# 4ESS™ Switch Input/Output System Description

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# 1. Overview

## Introduction

**1.01** This document describes the Input/Output (I/O) system for the 4ESS™ -2000 Switch which includes the I/O system for the 1B processor, Lucent 3B computer Attached Processor System (APS), and other I/O equipment and interfaces related to the operation of a 4ESS Switch office.

**NOTE:**
Information about the 1B Processor also applies to the 1A Processor except where differences are specified.

**1.02** The reason for the reissue of this document is to include general information obtained after publication of Issue 7. Specific changes are added to include the Alternate Signaling Transport Network (ASTN) capability.

**1.03** This document contains a **CAUTION** safety label. The **CAUTION** safety label in this practice is defined as follows:

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**1.08** This document contains the following information:

(a) Purpose of I/O system

(b) I/O system features

(c) Physical description

(d) Functional description.

## Purpose of I/O System

**1.09** The I/O system provides a means of transferring administrative, maintenance, and control data between the associated central processor —I/O control program—and external I/O devices. These external devices can be the following:

- Keyboard/display terminals
- Printers
- Magnetic storage units
- Other computer-based systems.

**1.10** Digital logic and/or microprocessor-based interface equipment are required to multiplex and control data transfers between the associated central processor and external I/O devices. Wired logic control and display panels in a 4ESS Switch office provides a limited measure of monitoring and control capability over the system.

**1.11** The increased manual access capability to the 4ESS Switch is accomplished with I/O devices located in all system work centers, equipment locations, and external control and repair centers. This I/O system also implements centralized administration, maintenance, and control functions of the 4ESS Switch office from remote locations.

**1.12** The control and display panels in a 4ESS Switch office are generally assigned specific functions. Each key control has a fixed function assigned to it, and each lamp display provides specific information to office personnel. The I/O system is a necessary subordinate of the control and display panels. It allows more precise control over individual units, and provides more detailed information than the control and display panels.

**1.13** The I/O system permits input of control commands to the system by means of electronic keyboards, flexible diskettes, or tape cassette devices. The I/O system provides output data in response to input commands and from software programs. These programs generate periodic and conditional reports to the following:

- Display screens
- Printers
- Flexible diskettes and/or tape cassette devices
- Other computer-based systems.

**1.14** The I/O system may be equipped to provide Alternate Signaling Transport Network (ASTN) capability. Additional information is available in the following documents:

- 234-090-233AC, 4ESS™ Switch Product Release Document 4E23 Release 3 Generic
- SD-4A193-01, IOP Alternate Signaling Capability Application Schematic.

## Input/Output System Features

**1.15** The primary I/O system for a 4ESS Switch is the 1B processor I/O system. It provides operating and maintenance personnel with a means to send and receive operational, maintenance, and control data to and from the switching system—4ESS Switch— software.

**1.16** A second I/O system is provided by a duplex 3B computer. This system provides access to the 3B computer in a similar fashion. The 3B computer, known as the Attached Processor System (APS), replaces the 1B processor disk files and provides the capability for off-line processing functions.

**1.17** The 1B processor and 3B computer I/O systems are independent systems. Normal stand-alone provisions are made for the following:

(a) Administration

(b) Maintenance

(c) Control.

The 4ESS Switch I/O system design permits supplementary control of the 3B computer through 1B processor I/O channels which is accomplished by the optional AP3BIO feature. This feature allows 3B I/O messages to be entered at the 1B processor I/O devices and delivered to the 3B computer for processing. A copy of messages generated by the 3B computer are sent to the 1B processor I/O channels.

**1.18** The administration and maintenance functions of all 4ESS Switch interoffice trunks are supported by the Trunk Operations Provisioning Administration System (TOPAS).

**1.19** The I/O system provides a number of I/O channels to support the various I/O devices required by all 4ESS Switch offices. Additional I/O channels may be equipped in each office according to local requirements. As an example, up to 96 1B processor I/O channels (software restriction) may be used for the various I/O functions associated with the switching system.

**1.20** The control and display capabilities of each I/O channel are defined and controlled by software programs. System control functions, such as system configuration changes, are limited to specific maintenance channels. Other I/O channel functions are limited to Recent Change (RC), service evaluation, and monitoring activities.

**1.21** Several I/O channels assigned specific functions may be connected via dedicated transmission facilities to external maintenance, monitoring, and evaluation facilities. The number of transmission facilities required for a single remote location may be minimized by using data multiplexing equipment. This equipment must be provided at both ends of the transmission facility. Data transfers between several I/O channels and remotely located I/O terminal devices are multiplexed over a common transmission path.

**1.22** The I/O channels may also be accessed from external locations via dial-up facilities connected via the Direct Distance Dialing (DDD) network. Security for these channels may be provided by a software-controlled callback to prespecified telephone numbers, or via I/O channel enabling devices (electronic code detectors). The electronic code detectors are controlled via other I/O channels connected to the remote location through dedicated transmission facilities.

**1.23** The I/O programs for the 1B processor are described in 254-280-111, *Input/Output Programs*. Other I/O system features and the equipment for each feature are described in the remainder of this document.

# 2. Physical Description

**2.01** This part briefly describes the various I/O system interfacing equipment and terminal devices used in a 4ESS Switch office. A more detailed description of this equipment is provided in frame-level documents listed in 234-000-000, *Division 234 Numerical Index*. The following types of I/O equipment are included:

(a) 1B processor I/O frame and I/O processor frame

(b) 3B computer I/O processor units

(c) Multiplexing equipment

(d) Data terminal equipment

(e) Data sets.

## 1B Processor I/O Frame and I/O Processor Frame

**2.02** A 4ESS Switch office may be equipped with one or more J5A006A I/O frames and/or J5A006C or J5A006D I/O processor frames. Up to 32 of the 96 1B processor I/O channels may be provided by two I/O frames. The remaining 64 channels must be provided by I/O processor frames. A minimum of one I/O frame or I/O processor frame is required. Additional I/O capability can be provided by up to three additional I/O frames or I/O processor frames.

### A. I/O Frame J5A006A

**2.03** The J5A006A I/O frame is a 7-foot frame with a single 2-foot 2-inch bay. This frame was equipped only in pre-4E3 software release offices and is now rated for Additions and Maintenance (A&M) only. A fully equipped I/O frame contains the following:

- One I/O peripheral bus unit
- A terminal strip unit
- Two I/O units
- Two power-off key units
- One filter unit.

**2.04** A fully equipped I/O frame contains two identical I/O units. Each unit contains one I/O unit selector that supports from one to eight I/O unit controllers. Each controller accommodates one software-defined I/O channel. In addition, each controller is equipped with three ports to support the one I/O channel. Additional information concerning the 1B processor I/O frame is contained in 234-110-150, *Input/Output Frame J5A006A*.

## B. I/O Processor Frames J5A006C and J5A006D

**2.05** The I/O processor frame is a 7-foot frame with a single 2-foot 2-inch bay. The J5A006C and J5A006D frames differ only in the equipage options of the I/O processor units. The J5A006C frame I/O processor can be equipped only with a 1A-type microprocessor growth unit. The J5A005D frame can be equipped with either a 1A/1B processor- or 3B computer-type microprocessor growth unit. The J5A006C frame is currently rated A&M. A fully equipped I/O processor frame contains the following:

- Two I/O processor bus units
- Two I/O processors, each consisting of one I/O processor logic unit and one microprocessor growth unit
- One I/O processor filter unit.

**2.06** The two I/O processor units are designated A and B. Each unit has one or two microprocessor and line interface unit communities. The basic microprocessor and line interface unit community in both A and B I/O processor units is designated community 0. When equipped with 1A-type microprocessor growth units, the growth unit community is designated community 1. Therefore, a fully equipped I/O processor frame with 1A-type microprocessor growth units has four microprocessor communities designated A0, A1, B0, and B1.

**2.07** When the J5A006D frame is equipped with 3B computer-type microprocessor growth units, the first growth community is designated community 2. The second growth community is designated community 3. Therefore, a fully equipped J5A006D I/O processor frame with 3B computer-type microprocessor growth units has the following:

- Two microprocessor communities designated A0 and B0
- Four peripheral controller communities designated A2, A3, B2, and B3.

**NOTE:**
Additional information concerning the J5A006C and J5A006D I/O processor frames is contained in 234-110-152, *Input/Output Processor Frame J5A006C* and 234-110-154, *Input/Output Processor Frame J5A006D*.

## 3B20D Computer I/O Processor Units

**2.08** The 3B20D computer I/O system configuration has two I/O processor basic units designated 0 and 1, and two optional I/O processor growth units designated 0 and 1. The APS may be equipped with a Model 1, 2, or 3 3B20D computer. The mountings for these models are described as follows:

- Model 1 for the 3B20D computer I/O processor units is mounted in separate single-bay peripheral control frames (0 and 1).

- Models 2 and 3 for the 3B20D computer I/O processor units are mounted in separate bays of the dual-bay (0 and 1) 3B computer frame/cabinet.

**2.09** Models 2 and 3 for the 3B20D computer bay 0, or Model 1 for the 3B20D computer peripheral control frame 1 are also equipped with two port switch circuit packs — contained on a port switch mounting plate. These circuit packs provide manual and automatic switching of the 3B20D computer maintenance I/O channels to the controlling I/O processor basic unit.

**2.10** Each of the two I/O processor basic units may be equipped with up to eight of the types of peripheral controller circuit packs. Four circuit pack positions are required to support the local and remote 3B20D computer maintenance facilities. Two I/O processor growth units are required when the 4ESS Switch is serving as the host switch for one or more network service complexes. Each I/O processor growth may be equipped with a maximum of eight peripheral controller circuit packs.

**NOTE:**
The 3B20D computer input/output functions required for the 4ESS Switch application are described in Part 3. More detailed information is provided in the following documents:

- 234-100-200, *3B20D Model 1 Computer - Attached Processor System - General System Information - Application.*
- 234-100-201, *3B20D Model 2 and Model 3 Computer - Attached Processor System - General System Information - Application.*

## 3B21D Computer I/O Processor Units

**2.11** The 3B21D computer can have four Input/Output Processors (IOPs) designated IOP 0 through IOP 3 in the processor cabinet. IOP 0 is equipped in Processor Unit 0 at EQL 19-065. IOP 1 is equipped in processor Unit 1 at EQL 45-065. IOP 2 is equipped in the Growth Unit at EQL 11-011. IOP 3 is equipped in the Growth Unit at EQL 62-011.

**2.12** Functionally, an IOP can support four peripheral controller communities with each community supporting four peripheral controllers. Therefore, 16 peripheral devices can be supported by an IOP. IOP 0 and IOP 1 are exceptions. IOP 0 and IOP 1 each support up to 15 Peripheral Controller (PC) slots. IOP 2 and IOP 3 each support up to 16 PC slots. The maximum number of available PC slots in a Processor Unit is 15; the maximium number of available PC slots in a Growth Unit is 16. For IOP 0 and IOP 1 peripheral community 0, slot 0 (PC00 is always equipped with a TN983 or UN 583 Maintenance Terminal Controller (MTTYC) circuit pack. Also, IOP 0 and IOP 1, peripheral community 0, slot 2 (PC02) is reserved for a UN33D or UN933 Scanner and Signal Distributor circuit pack, which provides scan and signal distributor point interfaces for the 3B21D computer.

## Multiplexing Equipment

**2.13** Multiplexing equipment may be provided on an office-engineered basis to reduce the number of transmission facilities required to interface several 1B processor I/O channels to a remote location, such as a centralized maintenance facility. This equipment consists of a microprocessor-controlled data concentrator which provides a high-speed composite interface to several I/O channels. Input data buffering, test mode capabilities, and user-specified operating parameters may be provided.

## Data Terminal Equipment

**2.14** Data terminal equipment consists of input and/or output devices used to terminate the various I/O channels in a 4ESS Switch office. These devices are located in the various 4ESS Switch work centers, at frame equipment locations, and at remote locations external to the office. An electronic keyboard/display terminal or magnetic storage equipment, such as a tape cassette or a floppy diskette unit, are used to input data to the system. Output data can be displayed on the keyboard/display terminal Cathode-Ray Tube (CRT), or recorded on printers and/or magnetic storage equipment. Data input via a keyboard can also be displayed on a CRT or printer.

### A. Advanced Interactive Maintenance System (AIMS)

**2.15** A PC6386SX/EL or equivalent IBM-compatible PC may be equipped with AIMS software to emulate a keyboard/display terminal, herein, referred to as an AIMS terminal. This setup provides a 4ESS Switch with advanced maintenance, reporting, and network management capabilities. Besides the typical terminal capabilities, the AIMS terminal provides color display, screen editing, password protection, on-line help, and the ability to save or retrieve screen information from storage.

### B. Keyboard/Display Terminal Equipment

**2.16** The AIMS terminal is currently specified by SD-4A016-02 for assignment to the various 1B processor I/O channels. The AIMS terminal replaces the formerly specified Teletype Corporation Model 5420/2 data terminal. The AIMS terminal may be provided as a Keyboard/Display (KD), as a combined Keyboard/Display/Printer (KDP), or as separate equipment (KD-P). When used as a KDP or KD-P, the AIMS terminal requires an adjunct read-only printer.

### C. Read-Only Printers

**2.17** Read-only printers provide "hard-copy'' printout of output data and are not equipped with a keyboard or any other device for data input. The 577 printer is recommended for high usage 4ESS Switch applications. Two versions of the printer for 4ESS Switch offices are the friction feed and the tractor feed printers, which are described as follows:

| Printer-type | Prints | Paper Width |
|---|---|---|
| Friction feed | single sheet | 6 to 17 inches wide. |
| Tractor feed* | continuous sheet, perforated paper | 3 to 16 inches wide. |

* Paper length on tractor feed can vary. The paper thickness can vary up to 6-ply in thickness (.022-inch maximum). Form width and length are both operator adjustable.

**NOTE:**
The 572 printer can be specified for areas of low to medium usage, or areas having space limitations.

## D. Mobile Keyboard/Display/Printer Cart Assembly

**2.18** A mobile KDP cart assembly is provided to allow maintenance personnel to access the CMS from trunk terminal equipment frame jacks and for maintenance testing at the 4ESS Switch Network equipment frames. This assembly is currently equipped with an AIMS terminal and a 572 printer.

## E. *Dataspeed*® 4540 Terminal Clustered Station Arrangement

**2.19** The *Dataspeed* 4540 terminal clustered station arrangement consists of a microprocessor-driven synchronous controller and an optional number of keyboard/display data terminals and printers. It provides highly interactive data communications with a line control unit and is designed for applications such as inquiry response, data entry, and data retrieval. The controller interconnects the various components and defines the individual operating characteristics of each station arrangement. It can provide up to 32 ports for device connection. One port is provided to interface the primary transmission line. This equipment is primarily used with the CMS.

## F. VT-100 Keyboard/Display Terminal

**2.20** The VT-100 terminal consists of a keyboard and display monitor manufactured by the Digital Equipment Corporation. A VT-100 terminal and a *Dataspeed* 40 Receive-Only Printer (ROP) are provided in the 4ESS Switch maintenance operations center to serve as the 3B computer local maintenance position. A VT-100 terminal mounted on a mobile cart is also provided in the 3B computer equipment area which may be connected to the Recent Change and Verify (RC&V) channels of the 3B computer I/O system. When the office is served by a Switching Management Control

Center (SMCC), a VT-100 terminal may also be located in the 4ESS Switch maintenance operations center to interface the remote facility. The KS-22921 color terminal may optionally be used instead of the VT-100 terminal for the VT-100 applications described above.

## G. *DECwriter II* ™ Keyboard Send and Receive Terminal

**2.21** The LA36-CA *DECwriter II** terminal consists of a keyboard and printer. The printer is a tractor-feed printer. This terminal is used to interface various CMS I/O channels.

## H. Magnetic Storage Equipment

**2.22** A COMM-STOR II Communication Storage Unit (CSU) or a *Dataspeed* Magnetic Tape Terminal (MTT) is used for recording data that may be used at a later time (such as RC messages). The *Dataspeed* MTT uses tape cassettes for data storage, and is now rated Manufacture Discontinued (MD). The COMM-STOR II CSU is a versatile, dual-drive magnetic diskette system for storage of messages received on-line or prepared locally for transmission. It uses 8-inch, single-sided, single-density, soft-sectored flexible diskettes with a capacity of 256K characters per diskette. The COMM-STOR II CSU with diskette memory is a terminal enhancement. It provides automatic sending and receiving capabilities, increases storage and improves the message preparation and communication functions of Model 5420/2 or equivalent data terminals.

**2.23** Four of the 1B processor I/O channels require the following equipment:

- Secondary Record Channel 1 (SREC1)
- Recent Change Monitor Channel (RCMOC)
- Recent Change Record (RCREC) channel
- Switching Control Center 1 (SCC1) maintenance channel.

**NOTE:**
The SCC1 channel is required only when the office is associated with an SMCC. Other I/O channels may be equipped with a CSU or MTT as required.

* Trademark of Digital Equipment Company.

## Data Sets

**2.24** Data sets must be used between the I/O system interface equipment and the various data terminal equipment when the direct cable distance exceeds a specified length. When data sets are required, a compatible data set must be provided at each end of the transmission facility. Data sets located at the I/O system interface must be within 50 cable feet of the interface equipment.

**2.25** Specific types of data sets are required for use with the 4ESS Switch I/O system. The type of data sets required for the various I/O channels is governed by the data transmission characteristics and type of transmission facility used to connect the far-end data set.

**2.26** Data sets are typically enclosed in a molded plastic cover mounted in a small extruded aluminum housing. They may be frame-, cabinet-, or shelf-mounted. The faceplate on some sets contain status indicators (light-emitting diodes) and various test switches. Connectors on the back of the data set provide digital interface connections to the I/O system or data terminal equipment, and to a 2-wire or 4-wire voiceband line circuit.

**2.27** A synchronous modem eliminator is used to interconnect the 1B processor RC1A3B I/O channel to the 3B computer I/O processor system. This interface is required only for 4ESS Switch offices owned by AT&T to interface the Integrated Routing Assignment System (IRAS). The synchronous modem eliminator removes the need for a data set (modem) at each end of the data link.

**2.28** Data sets are normally powered via a standard 117 V AC 3-conductor outlet from the office commercial or protected ac source. A separate transformer of the plug-mounted type designed to mount in a standard 3-conductor outlet is provided with some types of data sets. On other types of data sets, the data set power is provided by an internally mounted 117 V AC power unit.

**2.29** A brief functional description of data sets specified for use with the 4ESS Switch is provided in Part 3. Data sets specified for use with the 4ESS Switch include the following types:

- 202S
- 202T
- 208A
- 209A
- 212A
- 2048A
- 2096A.

# 3. Functional Description

## Introduction

**3.01** This part provides a brief functional description of the 4ESS Switch I/O system. A more detailed description of the various I/O equipment used in a 4ESS Switch office is provided in documents listed in numerical index 234-000-000. The following subjects are included:

(a) Data transmission features

(b) I/O system security

(c) I/O system redundancy

(d) I/O system messages

(e) Message classes

(f) 1B processor I/O channels

(g) 3B computer I/O channels

(h) Circuit Maintenance System I/O channels

(i) Trunk Operations Provisioning Administration Systems I/O Channels

(j) Network Services Complex I/O arrangements

(k) Data set functions.

## Data Transmission Features

**3.02** Input/output channels may be equipped to send and receive serial data in the asynchronous, synchronous, or isochronous mode of data communication. The three modes are discussed as follows:

- *Synchronous mode:* A symbol or character is represented by eight consecutive data bits which contain no start bit, stop bit, or time lag between symbols or characters.
- *Asynchronous mode:* A symbol or character is represented by eight consecutive data bits bracketed by a start and stop bit. There is no restriction for the time between symbols or characters.
- *Isochronous mode:* As in the asynchronous mode, a symbol or character is also represented by eight consecutive data bits bracketed by a start and stop bit. However, there is a definite time interval between symbols or characters. Therefore, the isochronous mode of data communication provides the highest level of synchronization among the three modes.

**3.03** The I/O system normally transfers data in the 8-bit American Standard Code for Information Interchange (ASCII). This code is slow and inefficient for use in transferring large quantities of data to another processor-equipped system.

**3.04** Four I/O frame channels (channels 5 and 7 per I/O unit selector) or any channel of an I/O processor frame may be configured to operate in the transparent mode. In this mode, the I/O channel merely transfers data in 8-bit groups. The end of text and parity bits within these 8-bit groups are not decoded. The data is pure binary rather than ASCII coded information. In this operating mode, all error checking and supervisory exchanges are executed directly between 4ESS Switch application programs and the remote facility served by the I/O channel.

**3.05** The I/O system is capable of either half-duplex or full-duplex operation in the asynchronous, synchronous, or isochronous mode of data communication. Half-duplex and full-duplex operations are defined as follows:

- Full-duplex operation permits data to be transmitted and received simultaneously over the voiceband transmission facility.
- Half-duplex operation restricts the transfer of data over the transmission facility to one direction at a time.

**3.06** When data terminal equipment is directly connected to an I/O processor frame, data rates up to 4800 b/s may be used in the asynchronous mode. Data rates up to 9600 b/s in the synchronous mode, and up to 4800 b/s in the isochronous mode, may be used when the I/O channel is connected to a private line voiceband transmission link. The capabilities of the 4ESS Switch I/O system and ASTN are shown in Table A.

**3.07** The I/O system also supports message and data link protocols. These protocols are defined as a set of operating rules for initiating, controlling, checking, and terminating data exchanges. The Digital Data Communications Message Protocol (DDCMP) serves as a data link protocol.

**3.08** The Bell Administrative Network Communications System (BANCS) serves as a message protocol. Application programs using channels on the J5A006D I/O processor frame use either the BANCS protocol or no protocol at the message level. If BANCS is not used, the application program is responsible for limiting the message size to within the maximum block size specified for the associated I/O channels. The application program must also provide an application-level protocol for the acknowledgment and sequencing of messages.

**Table A. 4ESS Switch I/O System Capabilities**

| Characteristics | Asynchronous I/O | Isochronous I/O | Synchronous I/O * |
|---|---|---|---|
| Mode of operation | Point-to-point | Point-to-point | Point-to-point |
| Mode of transmission | Half, full duplex | Half, full duplex | Half, full duplex |
| Data rates supported: | | | |
| Direct connection - | 110, 1200, 2400, 4800 b/s | Not supported | Not supported |
| Private line - | 110k 1200, 1800 b/s | 2400, 4800 b/s | 2400, 4800, 9600 b/s |
| Dialup connection - | 110, 1200 b/s | Not supported | 1200, 2400 4800 b/s |
| Link protocol | None | None | DDCMP |
| Message protocol | None | None | BANCS |
| Input data | ASCII | ASCII | ASCII, Binary |
| Output data | ASCII, Binary | ASCII, Binary | ASCII, Binary |

* ASTN is primarily 56000 b/s. For further information, see SD-4A193-01, IOP Alternate Signaling Capability Application Schematic.

## Input/Output System Security

**3.09** Security of 4ESS Switch I/O channels which may be accessed from remote locations is provided by using private line data links, electronic code detectors, or program-controlled callback arrangements to prespecified telephone numbers. Private line data links cannot be accessed via the DDD network. Electronic code detectors installed in private line data link I/O channels are used to control access to other I/O channels connected to the same remote facility via the DDD network.

**NOTE:**
Further details of electronic code detector arrangements and automatic callback features are provided in Paragraphs 3.39 and 3.50, respectively. Input/output channel security arrangements are provided on an office-engineered basis.

## Input/Output System Redundancy

**3.10** Sufficient redundancy is provided by the I/O system to permit the transfer of data during hardware failure conditions. The diversity of channel assignments provides this flexibility. The 3B computer is equipped with duplicate I/O processor units. Duplicate I/O channels are provided only for certain specified 3B I/O functions. The 1B processor I/O channels are not physically duplicated. However, backup channels are software assigned to provide the same I/O functions when I/O system failures occur. Dial backup channels may also be provided for I/O channels extended to remote facilities. Diverse routing of data links to these facilities also provides I/O system redundancy.

## Input/Output System Messages

**3.11** Input messages enable operating personnel to control, maintain, and administer the switching system. They consist of various data inputs that may require a series of system actions and/or reports. Listed below are some example functions that the I/O system performs:

- Executing diagnostic and exercise programs and reporting the results
- Performing tests and reporting the results
- Reporting the status of various subsystems
- Reporting traffic information
- Entering translation information into memory
- Restoring units to service or removing units from service.

**3.12** Input messages have a number of valid forms. Many input messages are complex because of the large number of variables and options.

**CAUTION:**
*Some messages can disable service. The user should use such messages with extreme caution, during periods of light traffic. The user should also know how to terminate the resulting process(es).*

**NOTE:**
Input message manuals IM-4A000-01 (4ESS Switch) and IM-4A001-01 (3B20D computer) contain a complete listing of all input messages and their functions.

**3.13** Output messages are generated in response to input messages, other manual requests, or in response to software-initiated requests. Output messages initiated by software include periodic reports as well as system error interrupt reports which require the attention of operating personnel. Data contained in output messages is used for applications such as locating system faults, reporting subsystem status, and supplying information on traffic conditions.

**NOTE:**
Output message manuals OM-4A000-01 (4ESS Switch) and OM-4A001-01 (3B20D computer) contain a complete listing of all output messages and their formats.

**3.14** An optional 4ESS Switch feature, called the AP3BIO feature, allows the entry of most 3B computer input messages on 1B processor I/O channels. The corresponding message is sent across the Attached Processor Interface to the 3B computer for execution, and the output is printed on both the 3B computer and 1B processor printers. This feature may be enabled or disabled in each office.

## Message Classes

**3.15** The 1B processor I/O program supports three categories of message classes as shown in Table B. Messages are classified according to function (**Functional** category), subject (**Unit-Type** category), and responsibility (**Maintenance Center** category). Specific 1B processor I/O channels (up to 96) are assigned in the system data base to some of the **Functional** message classes and to all of the **Maintenance Center** message classes. Channels are not assigned to the remaining **Functional** category message classes or to the **Unit-Type** category message classes.

**3.16** Except for the channels assigned to the **Maintenance Center** message classes, initial channel assignments may be changed (added/deleted) via input message requests. Additional channels may be assigned to any message class. Channel assignments for any or all message classes may be restored to their initial assignments via an INIT:MSGCLS input message.

**3.17** Message classes and their assigned channels are used by the 1B processor I/O program for control purposes such as input message screening and output message routing. Output messages are routed to any channel in response to a manual request received over that channel.

**3.18** Several input messages are available to change output message routing or output message class. These messages are described in the 4ESS Switch input message manual. However, operating personnel cannot delete channels that are initially assigned in the data base to **Maintenance Center** category message classes. These message classes are used to route messages associated with specific equipment (identified by unit type and member number) to the responsible maintenance center channels. These same message classes are also used to route audible alarms (if the message is an alarm type) to the responsible maintenance area.

**3.19** Message class routing provides routing flexibility which can be used when analyzing and troubleshooting system problems. As an example, the 4ESS Switch belt-line channel can be added to the call store message class when working on a call store. All messages relating to call store will then be routed to a data terminal connected to the belt-line channel in addition to all other channels assigned to the call store message class.

**Table B. 4ESS Switch Message — Categories and Classes**

| Functional Category | | | |
|---|---|---|---|
| **Message Classes** | **Definition** | **Message Classes** | **Definition** |
| ALLRC | All Recent Changes messages | INTPH | Interrupt and Phase messages |
| ALLTCA | All Trunk Control Area messages | NMGT | Network Management messages |
| AUD | Audit messages | RC | Recent Change messages |
| DGN | Diagnostic messages | SERA | Switching Error Analysis messages |
| FOR | Fault Recognition messages | TERA | Trunk Error Analysis messages |
| GROWTH | Growth messages | | |

| Unit-Type Category | | | |
|---|---|---|---|
| **Message Classes** | **Definition** | **Message Classes** | **Definition** |
| CC | Central Control | PUB | Peripheral Unit Bus |
| CCIS | Common Channel Interoffice Signaling | SP | Signal Processor |
| FADS | Files Stores (3B Computer) and Auxiliary Data System | STOR | Core Stores and Buses |
| | | TDN | Time Division Network |
| PTERM | Peripheral Terminal Equipment | | |

| Maintenance Center Category | | | |
|---|---|---|---|
| **Message Classes** | **Definition** | **Message Classes** | **Definition** |
| ALLMC | All Maintenance Center messages | TEC2 | Additional TEC if required |
| APSMPS | Attached Processor System Maintenance | TEC3 | Additional TEC if required |
| MOC | Maintenance Operations Center (repair messages) | TEC4 | Additional TEC if required |
| | | TEC5 | Additional TEC if required |
| MOCC | Maintenance Operations Center Control (control messages) | TOC1 | Trunk Operations Center |
| | | TOC2 | Additional TOC if required |
| TEC1 | Terminal Equipment Center | | |

## A. Output Message Routing Transfer

**3.20** Output message routing may be changed automatically by the I/O program or by input message request. Each 1B processor I/O channel has a designated backup channel assignment in the system data base. Output messages are automatically transferred to the designated backup channel when the primary channel is taken out of service.

**3.21** As previously described, channels may be added or deleted to output message classes. By this means, a monitor channel can be provided either in the office or to a remote facility, and any message class output messages can be directed to this monitor channel. Input messages are also provided to alter alarm routing (audible alarms and alarm messages).

## B. Input Message Screening

**3.22** It is important that control over input requests be imposed on some channels to prevent unauthorized use of critical control functions. This control is partially accomplished by input message screening. The remaining control is accomplished by administrative documents. Input messages are screened on a message-class basis. This makes it easier to preclude maintenance activity on processor or network units from the terminal equipment center areas.

**3.23** No screening should occur within a unit type. For example, administrative procedures must be used to limit access to those units (signal processors or voiceband interface units) assigned to one area. Changes in the screening of input messages can only be made by using the RC process. An RC input message is used to make additions and/or deletions in the list of allowable message classes for a particular channel.

## 1B processor I/O Channels

**3.24** Figure 1 shows the various I/O channel assignments in a 4ESS Switch office. Optional and conditional I/O channel designations are enclosed in parentheses. Required I/O channel designations are not enclosed in parentheses. The 1B processor I/O channel assignments, responsible work center, classification, terminal equipment, and backup channel assignments are listed in Table C. Required channels are necessary for every office. Optional channels may be equipped at the discretion of the operating company. Conditional channels are based on office size, daily work load, and physical location of the various work centers and data terminal equipment.

**3.25** The control information for all 1B processor I/O channels is stored in the Office Data Assembler (ODA) data base which is initially prepared for each office installation. This information includes channel identification, designated backup channel, interface equipment identification, and operating characteristics for each channel. Except for the two fixed-assigned maintenance channels, control data for all I/O channels may be updated in an operating office via the RC process.

**3.26** The Master Test and control (MTC) channel is always fixed-assigned in the ODA to I/O unit selector (IOUS) 0, I/O Unit Controller (IOUC) 0. (Software terms IOUS and IOUC are used to define either I/O frame or I/O processor frame equipage.) Either the Secondary Record 1 (SREC1) channel or the Switching Control Center 1 (SCC1) channel is fixed-assigned to IOUS1, IOUC0. The SCC1 channel is fixed-assigned for offices served by a switching Management Control Center (SMCC). The SREC1 channel is fixed-assigned for offices not served by an SMCC.

**3.27** The 1B processor I/O channels may be equipped with up to three ports. Port equipage is determined by channel application. When a message is output to a multiport channel, it is transmitted over all of the parallel ports of that channel. Channels which function in the isochronous or synchronous mode or serve as a dialup channel have only one port.

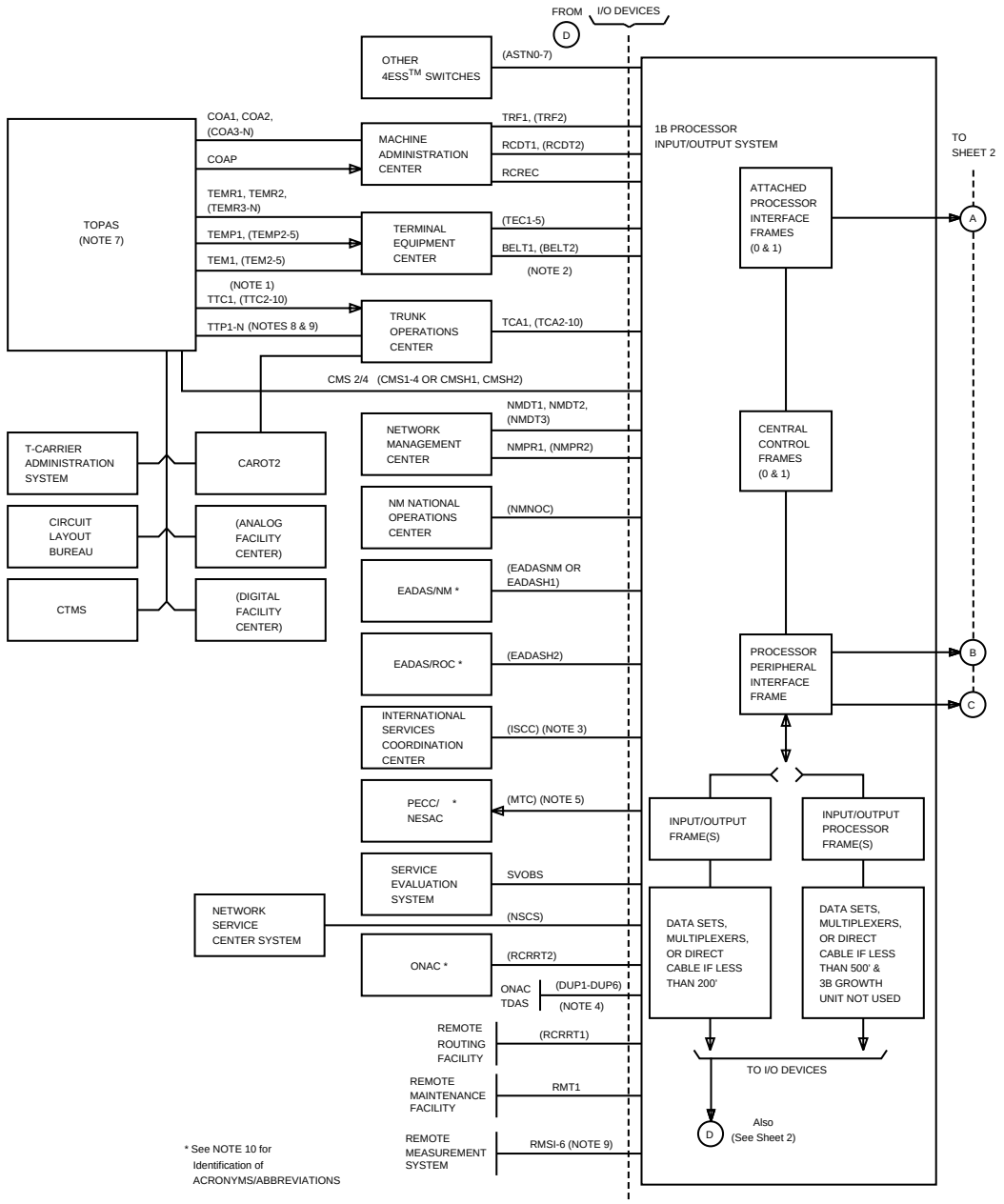
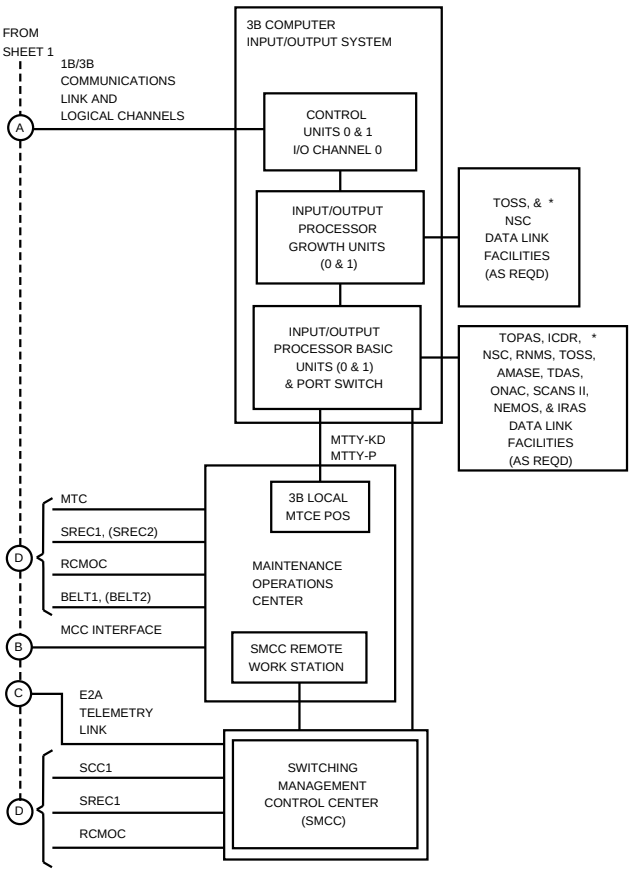



**Figure 1. 4ESS Switch Input/Output Channels (Sheet 1 of 2)**




NOTES:
1. ACCESSED AT TERMINAL EQUIPMENT FRAMES USING A MOBILE KEYBOARD/DISPLAY TERMINAL.
2. ACCESSED AT VARIOUS 4 ESS SWITCH EQUIPMENT (EXCLUDING TERMINAL EQUIPMENT) USING A MOBILE CART KEYBOARD/DISPLAY TERMINAL.
3. OPTIONAL FOR INTERNATIONAL OFFICES ONLY.
4. CALLBACK REQUIRED. USED ONLY WHEN OFFICE IS EQUIPPED WITH 1B INPUT/OUTPUT PROCESSOR.
5. PORT 2 OF THE MTC CHANNEL IS RESERVED TO PROVIDE A MONITOR-ONLY CAPABILITY TO PECC/NESAC DURING TROUBLE DIAGNOSIS OF A 4 ESS SWITCH. CONNECTION MUST BE MANUALLY ORIGINATED AT THE 4 ESS SWITCH OFFICE.
6. OPTIONAL OR CONDITIONAL CHANNELS ARE ENCLOSED WITHIN PARENTHESES. REQUIRED CHANNELS ARE NOT ENCLOSED IN PARENTHESES.
7. TOPAS REPLACES THE CIRCUIT MAINTENANCE SYSTEM. TOPAS USES I/O CMS2 AND CMS4 VIA DATA KIT CONNECTION 4800B, ASYNCHRONOUS, FULL DUPLEX
8. TRUNK TEST POSITIONS (51A) ARE REPLACED WITH REMOTE MEASUREMENT SYSTEM TEST POSITION WORK STATIONS CONNECTED TO TOPAS ACCESS RMS FRAMES VIA 9600B X25 LINK.
9. EACH RMS FRAME COMMUNICATES WITH 4ESS CHANNELS RMS(1-6) 4800B, ASYNCHRONOUS, FULL DUPLEX.
10. FOR DEFINITIONS OF ABBREVIATIONS AND ACRONYMS ON FIGURE, SEE PART 5 OF THIS DOCUMENT.

**Figure 1. 4ESS Switch Input/Output Channels (Sheet 2 of 2)**

**Table C. 1B Processor Input/Output Channels**

| Channel | Name | Work Center | Classification | | | Terminal Equipment | | | | Backup Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | REQ | COND | OPT | KD | P | CSU/ MTT | KSR | |
| MTC | Master Test and Control | MOC | X | | | X | X | | | SREC1 |
| SREC1 | Secondary Records Channel1 | MOC | X | | | X | X | X | | MTC |
| SREC2 | Secondary Records Channel2 | MOC | | | X | X | X | | | SREC1 |
| RCMOC | Recent Change Monitor Channel | MOC | X | | | | X | X | | SREC1 |
| BELT1 | Belt-Line Maintenance | MOC/TEC | X | | | X | X | | | MTC |
| BELT2 | Belt-Line Maintenance | MOC/TEC | | X | | X | X | | | MTC |
| TEC1—5 | Terminal Equipment Repair | TEC | | X | | X | X | | | SREC1 |
| RCDT1 | Recent Change Display Terminal | MAC | X | | | X | | | | RCREC |
| RCDT2 RCDT3 †† | Recent Change Display Terminal | MAC | | | X | X | | | | RCREC |
| RCREC | Recent Change Record | MAC | X | | | X | X | X | | SREC1 |
| TRF1 | Traffic Measurements | MAC | X | | | X | X | | | RCREC |
| TRF2 | Traffic Measurements | MAC | | | X | | X | | | RCREC |
| TCA1 | Text Control Area | TOC | X | | | X | X | | | SREC1 |
| TCA2—10 | Test Control Area | TOC | | X | | X | X | | | TCA1 |
| NMDT1 | Network Management Display Terminal | NMC | X | | | X | X | | | NMDT2 |
| NMDT2 | Network Management Display Terminal | NMC | X | | | X | X | | | NMDT1 |
| NMDT3 | Network Management Display Terminal | NMC | | X | | X | X | | | NMDT1 |
| NMPR1 | Network Management Printer | NMC | X | | | X | X | | | SREC1 |
| NMPR2 | Network Management Printer | NMC | | X | | X | X | | | NMPR1 |
| CMS1—4 | Circuit Maintenance System Interface* | | X | | | | | | | CMS1/3 CMS2/4 |
| OR CMSH1 & CMSH2 | Circuit Maintenance System Interface† | | X | | | | | | | CMSH2 |
| | Circuit Maintenance System Interface† | | X | | | | | | | CMSH1 |
| OR CMS2 & CMS4 | TOPAS Interface TOC | | X | | | X | | | | CMS4 |
| | TOPAS Interface TOC | | X | | | X | | | | CMS2 |

See footnotes at end of table.

**Table C. 1A Processor Input/Output Channels (Contd)**

| Channel | Name | Work Center | Classification | | | Terminal Equipment | | | | Backup Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | REQ | COND | OPT | KD | P | CSU/ MTT | KSR | |
| RC1A3B | Recent Change 1A to 3B (to Integrated Routing Assignment System) | | | | X | | | | | RCREC |
| ASTN 0-7 | Alternate Signaling Transport Network | | | X‡ | | | | | | |
| RMT1 | Remote Dialup Terminal | | X | | | | | | | MTC |
| RCRRT1 | Recent Change Remote Routing | | | X | | X | X | | | RCREC |
| RCRRT2 †† | Recent Change Remote Routing | | | | X | X | X | | | RCREC |
| SVOBS | Service Observing System | | X | | | | | | | MTC |
| NMNOC1 | Network Management No Circuit | | | | X | | | | | |
| EADAS/NM<br>or<br>EADASH1 | EADAS/NM Interface<br><br>High-Speed EADAS1 | | | | X<br><br>X | | | | | |
| EADASH2 | High-Speed EADAS2 | | | | X | | | | | |
| SCC1<br>SCC2 †† | Switching Control Center Maintenance | | | | X | | | | | SREC1 |
| DUP1—6 | Dialup | | | | X | | | | | |
| ISCC | International Services Coordination Center | | | | X | | | | | MTC |
| NSCS | Network Service Center System | | | | X | | | | | MTC |
| RMS1-6 | Remote Measurement System | | | X | | X | | | | SREC1 |

**Legend:**

| | |
|---|---|
| ASTN | Alternate Signaling Transport Network |
| COND | Conditional |
| CSU/MTT | Communications Storage Unit Magnetic Tape Terminal |
| KD | Keyboard Display |
| KSR | Keyboard Send and Received |
| MAC | Machine Administration Center |
| MOC | Maintenance Operations Center |
| NMC | Network Management Center |
| OPT | Optional |
| P | Printer |
| REQ | Required |
| RMS | Remote Measurement System |
| TEC | Terminal Equipment Center |
| TOC | Trunk Operations Center |
| TOPAS | Testing, Operations, Provisioning Administration System |

* Low-speed channels; two are active and two are backup.

† High-speed channels; one is active and one is backup.

‡ ASTN - Condition in 4 and not applicable in LEC.

†† Channels RCDT3, RCRRT2 and SCC2 are used exclusively by AT&T ITN for testing.

**3.28** The 1B processor I/O channel assignments are divided among six work centers and a nonwork center category. The six work centers are as follows:

(a) Maintenance Operations Center (MOC)

(b) Machine Administration Center (MAC)

(c) Terminal Equipment Center (TEC)

(d) Trunk Operations Center (TOC)

(e) Network Management Center (NMC)

(f) Switching Management Control Center (SMCC).

## A. Work Center Channels

**3.29** The MOC is served by the MTC, SREC1, Secondary Record 2 (SREC2), Recent Change Monitor Channel (RCMOC), and the two Belt-line Channels (BELT1 and BELT2). The data terminals associated with the MTC channel are always located at the Master Control Console (MCC). The terminal equipment associated with each of these channels is shown in Table C. The MOC I/O channels function as follows:

(a) ***MTC:*** This is the primary maintenance channel used to communicate with the system. It has access to all 1B processor messages except for those relating to network management functions. The MTC channel printer provides a hard copy of all MTC channel output messages. Port 2 of the MTC channel is equipped to provide a 2-wire manual dialup connection to the Product Engineering Control Center (PECC) or the National Electronic Systems Assistance Center (NESAC) for system trouble analysis. The dialup connection must be manually established at the 4ESS Switch office.

(b) ***SREC1,SREC2:*** The SREC1 channel supplements the MTC channel in all control, test, and repair operations. It receives all repair and diagnostic messages. It is also used to implement roll-forward procedures when a system rollback has been initiated. When the office is served by an SMCC, SREC1 ports 0 and 1 are remoted to the SMCC as described later in this subpart. The optional SREC2 channel may be used to augment the SREC1 channel.

(c) ***RCMOC:*** This channel provides the MOC (or SMCC when applicable) with printed copies of all RC messages entered in the buffered and test state. The data storage unit (cassette tape or flexible diskette) associated with this channel records all RC messages entered into the test state. This data is used to reinsert RC messages via the SREC1 channel after they have been rolled back.

(d) ***BELT1,BELT2:*** The belt-line channels are used for testing and repair activities at various equipment locations. Jack access is provided at the MCC, in the 1B processor area, and at the various common control and switching network frames to interface mobile carts equipped with an AIMS terminal and printer (KDP). Belt-line operations are particularly advantageous in permitting 1-man

testing when special test facilities are being used.

**NOTE:**
The belt-line channels may NOT be used to perform major system control functions. Such requests will be screened and denied. The belt-line channels can be used to request configuration status, diagnostic tests, and control operations on single units. System configuration requests will be denied.

**3.30** The following channels serve the MAC:

(a) Two traffic measurement channels (TRF1 and TRF2)

(b) Two recent change display terminal channels (RCDT1 and RCDT2)

(c) The recent change record (RCREC) channel.

**NOTE:**
A third recent change display terminal channel (RCDT3) is currently used at the RC1A3B I/O channel to the 3B computer to interface with the 1B processor.

**3.31** The actions for the channels that serve the MAC are described as follows:

- The TRF channels record system reports and traffic measurement information output automatically or per a requested schedule.
- The RCDT channels are used by the machine administrator to input RC messages.
- The RCREC channel maintains a printed copy of RC messages entered in the buffered and test state.

**NOTE:**
All RC messages entered into the buffered state are recorded on a data storage unit (cassette tape or flexible diskette). This unit is also used for reinserting the buffered messages should the buffer contents become mutilated.

**3.32** The TEC is served by up to five TEC channels (TEC1 through TEC5). These channels are used for repair of equipment located in the common control terminal equipment area. They receive diagnostic failure reports, alarm reports, and power alarms for the equipment types assigned to each channel.

**3.33** The TOC is served by up to ten Test Control Area (TCA) channels (TCA1 through TCA10). These channels are used by the TOC for interfacing with the 1B processor. Information received on these channels include reports on ineffective attempt data, plant measurements, carrier group alarms, routine trunk operation test reports, and trunk performance long-term analysis reports.

**3.34** The NMC may be served by three network management display terminal channels
(NMDT1 through NMDT3) and two network management printer channels (NMPR1 and NMPR2). The NMDT channels are used to interrogate the system network management data base in connection with existing or potential network congestion and to input network controls when required. These channels may be equipped with a KDP and operated at 1200 bits per second in the asynchronous mode. When equipped only with a KD, these channels may be specified as isochronous 4800-b/s channels. The NMPR channels provide detailed information that was presented initially on the network management exception panel along with printed copy of manual control actions taken.

**3.35** An SMCC provides the capability of performing switching maintenance surveillance, control, and analysis functions for a number of 4ESS Switch offices. The SCC1, SREC1, and RCMOC channels, and telemetry data are interfaced between each of the served offices and the SMCC. (Duplicate 3B computer I/O processor maintenance channels, MTTY 0 and 1, and duplicate 3B dial backup channels are also interfaced to the SMCC.) Figure 2 shows a typical 4ESS Switch/SMCC interface arrangement.

**3.36** The SCC1 channel is used to monitor the MTC and SREC1 channels and has the input capability of the MTC channel. An electronic code detector in the private line SCC1 channel interface serves to enable or disable telemetry control from the SMCC and to enable or disable the data sets associated with the SREC1 and RCMOC dial backup channels.

**3.37** The SREC1 channel is used for normal diagnostic output, RCMOC and SCC1 backup, and RC roll-forward procedures. Port 2 is dedicated to a KDP in the MOC to provide on-site diagnostic message capability.

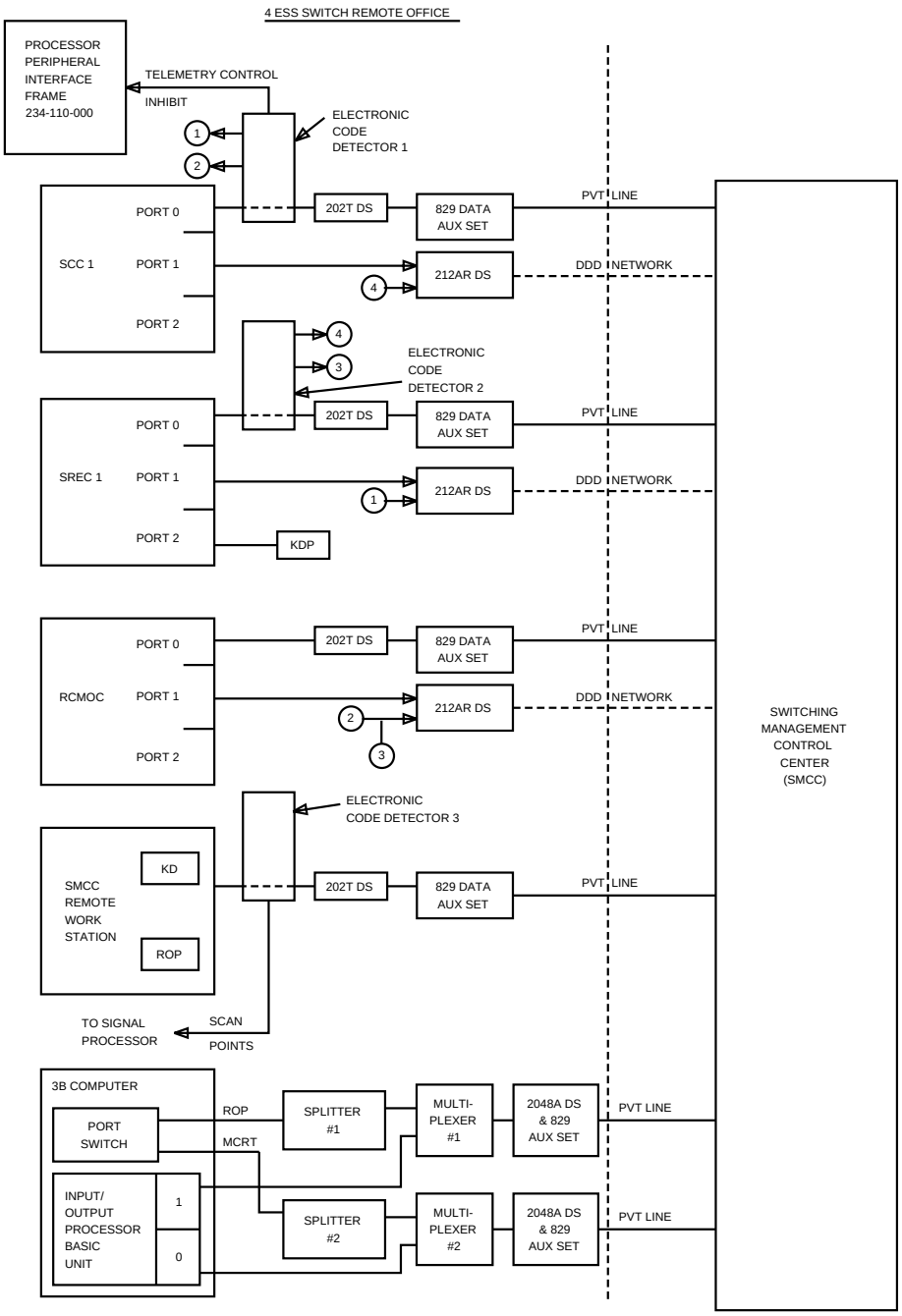



**Figure 2. Typical SMCC I/O Channel and Terminal Arrangement**

**3.38** The RCMOC channel is used to output all RC messages to the SMCC. Recent change messages entered into the test state are recorded on a data storage unit (cassette tape or flexible diskette) for use when the system requires the roll-forward/rollback function. The SMCC minicomputer logs the output of the RCMOC channel which serves as the hard-copy equivalent of all RC messages.

**3.39** Electronic code detectors provide the security for the automatic answer option associated with the 212A data sets used to interface the DDD network dialup facilities from the SMCC. Electronic code detector No. 1 (Figure 2) is used to open or close port 1 of the SREC1 channel and port 1 of the RCMOC channel. This electronic code detector is controlled by the SCC1 channel and is also used to enable and disable the telemetry control from the SMCC to the office. Electronic code detector No. 2 (controlled by the SREC1 channel) is used to open or close port 1 of the SCC1 channel and port 1 of the RCMOC channel. Electronic code detector No. 1 and/or 2 may also provide the security for the telemetry data dial backup arrangement between the office and the SMCC (not shown in Figure 2).

**3.40** An SMCC Remote Work Station (RWS) in the 4ESS Switch MOC is also interfaced
via private line facilities. The RWS is equipped with a KD and receive-only printer. The RWS provides MOC personnel with access to the SMCC minicomputer history files, analysis results, interrupt expansions, etc., to assist in trouble clearing. The RWS also serves as a communications link with the SMCC for work force management administration. An electronic code detector (No. 3) may also be equipped in this channel to interface with four miscellaneous scan points. This arrangement enables SMCC personnel to alert MOC personnel by activating any of four output messages stored in the 1B processor. The displayed messages are also accompanied by spurt-minor audible alarms.

## B. Nonwork Center Channels

**3.41** ***Network Management National Operations Center (NMNOC):*** This channel is used to transmit No Circuit (NC) information to the National Operations Center (NOC).

**3.42** ***EADAS/NM, EADASH1, EADASH2:*** Either the EADAS/NM or EADASH1 channel may be used to interface the Engineering and Administrative Data Acquisition System for Network Management (EADAS/NM). The EADASH2 channel provides an interface to the EADAS Regional Operations Center. The EADASH2 channel may be implemented only when the EADASH1 channel is provided. These interfaces are used to obtain, evaluate, and control various 4ESS Switch network management functions from a centralized facility which serves a geographical area.

**3.43** The EADAS/NM channel is a medium speed channel which operates at 1200 b/s, half-duplex, and in the transparent mode. The two high-speed channels, EADASH1 and EADASH2, are supported by the 4E5 or later versions of the generic program. These two channels provide synchronous full-duplex operation and are

currently operated at 4800 b/s. They are designed to replace the slower speed EADAS/NM channel. Link protocol DDCMP and message protocol BANCS are both used on the two high-speed channels. Network management data output in response to a data request received via either high-speed channel is output to both channels.

**3.44** ***NSCS:*** The NSCS channel provides an optional full-duplex asynchronous 1200-b/s interface to the Network Service Center System (NSCS). Call irregularity data is collected by the 4ESS Switch and transmitted to the NSCS in response to office data traps specified by the NSCS. The NSCS initiates data traps, modifies existing traps, and sets data sampling rates via input messages to the 4ESS Switch. The NSCS stores and analyzes the requested data as part of a service improvement function to detect far-end and facility problems which are not readily traceable with local maintenance tools.

**3.45** ***SVOBS:*** The Service Observing System (SVOBS) channel is required to interface the 4ESS Switch with the Service Evaluation System.

**3.46** ***ISCC:*** The International Services Coordination Center (ISCC) channel serves as an administrative channel through which the ISCC may access a study list of up to 60 designated international trunk subgroups. This study list permits the ISCC to determine if all international trunks are properly exploited and to derive international traffic distributions, foreign network penetration, and information about calls that do not receive answers.

**3.47** ***RCRRT1:*** The Recent Change Remote Routing 1 (RCRRT1) channel provides the capability for changes related to routing to be input from a remote routing facility.

**3.48** ***RCRRT2:*** The Recent Change Remote Routing 2 (RCRRT2) channel is used for making recent changes from a remote terminal or to interface the 4ESS Switch with the Operations Network Administration Center/Announcement Distribution System (ONAC/ADS) if the office is engineered for the Mass Announcement System (MAS). The RCRRT2 channel is a 1200-b/s, full-duplex, private line data circuit. The ONAC/ADS uses the MAS support system—a digital computer—to terminate the RCRRT2 channel from each MAS-equipped 4ESS Switch office.

**3.49** ***RMT1:*** The Remote Terminal 1 (RMT1) channel provides a manually originated interface for remote locations to monitor the 4ESS Switch. The remote locations can request certain types of information to be routed to this channel for analysis.

**3.50** ***DUP1 through DUP6:*** Up to six dialup channels (DUP1 through DUP6) may be provided when the office is equipped with 1B I/O processor frames. Dialup equipment may access any dialup channel provided by the office. The dialup procedure requires user equipment to initiate the call and present a user identification to the system. The dialup connection is broken and the 4ESS Switch maps the identification to a return phone number. This number is used by the 4ESS Switch to establish a return call to the user equipment. Callback is always required for security. The 4ESS Switch will respond to data requests only via the callback connection.

**3.51** ***CMS1-4, CMSH1, CMSH2:*** Either the four medium-speed (1200 b/s) CMS channels (CMS1 through CMS4) or the two high-speed (4800 b/s) CMS channels (CMSH1 and CMSH2) are required to interface the 1B processor I/O system with the CMS. The CMSH1 and CMSH2 channels are designed to replace the four lower speed channels as the CMS is updated with compatible software and equipment. The CMS supports the trunk maintenance activities for the 4ESS Switch office. For TOPAS application, channels CMS2 and CMS4 are used. The channels CMS2 and CMS4 are fully duplexed at 4800 b/s and asynchronous.

**3.52** When the lower speed CMS channels are used, CMS1 and CMS2 are designated primary channels. Channels CMS3 and CMS4 are designated backup channels. These channels are operated in the simplex mode (one way). Data is received from the CMS via CMS1 and CMS3. Data is transmitted to the CMS via CMS2 and CMS4. With TOPAS, CMS2 is designated primary and CMS4 is the backup operating at full duplex (2-way), asynchronous mode and at 4800 b/s.

**3.53** When the high-speed CMS channels are used, CMSH1 is designated the primary channel and CMSH2 the backup channel. These two channels provide synchronous, full-duplex operation and are currently operated at 4800 b/s. Link protocol DDCMP and message protocol BANCS are both used on the high-speed channels. With TOPAS, CMS2 is designated primary and CMS4 is the backup operating at full duplex (2-way), asynchronous mode, and at 4800 b/s.

**3.54** ***ASTN0 through ASTN7:*** Up to eight synchronous high-speed channels may be equipped to provide Alternate Signaling Transport Network Capacity Increase feature. ASTN channels provide call processing signaling backup at 56,000 bps during periods of CNI ring failure.

**NOTE:**
For further information see the following:

- SD-4A193-01, IOP Alternate Signaling Capability Application Schematic
- SD-4A016-01/02 Input/Output Terminals Connections Circuit

## 3B Computer Input/Output Channels

**3.55** The 3B computer I/O system (Figure 1) is equipped as specified by SD-4A125-01, SD-4A125-02, and SD-4A125-03 for the 4ESS Switch application of the Attached Processor System (APS). The I/O facilities of the 1B processor and 3B computer are completely separate. The 3B computer uses duplicate I/O processor units (and duplicate I/O channels) for redundancy. The 3B computer I/O system is equipped primarily to support the operation and maintenance of the APS.

## A. 3B Computer Local Maintenance Position Channels

**3.56** Two 3B computer I/O channels (MTTY-KD and MTTY-P) provide the interface to the 3B computer local maintenance position located in the 4ESS Switch MOC. The MTTY-KD and MTTY-P channels serve to interface a VT-100 keyboard/display data terminal and receive-only printer, respectively. Access to either of the two I/O processor units is provided by two manual/software-operated port switch circuits. Modified function keys on the VT-100 data terminal or the optional KS-22921 color terminal enable either normal I/O port access to the 3B computer or access to the 3B emergency action interface port.

## B. 3B Computer Recent Change and Verify

**3.57** The Recent Change and Verify facilities of the 3B computer may be accessed via a 3B mobile cart equipped with a VT-100 or equivalent keyboard/display data terminal and printer. This interface is also used for system trouble analysis in the 3B computer equipment area.

## C. 3B Computer/SMCC Interface

**3.58** Duplicate 3B computer I/O channels are extended via private line facilities to a designated SMCC when this optional office feature is implemented. These two I/O interfaces may be arranged for synchronous, full-duplex operation at 2400 b/s or 9600 b/s using the optional interface equipment specified in SD-4A125-01/02/03. The SMCC interfaces have the same I/O capabilities as the 3B computer local maintenance position MTTY-KD channel. They are duplicated to provide access to the duplicated 3B computer I/O processor basic units and 3B computer port switch channels. In addition to the two private line channels, DDD dialup channels may be provided to back up the primary SMCC data links.

## D. Scan/Signal Distributor and Tape Unit I/O Channels

**3.59** Duplicate magnetic tape unit I/O channels, one from each I/O processor basic unit, support duplicate tape formatter circuits located in the 3B tape unit frame or tape/disk cabinets. The second type of I/O channel equipage consists of two scan/signal distributor (SC/SD) circuits equipped in each 3B computer I/O processor basic unit. Each of these circuits provide 48 scan points and 32 signal distributor points used for 3B equipment monitor and control functions.

## E. Other 3B Computer Input/Output Channels

**3.60** In addition to the I/O processor basic unit channels described in the preceding paragraphs, four additional circuit packs may be optionally equipped in each I/O processor basic unit to support the following remote facilities as specified in SD-4A125-01/02/03:

- Software Change and Notification System (SCANS II)
- Trunk Data Acquisition System (TDAS)
- Automatic Message Accounting Standard Entries (AMASE)
- Network Management Operations Support (NEMOS)
- Integrated Routing Assignment System (IRAS)
- Operations Network Administration Center (ONAC) dialup link.
- Online Call Detail Data (OCDD)
- Trunk Operations Provisioning Administrative System (TOPAS)

**3.61** The 3B computer may also be optionally equipped with duplicated I/O processor growth units (0 and 1) to interface data link equipment to the following facilities:

- Maintenance channel of collocated Network Services Complexes (NSCs)
- Teleconferencing Operator Support System

The I/O processor growth may be equipped with up to eight peripheral controller circuit packs as specified by SD-4A125-01/02/03.

## Circuit Maintenance System I/O Channels

**3.62** As previously described in this document, either 1B processor or CMS channels— CMS1 through CMS4 or CMSH1 and CMSH2—provide a high-speed direct data link between the 4ESS Switch and the CMS processing facilities. The CMS supports the trunk maintenance activities for the 4ESS Switch office. A total of six 4ESS Switch offices can be supported by a CMS. The CMS I/O channel assignments, responsible work center, classification, terminal equipment, and backup channel assignments are listed in Table D. In addition to the 4ESS Switch/CMS direct data links, the following CMS I/O channels are provided for three work centers in each 4ESS Switch office and to other facilities associated with the CMS:

(a) ***CMS/MAC Channels:*** Two Circuit Order Administration (COA) channels and one Circuit Order Administration Printer (COAP) channel serve the 4ESS Switch MAC as shown in Figure 1. A number of additional COA channels may be provided as required (Table D). These channels provide the interactive interface with the CMS for performing the functions of the MAC.

(b) ***CMS/TEC Channels:*** One Terminal Equipment Maintenance (TEM) channel, one Terminal Equipment Maintenance Printer (TEMP) channel, and two Terminal Equipment Maintenance Rover (TEMR) channels serve the 4ESS

Switch TEC. A number of additional TEC, TEMP, and/or TEMR channels may be provided as required (Table D). These channels provide the interactive interface with the CMS for performing the functions of the TEC.

(c) ***CMS/TOC Channels:*** One Trunk Test Control (TTC) channel and one Trunk Test Position (TTP) channel serve the 4ESS Switch TOC. A number of additional TTC and TTP channels may be provided as required (Table D). These channels provide the interactive interface with the CMS for performing the functions of the TOC.

(d) ***CMS Maintenance Channels:*** The CMS Maintenance Center (CMSMC), System Terminal A (STA), and System Terminal Backup (STBU) channels are provided for use within the CMSMC. These channels provide an interactive interface for the operation, maintenance, and administration of the CMS. The CMSMC channel is terminated with an AIMS terminal KDP. The STA and STBU channels are terminated with LA36-CA DECWRITER II keyboard send and receive terminals. The STA channel is connected to the front-end CMS processor and the STBU channel is connected to the CMS backup processor. The CMSMC terminal is connected to the CMS processor currently on-line.

(e) ***CMS Channels to Trunk Administration and Test Systems:*** A number of CMS I/O channels are interfaced via data links to supporting trunk administration and test systems as shown in Figure 1. The CMS channels are interfaced with the Centralized Automatic Reporting On Trunks (CAROT) test system and the Carrier Transmission Maintenance System (CTMS) to provide access to these two trunk test systems. One CMS channel is interfaced with the T-Carrier Administration System (TCAS) to provide a means to obtain status information concerning trunks interfacing with the 4ESS Switch through T-carrier transmission systems. Circuit Layout Bureau (CLB) channels are provided to interface the CMS with Long Lines and Operating Company circuit layout bureaus. The CMS channels may also be interfaced to an Analog Facility Center and a Digital Facility Center where these facilities are provided.

## Network Services Complex I/O Arrangements

**3.63** An NSC consists of a frame equipment group used in the implementation of various customer services such as Teleconferencing (TC) and Direct Services Dialing Capability (DSDC). Each NSC is designed to be loosely coupled to the 4ESS Switch 1B processor. Its only operational interface consists of T1 trunks and N-links. A 4ESS Switch may serve as host office for a number of NSCs. Each NSC is configured for a specific application and operated independently of other NSCs.

**3.64** Each NSC is controlled by a main processor unit contained in a network service frame. The main control and display medium for an NSC consists of keyboard/dislay and printer driven by the I/O processor section of the main processor unit. Two I/O processor ports (A and B) are provided. The port A switch transfers input control between the mobile cart keyboard/display and the NSC/3B I/O processor

maintenance I/O channel while maintaining the monitor function for both channels. The port B switch transfers all I/O functions between a mobile cart Communications Storage Unit (CSU) and other auxiliary equipment.

**3.65** The NSC port A channel provides asynchronous, full-duplex 1200-b/s operation. Port B may be programmed via an input message over the port A channel to operate at high speed (up to 9600 b/s). The CSU is used for inputting the NSC generic program and for updating NSC operational data. A complete list of NSC I/O messages is contained in the NSC I/O manual.

**Table D. Circuit Maintenance System Input/Output Channels**

| Channel | Name | Work Center | Classification | | | Terminal Equipment | | | | Backup Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | REQ | COND | OPT | KD | P | CSU/ MTT | KSR | |
| TEM1 | Terminal Equipment Maintenance | TEC | X | | | X | | | | |
| TEM2 | | | | X | | X | | | | |
| TEM3—5 | | | | | X | X | | | | |
| TEMP1 | Terminal Equipment Maintenance Printer | | X | | | | X | | | |
| TEMP2 | | | | X | | | X | | | |
| TEMP3—5 | | | | | X | | X | | | |
| TEMR1 & 2 | Terminal Equipment Maintenance Rover | | X | | | X | | | | |
| TEMR3—N | Terminal Equipment Maintenance Rover | | | X | | X | | | | |
| COA1 & 2 | Circuit Order Administration | MAC | X | | | X | | | | |
| COA3—N | | | | X | | X | | | | |
| COAP | Circuit Order Administration Printer | | X | | | | X | | | |
| TTC1 | Trunk Test Control | TOC | X | | | | X | | | |
| TTC2—10 | | | | X | | | X | | | |
| TTP1 | Trunk Test Position | | X | | | X | | | | |
| TTP2—N | | | | X | | X | | | | |
| CAROT | Centralized Automatic Reporting on Trunks | | X | | | | | | | |
| CTMS | Carrier Transmission Maintenance System | | X | | | | | | | |
| CMSMC | Circuit Maintenance System Maintenance Center | CMSMC | X | | | X | X | | | STA and STBU |
| STA | System Terminal A | CMSMC | X | | | | X | | X | STBU |
| CLB | Circuit Layout Bureau | | X | | | | | | | |
| AFC | Analog Facility Center | | | | X | | X | | | |
| DFC | Digital Facility Center | | | | X | | X | | | |
| CMS 1—4 | Circuit Maintenance System Interface* | | X | | | | | | | CMS1/3 CMS2/4 |
| or | | | | | | | | | | |
| CMSH1 | Circuit Maintenance System Interface† | | X | | | | | | | CMSH2 |
| CMSH2 | Circuit Maintenance System Interface† | | X | | | | | | | CMSH1 |
| TCAS | T-Carrier Administration System | | X | | | | | | | |

**See footnotes at end of table.**

**Table D. Circuit Maintenance System Input/Output Channels (Contd)**

**Legend:**

| | |
|---|---|
| CMSMC | Circuit Maintenance System Maintenance Center |
| COND | Conditional |
| KD | Keyboard Display |
| KSR | Keyboard Send and Received |
| MAC | Machine Administration Center |
| CSU/MTT | Communications Storage Unit/Magnetic Tape Terminal |
| NMC | Network Management Center |
| OPT | Optional |
| P | Printer |
| REQ | Required |
| TEC | Terminal Equipment Center |
| TOC | Trunk Operations Center |

* Low-speed channels; two are active and two are backup.

† High-speed channels; one is active and one is backup.

## Data Set Functions

**3.66** Various types of data sets are required to interface the I/O system with data terminal equipment and remote facilities. The type of data set specified is dependent on the transmission characteristics required for each application and the capabilities of the I/O system interface equipment employed. When the cable distance to local data terminal equipment is within specified limits, data sets are not required. When required, a compatible data set must be provided at each end of the transmission facility. Typical data sets used in a 4ESS Switch office are listed in Table E along with their primary characteristics.

**3.67** Data sets primarily function as a serial, binary, transmitter-receiver. The transmitter section converts the serial digital (binary) data from the I/O system interface into voiceband signals suitable for transmission over 2- or 4-wire line facilities. The receiver section provides the inverse function. The data set I/O system interface conforms to Electronic Industries Association (EIA) connection standards (normally RS-232C) as shown in Table E. Data set types 2048A and 2096A provide an EIA RS-449 connection interface with electrical characteristics specified by EIA RS- 423. More detailed information concerning data sets is provided in documents listed in numerical index 592-000-000. Typical data set arrangements for the 1B processor I/O system are specified in SD-5A046-01.

**Table E. Typical Data Set Characteristics**

| Data Set Type | Transmission Rate | Operation | Mode | Line | Physical Interface |
|---|---|---|---|---|---|
| 201C | 2400 b/s | Synchronous | Full-duplex | 2- or 4-Wire | RS-232C |
| 202S | 1200 b/s | Asynchronous | Half-duplex | 2-Wire | RS-232C |
| 202T | 1200 b/s | Asynchronous | (2-W half-duplex); (4-W full-duplex) | 2- or 4-Wire | RS-232C |
| 208A | 4800 b/s | Synchronous | Half- or Full-duplex | 4-Wire private line | RS-232C |
| 209A | 9600 b/s (Single-channel operation) | Synchronous | Half- or full-duplex | 4-Wire private line | RS-232C |
| 212AR | 0 — 300 b/s<br>1200 b/s | Asynchronous<br>Synchronous | Full-duplex<br>Full-duplex | 2-Wire<br>2-Wire | RS-232C<br>RS-232C |
| 2048A | 4800 b/s | Synchronous | Full-duplex | 4-Wire private line | RS-449 and RS-423 |
| 2096A | 9600 b/s (Single channel operation) | Synchronous | Full-duplex | 4-Wire private line | RS-449 and RS-423 |
| 500A | 56000 b/s | Synchronous | Full-duplex | 4-Wire private line | V.35 |

# 4. References

**4.01** Additional information pertaining to the 4ESS Switch Input/Output System can be found in the following documents.

| SECTION | TITLE |
|---|---|
| 234-000-000 | *Numerical Index—Division 234 4ESS Switch* |
| 231-090-233AC | *4ESS Switch Product Release Document — 4E23, Release 3 Generic* |
| 234-100-200 | *3B20D Model 1 Computer Attached Processor System — Application* |
| 234-100-201 | *3B20D Model 2 and Model 3 Computer Attached Processor System — Application* |
| 234-110-152 | *Input/Output Processor Frame J5A006C-1 Description and Theory* |
| 234-110-154 | *Input/Output Processor Frame J5A006D-1 Description and Theory* |
| 254-280-111 | *Input/Output Programs* |
| 592-000-000 | *Numerical Index—Division 592 — 200 Series Data Sets and Associated Services* |
| CD-4A016-02 | *Terminals Connections Circuit* |
| IM-4A000-01 | *Input Message Manual 4ESS Switch* |
| IM-4A001-01 | *Input Message Manual 4ESS/APS Switch* |
| OM-4A000-01 | *Output Message Manual 4ESS Switch* |
| OM-4A001-01 | *Output Message Manual 4ESS/APS Switch* |
| SD-4A193-01 | *IOP Alternate Signaling Capability — Applications Schematic* |
| SD-4A016-02 | *Input/Output* |

# 5. Abbreviations

**5.01** This part defines the abbreviations used in this document.

| | |
|---|---|
| A&M | Additions and Maintenance |
| ADS | Announcement Distribution System |
| AIMS | Advanced Interactive Maintenance System |
| AMASE | Automatic Message Accounting Standard Entries |
| APS | Attached Processor System |
| ASCII | American Standard Code for Information Interchange |
| ASTN | Alternate Signaling Transport Network |
| BANCS | Bell Administrative Network Communications System |
| CAROT | Centralized Automatic Reporting On Trunks |
| CLB | Circuit Layout Bureau |
| CMS | Circuit Maintenance System |
| CMSMC | Circuit Maintenance System Maintenance Center |
| COA | Circuit Order Administration |
| COAP | Circuit Order Administration Printer |
| CRT | Cathode Ray Tube |
| CSU | Communications Storage Unit |
| CTMS | Carrier Transmission Maintenance System |
| DDCMP | Digital Data Communications Message Protocol |
| DDD | Direct Distance Dialing |
| DS | Data Set |
| DSDC | Direct Services Dialing Capability |
| EADAS | Engineering and Administrative Data Acquisition System |
| EIA | Electronic Industries Association |
| ICDR | International Call Detail Recording |
| I/O | Input/Output |
| IOUC | Input/Output Unit Controller |
| IOUS | Input/Output Unit Selector |
| IRAS | Integrated Routing Assignment System |
| ISCC | International Services Coordination Center |

| | |
|---|---|
| KD | Keyboard/Display |
| KDP | Keyboard/Display/Printer |
| MAC | Machine Administration Center |
| MAS | Mass Announcement System |
| MCC | Master Control Console |
| MCRT | Maintenance Cathode Ray Tube |
| MD | Manufacture Discontinue |
| MOC | Maintenance Operations Center |
| MTC | Master Test and Control |
| MTT | Magnetic Tape Terminal |
| NC | No Circuit |
| NEMOS | Network Management Operations Support |
| NESAC | National Electronic Systems Assistance Center |
| NM | Network Management |
| NMC | Network Management Center |
| NMDT | Network Management Display Terminal |
| NMNOC | Network Management National Operations Center |
| NMPR | Network Management Printer |
| NSC | Network Services Complex |
| NSCS | Network Service Center System |
| OCDD | Online Call Detail Data |
| ODA | Office Data Assembler |
| ONAC/ADS | Operations Network Administration Center/Announcement Distribution System |
| PECC | Product Engineering Control Center |
| PINET | Packet Internal Network |
| PVT | Private |
| RBOC | Regional Bell Operating Company |
| RC | Recent Change |
| RC&V | Recent Change and Verify |
| RCDT | Recent Change Display Terminal |
| RCMOC | Recent Change Monitor Channel |

| | |
|---|---|
| RCREC | Recent Change Record |
| RCRRT | Recent Change Remote Routing Terminal |
| RNMS | Regional Network Management System |
| RMT | Remote Terminal |
| ROC | Regional Operations Center |
| ROP | Receive-Only Printer |
| RWS | Remote Work Station |
| SCANS II | Software Change Administration and Notification System |
| SCC | Switching Control Center |
| SMCC | Switching Management Control Center |
| SREC | Secondary Record |
| STA | System Terminal A |
| STBU | System Terminal Backup |
| SVOBS | Service Observing System |
| TC | Teleconferencing |
| TCA | Test Control Area |
| TCAS | T-Carrier Administration System |
| TDAS | Traffic Data Acquisition System |
| TEC | Terminal Equipment Center |
| TEM | Terminal Equipment Maintenance |
| TEMP | Terminal Equipment Maintenance Printer |
| TEMR | Terminal Equipment Maintenance Rover |
| TOC | Trunk Operations Center |
| TOPAS | Trunk Operations Provisioning Administrative System |
| TOSS | Teleconferencing Operator Support System |
| TRF | Traffic |
| TTC | Trunk Test Control |
| TTP | Trunk Test Position |

# How Are We Doing?

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Document No.: 234-100-021 Issue 8 Date: May 1998

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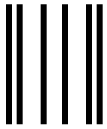

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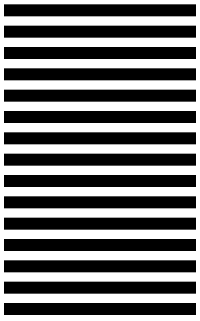

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