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INTER-TEL

616
1232

INSTALLATION AND FIELD MAINTENANCE MANUAL

Issue 2, April 1985

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NOTICE

This 616/1232 Installation and Field Maintenance Manual is released by INTER-TEL, Incorporated as a guide for service personnel. It provides the information necessary to properly install, program, operate, and maintain the 616/1232 systems.

The contents of this manual reflect current Inter-Tel standards and software version (827.1062-2), which are subject to revision or change without notice. Software packages released after the publication of this manual will be documented in addendums. Refer to earlier issues of this manual for information on earlier versions of software.

If additional information is required, please contact:

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TABLE OF CONTENTS

Page iv

LIST OF FIGURES

SYSTEM PROGRAMMING

DIAGNOSTIC PROGRAMMING

TROUBLESHOOTING

REPLACEMENT PARTS

FEATURES

PUBLIC NOTICE

A HEARING-AID COMPATIBLE HANDSET IS AVAILABLE AS AN ACCESSORY OPTION. PLEASE CONTACT YOUR LOCAL FACTORY REPRESENTATIVE FOR MORE INFORMATION.

FCC RULES PROHIBIT THE USE OF THIS TELEPHONE IN THE FOLLOWING LOCATIONS UNLESS IT HAS A HEARING-AID COMPATIBLE HANDSET

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

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

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

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

(5) Workstations for hearing impaired personnel.

(6) In hotel, motel, and apartment lobbies; in stores where telephones are used by patrons to order merchandise; in public transportation terminals where telephones are used to call taxis, reserve lodging, or rent automobiles.

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

FCC REGULATIONS

IMPORTANT:

1. Customers connecting this equipment to the telephone network shall, before such connection is made, give notice to the telephone company of the particular line(s) to which such connection is to be made, and shall provide the telephone company with the following information:

   - Complies with Part 68, FCC Rules
   - FCC Registration Number, BE287V-68377-KF-E
   - Ringer Equivalence Number, 0.9A
   - Type of jack to be ordered from the telephone company, RJ14C or RJ21X

   The telephone company should also be given notice upon final disconnection of this equipment from the particular line(s).

   It is also the responsibility of the customer to provide the telephone company with registration numbers of any other devices which are configured for connection to the telephone network.

2. It is prohibited to make connections to party lines.

3. Under certain circumstances the telephone company may temporarily discontinue service and make changes in facilities and services which may affect the operation of this equipment; however, the customer shall be given adequate notice in writing to allow the customer an opportunity to maintain uninterrupted service.

4. Users should not make adjustments, repairs or attempt to service this equipment. In the event that a problem originates, contact the local authorized factory service representative.

   In the event of trouble with the telephone line(s), this equipment must be disconnected from the telephone line(s). If trouble ceases, the equipment must be repaired by an authorized factory service representative. If the trouble continues to occur with the equipment disconnected, the telephone company should be notified that they have a problem. If this is the case, repairs or adjustments made by the telephone company will be made at their expense.

WARNING:

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the KSU with respect to the receiver
- Check that the KSU and receiver are not on the same circuit; the KSU must be powered from an isolated, dedicated, AC outlet.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

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

This booklet (Stock No. 004-000-00398-5) is available for approximately $5.00 from the U.S. Government Printing Office, Washington, D.C. 20402.

If RFI problems persist, contact the Inter-Tel Customer Support Department.

WARRANTY

INTER-TEL, Incorporated warrants its products (except for fuses and lamps) to be free of defects in materials and/or workmanship. This warranty shall extend for a period of one (1) year from the date the product was originally shipped. All shipping costs incurred in connection with warranty work will be paid by the buyer/customer. INTER-TEL's warranty does not apply to products that have been damaged due to and/or subject to improper handling by shipping companies, negligence, accidents, improper use, or alterations not authorized by INTER-TEL, Incorporated.

This warranty is in lieu of and excludes all other warranties, expressed or implied, and in no event shall INTER-TEL, Incorporated be liable for any anticipated profits, incidental or consequential damages, loss of time, or other losses incurred by the buyer/customer in connection with the purchase, operation or use of the product.

OVERVIEW

CONTENTS PAGE

1. INTRODUCTION

1.01 The Inter-Tel 616 and 1232 systems are versatile electronic key telephone systems designed to meet the needs of growing businesses. Modular design makes the system easy to install and service, and the programmable features provide a variety of services to meet each customer's needs. Highlights of the system's design include:

- Advanced microprocessor technology.
- Flexible programming to customize many system and station features.
- Capacity in the 616 system for 6 Central Office (C.O.) lines, 16 multi-line keysets, 5 private intercom channels, and 16 Direct Station Selector/Busy Lamp Field (DSS) Units.
- Capacity in the 1232 system for 12 C.O. lines, 32 multi-line keysets, up to 5 private intercom channels, and 32 DSS's.
- Modular, easily replaceable hardware with add-on capabilities for optional features.

2. HARDWARE SUMMARY

2.01 The SYSTEM SPECIFICATIONS section of this manual describes the hardware, including the Key Service Unit (KSU), multi-line keysets, Direct Station Selector/Busy Lamp Field (DSS) Units, and other optional equipment.

3. FEATURES SUMMARY

3.01 A list of features appears below. Those marked with an asterisk (*) are programable options. For detailed descriptions and operating instructions, refer to the FEATURES section of this manual.

NOTE: Additional equipment is required for some features. Refer to the SYSTEM SPECIFICATIONS and INSTALLATION sections for more information.

SYSTEM FEATURES

* • Station Message Detail Recording (SMDR)
* • Flexible Attendant Arrangements (Alternate Point Answering)
* • Flexible Night Ringing Arrangement
• System Battery Back-up
• Data Base Battery Back-up
• Dual-Tone Multi-Frequency (DTMF) or Dial Pulse Signalling
• Music-On-Hold
• Call Privacy
* • Toll Restriction
* • Variable Time-Out Capabilities

KEYSET FEATURES

Keyset General Features

• 6 Feature Keys
• 6 (616), 12 (1232), or 24 (2480) C.O. Line Keys
• LED Indications
* • Off-Hook Ringing
• Immediate Ringing
• Audible Tone Indications
• Volume Control
• Call Number Buffering
• ON/OFF Key
* • Direct Ring-In Line Flexibility
* • C.O. Line Restriction

Intercom Features

- Voice Announcing
* • Ring Intercom First
* • Handsfree Answering
- Station-to-Station Calling
- Intercom Camp-on, Call Waiting, and Call Splitting
* • Executive Call Waiting
* • Busy Station Callback (Queuing)
- Consultation Hold
- Intercom Transfer
* • Speed Transfer

Outside Call Features

- Placing and Receiving Outside Calls
- Account Codes
- Direct Line Key Selection
* • Busy Line Callback (Queuing)
- Outside Dial Tone Restore
- Line Key Skipping
- On-Hook Dialing
- Dialing SCC Numbers
* • Speed Dialing
* • Last Number Redial
* • Calls on Hold (I-Hold or System Hold)
- Transferring Outside Calls
- Off-Premise Transfer
- Reverse Transfer/Call Pick-up
* • Attendant, Hold, and Transfer Recall Times
- Conference Calls with One Inside Party/Two Outside
- Conference Calls with Two Inside Parties/One Outside
- Call Waiting
- On-Hook Monitoring

Special Station Features

- Call Forwarding
* • Do-Not-Disturb
- Message Waiting and Message Center
- Background Music to Stations
* • Paging -- All-Call, Internal Zone, External Zone

ATTENDANT FEATURES (DSS)

- 3 Feature Keys
- Direct Station Selector
- Busy Lamp Field
- Intercom Features
- Call Transfer and Reverse Transfer
- Call Transfer to Hold (Parking)
- Message Waiting Indication
- * Night Ring Mode

Features with Capacities	616 System	1232 System
Paging		
Internal Zone Page	2	5
External Zone Page	*	*
Speed Dialing		
Numbers Per Station	10	10
Digits Per entry	10	10
Simultaneous Three-party Conference Calls	2	2
C.O. Line and Station Queuing	5	5
Call Waiting		
I.C. Calls Waiting Per Station	1	1
I.C. Calls Initiated Per Station	1	1
C.O. Calls Waiting Per Station	6	12

*External paging zones use a vacant circuit on a STN PCB. Any vacant circuit(s) may be used.

4. INSTALLATION SUMMARY

4.01 The INSTALLATION section gives complete instructions on planning and installing the system. The PROGRAMMING section describes how to customize the system's features. Maintenance procedures are covered in the TROUBLESHOOTING and DIAGNOSTIC PROGRAMMING sections. The REPLACEMENT PARTS section lists parts available from Inter-Tel.

4.02 The modular design of the system, combined with self-diagnostics, facilitates rapid repair with minimal down-time. In the event of a failure, the defective module should be replaced by the service personnel from their inventory of spare parts.

4.03 Strict quality assurance standards for manufacturing and through field testing provide the system with the high degree of reliability demanded by today's high-technology market.

SYSTEM SPECIFICATIONS

CONTENTS

1. INTRODUCTION

1.01 This section describes the system hardware:

- Station Instruments
- Direct Station Selector/Busy Lamp Field (DSS) Unit
- Key Service Unit (KSU)
- Cabling and the Main Distribution Frame (MDF)
- SMDR and Diagnostic Programming Terminal Requirements
- System Battery Back-up
- Music-On-Hold Module
- Other Optional Equipment

1.02 The 616 system has capacity for 6 Central Office (C.O.) lines, 16 multi-line keysets and 16 Direct Station Selector/Busy Lamp Field (DSS) Units. The 1232 system has capacity for 12 C.O. lines, 32 multi-line keysets and 32 DSS's.

1.03 Photographs of the keysets, DSS's, and KSU's are located at the end of this section. For installation methods, refer to the INSTALLATION section.

2. STATION INSTRUMENTS

2.01 Three different models of multi-line keysets are available for use on the system: the 616, 1232, and 2480 keysets. Photographs of the keysets appear on pages 2-11 to 2-16.

2.02 Each model has a different number of C.O. line keys. The 616 keyset has six C.O. line keys, and the 1232 keyset has 12. The 2480 keysets, with 24 C.O. line keys, are recommended for use where the ability to expand and upgrade the equipment without purchasing new keysets is desired. (2480 keysets are compatible with Inter-Tel's larger 2456 and 32X128 systems.) If desired, combinations of the different keysets may be used on the same system.

NOTE: 616 keysets used on the 1232 system can access C.O. lines one through six only.

2.03 Keysets are equipped with a pushbutton keypad, C.O. line keys, six feature keys, an internal speaker, and voice volume and ring volume controls. Full-duplex, handsfree answer-back conversation is a standard keyset feature on received intercom calls. Keysets have a switch-enabled internal microphone for full-duplex, handsfree operation on outside calls with the optional Speakerphone Kit (part no. 828.1033) and Desk Speaker (part no. 828.1027) added.

2.04 The keyset dimensions are given below:

616, 1232, 2480
Keyset Dimensions

Height	3.5 in.
Width	7.5 in.
Depth	9 in.
Weight	2.5 lbs.

3. DIRECT STATION SELECTOR/BUSY LAMP FIELD (DSS) UNIT

3.01 A Direct Station Selector/Busy Lamp Field is an optional device which, when attached to a multi-line keyset, allows a user to access any station by pressing the corresponding DSS key. The lamps under the DSS keys comprise the busy lamp field, which indicates the condition of each station (idle, busy, in Do-Not-Disturb, transferred call recalling) by different flash rates.

3.02 DSS units may be powered from an AC outlet or from the Key Service Unit (KSU) power supply. When AC powered, one DSS may be connected to each multi-line keyset. An optional AC transformer (part no. 806.1009) is required. When AC power is inaccessible, up to two DSS's may be powered by the KSU (two Station printed circuit boards can support one DSS each). KSU and AC powered DSS's may be mixed on the same system. Refer to pages 2-17 and 2-18 for photographs.

3.03 The DSS dimensions are given below:

DSS Dimensions

Height	3.5 in.
Width	7.5 in.
Depth	9 in.
Weight	1.88 lbs.

4. KEY SERVICE UNIT (KSU)

A. KSU DESCRIPTION

4.01 The KSU houses the cardfile and printed circuit boards (PCB's). It performs all control and switching activities for the system, detects incoming calls, processes data-controlled features, and controls the interaction between keysets, C.O. lines, and intercom channels. Refer to pages 2-19 and 2-20 for photographs.

4.02 The system is a microprocessor-controlled, time division multiplexed system. Memory includes 24K bytes ROM and 2K bytes RAM in the microprocessor on the Central Processing Unit (CPU) printed circuit board (PCB). An eight-bit microprocessor in each keyset communicates with the master processor on the CPU PCB. Speech channels are divided as follows:

Speech Channels	616 System	1232 System
C.O. lines	6	12
Intercom	5	3 or 5*
Music-On-Hold	1	1

*When the sixth COU PCB is installed on the 1232 system, there are three intercom channels instead of five.

4.03 The KSU is wall mounted when powered by the 340.06 or 340.07 power supplies. When system battery back-up is required, the KSU is installed in a cabinet with the 680.06 power supply. The 616 cardfile has nine PCB slots and the 1232 cardfile has 16 PCB slots; each of the PCB's is described in Section E. Dimensions of the KSU's are given below:

616 KSU Dimensions		1232 KSU Dimensions		Battery Back-up KSU Dimensions	
Height	9.5 in.	Height	9.5 in.	Height	25.5 in.
Width	13.5 in.	Width	21.75 in.	Width	27 in.
Depth	11.25 in.	Depth	11.25 in.	Depth	19 in.
Weight	12 lbs.	Weight	18 lbs.		

B. SYSTEM POWER SUPPLY

4.04 The power supply (340.06, 340.07, or 680.06) provides power to the KSU, all stations, and up to two DSS units. It requires an isolated, dedicated 105-125VAC, 15A, 57-63Hz, single-phase commercial power source.

4.05 The 680.06 power supply is equipped to charge batteries that will provide back-up power to the system during a power outage or "brown-out" condition. The batteries are optional and are supplied by the customer. Refer to page 2-8, SYSTEM BATTERY BACK-UP, for more information.

4.06 The maximum power outputs for each power supply are shown below:

340.06 Power Supply	340.07 Power Supply	680.06 Power Supply
+5VDC, 6A	+5VDC, 11A	+5VDC, 20A
-12VDC, 0.3A	-12VDC, 0.3A	-12VDC, 0.5A
+30VDC, 1.8A	+30VDC, 4A	+30VDC, 8A
		+28VDC battery float voltage, 2A

C. ENVIRONMENTAL REQUIREMENTS

4.07 The environmental requirements for the KSU are as follows:

Requirements	In Operation	In Storage
Temperature	32° to 80° F	4° to 185° F
Humidity (Non-Condensing)	20% to 85%	0% to 85%
Altitude	Up to 10,000 ft.	Up to 40,000 ft.

D. CENTRAL OFFICE (C.O.) LINE CHARACTERISTICS

Characteristics

Loss from TELCO network to C.O. lines	0dB
Ringer Equivalence	0.9A
Ringing Voltage	40VAC RMS minimum

Protection

Tip-to-Ring	360V transient

NOTE: Also refer to page 2-6, Central Office Unit PCB.

E. PRINTED CIRCUIT BOARDS (PCB'S)

4.08 The various printed circuit boards are described below. Photographs of the PCB's appear in the INSTALLATION section.

Central Processing Unit (CPU) PCB

4.09 The CPU PCB contains the main controlling microprocessor and its associated control, logic, and memory circuits. This includes the central processor with up to 24K bytes of ROM storage, 2K bytes of RAM storage, an RS232C port, system clocks, internal Music-On-Hold circuitry, and a battery for data base protection.

4.10 The CPU PCB provides central software control for the KSU. It functions under the control of a generic program, stored in the ROM, which is activated when the system is initialized.

4.11 The 25-pin subminiature "D" female connector on the front of the CPU PCB is the RS232C interface. It is the connection point for the Station Message Detail Recording (SMDR) output device and diagnostic programming terminal. Refer to page 2-7, SMDR AND DIAGNOSTIC PROGRAMMING TERMINAL REQUIREMENTS, for more information.

4.12 Music-On-Hold is provided by a synthesized music chip on the PCB. If desired, an external music source may be connected to the system with an optional Music-On-Hold module (part no. 340.23) added. The module attaches to the CPU PCB and provides additional circuitry and a 1/8-inch mini-phone jack for the external music source interface. Refer to page 2-9, MUSIC-ON-HOLD MODULE, for more information.

4.13 The battery ON/OFF jumper on the CPU PCB is shipped in the open (out of circuit) position to protect the battery. It should be moved to the closed position during installation to protect the programmed information that is stored in the customer's data base. If the battery is fully charged, the data base will be protected for a maximum of 25 days. Allow two days for the battery to charge after installing the CPU PCB.

Central Office Unit (COU) PCB

4.14 Each COU PCB has circuitry for two C.O. lines. The 616 system has capacity for up to six two-way lines (three COU PCB's). The 1232 system has capacity for 12 lines (six PCB's). Each COU PCB is configured for DTMF signalling, but some or all of the lines can be converted to dial-pulse signalling using the Rotary Conversion Kit (part no. 828.1032).

4.15 Each of the two circuits on a COU PCB is assigned a circuit number by the PCB's physical location in the KSU and the location of the circuit on the PCB. The PCB inserted into COU slot 1 is assigned lines 1 and 2, (circuits 1.1 to 1.2) top to bottom. The slot 2 PCB is assigned lines 3 and 4 (circuits 2.1 to 2.2), and so on.

Station (STN) PCB'S

4.16 There may be four STN PCB's in the 616 system and eight in the 1232 system. Each STN PCB has the circuitry for up to four keysets. As described on page 2-3, two STN PCB's may support one DSS unit each, for a maximum of two DSS's powered by the system.

4.17 Each of the four circuits on a STN PCB is assigned a circuit number by the PCB's physical location in the KSU and the location of the circuit on the PCB. The first digit of the circuit number identifies a PCB slot. The second digit identifies one of the four circuits on the PCB. For example, circuit number 2.3 identifies the third circuit on the second STN PCB and is assigned extension (intercom) number 16. The circuits are assigned intercom numbers when the system is initialized and cannot be changed.

4.18 There is a 1A slow-blow fuse on the STN PCB to protect the KSU from foreign voltages/currents from the stations connected to the PCB. Fuses may be obtained from electronic supply outlets.

Conference (CNF) PCB

4.19 The CNF PCB provides the circuitry for up to two three-way conferences (one inside and two outside parties, or one outside and two inside parties). Conference calls are amplified so that all parties have normal volume.

5. CABLING AND THE MAIN DISTRIBUTION FRAME (MDF)

5.01 Three-pair cable serves all stations. The station cables are terminated on six-conductor modular jack assemblies. Connections between keysets and the STN PCB's in the KSU may be made directly (Method A) or on the MDF (Method B). Refer to the INSTALLATION section for a description of both methods. If Method B is used, the MDF is made up of special Siemens terminal blocks (part no. S66M450-MPK). If the Siemens blocks are unavailable, six-conductor modular jack assemblies can be used.

5.02 The C.O. lines, as specified in FCC regulations, should be terminated on telephone company RJ14C jacks or RJ21X blocks. If terminated on RJ14C jacks, the C.O. lines are then connected to the COU PCB's by two-pair line cords. If the C.O. lines are terminated on RJ21X blocks, cross-connect cable is used to terminate the C.O. lines onto four-conductor modular jack assemblies. Two-pair line cord is then run between the modular jack assemblies and the COU PCB's.

5.03 All terminal blocks, cables, line cords, connectors and modular jack assemblies are telephone industry standard and are available from electronic supply outlets.

6. SMDR AND DIAGNOSTIC PROGRAMMING TERMINAL REQUIREMENTS

6.01 The following requirements must be met for the SMDR output device or a diagnostic programming terminal to be connected to the system.

A. Both devices must be RS232C compatible and have a male 25-pin subminiature "D" connector. Refer to page 3-52 for a pin-out of the connector.

B. Both devices must be formatted for serial ASCII with no parity and must have full-duplex communications capability.

C. Both devices must communicate at 300 baud.

7. SYSTEM BATTERY BACK-UP

7.01 System battery back-up (Kit part no. 340.02) is an optional feature that allows customer-provided batteries to be connected to the system to prevent loss of service in the event of a power failure. The batteries are charged by the 680.06 power supply, which is mounted in a cabinet with the 616 or 1232 KSU. Inter-Tel recommends Globe Battery's lead calcium grid Type B battery line, based on cost, compatibility with power supply chargers, back-up time, number of batteries required, and availability.

NOTE: The 340.06 and 340.07 power supplies are not equipped with battery chargers. If desired, a Tripp-lite Standby Supply can be connected to the power supply to provide back-up power. For the 340.06 power supply, use Tripp-lite part no. SB200LVC; for the 340.07, use part no. SB400LVC.

7.02 Batteries may be placed in a battery compartment (part no. 823.1075). The compartment measures 12 inches high X 19 inches wide X 9 inches deep. To protect wires coming out of the compartment, use either 1/2-inch electrical-metallic tubing (EMT) or a HEYCO-type strain relief connector.

NOTE: Batteries connected in series form a "string." If desired, connect two strings in parallel to double the AH rating, which results in longer discharge rates; the voltage level remains the same.

7.03 The 616 system requires:

A. Two Globe #GC1245 batteries (12 volts, 4.5 AH @ 20 hr. rate) connected in series to provide 3/4 to 1-1/2 hours of back-up time. The batteries fit inside the KSU.

OR, B. Two Globe #GC12230 batteries (12 volts, 23.0 AH @ 20 hr. rate) connected in series to provide 7 to 12 hours of back-up time. The batteries fit inside one battery compartment.

7.04 The 1232 system requires:

A. Two Globe #GC12230 batteries (12 volts, 23.0 AH @ 20 hr. rate) connected in series to provide 3 to 7 hours of back-up time. The batteries fit inside one battery compartment.

OR, B. Two Globe #GC12800 batteries (12 volts, 80.0 AH @ 20 hr. rate) connected in series to provide 12 to 28 hours of back-up time. Batteries fit inside two battery compartments. Each battery weighs about 50 pounds each.

7.05 Batteries must be fully charged when they are installed. Charge batteries individually using a constant-voltage current-limited charger with less than three percent ripple. The charge voltage must be set to 2.3 volts per cell. Be careful not to damage the batteries by overcharging them. New Globe batteries require 25 days of float voltage or 25-30 discharge cycles to attain full capacity. Initial capacity is 80 percent of rated capacity.

7.06 All batteries should be of the same age and AH rating. Globe dates batteries by stamping them with a date code. For example: 410-B, where 4=last digit of year, 10=month, and B=type of electrolyte.

7.07 If a battery in a string needs to be replaced, the age of the string will determine if a fresh battery can be added. If the string is two to three years old, adding a fresh battery will reduce the life of the entire string. This is because a fresh battery will be overcharged, while the older batteries are under-charged.

7.08 These batteries give off explosive and corrosive gas. To reduce the effects of this gas, place the batteries in a well-ventilated room and coat the terminals with an anti-corrosive agent. Do not store batteries; they will self-discharge, and their capacity decreases with age. If you must store batteries, recharge them every six months. Recharge time may vary depending on the current limit of the charger and the battery charge.

7.09 If you find it necessary to consider another manufacturer's battery, or require longer system battery back-up time, contact Inter-Tel's Customer Support Department.

8. MUSIC-ON-HOLD MODULE

8.01 As an alternative to synthesized music, an external music source can be connected to the system with the addition of an optional Music-On-Hold module (part no. 340.23). The module attaches to the CPU PCB and provides interface circuitry and an input connection for the external music source.

8.02 A 1/8-inch mini-phone jack on the front edge of the Music-On-Hold module is the input connection for the external music source. An AGC circuit in the module automatically holds the volume to a predetermined level that is slightly lower than the normal voice volume, as required by FCC regulations. Optimal input level is 1 VRMS.

9. OTHER OPTIONAL EQUIPMENT

9.01 The following optional equipment is available from Inter-Tel:

A. Speakerphone Kit (part no, 828.1033): The module connects to multi-line keysets along with the Desk Speaker (part no. 828.1027) for full-duplex handsfree operation on outside calls.

B. PLT-2 Headset Adapter (part no. 828.1031): Connects to multi-line keysets to allow the use of industry-standard carbon-microphone headsets.

C. Hearing-Aid Compatible Receiver (part no. 828.1046): Replaces the standard receiver unit for compatibility with inductive pick-up hearing aids. There is no volume adjustment.

D. Loud-Ringing Adapter (part no. 828.1031): Connects to a multi-line keyset to allow the use of an external ringing device.

9.02 Inter-Tel recommends the Walker Amplified Handset (part no. W6-K-6K) and Handset Amplifier (part no. W10) for hard-of-hearing users who require adjustable volume control. The amplified handset is compatible with all Inter-Tel multi-line keysets; special wiring into the keyset is required. The handset amplifier is compatible with all Inter-Tel keysets.

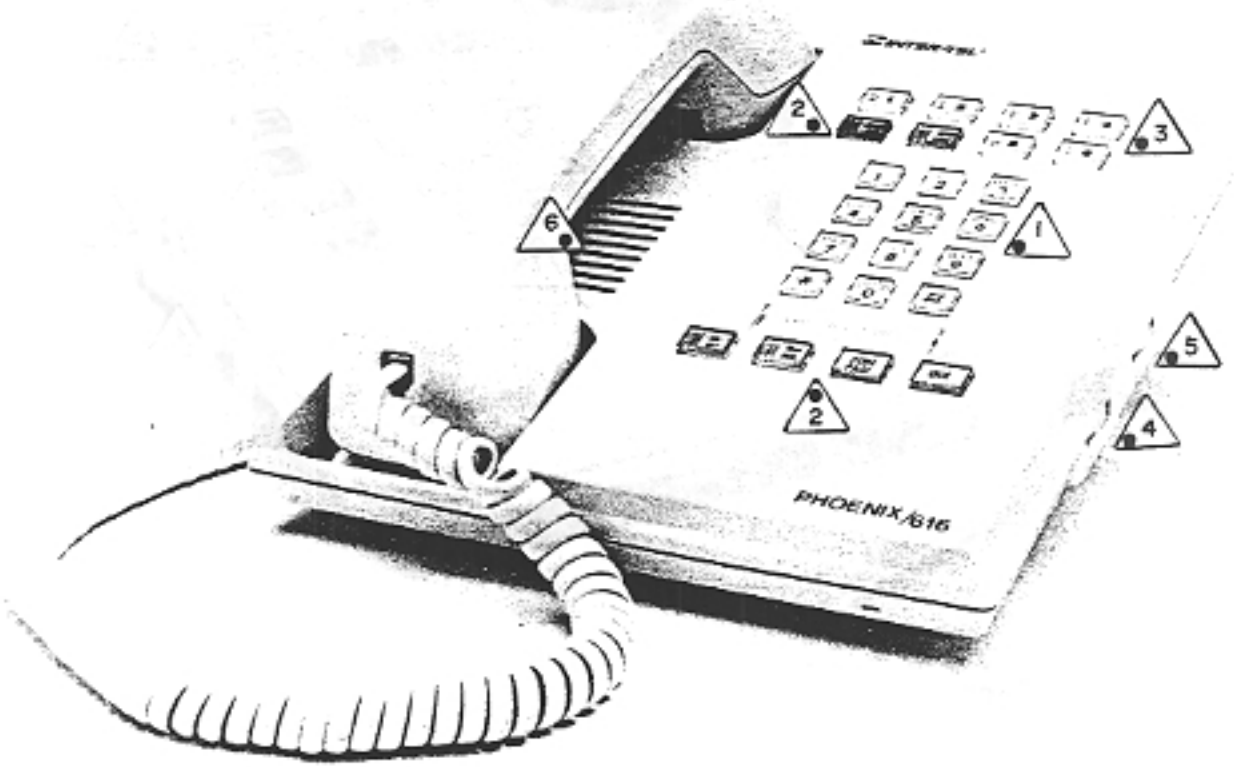
9.03 The following customer-provided equipment also may be added to the system. Each item is discussed in another section of the manual.

A. External Paging Speakers and Amplifiers: Refer to page 3-37.

B. External Ringing Devices: Refer to paragraph 9.01 (D), Loud-Ringing Adapter, above.

C. External Music Source (radio, tape recorder, etc.): Refer to pages 2-9 and 3-53.

FIGURE 2-1. 616 PHOENIX KEYSET

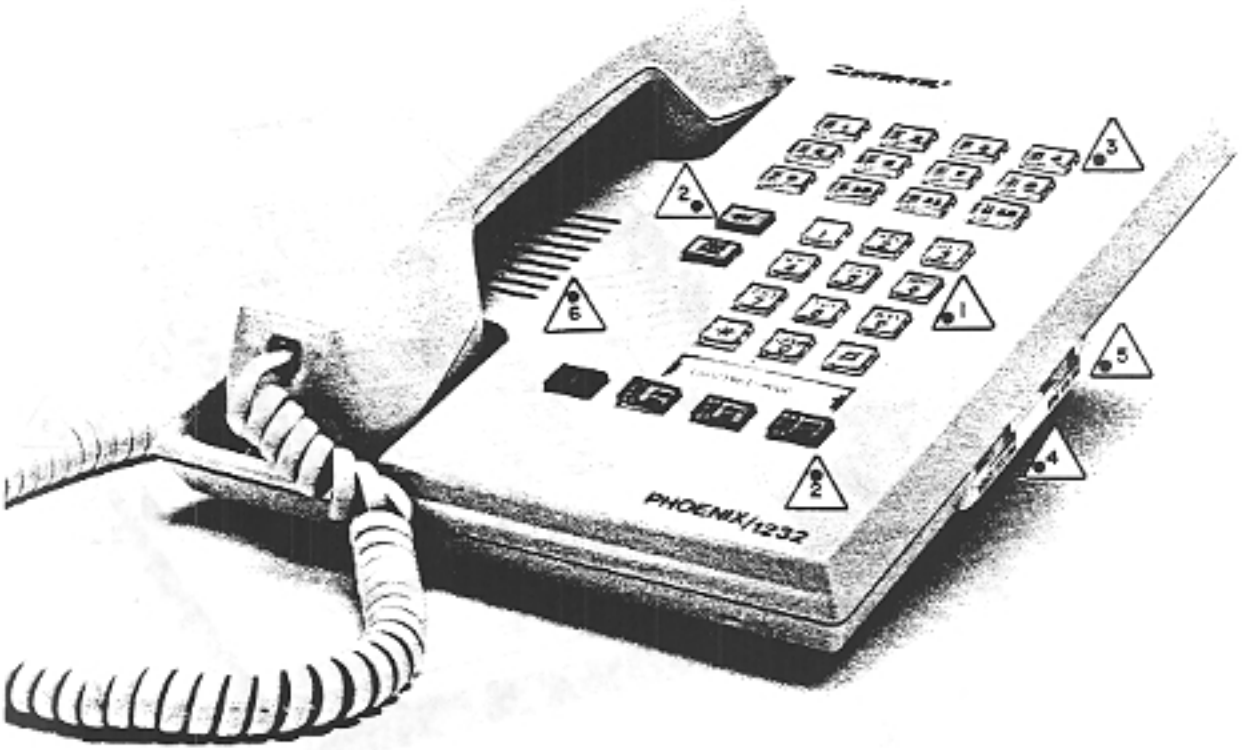


1. PUSHBUTTON KEYPAD
2. 6 FEATURE KEYS
3. 6 C.O. LINE KEYS
4. VOICE VOLUME CONTROL
5. RING VOLUME CONTROL
6. INTERNAL SPEAKER

FIGURE 2-2. 616 HITEC KEYSET

1. PUSHBUTTON KEYPADS
2. 6 FEATURE KEYS
3. 6 C.O. LINE KEYS
4. VOICE VOLUME CONTROL
5. RING VOLUME CONTROL
6. INTERNAL SPEAKER

FIGURE 2-3. 1232 PHOENIX KEYSET



1 PUSHBUTTON KEYPADS

2 6 FEATURE KEYS

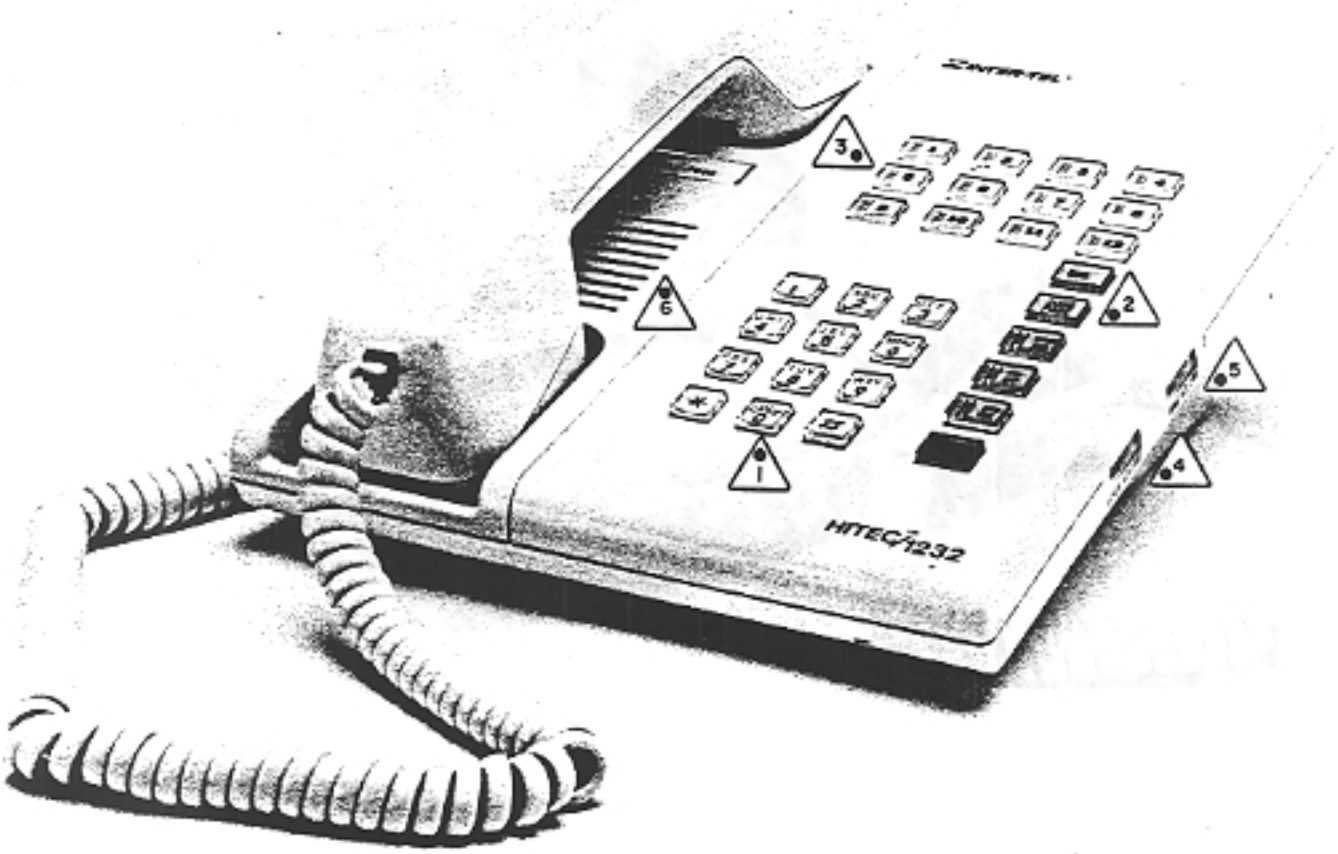
3 12 C.O. LINE KEYS

4 VOICE VOLUME CONTROL

5 RING VOLUME CONTROL

6 INTERNAL SPEAKER

FIGURE 2-4. 1232 HITEC KEYSET



1 PUSHBUTTON KEYPADS

2 6 FEATURE KEYS

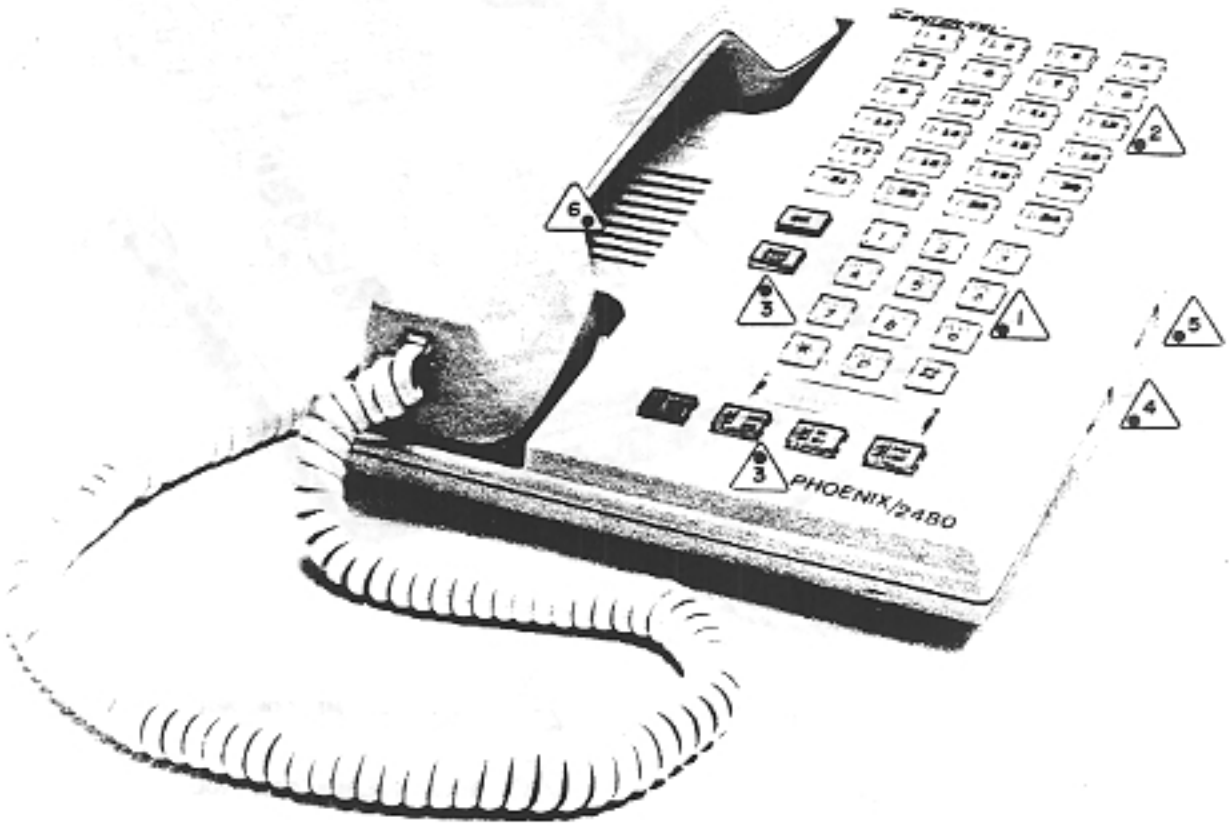
3 12 C.O. LINE KEYS

4 VOICE VOLUME CONTROL

5 RING VOLUME CONTROL

6 INTERNAL SPEAKER

FIGURE 2-5. 2480 PHOENIX KEYSET



1 PUSHBUTTON KEYPAD

2 24 C.O. LINE KEYS

3 6 FEATURE KEYS

4 VOICE VOLUME CONTROL

5 RING VOLUME CONTROL

6 INTERNAL SPEAKER

FIGURE 2-6. 2480 HITEC KEYSET

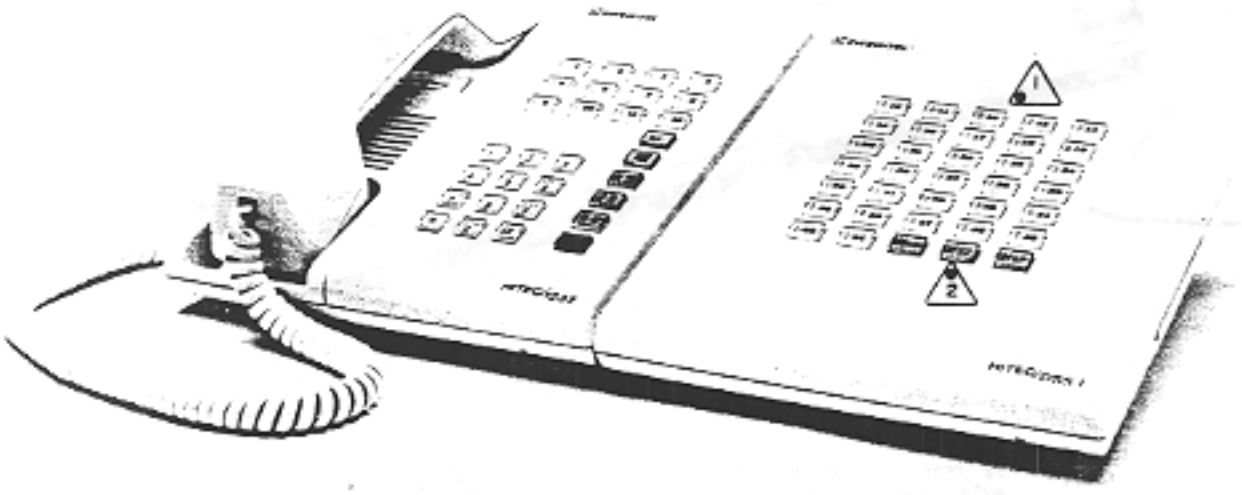
1. PUSHBUTTON KEYPAD
2. 24 C.O. LINE KEYS
3. 6 FEATURE KEYS
4. VOICE VOLUME CONTROL
5. RING VOLUME CONTROL
6. INTERNAL SPEAKER

FIGURE 2-7. PHOENIX DSS I

1 32 DIRECT STATION SELECTOR/ BUSY LAMP FIELD KEYS

2 3 DSS FEATURE KEYS

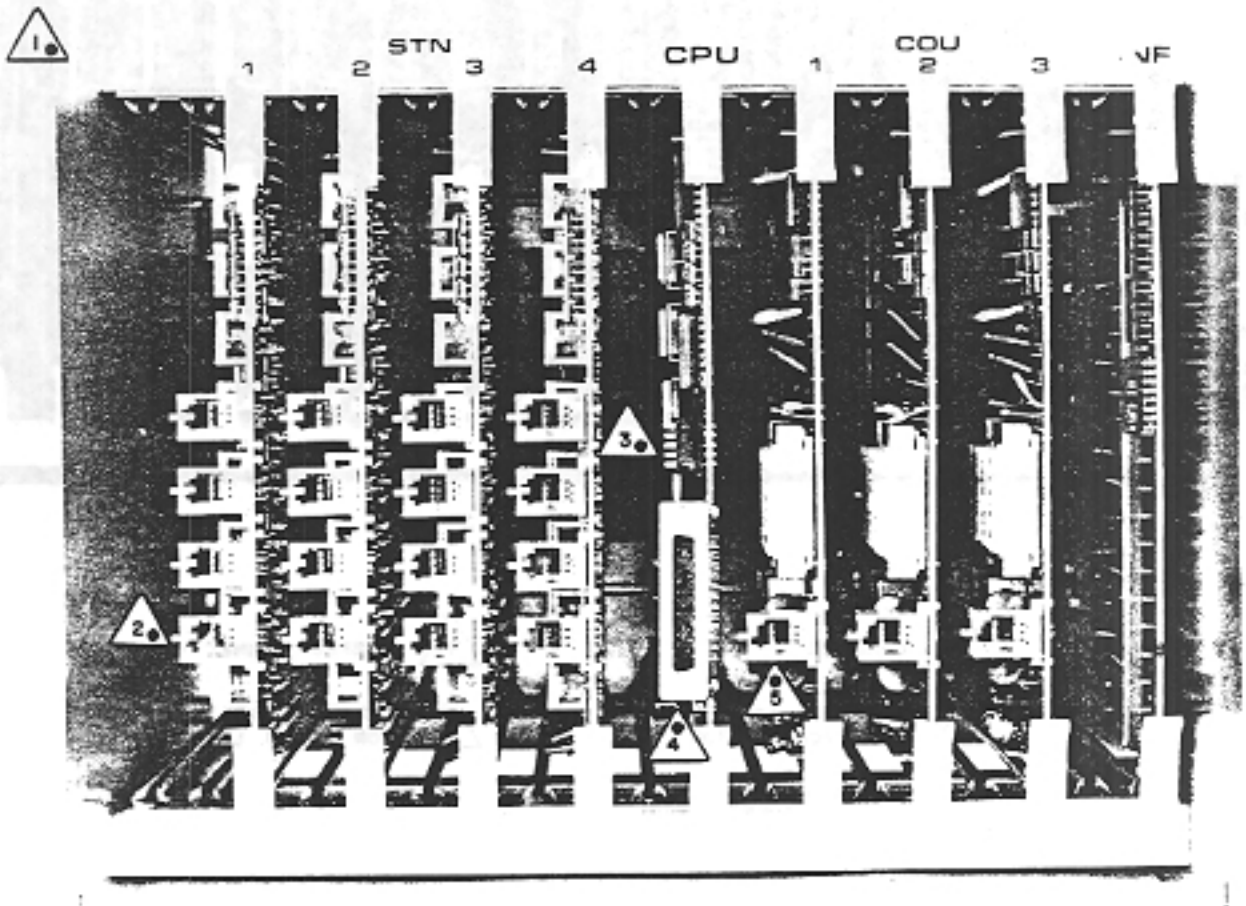
FIGURE 2-8. HITEC DSS I



1 32 DIRECT STATION SELECTOR/ BUSY LAMP FIELD KEYS

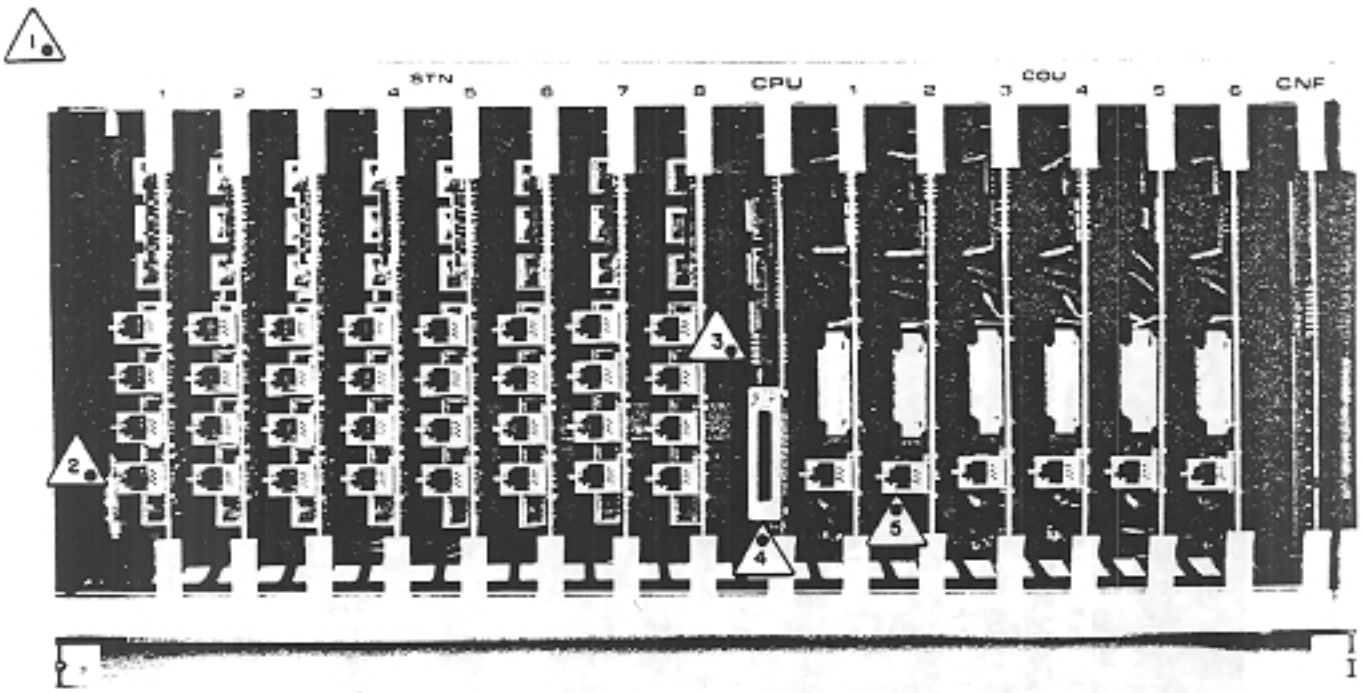
2 3 DSS FEATURE KEYS

FIGURE 2-9. 616 KEY SERVICE UNIT (KSU)



1. CARDFILE
2. MODULAR JACK FOR EACH STATION
3. PROGRAMMING DIP SWITCHES
4. RS232C CONNECTOR
5. MODULAR JACK FOR 2 C.O. LINES

FIGURE 2-10. 1232 KEY SERVICE UNIT (KSU)



1. CARDFILE
2. MODULAR JACK FOR EACH STATION
3. PROGRAMMING DIP SWITCHES
4. RS232C CONNECTOR
5. MODULAR JACK FOR 2 C.O. LINES

INSTALLATION

CONTENTS PAGE

1. INTRODUCTION

1.01 This section describes the recommended procedures for installing the system hardware. Refer to SYSTEM SPECIFICATIONS for hardware descriptions.

2. PRE-INSTALLATION PLANNING

A. SITE PLANNING

2.01 Before installing the equipment, select a centralized location for the KSU that will minimize cable run lengths from each station, and provide the proper environmental conditions.

a. Access to an isolated, dedicated 105-125VAC, 15A, 57-63Hz single-phase commercial power source.

   NOTE: This must be an isolated, dedicated AC input for proper operation. The ground wire must be dedicated to this outlet. Run the power, neutral, and ground wires directly from the breaker box to the KSU outlet.

b. Select the KSU location to minimize cable run length. Refer to STATION LOOP RESISTANCE TEST on page 3-12 for loop resistance limits.

c. Place the equipment in a climate-controlled room. The KSU internal temperature must be maintained at 32° F to 90° F, and the room temperature must not exceed 80° F.

d. Do not permit the equipment to be subjected to direct sunlight, high humidity, heat radiation, dust, or strong magnetic fields (such as heavy motors or large copy machines).

e. Provide ample air space around the power supply or battery back-up KSU; the power supplies are convection cooled. Place the battery back-up KSU (mounted in cabinet) at least four inches from any wall and NEVER set anything on top of it.

f. When wall mounting any equipment, select a wall that is strong enough to support twice as much weight as the equipment to be mounted. The KSU weighs approximately 12-18 pounds; the keyset weighs approximately 2.5 pounds. Equipment dimensions appear on page 2-4.

Page 3-3

g. A 4X6-foot area is required for mounting the Main Distribution Frame (MDF). This is sufficient to wall mount the KSU and attach the terminal block(s) and peripheral equipment.

h. Allow space for optional equipment (the SMDR output device, system back-up batteries, and amplifiers).

B. TOOLS AND SUPPLIES REQUIRED

a. A digital voltmeter with an accuracy of ±0.5% or better is required to set critical voltage levels in the station instruments, check the power supply, and ensure the correct wiring of the modular jack assemblies.

b. A grounding terminal and 10AWG wire for grounding the KSU.

c. Standard telephone hand tools.

d. For C.O. lines:

(1) If the C.O. lines are terminated on an RJ21X block:

--Four-conductor modular jack assemblies to terminate the lines on the MDF. You will need one assembly for every two lines.

--Cross-connect cable to terminate the RJ21X blocks to the four-conductor modular jack assemblies.

(2) To connect the C.O. lines from the cross-connected jacks on the MDF (or the RJ14C jacks) to the jacks on the Central Office Unit (COU) PCB's, you will need two-pair mod-to-mod line cords.

e. For Station Installations:

(1) Three-pair (six-conductor) cable to run from the KSU location to the station locations.

(2) Six-conductor modular jack assemblies to connect to the station end of the cable.

(3) For station installations terminated directly from the stations to the PCB's in the KSU (refer to page 3-9 for Method A):

--Six-pin modular plugs to attach to the KSU end of the three-pair cable (STN PCB's have modular jacks).

--A Futuronics crimping tool, part no. MCT-6S, to attach the modular plugs.

OR, (4) For station installations terminated from the station to the MDF and then to the PCB's in the KSU (refer to page 3-10 for Method B):

--Siemens terminal blocks(s) with 16 six-pin modular jacks, part no. S66450-MPK, to mount on the MDF. If not available, use six-conductor modular jack assemblies (one per station).

--Three-pair mod-to-mod line cords to connect the terminal blocks on the MDF to the modular jacks on the STN PCB's.

3. THE MAIN DISTRIBUTION FRAME (MDF)

3.01 The MDF is the point at which the KSU, the stations, and the C.O. lines are connected to one another. It is extremely important that this be done accurately.

3.02 Install a 4X6-foot, 3/4-inch plywood backboard on the wall. This is the surface that the required equipment is mounted on.

4. STATION CABLING

4.01 There are two ways to terminate the station cables. Method A connects station cables directly to the STN PCB's in the KSU (refer to Figure 3-1 on page 3-6). Method B first terminates the station cables on terminal blocks on the MDF; the blocks are then connected to the STN PCB's using mod-to-mod line cords (refer to Figure 3-2 on page 3-7).

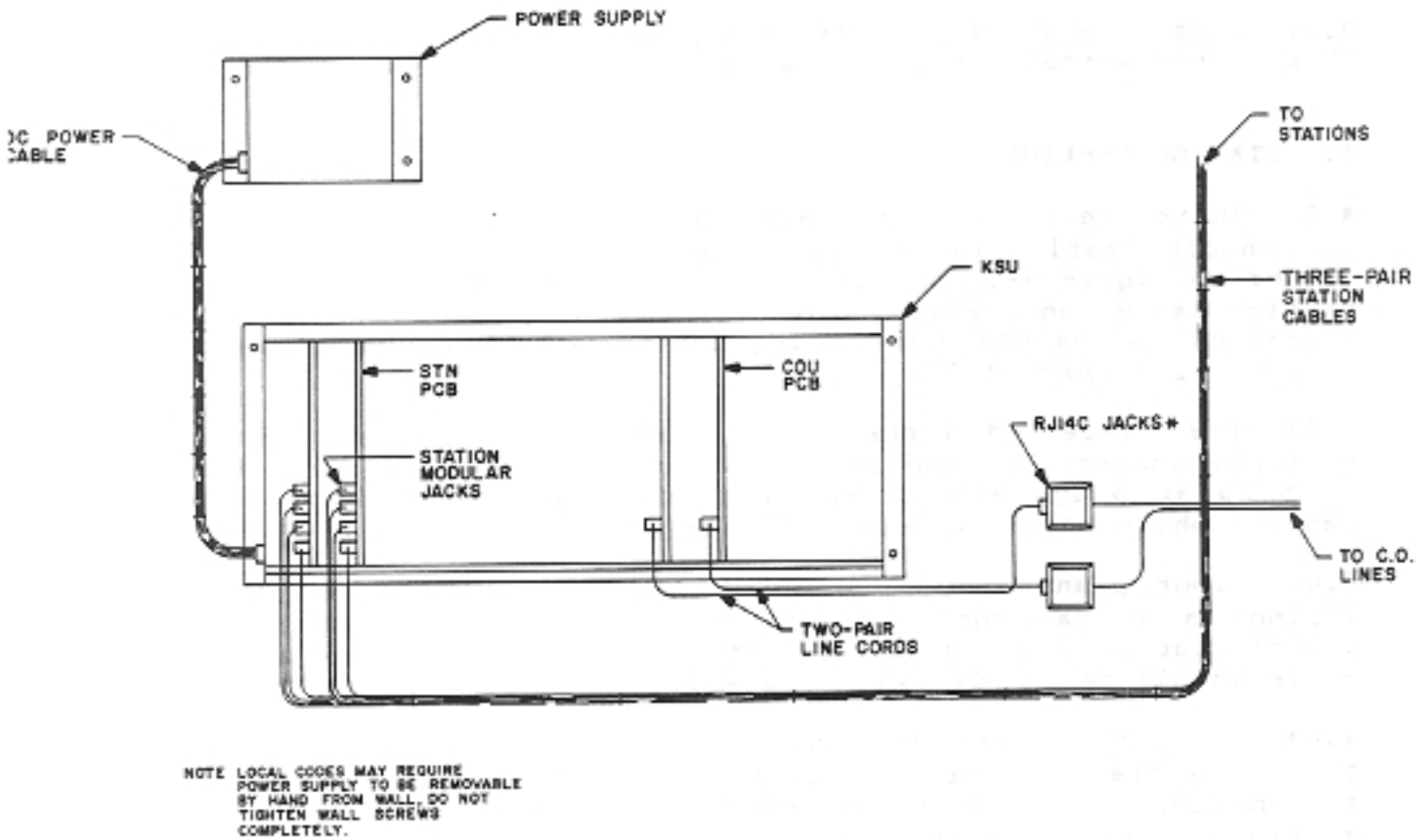
4.02 The preferred installation, Method B, provides the most reliable connections and is the easiest to service. With Method A, modular plugs are attached to the KSU end of the twisted cables, which offers a less reliable connection.

4.03 Floor plans should be developed to aid in proper station wiring in a star configuration from the KSU. Prepare a cable identification plan using circuit numbers. Both ends of every cable should be labeled with the station circuit number.

4.04 Circuit numbers are assigned as shown on the next page. The 616 system may have up to four Station STN PCB's; the 1232 system uses up to eight STN PCB's. Each STN PCB supports four stations. The first digit of the circuit number identifies a PCB slot. The second digit identifies one of the four circuits on the PCB. For example, circuit number 2.3 identifies the third circuit on the second STN PCB and is assigned extension (intercom) number 16.

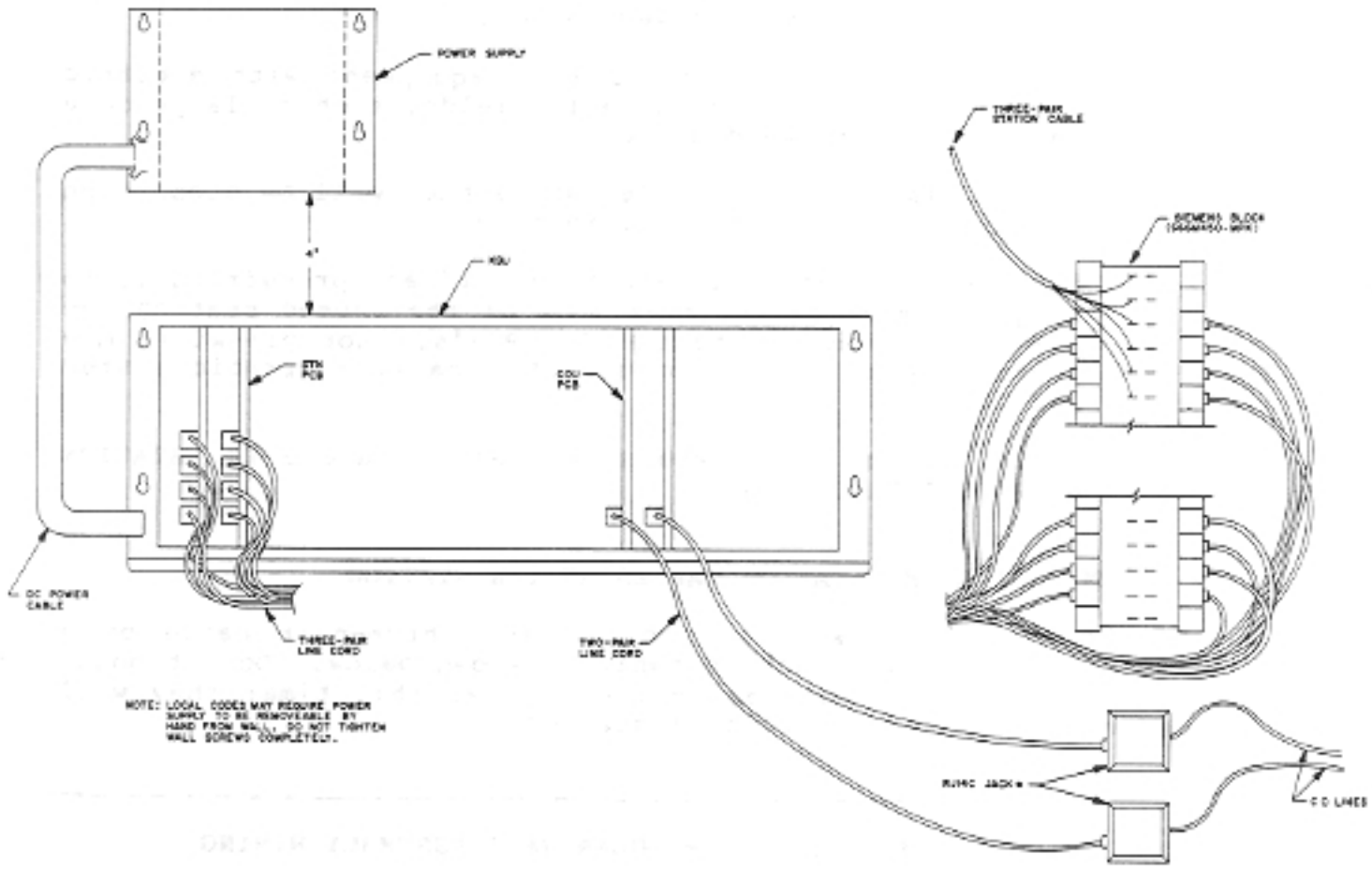
STN CKT	IC NO.	STN CKT	IC NO.	STN CKT	IC NO.	STN CKT	IC NO.
1.1	10	3.1	18	5.1	26	7.1	34
1.2	11	3.2	19	5.2	27	7.2	35
1.3	12	3.3	20	5.3	28	7.3	36
1.4	13	3.4	21	5.4	29	7.4	37
2.1	14	4.1	22	6.1	30	8.1	38
2.2	15	4.2	23	6.2	31	8.2	39
2.3	16	4.3	24	6.3	32	8.3	40
2.4	17	4.4	25	6.4	33	8.4	41

FIGURE 3-1. METHOD A (DIRECT KSU CONNECTION) LAYOUT



*C.O. lines terminated on RJ21X blocks are cross-connected to four-conductor modular jack assemblies.

FIGURE 3-2. METHOD B (MDF CONNECTION) LAYOUT



*C.O. lines terminated on RJ21X blocks are cross-connected to four-conductor modular jack assemblies.

A. RUNNING CABLE

4.05 Run three-pair cable to each station location shown on the floor plan. Label both ends of every cable with the circuit number. Follow these guidelines:

a. Avoid running cable parallel to fluorescent light fixtures or AC lines not in conduit. If it is unavoidable, run the station cable at right angles to the obstacles.

b. Do not run station cables inside electrical conduit already occupied by AC power cables.

c. Do not run station cables near equipment with electric motors or past strong magnetic fields, such as large copy machines or arc welding equipment.

d. Do not place station cables where they will be stepped on or rolled over by office furniture.

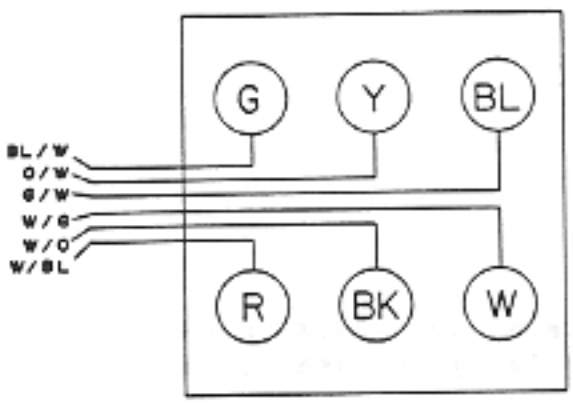
e. Hot pre-wires are NOT permitted. If any pre-wiring is to be performed, ensure that none of the unused station cables are connected to the STN PCB's. Hot pre-wires may transmit data errors to the KSU, causing erratic system performance.

f. Cable length limits are specified on page 3-12, STATION LOOP RESISTANCE TEST.

B. TERMINATING THE STATION CABLES AT THE STATION

4.06 Terminate the station end of each three-pair cable on a six-conductor modular jack assembly as shown below. Do not mount the modular jack assemblies on the wall at this time; they will be mounted when the keyset is installed.

FIGURE 3-3. STATION MODULAR JACK ASSEMBLY WIRING



5. METHOD A STATION CABLE CONNECTION (DIRECT KSU CONNECTION)

5.01 After each station cable has been terminated on a modular jack assembly, prepare the other end of each cable for connection to the KSU.

NOTE: This method does not provide the most reliable connections.

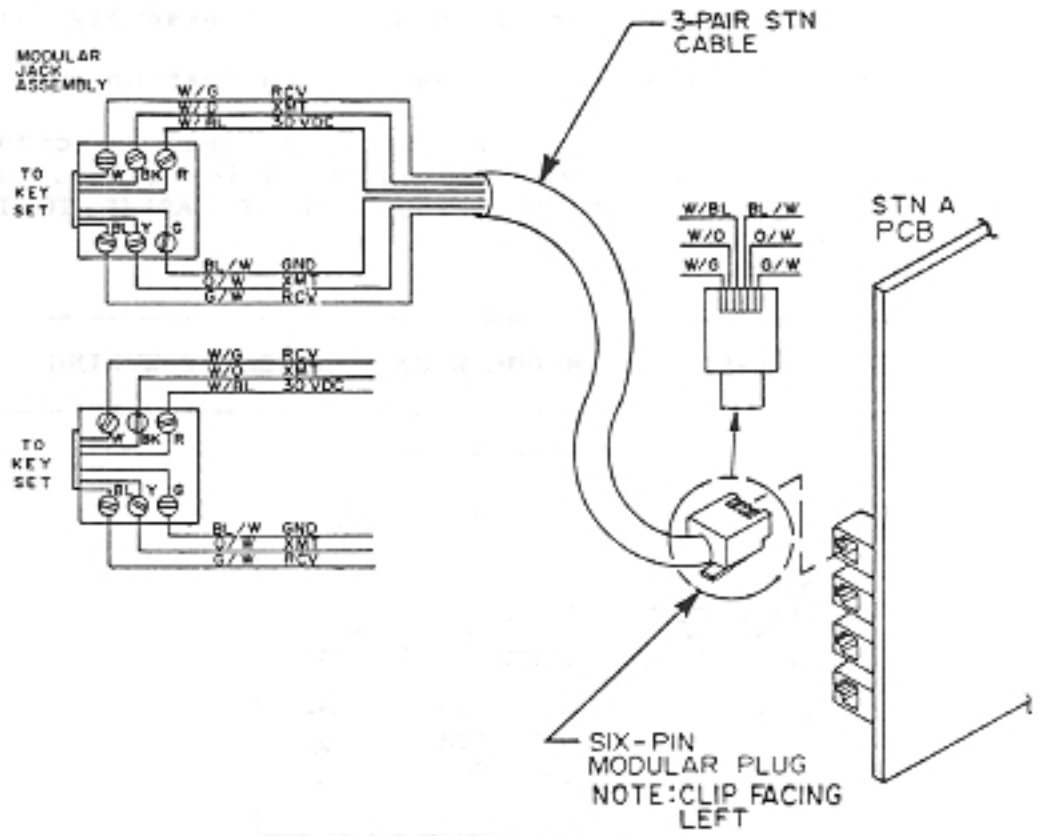
(1) Ensure that the free end of each cable is correctly labeled with the circuit number.

(2) Attach a six-pin modular plug to the free end of each cable using the Futuronics crimping tool. Refer to Figure 3-4 below.

(3) Leave the cables unattached until the KSU is installed. They will be plugged into corresponding station jacks on the STN PCB's.

(4) Perform the Station Loop Resistance Test on page 3-12.

FIGURE 3-4. METHOD A STATION CABLE TERMINATIONS



6. METHOD B STATION CABLE CONNECTION (MDF CONNECTION)

NOTE: This is the recommended method for cabling stations. It provides the most reliable connections and is the easiest to service.

6.01 The 616 system requires one Siemens terminal block (part no. S66M450-MPK) or 16 six-conductor modular jack assemblies; the 1232 system requires two blocks or 32 modular jack assemblies. Mount the terminal block(s) or modular jack assemblies on the MDF.

6.02 Terminate the free ends of the station cables on the MDF as follows:

(1) Ensure that the free end of each cable is correctly labeled with the circuit number.

(2) For Siemens block connections only: Punch down the cable on the block as shown in Figure 3-6 on the next page. The first eight station cables should be punched down on the left side of the block; the next eight station cables should be punched down on the right side of the block.

OR, For modular jack assembly connections only: Terminate each cable on a modular jack assembly as shown in Figure 3-5 below. Note that the WHITE/BLUE pair is reversed from the normal station modular jack assembly wiring.

(3) Perform the Station Loop Resistance Test on page 3-12.

6.03 Three-pair mod-to-mod line cords are used to connect the MDF to the STN PCB's after the KSU has been installed. Refer to page 3-37, CONNECTING STATION AND C.O. LINE CABLES TO THE KSU, for more information.

FIGURE 3-5. MDF MODULAR JACK ASSEMBLY WIRING

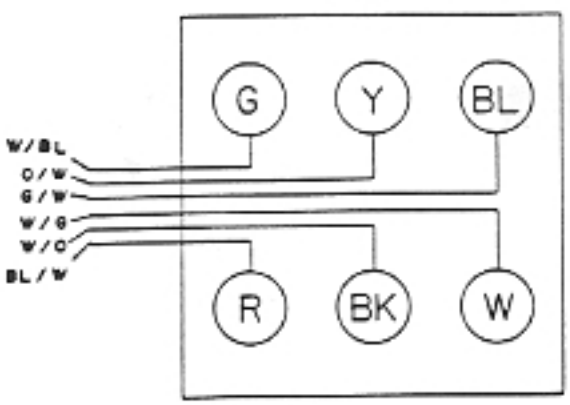
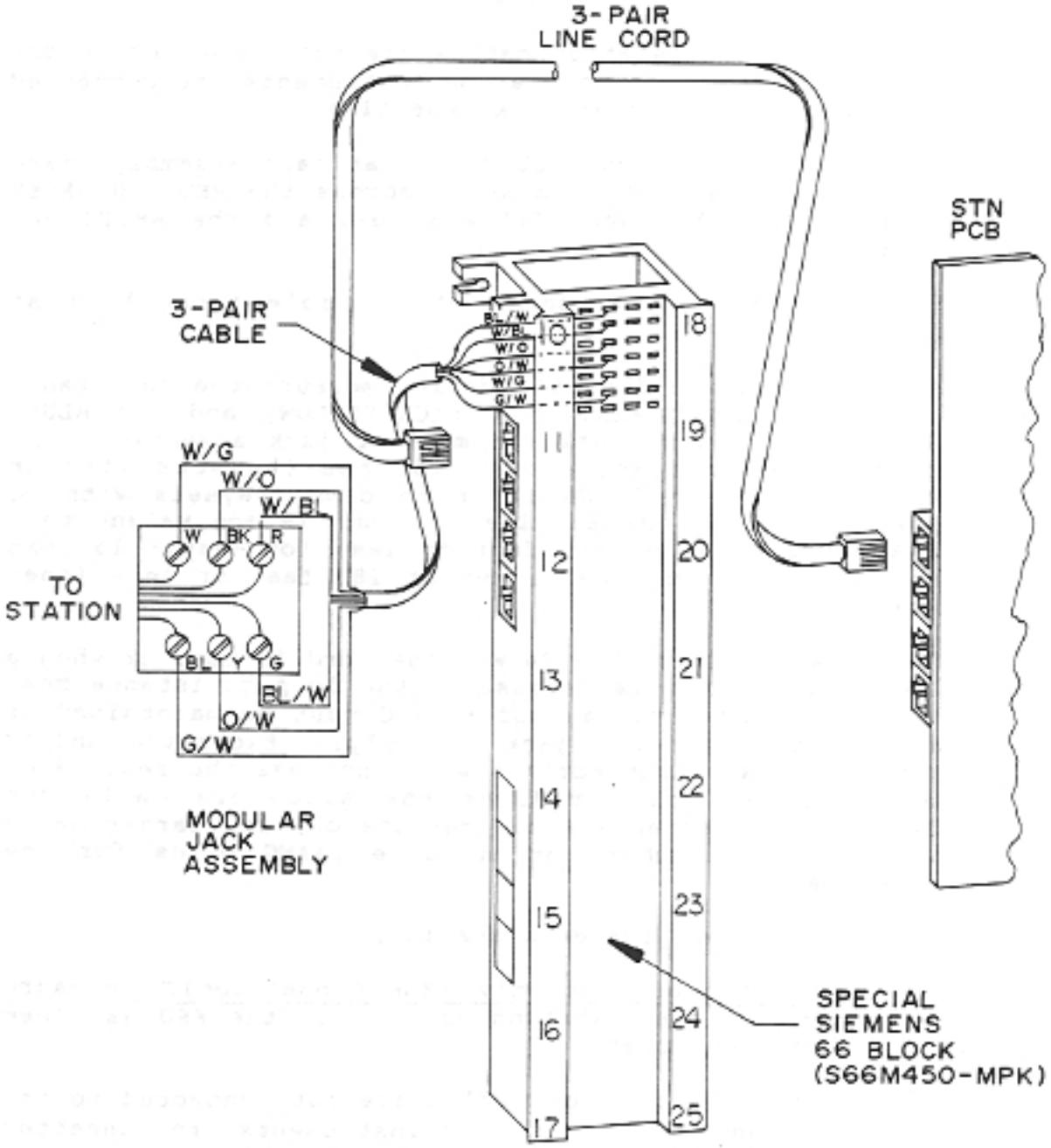


FIGURE 3-6. METHOD B STATION CABLE TERMINATIONS



NOTE: MEASURE +30 ±6VDC ON RED TERMINAL, GROUND ON GREEN TERMINAL.

7. STATION LOOP RESISTANCE TEST

7.01 For Method A Connections Only (Direct KSU Connection): Measure the loop resistance of each station cable. If the KSU has been installed, turn off the power.

(1) Ensure that the station cables are not connected to the STN PCB's, and that no station instruments are connected to the station modular jack assemblies.

(2) Using a spare six-conductor modular jack assembly, make a test jack by placing a short across the RED and GREEN wires, the BLACK and YELLOW wires, and the WHITE and BLUE wires.

(3) Plug the KSU end of one station cable into the test jack.

(4) At the station end of the cable, measure the resistance across the RED/GREEN, the BLACK/YELLOW, and the BLUE/WHITE pairs on the station modular jack assembly. The resistance must not exceed 45 ohms (keysets with or without AC powered DSS's) or 15 ohms (keysets with DC powered DSS's). As a guide, 45 ohms is equivalent to a 24AWG cable run of 877 feet or less (one-way); 15 ohms is equivalent to a cable run of 283 feet or less (one-way).

NOTE: When other than 24AWG line cord is used or when a longer cable run is necessary, the loop resistance measurements and a voltage of +18VDC must be maintained at the station modular jack assembly. Excessive and/or high resistance connections will increase the resistance of a cable, which reduces the allowable cable run length. To decrease cable resistance, use larger gauge (smaller AWG number) or multiple 24AWG wires for the power pair.

(5) Repeat this test for each station.

7.02 For Method B Connections Only (MDF Connection): Measure the loop resistance of each station cable. If the KSU has been installed, turn off the power.

(1) Ensure that the station cables are not connected to the STN PCB's and that no station instruments are connected to the station modular jack assemblies.

(2) Using a spare six-conductor modular jack assembly, make a test jack by placing a short across the RED and GREEN wires, the BLACK and YELLOW wires, and the WHITE and BLUE wires.

(3) Plug one end of a three-pair line cord into the station modular jack on the Siemens block or modular jack assembly on the MDF. Plug the other end of the line cord into the test jack.

(4) At the station end of the cable, measure the resistance across the RED/GREEN, the BLACK/YELLOW, and the BLUE/WHITE pairs on the station modular jack assembly. The resistance must not exceed 45 ohms (keysets with or without AC powered DSS's) or 15 ohms (keysets with DC powered DSS's). As a guide, 45 ohms is equivalent to a 24AWG cable run of 877 feet or less (one-way); 15 ohms is equivalent to a cable run of 283 feet or less (one-way).

NOTE: When other than 24AWG line cord is used or when a longer cable run is necessary, the loop resistance measurements and a voltage of +18VDC must be maintained at the station modular jack assembly. Excessive and/or high resistance connections will increase the resistance of a cable, which reduces the allowable cable run length. To decrease cable resistance, use larger gauge (smaller AWG number) or multiple 24AWG wires for the power pair.

(5) Repeat this test for each station.

8. CONNECTING THE C.O. LINES

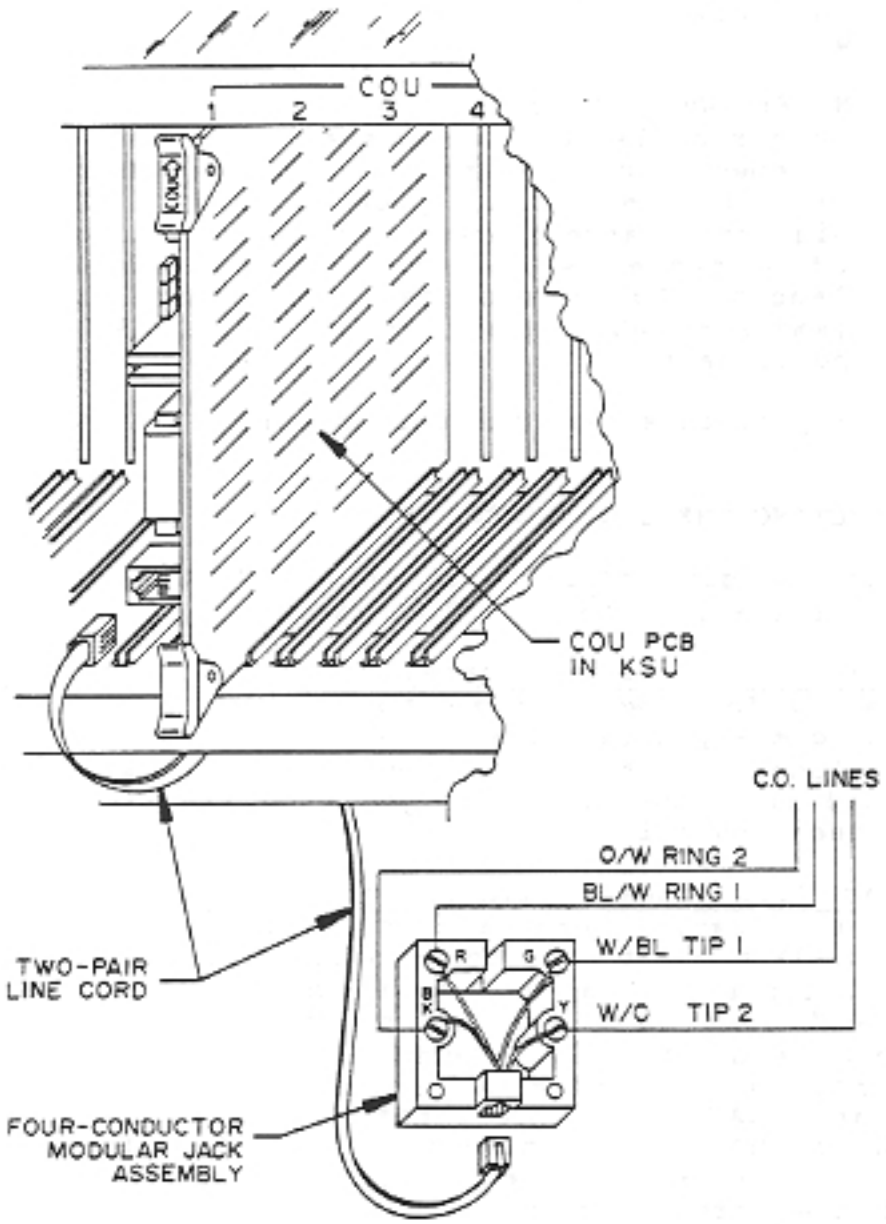
NOTE: The single modular jack on a COU PCB and the RJ14C jack provide terminations for two C.O. lines.

8.01 For C.O. lines terminated on RJ14C jacks only: Plug one end of a six-foot two-pair mod-to-mod line cord into each of the telephone company RJ14C jacks. Label both ends of the cords with the C.O. line numbers. Leave the free ends unattached; they will be plugged into the C.O. line jacks on the COU PCB's after the KSU has been installed.

8.02 For C.O. lines terminated on an RJ21X block only: Using cross-connect cable, terminate the C.O. lines from the telephone company RJ21X block to the four-conductor modular jack assemblies (two C.O. lines per jack). As shown in Figure 3-7 on the next page, the Tip and Ring circuits of the first line should be connected to the GREEN and RED terminals, respectively. The Tip and Ring circuits of the second line should be connected to the YELLOW and BLACK terminals, respectively. Mount the modular jacks on the MDF. Plug one end of a six-foot two-pair mod-to-mod line cord into each of the modular jack assemblies. Label both ends of the cords with the C.O. line numbers. Leave the free ends unattached; they will be plugged into the C.O. line jacks on the COU PCB's after the KSU is installed.

8.03 Lightning Protection: To protect the system from lightning surges, gas discharge tubes may be installed on the C.O. lines between the RJ14C jack or RJ21X block and the COU PCB's. The discharge tubes should absorb and filter low-level surge potentials on the C.O. lines.

FIGURE 3-7. C.O. LINE MODULAR JACK ASSEMBLY WIRING AND CONNECTION TO THE COU PCB



9. UNPACKING THE EQUIPMENT

9.01 Unpack and inspect the KSU equipment as follows:

(1) Check the equipment against the packing slip, and inspect it for damage. If equipment is missing or damaged, contact Inter-Tel's Order Processing Department immediately.

(2) Check all PCB assemblies as follows:

a. Handle all PCB's by the edges only. The PCB assemblies contain static-sensitive components.

b. Check the rear (solder side) of each PCB to ensure no shipping foam or tape is attached.

c. Inspect each PCB for shorted components.

d. The Central Office Unit (COU) PCB's have integrated circuits missing from sockets U20A and U20B. Refer to Figure 3-17 on page 3-34 for socket locations. If any additional circuits are missing, contact Inter-Tel's Customer Support Department.

e. Return all PCB's to their protective anti-static bags until they are installed in the KSU.

10. INSTALLING THE 616 OR 1232 KSU

A. WALL MOUNTING THE KSU CARDFILE

NOTE: For systems equipped with battery back-up, proceed to page 3-21, INSTALLING THE BATTERY BACK-UP KSU.

10.01 Mount the cardfile on the MDF as follows:

(1) Position the cardfile on the MDF, allowing room above it for the power supply as shown in Figure 3-2 on page 3-7.

(2) Mark the location of the mounting screw holes.

(3) Drive a screw into the center of each mounting hole marking, allowing the head of the screw to protrude slightly.

(4) Hang the cardfile on the screws. Adjust the screws if necessary to ensure that the cardfile is securely mounted.

B. WALL MOUNTING THE POWER SUPPLY

NOTE: For systems equipped with battery back-up, proceed to page 3-21, INSTALLING THE BATTERY BACK-UP KSU.

10.02 The 340.06 power supply is used with the 616 system, and the 340.07 is used with the 1232. Mount the power supply on the MDF as follows:

(1) Position the power supply above the cardfile so that there will be sufficient slack when the power cable is connected.

(2) Mark the location of the mounting screw holes.

(3) Drive a screw into the center of each mounting hole marking, allowing the head of the screw to protrude slightly.

(4) Hang the power supply on the screws. Adjust the screws if necessary to ensure that the power supply is securely mounted.

(5) Plug one end of the DC power cable into the power supply socket and the other end into the socket on the side of the cardfile as shown in Figure 3-8 on page 3-18.

(6) Do not plug in the AC power cord until the power supply electrical test has been performed.

C. 340.06 AND 340.07 POWER SUPPLY ELECTRICAL TEST

NOTE: The battery back-up (680.06) power supply electrical test is located on page 3-25.

10.03 Before plugging in the AC power cord, perform the following electrical checks:

(1) Inspect the fuses for correct voltage and current rating and ensure that they are in working order:

	340.06	340.07
F1 --	2A, 115VAC	4A, 115VAC
F2 --	3A, +30VDC	5A, +30VDC

(2) Ensure that all switches are off and that there are no PCB's installed in the cardfile.

(3) Plug the AC power cord into the designated isolated, dedicated 105-125VAC, 60Hz, 15A outlet.

(4) Turn on the ON/OFF switch.

(5) Using a digital voltmeter, measure the following voltages on the inside of the cardfile backplane as shown in Figure 3-9 on page 3-19. If the voltage measurements are not within limits, **DO NOT PROCEED.** Contact Inter-Tel's Customer Support Department.

Backplane Voltages

TP 1 to TP 2	+30 ±6VDC
TP 3 to TP 4	-12 ±1VDC
TP 5 to TP 4	+5.0 ±0.1VDC

(6) If the voltages are within limits, turn off the AC power to the KSU and unplug the AC power cord.

D. VOLTAGE SURGE PROTECTION

10.04 AC voltage surges may cause system malfunctions, misregistration, false logic, and damage to electronic components. To prevent surges, Inter-Tel recommends the use of an AC line conditioner or surge protector. The chosen device must:

a. Clip fast voltage transients at 300VDC nominal in 5 nanoseconds or less.

b. Sustain the input voltage level when the AC source drops below 97VAC.

c. Prevent extraneous signals carried into the equipment on the AC input, even thought the AC outlet has an isolated, dedicated circuit.

E. GROUNDING THE WALL-MOUNTED KSU

10.05 Using 10AWG wire, ground the KSU as follows:

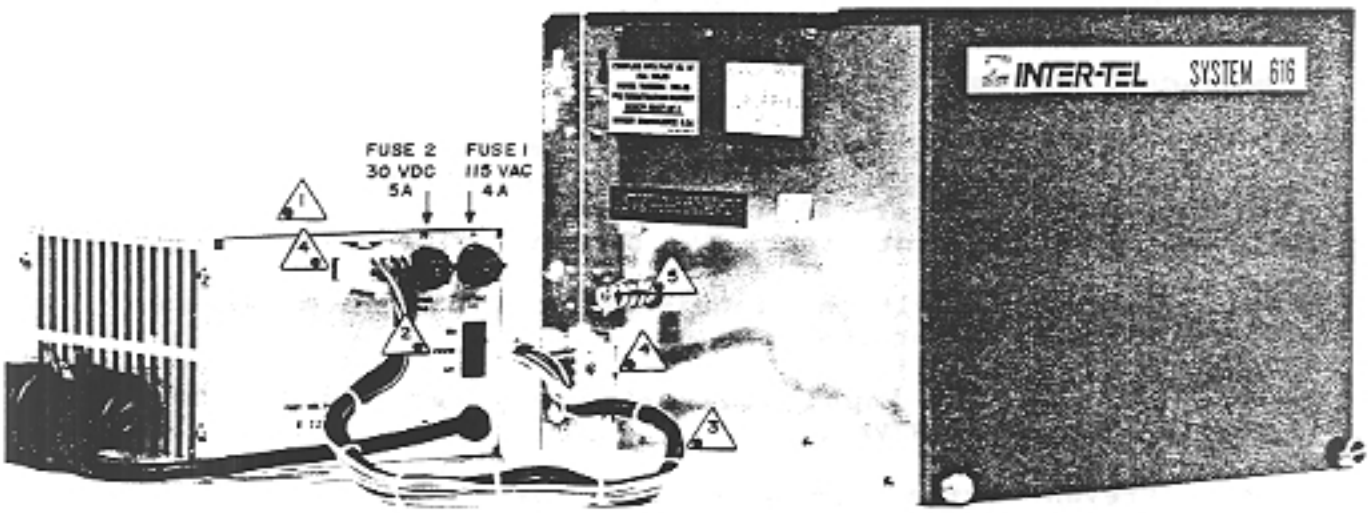
(1) Ensure that the power cord is unplugged from the AC outlet.

(2) Mount a grounding terminal on the MDF.

(3) Connect it to the earth ground and the ground lug on the side of the cardfile. Refer to Figure 3-10 on page 3-20.

NOTE: If a difference of potential exists between the third wire lead on the local electrical circuit and the earth ground, noise may develop on the system. If this occurs, call an electrician.

FIGURE 3-8. 340.06/340.07 CARDFILE AND POWER SUPPLY CONNECTIONS



1 POWER SUPPLY

2 ON/OFF SWITCH

3 DC POWER CABLE

4 12-PIN NYLON CONNECTOR

5 GROUND LUG

FIGURE 3-9. CARDFILE BACKPLANE VOLTAGE TEST POINTS

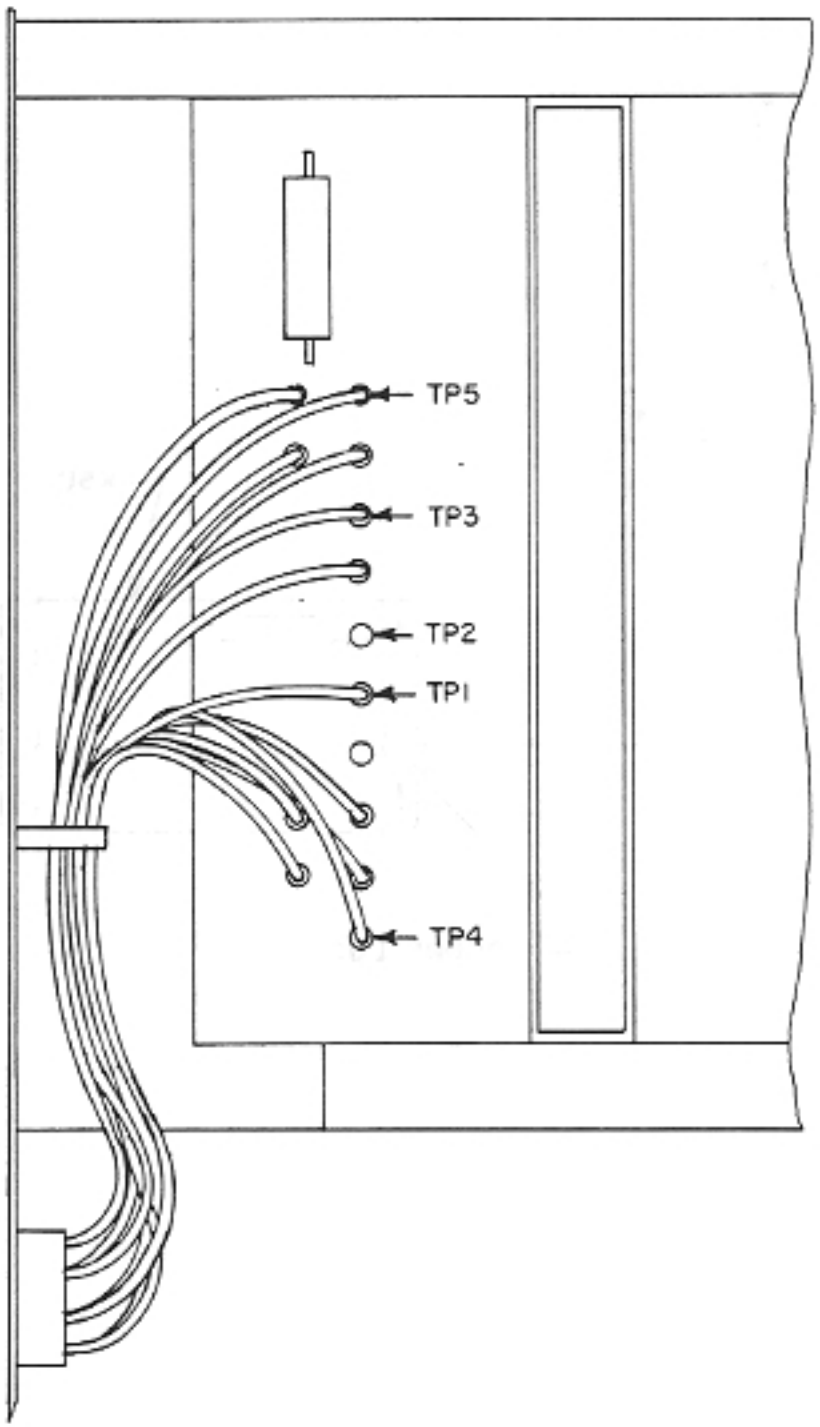
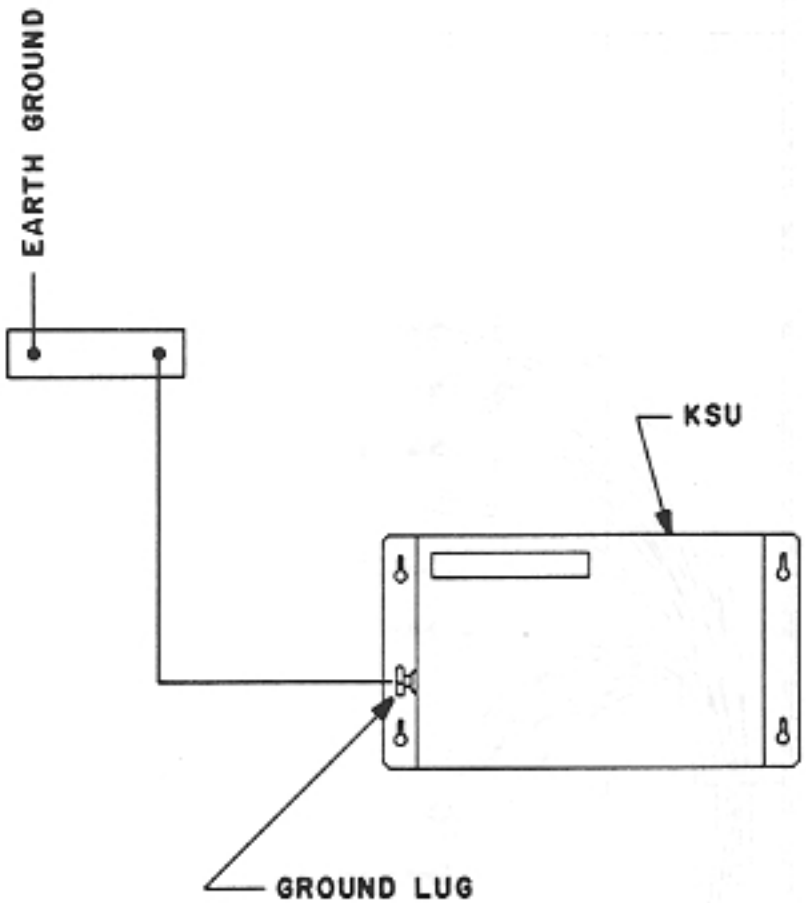


FIGURE 3-10. GROUNDING THE WALL-MOUNTED KSU



11. INSTALLING THE BATTERY BACK-UP KSU

NOTE: If you are not installing the battery back-up KSU and 680.06 power supply, proceed to page 3-27, INSTALLING THE PRINTED CIRCUIT BOARD'S (PCB'S).

11.01 Systems equipped with battery back-up are powered by the 680.06 power supply, which is mounted in a KSU cabinet along with the 616 or 1232 KSU cardfile.

A. INSTALLING THE CARDFILE ASSEMBLY

11.02 Ensure that you have the following items:

- KSU Cabinet with 10 mounting screws.
- Cardfile Assembly
- Package of 4 screws, 4 washers, 4 self-locking washers, and 4 nuts
- 15 inches of 14AWG grounding wire

11.03 Install the cardfile assembly into the KSU cabinet as follows (refer to Figure 3-11 on the next page):

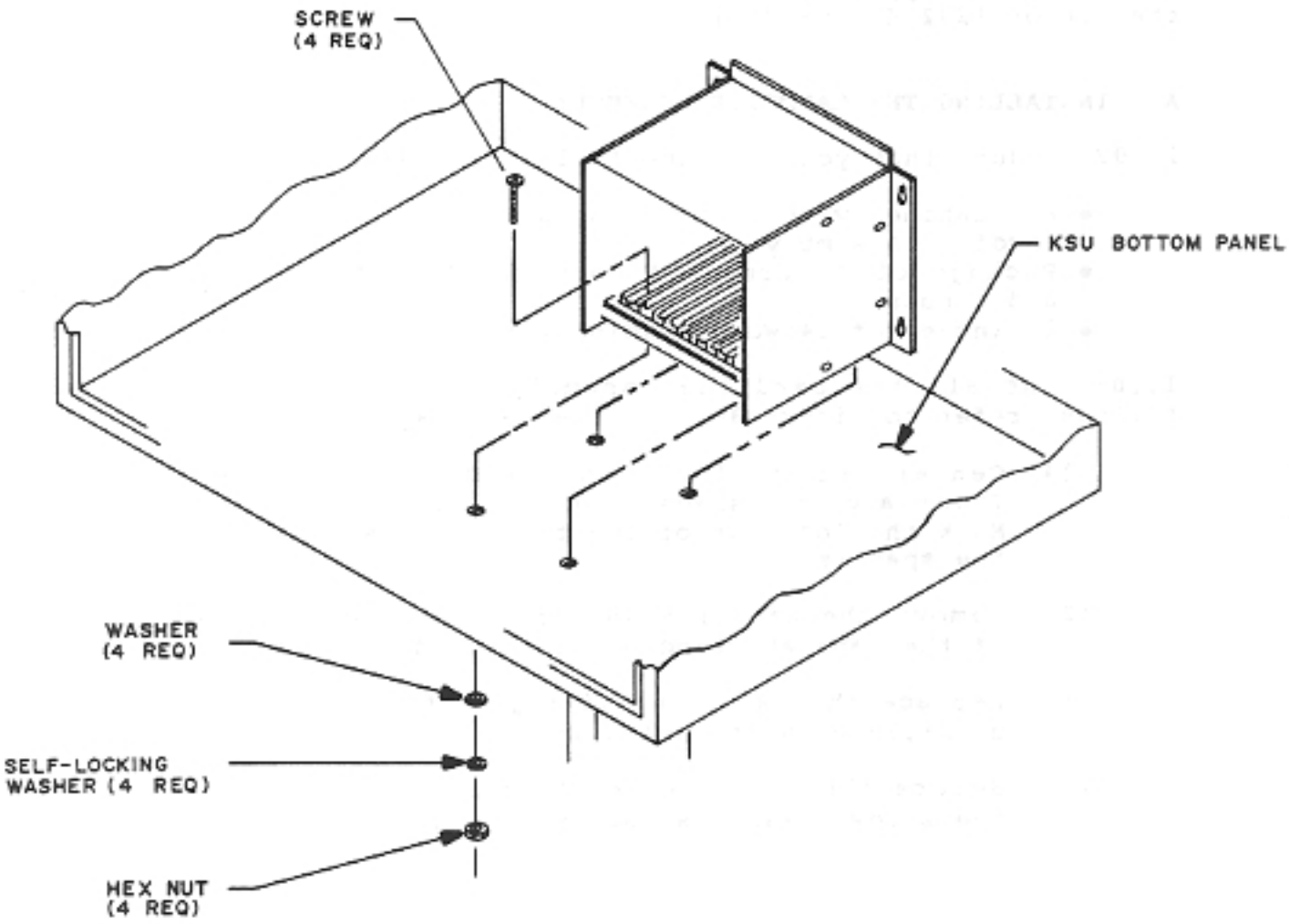
(1) Center the cardfile on the bottom of the cabinet. There are two spacers on the bottom of the cardfile. Mark the location of the two outermost holes on each of the spacers.

(2) Remove the cardfile and drill four holes in the floor of the cabinet using a .110-inch drill bit.

(3) Replace the cardfile, lining up the screw holes of the cardfile with the holes in the floor of the cabinet.

(4) Secure the cardfile to the floor of the cabinet using the screws, washers, self-locking washers, and nuts.

FIGURE 3-11. INSTALLING THE 616/1232 CARDFILE IN THE KSU CABINET



B. INSTALLING THE 680.06 POWER SUPPLY FOR BATTERY BACK-UP

```
**********************************************
*                  CAUTION                   *
*  AC and battery back-up power must be off. *
**********************************************
```

11.04 Install the power supply as follows:

(1) Connect the DC power cable assembly wires to the power supply as specified below and shown in Figure 3-12 on the next page.

Power Cable Assembly Wire	Power Supply Connection Terminal
Blue	+5V
Orange	+5V
Green	+5V Sense
Green/Black	+5V Sense Return
Blue/Black	+5V Return
Orange/Black	+5V Return
White	+28V
White/Black	+28V Return
Red	-12V
Red/Black	-12V Return
Black	+Battery
Black/White	-Battery

(2) Lay the KSU cabinet on its back and remove the top two mounting screws on each side of the cabinet.

(3) Position the power supply in the cabinet above the cardfile. Reinstall the mounting screws.

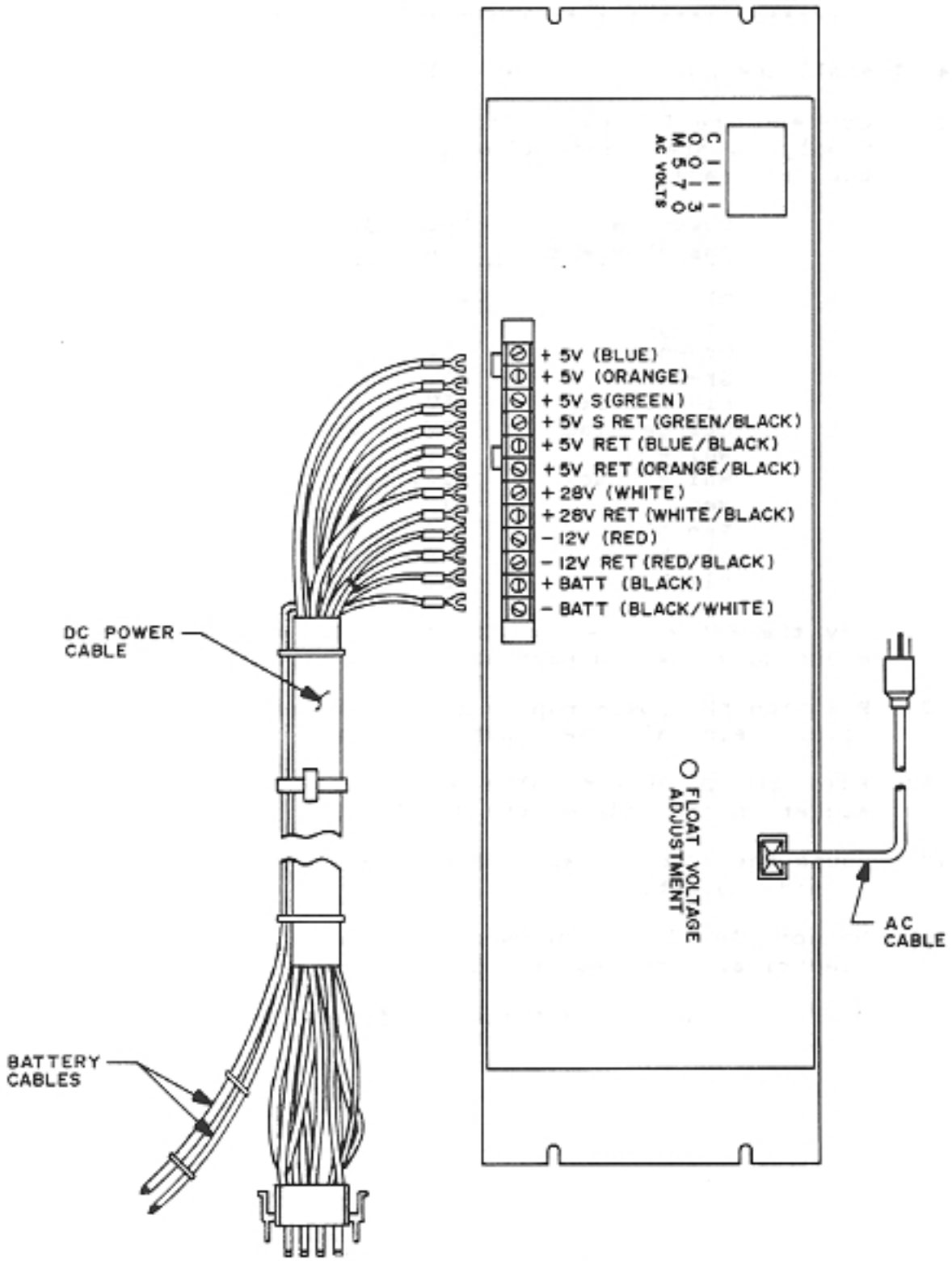
(4) Plug the DC power cable assembly connector into the socket on the side of the cardfile.

(5) Route the AC cable and battery cables through the bottom or side cutout.

(6) Do not plug in the AC power cord until the power supply electrical test has been performed.

NOTE: To install batteries, refer to page 3-49.

FIGURE 3-12. 680.06 POWER CABLE TO POWER SUPPLY CONNECTION



C. 680.06 POWER SUPPLY ELECTRICAL TEST (BATTERY BACK-UP KSU)

11.05 Before plugging in the AC power cord, perform the following electrical checks:

(1) Inspect the fuses for correct voltage and current rating and ensure that they are in working order:

F1 -- 8A, 250VAC Slow Blow (115VAC Input)
F2 -- 10A, 125VAC (+28VDC)
F3 -- 8A, 125 (+5VDC)
F4 -- 2.5A, 125VAC (-12VDC)
F5 -- 20A, 250VAC Slow Blow (Battery Charger)

(2) Ensure that the AC line and battery switches are off, and that there are no PCB's installed in the cardfile.

(3) Plug the AC power cord into the designated 105-125vac, 15a, 57-63hz source.

(4) Turn on the AC line switch. The red indicator will light.

(5) Using a digital voltmeter, measure the following voltages on the inside of the cardfile backplane. Refer to Figure 3-9 on page 3-19 for test point locations. If voltage measurements are not within limits, **DO NOT PROCEED.** Contact Inter-Tel's Customer Support Department.

Backplane Voltages

TP 1 to TP 5	+5.0 ±0.1VDC
TP 3 to TP 5	-12.0 ±2.5VDC
TP 4 to TP 2	+30 ±6VDC (unregulated)

(6) If the voltages are within limits, turn off the AC power to the KSU and unplug the AC power cord.

D. VOLTAGE SURGE PROTECTION

11.06 AC voltage surges may cause system malfunctions, misregistration, false logic, and damage to electronic components. To prevent surges, Inter-Tel recommends the use of an AC line conditioner or surge protector. The chosen device must:

a. Clip fast voltage transients at 300VDC nominal in 5 nanoseconds or less.

b. Sustain the input voltage level when the AC source drops below 97VAC.

c. Prevent extraneous signals carried into the equipment on the AC input, even though the AC outlet has an isolated, dedicated circuit.

E. GROUNDING THE BATTERY BACK-UP KSU

11.07 Ground the KSU as follows:

(1) Ensure that the AC power cord is unplugged.

(2) Refer to Figure 3-13 below. Mount a grounding terminal on the MDF. Using 10AWG wire, connect it to:

a. The earth ground.
b. The ground lug on the floor of the KSU cabinet.

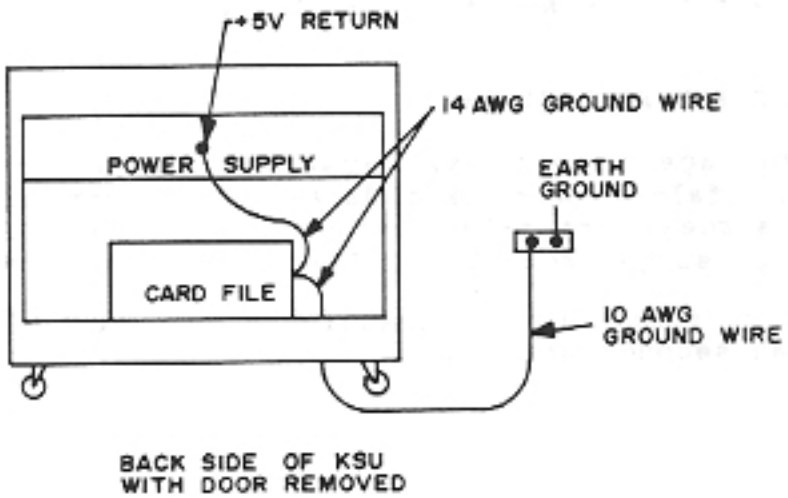
(3) Connect the KSU cabinet to the cardfile by running the 14AWG wire:

a. From the ground lug on the floor of the cabinet to the ground lug on the side of the cardfile.

b. From the ground lug on the side of the cardfile to the +5V return on the power supply.

NOTE: If a difference of potential exists between the third wire lead on the local electrical circuit and the earth ground, noise may develop on the system. If this occurs, call an electrician.

FIGURE 3-13. GROUNDING THE BATTERY BACK-UP KSU



12. INSTALLING THE PRINTED CIRCUIT BOARDS (PCB'S)

```
**************************************************
*                    CAUTION                     *
*  Inter-Tel recommends turning off the AC power *
*  when inserting or removing PCB's to prevent   *
*  electrical spikes.                            *
**************************************************
```

A. CENTRAL PROCESSING UNIT (CPU) PCB

12.01 Refer to the next page for a photograph. Install the CPU PCB as follows:

(1) Place the battery ON/OFF jumper in the ON position by connecting the center pin and the pin closest to the edge of the PCB.

NOTE: The jumper located near ROM #0 is the 32/64 memory jumper. It is set at the factory and should not be changed. The jumper addresses the CPU to use either 32K-bit or 64K-bit ROM's. With the center pin and the pin closest to the edge of the PCB connected, the CPU uses 32K-bit ROM's. With the center pin and the pin farthest from the edge of the PCB connected, the CPU uses 64K-bit ROM's (the factory setting).

(2) Check the three ROM's for proper seating. They should be numbered in order as shown in the photo.

(3) Place the DIP switches in the OPEN position.

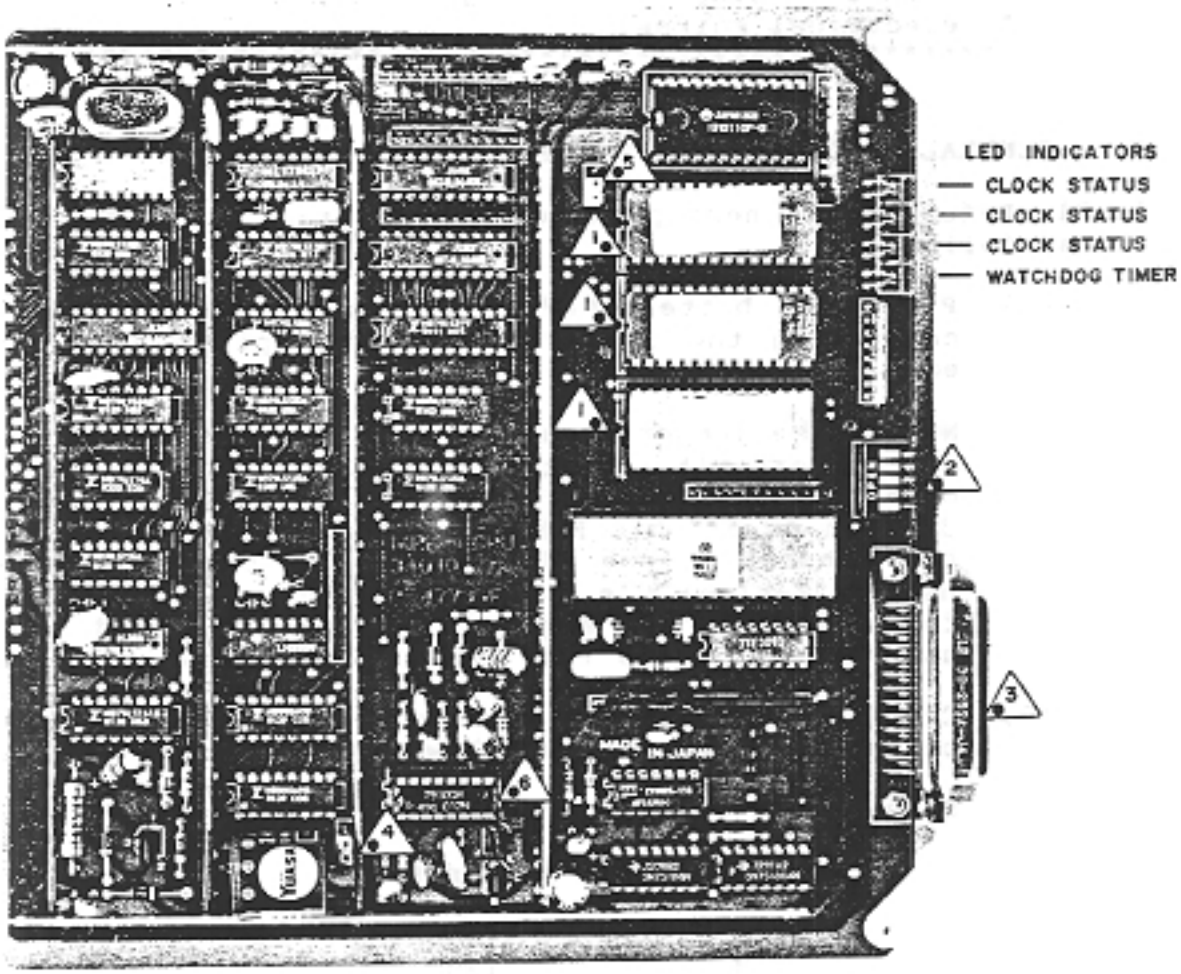
Switch	Function
5	(Unused)
4	TEST
3	INITIALIZE
2	RESET
1	PROGRAM

(4) Turn off the AC power to the KSU.

(5) Slide the CPU PCB (with components facing left) in the cardfile slot labeled "CPU."

(6) Turn on the AC power to the KSU.

FIGURE 3-14. CENTRAL PROCESSING UNIT (CPU) PCB



1. ROM STORAGE (3 PL)
2. DIP SWITCHES
   1 PROGRAM
   2 RESET
   3 INITIALIZE
   4 TEST
   5 UNUSED
3. RS232C CONNECTOR
4. BATTERY JUMPER
5. 32/64 MEMORY JUMPER
6. SYNTHESIZED MUSIC INTEGRATED CIRCUIT

(7) Refer to Figure 3-15 on page 3-30. On the back of the DC power cable connector that plugs into the KSU, measure the voltage from Test Point 5 to Test Point 6 and ensure that it is within tolerance (+5.0 ±0.1VDC). If the voltage is out of tolerance, turn off the AC power to the KSU and remove the PCB. Check for shorted components, replace the PCB, turn on the power, and re-check the voltage. If still out of tolerance, contact Inter-Tel's Customer Support Department.

(8) Observe the light-emitting diodes (LED's) on the front edge of the CPU PCB for the following indications:

a. The top LED flashes at regular intervals of approximately five times a second.

b. The second LED (counting down) flashes at regular intervals of approximately two or three times per second.

c. The third LED is almost constantly on.

d. The bottom-most LED is off.

(9) If the fourth LED is illuminated, momentarily close, then open DIP switch 2 (RESET). This will reset the CPU and place it in the proper operating mode.

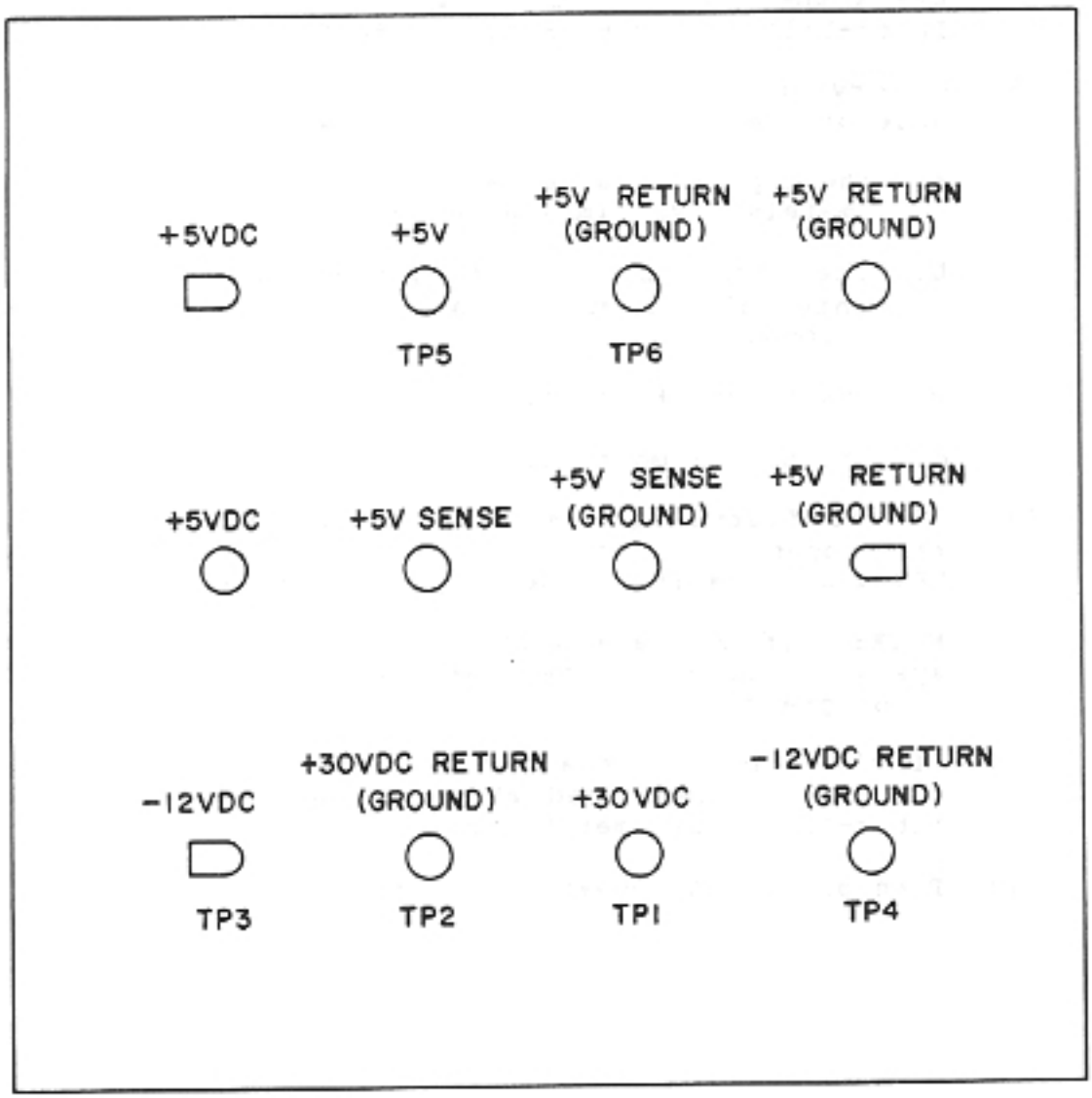
NOTE: If you are working on a previously installed system, activating the RESET switch will drop all calls in progress.

(10) If the LED lights again, or the other LED's do not function as described above, **DO NOT PROCEED.** Contact Inter-Tel's Customer Support Department.

(11) Turn off the AC power to the KSU.

FIGURE 3-15. POWER CABLE CONNECTOR PINOUT AND TEST POINT LOCATIONS

(BACK VIEW)



TP1	TO	TP2	30 ± 6 VDC
TP3	TO	TP4	-12 ± 1.0 VDC
TP5	TO	TP6	+5 ± 0.1 VDC

B. STATION (STN) PCB

12.02 Refer to page 3-32 for a photograph. Install the STN PCB's as follows:

(1) Inspect the STN fuse for the correct voltage and current rating (1A, 250V) and ensure that it is in working order.

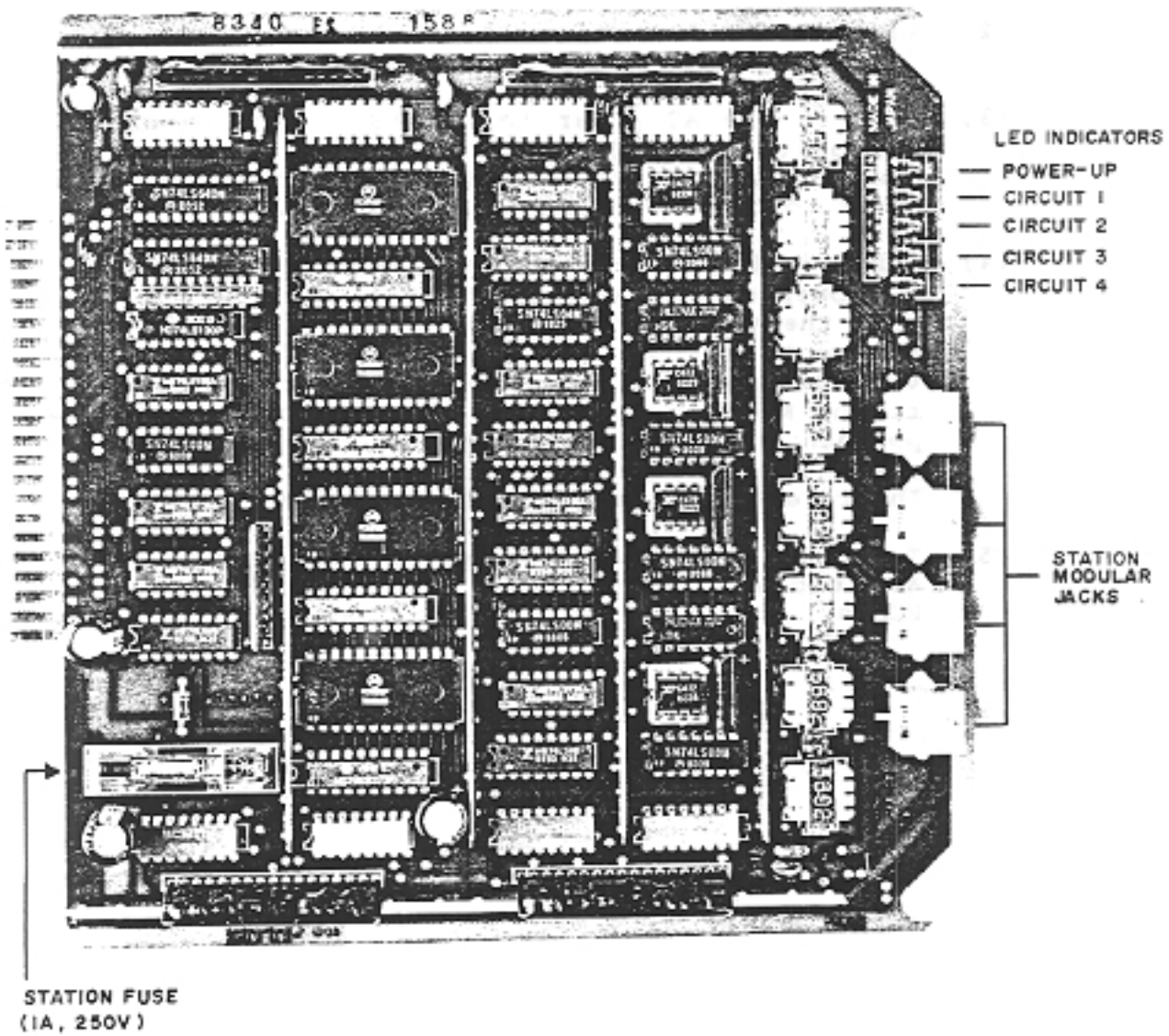
(2) Slide a STN PCB into the first available (furthest left) "STN" slot with components facing left.

(3) Turn on the AC power to the KSU. The power up (top) LED on the STN PCB will light for one to two seconds, then go out. If the LED does not perform as described, refer to the TROUBLESHOOTING section.

(4) Refer to Figure 3-15 on page 3-30. On the back of the DC power cable connector that plugs into the KSU, measure the voltage from Test Point 5 to Test Point 6 and ensure that it is within tolerance (+5.0 $\pm$0.1VDC). If the voltage is out of tolerance, turn off the AC power to the KSU and remove the PCB. Check for shorted components, replace the PCB, turn on the power, and recheck the voltage. If still out of tolerance, contact Inter-Tel's Customer Support Department.

(5) Turn off power to KSU. Repeat this procedure for each additional STN PCB. Do not skip slots between STN PCB's.

FIGURE 3-16. STATION (STN) PCB



C. CENTRAL OFFICE UNIT (COU) PCB

12.03 Refer to page 3-34 for a photograph. Install the COU PCB as follows:

(1) Slide a COU PCB into the first available slot marked "COU" with components facing left.

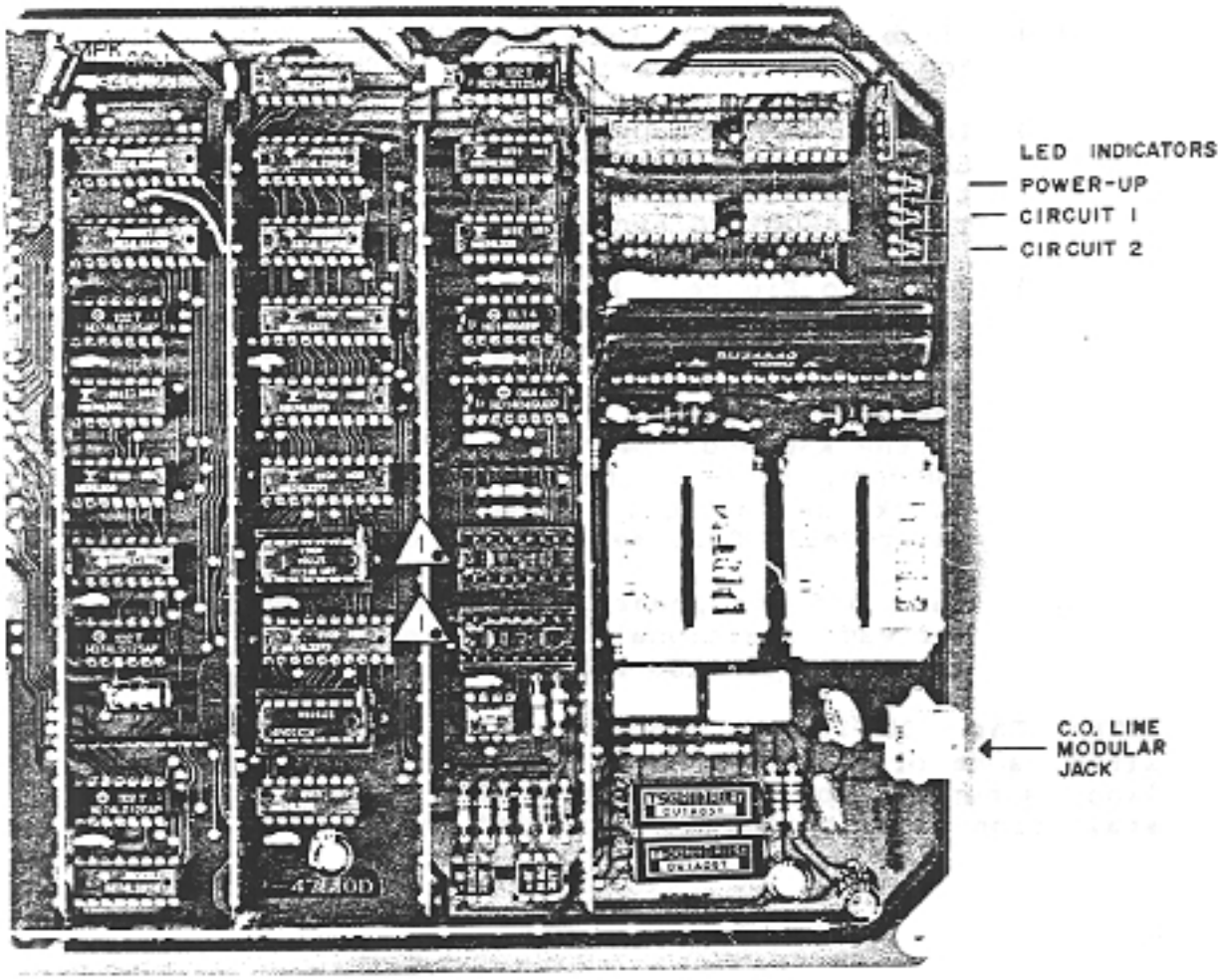
(2) Turn on the AC power to the KSU. The power up (top) LED will light for one to two seconds, then go out. If the LED does not perform as described, refer to the TROUBLESHOOTING section.

(3) Refer to Figure 3-15 on page 3-30. On the back of the DC power cable connector that plugs into the KSU, measure the voltage from Test Point 5 to Test Point 6 and ensure that it is within tolerance (+5.0 $\pm$0.1VDC). If the voltage is out of tolerance, turn off the AC power to the KSU and remove the PCB. Check for shorted components, replace the PCB, turn on the power, and recheck the voltage. If still out of tolerance, contact Inter-Tel's Customer Support Department.

(4) Turn off the power to the KSU. Repeat this procedure for each additional COU PCB in the system. Do not skip slots between COU PCB's.

NOTE: The COU PCB is configured for DTMF signalling. If desired, some or all lines may be converted for dial pulse signalling using the Rotary Conversion Kit, part no. 828.1032. Installation instructions are included in the kit.

FIGURE 3-17. CENTRAL OFFICE UNIT (COU) PCB



D. CONFERENCE (CNF) PCB

12.04 Refer to page 3-36 for a photograph. Install the Conference (CNF) PCB as follows:

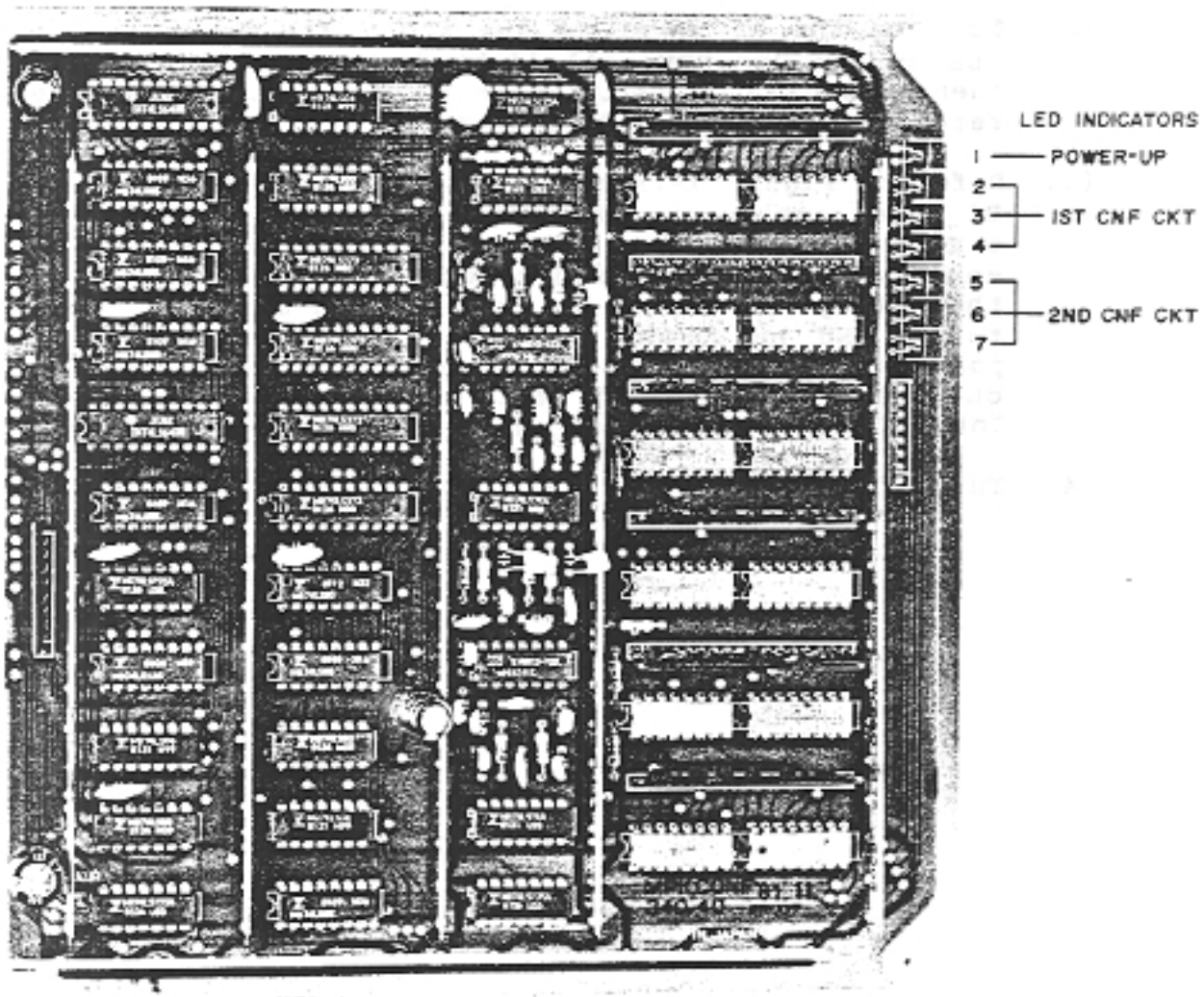
(1) Slide the CNF PCB into the slot marked "CNF" with components facing left.

(2) Turn on the AC power to the KSU. The power-up (top) LED on the CNF PCB will light for one or two seconds, then go out. If the LED does not perform as described, refer to the TROUBLESHOOTING section.

(3) Refer to Figure 3-15 on page 3-30. On the back of the DC power cable connector that plugs into the KSU, measure the voltage from Test Point 5 to Test Point 6 and ensure that it is within tolerance (+5.0 ±0.1VDC). If the voltage is out of tolerance, turn off the AC power to the KSU and remove the PCB. Check for shorted components, replace the PCB, turn on the power, and recheck the voltage. If still out of tolerance, contact Inter-Tel's Customer Support Department.

(4) Turn off power to the KSU.

FIGURE 3-18. CONFERENCE (CNF) PCB



13. CONNECTING STATION AND C.O. LINE CABLES TO THE KSU

13.01 With the KSU power off, connect the unattached ends of the station and C.O. line cables to the PCB's as follows:

NOTE: For system equipped with battery back-up only, feed the cables through the access cutout on the bottom of the cabinet. Longer cable or line cords are required.

13.02 Connect the C.O. lines by plugging the free end of each mod-to-mod line cord from the C.O. jacks on the MDF into the corresponding C.O. line jacks on the COU PCB. Refer to Figure 3-7 on page 3-14.

13.03 For Method A Station Connections Only: Connect the station cables to the STN PCB's by plugging the free end of each cable into the corresponding station jacks on the STN PCB's.

13.04 For Method B Station Connections Only: Plug one end of a six-foot three-pair mod-to-mod line cord into each of the jacks on the Siemens block or modular jack assemblies on the MDF. Label both ends of each cord with the circuit number. Then plug the free end of each cord into the corresponding station jack on the STN PCB.

NOTE: Some STN PCB circuits may be designated for external paging. Instructions are given below.

14. EXTERNAL PAGING CONNECTIONS

14.01 External paging is enabled by connecting a station circuit to a customer-supplied amplifier. By dialing the intercom number of that circuit, users may access the amplifier for paging.

(1) Determine which station circuit will be the paging circuit.

(2) Refer to Figure 3-19 on the next page. Connect the 500-ohm leads of a customer-supplied 500-8 ohm transformer to the BLACK and YELLOW terminals of a six-conductor modular jack assembly.

(3) Place a short across:

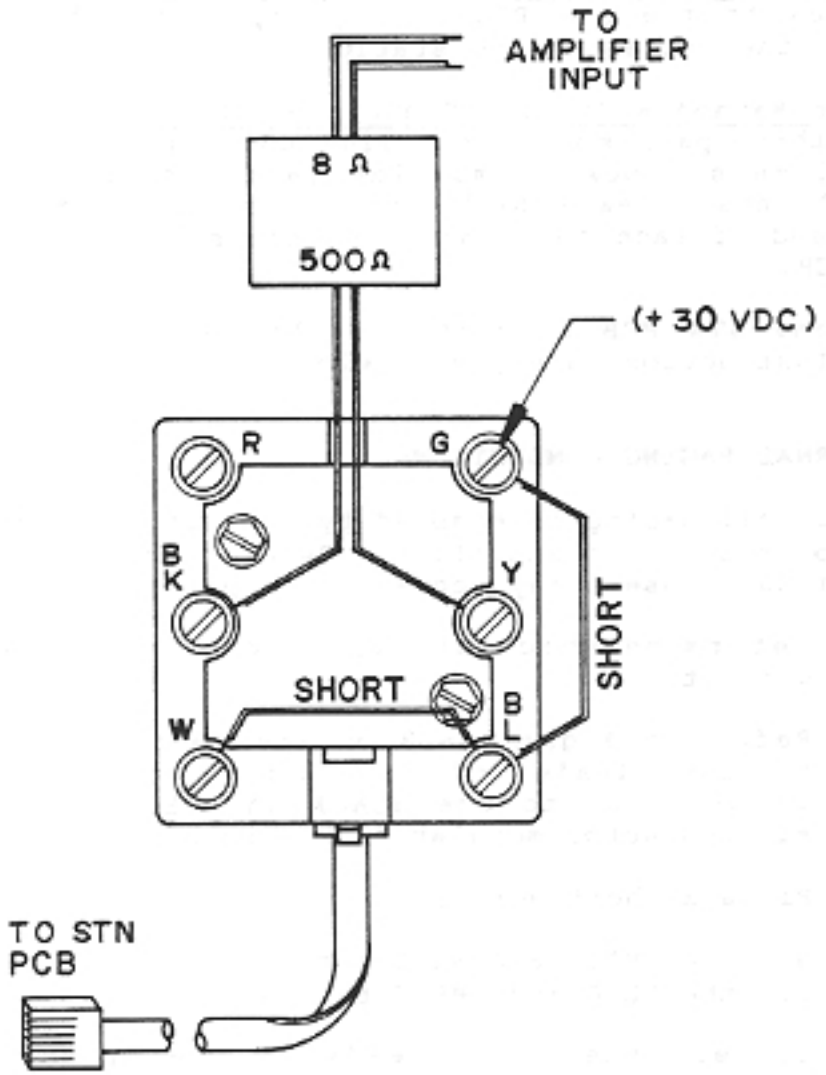
a. the WHITE and BLUE terminals.
b. the BLUE and GREEN terminals.

(4) Connect the 8-ohm leads of the transformer to the amplifier input.

(5) Plug one end of a six-foot three-pair mod-to-mod line cord into the modular jack assembly.

(6) Plug the other end of the line cord into the appropriate jack on the STN PCB to connect the amplifier to the paging circuit.

FIGURE 3-19. EXTERNAL PAGING CONNECTION



15. CONNECTING THE STATION INSTRUMENTS

NOTE: Ensure that the Station Loop Resistance Test has been performed before connecting any station instruments.

A. CONNECTING THE KEYSETS

15.01 Install the 616, 1232, or 2480 keysets as follows:

(1) Unpack each keyset and check for damage. A keyset, one seven-foot three-pair line cord, one two-pair coiled handset cord, and one handset are included. If items are damaged or missing, contact Inter-Tel's Order Processing Department.

(2) Turn on power to the KSU.

(3) Before connecting the keyset to the KSU, measure the voltage across the RED (+30) and GREEN (GROUND) terminals of the station modular jack assembly, which must be +30VDC. If -30VDC is measured on the RED terminal, check the cabling for a reversed pair and correct the wiring.

```
**************************************************
*                    CAUTION                     *
*  Incorrect voltage polarity will result in a   *
*  blown fuse when the keyset is connected.      *
*  This will affect operation of all keysets     *
*  connected to that PCB.                        *
**************************************************
```

(4) Ensure that there is no voltage across the other pairs. If there is, trace the wire back to the KSU and correct the wiring.

(5) Mount the modular jack assembly.

(6) Open up the keyset by removing the three screws on the bottom. Be careful not to dislodge the ribbon cable when the covers separate. Refer to Figure 3-20 on page 3-41.

(7) Set the internal DIP switches in the ON position for desired options, as shown in Figure 3-21 on page 3-42. For a photo of the control board, refer to page 3-43.

(8) With the keyset disassembled, plug one end of the seven-foot line cord into the modular jack assembly and the other end into the keyset jack labeled "KSU."

(9) With a digital voltmeter, measure the voltage across diode VR2, which must be +5.0 ±0.01VDC. If necessary, adjust potentiometer R15 to establish this voltage.

NOTE: While the keyset is disassembled, you may wish to install a speakerphone kit (kit part no. 828.1033), headset adapter (kit part no. 828.1031), or loud ringing adapter (kit part no. 828.1004). Installation instructions are included in each kit.

(10) Unplug the line cord from the keyset and reassemble the keyset.

(11) Reconnect the line cord.

Wall Mounting Keysets

15.02 To mount the keyset on a wall:

(1) Remove the baseplate from the keyset by pressing down on the top of the baseplate and pulling it out. Set the keyset aside.

(2) Hold the baseplate so that the mounting holes are at the top, and mark the location of the holes on the wall using the baseplate as a template.

(3) Drive a screw into the center of each mounting hole marking, allowing the head of the screw to protrude approximately 1/4 to 1/2 inch.

(4) Replace the baseplate on the keyset with the holes toward the top.

(5) Hang the keyset on the screws.

FIGURE 3-20. BOTTOM OF 616, 1232, OR 2480 KEYSET

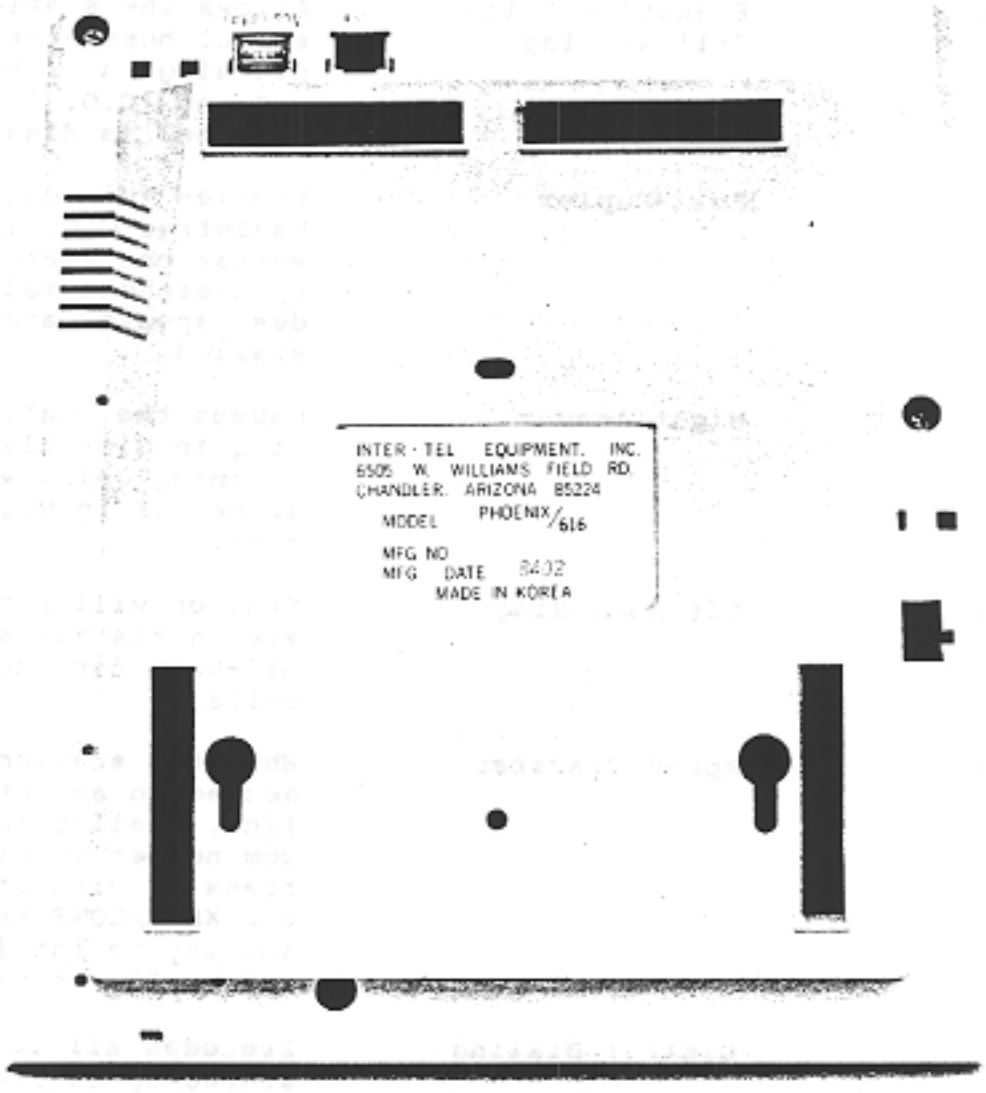
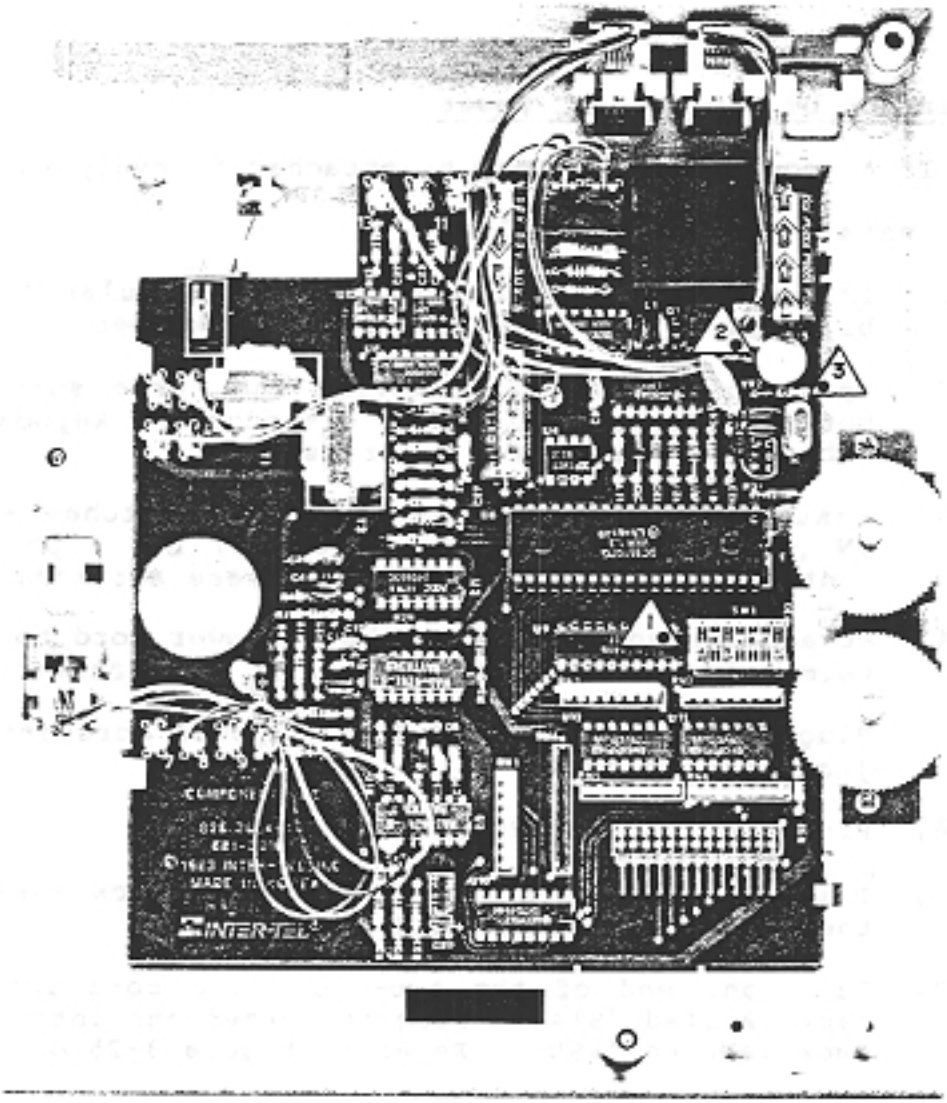


FIGURE 3-21. KEYSET DIP SWITCH OPTIONS

DIP Switch	Option	Description
1	Do-Not-Disturb/ Night Ring Mode	Allows the station to be placed in Do-Not-Disturb (Night Ring mode, attendants's station only).
2	Executive Call Call Waiting	Allows the station to signal busy stations by pressing the # key. All queuing (C.O. line and station) is disabled.
3	Full-Duplex	Enables full-duplex handsfree C.O. line conversations when optional speakerphone module and desk speaker are installed.
4	Night Answer	Causes the station to ring in directly for all incoming calls when the system is in Night Ring mode.
5	Off-Hook Ring	Station will ring (tones are in the handset) when off-hook for incoming calls.
6	Speed Transfer	When the station is connected to an outside line, dialing an intercom number initiates a transfer without using the XFER/CONF key. The ability to initiate outside calls is disabled.
7	Digit 1 Dialing	Precedes all 10-digit stored speed-dial numbers with a digit 1.

NOTE: The keyset must be reset following any DIP switch change (unplug the keyset line cord for 10 seconds, then reconnect).

FIGURE 3-22. 616/1232/2480 KEYSET CONTROL BOARD



1 DIP SWITCHES

2 5.0V ADJUST (R15)

3 5.0V TEST POINT (VR2)

B. CONNECTING THE DSS TO THE STATION CABLE AND KEYSET

15.03 A DSS attaches to a keyset. Included with the DSS are a two-foot three-pair line cord and a seven-foot AC power cord with spade lugs. If the DSS is to be AC powered, you will also need the optional AC transformer (part no. 806.1009). If parts are missing or damaged, contact Inter-Tel's Order Processing Department.

Installation of DSS with AC Power

NOTE: If AC powered, a DSS may be attached to every keyset.

15.04 Install the DSS as follows:

(1) If the keyset is plugged into the modular jack assembly, remove the line cord from the keyset.

(2) Open up the DSS by removing the three screws on the bottom. Be careful not to dislodge the keyboard ribbon cable when the covers separate.

(3) Ensure that the control board DIP switches are in the ON position. (Refer to page 3-47 for a photo of the control board.) Do not change these settings.

(4) Attach the spade lugs on the AC power cord to the screw terminals marked "LOAD" on the AC transformer.

(5) Plug the modular end of the AC power cord into the DSS jack labeled "PWR."

(6) Plug the transformer into an AC outlet.

(7) Plug the line cord from the modular jack assembly into the DSS jack labeled "KSU."

(8) Plug one end of the two-foot line cord into the DSS jack labeled "STA." Plug the other end into the keyset jack labeled "KSU." Refer to Figure 3-25 on page 3-48.

(9) With a digital voltmeter, measure the voltage across DSS control board diode CR4, which must be +5.0 $\pm$0.01VDC. If necessary, adjust potentiometer R5 to establish this voltage.

(10) Unplug the transformer from the AC outlet. Unplug the two line cords from the DSS jacks. Reassemble the DSS.

(11) Plug the two line cords into the DSS jacks. Plug the transformer into the AC outlet.

Installation of DSS with DC power

NOTE: Up to two DSS's may be DC powered by the KSU (two STN PCB's can support one DSS each). DC and AC powered DSS's may be mixed on the same system.

15.05 For a system with optional system battery back-up, or for a DSS without access to an AC outlet, install the DSS as follows:

(1) If the keyset is plugged into the modular jack assembly, remove the line cord from the keyset.

(2) Open up the DSS by removing the three screws on the bottom. Be careful not to dislodge the keyboard ribbon cable when the covers separate.

(3) Ensure that the control board DIP switches are in the ON position. (Refer to page 3-47 for a photo of the control board.) Do not change these settings.

(4) Remove the RED wire and the GREEN wire of the "PWR" modular jack from spade lug terminals 13 and 14 on the control board. Tape and store the leads.

(5) Solder two jumper wires between the terminals as follows:

a. From terminal 1 to 13.
b. From terminal 2 to 14.

(6) Plug one end of the two-foot line cord into the DSS jack labeled "STA." Plug the other end into the keyset jack labeled "KSU." Refer to Figure 3-25 on page 3-48.

(7) Plug the KSU line cord from the modular jack assembly into the DSS jack labeled "KSU."

(8) With a digital voltmeter, measure the voltage across DSS control board diode CR4, which must be +5.0 +0.01VDC. If necessary, adjust potentiometer R5 to establish this voltage.

(9) Unplug the two line cords from the DSS jacks. Reassemble the DSS unit.

(10) Plug the line cords into the DSS jacks to reconnect to the system.

FIGURE 3-23. DSS I BOTTOM

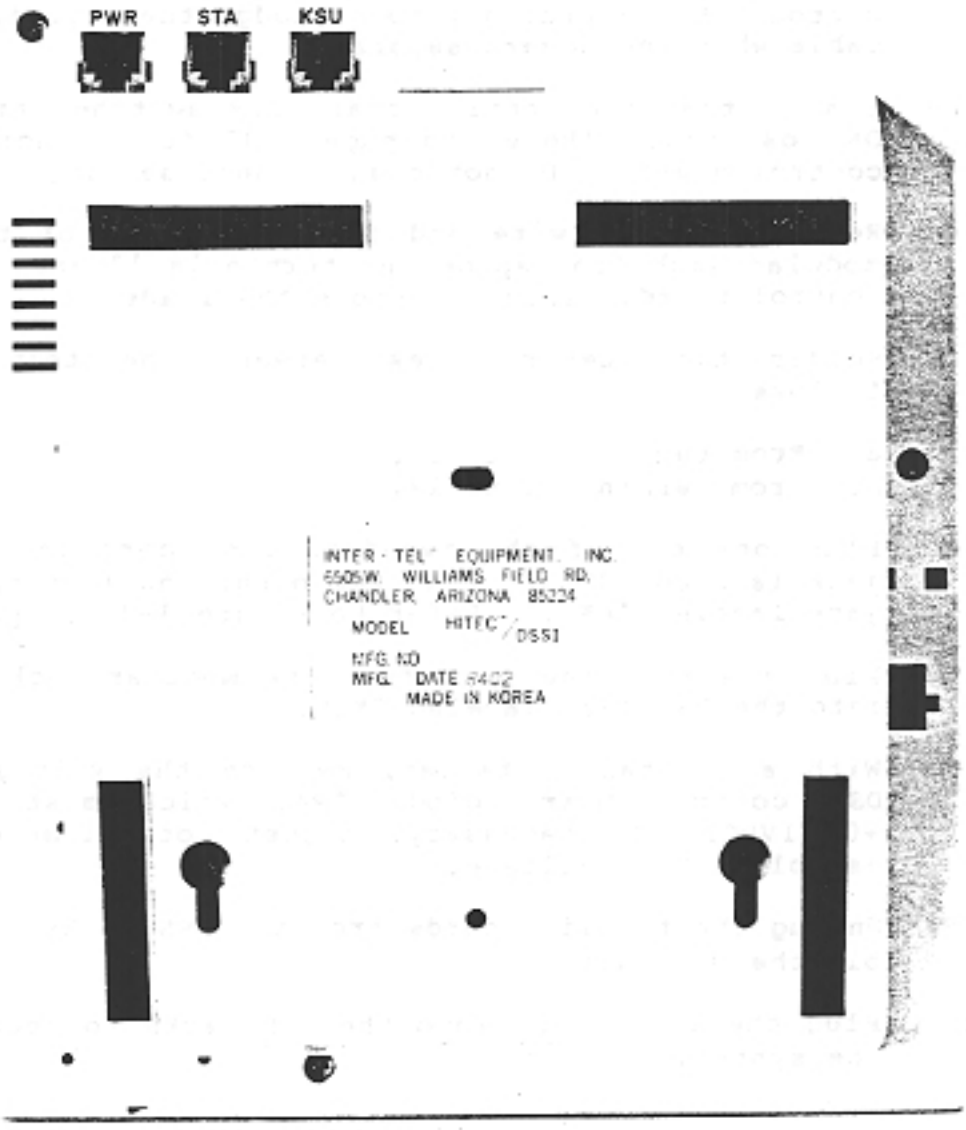
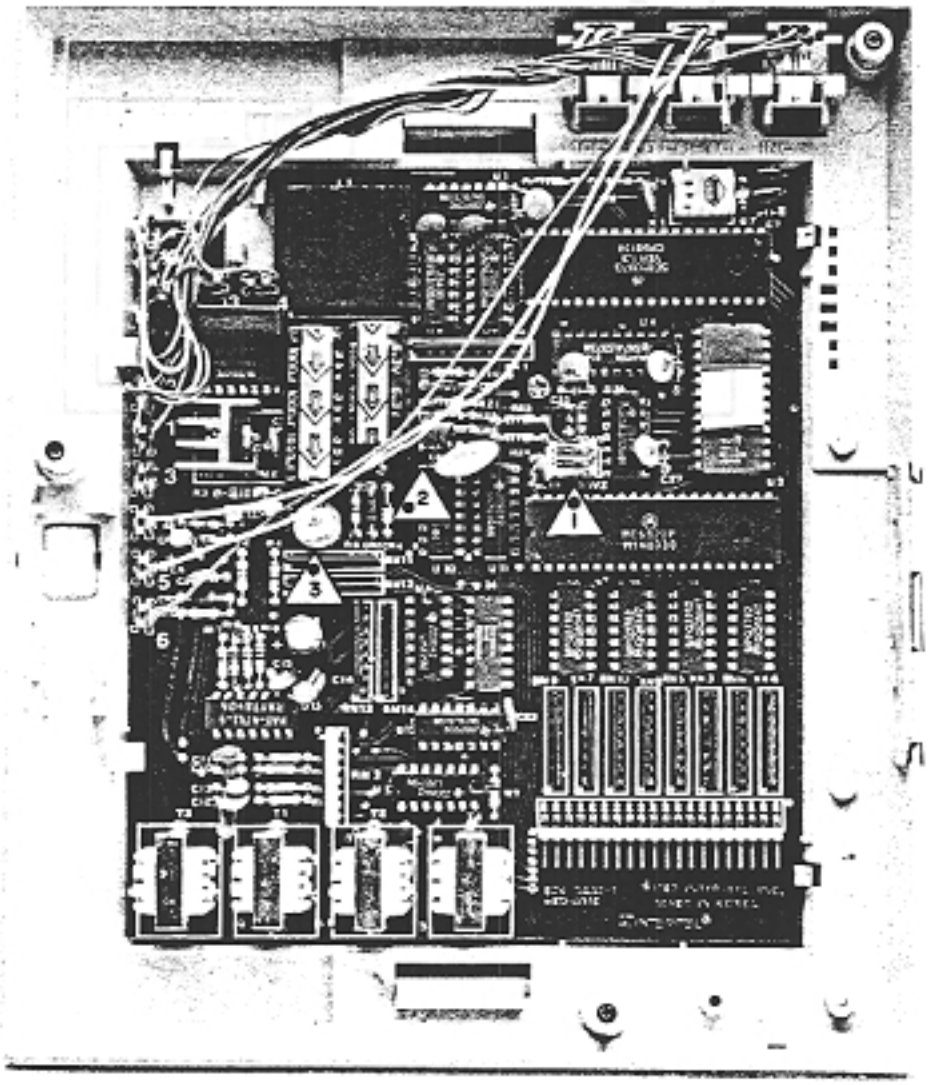


FIGURE 3-24. DSS I CONTROL BOARD

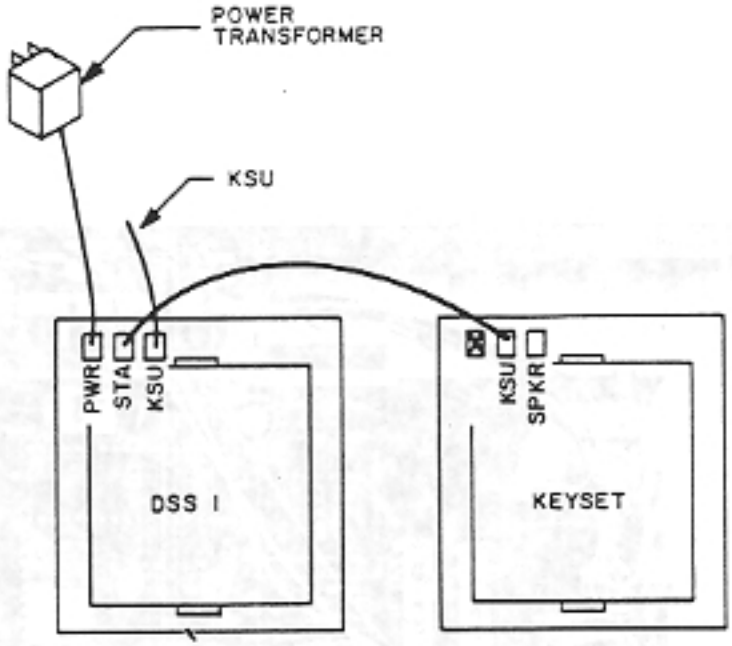


1 DIP SWITCHES

2 5.0 VOLTS TEST POINT (CR4)

3 5.0 VOLTS ADJUST (R5)

3-25. DSS TO KEYSET CONNECTIONS



16. INSTALLING THE SYSTEM BACK-UP BATTERIES

16.01 Refer to page 2-8, SYSTEM BATTERY BACK-UP, for battery specifications and more information. Install the optional back-up batteries as follows:

(1) The batteries may be placed in a ventilated battery compartment (part no. 823.1075). (Check your local codes.) To prepare each battery compartment:

a. Remove the three screws that hold the cover in place. Save the screws.

b. As required by local code, either strike out the knock-out on the side of the compartment and attach a 1/2-inch electrical-metallic tubing (EMT) connector, or use a 10AWG HEYCO-type strain relief connector on each of the two small openings when inserting the battery wires.

c. Using 10AWG wire, connect the compartment ground lug to the earth ground.

d. Place the batteries in the compartments.

(2) Using 10AWG wire, connect the selected batteries in series. **The batteries must be fully charged and of the same amp-hour (AH) rating and age.** (The AH rating of the string is the same as the AH rating of any single battery in the string.) The connecting wires must be the same length to ensure proper float voltage. Refer to Figure 3-26 on page 3-51 for a wiring diagram.

(3) If desired, you can connect two strings in parallel to double the AH rating and lengthen the discharge rate. The voltage level remains the same. Connect the positive side and negative side of the parallel batteries to common termination points. Refer to Figure 3-26.

(4) Turn off the AC line and battery switches on the KSU power supply.

(5) Ensure that the battery cable is connected to the power supply in proper polarity (BLACK = positive, BLACK/WHITE = negative). Then route the cable out the cutout in the bottom or side of the KSU cabinet.

(6) Install a 25A, 125V sealed in-line fuse on the (+) battery cable, as close to the battery pack as possible. Refer to Figure 3-26.

(7) Connect the power supply battery cables to the battery pack in proper polarity (BLACK = positive, BLACK/WHITE = negative).

(8) Turn on the power supply AC line switch and make sure that the POWER ON lamp is lit.

(9) Turn on the battery switch.

(10) Measure the float voltage on the power supply battery cable connections, which must be 26-28VDC. The 680.06 power supply has a float voltage adjustment on the back which should be used to establish this voltage. If the float voltage is out of tolerance, either the power supply or the batteries could be faulty. Contact Inter-Tel's Customer Support Department for assistance.

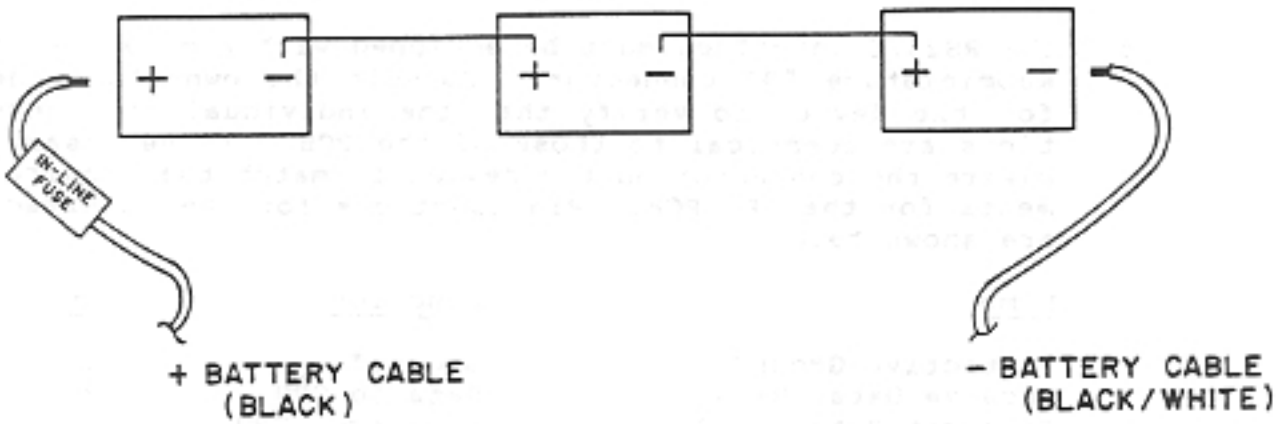
(11) Turn off the AC line switch and make sure that the BATTERY lamp is lit and that the system is operating. If it is not, ensure that the batteries are fully charged and that none of the batteries are defective.

(12) With the system operating on battery power, measure the system voltages using the test points located on the back of the DC power cable connector. Refer to Figure 3-15 on page 3-30.

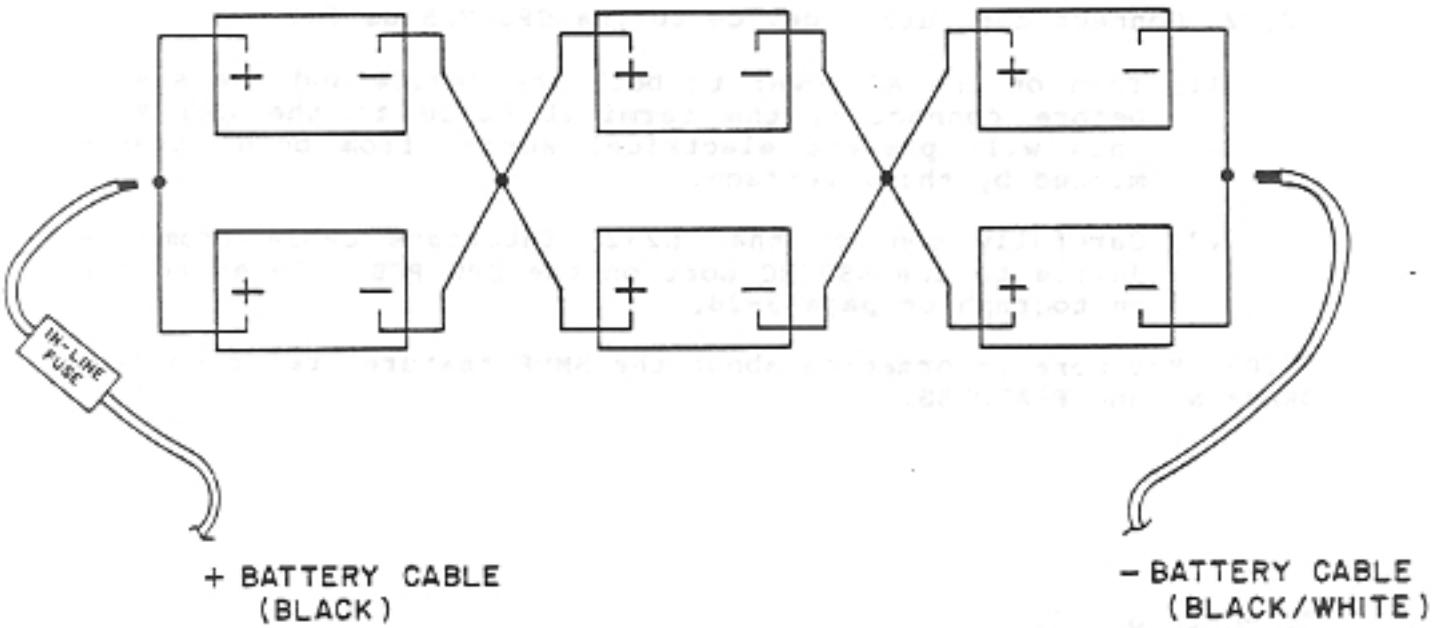
(13) Turn on the AC line switch. Leave the battery switch on.

FIGURE 3-26. CONNECTING THE BATTERY PACK

SERIES CONNECTION:



SERIES PARALLEL CONNECTION:



17. INSTALLING THE SMDR OUTPUT DEVICE

17.01 The output device for the Station Message Detail Recording (SMDR) feature must have these characteristics:

a. It must be RS232C compatible, formatted for serial ASCII with no parity.

b. It must communicate at 300.

c. The RS232C interface must be equipped with a male 25-pin subminiature "D" connector. Consult the owner's guide for the device to verify that the individual pin functions are identical to those of the PCB. If necessary, rewire the connector on the device to match the requirements for the CPU PCB. Pin functions for the interface are shown below.

Name	Function	Pin
Protective Ground	Ground*	1
Receive Data (RXD)	Data to CPU	2
Transmit Data (TXD)	Data from CPU	3
Clear to Send (CTS)	Signal from CPU	5
Data Set Ready (DSR)	Always true	6
Signal Ground	Ground	7
Data Carrier Detect (DCD)	Always true	8
Data Terminal Ready (DTR)	Signal to CPU	20

17.02 Connect the output device to the CPU PCB as follows:

(1) Turn on the AC power to both the device and the system before connecting the terminal cable to the CPU PCB. This will prevent electrical surges from being transmitted by the interface.

(2) Carefully connect the RS232C interface cable from the device to the RS232C port on the CPU PCB. Refer to the photograph on page 3-28.

17.03 For more information about the SMDR feature, refer to PROGRAMMING and FEATURES.

*Tied to pin 7.

18. INSTALLING THE MUSIC-ON-HOLD MODULE

18.01 The optional Music-On-Hold module provides a connection point for an external music source. For more information, refer to page 2-9. Install the Music-On-Hold module as follows:

(1) Ensure that you have the four mounting screws and two spacers shipped with the module.

(2) Inspect the fuse for correct voltage and current rating (1/16A, 250V) and ensure that it is in working order. Refer to page 3-54 for the location of the fuse.

(3) Remove the CPU PCB from the KSU. Remove the synthesized music integrated circuit (refer to the photograph on page 3-28).

(4) Remove and discard the two nuts and screws that fasten the RS232C connector to the CPU PCB.

(5) Refer to Figure 3-28 on page 3-55. From the solder side of the CPU PCB, insert two of mounting screws through the two holes in the CPU PCB and through the RS232C connector. Place a spacer on the end of each screw. Fasten the screws into the spacers until the connector is securely fastened to the CPU PCB.

(5) With the component sides of the two boards facing one another and the mini-phone jack positioned above the RS232C connector, carefully insert the 16-pin connector of the module into socket U31 of the CPU PCB. Ensure that the module is properly seated by placing the CPU PCB on a flat surface and pressing firmly on back of the 16-pin connector. When the module is seated properly, you will feel the pins of the interface socket pop into the CPU PCB.

(6) From the solder side of the module, insert the remaining two mounting screws through the two holes in the module and screw them into the spacers as shown in Figure 3-28.

(7) Replace the CPU PCB in the KSU.

(8) Connect the customer-provided external music source by attaching the leads of a 1/8-inch mini-phone plug to the music source, then insert the plug into the jack on the module. Place the music source 5 to 10 feet away from the KSU to avoid interference. If a radio is being used, an external antenna is recommended to avoid "drifting" stations.

(9) Set the volume 1/2 to 3/4 full, to allow the automatic gain circuitry to function efficiently. The optimal input level is 1VRMS.

FIGURE 3-27. MUSIC-ON-HOLD MODULE

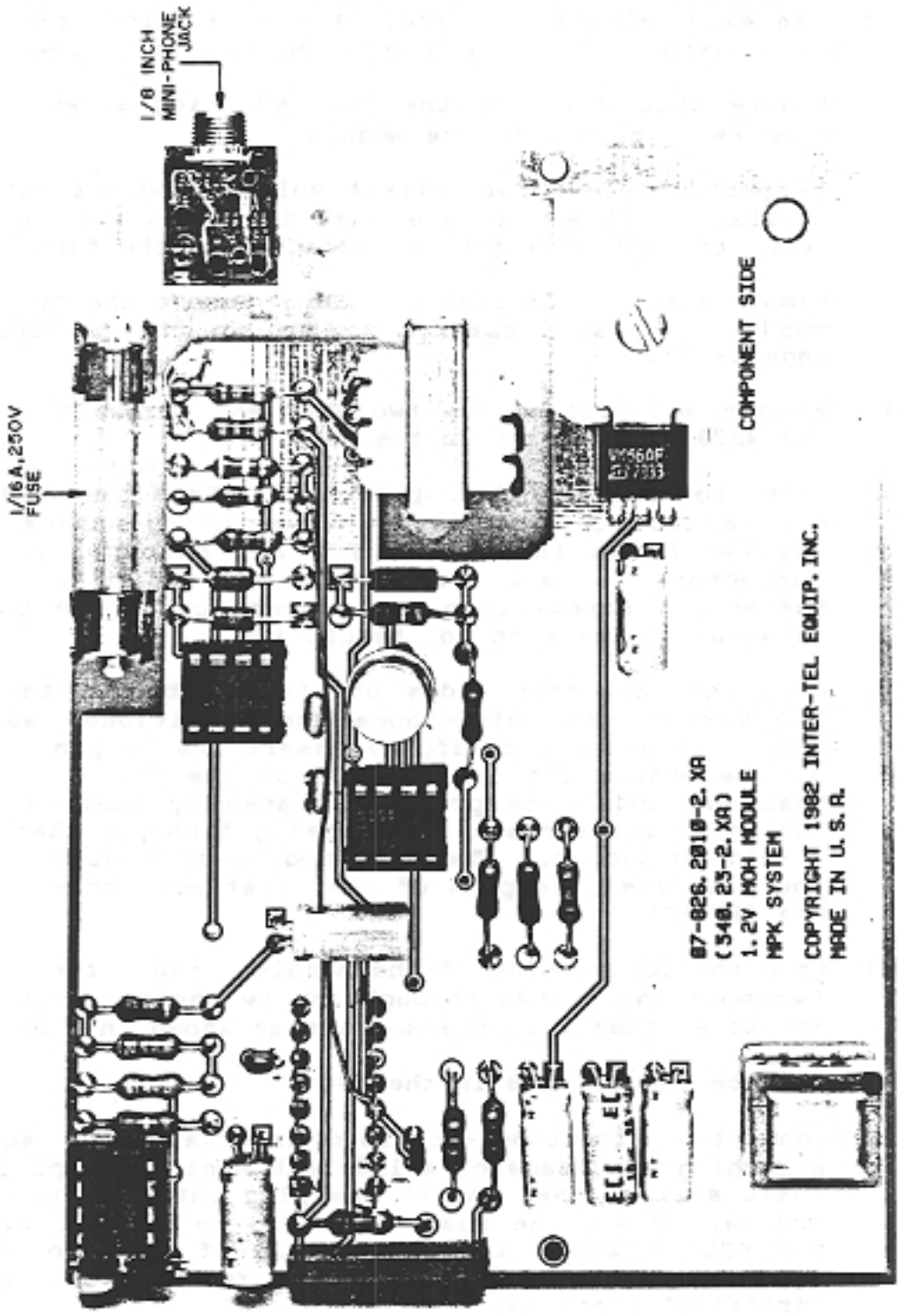
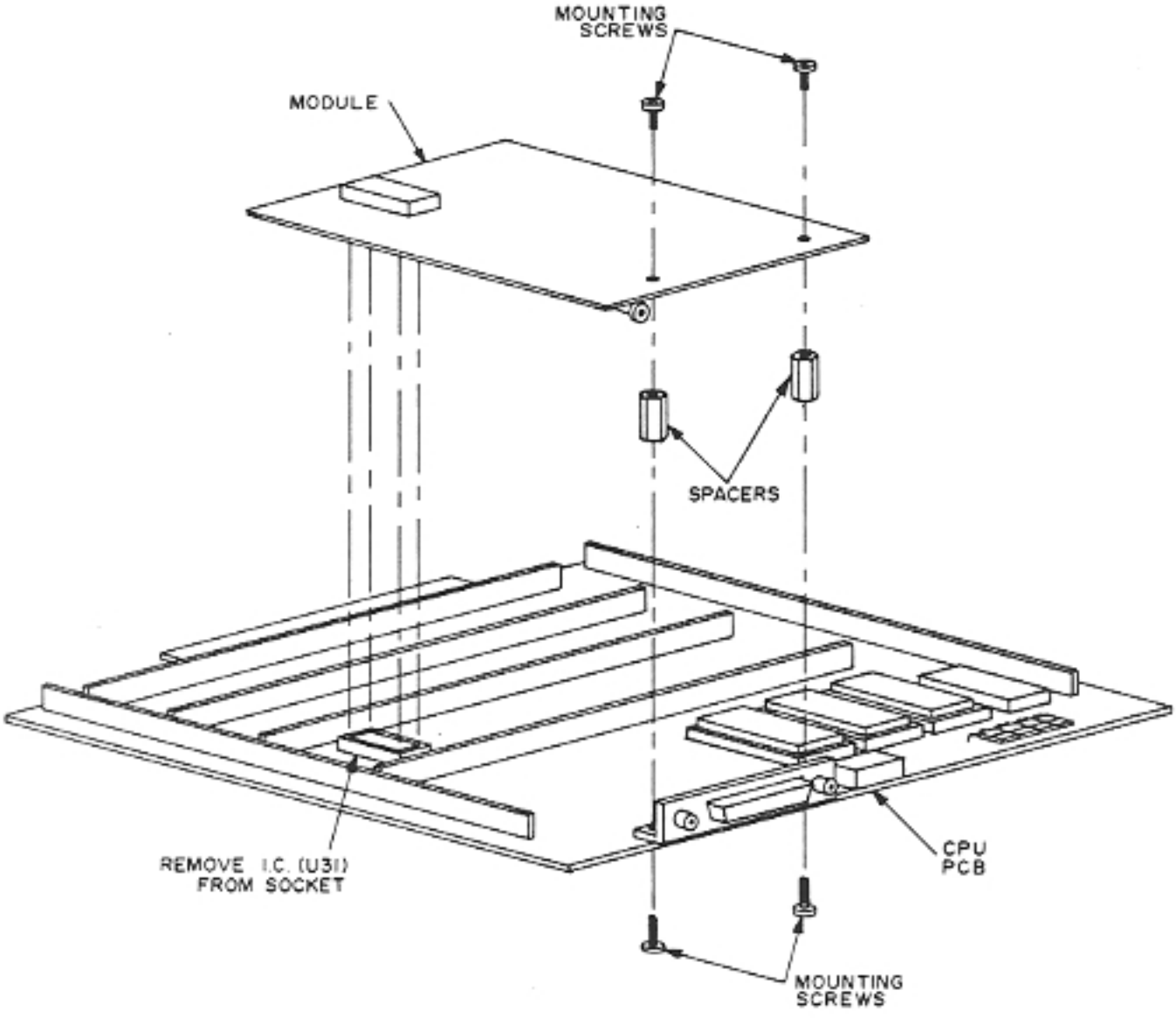


FIGURE 3-28. INSTALLING THE MUSIC-ON-HOLD MODULE



PROGRAMMING

CONTENTS PAGE

1. INTRODUCTION

1.01 This section describes the initialization and programming procedures for the 616 and 1232 systems. For proper operation, the system must be initialized when it is installed or after power has been off for more than 25 days. Programming allows service personnel to customize the system features to meet each user's requirements.

```
****************************************
* PROGRAMMING MUST ONLY BE PERFORMED   *
*    BY TRAINED SERVICE PERSONNEL      *
****************************************
```

2. PROGRAMMING METHODS

A. PROGRAMMING THE DATA BASE

2.01 Programming is performed using the DIP switches on the Central Processing Unit (CPU) printed circuit board (PCB) and the keypad and line keys on the keysets. A computer terminal is used only for running diagnostic programs, which are found in the DIAGNOSTIC PROGRAMMING section.

B. KEYSET PROGRAMMING

2.02 Some features are enabled by setting DIP switches inside the keysets in the CLOSED position. For information on the correct setting of these switches, refer to KEYSET INSTALLATION on page 3-42.

C. PROGRAMMING SHEETS

2.03 Programming is easier, quicker, and more accurate when system and station options are planned in advance. To assist you in the installation and programming of a system, a program planning sheet is provided. Refer to Figure 4-1 on the next page.

3. SYSTEM PROGRAMMING

3.01 The system has four programs which are controlled by DIP switches located on the CPU PCB. Refer to page 3-28 for a photograph of the CPU PCB. These programs are:

- PROGRAM - allows the system features to be programmed to meet the customer's needs (DIP switch 1).
- REST - resets the system hardware and software without affecting the data base (DIP switch 2).
- INIT - initializes the system data base (DIP switch 3).
- TEST - tests the software memory (DIP switch 4).

A. BATTERY ON/OFF JUMPER

3.02 The back-up battery protects the data base if power is removed. To allow the back-up battery to charge, the battery ON/OFF jumper must be in the ON position (with the center pin and the pin closest to the PCB edge connected). Refer to the photograph on page 3-28 for the location of the jumper on the CPU PCB. The battery requires two days to fully charge; if power is removed before it has charged, the programmed information stored in the data base will be lost.

FIGURE 4-1. PROGRAM PLANNING SHEET

SYSTEM FEATURES: (Performed at station 10)

4 Transfer Recall Time (1-255): _____
5 Hold Recall Time (1-255): _____
6 Absorbed Digit (2-9): ____
7 WATS Line(s): _____
8 System Options: (check options to be enabled)

___ 1 - SMDR 7 Digits or more, 30 sec.
___ 2 - SMDR 8 Digits or more, 30 sec.
___ 3 - Enable Error Messages
___ 4 - Conference Card Compatibility
___ 5 - 12-sec. Redial Timing
___ 6 - Held Call Loop Release (1.2 sec.)
___ 7 - 600 msec. Hookswitch Flash
___ 8 - I-Hold Enable
___ 9 - Allow Directory Assistance

STATION FEATURES: (Performed at individual station)

Extension Number _____

1 C.O. Lines Restricted:_____
2 Ring-In from C.O. Lines:_____
3 Options: (check options to be enabled)

___ 2 - Remove from Paging
___ 4 - Ring Intercom First
___ 6 - Toll Restrict
___ 7 - SCC Enable

KEYSET DIP SWITCH OPTIONS: (Inside keyset)

___ 1 - Do-Not-Disturb (Night Ring Mode, Station 10 only)
___ 2 - Executive Call Waiting
___ 3 - Full-Duplex
___ 4 - Night Answer
___ 5 - Off-Hook Ring
___ 6 - Speed Transfer
___ 7 - Digit 1 Dialing

B. OUTLINE TO PROGRAM NEW SYSTEMS

3.03 The procedure for initially programming the system after installation is shown below. Each program is explained on the following pages.

(1) Run TEST (close and then open DIP switch 4). Wait for TEST routine to finish.

(2) Turn the power supply off for 10 seconds, then back on.

(3) Run INIT (close and then open DIP switch 3).

(4) Program system and station features using PROGRAM (DIP switch 1).

C. SOFTWARE TEST (TEST)

```
**********************************************
*                  CAUTION                   *
* The TEST program scrambles the data base.  *
* Always initialize the system (INIT) after  *
* TEST.                                      *
**********************************************
```

3.04 This program tests the CPU Read-Only Memory (ROM) and Random Access Memory (RAM). To run the TEST program:

(1) Momentarily close DIP switch 4, then reopen.

(2) The top LED on the CPU PCB will light while testing.

(3) The second LED will light if the ROM passes.

(4) The third LED will light if the RAM passes.

(5) When the fourth LED lights, both have passed.

(6) Turn the power supply off for ten seconds, then turn it on to reset the memory.

(7) Proceed to the System Initialization (INIT) program.

3.05 If an LED does not light, the corresponding memory did not pass the test. Contact Inter-Tel Customer Support for assistance.

D. SYSTEM INITIALIZATION (INIT)

3.06 The initialization program sets the data base with the standard software configuration. To run INIT, momentarily close and then open DIP switch 3. The system will be initialized as follows:

- The attendant is station 10. It is the only station that will ring for incoming calls.
- Incoming calls flash on all keysets.
- Message center is station 10.
- Transfer Recall time is 60 seconds.
- Hold Recall time is 60 seconds.
- System hold is set.
- No WATS lines are designated.
- No absorbed digit is preset.
- All keysets can access all C.O. lines.
- Paging zones are set as follows:

Zone	1232 System	616 System
1	Stations 10-19	Stations 10-19
2	Stations 20-29	Stations 20-25
3	Stations 30-39	Not used
4	Stations 40-41	Not used
5	All Page 10-41	All Page 10-25

- No system options are preset.
- No station options are preset.

E. PROGRAMMING (PROGRAM)

3.07 Programming is performed using the keyset keypad and line keys. The keyset must be on-hook during the programming sequence. You will hear a tone for every digit or symbol entered; a beeping error signal will notify you if invalid information is entered. To cancel the error signal and erase the incorrect entry, press the pound (#) key and the programming code. Lifting and replacing the handset completes the programming sequence.

System Features Programming

3.08 System features are programmed through the attendant's keyset (station 10) using the keypad and line keys. For more information, refer to the FEATURES section of the manual.

NOTE: The keyset must be on-hook before starting, and must remain on-hook until the programming sequence is finished.

(1) Place DIP switch 1 of the CPU PCB in the CLOSED position.

(2) Program the following system features as follows:

NOTE: To remove previously stored information without adding new information, press # and the appropriate programming number, and lift and replace the handset. The entries will be deleted.

a. Transfer Recall Time: This is the time delay before an unanswered transferred call will recall the transferring station. It is preset to 60 seconds during initialization.

1. Using the keypad, press # and then 4.

2. Enter the transfer recall time in seconds (1-255).

b. Hold Recall Time: This is the time limit that: (1) calls can be placed on hold before recalling the station and (2) recalled calls (from hold or transfer) will ring at the station before returning to the attendant. It is preset to 60 seconds during initialization.

1. Using the keypad, press # and then 5.

2. Enter the hold recall time in seconds (1-255).

c. Absorbed Digit: The system toll-restriction table will ignore this digit if it is the first one dialed. By absorbing the digit, a long distance call from toll-restricted stations cannot be processed. There may be only one absorbed digit programmed for the system. No numbers are preset during initialization.

1. Using the keypad, press # and then 6.

2. Enter the absorbed digit (2-9).

d. WATS Line: These are the lines that toll-restricted stations may access to dial long distance numbers without being disconnected. These lines are not necessarily WATS lines, but may be local C.O. lines, FX lines, and PBX lines. No lines are preset during initialization.

1. Using the keypad, press # and then 7.

2. Press the line key(s) that will be used for long distance access. For example, pressing #, 7, and line keys 2 and 3 will designate lines 2 and 3 as WATS lines. If you make a mistake, or wish to add or delete line assignments, repeat the procedure for this feature and re-enter the designated lines.

e. System Options (no options are preset):

1. Using the keypad, press # and then 8.

2. Enter the desired option number(s) (1-9). For example, pressing #, 8, 2, 3, and 7 will enable options 2, 3, and 7. If you make a mistake, or wish to add or delete options, repeat the procedure for this feature and re-enter the designated options.

3. The options are:

Option 1 - SMDR 7 Digits and more, 30 sec.: The SMDR prints calls when 7 digits or more are dialed and the call exceeds 30 seconds.

Option 2 - SMDR 8 Digits and more, 30 sec.: The SMDR prints calls when 8 digits or more are dialed and the call exceeds 30 seconds.

NOTE: If options 1 or 2 are not selected, all incoming and outgoing calls will be recorded.

Option 3 - Enable Error Messages: A system diagnostic printout on the SMDR identifies defective stations or user errors. The SMDR diagnostic printout is explained in DIAGNOSTIC PROGRAMMING.

Option 4 - Conference Card Compatibility: Some early versions of hardware and software required this option for conferencing. It is never used in any software version later than 2.5. Contact Inter-Tel Customer Support if further assistance is required.

Option 5 - 12-sec. Redial Timing: The last number redial feature is delayed for 12 seconds. This allows speed-dial numbers to be chained by dialing the subsequent numbers within the 12-second delay.

Option 6 - Held Call Loop Release (1.2 sec.): The normal 0.1 second loop current interrupt time is increased to 1.2 seconds. This is the length of time that loop current can be removed before calls on hold will disconnect. Inter-Tel recommends that this option be enabled on all systems.

Option 7 - 600 msec. Hookswitch Flash: A 600 msec flash (normally 1.2 sec.) is generated on a line by pressing the line key in use. When the Inter-Tel system is used behind a PABX system, this feature allows access to the PABX features.

Option 8 - I-Hold Enable: Allows an outside call to be placed on hold at one station. Only this station can access the call by pressing the line key, although it can be reverse transferred. This option also causes incoming calls to flash and tone only on keysets programmed as direct ring-in stations. If disabled, incoming calls flash on all keysets and may be answered from any keyset; also, calls placed on system hold are accessible from all keysets.

Option 9 - Allow Directory Assistance: Allows toll-restricted stations to dial directory assistance (411, 1411, 1-555-1212, and 1-XXX-555-1212).

(3) Lift and replace the handset to store the programmed information.

(4) If no other programming is required for the system or stations, place DIP switch 1 in the OPEN position to take the CPU PCB out of the programming mode.

Station Features Programming

3.09 Station features are programmed for each station through its STN PCB circuit. If desired, all stations can be programmed at the Key Service Unit (KSU) using one keyset. To do this, plug a keyset into one of the modular jacks on the Station (STN) PCB and perform the programming sequence for that station. Then move the keyset to the next jack and repeat the programming process. Continue until all the stations have been programmed.

NOTE: The keyset must be on-hook before starting, and must remain on-hook until the programming sequence for that station is finished.

(1) Place DIP switch 1 of the CPU PCB in the CLOSED position.

(2) Program the station features as follows:

NOTE: To remove previously stored information without adding new information, press # and the appropriate programming number, and lift and replace the handset. The entries will be deleted.

a. C.O. Lines Restricted: Designates the C.O. lines that cannot be used to make outgoing calls from the station. Only incoming and transferred calls are received on these lines. No lines are preset during initialization.

NOTE: To create a private line: except for the designated station, restrict all other stations (including the attendant) from using the line. Then assign direct ring-in on that line for the designated station.

1. Using the keypad, press # and then 1.

2. Press the line key(s) that will be restricted for outgoing calls at that station. For example, pressing #, 1, and line keys 2 and 3 will prevent the station user from using lines 2 and 3 for outgoing calls.

b. Ring-In from C.O. Lines: Designates the C.O. lines that will ring in directly to the station. Upon initialization, only the attendant's station is assigned ring-in for all lines.

1. Press # and then 2 on the keypad.

2. Press the line key(s) that are to ring audibly for incoming C.O. calls at that station. For example, pressing #, 2, and line keys 4 and 5 will allow lines 4 and 5 to ring in directly for that keyset. If you make a mistake, or wish to add or delete line assignments, repeat the procedure for this feature and re-enter the designated lines.

c. Station Options (no options are preset):

1. Press # and then 3 on the keypad.

2. Press the desired option number(s). For example, pressing #, 3, and 2, 4, 6 will enable options 2, 4, and 6. If you make a mistake, or wish to add or delete options, repeat the procedure for this feature and re-enter the designated options.

3. The options are:

Option 2 - Remove from Paging: Removes the station from its preassigned paging zone and All Page. Refer to SYSTEM INITIALIZATION on page 4-5 for paging zone assignments.

Option 4 - Ring Intercom First: Prevents the station's speaker and microphone from being automatically activated by incoming intercom calls. (The voice announce feature is disabled for the keyset.) The keyset will double tone until answered.

Option 6 - Toll Restrict: Prevents toll calls from being made from the station. Refer to page 8-7 for a complete description of this feature. Refer also to Station Option 7 and System Option 9.

Option 7 - SCC Enable: Used together with Station Option 6, this option allows toll-restricted stations to dial Specialized Common Carrier (SCC) Numbers.

(3) Lift and replace the handset to store the programmed information. This completes the programming sequence for that station.

(4) Repeat the programming sequence for each station. Remember to complete the programming at every station by lifting and replacing the handset.

(5) After all stations are programmed, return DIP switch 1 of the CPU PCB to the OPEN position.

F. RESET (REST)

3.10 This program resets the microprocessor without cycling power or affecting the data base. It is primarily a maintenance routine used to restart the system after a Non-Maskable Interrupt (NMI) has occurred. To run REST, close and then open DIP switch 2.

```
*****************************************
*              CAUTION                  *
*    This program drops all calls       *
*    in progress.                       *
*****************************************
```

DIAGNOSTIC PROGRAMMING

CONTENTS PAGE

1. INTRODUCTION

1.01 This section describes the diagnostic programs used to maintain the system and provides instructions on how to use them. These programs include:

- Software Test (TEST) for testing the CPU ROM and RAM functions.
- Initialization (INIT) for initially programming the data base with the standard software configuration.
- Display (DISP) for monitoring the activity of the system and its stations.
- Reset (REST) for resetting the system's hardware and software without affecting the data base.
- On-Line Monitor (ONMN) for displaying and changing the system memory.
- Station Message Detail Recording (SMDR) for monitoring system generated error messages.

1.02 Certain diagnostic programs can also be run using the function switches on the Central Processing Unit (CPU) Printed Circuit Board (PCB). Alternate procedures for TEST, INIT, and REST are described in PROGRAMMING.

2. THE PROGRAMMING TERMINAL

2.01 Diagnostic programming requires the use of an input/output device such as a printer terminal or CRT terminal with a keyboard. The terminal is connected directly to the CPU PCB and must have these characteristics:

(1) RS232C compatible.

(2) Formatted for serial ASCII with no parity.

(3) Full-duplex transmission at 300 baud.

(4) The RS232C interface on the programming terminal must be equipped with a male 25-pin subminiature "D" connector. Consult the programming terminal owner's guide to verify that the individual pin functions are identical. If necessary, rewire the RS232C connector on the programming terminal to match the CPU PCB. Refer to page 3-52 for RS232C pin connections.

Connecting the Terminal

2.02 Connect the terminal to the CPU PCB as follows:

(1) Set the baud rate on the terminal to 300.

(2) To avoid electric surges when they are interfaced, turn on the terminal and the Key Service Unit (KSU) before connecting the terminal cable to the CPU PCB.

(3) Connect the RS232C connector from the terminal to the CPU PCB.

(4) "Sign on" by pressing the space bar.

Operating the Terminal

2.03 This section describes the functions of the programming terminal and its messages.

2.04 **Sign-on Message:** To access the programming functions, press the space bar. The sign-on message includes the software version, a list of programs, and the program selection equal sign (=) prompt as shown below.

```
INTER-TEL, INC. SOFTWARE PART NUMBER 827.1062-2 COPYRIGHT 1980
(1984)
ENTER: INIT,ONMN,TEST,REST,OR DISP
=
```

2.05 **Equal Sign (=):** The equal sign (=) prompt indicates that you must respond to the program line displayed to access the programming area.

2.06 **Command Line and <CR>:** The system uses the command line format for data entry. Your entry is not acknowledged until you enter a carriage return. This allows you to check your information before entering. Throughout this section <CR> refers to the carriage return key or enter key.

2.07 **Time-out and End Message:** The system contains a built-in timer which resets each time information is entered on the programming terminal. If no information is entered within 4-1/4 minutes, the system terminates programming and signs off. If a time-out occurs, any programming entered up to that point will be executed and you may redisplay the sign-on message by pressing the space bar.

2.08 **DEL or RUBOUT Key:** You may correct entry errors by using the DEL or RUBOUT key before the <CR> to backspace and erase characters.

2.09 **CONTROL-D Keys:** Holding down the CONTROL (CTRL) key and then pressing D at the same time allows you to redisplay the current line before the carriage return is pressed. If the input line has had several characters deleted with the DEL or RUBOUT key, the line may be unreadable. The CTRL-D keys can be used to show a "clean" copy of the line.

2.10 **CONTROL-X Keys:** Holding down the CONTROL (CTRL) key and then pressing X at the same time allows you to cancel the input line entered before a carriage return. Any characters entered on the current input line will be deleted, and the equal sign (=) prompt is displayed.

2.11 **Error Message:** If incorrect data is entered, the terminal will print the error message "WHAT?", and will redisplay the line in question followed by the equal sign (=) prompt.

2.12 **QUIT Command:** Entering QUIT<CR> will end the programming sequence and sign off.

2.13 **Upper Case Letters:** All entries must be made using upper case letters only.

3. SOFTWARE TEST (TEST)

3.01 This program tests the CPU Read-Only Memory (ROM) and Random Access Memory (RAM). To perform a software test:

(1) To start TEST, after the sign-on message equal sign (=) prompt, enter TEST<CR>.

(2) The terminal will respond with:

```
*ROM & RAM CHECK*
*ROM CHECK*
*RAM CHECK*
$8000-$87FF...PASS
TURN POWER-SUPPLY SW OFF,THEN ON !!
```

(3) Turn off the power supply for 10 seconds, then turn it on again.

(4) If the PASS message does not appear, contact Inter-Tel Customer Support for assistance.

(5) Press the space bar. The sign-on message equal sign (=) prompt will be displayed, and you may initialize the system.

```
************************************************
*                   CAUTION                    *
*  Using the TEST program will scramble the    *
*  existing data base.  Always initialize      *
*  the system (INIT) after the TEST program.   *
************************************************
```

4. INITIALIZATION (INIT)

4.01 The initialization program sets the data base with the standard software configuration, which is shown on page 4-5. To initialize the system, enter INIT<CR>. The system will be initialized automatically and the terminal will respond with:

```
OPT RAM INITIALIZING
INITIALIZATION COMPLETE
=
```

5. RESET (REST)

5.01 This program resets the system hardware and software without cycling power or affecting the data base. It is primarily a maintenance routine used to restart the system after a Non-Maskable Interrupt (NMI) has occurred; it is not used in general programming.

```
**********************************************
*                  CAUTION                   *
*     REST drops all calls in progress.      *
**********************************************
```

(1) To start REST, after the sign-on message equal sign (=) prompt, enter REST<CR>.

(2) The terminal will respond with:

JUMP TO NMI VECTOR!

(3) Press the space bar to display the sign-on message equal sign (=) prompt.

6. DISPLAY (DISP)

6.01 This program displays the activity of the system or of an individual station. The printout appears in ASCII characters, which can be decoded using Figure 5-1 on the next page. This aids in monitoring the use of a keyset or a DSS.

6.02 If the terminal has the capability, it will beep every 40 seconds as a reminder that the input/output port is tied up with this function and no SMDR printout is possible.

(1) To monitor the activity for all stations, after the sign-on message equal sign (=) prompt, enter DISP<CR>. The terminal will respond with:

DISPLAY IN PROGRESS!

OR, To monitor the activity of a single station, enter DISP (space) XX<CR>. XX represents the intercom number. The terminal will respond with:

DISPLAY IN PROGRESS! XX

(2) To terminate the DISP program, press the space bar. DISP will not time out. The terminal will respond with the equal sign (=) prompt and you may enter the name of the next program to run.

FIGURE 5-1. STATION AND DSS COMMAND CODE DEFINITIONS

STATION CODE COMMANDS

Encoded Character	Action
!	CALL FORWARD
"	DO-NOT-DISTURB
#	CANCEL CALL FWD/DND
$	STACK INTERCOM CALL
%	RECONNECT INTERCOM CALL
&	CONFERENCE ACCESS
'	CONFERENCE RELEASE
(	CALLBACK
) or /	EXEC CALL WAITING
*	CALL TRANSFER
+	OFF-HOOK
,	ON-HOOK
-	STATION POWER-UP
.	CANCEL ENTRY
/	INTERCOM TONE RING
0(zero)	PAGE COMMAND
1	LINE KEY 1 PRESSED
2	LINE KEY 2 PRESSED
3	LINE KEY 3 PRESSED
4	LINE KEY 4 PRESSED
5	LINE KEY 5 PRESSED
6	LINE KEY 6 PRESSED
7	LINE KEY 7 PRESSED
8	LINE KEY 8 PRESSED
9	LINE KEY 9 PRESSED
:	LINE KEY 10 PRESSED
;	LINE KEY 11 PRESSED
<	LINE KEY 12 PRESSED

Encoded Character	Action
0(zero)	* Key
N	0
O	1
P	2
Q	3
R	4
S	5
T	6
U	7
V	8
W	9
X	#
Y	SPEED DIAL
I or $	HOLD/FWD KEY
J or Y	MSG/DIAL KEY
+ or ,	ON/OFF KEY
* or &	XFER/CONF KEY

DSS COMMAND CODE DEFINITIONS

Encoded Character	Action
Z	KEY FUNCTION CODE
[	SPECIAL & KEY CODE
8	DSS SPECIAL KEY 1
9	DSS SPECIAL KEY 2
:	DSS SPECIAL KEY 3

7. SMDR ERROR MESSAGE CODES

7.01 The system monitors itself and prints error messages on the Station Message Detail Recording (SMDR) printout whenever a user or system error occurs (System Option 3 must be enabled). This section defines the error message format and code definitions used in the SMDR printout.

Error Message Format

7.02 The error message format of user and system error codes appearing on the SMDR printout is shown below. System Option 3 must be set to generate all error messages. Without Option 3, only *NMI messages are generated (refer to Figure 5-2 on page 5-9 for *NMI error format). If one of the fields is blank, the information appearing in that field does not apply to the error.

STN			NUMBER DIALED	DUR	LN
STATION NUMBER	ERROR TYPE	ERROR CODE	TELEPHONE NUMBER	RING DURATION	C.O. LINE
18	CURR	15	.....		
21	ONHK	8	.....		
10			2587600	1	2
10	RING		.....	0:08	12
***	RING		.....	0:17	11

7.03 **Station Number:** This message field indicates the station where the error was detected. Station numbers 10-41 (10-25 on the 616 system) or *** for an unanswered incoming call will appear in this field.

7.04 **Error Type:** The error types recognized by the system are categorized as RING, ONHK, OFHK, DROP, OFLN, CURR, DLAY, DATA, and *NMI. Each is described below.

A. RING: The RING code indicates that a C.O. call rang in on a specified C.O. line for the time recorded in the ring duration field. If the call was answered, the station answering the call is noted in the station number field. If the call was not answered, *** is printed in the station number field.

B. ONHK: The ONHK code indicates that the user entered data other than the off-hook command while the station was on-hook. For example, pressing the 2 on the keypad while on-hook will generate an ONHK P error message. Refer to Figure 5-1 on page 5-6.

NOTE: Pressing keyset buttons while on-hook may cause the station to be locked out until it is reset by a hook-flash.

C. OFHK: The OFHK code indicates that the user entered incorrect data while the station was off-hook and not in use. For example, an OFHK + indicates that the off-hook command was received with the station already off-hook.

D. DROP: The DROP code indicates that a station has been placed off-line because of excessive data errors. The data field indicates the connection lost if a call was in progress when the station was dropped. Drop code definitions are as follows:

Drop Code	Designates
01-0C	Lines 1-12
0D-11	Intercom Channels 1-5

E. OFLN: The OFLN code indicates that a previously off-line (dropped) station has been reconnected to the system and is communicating with the KSU. An error message of OFLN 20 indicates that an idle station was reconnected to the system.

F. CURR: The CURR code indicates that C.O. loop current was removed while the station was connected to a C.O. line. This is caused by the telephone company network releasing the line. The error code field shows the C.O. line that was released in hex value.

G. DLAY: The DLAY error code is printed when the station lamp status data processing has been delayed. The DLAY message is only displayed to measure data processing performance. DLAY followed by the data code L indicates a delay due to slow handling of previous station data. The data code field may be blank, indicating that processing of other system functions caused the delay.

H. DATA: This code displays any station-generated data errors outside the legal range for ONHK and OFHK error messages.

I. *NMI: The *NMI error code indicates that a non-maskable interrupt (watchdog timer interrupt) has occurred. An NMI will interrupt normal operation, record the condition of the system, and automatically reset. The system will continue to process calls and handle existing calls. C.O. lines that are on hold, transferred, parked, and in conference will be placed on hold. C.O. lines in use and intercom calls will remain connected. *NMI error messages are normally generated when software does not reset the system timer or when a hardware error occurs, such as a power spike or improper PCB insertion. Stack data in a hardware generated *NMI message will not contain significant diagnostic information. The *NMI error codes and system status are displayed in the following format:

NOTE: Any excess of soft resets within a certain time will cause the system to perform a hard reset, which results in all calls in progress being dropped.

FIGURE 5-2. *NMI MESSAGE FORMAT

```
 *NMI*NMI        !FFA     ..C9  ..  031  0B1  B23C1B1021
!   E           !! S   ! !          S                    !
!   R  C        !! T P ! !          T  D                 !
!   R  O        !! A O ! !          A  A                 !
!   O  D        !! C I ! !          C  T                 !
!   R  E        !! K N ! !          K  A                 !
!               !!   T ! !                               !
!               !!   E ! !                               !
!               !!   R ! !                               !
```

7.05 Error Code: This field contains the intercom number or C.O. line related to the error. The data may be either a single ASCII character or a two-digit hex value representing the ASCII character as shown on page 5-8, Drop Code.

7.06 Ring Duration: This field records the ring duration of incoming calls (in minutes and seconds) and the duration of C.O. calls (rounded up to the minute).

7.07 C.O. Line: This field indicates the C.O. line being used when the error occurred. If none were in use, or it does not apply to the error type, this field is blank.

8. ON-LINE MONITOR (ONMN)

8.01 The On-Line Monitor (ONMN) feature is used to display and change the system memory. Because it requires a knowledge of hex and binary mathematics, it is intended only for use by an advanced installer or engineer for debugging and maintaining the system. It is not intended for customer use; careless use may cause an operating system to "crash." Also, the SMDR cannot operate while the On-Line Monitor is in use.

```
**************************************************
*                    CAUTION                     *
*  Use of the On-Line Monitor by untrained       *
*  personnel can result in data base and         *
*  system execution errors. This could re-       *
*  quire reprogramming of the data base or a     *
*  system reset. The On-Line Monitor cannot      *
*  cause permanent system or hardware damage.    *
**************************************************
```

8.02 The ONMN feature allows the system to be monitored and the control block contents to be changed. Refer to Section B, CONTROL BLOCK FORMATS, for a list of the control blocks.

A. COMMANDS

8.03 To use the On-Line Monitor:

(1) When the sign-on message equal sign (=) prompt appears, enter ONMN <CR>.

(2) The terminal will respond with ON-LINE MONITOR and a pound (#) prompt. You may then enter one of the commands shown below and described on the following pages.

- Control Block Display
- Memory Display (M)
- Change (C)
- Quit (Q)

Control Block Display

8.04 Control blocks are memory areas which contain information for controlling system functions. To use the ONMN you must find the memory address for the block of memory you wish to display or change. The number of control blocks available varies with the type of control block. Numbers entered that are outside the normal range for a type of control block default to the lowest number allowed. Use Figures 5-3 through 5-10 on pages 5-14 through 5-18 to decode a control block. To find a memory address or display a control block:

(1) Enter designator letter, number value, and <CR>.

Designator Letter	Name	Number
B	Callback queue entry	1-5
F	Conference	1-2
I	Intercom Channel	1-5
L	C.O. line	1-12
S	Keyset station	10-41
T	Keyset station data base options.	10-41
X	System statistics	X R=reset

Examples:

S, S1, S 1, S10, or S 10 -- Displays the control block for the first circuit

S41 or S 41 -- Displays the last circuit

S99 or S 99 -- Displays the first circuit

(2) The terminal will display the control block in the following format:

BB AAAA DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

BB - is the hex equivalent of the requested block

AAAA - is the starting address of that RAM block

DD..DD - is the contents of the control block. Two characters are displayed for each data byte in the block

(3) Enter one of the following commands:

a. <CR> -- Entering a carriage return displays the next control block of the same type.

b. \<CR> -- Entering a backslash and a carriage return displays the preceding control block of the same type.

c. CTRL X -- Pressing X while holding down the CTRL key redisplays the current block.

d. Enter another ONMN Command and <CR> to change functions.

Memory Display (M)

8.05 To display a 16-byte area of memory:

(1) Enter M (space) XXXX <CR>. (XXXX is the desired address in hex.)

Find the four-character memory address using Control Block Display.

(2) The cursor remains at the end of the line. Enter one of the following:

a. <CR> -- Entering a carriage return displays the next block of memory.

b. \<CR> -- Entering a backslash and a carriage return displays the previous block of memory.

c. CTRL X -- Pressing X while holding down the CTRL key redisplays the current block of memory.

d. Enter another ONMN Command and <CR> to change functions.

Change (C)

NOTE: The following program changes the system memory and should be performed by trained personnel only.

8.06 To make changes in the memory area:

(1) Enter C (space) XXXX <CR>. (XXXX is the desired address in hex.)

Find the four-character memory address using Control Block Display.

(2) The terminal will display the data for that address. The cursor will remain at the end of the line. Enter one of the following:

a. 00 to FF<CR> -- Entering a hexadecimal value from 00 to FF followed by a carriage return enters the value in the memory. If the new value is in the correct location, the next memory block will appear.

b. \<CR> -- Entering a backslash and a carriage return displays the contents of the memory in the preceding block.

c. <CR> -- Entering a carriage return displays the contents of the next memory block.

d. CTRL X -- Pressing X while holding down the CTRL key redisplays the current memory block.

e. .<CR> -- Entering a period and the carriage return ends the Change function.

f. Enter another ONMN Command and <CR> to change functions.

Quit (Q)

8.07 To exit the On-line Monitor:

(1) Enter Q<CR>.

(2) The terminal will respond with the equal sign (=) prompt.

(3) Enter QUIT<CR> to end the programming function.

(4) The SMDR printout will continue.

B. CONTROL BLOCK FORMATS

8.08 The following figures list the control block formats and definitions.

5-3. STATION CONTROL BLOCK (S)

BYTE	LABEL	BIT 7	6,5,4	BIT 3	2,1,0
00	LS0		1		2
01	LS1		3		4
02	LS2		5	B-MUSIC	6
03	LS3		7		8
04	LS4		9		10
05	LS5		11		12
0C	LS12		HD		RD
OD	LS13		ON/OFF		CF
OE OF	CTL0 CTL1	Station Control Flags			
10	DBUF	STN Data			
11	SWORK	Work Area			
12	STIME	.1 Second Timer			
13 14	RTAH	Software Breakpoint			
15	LACON	Last Channel Connection			
16	CTL2	Software Control Flags			
17	FWD	Call Forward Stations			
18	OPT	STN Options DIP SW			

Line Lamp Status

LS0-LS11:

0 - Off
1 - Recall or XFER (120 IPM)
2 - Hold (60 IPM)
3 - Ring In (30 IPM)
4 - Unused
5 - Line Seized on Station (Double flash)
6 - Conference (15 IPM)
7 - Line In Use (Lit)

HOLD/FWD (HD) Lamp Status

1 - Intercom Call Waiting
2 - Call Forward/ Do-Not-Disturb

MSG/DIAL (RD) Lamp Status

1 - Message Waiting

XFER/CONF (CF) Lamp Status

2 - Non-Controlling Party
7 - Controlling Party

Station Option DIP Switches

80 - Always set high
40 - Do-Not-Disturb (1)
20 - Executive Call Waiting (2)
10 - Duplex Speakerphone (3)
08 - Night Ring Station (4)
04 - Off-Hook Tones (5)
02 - Speed Transfer (6)
01 - Digit 1 Dial (7)

FIGURE 5-4. STATION COMMAND CODE DEFINITIONS
- DBUF/DISP COMMAND/ERROR SMDR

20	No data (idle)
21	Call Forward
22	Do-Not-Disturb
23	Reset Call FWD/Do-Not-Dist
24	Stack Intercom Call
25	Reconnect Intercom
26	Conference Access
27	Conference Release
28	Call Back
29	Executive Call Waiting
2A	Call Transfer
2B	Off-Hook
2C	On-Hook
2D	Power-Up
2E	Cancel Entry
2F	Intercom Tone Ring
30	Page Command
31	Line Key 1
32	Line Key 2
33	Line Key 3
34	Line Key 4
35	Line Key 5
36	Line Key 6
37	Line Key 7
38	Line Key 8
39	Line Key 9
3A	Line Key 10
3B	Line Key 11
3C	Line Key 12
48	SPCL Key
49	HOLD Key
4A	MSG/DIAL Key
4B	ON/OFF Key
4C	XFER/CONF Key
4D	T/T *
4E	T/T 0
4F	T/T 1
50	T/T 2
51	T/T 3
52	T/T 4
53	T/T 5
54	T/T 6
55	T/T 7
56	T/T 8
57	T/T 9
58	T/T #
59	Repeat Dial Start
5A	DSS Key Flag
5B	DSS SPCL Key Flag
FF	Unterminated Extension

Station Control Flags CTL 0	
40	Incoming Intercom
20	In Intercom Ringing
10	In C.O. Ringing
04	In IC Complete
02	Monitor
01	Call Transferring

Station Control Flags CTL 1	
40	Out Intercom Busy
20	Out IC Complete
10	Out IC Ringing
04	Out C.O. Complete
02	Force Release
01	Clear to Send

Software Control Flags CTL 2	
80	STN is On-Hook
40	Offline Error Count
20	Offline Error Count
10	Offline Error Count
08	DSS XFR/HOLD Active
04	DSS ID is Next DBUF
02	Out IC Connected
01	Conference Active

FIGURE 5-5. C.O. LINE CONTROL BLOCK (L)

BYTE	LABEL	DEFINITION
00	COMD	Command
01	COST	Status
02	COST1	Status 1
03	STN	Station
04	OLD	Transfer Origin
05	TIME (2)	Call Duration 1 Sec
06	TIME1 (2)	Recall Time Remaining — 1 Sec
09	TIME2	5 Millisecond Tone Control
0A	TIME3	Timer 3
0B	DIAL	Dialed Digit
0C	DIAL1 (12)	Dial Buffer
18	POINT	Dial Buffer Index
19	RCTR	Ring Counter
1A	ACT1 (3)	Account Buffer
1D	BKP (2)	Program Return Address

COMD - Command Codes

0 - No Command
1 - Seize Line
2 - Reseize Line
3 - Release Line
4 - Disable Mute
5 - Dial Number
6 - Redial Buffer
7 - Hold Line
8 - Transfer Line
9 - Park
A - Conference
B - Unused
C - Unused
D - Unused
E - Unused
F - Unused
10- C.O. Callback Active
11- Immediate Transfer

COST - Status

80 - Music-On-Hold Connection
40 - Standard Connection Made
20 - Loop Current Timer
10 - Ring-In Timer Set
08 - Call Complete
04 - Ring Acknowledge
02 - Ringing-in
01 - Good Connection

COST1 - Status1

80 - Outgoing Call
40 - Reverse Transfer Ringing-in
20 - Ringing-in Refreshed
10 - '40' Previously Encountered
08 - Toll Restrict Edit Complete
04 - Unused
02 - Lamp Refresher Flag
01 - Ring-in Time Out (Forward)

FIGURE 5-6. CALLBACK QUEUE ENTRY (B)

BYTE	LABEL	DEFINITION
00	EXTN	Requesting Station
01	PORT	Requested Resource

If the requested value exceeds $C8 it is a C.O. Line.

The C.O. Line number is always offset by $C8. Otherwise the value indicates a station ID.

FIGURE 5-7. CONFERENCE CONTROL BLOCK (P)

BYTE	LABEL	DEFINITION
00	CFST	Status
01	CEX	Controlling STN
02	CP1	CHNL.1 (C.O. Line)
03	CP2	CHNL.2 (C.O. or STN)

CFST - Status

80 - 2-Station Mode
40 - Origin is in Conference
20 - CP2 is Known Gone
01 - Block is Active

NOTE: C.O. Line values are offset by $C8.

FIGURE 5-8. INTERCOM CHANNEL BLOCK (I)

BYTE	LABEL	DEFINITION
00	CHMD	Command
01	CHST	Status
02	IN	Calling Party
03	Out	Called Party
04	BKCH	Software Break
05		Point
06	TIMEX	.1 Msec. Timer

CHST - Status

80 - Out is Busy
40 - In Camped On - Music-On-Hold
20 - Out Just Reversed Intercom
10 - Out is Off-Hook
08 - Out Has Intercom Ring
04 - Camp-On is Causing Background Incoming C.O. Ring
02 - Connection Granted
01 - Out is in Do-Not-Disturb

NOTE: The IN field set to zero indicates an available channel.

Channel Command Codes

00 - OPEN (may be assigned)
01 - Connect to Station
02 - Reconnect
03 - Drop
04 - Transfer
05 - Ring Called Party
06 - Stack On Called Party
07 - Stack On Called Party
08 - Double Tone Ring Called
09 - Page
0A - Conference
0B - Unused
0C - Unused
0D - Unused
0E - DSS Tone Command
0F - Unused

FIGURE 5-9. STATION DATA BASE OPTIONS (T)

BYTE	LABEL	DEFINITION
00 01	L1.8 L9.16	Lines Restricted — This is a 2 byte field with the leftmost bit indicating line 1. This is the line restriction table.
02 03	R1.8 R9.16	Lines to Ring-In — This is a 2 byte field with the leftmost bit indicating line 1. This is the station ring-in table.
04	OPTION	Station Options
05	ZONES	Paging Zones
06	NUMB	Station ID

Options

80 - 1:Unused
40 - 2:Remove from Page
20 - 3:Unused
10 - 4:Ring Intercom First
08 - 5:Unused
04 - 6:Toll-Restricted
02 - 7:SCC Enable

Zones

80 - Page Zone 1
40 - Page Zone 2
20 - Page Zone 3
10 - Page Zone 4
08 - All Page (Zone 5)

FIGURE 5-10. SYSTEM STATISTICS AREA (X)

BYTE	LABEL	DEFINITION
00	SXTSTN	Maximum Station Loop Duration
02	SXTLNE	Maximum Line Loop Duration
04	SXLMIN	Minimum Line Loops Between Station Loops
05	SXLMAX	Maximum Line Loops Between Station Loops
06	SFTCTR	Soft Resets Available (Maximum: Ten)
07	SFTOTL	Soft Reset Count Since Last Power-Up Or 'REST'

All times are in milliseconds (msec). The available soft reset count (SFTCTR) is reset to 0A (ten) approximately every 3 hours. The count of soft reset occurrences is initialized to zero on power-up and when the REST program is used.

Entering either CTRL-X or <CR> after entering the X command will repeat the statistics display.

Entering X R<CR> will cause the statistics values to be re-initialized.

TROUBLESHOOTING

CONTENTS PAGE

1. INTRODUCTION

1.01 This section describes the troubleshooting procedures to follow in the event of a system malfunction. System repair is limited to replacement of modules, (e.g., printed circuit board, power supply, keyset, etc.). Repair beyond module replacement is not covered in this manual.

2. DEFECTIVE UNIT RETURN POLICY

2.01 Material Return Authorization (MRA) Tags: If it is necessary to return a defective unit after following the recommended troubleshooting procedures, first obtain an MRA tag from the Inter-Tel MRA Department and attach it to the defective unit. The following guidelines will help you fill out the tag properly.

NOTE: Inter-Tel does not accept the return of defective units without MRA tags.

(1) Obtain a repair authorization number from your Inter-Tel order processing clerk.

(2) Identify the unit by the equipment name, part number, and serial number.

(3) Describe the defect and, if applicable, the circuit number related to the defect.

(4) Document the estimated service time prior to failure.

(5) Attach the upper portion of the tag to the defective equipment. Retain the bottom portion for your files.

(6) Write the MRA number on the outside of the shipping box.

3. TROUBLESHOOTING PROCEDURE

A. PRELIMINARY TROUBLESHOOTING CHECKLIST

3.01 Use this troubleshooting checklist before you start the system troubleshooting procedures. It may save you time and possibly eliminate the need for detailed troubleshooting.

(1) Is the problem caused by user errors? You can monitor the system or individual stations using the DISP program described in DIAGNOSTIC PROGRAMMING. Or, use the features according to the instructions in the FEATURES section of this manual.

(2) Has the equipment been disconnected or disabled? Refer to the INSTALLATION and PROGRAMMING sections for more information.

(3) If the problem involves an optional feature, has the option been enabled? Refer to the INSTALLATION and PROGRAMMING sections for enabling procedures. Check keyset DIP switches if the feature is switch-enabled (refer to page 3-42).

(4) Are printed circuit boards and equipment cables securely seated and connected? Refer to INSTALLATION for details.

(5) Check all LED's for proper indication. Refer to Section B, LIGHT-EMITTING DIODE INDICATIONS (LED), on the next page.

(6) Is the problem caused by optional external equipment (e.g., auto-dialer, headset, loud ringing adapter, etc.), connected to the system?

(7) Each keyset contains a microprocessor that is essential to the operation of the keyset. Ensure that the supply voltage to the microprocessor is set at +5.0 $\pm$0.01VDC. For voltage adjustment procedures, refer to page 3-40.

(8) If a problem persists, after completing the checklist, proceed to Section C, SYSTEM TROUBLESHOOTING PROCEDURES, starting on page 6-6.

B. LIGHT-EMITTING DIODE (LED) INDICATIONS

3.02 The Light-Emitting Diodes (LED's) located on the front edge of each PCB indicate specific functions. Figure 6-1, Light-Emitting Diode Indications, on the next page, and Figure 6-2, LED Locations, on page 6-5, indicate the the normal condition of each LED. LED problems and corrective actions are listed below:

A. If the Power Reset LED does not light up, or will not go out after two seconds, when the PCB is reset or powered up:

(1) Remove the faulty PCB.

(2) Wait 10 seconds and re-insert the PCB.

(3) If the power reset LED still does not function properly, replace the PCB.

B. If the NMI (watchdog timer) bottom LED on the CPU PCB is lit, reset the system (momentarily close DIP switch 2 on the CPU PCB, then re-open).

NOTE: A reset will disconnect any calls in progress. If the NMI LED lights frequently, contact Inter-Tel Customer Support for assistance.

C. If the first three LED's on the CPU PCB are not flashing at the proper rates:

NOTE: The top LED flashes approximately 5 times per second, the second LED flashes 2 or 3 times a second, the third is almost constantly on, and the bottom is not lit unless a non-maskable interrupt has occurred.

(1) Turn off the AC power and remove all PCB's.

(2) Ensure that the CPU PCB ROM's are properly seated.

(3) Re-insert the CPU PCB and turn on the AC power.

(4) On the back of the DC power cable connector, measure the voltage from Test Point 5 to Test Point 6 as described on page 3-29. The voltage must be +5.0 $\pm$0.1VDC.

(5) If the voltage is out of tolerance, remove the CPU PCB and replace it with a new PCB. If still out of tolerance, contact Inter-Tel Customer Support.

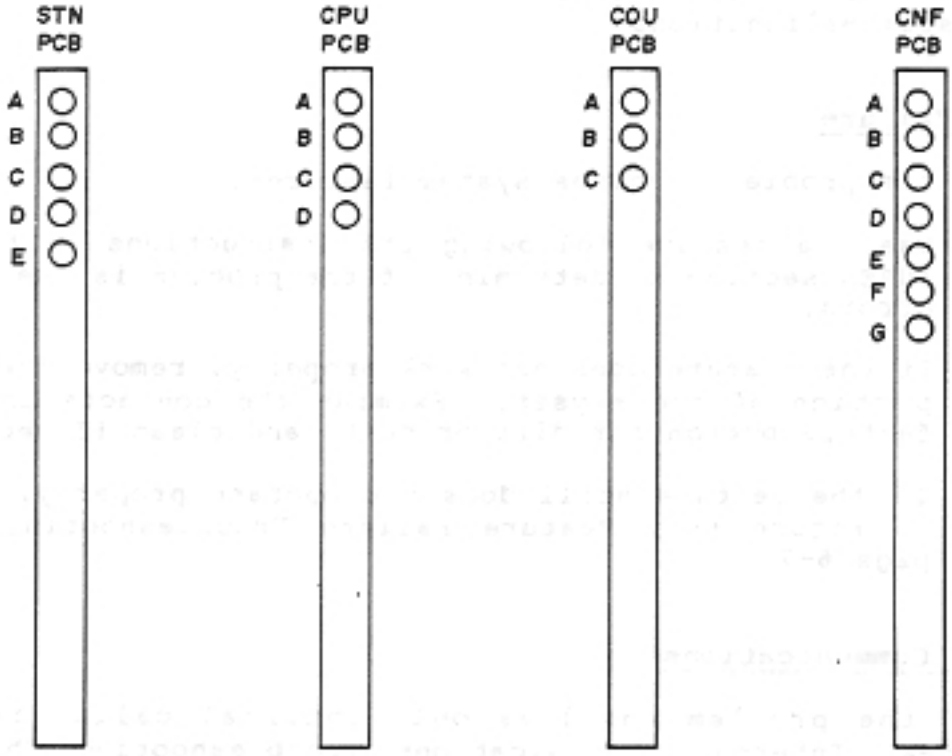
(6) If within tolerance, replace the remaining PCB's one at a time, rechecking the +5.0VDC each time. Replace any faulty PCB's.

FIGURE 6-1. LIGHT-EMITTING DIODE INDICATIONS

PCB	LED LOCATION*	DESCRIPTION
STN	A	Power Reset LED (normally off) Lights when the PCB has not been acknowledged and reset by the CPU.
	B-E	Circuit LED's (off when not in use) Lights when the station associated with that circuit is using processor time.
CPU	A-C	Data LED's Lights when the CPU is functioning. Rate of flash indicates the amount of activity.
	D	NMI LED (normally off) Lights when a non-maskable interrupt has occurred.
COU	A	Power Reset LED (normally off) Lights when the PCB has not been acknowledged and reset by the CPU.
	B and C	Circuit LED's Lights when the C.O. line associated with that circuit is accessed.
CNF	A	Power Reset (normally off) Lights when the PCB has not been acknowledged and reset by the CPU.
	B-D E-G	Conference Circuit 1 LED's (normally off) Conference Circuit 2 LED's (normally off) Lights when circuit is activated.

* Refer to Figure 6-2 on page 6-5 for the locations of the LED's.

FIGURE 6-2. LED LOCATIONS



C. SYSTEM TROUBLESHOOTING PROCEDURES

3.03 The troubleshooting procedures for correcting equipment failures have been divided into four categories:

- Feature Failure
- Internal Communications
- External Communications
- System Malfunctions

Feature Failure

3.04 If the problem involves system features:

(1) Use the feature following the instructions in the FEATURES section to determine if the problem is due to user errors.

(2) If the feature does not work properly, remove the keypad portion of the keyset. Examine the contacts under the feature button for dirt or dust, and clean if necessary.

(3) If the feature still does not operate properly, proceed to Figure 6-3, Feature Failure Troubleshooting Chart, page 6-7.

Internal Communications

3.05 If the problem involves only internal calls, refer to Figure 6-4, Internal Communications Troubleshooting Chart, on page 6-11.

External Communications

3.06 If the problem involves only external calls, refer to Figure 6-5, External Communications Troubleshooting Chart, on page 6-13.

System Malfunctions

3.07 If the problem appears throughout the system, refer to Figure 6-6, System Malfunctions Troubleshooting Chart, on page 6-14.

3.08 The troubleshooting charts list symptoms, possible causes, and corrective actions. Look for the problem reported and perform the corrective actions in the order given.

FIGURE 6-3. FEATURE FAILURE TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Cannot place a call on Hold	User error	Refer to page 8-19 and 8-27.
	5.0V regulator out of tolerance	Adjust keyset +5.0VDC setting as described on page 3-40.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Cannot put the station in Call Forwarding	User error	Refer to page 8-35.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Cannot put the station in Do-Not-Disturb	User error	Refer to page 8-35.
	Option not enabled	Place keyset DIP switch 1 in the ON position.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Cannot activate another keyset's Message Waiting key	User error	Refer to page 8-36.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

FIGURE 6-3. FEATURE FAILURE TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Last Number Redial does not work	User error	Refer to page 8-26. The conditions for redialling before or after disconnecting are explained.
	System Option 5 enabled	Option 5 delays the redial feature for 12 sec. to allow speed dial numbers to be chained. Either wait 12 sec. or disable Option 5.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Speed-dial number memory lost or not working	User error	Refer to page 8-24.
	Speed dial attempted without accessing a C.O. line	Reprogram the memory storage location. Use the speed-dial feature only after pressing a line key.
	Power to keyset was removed	Ensure that the keyset has power and reprogram the numbers.
	Defective keyset	Replace the keyset.
Full-duplex speakerphone not working	Option not enabled	Place keyset DIP switch 3 in the ON position.
	Defective speaker or speaker cable	Using an ohmmeter, check the cable for a broken wire. If cable is good, and speakerphone still does not work, replace speakerphone.
	Defective speaker-phone module	Replace speakerphone module.
	Defective keyset	Replace the keyset.

FIGURE 6-3. FEATURE FAILURE TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Cannot transfer outside calls to other keysets	User error	Refer to page 8-27.
	Called station is in Do-Not-Disturb	Any station in Do-Not-Disturb cannot receive transferred calls.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Cannot initiate a conference	User error	Refer to page 8-32.
	System is not equipped for conference	The system must have optional Conference (CNF) PCB.
	Defective keyset	Replace the keyset.
	Defective CNF PCB	Replace CNF PCB.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Cannot initiate a page	User error	Refer to page 8-37.
	Paging zone disabled	A keyset does not need to be in a programmed zone to initiate a page, but other keysets must be in the zone being used in order to receive the page. Check the Station Programming sheets for Station Option 2. Reprogram the keysets if necessary.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

FIGURE 6-3. FEATURE FAILURE TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Paging times out in less than 12 seconds	User error	Refer to page 8-37.
	STN PCB has unterminated extension	Remove the unused station cable from the PCB. Hot prewires are not permitted.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

FIGURE 6-4. INTERNAL COMMUNICATIONS TROUBLESHOOTING CHART

NOTE: These symptoms are isolated to one keyset only. For identical problems involving more than one keyset, refer to Figure 6-6, System Malfunctions Troubleshooting Chart, on page 6-14.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
No intercom dial tone	Defective cabling	Check cable connections.
	Defective keyset	Replace the keyset.
	Defective STN PCB	Determine which PCB corresponds to the affected station and replace it.
Cannot place intercom calls	Defective keyset	Replace the keyset.
	Defective STN PCB	Determine which STN PCB corresponds to the affected station and replace it.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Data noise in keyset	Defective cabling or connections	Check for loose or open connections, or crossed wires.
	STN PCB has unterminated extension	Remove the unused station cable from the PCB. Hot prewires are not permitted.
	Defective keyset	Replace the keyset.
	Defective STN PCB	Determine which PCB corresponds to the affected station and replace it.

FIGURE 6-4. INTERNAL COMMUNICATIONS TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Keyset not working	Defective or misadjusted keyset	Check the internal +5.0VDC setting and adjust if necessary (refer to page 3-40). Replace keyset if still not working.
	Defective cabling	Check for loose or open connections in corresponding cabling.
	Defective STN PCB	Refer to page 3-31, then replace the corresponding PCB.
Other station conversations can be heard on the line	STN PCB has unterminated extension	Remove the unused station cable from the PCB. Hot prewires are not permitted.
	Defective STN PCB	Replace the corresponding PCB.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

FIGURE 6-5. EXTERNAL COMMUNICATIONS TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Cannot obtain C.O. dial tone	C.O. line(s) restricted	Check the station programming for that keyset (refer to page 4-9).
	Defective keyset	Replace the keyset.
Cannot place an outside call. C.O. dial tone present (intercom works)	Keyset is toll restricted	Check the station option programming for that keyset.
	Speed transfer enabled	Standard operating procedure. Place keyset DIP switch 6 in the OFF position if speed transfer is not desired.
	Defective keyset	Replace the keyset.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Outside calls being dropped during conversation or upon answering C.O. call	Line key is pressed by user after initial connection is established	Standard operating procedure. Pressing a line key after the connection has been made will automatically drop the call in progress and reseize that C.O. line.
	STN PCB has unterminated extension	Remove the unused station cable from the PCB. Hot prewires are not permitted.
	Loop current interrupt from Central Office	The Central Office must supply constant loop current. Enable System Option 6 (1.2 second held call loop release) as described on page 4-8. This will only help calls on hold.
	Insufficient loop current supplied by Central Office	Central Office must supply a loop current of 20mA minimum.
	Defective keyset	Replace the keyset.
	Defective COU PCB	Replace the COU PCB.

FIGURE 6-6. SYSTEM MALFUNCTIONS TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
No keysets in the system will operate. No LED indication when a line key is pressed.	Main Power +30VDC fuse open	Examine the fuse and replace it if necessary. **CAUTION:** Do not exceed maximum rating of fuse (refer to page 3-16 or 3-25).
	Open connection in the cable between power supply and KSU cardfile.	Turn off the system. Use an ohmmeter to check the cable connector and replace or repair the faulty cable.
	Defective STN PCB	Remove all STN PCB's from the KSU. Check the voltage on the back of the DC connector as described on page 3-29. If in tolerance, replace the STN PCB's one at a time, measuring the voltage each time, until the defective PCB is isolated.
	Defective power supply	Using a voltmeter, check the voltage on the back of the DC connector. If the voltage is not +30 ±5VDC, replace the power supply. Refer to page 3-29.
A group of 4 keysets will not operate. No LED indication when a line key is pressed. All 4 sets are located on one STN PCB	Defective fuse on the STN PCB	Remove the STN PCB from the KSU and replace the 1A fuse.
	Defective STN PCB	Replace the STN PCB.
	Defective receptacle on KSU backplane	Replace the KSU cardfile. Contact Inter-Tel Customer Support for assistance.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

FIGURE 6-6. SYSTEM MALFUNCTION TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
C.O. line inoperative throughout system	Defective C.O. line from Central Office	Disconnect the C.O. line from COU PCB. Use a test set to verify the C.O. connection.
	Improper Programming	Ensure line is not restricted from access on all keysets.
	Defective COU PCB	Replace the COU PCB.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.
Terminal will not communicate with CPU PCB	Baud rates of the terminal and CPU PCB are not the same	Set the baud rate of the terminal to 300.
	Miswired or defective cable	Repair or replace connecting cable. Refer to page 3-52 for proper pinout for RS232C connector.
	Defective power supply	Check the -12VDC with a voltmeter on KSU power supply. Check the cable between the power supply and the KSU (refer to pages 3-16 to 3-23).
	RS232C interface on CPU PCB is faulty	Examine RS232C interface for faulty solder connections or broken pins. Contact Inter-Tel Customer Support for assistance.

FIGURE 6-6. SYSTEM MALFUNCTION TROUBLESHOOTING CHART (CONT'D)

SYMPTOM	PROBABLY CAUSE	CORRECTIVE ACTION
Repeated occurrence of dropped calls	AC line is not dedicated	Have dedicated, isolated AC line installed from the main power panel with a third wire ground. Ensure system power is on its own circuit breaker.
	Equipped but unterminated data lines (no keyset connected at the end of the cable)	Remove the unterminated station cables from the STN PCB.
	+5VDC low (KSU)	Replace faulty power supply. Contact Inter-Tel Customer Support for assistance.
	KSU located near a strong magnetic field (e.g., high voltage power transformer, or copying machines)	Relocate the KSU to an isolated room a minimum of 20 feet away from any equipment that produces a magnetic field.
	Defective CPU PCB	Refer to page 3-27, then contact Inter-Tel Customer Support for assistance.

D. HOW TO GET HELP

Customer Support

3.09 If the problem persists, contact Inter-Tel Customer Support for assistance. They can be reached between 8:00 AM and 5:00 PM Mountain Standard Time at 602-961-9000 or 1-800-523-8180.

3.10 **For Emergencies Only:** After office hours and on weekends, call 602-961-0277 and leave your message with the operator. A Customer Support Product Specialist will return your call within an hour. Please remember that this is an emergency number. Sales questions, equipment orders, etc., can only be processed during business hours.

ISIS

3.11 Inter-Tel Systems Information Service (ISIS) is available to distributors 24 hours a day. By following the instructions given below, you can access the latest news, Tech Tips, and sales information. You may access ISIS for up to 30 minutes per call. ISIS will disconnect automatically after 30 minutes.

3.12 To call ISIS, you will need to know your ISIS distributor code, which is identical to your Inter-Tel account number, and the ISIS access number (150377). You also need to have a computer terminal (CRT or printer) with a keyboard, and a modem with these characteristics:

A. Bell 103 or 212 standard modem compatibility.

B. 0 to 300 baud rate.

C. Full-duplex communication ability (parity is not checked).

3.13 Accessing ISIS:

(1) Dial 602-961-1825.

(2) When you hear the modem tone, activate your modem according to the manufacturer's instructions.

(3) Press the ENTER or RETURN key repeatedly until the terminal responds.

(4) When you are connected to ISIS, your terminal will print: USERNAME.

(5) Enter: ISIS and press RETURN or ENTER.

(6) Your terminal will print: ENTER ACCESS CODE.

(7) Enter: 150377 and press RETURN or ENTER.

(8) Your terminal will print: ENTER DISTRIBUTOR CODE.

(9) Enter: your distributor code (Inter-Tel account number as it appears on your monthly invoice) and RETURN or ENTER.

(10) Your terminal will print: WELCOME TO ISIS and will tell you when various files were updated last. (If the files have not been updated since you called last, you may not want to continue.) It will then print:

PLEASE CHOOSE ONE OF THE FOLLOWING:

A) Latest News (new or updated equipment and procedures)
B) Technical Service (training schedules and Tech Tips)
C) Marketing (Marketing Memos/Applications Guidelines)
D) Sales (training schedules)
E) Help (instructions on how to use ISIS)
F) Leave a Message
G) Exit ISIS (disconnects you from ISIS)

Field letter? (A-G):

(11) Enter the field letter (A-F) of the file you want to read and RETURN or ENTER. A sub-menu will then print. For example, if you choose B (Technical Services), your terminal will print:

PLEASE SELECT ONE OF THE FOLLOWING:

1) Latest News
2) Tech Tip Index for SPK (lists SPK Tech Tips available)
3) Tech Tip Index for MPK (lists MPK Tech Tips available)
4) Tech Tip Index (lists Tech Tips available)
5) Print SPK Tech Tip (prints selected SPK Tech Tips)
6) Print MPK Tech Tip (prints selected MPK Tech Tips)
7) Print Tech Tip (prints selected Tech Tips)
8) Training Information (monthly schedule)
9) Return to Main Menu (to select another area)

Field number? (1-9):

(12) Enter the field number (1-9) and RETURN or ENTER. You will now be able to read the information you selected.

(13) If you want to leave a file while it is printing, hold down the CONTROL key and press the Y key to return to the main menu.

(14) You may halt the file by holding down the CONTROL key and pressing S. To continue, hold down the CONTROL key and press the Q key.

(15) If you respond incorrectly to any prompt, ISIS will ask if you need help. If you respond by entering YES, ISIS will provide you with instructions to help you continue. Or, you may select the Help field from the main menu.

(16) When you are finished, select EXIT ISIS (G) from the main menu and terminate your call according to your modem's instructions. Make sure that you are disconnected; if you do not disconnect from ISIS, your telephone company will charge you for the length of time you were connected to ISIS.

NOTE: If you have any problems, please exit ISIS and report the problem to Customer Support between 8:00 and 5:00 PM (MST).

REPLACEMENT PARTS

CONTENTS PAGE

1. INTRODUCTION

1.01 This section provides the information necessary to order replacement parts for the 616 and 1232 systems.

2. ORDERING PROCEDURE

2.01 When ordering equipment for the 616 and 1232 systems, provide the following information to your Order Processing clerk:

- Company name
- Purchase order number
- Required date of shipment
- Part number(s) of equipment ordered
- Quantity required

3. REPLACEMENT PARTS LIST

3.01 Figure 7-1 on the next page lists the parts available for replacement on the 616 and 1232 systems.

4. RECOMMENDED SPARE PARTS

4.01 Spare parts must be kept on hand to ensure the best possible customer service. Figure 7-2 on page 7-5 lists the spare parts and quantities necessary to maintain and service ten 616 or 1232 systems.

FIGURE 7-1. REPLACEMENT PARTS

Part Description	HITEC Number	PHOENIX Number
Instruments		
Keyset - 24 line key	682.3000	681.3000
Keyset - 12 line key	344.3000	343.3000
Keyset - 6 line key	342.3000	341.3000
DSS I	344.3100	343.3100
Housings		
DSS I Top	810.5126	810.5123
DSS Bottom	810.5128	810.5124
DSS/Keyset Baseplate	810.5129	810.5125
Keyset Top - 24 line key	810.5131	810.5132
Keyset Top - 12 line key	810.5137	810.5139
Keyset Top - 6 line key	810.5136	810.5138
Keyset Bottom	810.5133	810.5134
Instrument Components		
Handset Assembly	817.3024	817.3025
Hookswitch	810.5135	810.5135
Transceiver for Handset	817.3005	817.3005
Handset Cable	813.1045	813.1042
Line Cord (mod to mod)	813.1044	813.1049
DSS Power Cable (mod/spade)	813.1052	813.1050
DSS Flat Cable (mod to mod)	813.1051	813.1053
Keyset Control Board	681.3010	681.3010
Volume Control Board	681.3011	681.3011
Control Board w/Voice & Tone	681.3012	681.3012
DSS I Control Board	683.3110	683.3110
Keyset Keyboard - 24 line key	682.3020	681.3020
Keyset Keyboard - 12 line key	344.3020	343.3020
Keyset Keyboard - 6 line key	342.3020	341.3020
DSS Keyboard - DSS I	344.3120	343.3120
Button Caps Kit - 24 line key	812.1022	812.1022
Button Caps Kit - 12 line key	812.1024	812.1024
Button Caps Kit - 6 line key	812.1023	812.1023
Button Caps Kit - DSS I	812.1021	812.1021

FIGURE 7-1. REPLACEMENT PARTS (CONT'D)

These parts have the same number for HITEC and PHOENIX models.

Part Description	Part Number
KSU	
616 KSU	341.1000
1232 KSU	343.1000
Battery Back-up KSU Assembly Kit*	341.02
Cabinet	823.1012
Power Supply	680.06
Power Cable Assembly	813.1010
PCB's	
CPU	340.10
COU (DTMF)	340.20
COU Rotary Conversion Kit	828.1032
STN	340.30
CNF	340.40
Power Supply	
616	340.06
1232	340.07
Battery Back-up Power Supply	680.06
Power Supply Cable	
340.06 Power Supply Cable	--
340.07 Power Supply Cable	--
Battery Back-up Power Cable Assembly	813.1010

*KSU must be ordered separately.

FIGURE 7-1. REPLACEMENT PARTS (CONT'D)

These parts have the same number for HITEC and PHOENIX models:

User Documentation

Installation and Field Maintenance Manual	341.8002
616 User Guide	341.8010
1232 User Guide	343.8010
DSS I User Guide	341.8006

Miscellaneous Equipment

Speakerphone Module Kit	828.1033
PLT-2 Headset Adapter	828.1031
Desk Speaker	828.1027
HAC Handset Receiver Kit	828.1046
DSS Power Transformer	806.1009

FIGURE 7-2. RECOMMENDED SPARE PARTS

Part Number	Description	Quantity
340.10	CPU PCB	1
340.20	COU PCB (DTMF)	2
828.1032	COU Rotary Conversion Kit	1
340.30	STN PCB	2
340.40	CNF PCB	1
340.06	616 Power Supply	1
340.07	1232 Power Supply	1
680.06	Battery Back-up Power Supply	1
341.1000	616 KSU	1
343.1000	1232 KSU	1
341.02	Battery Back-up KSU Assembly Kit	1
682.3000	HITEC Keyset - 24 line key	4
344.3000	HITEC Keyset - 12 line key	4
342.3000	HITEC Keyset - 6 line key	4
344.3100	HITEC DSS I	1
681.3000	PHOENIX Keyset - 24 line key	4
343.3000	PHOENIX Keyset - 12 line key	4
341.3000	PHOENIX Keyset - 6 line key	4
343.3100	PHOENIX DSS I	1

FEATURES

CONTENTS PAGE

SYSTEM FEATURES

1. INTRODUCTION

1.01 System features include the following:

- Station Message Detail Recording (SMDR)
- Flexible Attendant Arrangements (Alternate Point Answering)
- Flexible Night Ringing Arrangement
- System Battery Back-up
- Data Base Battery Back-up
- Dual-Tone Multi-Frequency (DTMF) or Dial Pulse Signalling
- Music-On-Hold
- Call Privacy
- Toll Restriction
- Variable Time-Out Capabilities

2. STATION MESSAGE DETAIL RECORDING (SMDR)

2.01 Station Message Detail Recording (SMDR) provides a detailed record of local and long distance calls.

2.02 Data may be recorded on a customer-provided printer or alternate device (such as magnetic tape or floppy disk). This device is connected to the RS232C port on the Central Processing Unit (CPU) printed circuit board (PCB). Refer to SYSTEM SPECIFICATIONS for more information.

2.03 SMDR options are selected through System Features Programming. The options are:

- All local and long distance calls, including incoming and outgoing calls (no options programmed).
- Local and long distance calls of seven digits or more lasting at least 30 seconds (System Option 1 enabled).*
- Only long distance calls of eight digits or more lasting at least 30 seconds (System Option 2 enabled).*
- Error messages (System Option 3 enabled). Refer to the DIAGNOSTIC PROGRAMMING section of this manual for details.

*Calls of less than seven digits (411, 1411, etc.) will not appear on the SMDR printout.

FIGURE 8-1. SMDR PRINTOUT

STN	NUMBER DIALED	DUR	LN
10	XXXXXXX	1	1
10	XXXXXXX	1	1

2.04 The following paragraphs describe the call data items that appear on the SMDR output report. A sample SMDR report is shown in Figure 8-1 above.

2.05 Station Number (STN): This field identifies the originator or recipient of an outside call by recording the station intercom number. If the call is transferred, the station that terminates the call is listed as the originator/recipient.

2.06 Number Dialed: This field records the telephone number dialed by the station user and the account code, if one was entered. The last 24 digits dialed appear in this field. The field is blank for incoming calls unless an account code is entered.

NOTE: An account code may be used to identify an outside call for billing or informational purposes. If SMDR System Option 1 or 2 is programmed, account codes will not be accepted for incoming calls. Refer to paragraph 4.05 on page 8-20 for instructions on entering an account code.

2.07 Duration of Call (DUR): This field indicates the duration of the call in minutes. The timer starts when the user finishes dialing (or when an account code is entered during an incoming call) and ends when the Central Office (C.O.) line in use is released. Calls are recorded in one-minute units, for up to 255 minutes. If more than 255 minutes have elapsed, three asterisks (***) will be printed.

2.08 C.O. Line Number (LN): This field identifies the C.O. line used to place or receive the call.

3. FLEXIBLE ATTENDANT ARRANGEMENTS (ALTERNATE POINT ANSWERING)

3.01 Incoming calls flash on all keysets and may be answered from any keyset. Keysets also may be programmed to tone for incoming calls through Station Features Programming (ring-in from C.O. lines). If System Option 8 (System Features Programming) is enabled, incoming calls will only flash and tone on keysets programmed as direct ring-in stations. All other keysets' line keys will be steadily lit and users will be unable to access incoming calls.

3.02 The system attendant (station 10) has full-feature capability for processing incoming calls. If desired, the system may be configured for multiple- or no-attendant operation. However, in the case of multiple attendants, there is only one system-identified attendant (station 10). Only this station will be able to place the system in the the Night Ring mode, respond to "0" as an intercom number, and receive recalls from within the system.

3.03 One-Attendant Operation: All incoming C.O. lines are initially programmed to ring in at the attendant's station (10).

3.04 Multiple-Attendant Operation: Incoming C.O. lines are programmed to ring in at two or more stations, but only station 10 is the system-identified attendant.

3.05 No-Attendant Operation: Incoming and outgoing calls may be processed without an attendant. This is accomplished in one of two ways. One way is to program C.O. lines to ring in at any station using Station Features Programming. Another method is to permanently place the system in Night Ring mode (refer to paragraph 4.01 below).

4. FLEXIBLE NIGHT RINGING ARRANGEMENT

4.01 The Night Ring mode allows the system to operate without an attendant. It is activated by placing the attendant's station (10) in Do-Not-Disturb (keyset DIP switch 1 must be enabled). When the system is in Night Ring mode, incoming calls flash on all keysets, and they flash and tone on keysets enabled with the Night Answer option (DIP switch 4).

4.02 If a line key flashes on a keyset to indicate an incoming call, the user may answer it by lifting the handset and pressing the flashing line key.

4.03 System features not requiring an attendant may be used while the system is in Night Ring mode. For example, calls may be put on hold or transferred to another station, but attendant recall will not be available.

5. POWER FAILURE CAPABILITIES

5.01 Back-up batteries provide power during a power outage or "brown-out" condition. They are trickle-charged by the power supply.

5.02 Data Base Battery Back-up: The data base memory is protected by a battery located on the the CPU PCB. In the event of a power failure, this battery protects the memory for up to 25 days before the data base must be reprogrammed.

5.03 System Battery Back-up: (Available with the 680.06 power supply.) During a power failure, systems with 340.06 and 340.07 power supplies drop calls in progress and lose stored speed-dial numbers. To keep a system fully operational during a power failure, the system can be equipped with the optional 680.06 power supply and back-up batteries. The customer-provided batteries are activated automatically and provide power to the system for a limited time. Refer to SYSTEM BATTERY BACK-UP on pages 2-8 and 3-49 for more information.

NOTE: The 340.06 and 340.07 power supplies are not equipped with battery chargers. If desired, a Tripp-lite Standby Supply can be connected to the power supply to provide back-up power. For the 340.06 power supply, use Tripp-lite part no. SB200LVC; for the 340.07, use part no. SB400LVC.

6. DUAL-TONE MULTI-FREQUENCY (DTMF) OR DIAL PULSE SIGNALLING

6.01 All instruments used on the system are equipped with push-button keypads. They generate a digital code that is decoded by the COU PCB as either a DTMF or dial pulse signal.

6.02 The COU PCB is initially configured for DTMF signalling, but some or all C.O. lines may be converted to dial pulse lines using the Rotary Conversion Kit (part no. 828.1032).

7. MUSIC-ON-HOLD

7.01 Music may be provided for calls on hold or waiting, and as background music to stations. This feature not only makes the wait as pleasant as possible, but it ensures the holding parties that they are still connected.

7.02 Synthesized music is a standard feature on the system. The CPU PCB is shipped with a melody integrated circuit chip. Alternately, an external music source (radio, tape recorder, etc.) may be used to provide background music and Music-On-Hold with the addition of a Music-On-Hold module (part no. 340.23). Refer to page 2-9, MUSIC-ON-HOLD MODULE, for more information.

8. CALL PRIVACY

8.01 The call privacy feature restricts access to a call by all other station users. This applies to intercom and outside calls. When an intercom channel is selected by dialing a two-digit intercom number, no other station may seize that channel.

8.02 When a C.O. line is selected by pressing one of the line keys, no other station can seize that line. Control of the line may be transferred to another station through a conference or a call transfer.

8.03 The system produces special tones to signal a station that an intercom or outside call is waiting. The tones are heard through the handset by the inside party only and do not disrupt the call in progress.

9. TOLL RESTRICTION

9.01 As a means of controlling costs, the system is capable of restricting specific stations from accessing outside C.O. lines or from making toll calls. The following restrictions are programmable:

A. Basic Toll Restrictions
B. WATS Line Access
C. Absorbed Digit
D. Specialized Common Carrier (SCC) Access
E. Allow Directory Assistance

A. BASIC TOLL RESTRICTIONS

9.02 Stations may be restricted from placing toll calls unless assisted by an unrestricted station. This permits control of long-distance dialing.

9.03 A station may be programmed for toll restrictions by enabling Station Option 6. This prevents the station user from placing a call when the number dialed has a 0 or 1 for the first or exceeds eight digits. Calls will be dropped immediately if the first digit dialed is a 0. If the first digit dialed is a 1, the call will be dropped on the fifth digit. If 0 or 1 is not the first digit dialed, the call will be dropped on the ninth digit unless Station Option 7 (SCC Enable) is enabled, which disables the digit counter.

9.04 The basic toll-restrictions feature expands to include additional restrictions and exceptions. Each is described below.

B. WATS LINE ACCESS

9.05 Using System Features Programming, the system may be programmed to allow access to an unrestricted line for placing toll calls that might otherwise be denied. This line does not need to be an actual WATS line. It may be a local C.O. line, FX line, PBX line, etc. This option is provided to allow a line to be excluded from toll restriction.

C. ABSORBED DIGIT

9.06 The system toll-restriction table will ignore this digit if it is the first one dialed. By absorbing the digit, a long distance call from a toll-restricted station cannot be processed. There may be only one absorbed digit programmed for the system. The local Central Office will inform you if a digit is absorbed by their facility.

D. SPECIALIZED COMMON CARRIER (SCC) ACCESS

9.07 Station Option 7 (Station Features Programming) allows a toll-restricted station to dial SCC numbers (i.e., SPRINT, MCI, etc.) for toll calls. This option disables the digit counter, which allows stations to dial the SCC access code, account number, and telephone number. The system will disconnect if the first digit dialed is a 0 or 1 (refer to paragraph 9.03 on page 8-7).

E. ALLOW DIRECTORY ASSISTANCE

9.08 System Option 9 (System Features Programming) allows toll-restricted stations to dial directory assistance (411, 1411, 1-555-1212, and 1-XXX-555-1212).

10. VARIABLE TIME-OUT CAPABILITIES

10.01 This feature provides time limits for the system. Variable timers are either preset or may be changed through System Features Programming. Standard and variable values are shown below.

Timer	Default Value	Variable Range
Transfer Recall	60 sec.	1-255 sec.
Hold Recall	60 sec.	1-255 sec.
Station Camp-On (rings busy before camp-on	4 sec.	--
Call Waiting Tone (incoming C.O.)	15 sec.	--
Callback Ring Duration	15 sec.	--
Lamp Status (Flash Sequence)	Refer to Figure 8-2, page 8-11	--
Abandoned Call Timer	10 min.	--
Page Time-out (Internal)	12 sec.	--

KEYSET FEATURES

1. INTRODUCTION

1.01 Keyset features include the following:

- Keyset General Features
- Intercom Features
- Outside Call Features
- Special Station Features

2. KEYSET GENERAL FEATURES

2.01 The following features are available on each keyset:

A. Feature and Line Keys
B. Light-Emitting Diodes (LED's)
C. Audible Tones
D. Volume Control
E. Call Number Buffering
F. ON/OFF Key
G. Direct Ring-In Line Flexibility
H. C.O. Line Restriction

A. FEATURE AND LINE KEYS

2.02 Keysets have six feature keys and 6, 12, or 24 line keys depending on the keyset model used. The line keys provide direct access to C.O. lines, and the feature keys provide user-friendly operation of the system features. Refer to STATION INSTRUMENTS on page 2-2 for more information on keysets.

2.03 The six feature keys are described below.

Key Name	Function
HOLD/FWD	Places a call on hold. Forwards calls to another station. Places the station in Do-Not-Disturb mode.
XFER/CONF	Transfers an outside call to another station. Reverse transfers a call from another station. Connects a three-party conference. Places a call on individual hold (I-Hold), when System Hold is enabled.
ZONE PAGE	Initiates internal pages.
QUE	Initiates intercom callback from a busy station. Requests a callback on a busy C.O. line.
MSG/DIAL	Activates another keyset's message waiting key and automatically dials the message center. Speed dials stored numbers. Redials last number manually dialed.
ON/OFF	Controls the internal speaker for call monitoring. Controls the optional speakerphone unit for handsfree operation. Disconnects when dialing on-hook. Indicates an incoming intercom call.

B. LIGHT-EMITTING DIODES (LED'S)

2.04 Light-Emitting Diodes (LED's) under each key indicate the status of the C.O. line keys and four of the feature keys. The flash rates of the LED's have distinct meanings, which are defined in Figure 8-2 on the next page. Flash rates are described below in interruptions per minute (IPM).

a. STEADY - Lit steadily, no flashing.

b. FAST - Flashes 120 IPM or two times per second.

c. MEDIUM - Flashes 60 IPM or one time per second.

d. SLOW - Flashes 30 IPM or once every two seconds.

e. DELAYED - Flashes 15 IPM or once every four seconds.

f. DOUBLE - Light repeatedly flashes twice and pauses.

FIGURE 8-2. LED INDICATIONS

	STEADY (0 IPM)	FAST (120 IPM)	MEDIUM (60 IPM)	SLOW (30 IPM)	DELAYED (15 IPM)	DOUBLE CADENCE
HOLD/FWD		IC call waiting on this keyset	Keyset has calls forwarded --- Keyset is in Do-Not-Disturb			
XFER/CONF	Conference initiated by this keyset is in progress		This keyset in conference (non-initiating party)			
MSG/DIAL		Message waiting				
ON/OFF	Microphone on --- Incoming IC call					
LINE KEYS	Line in use by another keyset	Line is recalling from transfer or hold --- Transferred call	Line on hold	Incoming call --- Queued line available --- C.O. call waiting on your keyset	Line in conference your keyset	You are using this line

C. AUDIBLE TONE INDICATIONS

2.05 There are several distinct "rings" (audible tones) for each type of call.

Ring Tones

2.06 The ring tones are described below.

a. Long continuous tones (_ _ _)

Incoming outside call
Line now available from busy line callback
Recalling outside call

b. One double tone (--)

Intercom call

c. Repeating double tones (-- -- --)

Private intercom call
Station callback

d. Repeating combination of 4 tones and pause (---- ---- ----)

Called station is in Do-Not-Disturb mode

e. Busy signal for 3 or 4 tones (----), then Music-On-Hold, if equipped.

Your station is camped on to a busy station

f. Continuous busy signal (---------)

C.O. line is busy
All intercom channels are busy
Another station is camped on to the busy station you are calling
You dialed an invalid intercom number
Your keyset is toll restricted

Immediate Ringing

2.07 A called station rings immediately after the station circuit is tested and found to be idle, without waiting for the normal ringing cycle.

Off-Hook Ringing

2.08 A keyset may be enabled to ring while off-hook (DIP switch 5). A signal tone is heard through the handset but is inaudible to the outside party.

a. A single tone every 15 seconds (-) indicates an outside call waiting.

b. A double tone (--) and flashing HOLD/FWD key indicate an intercom call waiting.

D. VOLUME CONTROL

2.09 A thumbwheel tone control adjusts the volume of all tones from the keyset. Another thumbwheel controls the voice volume from the internal speaker.

E. CALL NUMBER BUFFERING

2.10 Digits dialed are buffered by the CPU, preventing the user from dialing too fast for processing.

F. ON/OFF KEY

2.11 The ON/OFF key may be used to place outside calls without lifting the handset, but because the keyset microphone is inactive, the call must be conducted through the handset once the outside party answers (unless the keyset is equipped with an optional speakerphone unit).

G. DIRECT RING-IN LINE FLEXIBILITY

2.12 Direct ring-in line flexibility allows C.O. lines to ring in on specific stations, bypassing the attendant's station, if desired. If programmed for direct ring-in, an incoming call will cause the C.O. line key to flash and the keyset to ring. Assignments for ring-in are programmed through Station Features Programming.

H. C.O. LINE RESTRICTION

2.13 A station may be restricted from accessing one or more C.O. lines for outgoing calls (Station Features Programming). An attempt to use a restricted line will produce a busy signal. However, restricted stations may receive incoming calls on these lines, and these lines may be transferred from and to other stations.

3. INTERCOM FEATURES

3.01 The intercom features presented in this section are:

A. Intercom Dialing
B. Voice Announcing
C. Handsfree Answering
D. Ring Intercom First
E. Station-to-Station Calling
F. Intercom Camp-On, Call Waiting, and Call Splitting
G. Executive Call Waiting
H. Busy Station Callback (Queuing)
I. Consultation Hold
J. Intercom Transfer
K. Speed Transfer

A. INTERCOM DIALING

3.02 All stations are accessed by dialing a two-digit intercom number or pressing a single key on the optional Direct Station Selector/Busy Lamp Field (DSS) unit. (Refer to the ATTENDANT FEATURES section.)

B. VOICE ANNOUNCING

3.03 The internal speaker and microphone in your keyset are activated by incoming intercom calls, which allows the caller to announce the call and you to respond handsfree.

C. HANDSFREE ANSWERING

3.04 If you receive an intercom call, you may answer handsfree from anywhere in the room, or you may lift the handset for a private conversation. This feature may be disabled using Station Option 4 (Station Features Programming).

D. RING INTERCOM FIRST

3.05 If enabled on your keyset, the ring intercom first feature prevents your speaker and microphone from being activated by incoming intercom calls. (The voice announce feature is disabled for the keyset.) The keyset will continue to double tone. You may respond by lifting the handset or pressing the ON/OFF key. It is a programmable feature (Station Option 4).

E. STATION-TO-STATION CALLING

3.06 Intercom calls can be placed from one station to another. One of five available intercom channels is selected automatically when an intercom number is dialed. If all five intercom channels are busy, you will receive a busy signal when dialing the station. You may not transfer any outside calls when intercom channels are busy. If an unassigned, unequipped, or invalid intercom number is dialed, you will hear a busy signal.

NOTE: The number of intercom channels available is dependent on the system installed. Refer to page 2-3.

3.07 To place an intercom call:

(1) Lift the handset and dial the intercom number. If the called station is idle, both parties will hear one double tone and the called keyset's speaker and microphone will be activated.

(2) You may announce yourself.

3.08 If the called station is busy: If you hear a busy signal when you call another station, you have the following options:

A. Hang up and try later.

B. Do not hang up. You will camp on automatically. When the called station is available, you will be connected. Refer to Section 3F, INTERCOM CAMP-ON.

C. If your keyset is enabled for executive call waiting, you may camp on and send call waiting signals to the busy party. Refer to Section 3G, EXECUTIVE CALL WAITING.

D. Request a busy station callback. This is similar to camping on except that you hang up while waiting. Refer to Section 3H, BUSY STATION CALLBACK.

3.09 To receive an intercom call: When you hear a double-tone and possibly a voice announcement, and the ON/OFF key is lit, you may respond handsfree or lift the handset for privacy.

3.10 To place a private intercom call:

(1) Lift the handset and dial the intercom number.

(2) If the called station is idle, both parties will hear one double tone.

(3) Press the pound (#) key. You will hear continuous double tones until the called party answers by lifting the handset.

(4) If the called station is busy, the same options apply as described in paragraph 3.08 above.

3.11 To receive a private intercom call: When you hear continuous double tones, lift the handset or press the ON/OFF key.

3.12 To end an intercom call:

(1) The calling party may terminate an intercom call at any time by either hookflashing or hanging up.

OR, The called party may terminate an intercom call while on-hook by pressing any C.O. line key.

F. INTERCOM CAMP-ON, CALL WAITING, AND CALL SPLITTING

3.13 This feature allows you to camp on to a busy station and wait until it is available. You are automatically camped on as long as you remain off-hook and will hear Music-On-Hold, if equipped. The busy station is alerted with the call waiting signal.

3.14 Any station user may camp on to a busy station unless it is in Do-Not-Disturb mode (indicated by repeating four busy tones and a pause) or has a previous intercom call waiting (indicated by continuous busy signals).

3.15 To initiate intercom camp-on:

(1) If the called station is busy and no other intercom calls are camped on, you will hear the intercom busy signal for approximately two or three seconds and then Music-On-Hold, if equipped.

(2) Do not hang up. The called station is alerted to the call waiting by a fast flashing HOLD/FWD key. A double tone will be heard through the called party's handset if programmed (DIP switch 5).

(3) When the busy station becomes available, you will be connected automatically.

3.16 To answer a waiting intercom call while on an outside call (call-splitting): If you are notified of a call waiting by a fast flashing HOLD/FWD key and a double tone through the handset:

(1) Terminate the C.O. call and the intercom call will connect automatically.

OR, (1) Place the outside call on hold by pressing the HOLD/FWD key. The waiting intercom call will connect automatically.

(2) To reconnect with the outside call on hold, press the medium flashing line key. The intercom call will be camped on as long as the calling party remains off-hook. This allows you to split back and forth between calls as desired.

3.17 To answer a waiting intercom call while on another intercom call: If you are notified of a waiting intercom call by one double tone, terminate the current intercom call. The waiting intercom call will connect automatically.

G. EXECUTIVE CALL WAITING

3.18 Executive call waiting is a switch-enabled option (DIP switch 2) that allows a calling party to signal a busy station, without disrupting the ongoing call, that the calling party is waiting to talk.

3.19 Stations with the executive call waiting feature lose the busy station and line callback (queue) features. If the called busy station is not programmed to receive audible signals through the handset when off-hook, the waiting signal will not be heard.

3.20 To use executive call waiting:

(1) If you hear a busy signal when calling another station, press the pound (#) key to signal the user. Do not hang up. The busy station will hear a double tone every time the pound (#) key is pressed, not to exceed one every five seconds. The HOLD/FWD key on the busy station will flash at a fast rate.

(2) As soon as the busy station is free, you will be connected automatically.

H. BUSY STATION CALLBACK (QUEUING)

3.21 Busy station callback allows a station to be called back when a busy station becomes available. This feature is similar to intercom camp-on and call waiting, except that you may hang up while waiting. This feature is disabled if executive call waiting is enabled on the keyset (DIP switch 2).

3.22 The system can process up to five callback requests (busy station or busy line), but each station may request only one callback. If a second callback is requested, the previous request is cancelled.

3.23 To initiate a callback:

(1) If the called station is busy, press the QUE key.

(2) Hang up. This places you on a non-prioritized (first in, first out) callback list.

NOTE: Follow this procedure even if the call is camped on before the callback is requested.

3.24 To answer a callback:

(1) When the busy station becomes available, you will be alerted by continuous double tones.

(2) Lift the handset.

(3) The queued station will be called and the called party will hear one double tone.

(4) You may speak and the called party may respond handsfree or by lifting the handset.

3.25 If the calling party's station is busy when the callback is returned, the request is placed back in the queue list. The next station in the queue is then called back. If the waiting station is idle, the system will signal the station for a maximum of 15 seconds. If unanswered after this time, the callback request will be dropped from the queue list.

3.26 To cancel the callback:

(1) Lift the handset and dial your own intercom number.

(2) Press the QUE key.

(3) Press and release the hookswitch (hookflash) and hang up.

I. CONSULTATION HOLD

3.27 Consultation hold allows you to put an intercom call on hold, call someone else, and be reconnected without having to redial the intercom number.

3.28 To use consultation hold:

NOTE: Both stations must be off-hook.

(1) While connected to an intercom call, press the HOLD/FWD key. The HOLD/FWD key will flash at a fast rate after four seconds.

(2) Within four-seconds, dial another intercom number or press an available line key to dial an outside call.

(3) When you hang up, the original intercom call will reconnect automatically and you may answer on- or off-hook.

J. INTERCOM TRANSFER

3.29 Intercom transfer may be used to transfer an intercom call to another station.

3.30 To use intercom transfer:

NOTE: Both stations must be off-hook.

(1) While on an intercom call, press the XFER/CONF key.

(2) Within four seconds, dial the station to receive the call.

(3) Announce the call and hang up.

(4) The transfer will go through when you hang up, and the two intercom parties will be connected.

K. SPEED TRANSPER

3.31 The speed transfer feature is a switch-enabled option (DIP switch 6) that allows you to transfer outside calls by dialing only the number of the intercom you wish to reach. A station with this feature loses the ability to manually dial outside calls, but retains the ability to call out using speed-dial numbers.

4. OUTSIDE CALL FEATURES

4.01 The outside call features available on the system are divided into the following categories:

A. Placing and Receiving Outside Calls
B. Alternate Methods for C.O. Line Selection
C. Alternate Methods of Dialing
D. Calls on Hold
E. Transferring Outside Calls
F. Reverse Transfer/Call Pick-up
G. Automatic Recall Times
H. Outside Call Waiting
I. Conference Calls
J. On-Hook Monitoring

A. PLACING AND RECEIVING OUTSIDE CALLS

4.02 The basic procedure for placing outgoing calls and receiving incoming calls are described below. There also are many alternate procedures for selecting a C.O. line, dialing, and responding to different sources of calls (such as calls waiting, calls on hold, transferring calls, and conference calls).

4.03 Placing an outside call:

(1) Lift the handset and press an available unlit line key.

(2) Listen for the outside dial tone and dial the desired telephone number.

4.04 Receiving an outside call: When a line key is flashing at a slow rate and is accompanied by long, continuous tones, lift the handset and press the flashing line key. The call will be connected and the line key will double flash while the call is in progress.

4.05 To add an account code for SMDR reporting: An account code may be added during an outside call (outgoing or incoming) to identify it for billing or informational purposes. This code and the number dialed appear in the 24-digit number dialed field on the SMDR printout.

NOTE: If System Option 1 or 2 (System Features Programming) is enabled, account codes will not be accepted for incoming calls. Refer also to page 8-4.

(1) While on an outside call, tell the outside party that he will hear audible tones as you enter the account code.

(2) Press the asterisk (*) or pound (#) key twice, then dial the account code. The call duration timer will be activated.

B. ALTERNATE METHODS FOR C.O. LINE SELECTION

4.06 The following sections describe alternate methods of selecting C.O. lines. These methods include:

- Direct Line Key Selection
- Busy Line Callback (Queuing)
- Outside Dial Tone Restore
- Line Key Skipping

Direct Line Key Selection

4.07 This feature allows you to press any unlit line key to access a C.O. line for an outgoing call. A station user may have access to up to six or 12 C.O. lines, as determined by the system installed and its data base.

Busy Line Callback (Queuing)

4.08 Busy line callback allows stations to be placed on a callback list waiting for an available C.O. line. When the C.O. line becomes available, the system recalls the waiting station. This feature is disabled if executive call waiting is enabled on the keyset (DIP switch 2).

4.09 The callback order is organized on a first in, first out basis. No station has the priority to override another station's position in the callback order.

4.10 It is possible for the system to have five callbacks requested at a time, including C.O. line and station callbacks. Any C.O. line available to a station may be queued, but only one callback may be requested by each station. If a second callback (busy station or busy line) is requested, the previous request is cancelled.

4.11 To initiate busy line callback:

(1) Lift the handset and press a busy (lit) line key. You will hear a busy signal.

(2) Press the QUE key and hang up.

4.12 To answer a callback:

(1) When the busy line becomes available, the line key will flash at a slow rate and you will hear long, single tones.

(2) Lift the handset and press the flashing line key.

(3) When you hear the outside dial tone, proceed with the call.

4.13 To cancel a callback:

(1) Lift the handset and dial your own intercom number.

(2) Press the QUE key.

(3) Press and release the hookswitch (hookflash) and hang up.

4.14 If the waiting station is busy when the line requested is available, that station is placed back in the callback list. The next station waiting will receive a signal for the available line. If the waiting station is idle, the system signals the station for a maximum of 15 seconds. If unanswered after this time, the next person in line is signalled, and the unavailable party is removed from the callback list.

Outside Dial Tone Restore

4.15 This feature allows you to disconnect from one call and reaccess the same line for another call by pressing the line key already in use. This is faster than pressing and releasing the hookswitch and pressing an available line key to make a call.

4.16 To use outside dial tone restore: After you are finished with the call, do not hang up. Press the same flashing line key and the system will disconnect the call and reseize outside dial tone automatically.

Line Key Skipping

4.17 Line key skipping allows you to disconnect from one call and access another C.O. line by pressing an available line key. This is faster than pressing and releasing the hookswitch and pressing an available line key to make a call.

4.18 To use line key skipping: After you are finished with the call, do not hang up. Press an available unlit line key and the system will automatically disconnect you from the first line and connect you to the second.

C. ALTERNATE METHODS OF DIALING

4.19 Additional methods available for dialing include:

- On-Hook Dialing
- Manually Dialing Specialized Common Carrier (SCC) Numbers
- Station Speed Dialing
- Speed Dialing SCC Numbers
- Last Number Redial

On-Hook Dialing

4.20 To dial on-hook:

(1) Press the ON/OFF key.

(2) Press an available unlit line key and listen for the outside dial tone.

(3) Dial the telephone number.

(4) When the called party answers, lift the handset to respond. Or, if you have dialed a recorded message, listen without lifting the handset.

OR, If you reach a busy or unanswered line, disconnect by pressing the ON/OFF key.

NOTE: When this feature is used, your keyset's microphone is not activated and you cannot be heard by the outside party. However, if you have a speakerphone kit attached to your keyset, you do not need to pick up the handset to respond when the called party answers.

Manually Dialing Specialized Common Carrier (SCC) Numbers

4.21 To dial SCC numbers:

(1) Lift the handset and press an available unlit line key.

(2) Listen for the outside dial tone and dial the SCC local access number.

(3) Listen for the computer tone; dial the SCC security code.

(4) Dial the area code and telephone number.

NOTES: (1) Toll-restricted stations must be have Station Option 7 enabled to dial SCC numbers.

(2) For your convenience, SCC numbers may be speed dialed. Refer to paragraph 4.27 on page 8-25.

Station Speed Dialing

4.22 The speed-dial feature allows up to 10 frequently-called numbers to be stored in the keyset. Each number can be up to 10 digits long and is identified with a one-digit memory location code (0 through 9). These numbers can be changed or erased as desired. The leading digit 1 for direct long distance dialing can be inserted automatically before all 10-digit speed-dial numbers (DIP switch 7).

4.23 If power to the keyset is lost due to a power failure or unplugging the keyset, the stored speed-dial numbers will be erased. The data base back-up battery on the CPU PCB will not save speed-dial numbers.

4.24 To store or change frequently called numbers:

(1) While on-hook, press the MSG/DIAL key.

(2) Enter the memory location code (0-9) on the keypad.

(3) Enter the phone number (up to 10 digits).

(4) Repeat steps 1 through 3 until all numbers are entered. If the same code is used more than once, the last phone number entered with that code will be retained.

(5) Press the ON/OFF key to complete the procedure and store the numbers.

4.25 To speed dial numbers:

(1) Lift the handset and press an available unlit line key.

(2) Listen for the outside dial tone and press the MSG/DIAL key.

(3) Dial the one-digit memory location code on the keypad. The number will be dialed.

CAUTION: If you do not press the C.O. line key before you press the one-digit memory location, the number stored at that location will be erased.

4.26 To erase one stored number:

(1) Lift the handset and press the MSG/DIAL key.

(2) Dial the one-digit memory location code to be erased and hang up.

Speed Dialing SCC Numbers

4.27 Memory location codes may be chained together for use with Specialized Common Carrier (SCC) services requiring more than 10 digits.

4.28 SCC dialing includes the SCC local access number, your account or security code, and the long distance telephone number. These three numbers are linked together in the dialing process.

4.29 In order for the numbers to be linked, System Option 5 (System Features Programming) must be enabled; this inserts a 12-second pause after the MSG/DIAL key is pressed. Without this option, pressing the key a second time would redial the first number. When this option is enabled, calls of less than 12 seconds in duration will not be recorded on the SMDR printout. In addition, 12 seconds must elapse before the last number redial feature can be used.

4.30 If the SCC network you are accessing does not accept a leading 1, disable keyset DIP switch 7.

4.31 To store SCC numbers:

(1) While on-hook, press the MSG/DIAL key.

(2) Enter the memory location code (0-9) on the keypad.

(3) Enter the SCC local access number.

(4) Repeat steps 1 through 3 to store the security code in another memory location.

(5) Press the ON/OFF key.

4.32 To speed-dial SCC numbers:

(1) Lift the handset, press an available unlit line key, and listen for the outside dial tone.

(2) Press the MSG/DIAL key.

(3) Dial the memory location code for the SCC local access number; listen for the computer tone.

(4) Press the MSG/DIAL key again.

(5) Dial the memory location code for the SCC security code.

(6) Press the MSG/DIAL key again, followed by the memory location of the long distance number.

OR, Manually dial the telephone number if it is not stored in speed-dial memory.

Last Number Redial

4.33 This feature remembers the last phone number dialed on the keyset and stores it in the keyset buffer. The number can then be redialed automatically, using the procedures below. The redial feature is dependent on two conditions: (1) If you do not hang up after dialing a number, the system will remember that number, whether it was manually dialed or speed dialed. (2) If you do hang up after dialing a number, only the last number manually dialed will be stored and can be redialed; speed-dialed numbers are not stored in the redial buffer after hanging up.

NOTE: If System Option 5 (12-second redial timing) is enabled, the last number redial feature is delayed 12 seconds to allow speed-dial numbers to be chained. If you use the last number redial feature without hanging up, you will have to wait 12 seconds before pressing the MSG/DIAL key. If you press the MSG/DIAL key before the 12 seconds are up, nothing will happen, but you will need to wait another 12 seconds. For example, if you place a call and receive a busy signal, listen to the busy signal for 12 seconds, then press the MSG/DIAL key to redial the number.

4.34 To redial the last number dialed (manually or speed dialed) while still on the line:

(1) When you reach an outside number which is busy or does not answer, do not hang up.

(2) Press the MSG/DIAL key. The system will drop and re-access the C.O. line, and the number will be redialed immediately.

4.35 To redial the last number manually dialed after disconnecting:

(1) Lift the handset and press an available unlit line key.

(2) Listen for the outside dial tone and press the MSG/DIAL key.

(3) Press the asterisk (*) key. The number will be dialed.

D. CALLS ON HOLD

4.36 The hold feature allows you to leave an outside call without disconnecting the outside party. The station can then be used to make intercom or outside calls. If System Option 8 is enabled, the call is placed on individual hold (I-Hold) and is accessible to that keyset only by pressing the line key; it can be accessed from other keysets using the reverse transfer feature. While on I-Hold, the line key will medium flash on that keyset, but will be steadily lit on all other keysets. If System Option 8 is disabled, the call is placed on system hold; it will flash on all keysets and may be accessed from any keyset.

NOTE: If System Hold is enabled and you want to place a call on I-Hold, press the XFER/CONF key instead of the HOLD/FWD key.

4.37 To place a call on hold: While on an outside call, press the HOLD/FWD key. You will receive the intercom dial tone and the line key will flash at a medium rate. The caller will hear Music-On-Hold, if equipped.

4.38 To return to a call on hold: Lift the handset and press the medium flashing line key. The flash will return to a double rate.

4.39 To answer a call on I-Hold from another station (reverse transfer):

(1) Lift the handset and dial the intercom number where the call is holding.

(2) When you hear the double tone, press the XFER/CONF key.

(3) Press the medium flashing line key.

4.40 If you do not return to a call you have placed on hold within the programmed hold recall time, the call will ring at your station and the line key will flash fast. If it remains unanswered for a second hold recall time, it will return to the attendant. Refer to Section 4G, AUTOMATIC RECALL TIMES.

E. TRANSFERRING OUTSIDE CALLS

4.41 The call transfer feature allows you to transfer an outside call to any other station, including the attendant.

4.42 If transferred calls are not answered within the programmed transfer recall time, the call will return to the station which transferred it. If it is still unanswered, it will return to the attendant after the hold recall time. If the call is transferred to hold per paragraph 4.43, it will recall the attendant after two hold recall times. Refer to Section 4G, AUTOMATIC RECALL TIMES.

Call Transfer

4.43 To transfer a call to another station:

(1) While on an outside call, press the XFER/CONF key. The line key will flash at a medium rate.

(2) Dial the intercom number.

(3) If the called station is idle, after the double tone, announce the call. Then do one of the following:

a. If the call is accepted:

1. Either hang up to complete the transfer (the called keyset's line key will fast flash and the call will ring until answered).

2. Or, press the HOLD/FWD key and hang up to transfer the call to hold (the called keyset's line key will medium flash but the call will not ring while waiting).

b. If the called party does not answer or refuses the call, press the medium flashing line key to return to the caller.

c. If the called party does not answer, first transfer the call by pressing the HOLD/FWD key and the hookswitch. Then page the party and announce that a call is holding.

OR, (4) If the called station is busy, do one of the following:

a. Return to the caller by pressing the medium flashing line key.

b. Transfer the call by hanging up. The caller will camp on and the busy station will be alerted by the fast flashing line key and a call waiting signal every 15 seconds (DIP switch 5 enabled).

c. Transfer the call to hold by pressing the HOLD/FWD key and hanging up. The caller will camp on and the busy station will be alerted by the medium flashing line key only.

4.44 To receive a transferred call:

(1) When you hear a double tone and possibly a voice announcement, wait for the transferring station user to hang up.

(2) Lift the handset and press the flashing line key.

Off-Premise Transfer

4.45 This feature allows you to transfer an incoming outside call to an off-premise location which is not part of the system. For more information, refer to Section 4I, CONFERENCE CALLS.

4.46 To use off-premise transfer:

(1) While on an outside call, ask the party to hold, then press the HOLD/FWD key.

(2) Select an outside line and dial the external telephone number.

(3) When that party answers, ask him to hold, then press the HOLD/FWD key.

(4) Press the XFER/CONF key and hang up. The two outside parties will be connected.

F. REVERSE TRANSFER/CALL PICK-UP

4.47 This feature allows the station user to pick up an outside call which is ringing or on hold at another station. Only outside calls may be reverse transferred. Calls on hold or recalling at the attendant's station cannot be reverse transferred.

4.48 To answer a call on hold or ringing at another station:

(1) Lift the handset and dial the intercom number of the station where the call is on hold or ringing.

(2) After the double tone, press the XFER/CONF key.

(3) Press the line key that is flashing at a medium rate.

G. AUTOMATIC RECALL TIMES

4.49 With the attendant recall feature, it is impossible for calls on hold or transferred to be forgotten. When the call goes unanswered for the programmed period of time, the station which placed the call on hold or transferred it is recalled. The two system programmable (System Features Programming) recall time limits are transfer recall and hold recall.

4.50 When the system attendant transfers an outside call to an unattended station, the call returns to the attendant after the transfer recall time elapses.

4.51 Transfer Recall: When any station transfers an outside call to another station, the call must be answered within the transfer recall time limit. If there is no response, the call returns to the station that transferred it. The station is alerted by a fast flashing line key and continuous ringing for the hold recall time. If there is no response, the call returns to the attendant's station (10), which is alerted by a fast flashing line key and continuous ringing for up to 10 minutes before the system considers it abandoned and disconnects the line.

4.52 Hold Recall: After the hold recall time elapses, a call on hold recalls the station where it is waiting, alerting the station with continuous ringing and a fast flashing line key. If the hold recall time elapses again, the call returns to the attendant's station (10), which is alerted by continuous ringing and a fast flashing line key for up to 10 minutes before the system considers it abandoned and disconnects the line.

H. OUTSIDE CALL WAITING

4.53 This feature allows an outside call to be camped on to a busy station. An outside call may be transferred and camped on to a station by the attendant or from another station.

4.54 The number of outside calls which can be camped on to one station is only limited by the number of C.O. lines connected to the system.

4.55 If an outside call is waiting on your station, the line key will flash fast and you will hear a single tone through the handset every 15 seconds (if programmed for off-hook ringing, DIP switch 5). The party you are speaking to will not hear the tone.

4.56 To answer an outside call waiting while on another outside call:

(1) End the current call; press the fast flashing line key.

OR, (1) Place the current call on hold by pressing the HOLD/FWD key. The outside party will hear Music-On-Hold, if equipped. The line key will flash at a medium rate.

(2) Press the fast flashing line key to answer the waiting call.

(3) To go back to the first call and put the second call on hold, press the HOLD/FWD key and then press the other medium flashing line key.

OR, To go back to the first call after ending the second call, press the medium flashing line key.

4.57 To answer an outside call waiting while on an intercom call:

(1) End the intercom call; press the fast flashing line key.

OR, (1) Place the intercom call on hold by pressing the HOLD/FWD key. If the other station is off-hook, the call will be camped on and the HOLD/FWD key will flash after two or three seconds. If the other station is on-hook, the call will be disconnected.

(2) Press the fast flashing line key.

(3) To go back to the camped on intercom call and place the outside line on hold, press the flashing HOLD/FWD key.

OR, The camped on intercom call will connect automatically when the outside call is ended and you hang up.

I. CONFERENCE CALLS

4.58 This feature permits a station user to establish a three-way conversation without operator assistance. The three parties may include one inside party and two outside parties, or two inside parties and one outside party. The conference call feature requires a Conference (CNF) PCB in the KSU.

4.59 A keyset user may initiate one conference at a time. The system can maintain two conference calls simultaneously.

Two Inside Parties and One Outside Party

4.60 This feature allows a keyset user to initiate a conference with another inside party and one outside party. The initiating station has control of the conference, but may pass control to the other inside station.

4.61 To place a conference call:

(1) While on an outside call, press the XFER/CONF key. The line key will flash at a medium rate.

(2) Dial the intercom number of the station you wish to add to the conference and instruct them to lift the handset.

(3) After the inside party lifts the handset, press the XFER/CONF key. Your XFER/CONF key will light steadily, and the light on the other inside party's keyset will flash at a medium rate. The conference will be initiated and the key for the outside line will flash at a delayed rate.

(4) You may end the conference by pressing the asterisk (*) key and hanging up.

OR, If any of the three parties hangs up during the conference, the call becomes a regular two-party call for the remaining parties.

NOTE: The conference cannot be re-entered. To speak to the other parties, the process of establishing a conference must be repeated.

One Inside Party and Two Outside Parties

4.62 This feature allows a three-party conference between one inside station and two outside parties. The station user has control of the conference.

4.63 To place a conference call:

(1) Place the first outside call.

(2) When that party is on the line, press the HOLD/FWD key. The line key will flash at a medium rate.

(3) Place the second outside call.

(4) When the second outside party is on the line, press the HOLD/FWD key. The line key will flash at a medium rate.

(5) When both outside parties are holding, press the XFER/CONF key. This will initiate the conference. The XFER/CONF key will be lit and the keys of the lines in conference will flash at a delayed rate.

(6) If you want to leave the conference, but not disconnect the two outside parties, hang up. The outside lines will remain in conference and you can use all of the system and station features available except the conference feature. The XFER/CONF key will be lit as long as the outside parties are connected.

(7) You may re-enter the conference by lifting the handset and pressing the XFER/CONF key. You will be connected to the two outside parties once again.

(8) To end the conference, press the asterisk (*) key and replace the handset. All parties will be disconnected. The line keys and XFER/CONF key will no longer be lit.

OR, You may press the HOLD/FWD key to place both outside parties on hold. The conference circuit will be dropped and you can talk to each party individually. To re-establish the conference, place each party on hold and press the XFER/CONF key.

J. ON-HOOK MONITORING

4.64 On-hook monitoring allows stations to monitor an outside line without lifting the handset. It is usually used for monitoring time and weather announcements, recorded messages, etc. (refer to paragraph 4.20 on page 8-23). It can also be used when you are waiting for an outside party to return to the line.

4.65 When this feature is in use, the station's microphone is not activated and you cannot be heard by an outside party unless a speakerphone kit is attached to the keyset.

4.66 To monitor a call when you have been put on hold:

(1) When the called party has left the phone or put you on hold, press the ON/OFF key and replace the handset.

(2) You will be able to monitor the line until the called party returns. Lift the handset to respond.

5. SPECIAL STATION FEATURES

5.01 This section includes the following special features:

A. Call Forwarding
B. Do-Not-Disturb
C. Message Waiting and Message Center
D. Background Music to Stations
E. Paging Features

A. CALL FORWARDING

5.02 This feature enables you to temporarily forward all intercom and outside calls to another station, including direct ring-in lines.

5.03 Several stations may have calls forwarded to the same station.

5.04 If there are any busy line or station callback requests in process, these requests will remain queued at that station.

5.05 To forward calls:

(1) Lift the handset and press the HOLD/FWD key.

(2) Dial the intercom number where you want the calls to be forwarded, and hang up. The HOLD/FWD key will flash at a medium rate.

5.06 To cancel call forwarding:

(1) Lift the handset and press the HOLD/FWD key.

(2) Hang up. The light in the HOLD/FWD key will go out.

B. DO-NOT-DISTURB

5.07 This switch-enabled feature (DIP switch 1) allows you to block all calls and pages to your station, except for C.O. lines set to ring in directly at your station. All system and station features are available to you while your station is in this mode. Placing the attendant's station (10) in Do-Not-Disturb mode will put the system into Night Ring mode.

5.08 To place a station in Do-Not-Disturb mode:

(1) Lift the handset and press the HOLD/FWD key.

(2) Press the asterisk (*) key, and hang up. The HOLD/FWD key will flash at a medium rate.

5.09 To cancel Do-Not-Disturb mode:

(1) Lift the handset and press the HOLD/FWD key.

(2) Hang up. The light under the HOLD/PWD key will go out.

5.10 If any other station user tries to access this station while it is in Do-Not-Disturb mode, they will hear four busy tones and a pause repeatedly (---- ---- ----).

C. MESSAGE WAITING AND MESSAGE CENTER

5.11 When a called station is busy or goes answered, inside callers may leave a message at the message center (station 10). The called station's MSG/DIAL key will flash at a fast rate to inform the user that a message is waiting at the message center. Messages may be left for stations in the Do-Not-Disturb mode, and there is no restriction on the number of messages that can be left for any one station.

5.12 To leave a message:

(1) Dial the intercom number of the desired station.

(2) If the station is busy or there is no answer, press the MSG/DIAL key.

(3) You will hear a double tone as the message center is automatically dialed.

(4) When the message center answers, leave your message.

(5) The light under the MSG/DIAL key at the called party's station will flash at a fast rate.

5.13 To pick up messages:

(1) If the MSG/DIAL key is flashing at a fast rate on your keyset, lift the handset. (The light under the MSG/DIAL key will go off.)

(2) Dial the message center.

D. BACKGROUND MUSIC TO STATIONS

5.14 A user may listen to the system's Music-On-Hold (if equipped on the system) through the keyset's internal speaker. Signal tones, announcements, and pages will momentarily interrupt the background music. All calls will be received as usual.

5.15 To enable background music:

(1) While on-hook, press the pound (#) key.

(2) Press the digit 6 key.

5.16 To cancel background music:

(1) While on-hook, press the pound (#) key.

(2) Press the digit 6 key.

E. PAGING FEATURES

5.17 The paging features of the system allow pages to stations in up to five internal zones. Pages are heard through the internal speaker of each keyset. During initialization, paging zones are assigned as shown below and cannot be changed. If desired, stations may be excluded from receiving pages through Station Features Programming (Station Option 2).

Zone	616 System	1232 System
1	Stations 10-19	Stations 10-19
2	Stations 20-25	Stations 20-29
3	Not used	Stations 30-39
4	Not used	Stations 40-41
5	All page 10-25	All page 10-41

5.18 An optional feature allows paging to external zones such as warehouses and loading docks. It requires additional customer-provided paging equipment. For each external zone, a circuit on a STN PCB is used to access the paging equipment, which is completely separate from the internal paging zones. The zones are accessed by dialing the intercom number assigned to the STN circuit.

5.19 To page an internal zone:

(1) Lift the handset and press the ZONE PAGE key.

(2) Dial the zone code (1,2,3,4,5) and listen for the double tone.

(3) Make your announcement within 12 seconds.

5.20 To page an external zone:

(1) Lift the handset and dial the intercom number assigned to the external paging equipment.

(2) Make your announcement. There is no time limit for the page.

ATTENDANT FEATURES

1. INTRODUCTION

1.01 This section lists the attendant features of the system, which are available through the optional Direct Station Selector/Busy Lamp Field (DSS) unit. The DSS attaches to a keyset and allows access to stations with one keystroke. The busy lamp field indicates the condition of every station. The DSS features include:

- Feature and Station Keys
- Direct Station Selector
- Busy Lamp Field
- Intercom Features
- Call Transfer and Reverse Transfer
- Message Waiting
- Night Ring Mode

2. FEATURE AND STATION KEYS

2.01 The DSS I has three feature keys and 32 direct station selector (DSS) keys as described below.

Name of Key	Function
DSS KEYS	Place intercom calls to stations.
PARK	Places transferred calls on hold (parking).
XFER/RLS	Releases (or terminates) a transferred call without hanging up.
C.W. IND	Generates an immediate call waiting signal to a called station, permitting call screening before transferring.

NOTE: For your convenience, there are three methods of "hanging up." You may hang up the handset, press the XFER/RLS key, or press the hookswitch.

3. BUSY LAMP FIELD

3.01 The light emitting diodes (LED's) under the DSS keys comprise the busy lamp field. The LED's indicate the status of each station with different flash rates. Each flash rate has a distinct meaning, as described below. Flash rates are given in interruptions per minute (IPM).

Rate of Flash	Indication
Steady	The station is in use.
Slow 30 IPM	The station is in the Do-Not-Disturb mode.
Fast 120 IPM	There is an outside call recalling from that station. If the call is recalling a DSS station, the DSS key and the corresponding line key will flash at a fast rate.

4. INTERCOM FEATURES

4.01 All stations can be accessed by pressing the station's corresponding DSS key.

4.02 To place an intercom call:

(1) Lift the handset and press the station's DSS key.

(2) After the double tone, announce the call.

4.03 To place a private intercom call:

(1) Lift the handset and press the station's DSS key.

(2) Listen for the double tone and press the pound (#) key on the keyset.

(3) The called party will hear continuous double tones and can pick up the handset or press the ON/OFF key to answer.

5. CALL TRANSFER AND REVERSE TRANSFER

A. CALL TRANSFER

5.01 Calls may be transferred, camped on, or placed on hold (parked) at a station. They may also be screened to see if the receiving party is busy or wants to refuse the call.

5.02 If a call is transferred to an idle station, it will ring until answered and the caller will hear Music-On-Hold, if equipped. If it goes unanswered for the programmed transfer recall time, it will return to the attendant.

5.03 If a call is transferred to a busy station, the caller will camp on and hear Music-On-Hold, if equipped. The busy station will be alerted by a flashing line key and a call waiting signal through the handset every 15 seconds (if DIP switch 5 is enabled).

5.04 If a call is transferred to hold at an idle station, only the line key will flash; there will be no audible signal. If it goes unanswered for the hold recall time, the call will ring at the station for the hold recall time. If still unanswered, the call will return to the attendant.

5.05 If a call is transferred to hold at a busy station, the line key will flash, but the busy party will not receive an audible call waiting signal until after the hold recall time has expired. If a second hold recall time expires, the call will return to the attendant.

5.06 To transfer a call to an idle station:

(1) If the station's DSS key is not lit:

a. Press the DSS key.

b. After the double tone, call out the party's name.

(2) If the called party answers, announce the call.

a. If the call is accepted, hang up or press the XFER/RLS key to transfer the call.

OR, b. If the call is refused, press the medium flashing line key to return to the caller.

OR, (3) If there is no answer:

a. Press the medium flashing line key to reconnect with the caller.

b. Announce that there was no answer and ask if the caller wants to leave a message or hold while you try paging the called party.

c. If the caller wants to hold, press the called party's DSS key and press the PARK key to transfer the call to hold.

d. Page the called party and announce that a call is holding for them.

5.07 To transfer and announce a call to a busy station (the DSS key is lit):

(1) Ask if the caller wants to hold. If so, press the busy stations's DSS key. The caller will be put on hold and will hear Music-On-Hold, if equipped. You will hear a busy signal.

(2) Press the C.W. IND key to immediately send a call waiting signal to the busy station. You will hear Music-On-Hold, if equipped. The busy station will hear the signal (if DIP switch 5 is enabled) and the HOLD/FWD key will flash fast. Wait for the party to respond.

a. If the call is refused, press the medium flashing line key to return to the caller.

OR, b. If the call is accepted, press the PARK key to transfer it to hold.

5.08 If a call returns to the attendant: If a transferred call goes unanswered for the programmed recall time, it will return to the attendant. This is indicated by a line key and a DSS key both flashing fast. Press the line key to connect to the caller.

B. REVERSE TRANSFER

5.09 To reverse transfer:

(1) Lift the handset and dial the number of the intercom where the call is waiting or ringing in. (Dial on the keyset, do not use the DSS key.)

(2) When you hear the double tone, press the XFER/CONF key on the keyset.

(3) Press the medium flashing line key on the keyset and you will be connected to the outside call.

6. MESSAGE WAITING INDICATION

6.01 To activate the message waiting indication:

(1) Lift the handset and press the DSS key where you want to leave a message waiting indication.

(2) After the double tone, press the MSG/DIAL key on the keyset and hang up. The MSG/DIAL key will fast flash at the called party's keyset to indicate a message waiting.

7. NIGHT RING MODE

7.01 The system is placed in Night Ring mode by placing the attendants station (10) in Do-Not-Disturb (keyset DIP switch 1 enabled). For more information, refer to page 8-5.

7.01 To place the system in Night Ring mode:

(1) Lift the handset of the attendant's keyset and press the HOLD/FWD key.

(2) Press the asterisk (*) key and hang up. The HOLD/FWD key will flash at the medium rate.

7.02 To cancel Night Ring mode: Lift the handset, press the HOLD/FWD key, and hang up. The light under the HOLD/FWD key will go out.

-- J-K --

-- K cont'd --

-- L --

-- X-Z --

CHANGES AND ADDITIONS TO THE 616/1232 INSTALLATION AND FIELD MAINTENANCE MANUAL Issue 2, Part No. 341.8002

SYSTEM SPECIFICATIONS

Page	Location	Change
2-10	9.01	Part numbers are incorrect; they should be: Speakerphone Kit 828.1057-1 and LRA 828.1004

INSTALLATION

Page	Location	Change
3-12	NOTE	Correct to: When other than 24AWG cable is used...
3-17	10.04	Voltage surge/spike protector specifications: Check the manufacturer's specifications for the following: a. Clamp voltage transients at 300V within 5 nanoseconds when exposed to waveforms as described in ANSI/IEEE Standard C62.41-1980 (IEEE 587). b. Reduce RFI/EMI noise by at least 20dB at frequencies between 5KHz and 30MHZ.
3-27	12.01 (3)	Correct to: Place the DIP switches in the OPEN or OFF position.
3-50	(7)	Add to the beginning: Insert the battery cables through the holes in the battery compartment.
3-50	(12)-(13)	Add a step (12A): Replace the cover on the battery compartment.

To start programing
1. At ksu dip sw. # 1 closed possition
2. At each station while on Hook
   A). press # key
   B). press 2 key
   C). press Line key to ring
   D). Lift handset
3. At ksu dip sw. # 1 open possition

To Allow # 1 digit to remain in memory for speed dialing
1. At Each keyset
   A). Open phone
   B). move dip sw # 7 to enablepassition

*

To connect second line
1. At C.O. RJ14C Jack connect o/w to Black terminal w/o to Yel. terminal
2. OR crossconnect to achieve same possitioning

Station wiring

W/BL	= Red
BL/W	= Green
W/O	= Black
O/W	= Yellow
W/G	= White
G/W	= Blue

* If specialized common carrier is used See page 8-25 For Speed Dialing SCC Numbers.

LINE _____ DATE _____ SHIFT ____

SIZE	MILL	GRADE	VINYL / PAP