Line.
VENTILATION AND TEMPERATURE	Check that site is adequately ventilated with a temperature range of 40° F to 100° F (4° C to 38° C) and a humidity range of 5% to 95% relative, non-condensing.
EARTH GROUND	Check that a proper earth ground connection is made using 14 AWG (or larger) wire.
SERVICEABILITY	Check that lighting conditions and the amount of working space are adequate for future servicing.
KSU	Check that the ¼" KSU hanger bolts have been tightened sufficiently.
EXPANSION CABINET	Check that the ¼" Expansion Cabinet hanger bolts have been tightened sufficiently.
POWER SUPPLY	Check that the ¼" power supply hanger bolts have been tightened sufficiently.
PUNCH DOWN BLOCK	Check that bridging clips have been installed.
FUSES	Check that fuse ratings for fuses on KSU backplane and Expansion Cabinet backplane are correct.

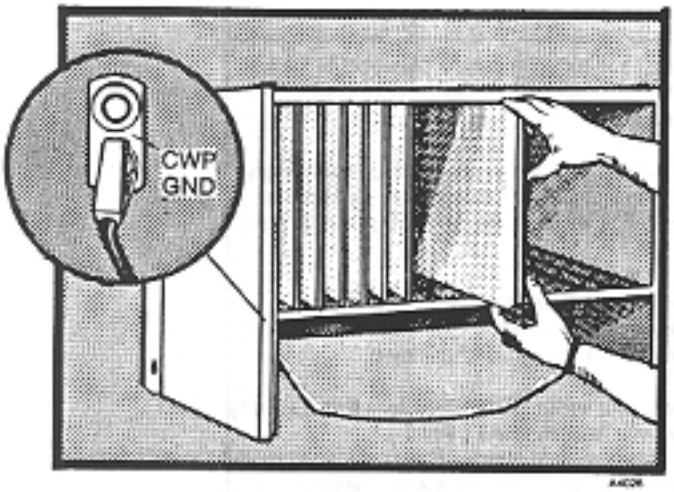


Figure 5-8 PCB INSERTION

PCB Location

6.05 The PCBs are keyed to fit only in their proper slot (Figures 5-9 and 5-10). When inserting the PCBs, the connector edge goes into the slot with the component side of the PCB to the installer's right.

6.06 PCBs should be installed with the thumb of each hand on the PCB extractors and the fingers on the KSU frame (Figure 5-8). Push the PCB until firmly seated. Do not use the heel of your hand or any tool to hammer a PCB into a connector.

WARNING: ALWAYS TURN SYSTEM POWER OFF BEFORE INSERTING OR REMOVING PCBs.

Central Processing Unit PCB

6.07 The Central Processing Unit (B-CPU-B) contains a Nicad battery to prevent memory loss when the power is out or the CPU PCB has been removed from the KSU. The battery capacities are as follows:

(a) Shipping Mode (E1 strapped to E3). Battery will hold charge for 2 months.
(b) Program Protect Mode (E1 strapped to E2). Battery will hold program in CPU for 10 days.
(c) A discharged battery (3.6 to 3.9 V DC) requires 12 hours to charge if E1 is strapped to E2, the CPU is plugged into the KSU and the KSU is connected to the AC power.

6.08 Strap the B-CPU-B PCB:

- *From 'E1' to 'E2' to prevent memory loss during power failur (Figure 5-11).*
- *Set the baud rate switch (S2) to match the baud rate of th programming terminal (Table 5-6 and Figure 5-11).*
- *Set the Data Format Switch (S3) before the system i programmed (Table 5-7 and Figure 5-11).*
- *Insert the B-CPU-B PCB into KSU slot J17.*
- *Press the Reset Switch (S1) (Figure 5-11).*

Tone Generator PCB

6.09 Up to two Tone Generator (B-TGU-B) PCBs can be installed in the TCX-128 system. If additional DTMF receiver are required (per Table 3-6), install them on the Tone Generato PCB (Figure 5-12). Strap the B-TGU-B PCB as follows:

- *From 'E1' to 'E2' if installed in the J15 slot and 'E1' to 'E3' i installed in the J16 slot.*
- *Insert the B-TGU-B PCB into the appropriate slot.*

CO Line PCB

6.10 CO Line (B-4COU-A) PCBs do not require any strapping. Each PCB contains 4 CO line circuits. Insert each B-4COU-A PCB required in the appropriate slot:

MAIN KSU

CO LINES	PCB SLOT
1 to 4	J 6
5 to 8	J 5
9 to 12	J 4
13 to 16	J 3
97 to 20	J 2
21 to 24	J 1

EXPANSION CABINET

25 to 28	J 4
29 to 32	J 3

Station PCB

6.11 Station (B-8SCU-C) PCBs do not require any strapping. Each PCB has eight station circuits. Insert each B-8SCU-C PCB required in the appropriate slot:

MAIN KSU

PORTS	EXTENSIONS	PCB SLOT
1 to 8	301 to 308	J14
9 to 16	309 to 316	J13
17 to 24	317 to 324	J12
25 to 32	325 to 332	J11
33 to 40	333 to 340	J10
41 to 48	341 to 348	J9
49 to 56	349 to 356	J8
57 to 64	357 to 363, 401	J7

EXPANSION CABINET

PORTS	EXTENSIONS	PCB SLOT
65 to 72	402 to 409	J15
73 to 80	410 to 417	J14
81 to 88	418 to 425	J13
89 to 96	426 to 433	J12
97 to 104	434 to 441	J11
105 to 112	442 to 449	J10
113 to 120	450 to 457	J9
121 to 128	458 to 465	J8

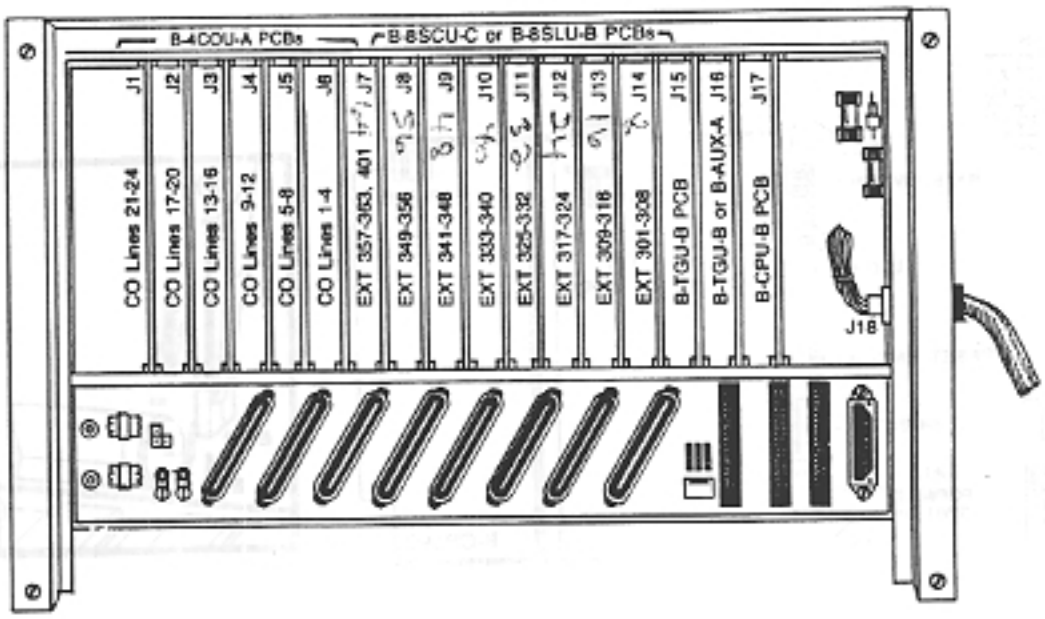


Figure 5-9 PCB LOCATION, KSU, TCX-128

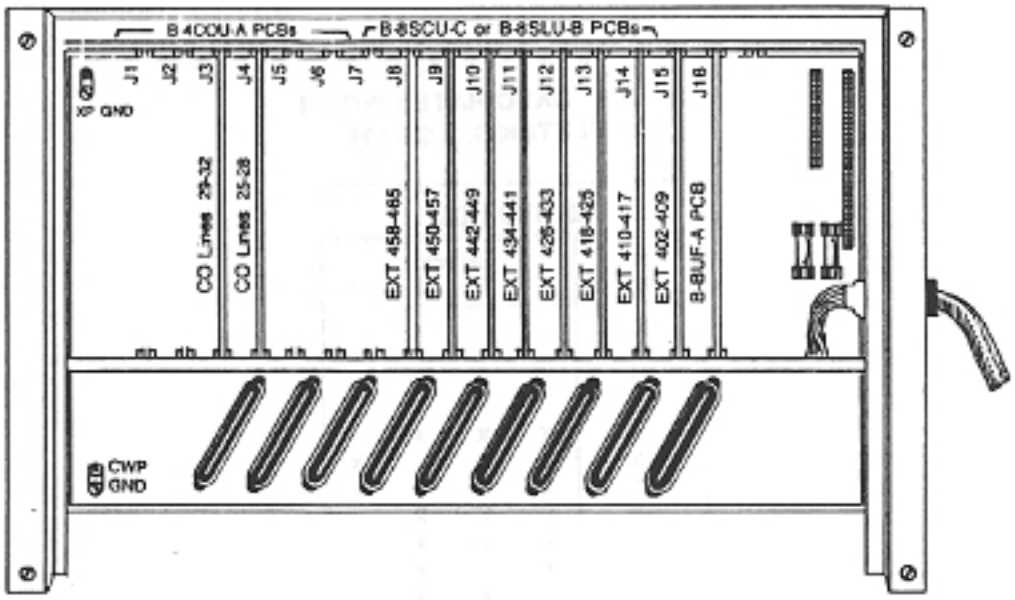


Figure 5-10 PCB LOCATION, EXPANSION CABINET, TCX-128

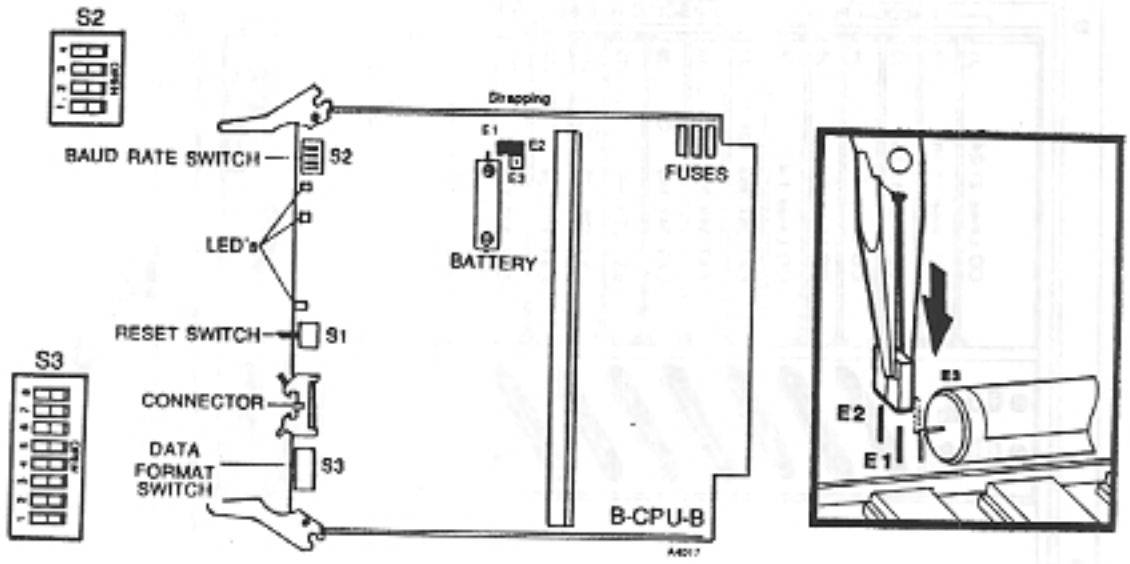


Figure 5-11 CENTRAL PROCESSING UNIT (B-CPU-B) PCB

Table 5-6 BAUD RATE SWITCH (S2) SETTINGS, TCX-128

SWITCH S2				
Baud Rate	Selector 4	3	2	1
50	-	-	X	-
75	-	-	X	X
110	X	X	X	X
135	-	X	-	-
150	X	X	X	-
200	-	X	-	X
300	X	X	-	X
600	-	X	X	-
1200	X	-	X	X
1800	X	-	X	-
2400	-	X	X	X
4800	X	-	-	X
9600	X	-	-	-

T 4000A

Note: X equals the OPEN position on the selectors

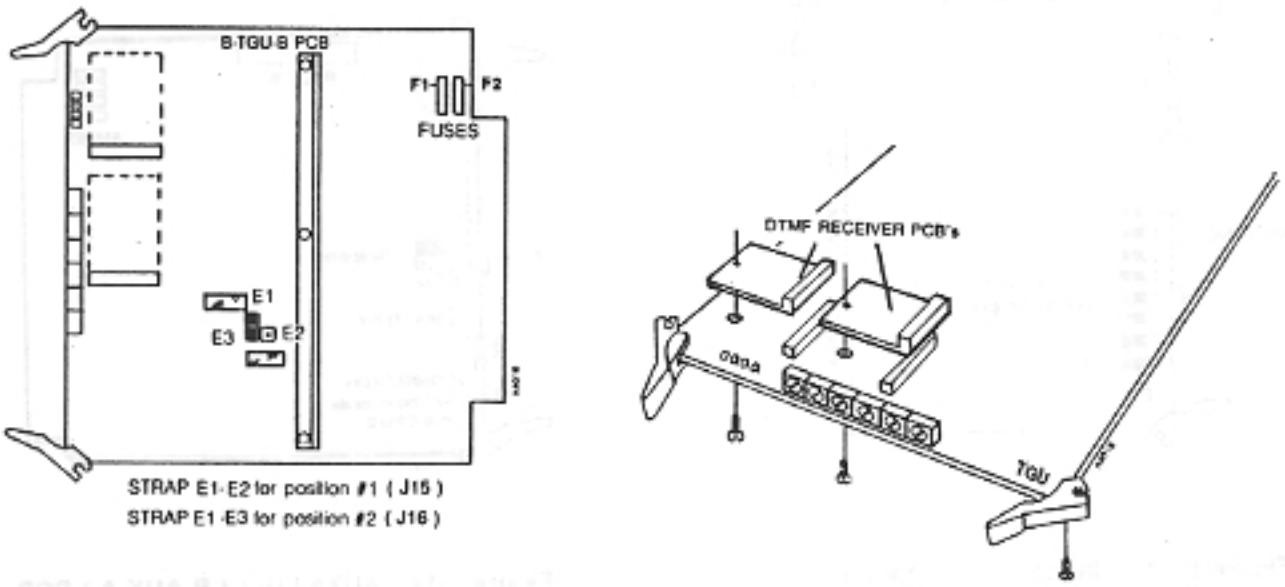


Figure 5-12 TONE GENERATOR (B-TGU-B) PCB

Table 5-7 DATA FORMAT SWITCH (S3) SETTINGS, TCX-128

SWITCH S3								
8	7	6	5	4	3	2	1	
				X	X	X	X	Not Used
			C					Baud Rate
		O						1 Stop Bit
		C						2 Stop Bits
	O							Parity Even
	C							Parity Odd
O								Parity Enable
C								Parity Disable

Bit Number O = Open C = Closed X = Don't Care

140000

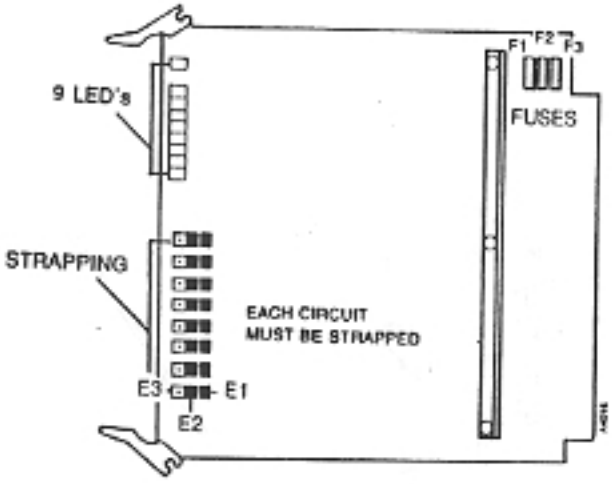


Figure 5-13 SINGLE-LINE (B-8SLU-B) PCB

Figure 5-14 AUXILIARY (B-AUX-A) PCB

Single-Line PCB

6.12 Single-Line (B-8SLU-B) PCBs are required when single-line (2500 type) telephones are used in the system. Each PCB contains eight single-line circuits and occupies one station PCB slot in the KSU or Expansion Cabinet. Strap each circuit on the B-8SLU-B in the 1-2 position (Figure 5-13) and insert each B-8SLU-B PCB in the appropriate slot.

Buffer PCB

6.13 If an Expansion Cabinet is installed, a Buffer PCB is required. The Buffer (B-BUF-A) PCB is installed in slot J16 of the Expansion Cabinet. This PCB does not require any strapping.

Auxiliary PCB

6.14 An Auxiliary (B-AUX-A) PCB is required with the installation of a rate chip. This PCB must be installed in the KSU in place of the second tone generator (BTGU-B) PCB.

- *Strap the battery on the B-AUX-A PCB from E1 to E2 to provide backup power for the system Random Access Memory (Figure 5-14).*
- *Insert the B-AUX-A PCB in KSU slot J16.*
- *Attach the ribbon cable shipped with the Auxiliary PCB to the connectors on the B-AUX-A and the B-CPU-B PCBs (Figures 5-11 and 5-14).*

7. INSTALLING TELEPHONES

7.01 To install the telephone or console, simply plug the unit into the modular jack.

7.02 If wall mounting is required, refer to the instructions shipped with the wall mounting kits.

8. SYSTEM VOLTAGE CHECK

8.01 System voltage levels can be tested and verified at test points (Tables 5-8 and 5-9). This procedure should be completed prior to connecting to the telco lines or programming to insure the system is functioning properly.

To verify system voltage levels:

- *Turn on KSU power supply.*
- *Turn on Expansion Cabinet power supply (if installed).*
- *Verify voltage per Figures 5-15 through 5-21 (i.e., observe LEDs and measure testpoints with voltmeter recommended in paragraph 2.05).*
- *Refer to Section 7 if voltages are incorrect.*

PCB INSTALLATION CHECK

- *Strap, set switches and insert Central Processing Unit PCB (para. 6.08).*
- *Strap and insert Tone Generator PCBs (para. 6.09).*
- *Insert CO Line PCBs (para. 6.10).*
- *Insert Station PCBs (para. 6.11).*
- *Strap and insert Single-Line PCBs (para. 6.12).*
- *Insert Buffer PCB if required (para. 6.13).*
- *Attach ribbon cable, strap battery and insert Auxiliary PCB if required (para. 6.14).*
- *Install telephones (para. 7.01).*
- *Check system voltage levels (para. 8.01).*

9. CONNECTING TELCO LINES

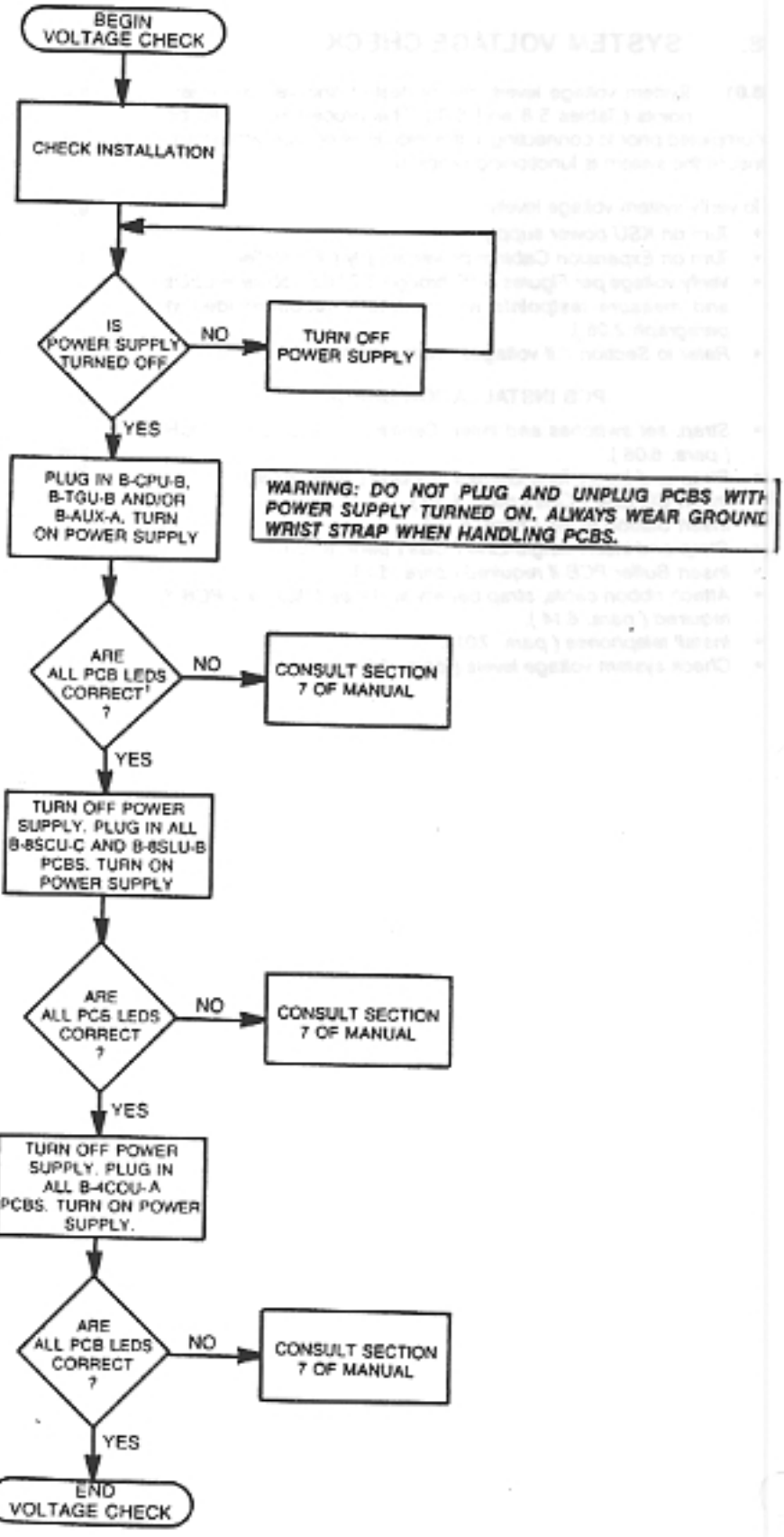
9.01 Each RJ21X connector from the telco provides service for 12 CO lines (Table 5-10). The RJ21X connector is joined to the TCX-128 system by using a 25 pair cable terminated with a Type 57 connector. This cable cannot exceed 25 feet in length.

9.02 Lines 1 through 12 appear at P2 on the KSU (Figure 5-3). These lines are connected with a 25 pair cable from P2 to the RJ21X from the telco assigned to lines 1-12.

9.03 Lines 13 through 24 appear at P1 on the KSU (Figure 5-3). These lines are connected with a 25 pair cable from P1 to the RJ21X from the telco assigned to lines 13 -24.

9.04 Lines 25 through 32 appear at P1 on the Expansion Cabinet (Figure 5-4). These lines are connected with a 25 pair cable from P1 to the RJ21X from the telco assigned to lines 25-32.

Table 5-8 VOLTAGE CHECK FLOWCHART, TCX-128



[1] Verify LEDS per Table 5-

Table 5-9 SWITCHES AND LEDs, TCX-128

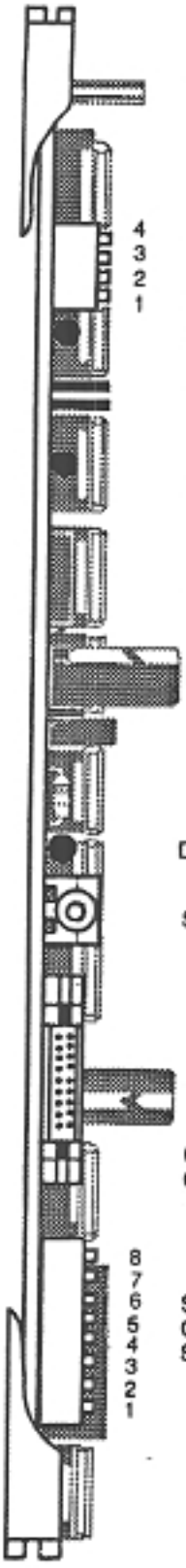
ITEM [1]	DESCRIPTION	NORMAL CONDITION
B-CPU-B		
S1	Reset Switch	N/A
S2	Baud Rate Switch	See Table 5-6
S3	Data Format Switch	See Table 5-7
DS1	Z80 Processor LED	Fast Flash (RED)
DS2	6502 Processor LED	Slow Flash (RED)
DS3	+ 5V, ±12V LED	ON (RED)
B-TGU-B		
DS1	+ 5V LED	ON (GREEN)
DS2	+15V LED	ON (GREEN)
DS3	+12V LED	ON (GREEN)
DS4	+ 5V LED	ON (GREEN)
B-4COU-A		
DS1	+15V, −12V LED	ON (GREEN)
DS2	+ 5V LED	ON (GREEN)
DS101	Line Circuit #1 Status LED	ON (RED) when seized
DS201	Line Circuit #2 Status LED	ON (RED) when seized
DS301	Line Circuit #3 Status LED	ON (RED) when seized
DS401	Line Circuit #4 Status LED	ON (RED) when seized
B-8SCU-C		
DS1	Station Circuit #1 Status LED	ON (RED) when station is functioning and is on hook. Flashes slowly when station is off hook. Off when station is inoperable or not plugged in.
DS2	Station Circuit #2 Status LED	
DS3	Station Circuit #3 Status LED	
DS4	Station Circuit #4 Status LED	
DS5	Station Circuit #5 Status LED	
DS6	Station Circuit #6 Status LED	
DS7	Station Circuit #7 Status LED	
DS8	Station Circuit #8 Status LED	
DS9	± 5V, +15V LED	ON (GREEN)
B-8SLU-B		
DS1	Station Circuit #1 Status LED	ON (RED) when station is functioning and is on hook. Flashes slowly when station is off hook. Off when station is inoperable or not plugged in.
DS2	Station Circuit #2 Status LED	
DS3	Station Circuit #3 Status LED	
DS4	Station Circuit #4 Status LED	
DS5	Station Circuit #5 Status LED	
DS6	Station Circuit #6 Status LED	
DS7	Station Circuit #7 Status LED	
DS8	Station Circuit #8 Status LED	
DS9	± 5V, +15V LED	ON (GREEN)
B-BUF-A		
DS1	Power Indicator	ON
B-AUX-A		
S1	Baud Rate Switch	Not Used
DS1	Power On	ON (RED)
DS2	Power On	ON (RED)
DS3	Power On	ON (RED)

[1] Refer to figures 5-15 through 5-21 for device location.

NOTE: On some PCBs the LEDs may be a different color than indicated.

1.4046

CENTRAL PROCESSING UNIT PCB B-CPU-B



Switch S2
Programming Terminal
Baud Rate Selection

DS3 +5V, +12V & −12V power. Normally ON. (RED)

TP2 GND.
TP1 +5VDC.

DS2 6502 Processor running. Normally flashing. (RED)

DS1 500ms CLOCK 250on/250 off. (Z80 Processor running.) (RED)

S1 Reset Switch

Connector for Ribbon Cable to B-AUX-A

Switch S3
Output Data Format Selection

CENTRAL PROCESSING UNIT B-CPU-B

OPEN FUSE DATA *
F2 + 5VDC, 4A:
1. Amplified noise transmitted from telephones.
2. No LEDs lit on CPU PCB.

F1 & F3 +24VDC, 1A:
1. System operational.
2. DS4 out on CPU PCB.
3. Cannot program system from CRT. Depressed CRT key causes system reset.

* Open fuse data is provided for troubleshooting purposes only. Do not attempt to change PCB fuses in the field.

CAUTION: Turn off power before inserting or removing B-CPU-B PCB.

VIEW:
Front Edge of Card

Figure 5-15 STATUS INFORMATION, B-CPU-B PCB

TONE GENERATOR PCB B-TGU-B

DS4 +5VDC power indicator.
DS3 +12VDC power indicator.
DS2 +15VDC power indicator.
DS1 +5VDC power indicator.

Normally ON. (GREEN)

TP5 GND.
TP4 +5VDC.
TP3 +12VDC
TP2 +15VDC
TP1 +5VDC

R45 Page Volume-Ports 1-16 * (65-80)**
R38 Page Volume-Ports 17-32 * (81-104)**
R31 Page Volume-Ports 33-48 * (105-128)**
R24 Page Volume-Ports 49-64 * (Not Used)**
R62 BGM Volume
R59 MOH Volume

OPEN FUSE DATA *

F1 + 5VDC, 1.5A:
1. DS4 LED out on B-TGU-B PCB.
2. CO Lines operational.
3. No dial tone for internal calls.

F2 +24VDC, 1.5A:
1. DS1, DS2 and DS LEDs out on B-TGU-B PCB.
2. CO Lines operational.
3. No dial tone for internal calls.

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

B-TGU-B PCB STRAPPING

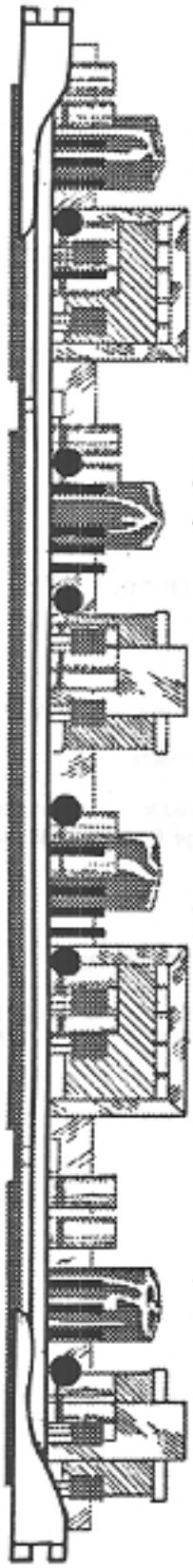
Tone Gen. #1 strap E1 to E2. (J15)
Tone Gen. #2 strap E1 to E3. (J16)

* Initialization Ports
** Parenthetical port numbers are for B-TGU-B PCB in slot J16.

VIEW:
Front Edge of Card

Figure 5-16 STATUS INFORMATION, B-TGU-B PCB

CO LINE PCB B-4COU-A



TP403 XPT Analog
TP402 Tip
TP401 Ring
DS401 Status (RED)

Line Ckt. #4

TP3 −12VDC

DS1 +15 & −12VDC (GREEN)
TP2 +15VDC

TP303 XPT Analog
TP302 Tip
TP301 Ring
DS301 Status (RED)

Line Ckt. #3

DS2 +5VDC (GREEN)
TP1 GND

TP203 XPT Analog
TP202 Tip
TP201 Ring
DS201 Status (RED)

Line Ckt. #2

TP103 XPT Analog
TP102 Tip
TP101 Ring
DS101 Status (RED)

Line Ckt. #1

Normal LED Status

DS1 and DS2 - ON

DS101-401:
OFF Line is idle
On Steady - Line is busy or busied out by program

OPEN FUSE DATA *
F1 + 24VDC, ¾A
1. DS1 dims (same as DS2)
2. Lines on affected PCB "dead"

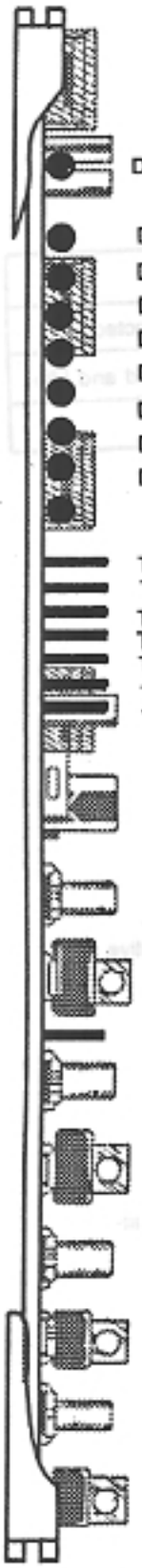
F2 −24 VDC, ¾A
1. DS1 dims (becomes same as DS2)
2. Distorted MOH and audio on CO calls

F3 +5VDC, ¾A
1. DS2 LED out
2. Lines on affected PCB "dead"

VIEW: Front Edge of Card

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

Figure 5-17 STATUS INFORMATION, B-4COU-A PCB



STATION PCB B-8SCU-C

DS9 +5, −5, & +15VDC power-indicator (GREEN)

DS8 Station 8
DS7 Station 7
DS6 Station 6
DS5 Station 5
DS4 Station 4
DS3 Station 3
DS2 Station 2
DS1 Station 1

RED

IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected
'ON STEADY'	- Telephone is connected and idle
'FLASHING'	- Station is busy

TP7 SYNC
TP6 +5VDC
TP5 +24VDC
TP4 −5 VDC
TP3 +15VDC
TP2 −24VDC
TP1 GND

OPEN FUSE DATA

F1 + 24VDC, 3A
1. DS9 LED out on Station PCB
2. Telephones connected to PCB are completely inoperative

F2 −24 VDC, 3A
1. Same as F1

F3 +5VDC, 3A (for digital circuit)
1. Same as F1

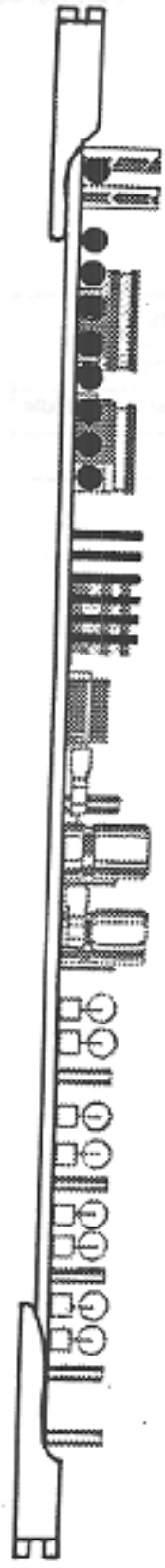
F3 +5VDC, 3A (analog circuits)
1. Telephones connected to the PCB have normal signaling but no audio

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

VIEW: Front Edge of Card

Figure 5-18 STATUS INFORMATION, B-8SCU-C PCB

SINGLE LINE PCB B-8SLU-B



DS9 +5, −5, & +15VDC power-indicator NORMALLY ON (GREEN)

DS8	Station 8	RED
DS7	Station 7	
DS6	Station 6	
DS5	Station 5	
DS4	Station 4	
DS3	Station 3	
DS2	Station 2	
DS1	Station 1	

IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected
'ON STEADY'	- Telephone is connected and idle
'FLASHING'	- Station is busy

TP6	+5VDC
TP5	+24VDC
TP4	−5VDC
TP3	+15VDC
TP2	−24VDC
TP1	GND

OPEN FUSE DATA

F1 + 24VDC, 3A
1. DS9 LED out on SLU PCB
2. Telephones connected to this PCB are completely inoperative

F2 −24 VDC, 3A
1. Same as F1

F3 +5VDC, 3A
1. Same as F1

F3 +5VDC, 3A
1. Same as F1

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

VIEW: Front Edge of Card

Figure 5-19 STATUS INFORMATION, B-8SLU-B PCB

BUFFER PCB B-BUF-A

DS1 power-indicator NORMALLY ON

OPEN FUSE DATA

F1 + 5VDC, ¾AMP

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

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VIEW: Front edge of card

Figure 5-20 STATUS INFORMATION, B-BUF-A PCB

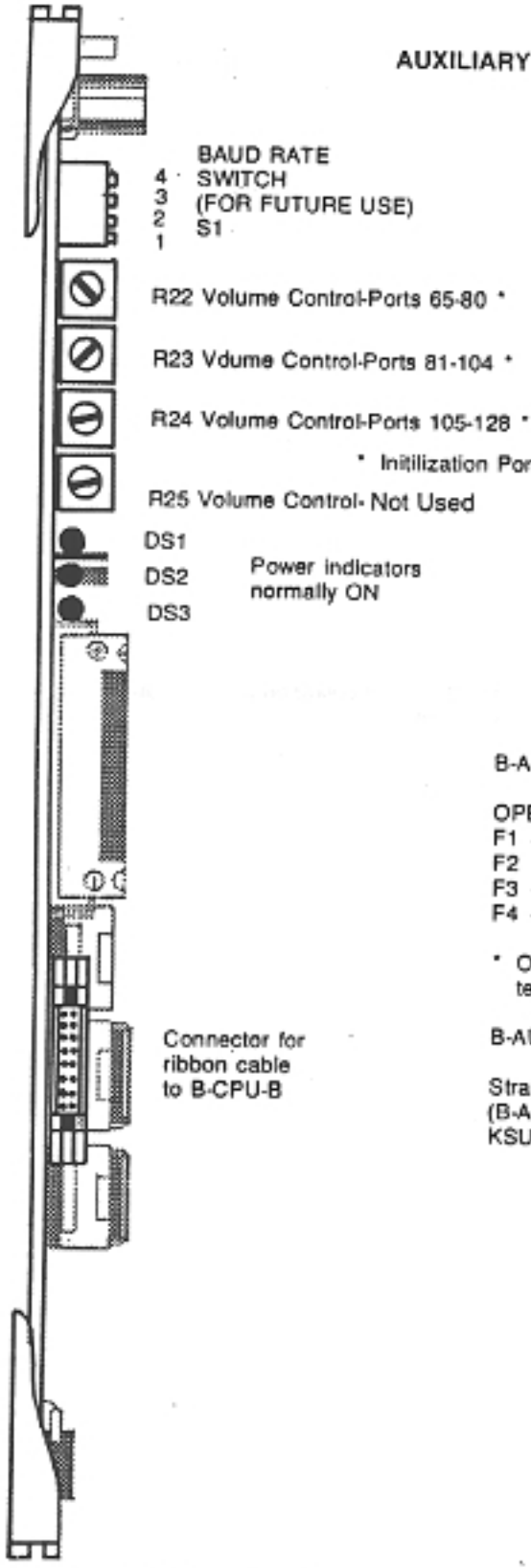


Figure 5-21 STATUS INFORMATION, B-AUX-A PCB

10. RADIO FREQUENCY INTERFERENCE

WARNING: THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY.

10.01 This equipment generates, uses, and can radiate radio frequence energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case, the user, at his own expense, will be required to take whatever measures may be required to correct the interference. If an interference problem exists, the problem may be solved in one or more of the following ways:

(i) Re-orient the receiving antenna.
(ii) Relocate the receiver with respect to the equipment.
(iii) Plug the equipment and receiver into different outlets so that both are on different branch circuits.

10.02 If necessary, consult your dealer for additional assistance. The following booklet, prepared by the FCC, may be helpful:

"How to Identify and Remove Radio-TV Interference Problems"

Order this booklet from:

U.S. Government Printing Office
Washington, D.C. 20402
(Stock No. 004-000-00345-4)

Radio Frequency Susceptibility

10.03 If the TCX-128 System is installed in a strong Radio Frequency (RF) field, it may interfere with the proper operation of the System. The use of proper installation and grounding procedures outlined in this manual will help minimize RF susceptability.

Table 5-10 TELCO RJ21X CONNECTOR/ CO LINE REFERENCES, TCX-128

		CO LINES		
PIN	FUNCTION	P2 (KSU)	P1 (KSU)	P1 (Exp Cab)
26	TIP	1	13	25
1	RING			
27	TIP	2	14	26
2	RING			
28	TIP	3	15	27
3	RING			
29	TIP	4	16	28
4	RING			
30	TIP	5	17	29
5	RING			
31	TIP	6	18	30
6	RING			
32	TIP	7	19	31
7	RING			
33	TIP	8	20	32
8	RING			
34	TIP	9	21	
9	RING			
35	TIP	10	22	
10	RING			
36	TIP	11	23	
11	RING			
37	TIP	12	24	
12	RING			

130012

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 6, PROGRAMMING

1. INTRODUCTION

1.01 The PROGRAMMING Section describes the programming procedures for the TCX-128 Telephone system. The Program Record Forms (PRFs) completed in SECTION 4 contain all the data necessary for input.

1.02 No major revisions were made to this section in Issue 2-1.

2. PREPARATION

2.01 The following procedure is required to prepare the system for programming.

- *Plug any keyboard with CRT or printer having RS-232C interface with ASCII format into the J28 connector on the Key Service Unit (KSU) backplane (Figure 6-1).*
- *The battery on the Central Processing Unit (CPU) Printed Circuit Board (PCB) must be strapped from E1 to E2 (Figure 6-2) to retain the system program during a power failure.*
- *The baud rate switch (S2) on the CPU PCB (Figure 6-2) must match the baud rate on the terminal (Table 6-1).*
- *Set the data format switch (S3) on the CPU PCB (Figure 6-2) to be compatible with the programming terminal (Table 6-2)*

3. SYSTEM INITIALIZATION

3.01 The system must be initialized before programming to set all fields to default entries.

Changes To Entries

3.02 If a specific feature requires modification at a later date, follow the programming procedures but do not initialize the system again.

CAUTION: INITIALIZATION ERASES ALL PREVIOUSLY ENTERED PROGRAMMING.

To initialize the TCX-128 system:

- *Press the 'M' key. The program selection menu appears:*

'E' – STATIONS FEATURES
'S' – SYSTEM FEATURES
'I' – SYSTEM INITIALIZATION
'Q' – EXIT PROGRAMMING MODE
'D' – DISPLAY SYSTEM STATUS

- *Press the 'I' key to start the Initialization program.*

When Initialization is complete the following message appears:

PROGRAM COMPLETE BT15 X10

- *Press the reset switch (S1) on the CPU PCB (Figure 6-2), the following message appears: "WELCOME TO CX-128." The system is now ready for programming.*

4. PROGRAMMING

4.01 The programming section is arranged corresponding to the order of Program Record Forms in Section 4. However, the programmer can enter data to any program in any order. To access a program, type the corresponding letter on the program selection menu.

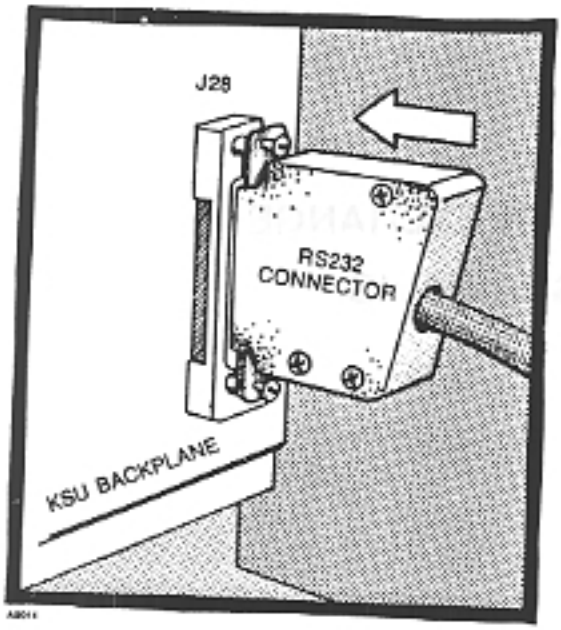


Figure 6-1 RS-232C CONNECTOR, KSU, TCX-128

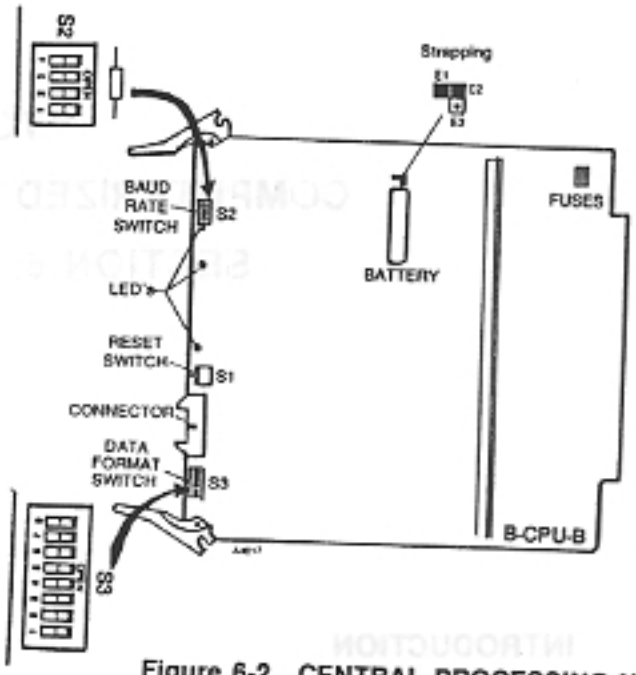


Figure 6-2 CENTRAL PROCESSING UNIT (B-CPU-B) PCB

4.02 The following paragraphs outline the procedure to program system and extension features. The system prompts in order as each entry is made. If no entry for a prompt is required, press the RETURN key; the system advances to the next prompt.

To exit a program:

- *Press the 'Q' key once.*

SYSTEM FEATURES

To program System Features:

- *Press the 'M' key for the program selection menu.*
- *Press the 'S' key for the following menu:*

'T' – TIME OF DAY
'D' – DATE
'O' – OPERATORS & DSS
'M' – TIMERS
'L' – LEAST COST ROUTING
'R' – RELAYS CONTROL
'G' – CO GROUPS
'P' – CO TYPE
'A' – OFFICE CODE TYPES
'K' – COS ALLOWED AREA CODES
'E' – EXTERNAL OUTPUTS
'N' – OUT KEYS GROUPS
'F' – SYSTEM OPTIONS
'?' – COMMAND LIST

NOTE: At any point during System Features programming, the System Feature menu may be displayed at the terminal.

To recall the menu:

- *Press the 'Q' key.*
- *Press the '?' key while holding the SHIFT key.*

Time of Day

4.03 To program the Time of Day, press the 'T' key. The system prompts:

ENTER HOURS HH.....

- *Enter 2-digits for the hour (00-23).*
- *Press the RETURN key, the system prompts:*

ENTER MINUTES MM.....

- *Enter 2-digits for the minutes past the hour (00-59).*
- *Press the RETURN key.*

Date

4.04 To program the date, press the 'D' key. The system prompts:

ENTER MONTH.....

- *Enter 2-digits for the month (01-12).*
- *Press the RETURN key.*

The system prompts:

ENTER DATE.....

- *Enter 2-digits for the day of the month (01-31).*
- *Press the RETURN key, the system prompts:*

ENTER YEAR.....

- *Enter 2-digits for the year (i.e. 1984, enter 84).*

SWITCH S2				
Baud Rate	Selector 4	3	2	1
50	-	-	X	-
75	-	-	X	X
110	X	X	X	X
135	-	X	-	-
150	X	X	X	-
200	-	X	-	X
300	X	X	-	X
600	-	X	X	-
1200	X	-	X	X
1800	X	-	X	-
2400	-	X	X	X
4800	X	-	-	X
9600	X	-	-	-

1-40004

Note: X equals the OPEN position on the selectors

Table 6-1 BAUD RATE SETTINGS, TCX-128

SWITCH S3								
8	7	6	5	4	3	2	1	
				X	X	X	X	Not Used
			C					Baud Rate
		O						1 Stop Bit
		C						2 Stop Bits
	O							Parity Even
	C							Parity Odd
O								Parity Enable
C								Parity Disable

Bit Number O = Open X = Don't Care
C = Closed

1-40005

Table 6-2 DATA FORMAT SWITCH (S3) SETTINGS, TCX-128

Operators & DSS

4.05 To program Operators and DSS, press the 'O' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for Operators and DSS:

OPERATOR 1 IS .....301__
DSS OPERATOR 1 IS .....NONE__
ALTERNATE OPERATOR 1 IS .....NONE__
OPERATOR 2 IS .....NONE__
DSS OPERATOR 2 IS .....NONE__
ALTERNATE OPERATOR 2 IS .....NONE__
OPERATOR 3 IS .....NONE__
DSS OPERATOR 3 IS .....NONE__
ALTERNATE OPERATOR 3 IS .....NONE__
OPERATOR 4 IS .....NONE__
DSS OPERATOR 4 IS .....NONE__
ALTERNATE OPERATOR 4 IS .....NONE__
OPERATOR 5 IS .....NONE__
DSS OPERATOR 5 IS .....NONE__
ALTERNATE OPERATOR 5 IS .....NONE__
OPERATOR 6 IS .....NONE__
DSS OPERATOR 6 IS .....NONE__
ALTERNATE OPERATOR 6 IS .....NONE__

Timers

4.06 To program Timers, press the 'M' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for Timers:

HOLD RECALL TIMER . (SEC).....060__
ORBIT RECALL TIMER . (SEC).....060__
PAUSE TIME-OUT . (SEC).....006__
FLASH TIMER . (N*50MSEC).....020__
DIAL TONE TIME-OUT . (SEC).....002__
SMDR TIMER . (SEC).....030__
TRANS RECALL . (SEC).....120__

Least Cost Routing

4.07 To program Least Cost Routing (LCR), press the 'L' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for LCR:

LCR ENABLED....NO__

To enable LCR, press the 'Y' key, then press RETURN.

The following prompts only appear if LCR is enabled.

LCR SERVICE # 01
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 02
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 03
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 04
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 05
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 06
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 07
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 08
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 09
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__
LCR SERVICE # 10
LINE GROUP.....__77__
OCC DIALUP SYS BIN..__00__
FX SERVICE/OTHER..1/0..__00__

NOTE: If a rate chip is installed for cost display and LCR is not installed, disable LCR after programming the line groups.

Relays Control

4.08 To program Relays Control, press the 'R' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for Relays Control:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	NIGHT	ALLP	ANYP			NRNGR	ZPAGE	RINGR

RELAY #1 CONTROL.....00__
RELAY #2 CONTROL.....00__
RELAY #3 CONTROL.....00__
RELAY #4 CONTROL.....00__

CO Groups

4.09 To program CO Groups, press the 'G' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for CO Groups:

LINE..01..GROUP IS.....01__
LINE..02..GROUP IS.....01__
LINE..03..GROUP IS.....01__
LINE..04..GROUP IS.....01__
LINE..05..GROUP IS.....01__
LINE..06..GROUP IS.....01__
LINE..07..GROUP IS.....01__
LINE..08..GROUP IS.....01__
LINE..09..GROUP IS.....02__
LINE..10..GROUP IS.....02__
LINE..11..GROUP IS.....02__
LINE..12..GROUP IS.....02__
LINE..13..GROUP IS.....02__
LINE..14..GROUP IS.....02__
LINE..15..GROUP IS.....02__
LINE..16..GROUP IS.....02__
LINE..17..GROUP IS.....03__
LINE..18..GROUP IS.....03__
LINE..19..GROUP IS.....03__
LINE..20..GROUP IS.....03__
LINE..21..GROUP IS.....03__
LINE..22..GROUP IS.....03__
LINE..23..GROUP IS.....03__
LINE..24..GROUP IS.....03__
LINE..25..GROUP IS.....77__
LINE..26..GROUP IS.....77__
LINE..27..GROUP IS.....77__
LINE..28..GROUP IS.....77__
LINE..29..GROUP IS.....77__
LINE..30..GROUP IS.....77__
LINE..31..GROUP IS.....77__
LINE..32..GROUP IS.....77__

CO Type

4.10 To program CO Types, press the 'P' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for CO Type:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	IN	PBX	PIT					

LINE..01..TYPE IS.....01__
LINE..02..TYPE IS.....01__
LINE..03..TYPE IS.....01__
LINE..04..TYPE IS.....01__
LINE..05..TYPE IS.....01__
LINE..06..TYPE IS.....01__
LINE..07..TYPE IS.....01__
LINE..08..TYPE IS.....01__
LINE..09..TYPE IS.....01__
LINE..10..TYPE IS.....01__
LINE..11..TYPE IS.....01__
LINE..12..TYPE IS.....01__
LINE..13..TYPE IS.....01__

LINE..14..TYPE IS.....01__
LINE..15..TYPE IS.....01__
LINE..16..TYPE IS.....01__
LINE..17..TYPE IS.....01__
LINE..18..TYPE IS.....01__
LINE..19..TYPE IS.....01__
LINE..20..TYPE IS.....01__
LINE..21..TYPE IS.....01__
LINE..22..TYPE IS.....01__
LINE..23..TYPE IS.....01__
LINE..24..TYPE IS.....01__
LINE..25..TYPE IS.....01__
LINE..26..TYPE IS.....01__
LINE..27..TYPE IS.....01__
LINE..28..TYPE IS.....01__
LINE..29..TYPE IS.....01__
LINE..30..TYPE IS.....01__
LINE..31..TYPE IS.....01__
LINE..32..TYPE IS.....01__

Office Code Types

4.11 To program Office Code Types, press the 'A' key. The system prompts:

0 : 10-11 DIGITS TOLL
1 : TOLL IF 1-NNN..., OTHERWISE LOCAL
2 : LOCAL 3-4 DIGITS
3 : LOCAL 7-8 DIGITS
4 : SPECIAL 1NN PREFIX

ENTER EXCHANGE...(NNN).__
000__

- *Use Table 4-5 and enter the first 3-digit exchange to be assigned an office code type.*
- *Press the RETURN key, the system prompts:*

UP TO AND INCLUDE.....__
000__

- *Use Table 4-5 and enter the last 3-digit exchange in a series of consecutive exchanges to be assigned the same type.*
- *Press the RETURN key, the system prompts:*

EXCHANGE TYPE IS.....__01__

- *Use Table 4-5 and enter the 2-digit office code type assigned to the exchange(s) just entered.*
- *Press the RETURN key, the system prompts to program another group of consecutive exchanges.*

Prompts for Office Code Types continue until exchange 999 is entered or the Q key is pressed.

COS Allowed Area Codes

4.12 To program COS Allowed Area Codes, press the 'K' key. The system prompts:

ALLOWED COS FOR OFFICE CODE.

BIT NUMBER	7	6	5	4	3	2	1	0
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON

ENTER EXCHANGE..., (NNN).__
000__

- *Use Table 4-6 and enter the first 3-digit area code to be assigned a code.*
- *Press the RETURN key, the system prompts:*

UP TO AND INCLUDE .....__
000__

- *Use Table 4-6 and enter the last 3-digit area code in a series of consecutive area codes to be assigned the same Hex code.*
- *Press the RETURN key, the system prompts:*

COS RECORDED/NEW....__01__

- *Use Table 4-6 and enter the HEX code for the COS to be assigned to the area code(s) just entered.*
- *Press the RETURN key, the system prompts to program another group of consecutive area codes.*

Prompts for COS Allowed Area Codes continue until exchange 999 is entered or the Q key is pressed.

External Outputs

4.13 To program External Outputs, press the 'E' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for External Outputs:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	NIGHT	BGM	PAGE			PG D2	ON	C OFF

OUTPUT..01..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..02..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..03..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..04..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..05..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..06..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..07..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__
OUTPUT..08..CONTROL IS...20__
ALTERNATE AUDIO PORT IS..NONE__

Out Keys Groups

4.14 To program Out Keys Groups, press the 'N' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts and default values for Out Keys Groups:

OUTGOING KEYS FORMAT.
OUT__KEY # 01 SELECT GROUP # __01__
OUT__KEY # 02 SELECT GROUP # __01__
OUT__KEY # 03 SELECT GROUP # __02__
OUT__KEY # 04 SELECT GROUP # __02__
OUT__KEY # 05 SELECT GROUP # __03__
OUT__KEY # 06 SELECT GROUP # __03__

System Options

4.15 To program System Options, press the 'F' key. For each prompt:

- *Enter data from Table 4-4.*
- *Press the RETURN key.*

Prompts for System Options shown below continue, depending on how many options are programmed. Press the Q key to exit.

SYS OPTION EDIT
ENTER OPTION #..__1
OPTION ENABLED..01..YES__

Command List

4.16 To bring up the menu for System Features, press the '?' key while pressing the SHIFT key.

System Programming Complete

4.17 When all data for system features has been programmed:

- *Press the 'Q' key twice.*

STATIONS FEATURES

To program features for each extension:

- *Press the 'M' key for the program selection menu.*
- *Press the 'E' key, the system prompts:*

ENTER STATION NUMBER..

- *Press the RETURN key to program station 301 or enter the number of the station to be programmed.*
- *Enter data from Table 4-7 for each field pertaining to the extension being programmed.*
- *Repeat procedure until all extensions are programmed.*

To program another station:

- *Press the 'Q' key to access another extension number without stepping through all the fields.*

To program only a selected field for each extension:

- *Press the 'X' key at the field desired.*
- *Press the RETURN key.*

Each time the RETURN key is pressed, the next consecutive station appears with the selected field.

To program a selected field for non-consecutive extensions:

- *Press the 'Q' key and enter desired extension number.*

To select another field:

- *Press the 'Q' key twice.*
- *Re-enter program.*
- *Press the 'X' key at the selected field.*

Prompts for Stations Features:

PROGRAMMING STATION.....__

PORT NUMBER.....__
TYPE OF PHONE.....KEY
HOT-LINE KEY.....
CLASS OF SERVICE.....00__
CO AUDIBLE [01..08] IS.....FF__
CO AUDIBLE [09..16] IS.....FF__
CO AUDIBLE [17..24] IS.....FF__
CO AUDIBLE [25..32] IS.....FF__
CO ACCESS [01..08] IS.....FF__
CO ACCESS [09..16] IS.....FF__
CO ACCESS [17..24] IS.....FF__
CO ACCESS [25..32] IS.....FF__
RECEIVE ALL-PAGE.....YES__
BARGE IN ENABLED.....NO__
BLOCK BARGE ENABLED.....NO__
NIGHT RING ENABLED.....YES__
DIL OFF HOOK SIGNAL.....NO__
DIAL C.O. GROUP.....NO__
CAMP-ON ORIGINATE.....YES__
CAMP-ON RECEIVE.....YES__
PAGE ZONE RECEIVED.....__
PICK UP GROUP IS.....00__
PRIVATE LINE.....IS.....NONE__

Programming Complete

4.18 When all data for the system and extension features has been entered:

- *Press the 'Q' key twice to exit the programming mode.*
- *Press the reset switch (S1) on the CPU PCB to set the program (Figure 6-2).*

NOTE: When the reset switch is pressed all calls in progress are dropped. It is suggested that a page announcement be made which provides at least 3-minutes as a warning.

Table 6-3 ROM CHECK SUMS (BT15 X10), TCX-128

ROM	PROM	CHECK SUM	BEGINNING ADDRESS	ENDING ADDRESS
U-04	#1	4736	0000	1FFF
U-05	#2	85F9	2000	3FFF
U-06	#3	49A4	4000	5FFF
U-07	#4	504D	6000	7FFF
U-08	#5	B038	8000	9FFF
U-09	#6	E034	4000	BFFF
U-10	#7	C9D5	2000	3FFF
U-11	#8	A194	4000	5FFF
U-23	#9	73B9	C000	CFFF

5. READ ONLY MEMORY CHECK

5.01 The Central Processing Unit (B-CPU-B) PCB has ten Read Only Memory (ROM) integrated circuits containing the system program. Each ROM has an individual check sum to verify the program.

To verify the check sums for ROMs U4 through U9 (Table 6-3):

- *Press the M key, the program selection menu appears.*
- *Press the S key, the system features menu appears.*
- *Press the H key, the system prompts:*

DISPLAY/CHECKSUM
0=DO,1=D1,2=D__TC,3=D__AX,4=C__O,5=C__1,6=C__TC,7=C__AX..

- *Enter 4.*
- *Press the RETURN key, the system prompts:*

ADDR..

- *Enter starting address for ROM U4 (0000)*
- *Press the RETURN key, the system prompts:*

UP-TO.

- *Enter ending address for ROM U4 (1FFF)*
- *Press the RETURN key. The check sum for the ROM prints in approximately one minute.*
- *Press the Y key and the RETURN key to display each subsequent ROMs check sum (U5-U9).*

To verify the check sums for ROMs U-10 through U-11 (Table 6-3):

- *Press the Q to exit ROM check U-4 through U-9.*
- *Press the H key, the system prompts:*

0=DO,1=D1,2=D__TC,3=D__AX,4=C__O,5=C__1,6=C__TC,7=C__AX..

- *Enter 5.*
- *Press the RETURN key, the system prompts:*

ADDR..

- *Enter beginning address for ROM U-10 (2000)*
- *Press the RETURN key, the system prompts:*

UP-TO.

- *Enter ending address for ROM U-10 (3FFF)*
- *Press the RETURN key. The check sum for the ROM U-10 prints in approximately one minute.*
- *Press the Y key and the RETURN key to display the check sum for ROM U-11.*

To verify the check sums for ROM U-23 (Table 6-3):

- *Press the Q key to exit ROM check U-10 through U-11.*
- *Press the H key, the system prompts:*

0=DO,1=D1,2=D__TC,3=D__AX,4=C__O,5=C__1,6=C__TC,7=C__AX..

- *Enter 4.*
- *Press the RETURN key, the system prompts:*

ADDR..

- *Enter beginning address for ROM U-23 (C000)*
- *Press the RETURN key, the system prompts:*

UP-TO.

- *Enter ending address for ROM U-23 (CFFF)*
- *Press the RETURN key, the check sum for ROM U-23 prints in approximately one minute.*

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 7, OPERATIONAL TEST & FAULT LOCATION

1. INTRODUCTION

1.01 The OPERATIONAL TEST AND FAULT LOCATION section contains information and instructions to test the TCX-128 system. It contains an operational checklist to test the system under operating conditions and a fault analysis table of common system faults.

1.02 Major revisions to this section included correcting the CPU slot assignments in Table 7-1.

2. OPERATIONAL TEST

2.01 Table 7-1, Operational Tests, lists tests for the TCX-128 system to verify system operation under normal operating conditions.

2.02 The operational test checklist includes a power supply test, a visual check of PCB LEDs, and operational system and extension tests. Extensions should be tested for options noted on the Option Configuration Worksheet, using the appropriate user's guide.

3. FAULT LOCATION

3.01 Table 7-2, Fault Analysis, provides information on system faults and fault location. It lists common system faults, fault locations and recommendations for fault repair.

3.02 PCB faults are indicated by LEDs. These LEDs indicate a failing PCB or a missing voltage level. Each PCB is fuse protected. Test points are provided on each board for checking voltage levels. Fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field. Refer to the individual PCB layouts in Section 5 of this manual. A pinout diagram of the Power Supply Output plug, with voltage readings is provided in Figure 7-1.

Service Telephone Connection

3.03 Provisions have been made to connect a service telephone for troubleshooting. To connect a service telephone:

- *Strap J20 to J21 (Figure 7-2).*
- *Connect the service telephone to J19 (Figure 7-2).*

J20 is normally connected to J22.

Table 7-1 OPERATIONAL TEST, TCX-128

ELECTRICAL VOLTAGE TEST

The electrical voltages for the TCX-128B system are shown below. The voltages should be tested with a digital voltmeter having an accuracy better than 1%.

Voltage Type	Voltage Readings	Test Condition	Test Point Location
1. Power Supply			
+ 5	+4.75 to +5.50 VDC	1 Station card	SCU PCB. Any station slot.
+24	+24.3 to +25.0 VDC		
−24	−24.3 to −25.0 VDC		

NOTE: If any of the VOLTAGES are not present after completing test 1, ***DO NOT*** install any additional cards. Refer to pinout diagram (Figure 7-1) for testing of power supply voltages.

2. SCU PCB Voltages			
+ 5	+4.75 to +5.25 VDC	All cards and phones	SCU PCB in slot J7.
+24	+24.3 to +25.0 VDC		
3. CPU Voltage			
+ 5	+4.75 to 5.25 VDC	All cards and phones	CPU PCB in slot J17.

Visual Indication

LEDs on PCB	Refer to PCB figures in Section 5 for LED location.

SYSTEM TEST

The following system tests should be performed from the attendant's telephone.

Internal dial tone
CO line dial tone
Paging - All Call and Zone

Check out each CO line. Use any telephone in the system to:

- Access each CO line and listen for dial tone.

Test each feature using the appropriate user's guide.

EXTENSION TEST

The following tests are performed to verify that each station is functioning properly.

Programming Options Test

Test each extension for its assigned programming options listed on the Option Configuration Worksheet in Section 3.

Features Test

Test each feature using the appropriate user's guide.

T-4023A

Table 7-2 FAULT ANALYSIS, TCX-128 (Page 1 of 2)

NOTE: Turn off all power before removing or replacing PCBs.

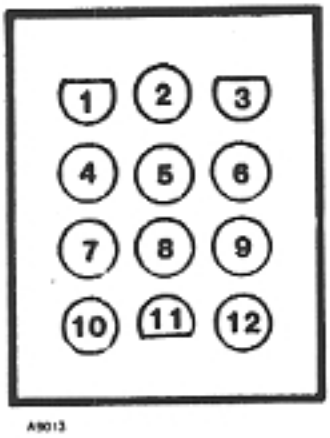
Fault	Reason	Recommendation	Fault Location
Intermittent or delayed dial tone.	All DTMF Receivers busy due to heavy traffic. Telephone could be restricted.	Add additional DTMF receivers.	
Unable to program B-CPU-B PCB.	Incorrect baud rate match. Acoustic coupler disable on Texas Instrument Terminal 700 models.	Set baud rate switches properly. Remove jumpers for E401, 402 and 403 on Texas Instruments Terminal PCB.	KSU; B-CPU-B PCB. Texas Instruments PCB; (located inside T.I. terminal).
Unable to access CO line group from operator's station.	Defective B-4COU-A PCB or incorrect or incomplete programming.	Replace defective B-4COU-A PCB. Busy out unused lines.	KSU; B-4COU-A PCB
CPU does not reset B-8SCU-C and B-8SLU-B PCBs	Defective B-8SCU-C or B-8SLU-B PCB.	Power down. Remove all PCBs. Install the B-CPU-B PCB and B-8SCU-C or B-8SLU-B PCBs. Power up. If CPU resets station PCB, power down and repeat procedure for each station PCB until defective PCB is found. If problem still exists replace CPU PCB.	KSU; B-8SCU-C or B-8SLU-B PCB. KSU; B-CPU-B PCB.
Crosstalk on CO/INT or PAGE.	Defective B-TGU-B or no B-TGU-B PCB in second slot (required with expansion cabinet).	Replace B-TGU-B PCB or insert a B-TGU-B or B-AUX-A PCB in second tone generator slot.	KSU; B-TGU-B PCB
Unable to program individual memory numbers (LEDs flash after 4 digits entered).	Defective B-TGU-B or B-CPU-A PCB. Extensions 51-128 do not have memory programming.	Replace B-TGU-B PCB.	KSU; B-TGU-B PCB.
SMDR prints alpha characters instead of numbers.	Defective B-CPU-B PCB.	Replace B-CPU-B PCB.	KSU; B-CPU-B PCB.
LEDs flash on extension telephone for associated B-8SCU-C or B-8SLU-B PCBs.	Defective B-8SCU-C or B-8SLU-B PCBs or B-CPU-B PCB.	Replace defective B-8SCU-C or B-8SLU-B PCBs.	KSU; B-8SCU-C or B-8SLU-B PCBs.
Fluctuating Brightness display on display telephone.	Wrong handset installed. Handsets for display telephones are not interchangeable with those for non-display telephones.	Install proper handset. Look into transmitter. Display handsets appear "Silver Metalic." Other TCX handsets appear black.	Display Telephones
Low volume on paging	A 1 must be entered under page when programming external outputs, even if no external amplifiers will be connected.	Program a "1" under page when programming external outputs.	Program: Select "S" from main programming menu. Then select option "E" to go to external output programming.

Table 7-2 FAULT ANALYSIS, TCX-128 (Page 2 of 2)

NOTE: DO NOT ATTEMPT TO CHANGE PCB FUSES IN THE FIELD.

Fault	Reason	Recommendation	Fault Location
PCB FUSE FAILURES			
B-CPU-B PCB			
Unable to address through terminal.	Fuse 1.	Replace B-CPU-B PCB.	KSU; B-CPU-B PCB.
Constant ringing on all telephones. No LEDs light.	Fuse F2.	Replace B-CPU-B PCB.	KSU; B-CPU-B PCB.
Unable to address terminal.	Fuse F3.	Replace B-CPU-B PCB.	KSU; B-CPU-B PCB.
B-TGU-B PCB			
No dial tone (INT or Trunk). No audible tones.	Fuse F1	Replace B-TGU-B PCB	KSU; B-TGU-B PCB.
No INT dial tone. Unable to dial out on CO lines. Dial produces tones.	Fuse F2.	Replace B-TGU-B PCB	KSU; B-TGU-B PCB
B-8SCU-C PCB			
Extension LEDs flash. Extensions do not work. No power light on PCBs.	Fuse F1.	Replace B-8SCU-C PCB.	KSU; B-8SCU-C PCB.
Extension does not work. No LEDs on PCB. All telephones ring constantly.	Fuse F2.	Replace B-8SCU-C PCB.	KSU; B-8SCU-C PCB
Some LEDs flash, some remain steady. Telephones dead. All LEDs out on 4-Button telephones.	Fuse F3	Replace B-8SCU-C PCB.	KSU; B-8SCU-C PCB.
B-8SLU-B PCB			
No power. LEDs, Extension LEDs steady.	Fuse F1.	Replace B-8SLU-B PCB.	KSU; B-8SLU-B PCB.
Constant ringing on all telephones.	Fuse F2.	Replace B-8SLU-B PCB.	KSU; B-8SLU-B PCB.
B-4COU-A PCB			
No dial tone, no audio, unable to seize line; LED DS1 on B-4COU-B PCB edge off.	Fuse F1.	Replace B-4COU-A PCB.	KSU; B-4COU-A PCB.
No dial tone, DS1 on PCB edge off.	Fuse F2.	Replace B-4COU-A PCB.	KSU; B-4COU-A PCB.
No audio, unable to seize line; LED DS2 off.	Fuse F3.	Replace B-4COU-A PCB.	KSU; B-4COU-A PCB.

T-4024A



PIN 1 = -24VDC
PIN 2 = -24VDC
PIN 3 = Remote Shutdown Control
PIN 4 = +5VDC
PIN 5 = +5VDC
PIN 6 = +5VDC
PIN 7 = Chassis Ground
PIN 8 = +24VDC
PIN 9 = +24VDC
PIN 10 = + 5V RET
PIN 11 = + 5V RET
PIN 12 = +/-24VDC RET

Figure 7-1 POWER SUPPLY PLUG PIN-OUT DIAGRAM

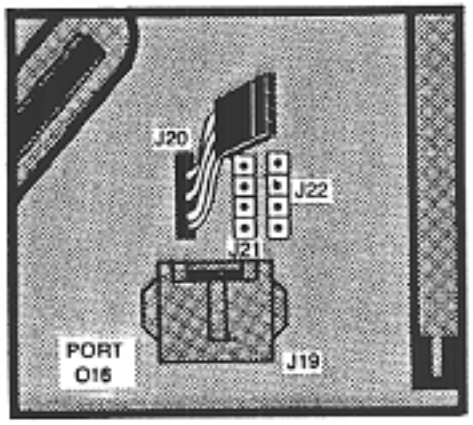


Figure 7-2 SERVICE TELEPHONE CONNECTION, TCX-128

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 8, MAINTENANCE

1. INTRODUCTION

1.01 The MAINTENANCE section contains information for maintaining the TCX-128 system. It consists of general maintenance information and a list of recommended spare parts.

1.02 No major revisions were made to this section in Issue 2-1.

2. MAINTENANCE

2.01 After the TCX-128 system is installed, it requires little or no maintenance. However, on occasion, the system can be checked in accordance with operational tests outlined in Section 7.

2.02 Maintenance consists of checking the KSU PCB status indicators and the connector cables, verifying that the installation area is dry and well ventilated, and dusting the KSU and power supply.

3. RECOMMENDED SPARE PARTS

3.01 A list of recommended spare parts for the TCX-128 system is provided in Table 8-1. The number of recommended spare parts for maintaining the TCX-128 system is based on 1-10 systems. As the number of system installations increase, the number of recommended spare parts will also increase.

Table 8-1 RECOMMENDED SPARE PARTS FOR 1 TO 10 SYSTEMS

SPARE PARTS	NUMBER TO BE STOCKED
Printed Circuit Boards	
Central Processing Unit B-CPU-B PCB	1-3
Tone Generator B-TGU-B PCB	1-2
Line B-4COU-B PCB	1-3
Station B-8SCU-C PCB	1-3
Single Line B-8SLU-B PCB	1-2
Auxiliary B-AUX-A PCB	1-2
Buffer B-BUF-A PCB	1-2
Equipment	
Power Supply	1
Telephones	3-12
KSU Power Fuses *	5 of each type
Key caps	1 dozen
Rubber feet	1 dozen
Line cords	6
Handset cords	6-12
Special tone devices for 2500 type phones	12 **

* NOTE: DO NOT CHANGE ANY FUSES LOCATED ON ANY PCB.
** Dependent upon number of 2500 type telephones in system.

T-4022C

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 9, OPTIONAL EQUIPMENT

1. INTRODUCTION

1.01 The OPTIONAL EQUIPMENT section provides information on the equipment, accessories and customer-supplied equipment which may be used with the TCX-128 system.

1.02 Major revisions to this section included correcting SMDR information on Tables 9-1 and 9-2.

2. EQUIPMENT ACCESSORIES

2.01 The following is a list of equipment accessories available for the TCX-128 system:

Address Tray
Tie Special Tone Ringer for 2500-type telephones (TIE P/N 86185)
Long cords for handset
Wall mounting kits

3. OPTIONAL FEATURES

3.01 Optional customer-provided equipment items may be required to configure the system in accordance with Section 3.

EXTERNAL RELAYS

3.02 Two relays are available on each Tone Generator PCB. They can be programmed to activate External Paging or Loud Ringing.

EXTERNAL PAGING

3.03 Customers with facilities which have large, noisy, open spaces may require external paging equipment: heavy duty speakers driven by auxiliary amplifiers.

3.04 Auxiliary amplifiers should have an input impedance of 600 ohms or a matching transformer to transform 600 ohms to the amplifiers input impedence. Amplifier capacity should not exceed speaker capacity or speaker may be damaged.

3.05 The KSU is equipped with paging contacts that can be programmed to close during paging (Section 6). Following are directions for using contacts that close when paging.

3.06 External page zone audio is available at the alternate audio ports programmed in Section 6. The audio outputs are accessed by cross connecting the "B" pairs of the alternate audio ports to the external amplifiers (Figure 9-1). The page relays may be used to switch the amplifier DC supplies, turning the amplifiers on and off, if required.

LOUD RINGING

3.07 Customers with large, noisy areas may require loud ring devices, such as bells, buzzers or loudspeaker horns, to call attention to incoming calls, especially during night hours.

Relay Contacts

3.08 When a call comes in, the relay contact closes, causing the loud ringing. The relay provided is a 1 amp, 30 VDC relay. A more powerful relay must be provided if required to operate the customer's loud ringing equipment.

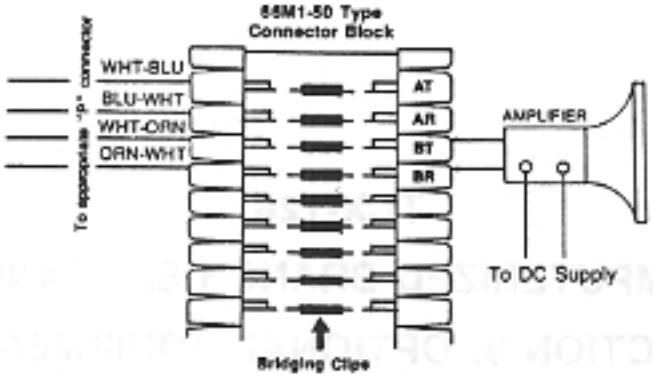


Figure 9-1 TYPICAL ALTERNATE AUDIO PORT CONNECTIONS, TCX-128

Programming Options

3.09 As with external paging, contacts can be programmed to be either open or closed when active. As explained in Section 6, PROGRAMMING, the continuous or interrupted operation of the relays can be altered through programming. The relays can be programmed to operate in day or night mode and can be controlled by either tenant in a two tenant system.

Equipment Required

3.10 The Loud Ringing Device must be either a bell with ringing generator, a buzzer with power supply or a loudspeaker horn. A more powerful relay must be supplied if required, as mentioned earlier.

Installation

3.11 To install the loud ringing equipment (Figure 9-2):

- *Verify that the appropriate leads in the 25 pair cable from the P8 connector are connected to the B1 block.*
- *If necessary, connect the leads from the bell or buzzer power supply to the B1 block.*
- *Install bridging clips.*
- *Install bell, buzzer or loudspeaker.*
- *Refer to Section 6, PROGRAMMING for the appropriate relay programming.*

BACKGROUND MUSIC AND MUSIC-ON-HOLD

3.12 Background Music and Music-on-Hold may be provided by any music source (AM/FM radio, cassette tape deck, or automatic turntable). The music source must have adjustable volume and an output of 600-2000 ohms.

Installation

3.13 The lower left portion of the KSU backplane (Figure 9-2) is equipped with RCA-type phono jacks; J23 and J24, and strapping pins: E1, E2, and E3. J24 is for Background Music. J23 is for Music-on-Hold. The strapping pins determine whether one or two music sources are installed.

3.14 To install the music source(s):

- *Connect the J23 and/or J24 jacks to the music source(s).*
- *Strap E1 and E2 if one source is used.*
- *Strap E2 and E3 if two sources are used.*
- *Listen to the music and adjust the volume on the Tone Generator PCB and the music source.*

STATION MESSAGE DETAIL RECORDER PRINTER

3.15 An SMDR printer whose data format is compatible with the TCX-128 may be used. The manufacturer of SMDR equipment can verify compatibility. The SMDR will record the following call data: start and stop times, extension and line used, number dialed, cost and account code. Table 9-1 is a sample SMDR printout. Table 9-2 presents the SMDR format.

Installation

3.16 The SMDR terminal is plugged into J28, the RS232C port in the KSU (Figure 9-3). Hardware (switch) adjustments should be made during installation of the B-CPU-B PCB (Section 5, INSTALLATION).

TELE-RECORD

3.17 The Tele-record SMDR computer can be used with the TCX-128 system to provide automatic call accounting. The Tele-record can compile and print seven unique reports:

Detailed Usage by Station
Summary Usage by Extension
Detailed Usage by Line
Detailed Usage by Account Code
Summary Usage by Line
Summary Usage by Account Code
Hardware Test and Storage

4. OPTIONAL EQUIPMENT

4.01 The following publications on optional equipment are included at the end of this section:

SPECIAL LOUD RINGING TONE BOARD TP01042
TCX-128 OFF PREMISES EXT. SUPPLEMENT TP00251
TELE-RECORD OPERATOR'S MANUAL TP01026

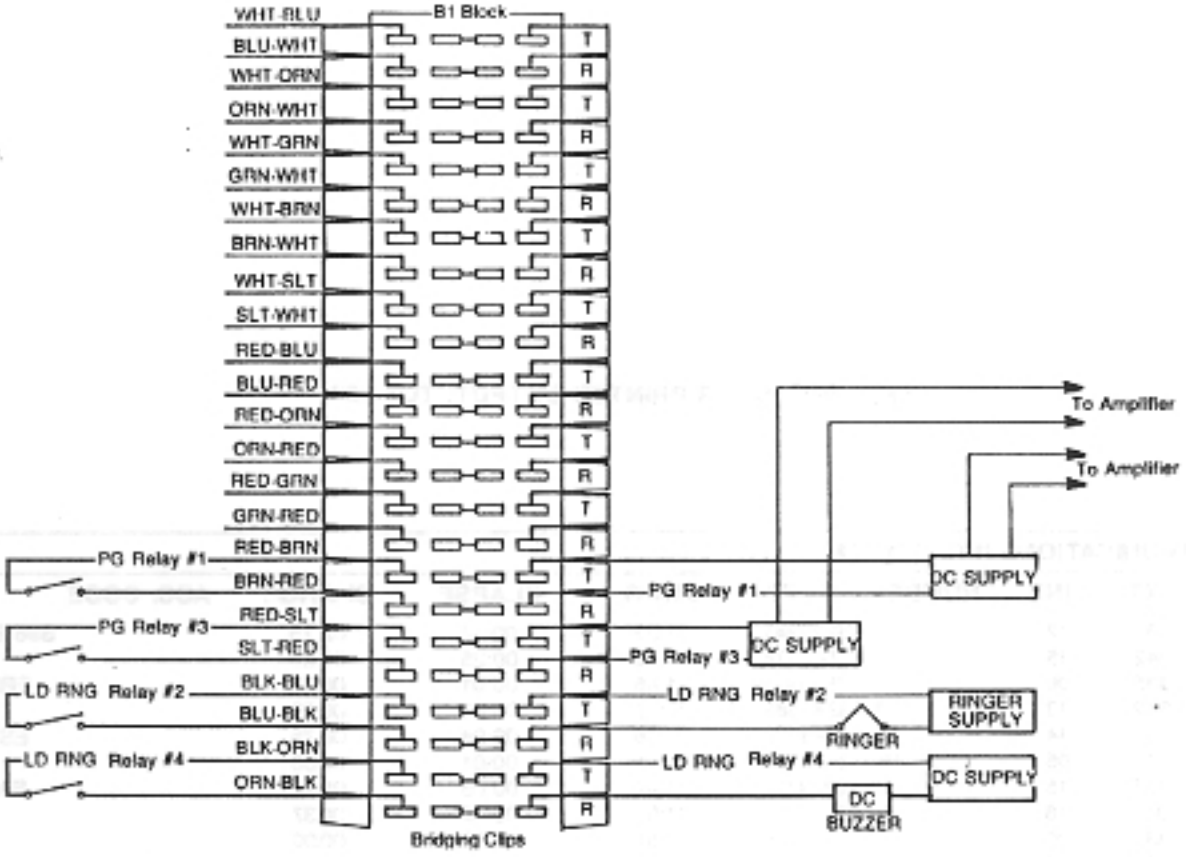


Figure 9-2 TYPICAL USE OF OPTIONAL EQUIPMENT, TCX-128

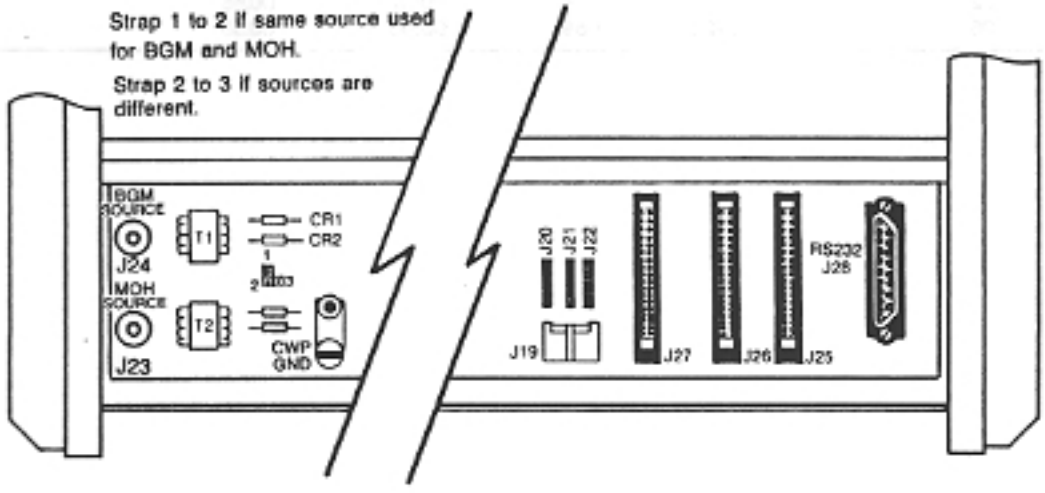


Figure 9-3 KSU CONNECTIONS FOR OPTIONAL EQUIPMENT, TCX-128

Table 9-1 SMDR PRINTER OUTPUT, TCX-128

TIE COMMUNICATIONS INC. TCX-128							
DATE	EXT	LINE	NUMBER DIALED	START	ELAPSE	CHARGE	ACC. CODE
05/03	336	12	12085223341	11:33	00:12	02.75	S98 ERD
05/03	342	15	14067211776	11:20	00:25	06.25	
05/03	335	06	7625914	11:46	00:01	00.00	ERD
05/03	342	13	16178245588	11:48	00:03	00.50	
05/03	341	14	13157895922	11:48	00:04	00.75	ESV
05/03	317	05	18002433552	11:51	00:01	00.00	
05/03	338	15	13172824121	11:47	00:05	01.25	E08
05/03	317	16	19297373	11:51	00:02	00.37	
05/03	339	05	5448855	11:51	00:02	00.00	
05/03	338	13	13176422662	11:54	00:01	00.25	
05/03	337	15	18133455391	11:52	00:04	00.75	
05/03	334	12	15135234880	11:54	00:02	00.25	
05/03	339	01	13841349	11:56	00:01	00.25	
05/03	347	04	5449512	11:56	00:02	00.00	
05/03	337	05	15720012	11:56	00:03	00.96	
05/03	301	06	2220885	11:48	00:11	00.00	
05/03	316	03	18009823055	11:57	00:04	00.00	
05/03	340	14	17175230808	11:53	00:09	02.25	
05/03	338	02	18699172	11:58	00:07	00.85	
05/03	324	06	13480423	11:59	00:05	00.55	

Table 9-2 FORMAT OF SMDR PRINTOUT, TCX-128

Delimiter Character: ASCII Code = 7C, Hex	
Except for header lines, each line consists of the following fields:	
CHARACTER	**FIELD**
1	Delimiter
2 - 6	Date (MM/DD) MM = Month DD = Date
7	Delimiter
8 - 12	Calling Sta. # (__XXX__) X = Digit, __ = Space
13	Delimiter
14 - 18	Trunk # (__XX__) X = Digit, __ = Space
19	Delimiter
20 - 35	Number Called, Left Justified in 16 Character Field
36	Delimiter
37 - 44	Start Time (__HH:MM__) HH = Hour, MM = Min, __ = Space
45	Delimiter
46 - 51	Call Duration (__HH:MM__) H = Hour, MM = Min., __ = Space
52	Delimiter
53 - 58	* Charge (__DD.CC) DD = Dollars, CC = Cents, __ = Space
59	Delimiter
60 - 68	Account Code, Left Justified in 9 Character Field
69	Delimiter
70-76	Speed Dial Bin No. (SSS/EEE) S = System Bin No. E = Station Bin No.
77	Delimiter
78	Carriage Return
79	Line Feed

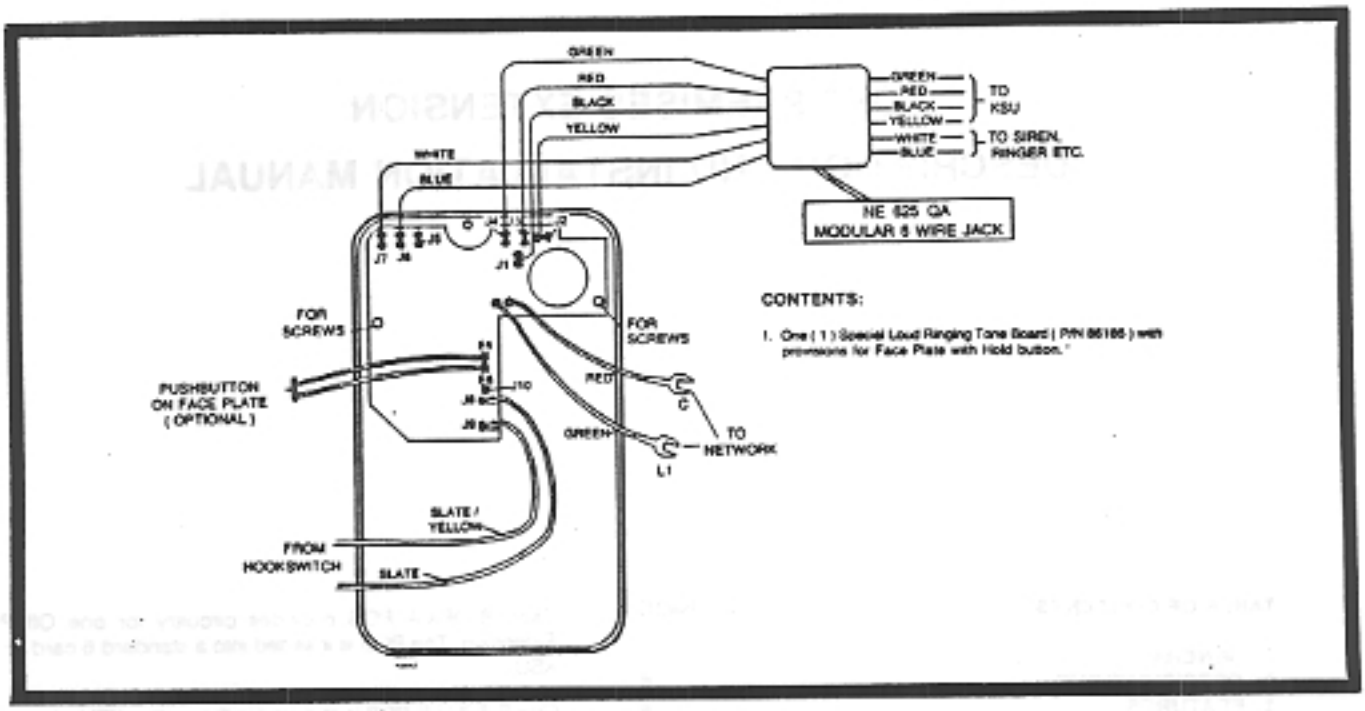
* Charge Field only valid if system includes rate option, otherwise Charge Field reads 00.00.

After each 21 lines of data, a sequence of 5 lines of header formatting are output, none of which begins with a delimiter, but which have delimiter characters within them. Only valid data records begin with a delimiter.

T4339

SPECIAL LOUD TONE RINGING BOARD AND HOLD BUTTON INSTALLATION INSTRUCTIONS FOR THE 2500 TYPE TELEPHONE

TP01042



INSTALLATION PROCEDURE:

1. Remove plastic cover of 2500 type telephone by loosening the two screws underneath the telephone.
2. Remove existing Face Plate from cover and replace with new one (optional).
3. Disconnect and remove existing Ringer Board by removing the two screws holding it in place.
4. Mount the TIE Special Loud Tone Ringing Board and tighten screws.
5. Connection of Wires:
   a. Connect GREEN, RED, BLACK, and YELLOW wires from NE 625 QA Modular 6 wire jack to Special Loud Ringing Board as follows:
      1. GREEN TO J4 CONNECTOR.
      2. RED TO J3 CONNECTOR.
      3. BLACK TO J1 CONNECTOR.
      4. YELLOW TO J2 CONNECTOR.
   b. Connect RED (E3) and GREEN (E4) wires coming from the Special Loud Tone Ringing Board to the telephone network as follows:
      1. RED TO C CONNECTOR.
      2. GREEN TO L1 CONNECTOR.

      NOTE: For ITT telephones using H20PG dials:
      1. RED TO L2 CONNECTOR.
      2. GREEN TO L1 CONNECTOR.
   c. Connect the SLATE and SLATE/YELLOW wires coming from the hookswitch to the Special Loud Tone Ringing Board as follows:
      1. SLATE TO J8 CONNECTOR. [2]
      2. SLATE/YELLOW TO J9 CONNECTOR.
      3. Disconnect SLATE/WHITE and SLATE/BROWN wires and tape ends.

      NOTE: For ITT telephones using H20PG dials:
      1. SLATE TO J9 CONNECTOR.
      2. SLATE/YELLOW TO J8 CONNECTOR. [2]
      3. Disconnect SLATE/BROWN wire and tape ends.
      4. Connect a jumper from 2 position terminal on dial to L2 on network.
6. Connection of the Hold button for HLD/TRF function (optional if installed on the Face Plate).
   a. Connect the Berg Header from the Hold button to the Berg Pin at E5 and E6 on the Loud Ringing Board.
7. Connection of Loud Ringing devices to the DRY RELAY CONTACT CLOSURE (if required).
   a. Connect WHITE and BLUE wires from the NE 625 QA Modular 6 wire jack to the Special Loud Tone Ringing Board as follows:
      1. WHITE TO J7 CONNECTOR.
      2. BLUE TO J6 CONNECTOR.
8. Replace plastic cover.

[1] Face Plate with Hold button is available from local telephone equipment supply houses.

[2] If optional face plate with pushbutton is not used, connect wire to J10.

TIE/communications, Inc.

OFF PREMISES EXTENSION
DESCRIPTION AND INSTALLATION MANUAL

TABLE OF CONTENTS PAGE

1. GENERAL

1.01 The Off Premises Extension (OPX) Adaptor Printed Circuit Board (PCB), B-OBX-A, enables a Class C OPX line supplied by the local telephone company to be connected to a TCX-128, EK-1648, EK-1232 and EK-818 system via a port on the B-8SLU-B PCB. This adaptor meets the requirements defined in FCC Facility Interface Code OL13C and EIA Specification 464-1. A telephone in a distant location connected to the system via the OPX Interface Circuit, will have access to all system features available to single line telephones. The B-OPX-A PCB requires ancillary equipment and additional connections.

1.02 The OPX equipment installed in a system can also be used to enhance the performance of a single line telephone assigned as an On Premises Extension (ONX). A single line telephone, assigned as an ONX, does not need to be modified with a TIE Electronic Tone Ringer.

NOTE: The OPX must be installed by a certified technician.

Required Equipment

1.03 An OPX interface requires additional connections and the following equipment: B-OPX-A PCB, B-8SLU-B PCB, a 48V Power Supply, Ringing Generator and a 13 Card Key Service Unit (KSU) or a 6 Card KSU. The recommended units are the Tellabs 48V Power Supply, the Tellabs Ringing Generator and the ITT 13 Card KSU or the ITT 6 Card KSU. The 13 Card KSU allows for future expansion and is recommended for systems which may require tielines at a later date.

Each B-OPX-A PCB provides circuitry for one Off Premises Extension. The PCB is inserted into a standard 6 card or 13 Card KSU.

One B-8SLU-B PCB is required in the system KSU when an OPX is installed in the system. An B-8SLU-B PCB can serve up to 8 OPXs.

6 Card KSU and Power Supply

1.04 The 6 Card KSU is designed for wall mounting and holds a maximum of 6 B-OPX-A PCBs. These boards are inserted into the hinged shelf or rack (Figure 1). The 48V Power Supply and Ringing Generator are mounted inside the KSU cabinet (Figure 2). The shelf containing the PCBs is hinged so that it can be opened to provide access to two 50-pin connecting blocks. One block is split.

Functions of the connecting blocks when installing an OPX are as follows:

Block A--Contains connections from the B-8SLU-B PCB to the OPX extensions.

Block B--Contains internal wiring of the 6 Card KSU and requires no additional wiring.

Block C--Contains connections from the 48V Power Supply and Ringing Generator. Provides connections for telco lines.

13 Card KSU and Power Supply

1.05 The 13 Card KSU is designed for wall mounting. Eight of the 13 card positions can be used for B-OPX-A PCBs (Figure 3). Remaining positions can be used to accommodate future teline applications. The 13 Card KSU is similar to the 6 Card KSU in that the Power Supply and Ringing Generator are mounted on the shelf (Figure 4). The 13 Card KSU contains four 50 pin plugs located on the back of the unit and a terminal block located on the front.

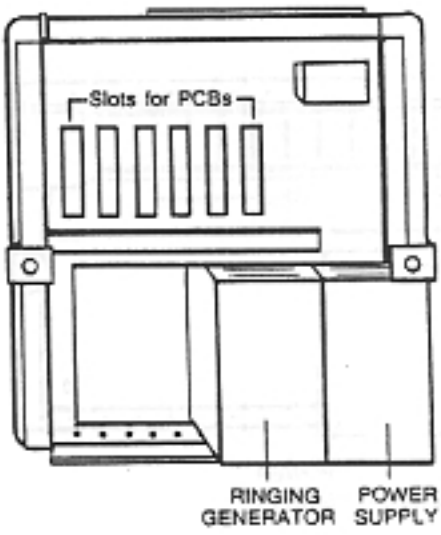


Figure 1 6 CARD KSU OUTSIDE VIEW

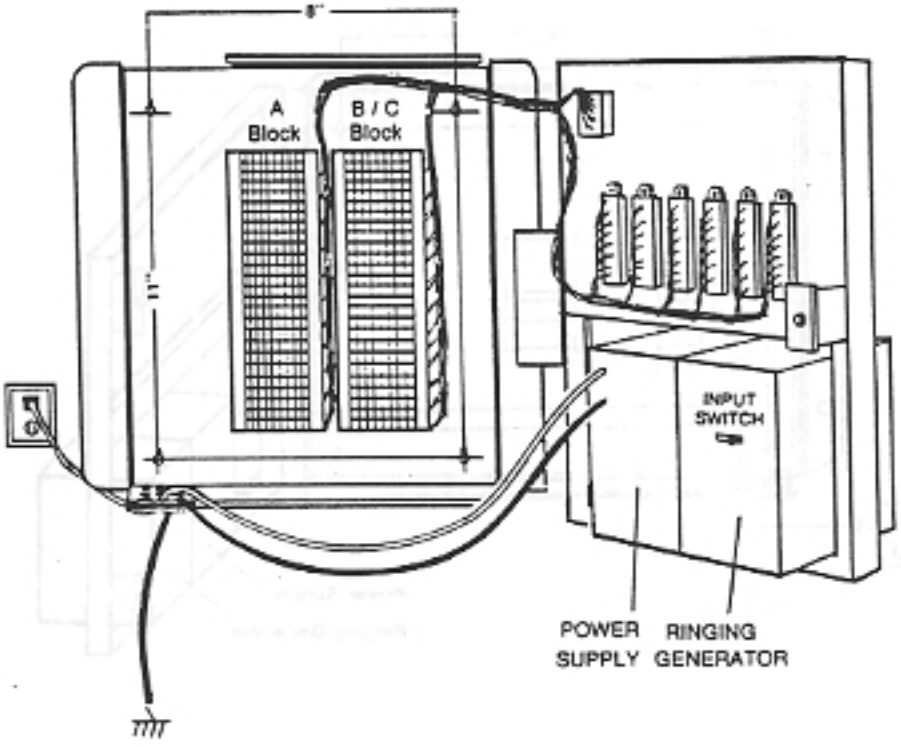


Figure 2 6 CARD KSU WITH HINGED SHELF OPENED

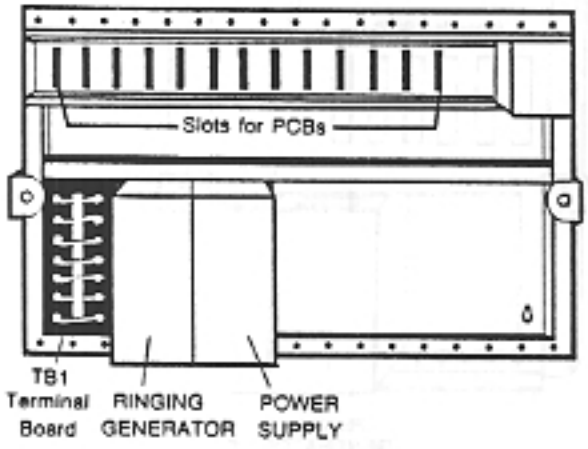


Figure 3 13 CARD KSU OUTSIDE VIEW

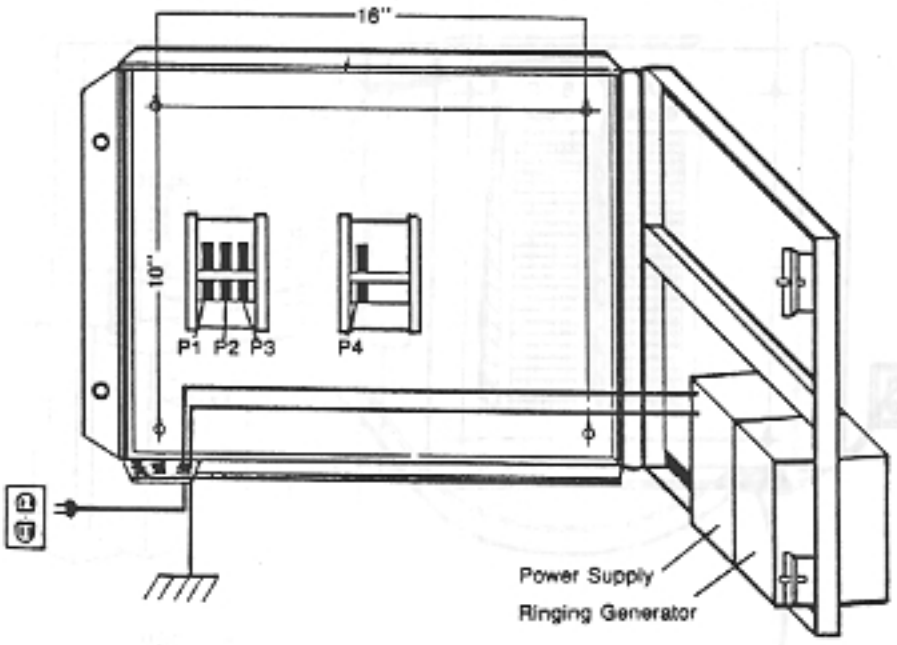


Figure 4 13 CARD KSU WITH HINGED SHELF OPENED

Assignments of the plugs when installing an OPX are as follows:

Plugs 1 & 2--Used for connections from the B-8SLU-B PCB to the OPX extensions and from the OPX extensions to the telco lines.

Plug 3-- Contains internal wiring and requires no additional wiring.

Plug 4-- Provides connections for Power Supply and ground to each station.

2. SPECIFICATIONS

2.01 Refer to Table 1 for technical specifications pertaining to the OPX.

3. FEATURES

3.01 The following paragraphs provide information on the features that are available to a single line telephone used as an OPX. Each feature paragraph provides a description of the feature. Table 2 shows the features that are available in each system. Instruction for use of the feature is contained in the appropriate system single line User's Guide. The following features are available:

Account Code
Barge-In
Call Waiting
Central Office Call, Incoming
Central Office Call, Outgoing
Conference
Directed Call Pick-Up
Group Pick-Up
Hold
Intercom
Last Number Redial
Paging
Park
Speed Dial
Split
Toll Restriction
Transfer
Universal Night Answer

ACCOUNT CODE

3.02 If the system has been installed with a customer supplied printer, a record of all calls may be kept by assigning account codes of up to nine digits. Account codes are assigned at the telephone from which the call is being placed. This feature is available from all telephones in the system.

BARGE-IN

3.03 Barge-In is a system programmable feature that permits designated extensions to override the system privacy on other specified extensions. When this feature is invoked, the conversation in progress receives a Barge-In signal (splash tones) followed by a delay, and then the voice of the extension user who is barging-in. Extensions can be programmed individually to block Barge-In. Unless the call is terminated, only the party initiating the Barge-In can release the Barge-In status.

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE-IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

CALL WAITING

3.04 Call Waiting is a system programmable feature which provides a busy station with an audible and visual indication that a call is waiting to be answered. The entire system may be programmed to allow or disallow Call Waiting signals. However, if signaling is allowed on a system wide basis it may still be disallowed on a station wide basis. All programming for this feature is done during installation.

CENTRAL OFFICE CALL, INCOMING

3.05 Central Office Call, Incoming is a system programmable feature. Incoming calls can be answered from any extension programmed to receive calls. Incoming CO calls provide a distinctive tone signal at the extension.

CENTRAL OFFICE CALL, OUTGOING

3.06 Outside calls can be initiated from any extension provided that the extension's Class of Service (COS) does not restrict the outgoing call. This is a system programmable feature.

CONFERENCE

3.07 Conference Call is a permanent feature that permits a three-way telephone conversation. The Off-Premises Extension cannot initiate conference calls; however, these telephones can be included in conference calls initiated by other key telephones.

DIRECTED CALL PICK UP

3.08 Directed Call Pick Up is a permanent feature that permits a transferred CO call to be answered at an extension near the extension to which the call is being transferred. The call can be answered at the OPX telephone. If the call is unanswered, it will automatically revert to the attendant.

GROUP PICK UP

3.09 Group Pick Up is a system programmable feature. It permits an incoming CO line call to be answered from any extension within a selected pickup group, including the Off-Premises Extension. Multiple pickup groups can be established in the system; however, each extension can belong to only one group. Each extension in a pickup group may be individually programmed to receive ringing for a call directed to its group.

Table 1 OPX SPECIFICATIONS

OPX Capacity:
Single line telephone as OPX 8
Maximum Line Loss - 1300 ohms

Tellabs 8102 Ringing Generator:
Input voltage: 22 - 26VDC or 44 - 56VDC, switch selectable. Set switch to 48V position.
Input current at 48VDC: 75mA idle, 250mA full load (48VDC is used with the OPX.
Output: 85 - 135 VAC, 5 Watts maximum
Ring Equivalence: Up to 5 high impedance ringers simultaneously.
Fusing: Input to ringing generator: 1 amp slow-blow cartridge type (Bussman 3AG or equivalent)
Polarity: Floating output may be biased positively or negatively
Dimensions and Weight:
3" W × 7" H × 7" D (18cm × 7cm × 18cm) 5lbs. (3 kg).
Operating Environment:
20 - 130° F (−7 - 54° C), humidity −95%, non condensing.
Part number: 5W 8102.

Power Supply:
Tellabs 8001 Power Supply.
Input voltage range:
105 - 130VAC rms, 57 - 63Hz, single phase.
Output: 24 or 48VDC, switchable, 1 ampere maximum current. Set switch to 48V position.
Regulation: +1.0 or −1.0 volt, no load to full load, low line to high line.
Ripple: 2mV RMS typical: 5mV RMS maximum, measured at full load and low line voltage.
Output protection: Current / voltage foldback, activated at approximately 1 2 amperes output current.
Short circuit protection: Will tolerate output short circuit of any duration.
Polarity: Either positive or negative output terminal can be referenced to ground.
Fusing: Line fuse, 1 5 ampere.
Operating Environment: 20-120° F (−7 - 49° C) no load to full load, low line to high line (humidity to 95%, non condensing).
Dimensions and Weight:
3" W × 7" H × 7" D (18cm × 7cm × 18cm).
Approximately 7 lbs.
Part Number: 1A-8001.

KSUs:
Dimensions:
6 Card KSU:
13" W × 16" H × 11" D (33cm × 41cm × 30cm).
13 Card KSU:
25" W × 16" H × 11" D (64cm × 41cm × 30cm).
Part Numbers: ITT 6 Card KSU: 501A00-101
ITT 13 Card KSU: 512A00-101

Table 2 OPX FEATURES

FEATURE	TCX-128	EK-1648	EK-1232	EK-818
Account Code	X	X	X	X
Barge-In	X	–	X	X
Call Waiting	–	X	–	X
Central Office Call, Incoming	X	X	X	X
Central Office Call, Outgoing	X	X	X	X
Conference	X	X	X	X
Directed Call Pick-Up	X	–	X	–
Group Pick-Up	X	–	X	–
Hold	X	X	X	X
Intercom	X	X	X	X
Last Number Redial	X	X	X	X
Paging	X	X	X	X
Park	X	–	X	–
Speed Dial	X	X	X	X
Split	X	–	X	–
Toll Restriction	X	X	X	X
Transfer	X	X	X	X
Universal Night Answer	X	X	X	X

X: Indicates system has feature.
–: Indicates system does not have feature.

HOLD

3.11 Hold is a permanent feature for placing a call in a temporary waiting condition. If the call is left on hold longer than the programmed period, the call will ring again at the extension.

INTERCOM

3.11 Intercom (ICM) is a system programmable feature. Intercom (internal) calls can be initiated from any extension in the system. If the extension being called is a key telephone, the called party can respond Handsfree. If the called party has a 2500 type single line telephone, the handset must be lifted for response. On ICM calls from single line telephones, the called extension will receive a distinctive ICM ring tone.

LAST NUMBER REDIAL

3.12 Last Number Redial is a permanent feature available to all extensions capable of placing outside calls. This feature stores the last manually dialed outside telephone number to be automatically redialed at a later time. The number is held in memory regardless of whether the call was answered or not answered (not picked up or busy).

PAGING

3.13 Paging is a system programmable feature. There are two types of Paging: ***All Call Paging*** and ***Zone Paging.***

All Call Paging

3.14 All Call Paging is broadcast over all extensions in the system except those extensions programmed not to receive page announcements. All Call Paging may be initiated from any of the telephones in the system. Off-Premises Extensions cannot receive All Call Paging. Optional external amplifiers and speakers can also be connected to each zone for page broadcasts.

Zone Paging

3.15 Zone Paging provides paging to groups of extensions. Multibutton telephones may receive paging via the speakerphone. Off-Premises Extensions cannot receive Zone Paging; however, they can initiate Zone Page.

PARK

3.16 You can park an outside call, page a third person and have that person pick up the parked call from any extension in the system. There are two types of parking orbits: ***General Park Orbit*** and ***Personal Park Orbit.*** This is a permanent feature on all telephones used in the system.

General Park Orbit

3.17 General Park Orbit provides access to parked calls from any extension in the system. A call is retrieved from a General Park Orbit by dialing designated codes.

Personal Park Orbit

3.18 Personal Park Orbit provides access to calls that are parked at a particular extension. These calls can be answered at any other extension by dialing the extension number of the extension where the call is parked.

SPEED DIAL

3.19 Speed Dial is a programmable feature that permits automatic dialing of stored telephone numbers. There are two types of Speed Dial. System Speed Dial and Extension Speed Dial. Extension Class of Service and Toll Restriction programming can deny or limit Speed Dial for a particular extension.

3.20 Extensions can store frequently dialed numbers as Extension Speed Dial numbers. The attendant can store frequently dialed numbers as System Speed Dial numbers. System Speed Dial numbers are available to every extension in the system.

SPLIT

3.21 Split is a permanent feature that allows an extension user to place a call on hold and answer a second incoming call. Using the Split feature the user can alternate between the two calls. This feature may be accessed on all telephones used in the system.

TOLL RESTRICTION

3.22 Toll Restriction is a programmable feature that prohibits selected extensions from placing unauthorized long distance (toll) calls. Extensions can be restricted to internal calls, local calls, Speed Dial, or selected area codes depending on the Class of Service designated for that line and / or extension.

TRANSFER

3.23 Transfer is a permanent feature that transfers an established outside call to a different extension. Calls may be transferred unscreened (unannounced) or screened (announced). Transferred calls that are unanswered return to the attendant after a programmable period of time.

UNIVERSAL NIGHT ANSWER

3.24 The NIGHT key on the Attendant Multibutton Key Telephone is used during off hours to put the system in the Universal Night Answer (UNA) mode. In this mode telephones and optional external page systems, so programmed during installation, can receive indications of incoming calls. The ability to put the system into the UNA mode is available at the attendant's extension only.

3.25 Off-Premises Extensions (2500 type single line telephones) can answer Night Ringing heard over the paging system. When more than one incoming CO line is ringing, while the system is in the Universal Night Answer mode, these telephones will automatically access the first incoming call.

NOTE: The incoming CO lines which will ring at all extensions in the Universal Night Answer mode are programmed individually. This allows special lines, such as Direct Inward Lines (DILS) or Private Lines to ring only at selected extensions as they do when the system is in the normal daytime mode. These special lines will not ring over the paging circuit.

4. INSTALLATION

Preparation

4.01 The following paragraphs provide instructions for connecting the OPX to the system equipment. It is recommended that the 6 Card and 13 Card KSU be mounted on a separate mounting board to the left of the system equipment and near a separate 115VAC, 15 amp outlet (Figures 5a and b). The maximum line loss for the OPX is 1300 ohms.

4.02 Before proceeding with the installation, have the necessary hardware and cables available. This includes: exterior grade plywood backboard, 25-pair cable for telco connection, standard 4-conductor (quad) station cabling, grounding wire (14 AWG), connecting blocks (66M1-50 type with bridging clips), modular jack (625 A, 625 F, or equivalent) and the appropriate mounting hardware.

Mount the 6 Card or 13 Card KSU as follows:

- *Attach the plywood backboard in the designated location with the appropriate fasteners. Mark the equipment layout on the board using the installation layout drawing (Figure 5).*
- *Drill pilot holes at these points and insert suitable fasteners having a ¼ inch shank diameter. Screw in fasteners until the clearance between the fastener head and the mounting surface is ¼ inch.*
- *Mount the KSU on the four fasteners and tighten each fastener until the KSU is securely attached to the mounting surface.*

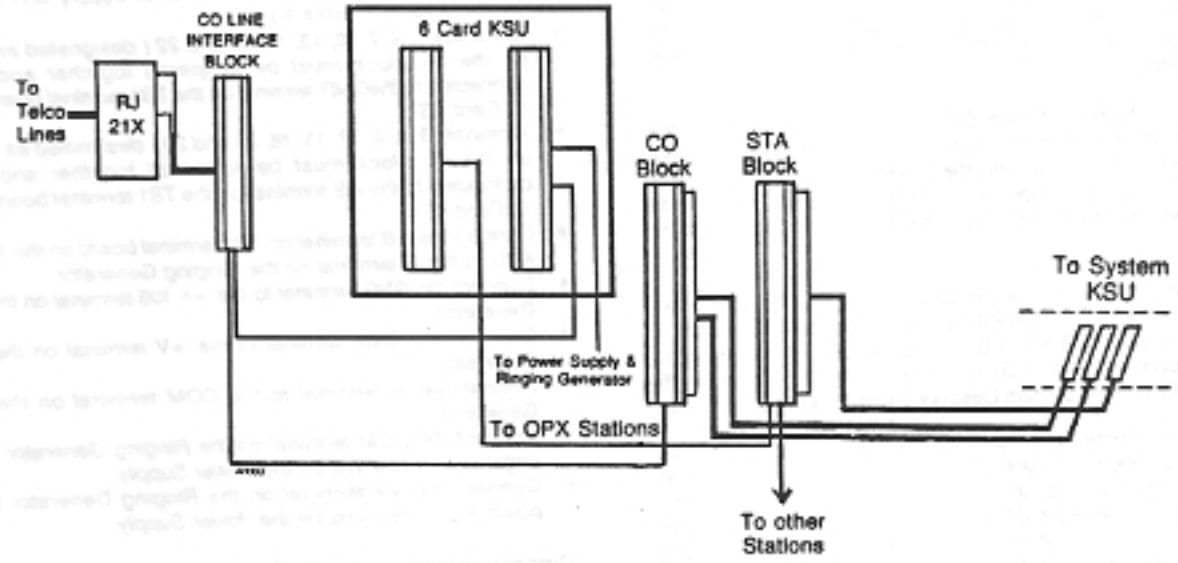


Figure 5a OPX INSTALLATION WITH 6 CARD KSU

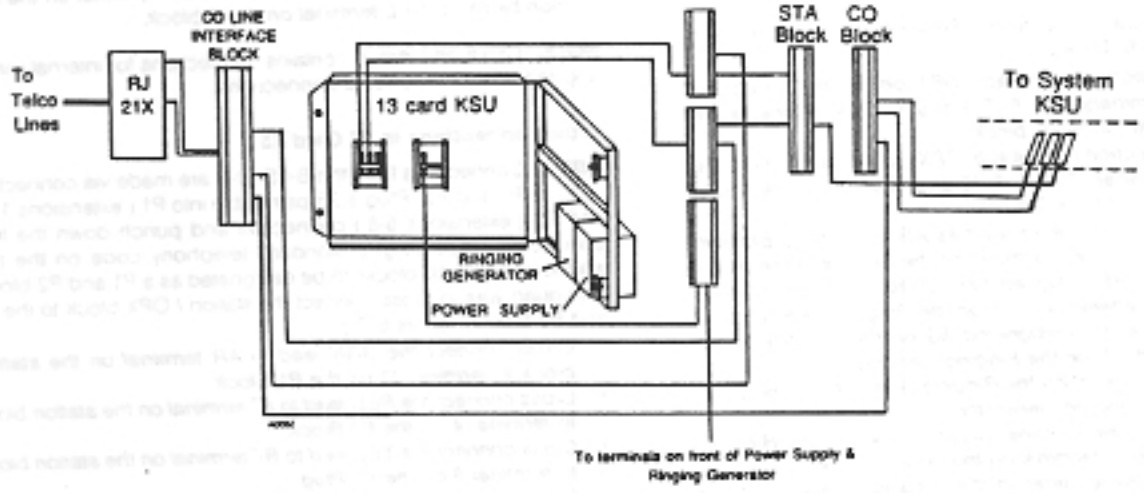


Figure 5b OPX INSTALLATION WITH 13 CARD KSU

4.03 The Power Supply and Ringing Generator are mounted on the hinged rack of the 6 Card or 13 Card KSU (Figures 2 and 4). The Power Supply and Ringing Generator should be mounted near the terminal board on a 13 Card KSU to facilitate cross connecting.

4.04 Mount three additional 66M1-50 connecting blocks to the left of the system KSU when a 13 Card KSU is installed. These blocks are used to access the connections on the connectors P1, P2 and P4 located inside the 13 Card KSU. P1 and P2 provide access to system and telco connections: P4 provides access to the Power Supply.

4.05 Check to ensure that the station plug (P3-P8 in the main system KSU or P3 to P9 if an expansion cabinet is used), which corresponds to B-8SLU-B serving the OPX, is connected to the appropriate station / OPX block. Refer to Section 5, INSTALLATION, of the System Description and Installation Manual.

NOTE: It is recommended that the B-8SLU-B serving the OPX be inserted in the system KSU slots J13, J12, J10, J9 or J8. This prevents having to cross connect to two station blocks to access the connections for the eight OPXs. The expansion cabinet, when applicable, can also be used. It is recommended that the B-8SLU-B be inserted into slot J16, J14, J13, J11, J10 or J9 of the expansion cabinet.

4.06 Ground the KSU and Power Supply by connecting a 14 AWG wire to the positive (+) terminal on the Power Supply and a cold water pipe ground (Figures 6, 7).

4.07 Connect the 6 Card or 13 Card KSU to the Power Supply and Ring Generator as follows (Figures 6, 7):

NOTE: Check to ensure the switches on both units are in the OFF position when cross connecting. Switches should be in the position labeled 48V when the system is operating.

To connect the 6 Card KSU to the Power Supply and Ringing Generator (Figure 6, Table 3):

- *The AG connections for each OPX on block C must be jumpered (terminals 1, 3, 5, 7, 9 and 11) and connected to terminal 43, also on the C block.*
- *The AB connections for each OPX on block C must be jumpered (terminals 2, 4, 6, 8, 10 and 12) and connected to terminal 44, also on the C block.*
- *Connect terminal 44, designated as AB, from the C Block in the KSU to the -V screw terminal on the Ringing Generator.*
- *Connect terminal 48, designated as RB, from the C Block to the screw terminal labeled +/- 105 on the Ringing Generator.*
- *Connect terminal 43, designated AG on the C Block to the terminal labeled +V on the Ringing Generator.*
- *Jumper the -V terminal on the Ringing Generator to the COM terminal on the Ringing Generator.*
- *Connect the screw terminal labeled +V on the Ringing Generator to the + terminal on the Power Supply.*
- *Connect the COM terminal on the Ringing Generator to the negative (-) terminal on the Power Supply.*

To connect the 13 Card KSU to the Power Supply and Ringing Generator (Figure 7, Table 4):

- *Terminals 1, 4, 7, 10, 13, 16, 19 and 22 (designated as GND) on the P4 block must be jumpered together and cross connected to theGND terminal on the TB1 terminal board in the 13 Card KSU.*
- *Terminals 3, 6, 9, 12, 15, 18, 21 and 24 (designated as -48VT) on the P4 block must be jumpered together and cross connected to the AB terminal on the TB1 terminal board in the 13 Card KSU.*
- *Connect the AB terminal on TB1 terminal board on the 13 Card KSU to the -V terminal on the Ringing Generator.*
- *Connect the RNG terminal to the +/- 105 terminal on the Ring Generator.*
- *Connect the GND terminal to the +V terminal on the Ring Generator.*
- *Jumper the -V terminal to the COM terminal on the Ring Generator.*
- *Connect the COM terminal on the Ringing Generator to the negative (-) terminal on the Power Supply.*
- *Connect the +V terminal on the Ringing Generator to the positive (+) terminal on the Power Supply.*

Crossconnections to the 6 Card KSU

4.08 Connections from the B-8SLU-B are made on the A block (Figure 8 and Table 5) in the 6 Card KSU. Use two pair wire to cross connect the appropriate SLU connector block to the A Block in the 6 Card KSU. For each OPX, cross connect clips 1-5 as follows:

- *Cross connect the GRN wire from the AT lead on the station block to the T terminal of the A block in the 6 Card KSU.*
- *Cross connect the RED wire from the AR terminal on the station block to the R terminal of the A block.*
- *Cross connect the BLK wire from the BT terminal on the station block to the A terminal of the A block.*
- *Cross connect the YEL wire from the BR terminal on the station block to the L terminal on the A block.*

NOTE: Clip 6 on block A contains connections for internal wiring and requires no additional connections.

Crossconnections to 13 Card KSU

4.09 Connections from the B-8SLU-B are made via connectors P1 and P2. Plug a 25-pair cable into P1 (extensions 1-5) and P2 (extensions 6-8) connectors and punch down the free conductors according to standard telephony code on the two additional 66M1-50 blocks to be designated as a P1 and P2 block. Use quad wire to cross connect the station / OPX block to the P1 and P2 block (Tables 6, 7).

- *Cross connect the GRN lead to AR terminal on the station block to terminal 13 on the P1 Block.*
- *Cross connect the RED lead to AT terminal on the station block to terminal 4 on the P1 Block.*
- *Cross connect the YEL lead to BT terminal on the station block to terminal 8 on the P1 Plug.*
- *Cross connect the BLK lead to BR terminal on the station block to terminal 25 on the P1 Plug.*

NOTE: P3 requires no additional wiring.

4.10 Repeat the preceding procedure for each OPX.

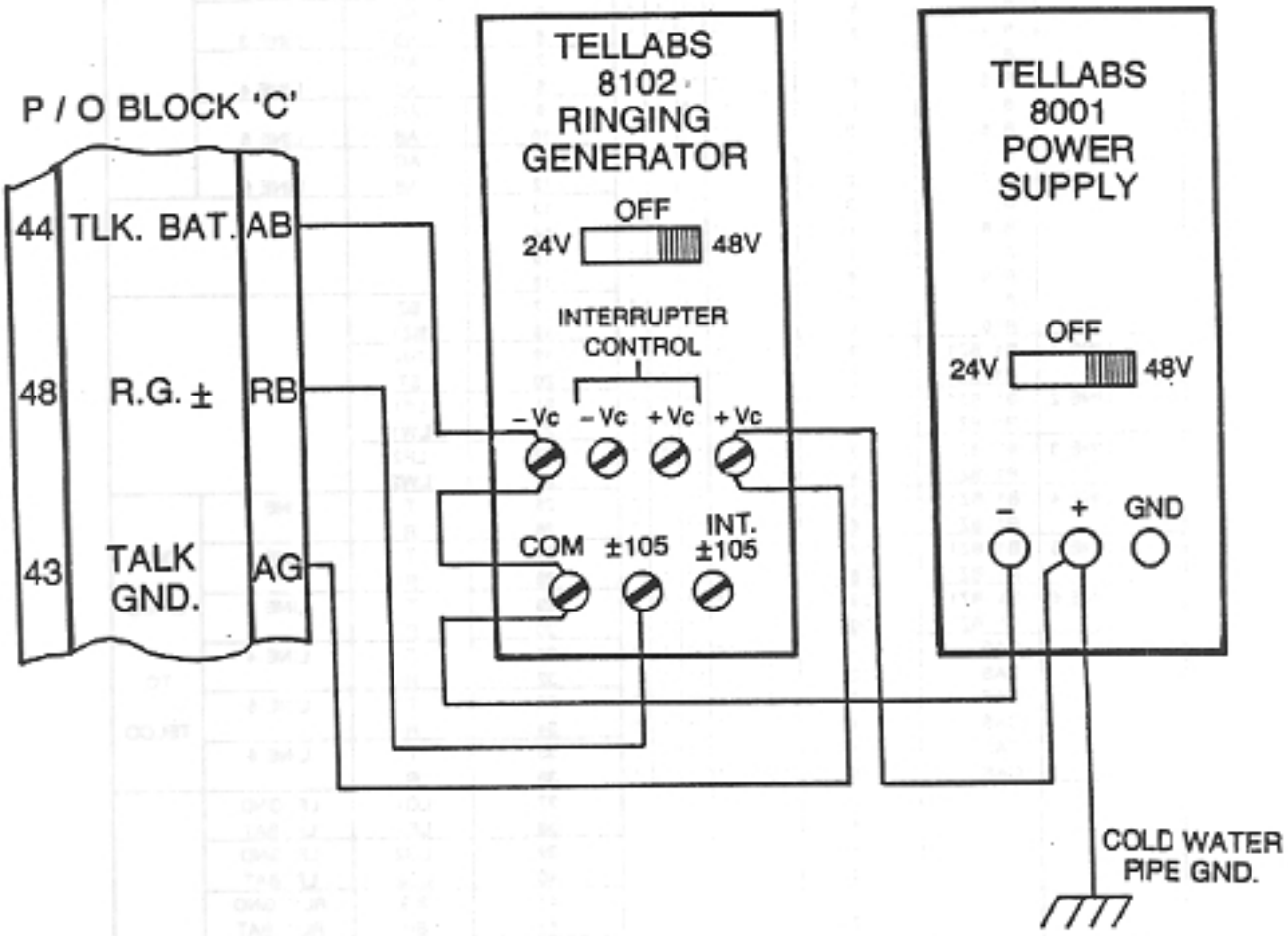


Figure 6 CONNECTING 6 CARD KSU TO POWER SUPPLY AND RINGING GENERATOR

Table 3 6 CARD KSU B / C BLOCK CONNECTIONS

BLOCK B								BLOCK C			
FEATURE	LEAD DESIG.	TERMINAL NUMBER	CLIP 1	CLIP 2	CLIP 3	CLIP 3	CLIP 2	CLIP 1	TERMINAL NUMBER	LEAD DESIG.	FEATURE	
	B	1	*	*	**	**	*	*	1	AG		
	R 2	2	*	*	**	**	*	*	2	AB	LINE 1	
	B	3	*	*	**	**	*	*	3	AG		
	R 3	4	*	*	**	**	*	*	4	AB	LINE 2	
	B	5	*	*	**	**	*	*	5	AG		
	R 4	6	*	*	**	**	*	*	6	AB	LINE 3	
	B	7	*	*	**	**	*	*	7	AG		
	R 5	8	*	*	**	**	*	*	8	AB	LINE 4	
	B	9	*	*	**	**	*	*	9	AG		
	R 6	10	*	*	**	**	*	*	10	AB	LINE 5	
	B	11	*	*	**	**	*	*	11	AG		
	R 7	12	*	*	**	**	*	*	12	AB	LINE 6	
	B	13	*	*	**	**	*	*	13			
	R 8	14	*	*	**	**	*	*	14			
	B	15	*	*	**	**	*	*	15			
	R 9	16	*	*	**	**	*	*	16			
	B	17	*	*	**	**	*	*	17	BZ		
	R 0	18	*	*	**	**	*	*	18	BZ1		
LINE 1	B1 BZ1	19	*	*	**	**	*	*	19	RN		
	R1 BZ	20	*	*	**	**	*	*	20	ST		
LINE 2	B1 BZ1	21	*	*	**	**	*	*	21	LF1		
	R1 BZ	22	*	*	**	**	*	*	22	LW1		
LINE 3	B1 BZ1	23	*	*	**	**	*	*	23	LF2		
	R1 BZ	24	*	*	**	**	*	*	24	LW2		
LINE 4	B1 BZ1	25	*	*	**	**	*	*	25	T	LINE 1	OPX LINES TO TELCO
	R1 BZ	26	*	*	**	**	*	*	26	R		
LINE 5	B1 BZ1	27	*	*	**	**	*	*	27	T	LINE 2	
	R1 BZ	28	*	*	**	**	*	*	28	R		
LINE 6	B1 BZ1	29	*	*	**	**	*	*	29	T	LINE 3	
	R1 BZ	30	*	*	**	**	*	*	30	R		
	CAS	31	*	*	**	**	*	*	31	T	LINE 4	
	CAS	32	*	*	**	**	*	*	32	R		
	CAS	33	*	*	**	**	*	*	33	T	LINE 5	
	CAS	34	*	*	**	**	*	*	34	R		
	CAS	35	*	*	**	**	*	*	35	T	LINE 6	
	CAS	36	*	*	**	**	*	*	36	R		
SHARE		37							37	LG1	LP GND	
		38							38	LB1	LP BAT	
		39							39	LG2	LP GND	
		40							40	LG2	LP BAT	
		41							41	BG	RLY GND	
		42							42	BR	RLY BAT	
		43							43	AG	TLK GND	
		44							44	AB	TLK BAT	
		45							45	BG	RLY GND	
		46							46			
		47							47	RG	RG GND	
		48							48	RB	RG	
		49							49	RG	BZ GND	
		50							50	RB	BZ	

* Connect to clips as required.
** Pre-wiring is terminated on this clip, no additional wiring is required.

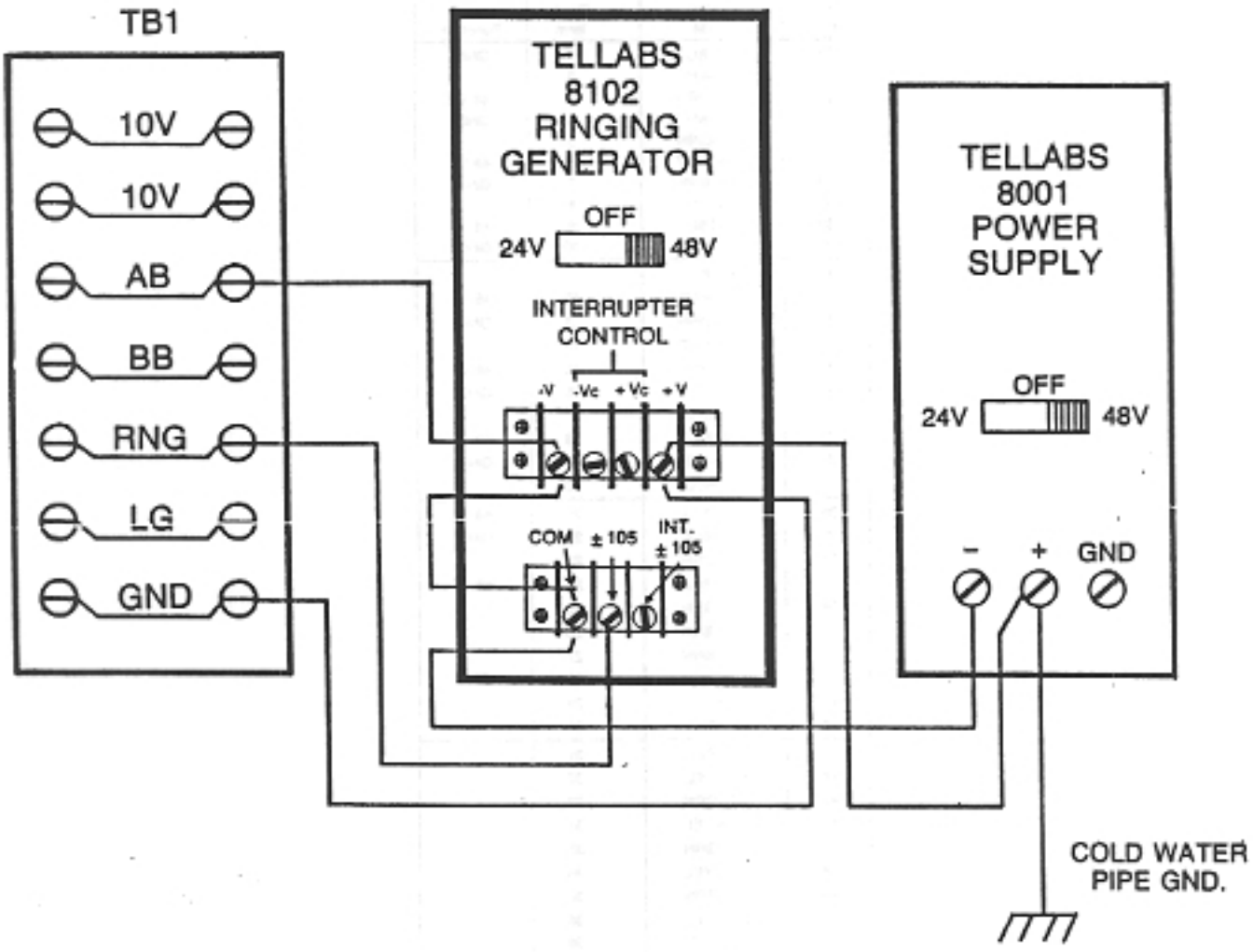


Figure 7 CONNECTING 13 CARD KSU TO POWER SUPPLY AND RINGING GENERATOR

Table 4 13 CARD KSU P4 CONNECTIONS

25 Pair Cable		P4 Connector	
Conn Pin	Color Code	Block Term.	Function
26	WHT-BLU	1	GND
1	BLU-WHT	2	
27	WHT-ORN	3	-48 VT
2	ORN-WHT	4	GND
28	WHT-GRN	5	
3	GRN-WHT	6	-48 VT
29	WHT-BRN	7	GND
4	BRN-WHT	8	
30	WHT-SLT	9	-48 VT
5	SLT-WHT	10	GND
31	RED-BLU	11	
6	BLU-RED	12	-48 VT
32	RED-ORN	13	GND
7	ORN-RED	14	
33	RED-GRN	15	-48 VT
8	GRN-RED	16	GND
34	RED-BRN	17	
9	BRN-RED	18	-48 VT
35	RED-SLT	19	GND
10	SLT-RED	20	
36	BLK-BLU	21	-48 VT
11	BLU-BLK	22	GND
37	BLK-ORN	23	
12	ORN-BLK	24	-48 VT
38	BLK-GRN	25	
13	GRN-BLK	26	
39	BLK-BRN	27	
14	BRN-BLK	28	
40	BLK-SLT	29	
15	SLT-BLK	30	
41	YEL-BLU	31	
16	BLU-YEL	32	
42	YEL-ORN	33	
17	ORN-YEL	34	
43	YEL-GRN	35	
18	GRN-YEL	36	
44	YEL-BRN	37	
19	BRN-YEL	38	
45	YEL-SLT	39	
20	SLT-YEL	40	
46	VIO-BLU	41	
21	BLU-VIO	42	
47	VIO-ORN	43	
22	ORN-VIO	44	
48	VIO-GRN	45	
23	GRN-VIO	46	
49	VIO-BRN	47	
24	BRN-VIO	48	
50	VIO-SLT	49	
25	SLT-VIO	50	

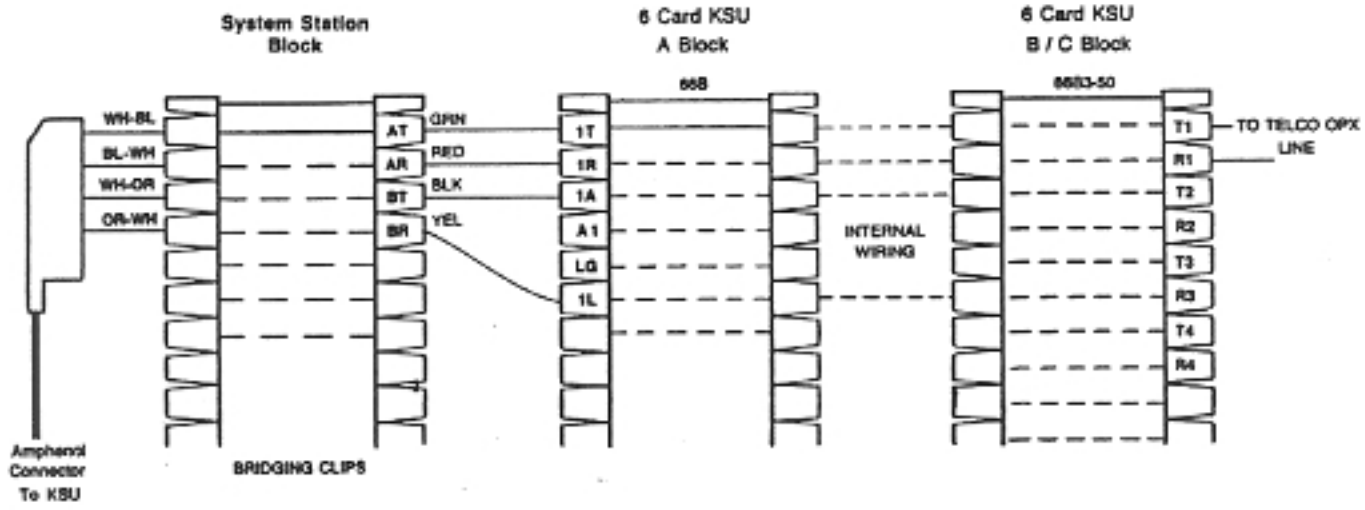


Figure 8 6 CARD KSU CROSSCONNECTIONS

Table 6 13 CARD KSU P1 CONNECTIONS

25 Pair Cable		P1 Connector			Station Cable	Interconnect
Conn Pin	Color Code		Block Term.	Function	To Station Block	To Trunk Interface
26	WHT-BLU	OPX 1	1	OPX 1T		WHT-BLU
1	BLU-WHT		2	OPX 1R		BLU-WHT
27	WHT-ORN		3	CX T	GRN	
2	ORN-WHT		4	CX R	RED	
28	WHT-GRN		5	CX†	BLK	
3	GRN-WHT		6			
29	WHT-BRN		7			
4	BRN-WHT		8	CX†	YEL	
30	WHT-SLT		9			
5	SLT-WHT		10			
31	RED-BLU	OPX 2	11	OPX 2T		WHT-BLU
6	BLU-RED		12	OPX 2R		BLU-WHT
32	RED-ORN		13	CX T	GRN	
7	ORN-RED		14	CX R	RED	
33	RED-GRN		15	CX†	BLK	
8	GRN-RED		16			
34	RED-BRN		17			
9	BRN-RED		18	CX†	YEL	
35	RED-SLT		19			
10	SLT-RED		20			
36	BLK-BLU	OPX 3	21	OPX 3T		WHT-BLU
11	BLU-BLK		22	OPX 3R		BLU-WHT
37	BLK-ORN		23	CX T	GRN	
12	ORN-BLK		24	CX R	RED	
38	BLK-GRN		25	CX†	BLK	
13	GRN-BLK		26			
39	BLK-BRN		27			
14	BRN-BLK		28	CX†	YEL	
40	BLK-SLT		29			
15	SLT-BLK		30			
41	YEL-BLU	OPX 4	31	OPX 4T		WHT-BLU
16	BLU-YEL		32	OPX 4R		BLU-WHT
42	YEL-ORN		33	CX T	GRN	
17	ORN-YEL		34	CX R	RED	
43	YEL-GRN		35	CX†	BLK	
18	GRN-YEL		36			
44	YEL-BRN		37			
19	BRN-YEL		38	CX†	YEL	
45	YEL-SLT		39			
20	SLT-YEL		40			
46	VIO-BLU	OPX 5	41	OPX 5T		WHT-BLU
21	BLU-VIO		42	OPX 5R		BLU-WHT
47	VIO-ORN		43	CX T	GRN	
22	ORN-VIO		44	CX R	RED	
48	VIO-GRN		45	CX†	BLK	
23	GRN-VIO		46			
49	VIO-BRN		47			
24	BRN-VIO		48	CX†	YEL	
50	VIO-SLT		49			
25	SLT-VIO		50			

† Provides POWER/CONTROL signals to the electronic ringer.

Table 7 13 CARD KSU P2 CONNECTIONS

25 Pair Cable		P2 Connector			Station Cable	Interconnect
Conn Pin	Color Code		Block Term.	Function	To Station Block	To Trunk Interface
26	WHT-BLU	OPX 6	1	OPX 6T		WHT-BLU
1	BLU-WHT		2	OPX 6R		BLU-WHT
27	WHT-ORN		3	CX T	GRN	
2	ORN-WHT		4	CX R	RED	
28	WHT-GRN		5	CX†	BLK	
3	GRN-WHT		6			
29	WHT-BRN		7			
4	BRN-WHT		8	CX†	YEL	
30	WHT-SLT		9			
5	SLT-WHT		10			
31	RED-BLU	OPX 7	11	OPX 7T		WHT-BLU
6	BLU-RED		12	OPX 7R		BLU-WHT
32	RED-ORN		13	CX T	GRN	
7	ORN-RED		14	CX R	RED	
33	RED-GRN		15	CX†	BLK	
8	GRN-RED		16			
34	RED-BRN		17			
9	BRN-RED		18	CX†	YEL	
35	RED-SLT		19			
10	SLT-RED		20			
36	BLK-BLU	OPX 8	21	OPX 8T		WHT-BLU
11	BLU-BLK		22	OPX 8R		BLU-WHT
37	BLK-ORN		23	CX T	GRN	
12	ORN-BLK		24	CX R	RED	
38	BLK-GRN		25	CX†	BLK	
13	GRN-BLK		26			
39	BLK-BRN		27			
14	BRN-BLK		28	CX†	YEL	
40	BLK-SLT		29			
15	SLT-BLK		30			
41	YEL-BLU		31			
16	BLU-YEL		32			
42	YEL-ORN		33			
17	ORN-YEL		34			
43	YEL-GRN		35			
18	GRN-YEL		36			
44	YEL-BRN		37			
19	BRN-YEL		38			
45	YEL-SLT		39			
20	SLT-YEL		40			
46	VIO-BLU		41			
21	BLU-VIO		42			
47	VIO-ORN		43			
22	ORN-VIO		44			
48	VIO-GRN		45			
23	GRN-VIO		46			
49	VIO-BRN		47			
24	BRN-VIO		48			
50	VIO-SLT		49			
25	SLT-VIO		50			

† Provides POWER/CONTROL signals to the electronic ringer.

PCB Strapping

4.11 One 8-8SLU-B PCB is required to serve the maximum of eight extensions. The PCB must be strapped in the 2-3 position to indicate that single line telephones are used (Figure 9). The SLU PCB can be inserted in any station position in the main or expansion cabinet (if used). However it is recommended that the PCB be inserted in a position where one 25 pair cable out of the KSU serves all 8 station ports. This prevents cross connecting two station blocks to access the 8 OPXs.

4.12 The 8-OPX-A PCB serves one Off Premises extension. It must be strapped for the desired ring mode. Strap E1 and E2 to provide the Norm ring mode (1 second on; 3 seconds off). Strap E2 and E3 to provide the Extend ring mode (2 seconds on; 2 seconds off) (Figure 10). An OPX with a longer loop may require the Extend strapping to ensure proper ring detection.

Connections to Telco

4.13 Each OPX requires one OPX line. Access to OPX lines are provided on the RJ21X connecting block with CO lines. The OPX line(s) is designated as 1LM. Plug a female ended 25-pair cable into the telco RJ21X. Punch down free connectors into a 66M1-50 connecting block to be designated as CO Line Interface Block.

Connect the 6 Card KSU to the OPX lines as follows (Table 3):

- *Cross connect terminals 25-36 in the C Block, depending on the number of OPX lines required, to the terminals for the OPX lines on the CO Line Interface Block.*

Connect the 13 Card KSU depending on the number of OPX lines required, as follows (Tables 6, 7):

- *Cross connect terminals 1 and 2 for OPX line 1; 11 and 12 for OPX line 2; terminals 21 and 22 for OPX line 3; terminals 31 and 32 for OPX line 4; and terminals 41 and 42 for OPX line 5 on the P1 Block to the CO Line Interface Block.*
- *Cross connect terminals 1 and 2 for OPX line 6; terminals 11 and 12 for OPX line 7; and terminals 21 and 22 for OPX line 8 on P2 Block to the CO Line Interface Block.*

On Premises Extension

4.14 The same installation procedures are used when connecting an On Premises Extension (ONX). The telephone used as an ONX is connected to the terminals on the C block (or P1 and P2 block) that are normally connected to the CO Line Interface Block.

5. CIRCUIT DESCRIPTION

General

5.01 An on-card voltage regulator provides 12 volts DC to power all logic circuits. OPX Tip and OPX Ring are protected by metal-oxide varistors (MOVs) against possible lightning strikes.

Refer to Figure 11 for electrical connections to OPX adaptor.

5.02 Ring Equivalence Number (REN) considerations when connecting off-premise stations are provided in Figure 12.

Figure 12 shows the relationship between the ring enable signals found on one SLU card. The ring equivalence number (REN) of the station pairs shown (1 and 2), (3 and 4), (5 and 6), (7 and 8) must not exceed 5.0B, when both stations in each pair be addressed to ring at the same time.

Call Originating

5.03 When the OPX station connected to the adaptor is signaled by the system, the Ring Detect Circuit senses the change in DC voltage (from 24VDC to 9VDC) on the SLU Tip lead referenced to SLU BLK and generates a Ring Enable signal. The Ring Relay Drive Circuit uses this Enable signal to turn on the Ring Relay (RR). This relay applies GND to OPX Tip and ringing generator (90VAC @ 20Hz) to OPX Ring. A strap option is provided for 2 modes of ringing: Norm (1 second on, 3 seconds off) or Extend (2 seconds on, 2 seconds off). This option is provided because 1 second may not be long enough for reliable ring detection by remote equipment on long loops. The ringing generator must be biased to -48 volts DC. When the called party goes off hook, a DC current is generated. The Ring Trip Circuit senses this current and generates a Reset signal which shuts off the ring relay. The talk path is now established.

Call Answering

5.04 When the OPX station goes off hook, a DC current of at least 20ma flows through the battery-feed coil (T1) and the two resistors (Figure 13). This current is detected by the Loop-Current Detector. This detector closes a DC path across SLU Tip and SLU Ring. Current flows through this path and an off hook condition is detected on the SLU card. System ICM dial tone is heard at the OPX station.

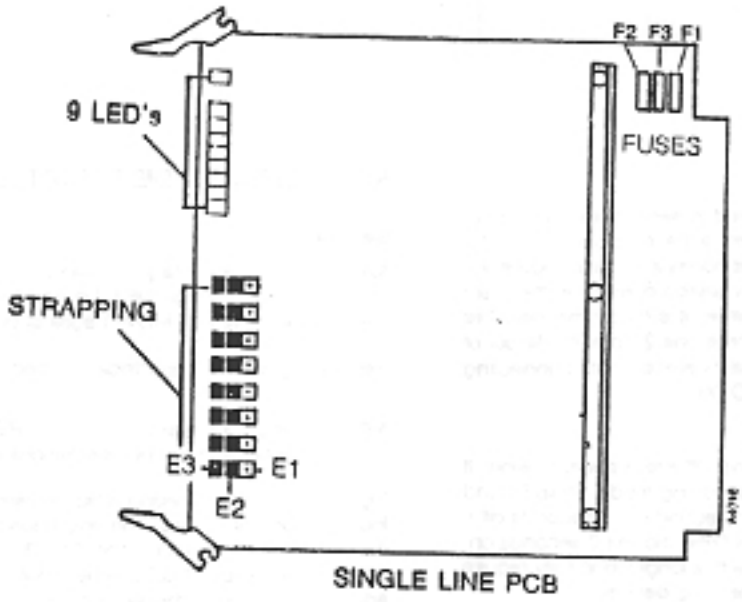


Figure 9 B-8SLU-B PCB

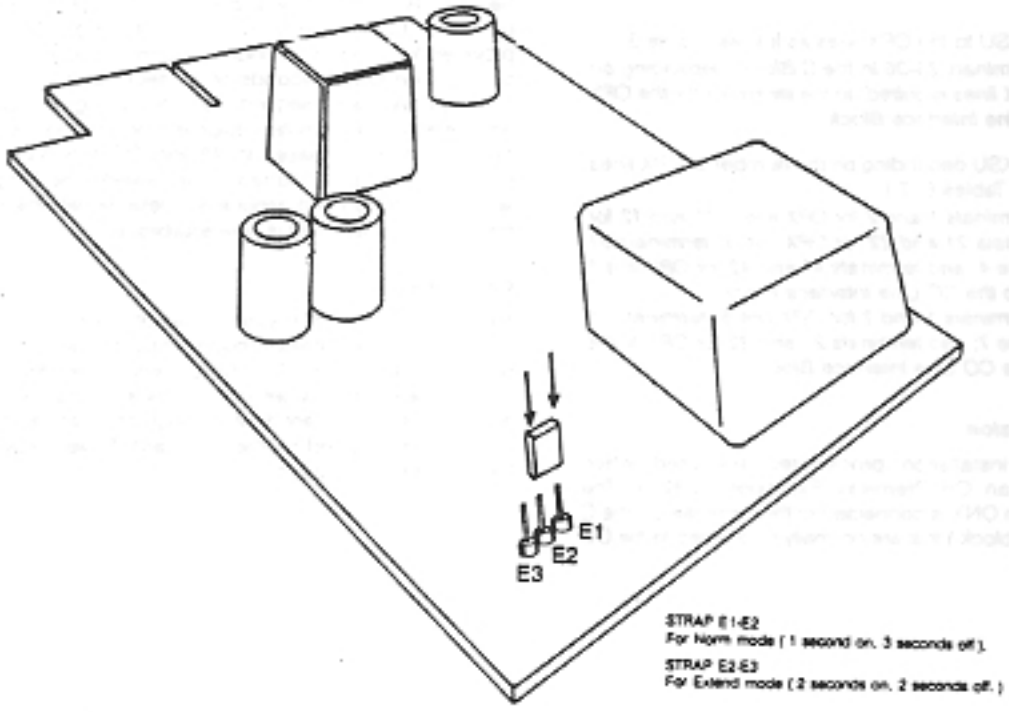


Figure 10 B-OPX-A PCB WITH STRAP OPTIONS

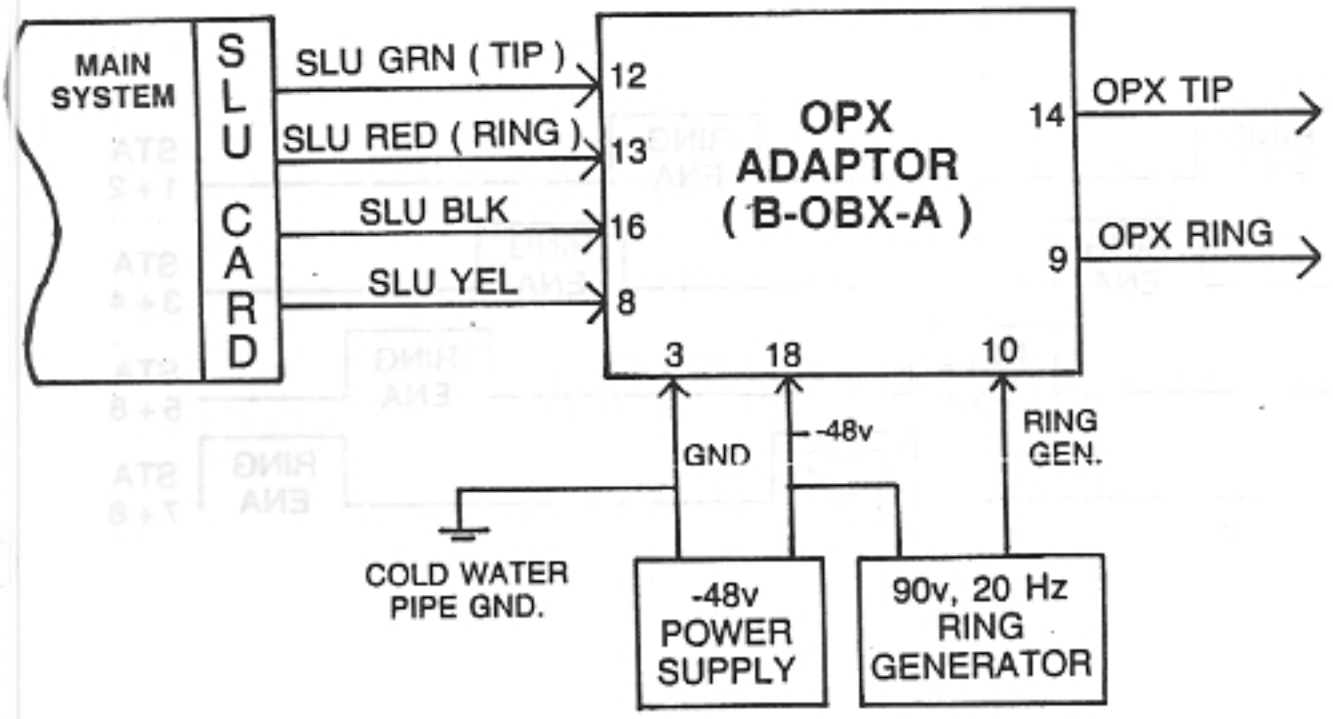


Figure 11 ELECTRICAL CONNECTIONS TO B-OPX-A PCB

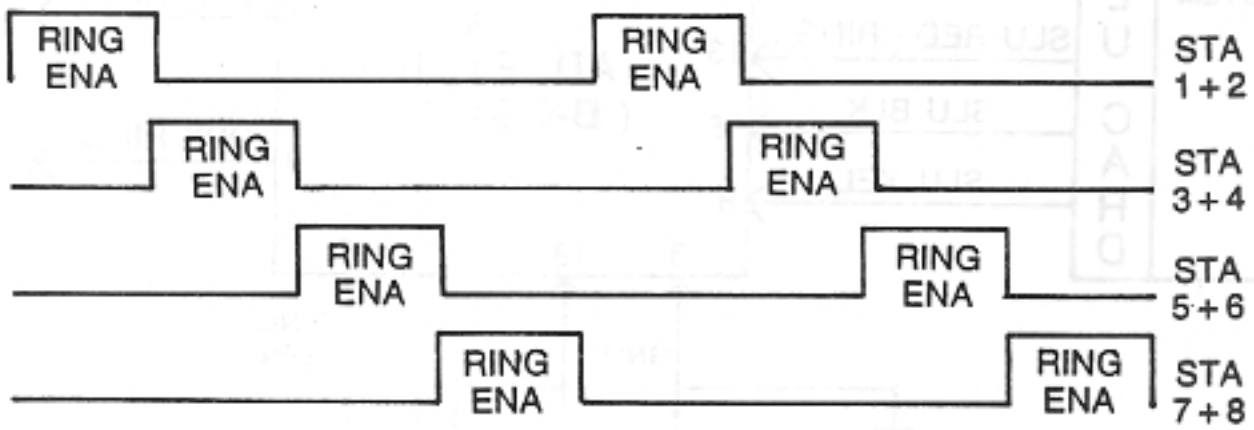


Figure 12 B-8SLU-B RING ENABLE CYCLES

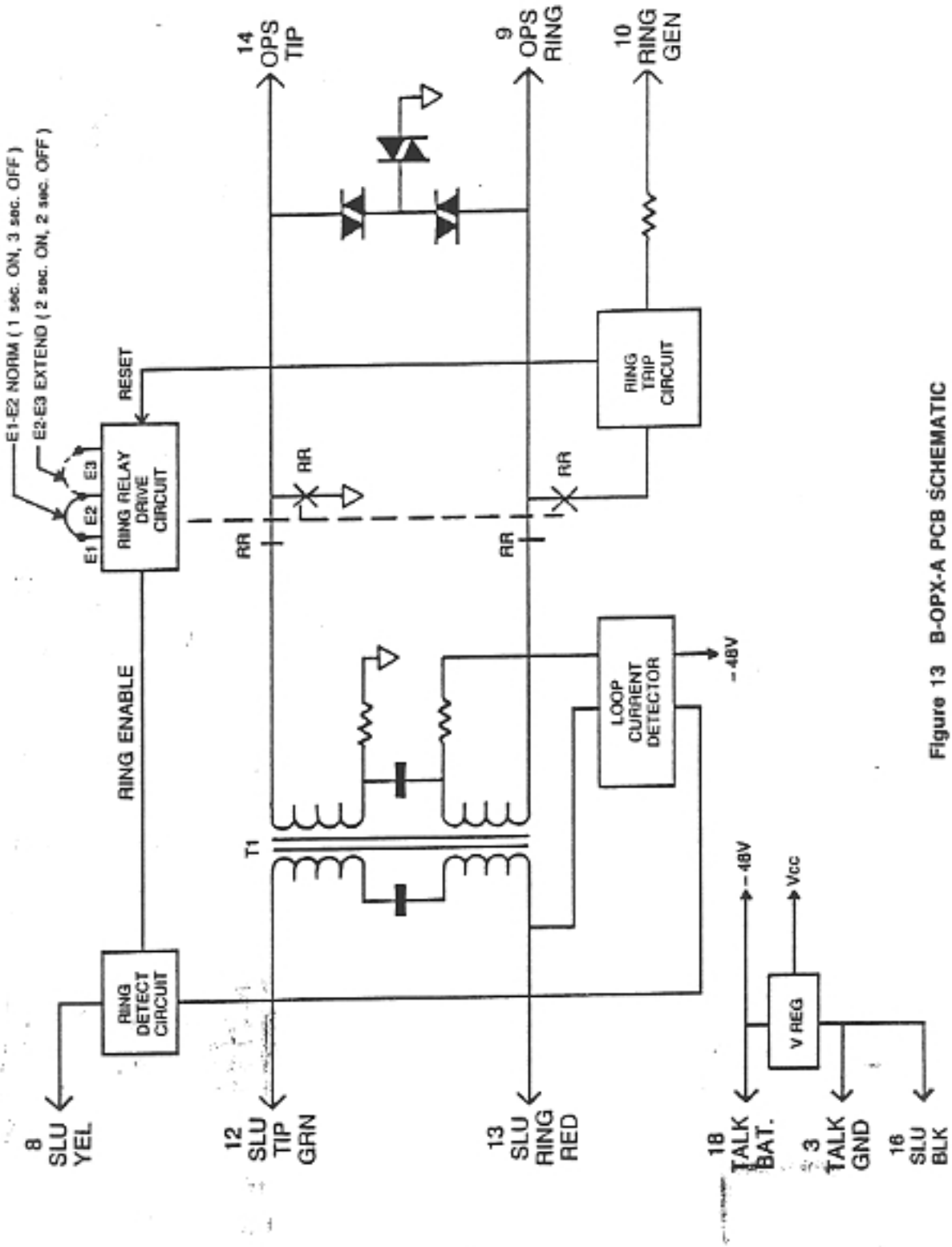
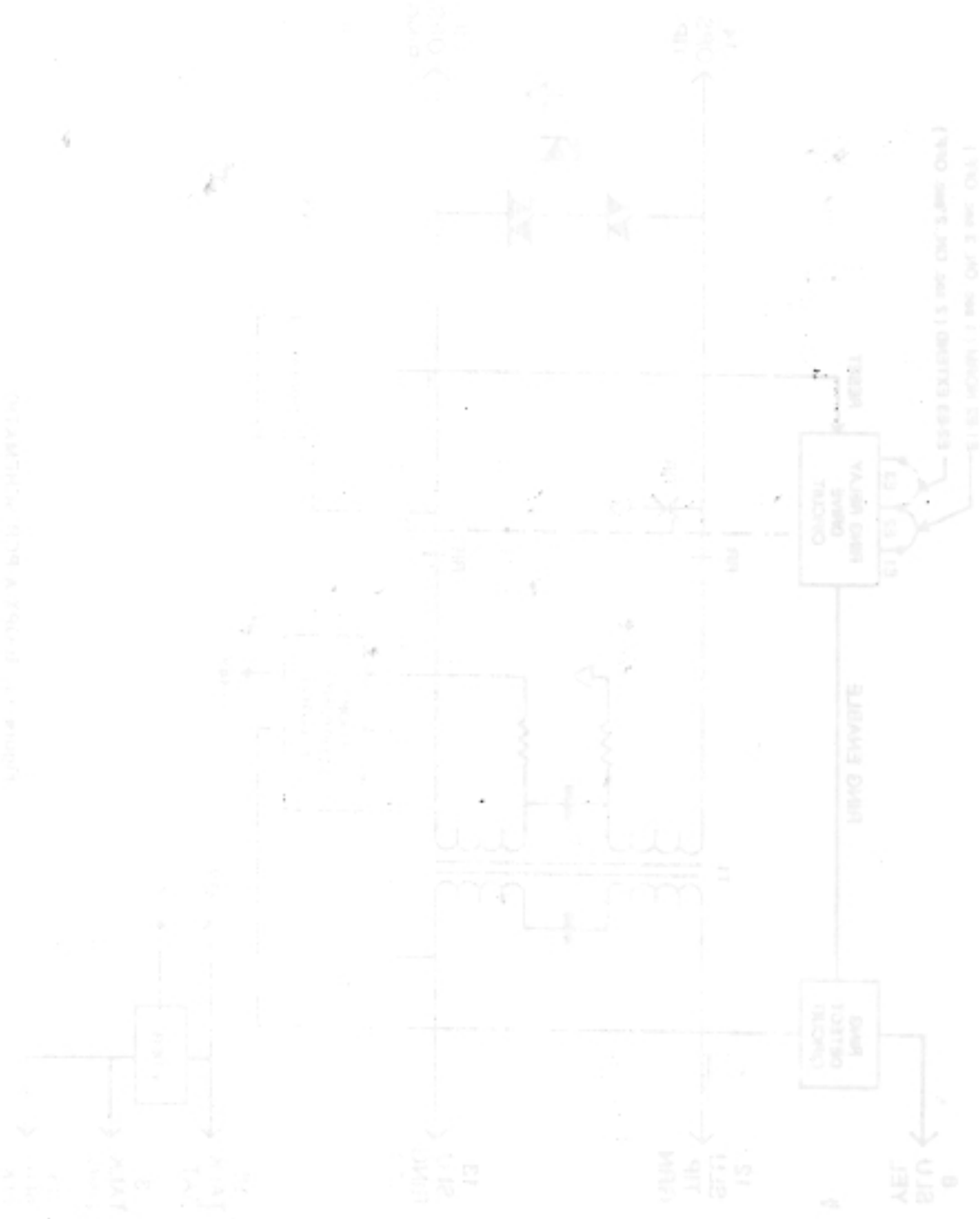
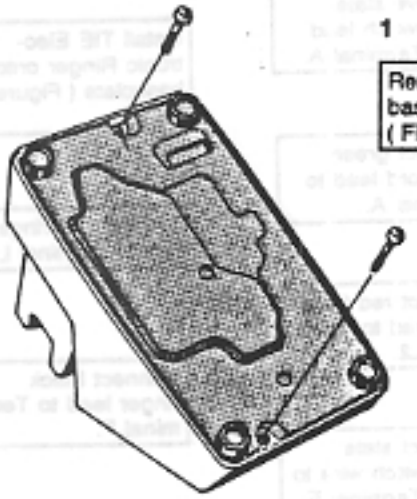


Figure 13 B-OPX-A PCB SCHEMATIC



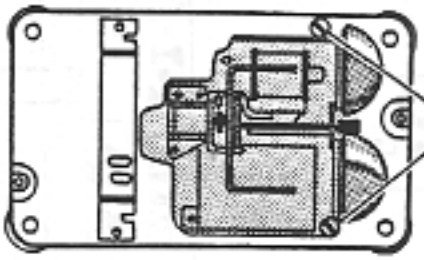
INSTALLATION OF TIE ELECTRONIC RINGER MODEL SP-413* IN STROMBERG CARLSON 2500 DESK SET EQUIPPED WITH 35A11 DIAL AND ITT MODEL 2500 DESK SET EQUIPPED WITH 42 OPG DIAL



1

Remove 2 bottom baseplate screws (Figure 1).

Figure 1 REMOVAL OF BASEPLATE SCREWS



2

Remove Ringer Assembly (2 screws & 4 wires, Figure 2).

Figure 2 RINGER REMOVAL

3

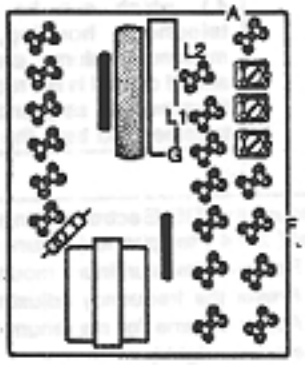
Remove red Line cord from Terminal (Figure 3).

4

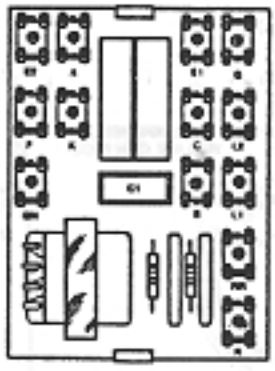
Remove green Line cord lead from Terminal L1.

5

Place red Line cord lead on Terminal L1.



(STROMBERG CARLSON NETWORK)



(ITT NETWORK)

6

Place green Line cord lead on Terminal L2.

7

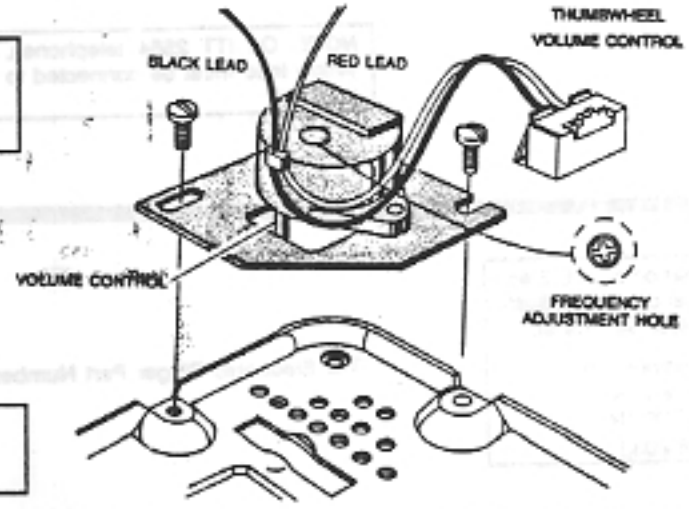
Move slate hookswitch lead from Terminal L2 to Terminal A.

NOTE: On the ITT 2500 and Stromberg Carlson 2500 telephones, the yellow Line cord lead inside the telephone must be connected to Terminal G.

Figure 3 TERMINAL LOCATIONS ON STRIP

8

Place TIE Electronic Ringer black lead on A (Figure 4).



9

Place TIE Electronic Ringer red lead on G.

10

The volume control thumbwheel (Figure 4), which can be clipped to the telephone housing, provides for maximum volume attenuation. If this added control is not required, cut off the thumbwheel, strip and twist the leads together and tape the connection.

11

The frequency of the electronic ringer can be adjusted to provide for distinctive tone ringing. The frequency adjustment control (Figure 4) can be turned clockwise to lower the frequency. The volume will vary somewhat as the frequency is adjusted.

Figure 4 ELECTRONIC RINGER INSTALLATION

INSTALLATION OF TIE ELECTRONIC RINGER MODEL SP-413* IN ITT 2554 WALL SET EQUIPPED WITH 42 OPG DIAL

1

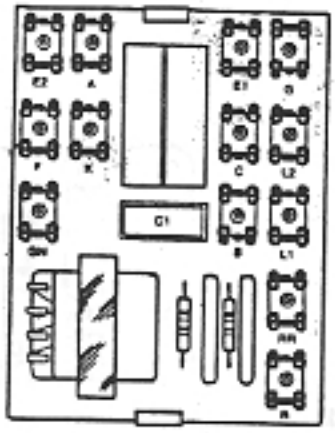
Disassemble as described for desk telephones.

2

Remove green Line cord lead from Terminal L2 (Figure 5).

3

Remove red Line cord lead from Terminal A.



(ITT NETWORK)

Figure 5 TERMINAL LOCATIONS ON STRIP

4

Remove slate hookswitch lead from Terminal A.

5

Connect green Line cord lead to Terminal A.

6

Connect red Line cord lead to Terminal L2.

7

Connect slate hookswitch wire to spare Terminal F.

8

Install TIE Electronic Ringer onto baseplate (Figure 6).

9

Connect red ringer lead to Terminal L1.

10

Connect black ringer lead to Terminal F.

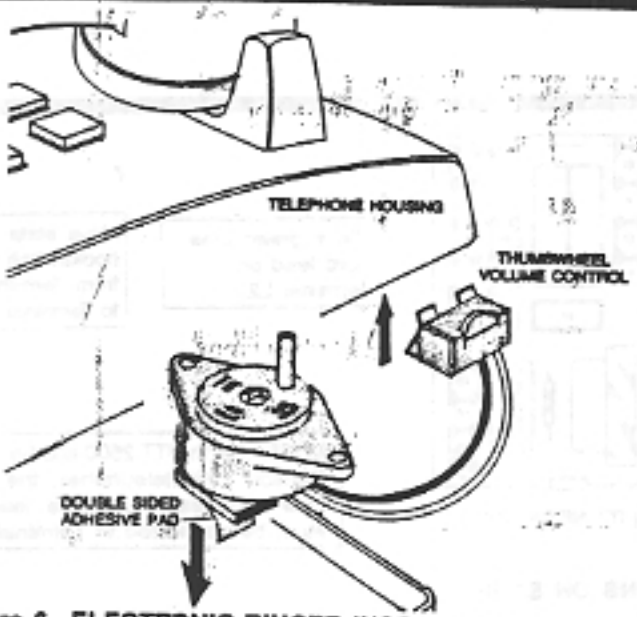


Figure 6 ELECTRONIC RINGER INSTALLATION IN A WALL MOUNTED TELEPHONE

11

The volume control thumbwheel (Figure 4), which can be clipped to the telephone housing, provides for maximum volume attenuation. If this added control is not required, cut off the thumbwheel, strip and twist the leads together and tape the connection.

12

To mount the TIE Electronic Ringer in a wall model (2554) telephone (Figure 6):

a. Remove the aluminum mounting bracket.
b. Preset the frequency adjustment control.
c. Adjust volume for maximum (slide to extreme right).
d. Attach double sided adhesive pad to top of ringer.
e. Attach ringer to suitable place inside telephone (clean surface before attaching).
f. Clip thumbwheel to telephone housing.

NOTE: On ITT 2554 telephones, the yellow lead must be connected to Terminal L1.

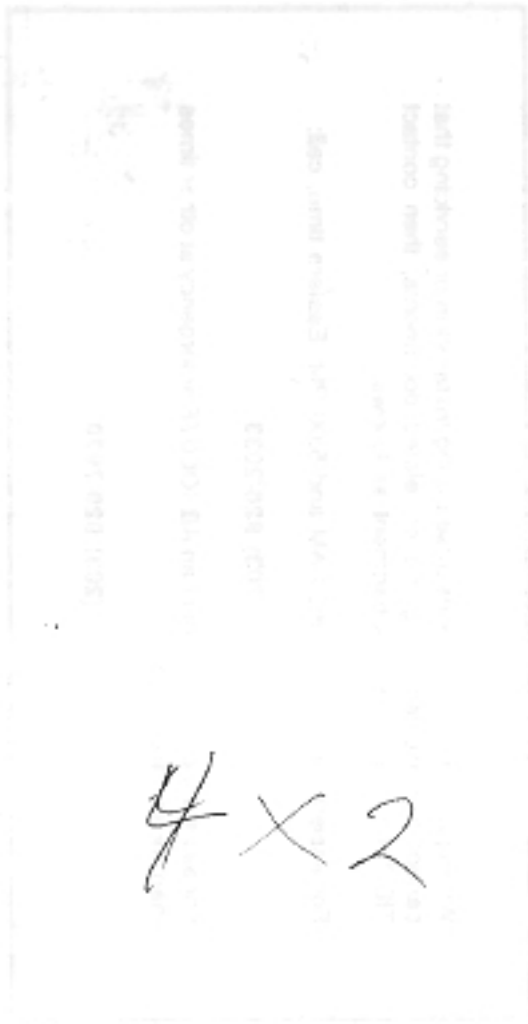
For Additional information on TIE Electronic Ringer installation and adjustment, contact Technical Service at:

TIE/communications, Inc.
12 Commerce Drive
Shelton, CT 06484
(203) 926-2033

* TIE Electronic Ringer Part Number 86187

01084
Issue 2.0 March 1984

Printed in U.S.A.



4×2

TECHNICAL ASSISTANCE

When problems or questions arise during installation or servicing that cannot be resolved using this or related documents, then contact TIE Technical Service Department as follows:

For assistance between 8:30 AM and 5:00 PM, Eastern time, call:

(203) 926-2033

For assistance in the event of an ***ABSOLUTE*** emergency at other times than those listed, call:

(203) 929-7920

Form 0009A May 1983

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