1270 Terminal Control Unit

Product Description Manual

2970.001

MEMOREX

Communication Products

March 1973 Edition

Memorex Corporation
Santa Clara, California 95052

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PREFACE

The Memorex 1270 Terminal Control Unit is a functional replacement for the IBM 2701 Data Adapter Unit*, the IBM 2702/2703 Terminal Control Units, and the IBM 3704/3705 Communications Controller* in emulation mode. The 1270 enables users of IBM System 360/370 to interface with a variety of local or remote communications devices.

This publication contains reference information on the features and capabilities of the 1270, a hardware component description, operating environment for the controller, and detailed programming material. Early sections of the manual are recommended reading for management, programming, operations, and maintenance personnel.

The manual is divided into five sections:

- The introduction to the 1270 Terminal Control Unit highlights its advantages in the teleprocessing environment, and provides a general discussion of prominent hardware features available to the Memorex customer.
- A systems description is included for clear understanding of the major components of the 1270 hardware and the elements of the communications network. Features, prerequisites, and interface requirements have been provided to aid in the planning of the most efficient and capable customer installation.
- Section 3 provides the reader with basic principles of operation from a programming viewpoint. The Central Processing Unit and Terminal Control Unit are described in terms of physical level input/output commands.
- Asynchronous, or Start/Stop, communications are defined and discussed in depth. Operating modes, commands, terminal controls, and other details are presented for programming and other technical personnel. 1270 features are addressed at the command level.
- Section 5 presents a full discussion of Binary Synchronous and Synchronous concepts and operations to the level required for technical personnel. Features and prerequisites are reamplified.

Appendices contain procedures, tables and other relevant reference material for the reader requiring in depth information for installion and enhancement of the Memorex 1270 TCU. A glossary and index have been included as reader aids.

*Trade name for International Business Machines Corp.

A summary of many of the communications charts and tables found in this manual are available to the 1270 Terminal Control Unit user in the Memorex Communications Data Reference Card, form number 2575.001. For comprehensive discussions of modems and the communications network in general, the following publications are recommended:

2979.001 Modems General Descriptions
2579.001 Modems Technical Descriptions

This publication supersedes:

804021 System Reference Manual
1270 Terminal Control Unit - May 1971

No # General Description Manual
1270 Terminal Control Unit - November 1970

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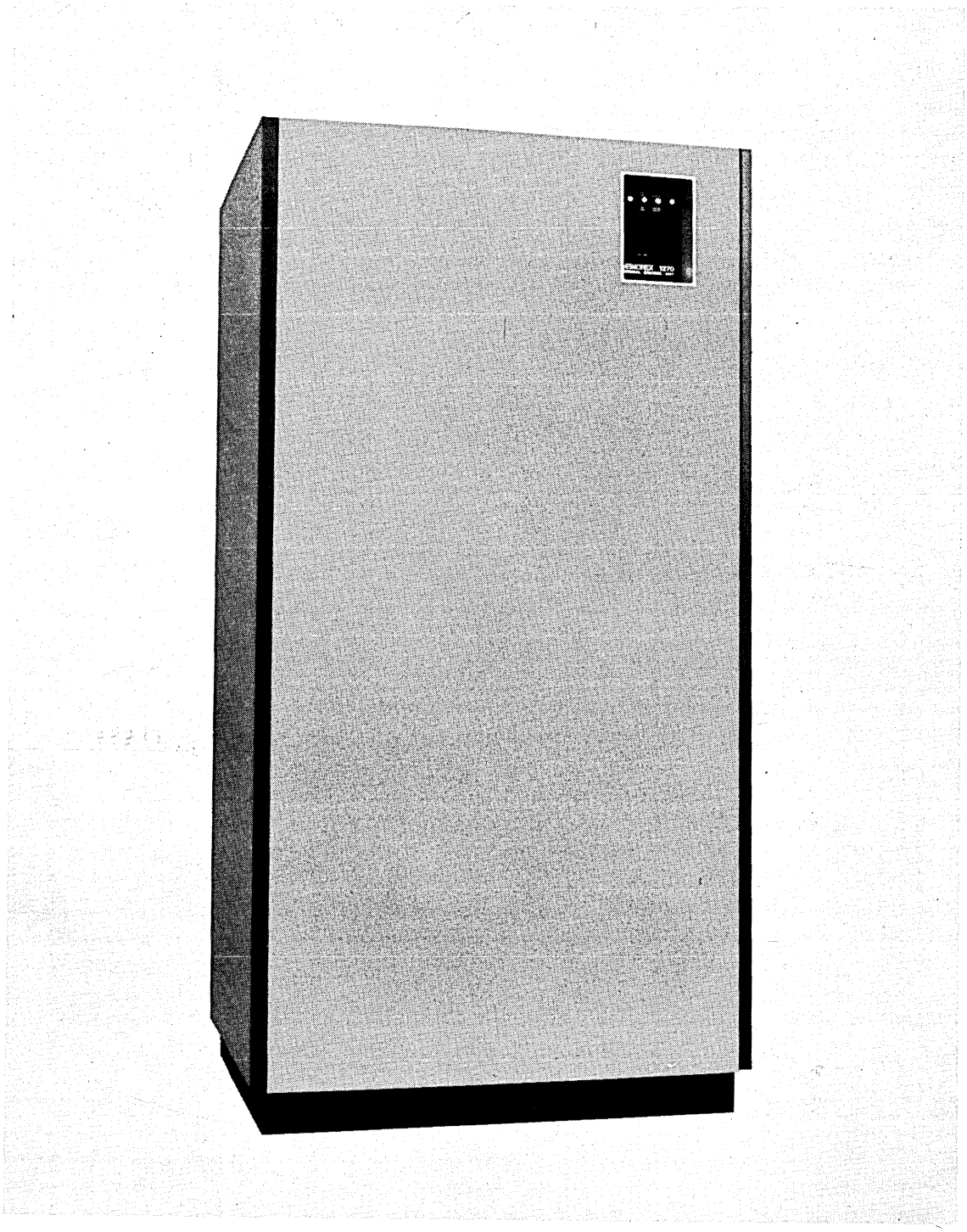


Memorex 1270 Terminal Control Unit

SECTION 1.

INTRODUCTION

The Memorex 1270 Terminal Control Unit provides the IBM* System/360 or System/370 user with a versatile interface to a wide range of communication terminals. The 1270 schedules and controls information flow between the relatively slow communication terminals and the relatively fast CPU (Central Processing Unit). Information flow between the 1270 and the terminals is directed and controlled over switched common-carrier, leased common-carrier, or equivalent privately-owned communications facilities. Figure 1-1 illustrates the types of devices that can be attached to the 1270.

The various models of the 1270 are identical in function, differing only in the features supported and in the number of communication lines available.

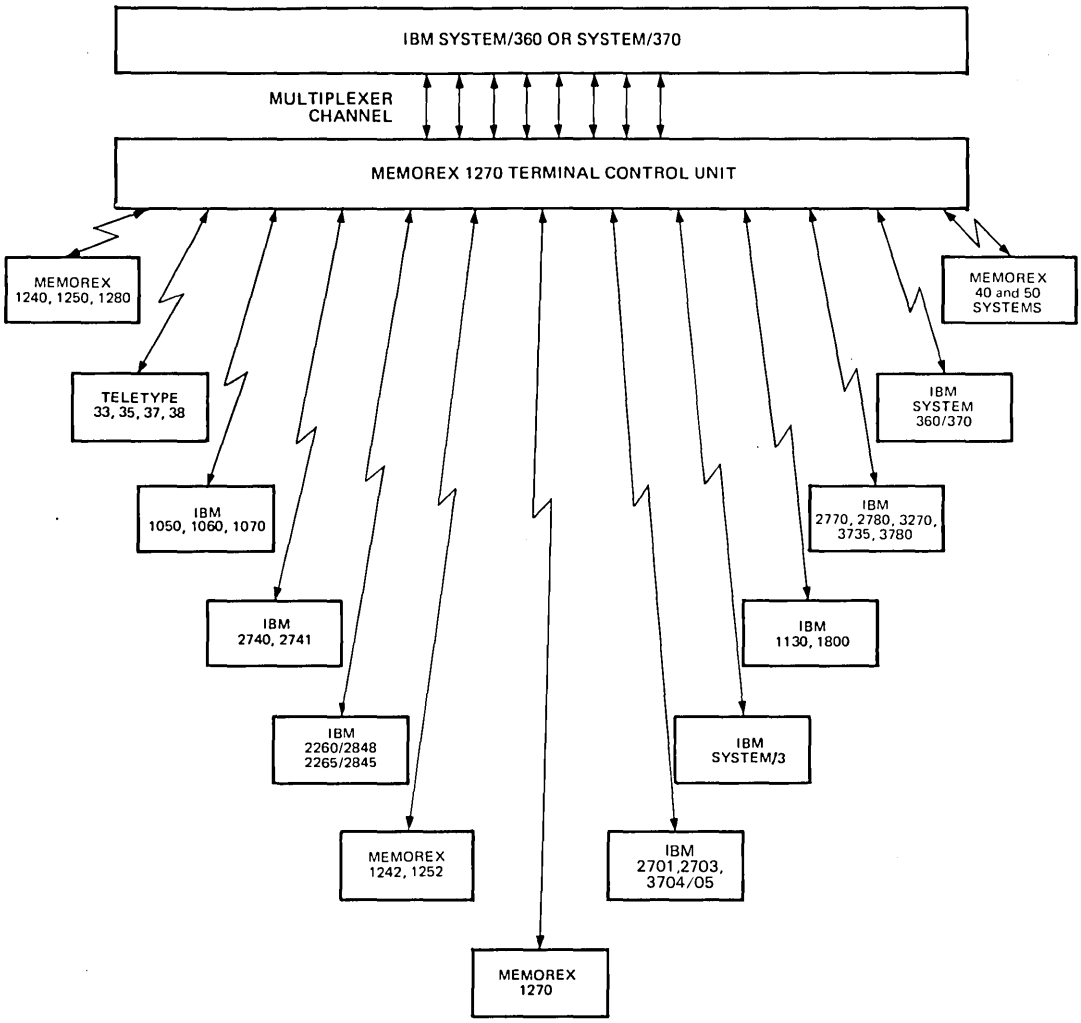


Figure 1-1. Examples of Compatible Devices

*This is a tradename for International Business Machines Corp.

ADVANTAGES OF THE MEMOREX 1270

The Memorex 1270 Terminal Control Unit offers substantial improvements in performance and capability in a single communications controller. Memorex offers its customers unique features and capability while maintaining functional compatibility with IBM programming systems.

FACILITIES

The Memorex 1270 controller is capable of operation in half- or full-duplex mode over two- or four-wire facilities for asynchronous and synchronous transmissions. Full duplex in the 1270 means that no delays occur for line turnaround and that data will be transmitted or received in one direction at a time. Asynchronous transmission facilities may be voice grade and may be switched, leased, or privately owned. Synchronous transmission facilites are supported via voice-grade and Wideband line control.

In addition to the standard EIA interface (CCITT for European operations), as defined in RS-232C, Memorex offers a series of integral modems for use with the 1270. Modems may be either Memorex Integral Modems or external Western Electric Modems (or equivalent). Section 2 provides an in-depth discussion of customer modem requirements.

FLEXIBILITY

A significant advantage of the 1270 Terminal Control Unit is the high degree of flexibility provided the Memorex customer. Installation requirements can be tailored from a vast number of configuration possibilities and feature offerings.

The Memorex 1270 enables users of IBM System 360/370 to interface with a broad range of local and remote communications devices using synchronous mode for high-speed devices which follow established IBM Binary Synchronous Communication (BSC) conventions at speeds up to 50,000 bits per second, and asynchronous mode for low-speed transmissions at line speeds which range from 110 bps to 1,200 bps (Table 1-1). The 1270 Terminal Control Unit recognizes and translates a wide variety of transmission codes including USASCII, Correspondence, PTTC, and BCD in Asynchronous mode, and EBCDIC and USASCII in BSC mode. BSC code independence via Synchronous Transparency is available.

DESIGN TECHNOLOGY

Advanced circuit technology allows Memorex to offer the user a high degree of reliability. Functional packaging and modular design result in an extremely compact, versatile device that can be field reconfigured with a minimal impact on user operations.

NETWORK DIAGNOSTICS

Memorex has developed diagnostic programs to aid in the timely isolation and correction of potential problems. Troubleshooting and preventive maintenance can be performed through unit functional test programs. The user is provided with detailed on-line monitoring and diagnostic capability through extensive control and indicator test panel functions (see Appendix B). The standard automatic wraparound (Autowrap) feature can be used to further isolate communication problems. Autowrap is discussed in detail at the end of Section 3.

TABLE 1-1. LINE SPEEDS AND CODES

Transmission Code	Mode	Bits Per Second (Baud)
USASCII	Asynchronous	110 to 1,200
BCD/PTTC or BCD/Correspondence	Asynchronous	134.5 or 600
USASCII (2260/2265)	Asynchronous	up to 9,600
USASCII or USASCII with Transparency	Synchronous	up to 9,600
EBCDIC or EBCDIC with Transparency	Synchronous (Wideband)	up to 50,000

ERROR CHECKING

Error checking conventions are compatible with IBM conventions for asynchronous and Binary Synchronous Communication modes. Asynchronous USASCII LRC (Longitudinal Redundancy Checking) is available as a special option. Parity checking can be even, odd, or not checked at all, at the user's option. Error status information is available to the user.

FEATURE HIGHLIGHTS

Memorex has developed a single communication controller that provides its customers with a number of desirable and unique features. Highlights described herein, are amplified in a more technical manner elsewhere in this manual.

Line Expansion

The 1270 Terminal Control Unit is capable of supporting from 1 to 96 communications lines through line expansion offerings.

Alternate Channel Switch

This feature permits the 1270 to be manually switched between the multiplexer channels of two separate IBM System 360/370 processors. The 1270 can be attached to only one processor at a time.

Automatic Line Connections (Autocall)

On switched (dial) networks, calls can be answered or initiated automatically. Autoanswer allows the 1270 to answer incoming calls under user program control.

The Autocall Feature allows the 1270 to initiate calls under user program control. Autocall is available on a Touch-Tone* or rotary network via the use of:

1. a Western Electric 801C with a Western Electric modem,
2. an Autocall adapter with a different modem (non-Western Electric),
3. an MRX Autocall modem.

The Autocall feature is only available with 60 Hz models (domestic and Canada).

Station Selection

The 1270 with BSC capabilities may be used on a multipoint network as a tributary (remote) station. The basic BSC-equipped 1270 is designed to operate as a Control Station on a point-to-point or multipoint basis. However, with the installation of the Station Selection feature, a BSC-equipped 1270 can be used as the tributary station.

Automatic Speed Recognition (Autospeed)

The Autospeed feature allows a variety of asynchronous dial-up terminals of different speeds (110 - 1200 bps), using BCD or USASCII communication code, to share the same Line Interfaces and modems on the 1270. Autospeed can be used effectively to optimize the usage of available line and modem facilities, thus reducing the user's overall operation costs.

Dual Speed

Dual Speed is a unique 1270 feature designed for exclusive use with Memorex modems. When installed with a 1222-2A Integral Modem, the 1270 allows two-way alternate data transmission by way of the reverse channel, thereby eliminating line turnaround.

Automatic Polling (Autopoll)

The 1270 reduces CPU interference (overhead) during POLL operations in a multipoint (multidrop) environment.

Autopad

The Autopad feature compensates for unique timing characteristics in the Memorex 1240, 1250 and and 1280 terminals, so that the enhanced capability of these terminals can be utilized without programming changes. Lines can be dedicated to Autopad or selected under program control.

*This is a tradename of Western Electric Corporation.

Line Adapters

Line adapters serve as the interface between the communications lines and the 1270. These units provide bit buffering.

- Asynchronous Adapters each support up to four asynchronous lines at speeds which range to 1,200 bits per second. With the Autospeed feature, it is possible to mix various speeds and codes on the same adapter.
- Synchronous Adapters each support up to four binary synchronous lines at speeds which range to 9,600 bits per second. Lines of varying speeds on one line adapter are possible through modem speed differences.
- Wideband Synchronous Adapters permit the attachment of wideband lines to support synchronous transmission speeds of up to 50,000 bits per second. The IBM BSC-Synchronous Terminal Control feature is required for wideband adapter use.

Line Interfaces

Line interfaces provide cabling and, in certain applications, modem functions required in attaching the 1270 to a communications network. There are several types of line interfaces, including both synchronous and asynchronous types.

- Autocall Adapters are used for interfacing to non-Bell System modems with the auto-dial capability on synchronous lines.
- 801 Autocall Adapters are used for interfacing to a Bell System 801C2 or 801C4 autocall unit via Touch-Tone facilities. Operating speeds are constrained to the normal dialing rate of the 1270 Autocall feature, which is required. Available with asynchronous, synchronous, and Wideband lines.

EIA Interface

This feature allows the 1270 to attach to Western Electric external modems (or equivalent). The signal designators and pin assignments of the interface with common-carrier data sets (asynchronous or synchronous) conform to EIA Recommended Standards 232C (EIA RS232B).

Modems

Modems are an essential part of any data communications network. Memorex offers a variety of modem equipment which can replace many Western Electric and IBM modems. Memorex Integral modems include:

1220 models - 103 compatible with full-duplex capability

1221 models - IBM TYPE I compatible Limited Distance Adapters

1222 Dual Speed - a unique Memorex offering

Terminal Control Features

The terminal control features available on the 1270 Terminal Control Unit provide communications services including bit assembly and disassembly according to unique terminal code, mode of transmission, timing considerations, control character recognition and error checking.

Up to four Asynchronous plus one Synchronous Terminal Controls may be specified in any combination. To satisfy customer requirements, the 1270 is designed to accept more than one terminal control of the same type. Tables 1-2 and 1-3 should be referenced for specific terminal devices supported by the 1270 for the following control types:

- USASCII - an asynchronous terminal control feature that provides control and validation services for supported USASCII devices such as Memorex 1240, 1250, and 1280 Communications Terminals; and Models 33 and 35 Teletype.* Odd, even, and no parity checking are supported.

- Code Convert Ia, Ib - these two terminal control features allow the high performance Memorex 1240 and 1280 Communication Terminals to be software compatible with the IBM 2741 type of terminal. Code Convert Ia translates incoming USASCII generated code into the BCD/PTTC code set and the reverse for outgoing data. Code Convert Ib provides the same kind of conversion for IBM BCD/Correspondence code. The 1270 Autopad feature is required with Code Convert I (see Autopad).

- Code Convert II - a Memorex Communication Terminal Control feature which offers software compatibility between the Memorex 1280 and IBM 2740-1 terminals, as well as the Memorex 1242 and IBM 2740-2 terminals. USASCII code is translated to the BCD code set and vice-versa. LRC checking is standard with Code Convert II.

- USASCII Checking - this feature provides all of the function and capability of the standard USASCII control described above, plus LRC checking. The feature is designed to support Memorex 1240, 1242 and 1280 Communications Terminals equipped with USASCII Checking.

- IBM TYPE I - a feature that provides control services for supported IBM asynchronous devices. VRC and LRC checking, autopolling, 2471 break and TYPE I interrupt features are included with this terminal control. Three code groupings are supported: Correspondence, PTTC (Paper Tape Transmission Code)/EBCD, and PTTC/BCD.

- IBM TYPE III - this feature provides validation and control functions for remote IBM 2848 and 2845 Display Controllers. Asynchronous speeds of up to 9600 bps are supported; however, for speeds of 1200 bps or more, data set clocking (in lieu of internal clocking) and synchronous line adapters are required.

- IBM BSC-Synchronous - provides line control services for synchronous terminals (or stations) which conform to the IBM Binary Synchronous Communications (BSC) Conventions. Autopolling and EBCDIC and USASCII codes are included in this support.

  Synchronous Transparency is provided to allow for the unrestricted use of all bit patterns within each transmission code type using a special procedure for control character recognition.

*This is a tradename of the Teletype Corporation.

TABLE 1-2.

ASYNCHRONOUS TERMINALS SUPPORTED (USASCII, PTTC/EBCD, PTTC/BCD, Correspondence)

TERMINAL TYPE	SPEED (bps)*	TERMINAL TYPE	SPEED (bps)*
MRX 1240	110,150,300,600	TTY 37	150
MRX 1242	1200	IBM 1050	134.5
MRX 1250	110,150,300,600	IBM 1060	134.5
MRX 1252	1200	IBM 1070	134.5 or 600
MRX 1280	110,150,300, 600,1200	IBM 2740	134.5 or 600
		IBM 2741	134.5
TTY 33	110	IBM 2260/2848	up to 9600
TTY 35	110	IBM 2265/2845	up to 9600

TABLE 1-3.

BINARY SYNCHRONOUS TERMINALS SUPPORTED (USASCII, EBCDIC, and TRANSPARENCY)

TERMINAL TYPE	SPEED (bps) **	TERMINAL TYPE	SPEED (bps)**
MRX 1270	50,000 Maximum	IBM 2770	7200 Maximum
MRX/40 and 50	9600 Maximum	IBM 2780	4800 Maximum
IBM 1130	4800 Maximum	IBM 3270 **	4800 Maximum
IBM 1800	4800 Maximum	IBM 3704/05**	50,000 Maximum
IBM 2020	50,000 Maximum	IBM 3735 **	2400 Maximum
IBM 2701	50,000 Maximum	IBM 3780 **	7200 Maximum
IBM 2703	4800 Maximum	IBM SYSTEM/3	50,000 Maximum

*Speeds are terminal limitations.

** IBM speeds are current published maximums.

SECTION 2.

SYSTEM DESCRIPTION

GENERAL

The 1270 accommodates 1 to 96 communication lines. In communicating with a remote terminal, the 1270 transmits and receives serially by bit. The 1270 provides internal character buffering of up to eight bytes for both asynchronous (start/stop) and synchronous communication terminals. Asynchronous terminals, using the USASCII or BCD code set, are supported by the 1270 at speeds of 110, 134.5, 150, 300, 600, and 1200 bits per second (bps). BSC terminals, using the USASCII or EBCDIC code set, are supported by the 1270 at speeds of up to 9600 bps. The 1270 will also support synchronous transmission over Wideband lines at speeds up to 50.0 K bps.

The 1270 attaches to the multiplexer channel of the IBM System/360 or System/370. When communicating with the channel, the 1270 operates in multiple-byte multiplex mode to request and transfer data to or from the CPU. Data is transferred in bursts of up to four bytes during any one I/O channel servicing cycle.

The 1270 does not impose restrictions on message length and can accommodate transmission codes not exceeding eight-level, eleven-unit structure (eight data bits and three start/stop bits).

I/O INTERFACE

The multiplexer channel directs the flow of information between main storage and the 1270. The 1270 occupies one control unit position on the multiplexer channel. When communicating with the channel, the 1270 operates in multiple-byte multiplex mode to transfer information between the CPU and various remote communication terminals attached to the 1270. In the multiplex mode, the single data path between the channel and the 1270 is time-shared by the remote terminals attached to the 1270. The multiplexer channel functionally divides this single data path into many subchannels. Each communication line attached to the 1270 is assigned to one of these subchannels. The number of subchannels provided by the multiplexer channel is established by the System 360/370 model (Figure 3-1).

Channel Attachment Considerations

Restrictions

The following restrictions pertain to the attachment of a 1270 to the multiplexer channel:

1. The control unit position of the 1270 on the multiplexer channel may vary in different installations. As a rule, TCUs receive high priority (first control unit position) and are not positioned after low-speed peripheral devices such as printers. When two 1270s are attached to the same multiplexer channel, they will have sequential priority.

2. The 1270 data transfer rate must not exceed the aggregate data rate for the multiplexer channel.

3. The maximum line speeds for lines attached to the 1270 are:

   Asynchronous (Start/Stop) type lines - 1200 bps
   (IBM TYPE III up to 9600 with data set clocking)
   Synchronous (BSC) type lines - 9600 bps
   Synchronous Wideband (BSC) lines - 50,000 bps

Installation

Refer to Appendix D for multiplexer channel cabling, and other general installation requirements, for Domestic and Canadian (60 Hz), and other countries (50 Hz) systems.

TERMINAL CONTROL UNIT DESCRIPTION

Major Components and Features

The main functional sections of the 1270 Terminal Control Unit are the I/O (input/output) Control, the Terminal Control, the Assemble/Disassemble Section and the Line Control Section (see Figure 2-1). These are described in the following paragraphs.

I/O Control Section

The I/O Control Section is the functional interface between the 1270 and the multiplexer channel of the CPU. This section controls the interchange of communication between the channel and the 1270. The I/O Control decodes data and command signals from the channel and transmits data and status signals to the channel. Data is received from the channel in parallel, one byte at a time, and stored in a 4-byte buffer

The I/O Control Section provides a temporary buffer for up to 4 bytes of incoming data and transfers it to the Terminal Control Section. For data transfer to the channel, the I/O Control Section receives data or status bytes from the Terminal Control Section, provides a temporary buffer for the outgoing byte, and then transfers the byte to the channel.

ALTERNATE CHANNEL SWITCH FEATURE

The Alternate Channel Switch feature enables the 1270 to be manually switched between the multiplexer channels of two separate IBM System/360/370 processors. When this feature is installed, the CHANNEL A/B switch on the 1270 control panel permits the 1270 operator to manually select an alternate multiplexer channel connection in the system if problems develop at the channel that is currently being used.

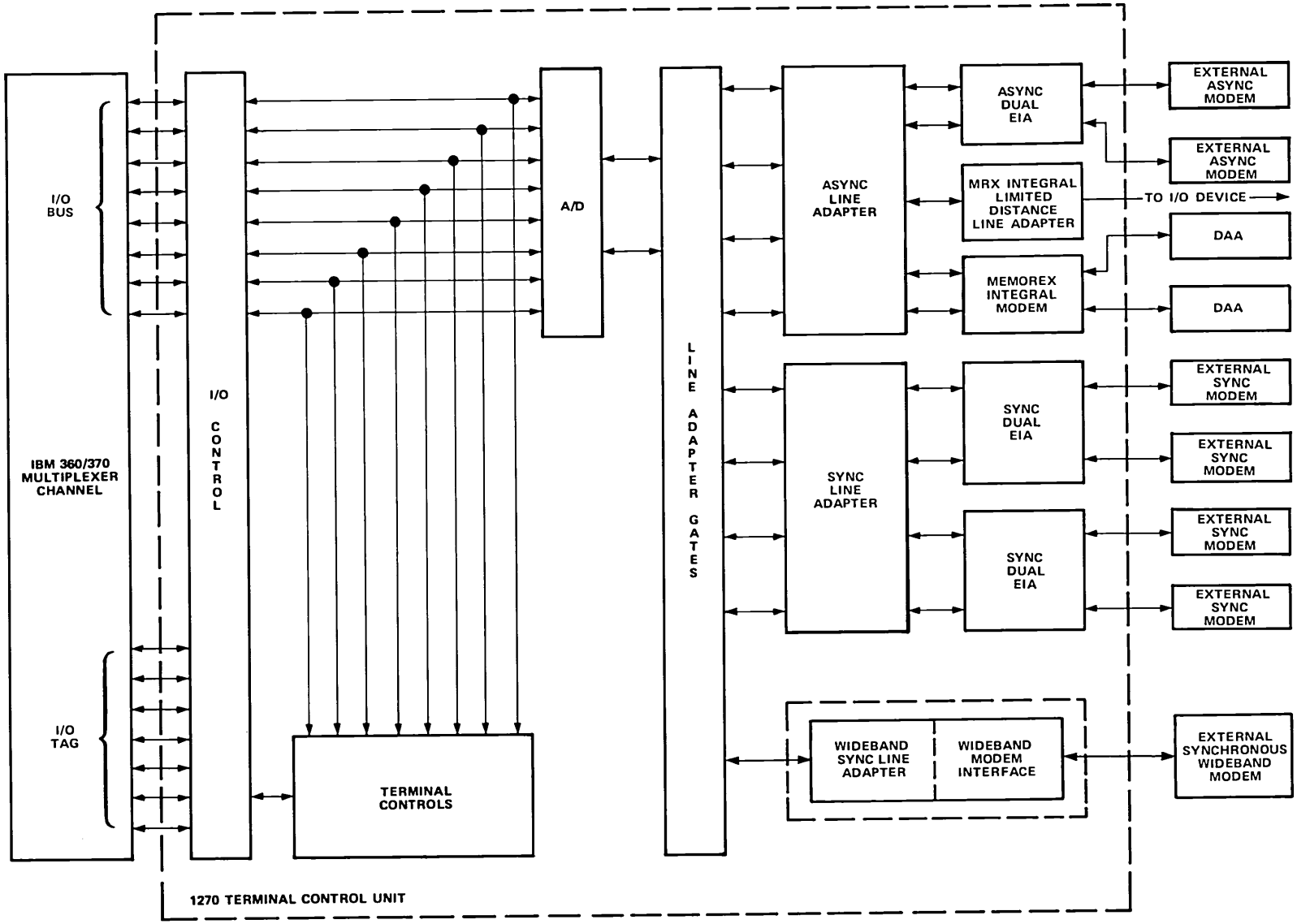


Figure 2-1. 1270 Block Diagram

Terminal Control Section

The Terminal Control Section consists of at least one terminal control feature (USASCII, IBM TYPE I, IBM TYPE III, USASCII Checking, Code Convert I, Code Convert II, and/or Synchronous) which performs the control functions required to communicate with a particular type of terminal equipment. These functions include character sequencing, control-character recognition, and character length definition. The 1270 provides both synchronous and asynchronous (start/stop) terminal support. A maximum of four asynchronous terminal control features (USASCII, IBM TYPE I, IBM TYPE III, USASCII Checking, Code Convert Ia, Ib, or Code Convert II) and one Synchronous Terminal Control feature (includes both USASCII and EBCDIC codes) are allowed in the 1270 Terminal Control Section. With the exception of Autospeed, terminal control features are assigned to specific line adapters (synchronous and asynchronous), and all communication lines connected to each line adapter must be of the same terminal type. Detailed descriptions of asynchronous and synchronous terminal control operations are provided in Sections 4 and 5, respectively.

AUTOCALL FEATURE

The Autocall feature enables the 1270 to originate calls on a switched communication network by processing DIAL commands issued by the IBM System/360/370 user application programs. This permits the 1270 to establish a communication link with a remote terminal, via an asynchronous or synchronous communication line, without manual intervention. (See page 6 for information on use with Autospeed feature.)

The Autocall feature is supported by one or more of the following communication line interface combinations:

1. An Asynchronous Line Adapter and Memorex Integral Modems (1220-B2, 1222-2A) interfacing to a Bell Systems CBT 1001B Automatic Data Access Arrangement (ADAA) in an autocall environment.

2. An Asynchronous Line Adapter and the 801 Autocall Adapter interfacing to a Bell 801C2 or 801C4 Autocalling Unit in a Touch-Tone autocall environment with an asynchronous Western Electric Autocall modem.

3. A Synchronous Line Adapter and the synchronous Autocall Adapter interfacing to non-Western Electric Autocall modems in an autocall environment.

4. A Synchronous Line Adapter and the 801 Autocall Adapter interfacing to a Bell 801C2 or 801C4 Autocalling Unit in a Touch-Tone autocall environment.

The Autocall feature is available only with 60 Hz models (Domestic and Canadian) of the 1270.

AUTOSPEED FEATURE

The Autospeed feature enables the 1270 to control a variety of asynchronous terminals with different speed and code characteristics. An asynchronous line adapter plugged for Autospeed will automatically adjust the 1270 clocking rate to inbound and outbound data based on the first character transmitted or received. At least one asynchronous terminal control (USASCII) and one Asynchronous Line Adapter are required for Autospeed operation. Terminal speeds supported by the Autospeed feature include 110, 134.5, 150, 300, 600, and 1200 bits per second (bps). Modem limitations, rather than the Memorex 1270, normally result in line speeds to 110-300, or 600-1200 bits per second.

When using autodial with receive answer back equipment (drum or cassette) and Autospeed, the first character on the drum must be the speed select character followed by one or two FF's, depending on line speed.

For an illustration of the characters used to set clocking and how the characters look to the 1270 when sampled at 600 bps, see Figure 2-2.

Baud Rate	Character Rcv'd.	Character Sent		
	Bits	SB	Bits	Symbol
1200	1 1 ? ? ? ? ? ?	0	0 1 1 1 1 0 1 P	^
600	1 0 1 0 1 1 0 P	0	1 0 1 0 1 1 0 P	5
300	0 1 1 1 1 1 1 1	0	1 1 1 1 0 0 1 P	O
150	0 0 0 1 1 1 1 0	0	1 0 0 1 1 0 1 P	Y
134.5	0 0 0 0 0 0 0 0	0	0 0 0 1 0 1 1 0	Ⓓ
110	0 0 0 0 ? 1 1 1	0	1 1 0 0 1 0 1 P	S

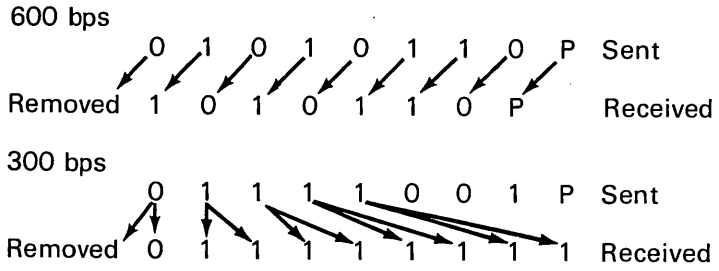
1200 Decode Bits — Other Baud Rate Decode Bits — All Baud Rate Decode Bits

Figure 2-2. Autospeed Character Sample

For a Read type operation, the first two bits of the incoming character from the terminal are examined for the 1200 bit rate indication (two 1 bits). If two 1 bits are not present, then bits 3, 4, and 7 are examined to determine the bit rate as follows:

Bit Position 3, 4, & 7	Bit Rate
100	600 bps
111	300 bps
011	150 bps
000	134.5 bps
001	110 bps

Keeping in mind that the line is being sampled at 600 bps and the start bit is removed, the following illustration shows how the character received is derived from the character sent.



When the 300 bps symbol is sampled at 600 bps, each bit sent represents two bits received. Each 150 bps symbol represents four bits received, etc.

When transmitting from the CPU to the terminal, bits 3, 4, and 5 of the transmitted character are used to derive the speed. Once the clocking rate has been determined, it remains in effect until it is reset by a DISABLE command.

AUTOPAD FEATURE

The Autopad feature provides software compatibility by automatically compensating for Memorex 1240/1280 carriage return/line timing characteristics. This feature may be used with all asynchronous Terminal Controls except IBM Type III. It is required with Code Convert I and Code Convert II Terminal Controls. The Autopad feature may be program selected and de-selected (via set mode commands) for operation on individual, pre-designated communication lines dedicated to a given asynchronous Terminal Control. It also may be dedicated to operate with a given asynchronous Terminal Control for all lines assigned to that Terminal Control.

STATION SELECTION FEATURE

A 1270 equipped with BSC Terminal Control may be operationally used as a control station, or may be used in a synchronous-equipped, multipoint network as a tributary (remote) station. The basic 1270 equipped with the Synchronous Terminal Control feature is designed to operate as a control station on a point-to-point or multipoint basis. However, with the installation of the Station Selection feature, a BSC equipped 1270 can be used as a tributary station, thus allowing it to exist as a remote station on a multipoint line with other similar BSC terminals (see Figure 2-3).

The station selection feature eliminates interference that would otherwise be caused by interstation transmission on the line. Thus, the CPU is interrupted only when the 1270's selection or polling address is received and transferred to main storage, at which point main storage can be interrogated for proper program action.

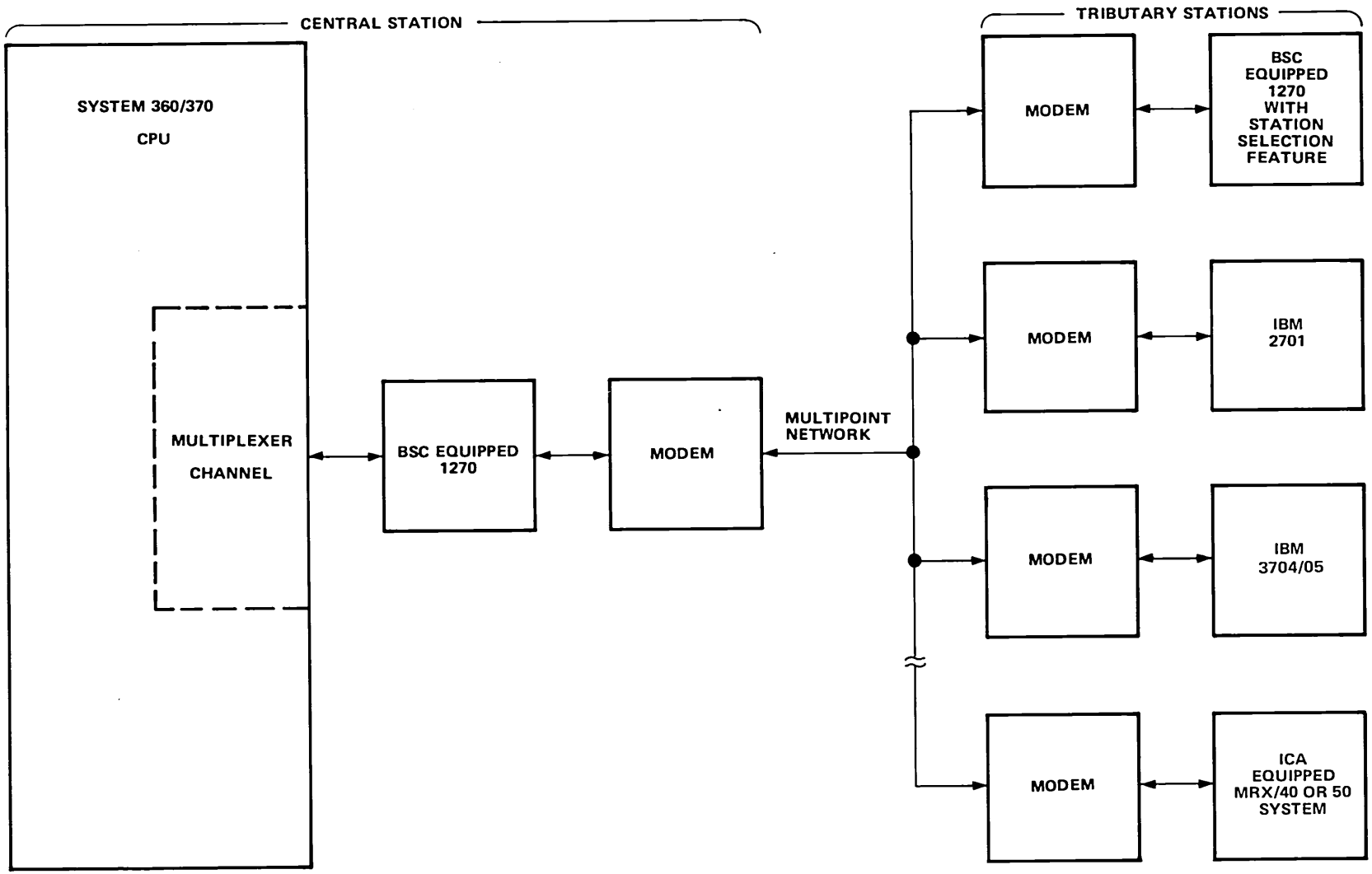


Figure 2-3. BSC Equipped 1270 in Multipoint Configuration

The Station Selection feature is required when the 1270 is attached to a multipoint network and the station is operating as a remote station.

Synchronous-equipped stations can operate on the same multipoint lines, provided they (1) all use the same transmission code, (2) all utilize the same error checking features, (3) all are able to handle the same optional features and special operations, and (4) all operate at the same line speed. The Station Selection feature implements two additional commands: ADDRESS PREPARE (ADPREP) and SEARCH.

Assemble/Disassemble Section

The Assemble/Disassemble (A/D) Section converts outgoing data from parallel to serial, and incoming data from serial to parallel. It stores the data byte being transmitted or received. Data in the A/D Unit can be shifted one bit position at a time until the entire eight-bit character is transferred.

Line Interface Section

The Line Interface Section attaches selected communication lines to the 1270. This section consists of line adapter gates, line adapters, and line interfaces (EIA, modems).

Line adapter gates permit passage of data from the 1270 A/D Section to the selected line adapter or vice-versa (Figure 2-1). The line adapter gates also condition and route control signals and responses from the line adapters to the Terminal Control Section of the 1270.

ASYNCHRONOUS LINE ADAPTER

The Asynchronous Line Adapter provides addressing for data transfer between the 1270 equipped with one or more Asynchronous Terminal Controls. Each Line Adapter supports up to two Line Interfaces (up to four lines each) and must be dedicated to the same line speed (or modem restrictions) and terminal control. Asynchronous communication lines speeds supported are 110, 134.5, 150, 300, 600, and 1200 bps. The Autospeed feature allows various line speeds and codes to be serviced by the same Asynchronous Line Adapter. The following limitations apply to communication lines that can be connected to the same Asynchronous Line Adapter:

1. All lines must be dedicated or have Autospeed
2. Speed - all the same at 110, 134.5, 150, 300, 600, or 1200 bps for dedicated lines
3. Line Type - all switched (dial) or all leased
4. Modem Characteristic - all half duplex or all full duplex

Any group of lines not conforming to the above criteria will require additional line adapters.

SYNCHRONOUS LINE ADAPTER

The Synchronous Line Adapter provides addressing for data transfer between the 1270 equipped with a Synchronous Terminal Control or an IBM Type III Terminal Control and up to four synchronous communication lines at speeds up to 9600 bps. Since the external modems must supply the clocking

for inbound and outbound data, lines of varying speeds may be attached to the same Synchronous Line Adapter. The following limitations apply to line mix on the same Synchronous Line Adapter:

1. Code Type - all USASCII or all EBCDIC
2. Modem Characteristic - all half duplex or all full duplex
3. Switched or leased line.

Any group of lines not conforming to the above criteria will require additional line adapters.

WIDEBAND LINE ADAPTER

This feature enables the 1270 to support synchronous transmission over wideband lines at speeds of up to 50,000 bits per second. One Wideband Line Adapter is required for each Wideband line. The 1270 supports up to two Wideband Line Adapters. Synchronous Line Adapter and EIA Interface features are included with the Wideband Line Adapter feature. A prerequisite for the Wideband Line Adapter feature is the BSC Synchronous Terminal Control feature. The Wideband Line Adapter interfaces to the following Bell data sets:

Speed	Data Set
19.2 K bps	Western Electric 303B
40.8 K bps	Western Electric 301B
50.0 K bps	Western Electric 303C

Wideband Line Adapters must occupy the first two (0 and 1) line addresses of the 1270. Addresses 2 and 3 (if used) must be for synchronous lines, and they require the appropriate synchronous Line Adapter and Line Interface.

ASYNCHRONOUS LINE INTERFACES

Asynchronous communication line interfaces available with the 1270 include the Asynchronous Dual EIA feature, Memorex Integral Modems (described in detail on the following pages), and the 801 Autocall Adapter feature. See Figure 2-4 for a block diagram of asynchronous line interfaces.

Asynchronous Dual EIA

The Asynchronous Dual EIA feature performs the interface functions necessary to attach external modems to Asynchronous Line Adapters in the 1270. The Asynchronous Dual EIA feature will support two asynchronous communication modems (lines).

Asynchronous Dual CCITT

The Dual CCITT feature is functionally identical to the Asynchronous Dual EIA feature with the exception of additional control lines for European modems. The Dual CCITT interface will support two asynchronous communication lines.

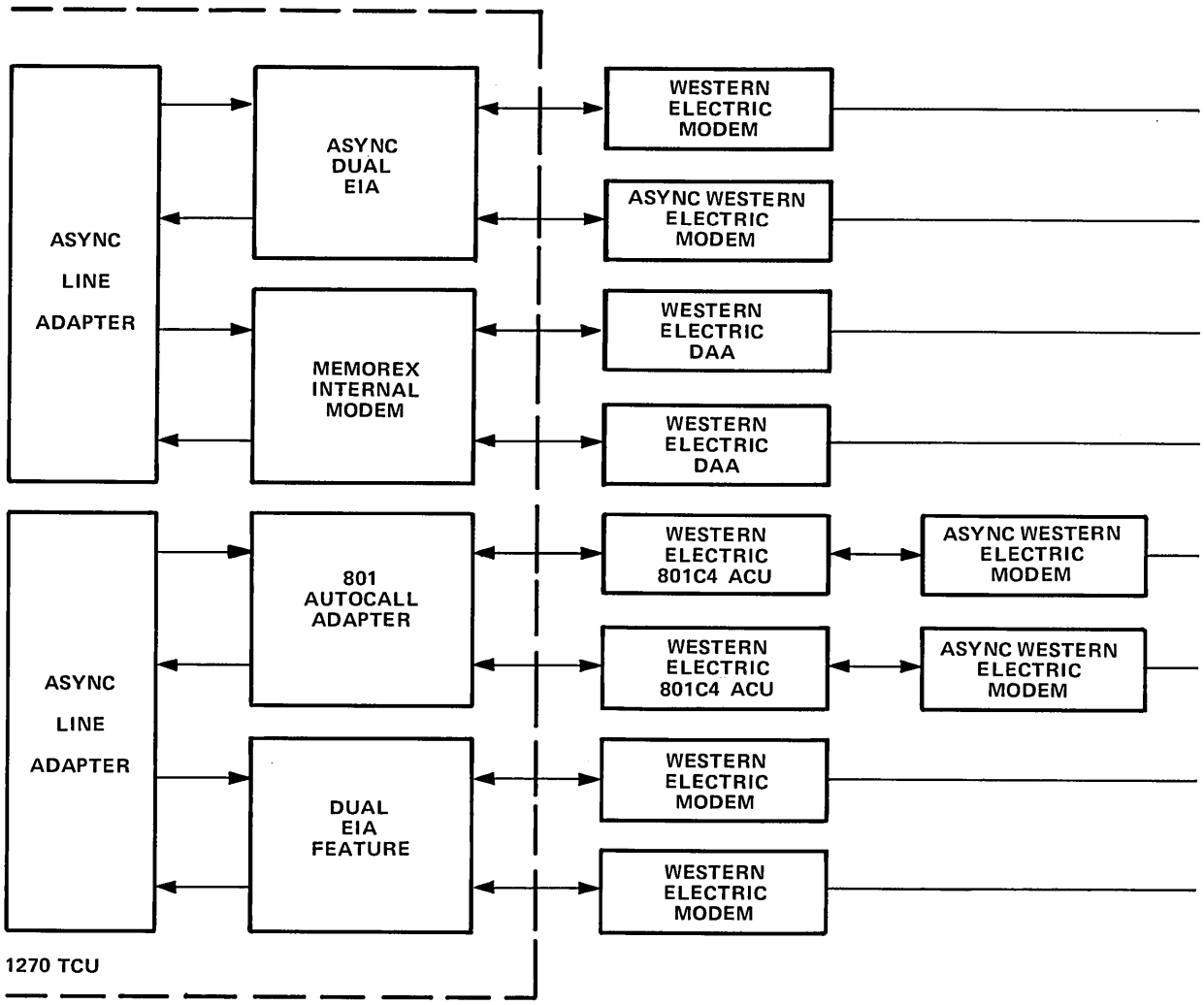


Figure 2-4. Asynchronous Line Interfaces

Memorex Dual Integral Modems

Memorex Integral Modems are available for internal installation in the 1270. They allow for attachment of two asynchronous lines with DAA's. Refer to Figure 2-5 for a list of the Memorex Integral Modems used with the 1270.

Memorex 1220 B2 Modem

This integral modem is compatible with Western Electric 103 series modems and is capable of full duplex transmission over switched lines. The 1220 B2 is capable of operating speeds up to 300 bits per second. When operating in conjunction with the Autocall feature, the 1220 B2 provides autocall/autoanswer capabilities. Prerequisites for the 1220 B2 modem are at least one Asynchronous Terminal Control feature, one Asynchronous Line Adapter, and one of the following Bell System Data Couplers: 1001B (CBT), 1001D, 1000A (CDT), or F58118.

MEMOREX MODEM	TYPE		COMMUNICATION FACILITY					OPERATE MODE				DATA RATE (BITS/SEC)							EQUIVALENT MODEMS									
																			BELL SYSTEM					IBM				
	ASYNCHRONOUS	SYNCHRONOUS	LEASED	DIAL-UP	2-WIRE	4-WIRE	POINT-TO-POINT	ORIGINATE	AUTO DIAL	ANSWER	AUTO ANSWER	0-300	0-600	0-1200	1000	2000	2400	4800	103A	103E	201A	201B	202C	LD-1A	LD-1B	LD-2A1	LD-2A2	LD-2B
1220-B2	X			X	X		X	X	X	X	X	X							X	X								
1221-LD1	X		X		X	X	X					X												X	X			
1221-LD2	X		X		X		X					X	X													X	X	X
1222-2 A	X			X	X		X	X	X	X	X				X	X												
1220-DA	X			X	X		X			X	X	X							X	X								

Figure 2-5. Memorex Integral Modems

Memorex 1220 DA Modem

This integral modem is compatible with Western Electric 103 series data sets and is capable of full duplex transmission over switched lines at speeds up to 300 bits per second. The 1220 DA also provides an autoanswer facility. Prerequisites for the 1220 DA modem are at least one Asynchronous Terminal Control feature, one Asynchronous Line Adapter, and a Bell System CBT 1001B Data Coupler.

Memorex 1221-LD1 Modem

The 1221-LD1 modem is compatible with the IBM Limited Distance Line Adapter (IBM Type I support) for transmission over two-wire or four-wire leased networks. The 1221-LD1 is capable of transmissions up to 4.5 miles at speeds of 134.5 bits per second. Prerequisites for the 1221-LD1 modem are an IBM Terminal Control feature and at least one Asynchronous Line Adapter.

Memorex 1221-LD2 Modem

This integral modem is compatible with the IBM Limited Distance Line Adapter, Type 2B, for transmission over two-wire leased or private line facilities. The 1221-LD2 Integral Modem is capable of transmissions up to eight wire miles at speeds of 134.5 or 600 bits per second. A prerequisite for the 1221-LD2 modem is at least one IBM Terminal Control feature on the 1270 and line adapter.

Memorex 1222-2A Modem

This integral modem is a Memorex exclusive and is therefore only compatible with a Memorex 1222 Integral Modem at the terminal and of the communication line facility. The modem is capable of dual-speed transmission in opposite directions, provides autoanswering service, autodial when Autocall feature selected, and operates at the following transmit/receive speeds:

Transmit/Receive
1200 bps/150 bps
600 bps/150 bps
150 bps/600 bps
150 bps/1200 bps

A prerequisite for the 1222-2A modem is the Dual Speed feature on the 1270. One of the following Bell System Data Couplers is also required: 1001B (CBT), 1001D, 1000A (CDT), or F58118.

801 Asynchronous Autocall Adapter

The 801 Autocall Adapter (in conjunction with the Autocall feature) performs the interface, translation, and control functions required for operation of Bell System 801C4 Automatic Calling Units (801 C4 ACU-parallel tone -- Bell Touch-Tone) along with compatible Western Electric or equivalent modems. The 801 Autocall Adapter feature is designed to operate in conjunction with the basic Autocall feature in the 1270.

The 801 Autocall Adapter will service two asynchronous communication lines and interfaces with the 1270 line adapter exactly the same as the Dual EIA feature.

SYNCHRONOUS LINE INTERFACES

Synchronous line interfaces available with the 1270 include the Synchronous Dual EIA feature, the Wideband Line Adapter feature, the Autocall Adapter feature, and the Synchronous 801 Autocall Adapter. See Figure 2-6 for a block diagram of synchronous line interfaces.

Synchronous Dual EIA Feature

The Synchronous Dual EIA feature performs the interface functions required to attach external modems to Synchronous Line Adapters in the 1270. The Synchronous Dual EIA feature will support two synchronous communication lines.

Synchronous Autocall Adapter

The Autocall Adapter feature provides the interface functions required to attach non-Memorex and non-Bell modems to the 1270 in an Autocall environment. The Autocall Adapter feature is designed to operate with the basic Autocall feaure in the 1270.

The Autocall Adapter feature will support two synchronous communication lines which interface with the corresponding line adapters. This feature will not support reverse channel disciplines (i.e., Western Electric 2002C type reverse channel capability).

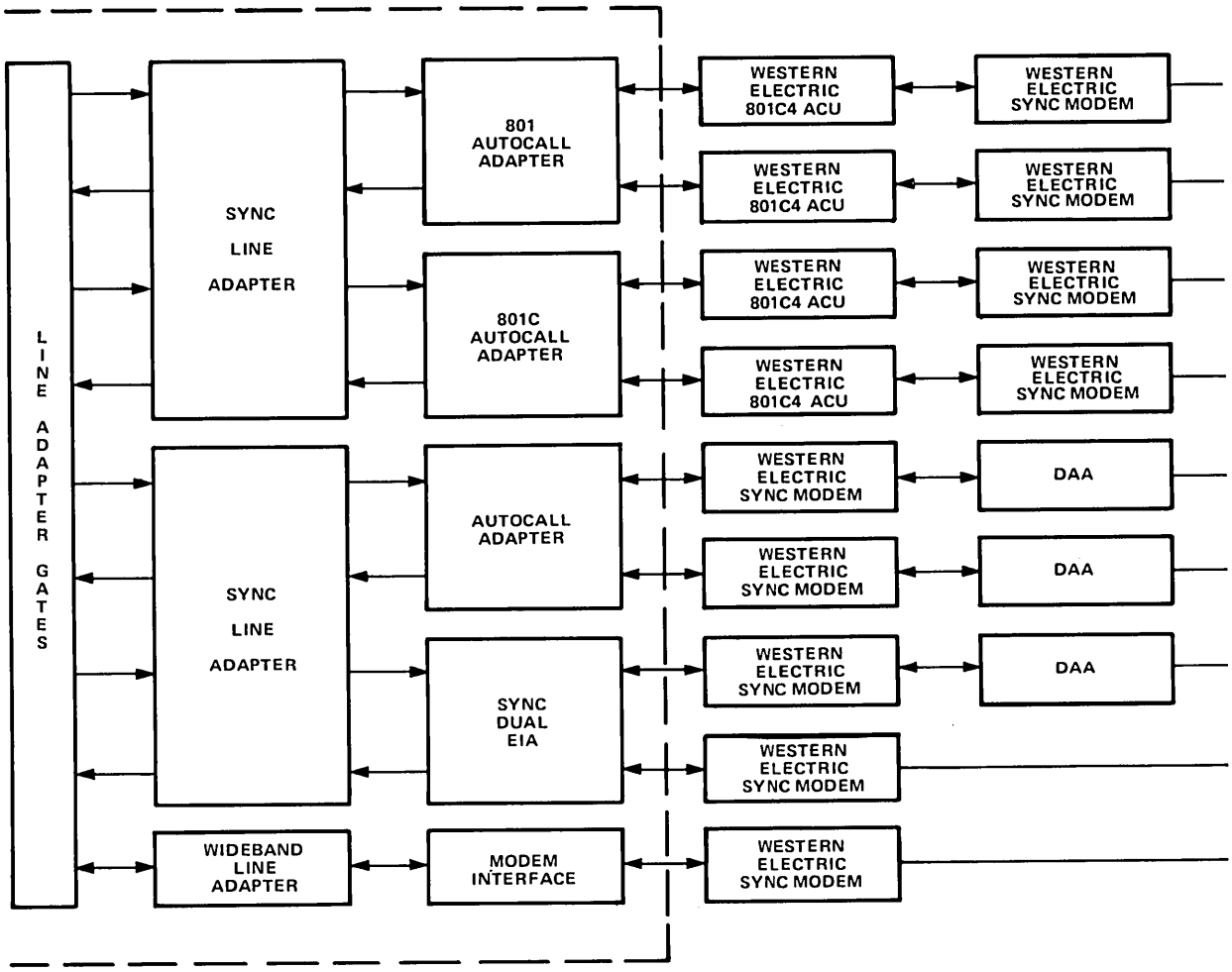


Figure 2-6. Synchronous Line Interfaces

801 Synchronous Autocall Adapter

The 801 Autocall Adapter (in conjunction with the Autocall feature) performs the interface, translation, and control functions required for operation of Bell system 801C4 Automatic Calling Units (801C4 ACU-parallel tone -- Bell Touch-Tone) along with compatible Western Electric or equivalent modems. The 801 Autocall Adapter will service two synchronous communication lines and interfaces with the 1270 line adapter exactly the same as the Dual EIA feature.

COMMUNICATION FACILITIES

Communication equipment that can be connected to the 1270 is listed in Tables 2-1 and 2-2. Table 2-1 lists attachable terminals and communication facilities for asynchronous communication. Table 2-2 lists attachable terminals and communication facilities for synchronous communication.

TABLE 2-1.
ATTACHABLE TERMINALS AND COMMUNICATION FACILITIES
FOR ASYNCHRONOUS COMMUNICATION (Page 1 of 2)

TERMINAL	SPEED (bps)	COMMUNICATION FACILITY	DATA SET
IBM 2260 2265	2400	Common-carrier leased private line service	Western Electric 201B or equivalent
	4800	Common-carrier leased private line service	Western Electric 203 or equivalent
Memorex 1240 1250,1280	110	Common-carrier switched telephone network	Memorex 1220 DA, 1220 B2, or Western Electric or equivalent
		Common-carrier switched (150 baud) TWX network	Western Electic 103A1 or equivalent
Teletype Models 33/35	110	Common-carrier switched 150 baud TWX network	Memorex 1220 DA, 1220 B2, or Western Electric 103A or equivalent
Memorex 1240 1250,1280	150 or 300	Common-carrier switched telephone network	Memorex 1220 DA, 1220 B2, or Western Electric or equivalent
		Common-carrier switched (150 baud) TWX network	Western Electric 103A1 or equivalent
Teletype Model 37	150	Common-carrier switched 150 baud TWX network	Western Electric 103A1 or equivalent
Memorex 1240 1250,1280	600	Common-carrier switched Telephone service	Memorex 1222 Dual-Speed Western Electric 202C or equivalent
Memorex 1280	1200	Common-carrier leased private line telephone service	Memorex 1222 Dual-Speed Western Electric 202C or equivalent
Memorex 1242	1200	Common-carrier leased private line telephone service	Western Electric 202D or equivalent

TABLE 2-1.
ATTACHABLE TERMINALS AND COMMUNICATION FACILITIES
FOR ASYNCHRONOUS COMMUNICATION (Page 2 of 2)

TERMINAL	SPEED (bps)	COMMUNICATION FACILITY	DATA SET
IBM 1050	134.5	Common-carrier switched telephone network	Memorex 1220-DA, 1220-B2 or Western Electric 103A2 or equivalent
		Common-carrier switched (150 baud) TWX network	Western Electric 103A1 or equivalent
		Common-carrier leased private telephone service	Western Electric 103F2 or equivalent
			Memorex 1221-LD1 or LD2
IBM 1060	134.5	Common-carrier leased private line telephone service	Western Electric 103F2 or equivalent
			Memorex 1221-LD1 or LD2
IBM 2740/ 2741	134.5	Common-carrier switched telephone network	Memorex 1220-DA, 1220-B2 or Western Electric 103A2 or equivalent
		Common-carrier switched (150 baud) TWX network	Western Electric 103A1 or equivalent
		Common-carrier leased private line telephone service	Western Electric 103F2 or equivalent
			Memorex 1221-LD1 or LD2
IBM 2740 Model 2	600	Common-carrier leased private line telephone service	Western Electric 202D or equivalent
			Memorex 1221-LD2
IBM 2260 2265	1200	Switched telephone network	Western Electric 202C or equivalent
	1200	Common-carrier leased private line service	Western Electric 202D or equivalent
	2000	Switched telephone network	Western Electric 201A or equivalent

TABLE 2-2.
ATTACHABLE TERMINALS AND COMMUNICATION FACILITIES
FOR SYNCHRONOUS COMMUNICATION

SPEED (bps)	COMMUNICATION FACILITY	MODEM	SUPPORTED DEVICES
2000	Switched common-carrier line	Western Electric 201A or equivalent	Memorex 1270, MRX/40 or 50 Systems. IBM 360/370, SYSTEM/3, 1130, 1800, 2701, 2703, 2020, 2770, 2780, 3270, 3704/05, 3735, 3780
2400	Leased private (voice grade) line	Western Electric 201B or equivalent	(as described above)
4800	Leased private line	Western Electric 203A or equivalent	Memorex 1270, MRX/40 or 50 Systems. IBM 360/370, SYSTEM/3, 1130, 1800, 2701, 2703, 2020, 2770, 2780, 3270, 3704/05, 3780
7200	Leased private line	Western Electric 203A or equivalent	Memorex 1270, MRX/40 or 50 Systems. IBM 360/370, SYSTEM/3, 2701, 2020, 2770, 3780, 3704/05
9600	Leased private line	Unspecified	Memorex 1270, MRX/40 or 50 Systems. IBM 360/370, SYSTEM 3, 2701, 2020, 3704/05
19,200	Wideband	Western Electric 303B or equivalent	Memorex 1270 IBM SYSTEM/3, 2701, 2020, 3704/05
40,800	Wideband	Western Electric 301B or equivalent	Memorex 1270 IBM SYSTEM/3, 2701, 2020, 3704/05
50,000	Wideband	Western Electric 303C or equivalent	Memorex 1270 IBM SYSTEM/3, 2701, 2020, 3704/05

TERMINAL CONTROL UNIT PLUGGING OPTIONS

The various standard and optional features for the 1270 terminals and modems are plugging options and are accomplished by use of adapter jumper connections. Appendix C provides a detailed analysis of plugging options. Appendix F discusses EIA interface options.

SECTION 3.
DESCRIPTION OF OPERATION

MULTIPLEXER CHANNEL OPERATIONS

The 1270 connects to and operates with the multiplexer channel via the I/O Control Section. The multiplexer channel initiates an operation to a 1270 during the CPU execution of a Start I/O instruction. The specific 1270 operation desired is defined in the channel command word (CCW).

Selection of devices (1270, card reader, etc.) is on a priority basis. However, the same 1270 is again selected if any line attached to this unit requires service and no higher priority machine on the channel interface is selected. Usually the 1270 is attached to the multiplexer channel in the position of highest priority.

Input/Output Operation

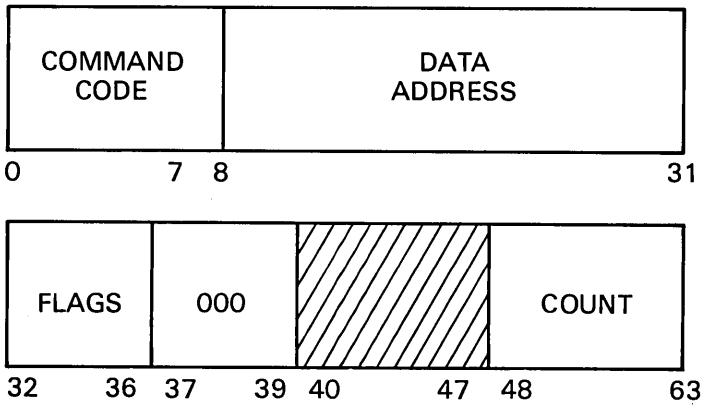
Two types of information, instructions and commands, initiate and control I/O (input/output) operation for the Memorex 1270. Instructions are decoded by the CPU and are part of the CPU program. Commands are decoded and executed by the channels and I/O devices, and initiate I/O operations such as reading or writing. A channel program is formed by arranging one or more commands for sequential execution. Both instructions and commands are fetched from main storage and are common to all types of I/O devices. However, modifier bits in the command code may specify device-dependent conditions for the execution of a data-transfer operation at the device.

I/O Inititiation

The CPU program initiates 1270 I/O operations with the Start I/O instruction. This instruction identifies the channel and the device, and causes the channel to fetch the channel address word (CAW) from a fixed location in main storage. The format of the CAW is:

KEY	0000	COMMAND ADDRESS
0 - 3	4 - 7	8 — 31

The CAW contains the protection key and designates the location in main storage from which the channel subsequently fetches the first CCW. The CCW specifies the command to be executed and the storage area, if any, to be used. The format for the CCW is:



If the subchannel associated with the addressed I/O device is not busy, the channel attempts to select a device by sending the address of the device to all control units attached to the channel. The control unit that recognizes the address connects itself logically to the channel and responds to its selection by returning its address. The channel subsequently sends the command-code part of the CCW over the interface, and the device responds with a status byte indicating whether it can execute the command.

At this time, the execution of Start I/O is terminated. The results of the the command are indicated by setting the condition code in the program status word (PSW), and, under certain conditions, by storing pertinent information in the channel status word (CSW).

If the operation is initiated at the device and its execution involves transfer of data, the subchannel is set up to respond to service requests from the device and assumes further control of the operation. In the case of operations that do not require any data to be transferred to or from the device, the device may signal the end of the operation immediately on receipt of the command code.

An I/O operation may involve transfer of data to one storage area, designated by a single CCW, or to a number of non-contiguous storage areas. In the latter case, a list of CCWs is used for execution of the I/O operation with each CCW designating a contiguous storage area. The CCWs within the list are said to be coupled by data chaining. Data chaining is specified by a flag in the CCW and causes the channel to fetch another CCW upon the exhaustion or filling of the storage area designated by the current CCW. The storage area designated by a CCW fetched on data chaining pertains to the I/O operation already in progress at the 1270, and the 1270 is not notified when a new CCW is fetched. Provision is made in the CCW format for the programmer to specify that, when the CCW is decoded, the channel requests an I/O interruption as soon as possible, thereby notifying the CPU program that chaining has progressed to a particular CCW in the channel program. Conditions that initiate I/O interruptions are asynchronous to activity in the CPU, and more than one condition can occur at the same time. The channel and CPU establish priority among the conditions so that only one interrupt request is processed at a time. The conditions are preserved in the I/O devices and subchannels until accepted by the CPU.

I/O Termination

Termination of the I/O operation normally is indicated by two conditions: Channel End and Device End. The Channel End condition indicates that the I/O device has received or provided all information

associated with the operation and no longer needs channel facilities. The Device End signal indicates that the I/O device has terminated execution of the operation. For the 1270, the Device End condition always occurs concurrently with the Channel End condition.

The conditions signalling the termination of an I/O operation can be brought to the attention of the program by I/O interruptions. These conditions cause storing of the CSW which contains additional information concerning execution of the operation. At the time the Channel End/Device End condition is generated, the channel identifies the program of the last CCW used and provides its residual byte count, thus indicating the extent of main storage used. Both the channel and the device can provide indications of unusual conditions with Channel End. The Channel End/Device End condition can be accompanied by error indications from the device.

Facilities are provided for the program to initiate execution of a chain of operations with a single Start I/O. When the chaining flags in the current CCW specify command chaining and no unusual conditions have been detected in the operation, the receipt of the Channel End/Device signal causes the channel to fetch a new CCW and to initiate a new command at the device. A chained command is initiated by means of the same sequence of signals over the I/O interface as the first commands specified by Start I/O. The ending signals that occur at the termination of an operation initiated by a CCW specifying command chaining are not made available to the program when another operation is initiated by the command chaining; the channel continues execution of the channel program. If, however, an unusual condition has been detected, the ending signals cause suppression of command chaining and termination of the channel program.

I/O Instructions

The IBM System/360 or System/370 operates with the 1270 through the following I/O instructions: Start I/O, Halt I/O, and Test I/O.

Start I/O

A Start I/O instruction executed by the CPU causes initial command selection and transfer of a command to the 1270. Command chaining within the multiplexer channel also causes selection and transfer of a command to the 1270. However, the 1270 does not signal Control Unit Busy status in response to a command cycle resulting from command chaining. During initial selection, the 1270 loads the line address and the command byte into registers. The 1270 can make the following status responses to Start I/O:

1. If the command is acceptable to the 1270, an all-zero status byte is sent to the channel.

2. If the command is not acceptable to the 1270, Unit Check is returned to the channel and the reason for responding with Unit Check is set in the sense byte.

3. If the 1270 is busy, it signals Control Unit Busy to the multiplexer channel. Control Unit Busy is defined for the 1270 as the Busy, Status Modifier, and Control-Unit-End bits being On in the status byte transferred to the channel.

Halt I/O

Once the 1270 has responded to initial command selection, the channel can signal Halt I/O. When the 1270 detects a Halt I/O, it loads the line address into a register, the same as for Start I/O. The addressed line is commanded to halt. When the current command at the addressed line is terminated, the proper status information is returned to the channel.

If the current command is WRITE, the character being transmitted and the characters buffered, if present, are sent before Channel End and Device End status are presented to the channel. The delay between the time the Halt I/O is accepted and the presentation of Channel End and Device End status to the channel is less than nine character times for that line.

Test I/O

The 1270 responds unconditionally to an all-zero command byte during initial command selection by setting the appropriate bits within the status byte.

Channel Commands

The command code (bits 0 through 7) in the CCW specifies to the multiplexer channel and to the 1270 the operation to be performed. The commands listed below are valid to the 1270 in both asynchronous and synchronous operations, except as noted. These commands are classified in five groups: transmit-type commands, receive-type commands, control commands, no-op commands, and the sense command. The command groups are identified by the two low-order bit positions (bits 6 and 7) of the CCW:

Bit 6	Bit 7	Command Group
0	1	Transmit-Type
1	0	Receive-Type
1	1	Control and No-Op
0	0	Sense

The SAD (Set Address) commands are treated as I/O No-Op when received by the 1270.

- Transmit-Type Commands

  WRITE
  WRITE BREAK (IBM 2848/2260 operation)
  Diagnostic WRITE (IBM 2848/2260 operation)
  WRAP
  BREAK (asynchronous only)
  POLL
  DIAL

- Receive-Type Commands

  READ
  READ CLEAR (IBM 2848/2260 operation)
  Diagnostic READ (IBM 2848/2260 operation)
  PREPARE
  INHIBIT
  ADDRESS PREPARE (synchronous only)
  SEARCH (synchronous only)

- Control Commands

  SET MODE
  ENABLE
  DISABLE

- No-Op Commands

  I/O NO-OP
  SAD ZERO
  SAD ONE
  SAD TWO
  SAD THREE

- SENSE Command

Communication Line Addressing

The 1270 appears as a control unit to the IBM System/360 or System/370. As many as eight 1270's can be attached to the same multiplexer channel. One non-shared multiplexer subchannel is required for each communications line. Each communication line attached to the 1270 is identified by a unique I/O address. This address is specified by a sixteen-bit binary number that appears in the address field of the I/O instruction. For 1270 operation, this I/O address consists of two parts: a channel address, for 1270 operation, and a communication-line address. The eight high-order bit positions of this field specify the channel address. However, since only channels 0-6 are available to the 1270, the five high-order positions of this byte are unused for channel addressing for all 1270 operations.

The low-order eight bits specify the communication line attached to the 1270. The basic I/O-address format for the IBM System/360 or System/370 is as follows:

Channel Address 0000 0XXX	1270 Line Address XXXX XXXX
Byte 1	Byte 2

Addresses in the 1270 are assigned consecutively starting with the low-limit address. The low-limit is specified by the user at installation time and may be changed at any time by a Memorex Field Support Representative.

Address-Assignment Considerations

Several items must be considered when determining 1270 address assignments. The following is a list of the major considerations:

1. A multiplexer channel can accommodate a maximum of 256 individual addresses. Each address is associated with an individual subchannel within the multiplexer channel. The capabilities of a specific channel are dictated by the IBM System/360 or System/370 processor model employed and the available core storage (see Figure 3-1).

2. The range of addresses available for assignment is 0-255.

3. Any one 1270 is limited to a maximum of 96 addresses (or lines).

4. The lowest address within the 1270 is always assigned as the WRAP address. The WRAP address is the address of the line used to read data back to the channel from any line issued the WRAP command. The WRAP address and its associated line can be used for normal transmission at all times, except when the 1270 is being checked with the WRAP command.

5. Although addresses must be assigned consecutively, the 1270 does not require a line to be attached to every address. These addresses (or gaps), however, are not available for assignment to other devices.

6. Address assignment has no bearing on the priority of a line.

7. If two or more 1270's are attached to the same channel, their addresses must not overlap nor be interpersed.

8. If the Wideband Synchronous feature is installed, Wideband Adapters must occupy the first two line address of a given 1270 and addresses 2 and 3 must be used for synchronous lines (if connected).

1270 OPERATIONS

The functional operation and programming of the 1270 are basically the same as those for the control units used with disc drives, line printers, tape drives, or card-handling devices. The 1270 can operate

360/370 CPU	Subchannels	Minimum Core-Storage Size (Bytes)
Model 30	32	8K
Model 30	96	16K
Model 30	224	32K - 64K and IBM feature#5250*
Model 40	16	16K
Model 40	32	32K
Model 40	64	64K
Model 40	128	128K
Model 50	64	64K
Model 50	128	128K
Model 50	256	256K - 512K and IBM feature#5250*
Model 145	Up to 256	
Model 145	Up to 256	
Model 155	Up to 256	

*Feature#5250 for additional multiplexer subchannels

S360/370 CPU	Maximum Number of Subchannels	Multiplexer Model
Model 65	192/256	2870
Model 75	192/256	2870
Model 85	192/256	2870/2880
Model 165	192/256	2870/2880
Model 195	192/256	2870/2880

Core storage is not a factor for the number 2870/2880 subchannels

Figure 3-1. Maximum Lines Available by Processor Model

in an asynchronous mode for start/stop communication or in synchronous mode for binary synchronous communication. In asynchronous operation, start and stop bits are generated by the 1270 for transmission onto the communications line. During receipt of start/stop communications data, the start and stop bits are removed from the code structure before data is transferred to the computer multiplexer channel. For binary synchronous communication, sync characters are inserted and removed in a similar manner.

TRANSMIT AND RECEIVE OPERATIONS

For transmit or receive operations, each attached communication line is scanned to monitor its status. If any line has data for the CPU, a receive operation is initiated; similarly, if the CPU has data ready to transmit to a terminal, a transmit operation is initiated. Parity bits are added or stripped off, as needed, at the interface between the multiplexer channel and the 1270. Data transmission between the host processor and the 1270 is in parallel, one byte at a time; data transmission between the 1270 and a terminal is a serialized string of bits.

All character and bit control, character decoding, data handling, and matching to common-carrier equipment is accomplished by the functional sections within the 1270. Asynchronous and synchronous transmission codes and bit structures are discussed in detail in Sections 4 and 5 of this manual. For example:

- The 1270 inserts and deletes certain control characters required by the remote terminals that are not a part of the data required by the CPU.
- The 1270 generates time-out intervals to ensure that no unreasonable delays occur.
- The 1270 handles the polling and selection of remote terminals under control of the CPU.
- The 1270 signals an interrupt to the CPU when the data transmission is ended.
- The 1270 provides wrap-around checking of individual communication lines under program control from the CPU.
- The 1270 handles line control operations.

Operating Modes

Four operating modes (mode 0 through mode 3) determine the function of a 1270 terminal control feature (asynchronous and synchronous) at any point in time. These operating modes are individually set and reset (in the particular terminal control features installed in the 1270) by control characters received from the CPU and control characters received from an attached terminal. The control characters recognized, converted, and/or acted on in each mode of terminal control feature operation are determined by the type of terminal control feature being used. The control characters recognized by the individual start/stop (asynchronous) terminal control features are described in Section 4 of this manual. Control characters recognized by the synchronous terminal control feature are described in Section 5.

Mode 0 (Control Mode)

A terminal control feature resides in the control mode for all transmit and receive operations except when transmitting or receiving the text part of a message.

Mode 1 (Text-Out Mode)

The text-out mode is used when transmitting the text part of outgoing messages. The text-out mode can be entered by a terminal control feature only if it is in the control mode or text-in mode (mode 2), and it recognizes the required control character when a transmit operation is initiated.

Mode 2 (Text-In Mode)

The text-in mode is used when receiving the text part of an incoming message. The text-in mode can be entered by a terminal control feature only if it is in the control mode during a read operation, and it recognizes the required control character.

Mode 3 (Polling Answer Back Mode)

The polling answer back mode is used to read the polling response from an attached terminal. The polling answer back mode can be entered by a terminal control feature only if it is capable of performing a poll operation and has received a POLL command.

PROGRAMMING CONSIDERATIONS

From a programming standpoint, the 1270 appears as a number of individual communication devices. When an operation or sequence of operations is to be performed, the programmer prepares a list of one or more CCWs in main storage. Channel command words specify:

1. The command to be performed (READ, WRITE, etc.).
2. The number of bytes contained in the record.
3. The address in main storage where data is to be placed when receiving, or the address of the first byte to be transmitted when sending.
4. Command flags to control possible modification in command execution. The flags are: chain data, CHAIN command, suppress length, skip, and program-controlled interruption.

When the CCWs have been formed, the programmer specifies the channel and line address of the communication line. The execution of a Start I/O instruction causes the command, count, data address, and control information to be stored in a specified subchannel within the multiplexer channel. The channel then selects the 1270 and relays the command and the line address to it; the 1270 accepts the command if valid. The channel then indicates successful or unsuccessful execution of the Start I/O instruction to the program.

Once a command has been accepted by the multiplexer channel and the 1270, the CPU program is unaware of the continuance of the operation until the message has been received or transmitted, or until the multiplexer channel requires interruption either to perform functions such as dynamic storage allocation or because an unusual condition is detected during execution. Since the multiplexer

channel contains all the necessary information pertaining to the current operation, data transfer between main storage and the 1270 can be overlapped with CPU processing. The extent of the overlap varies, depending on the processor model.

Autowrap

The Automatic Wraparound (Autowrap) capability is a standard feature of the 1270 and can be utilized by the program to determine the source of error for a given 1270 line. The wraparound function is initiated by issuing the WRAP command to the 1270 line address on which trouble is suspected. Autowrap cannot be used with the IBM Type III Terminal Control feature.

The 1270 wraps the output of the line to which the WRAP command is issued to the input of the line with the lowest address within the 1270. This line is used as a return line for the test data. Wraparound is accomplished within the line adapter to avoid line termination mismatches, because the line with the lowest address is not necessarily the same type of line as the line being tested. The execution of WRAP is always one way; that is, the transmit operation is performed on the line in question and the receive operation on the lowest line address. A READ command must be issued to the low line address before Autowrap is started in order to permit the data transmitted by the WRAP command to be received.

The program must ensure that normal operations on the low line have been completed before issuing WRAP to any communication line on the 1270. The program must not issue WRAP to more than one communication line at a time. The program can make a character-by-character comparison of received data with transmitted data and/or monitor the operation for recognizable control characters. The low line is not reserved as a test line, but is used during the Autowrap process.

It should be recognized that the low line itself can never be issued a WRAP command. Since the low line is used with all wraparound operations, the Autowrap operation selects the proper terminal control so that this low line operates as if it were the same kind of commmunication line as the line being tested. Output data can be blocked from going on the communication line by issuing a DISABLE command to the 1270 line just before the WRAP is issued. A DISABLE must be issued to the low line address to reset it to its prior condition.

SECTION 4.

ASYNCHRONOUS COMMUNICATIONS

DESCRIPTION OF ASYNCHRONOUS OPERATIONS

Asynchronous (start/stop) type communications involve the coding of each character with a start bit and one or more stop bits, in addition to the data bits and possibly a check bit for parity. The following is an example of 11 bit asynchronous character code:

Start Bit	Data Bit 1	Data Bit 2	Data Bit 3	Data Bit 4	Data Bit 5	Data Bit 6	Data Bit 7	VRC (Parity) Bit	Stop Bit	Stop Bit

The transmission of characters can occur at an irregular rate since each character contains its own sync information (character timing). This is particularly useful for transmission of data from unbuffered units such as keyboard terminals.

Transmit Operation (WRITE Command)

Transmit operations are initiated when the 1270 accepts a WRITE command from the multiplexer channel. Before transmission to the terminals occurs, the 1270 requests the first four bytes of data from the multiplexer channel. These bytes are then transmitted on a bit-by-bit basis to the terminal. Additional requests for four more bytes of data are made each time four bytes are transferred from Data Buffer-2 to Data Buffer-1.

Receive Operation (READ Command)

Receive operations are initiated whenever there are no active WRITE type commands present. On detection of the start bit, the 1270 prepares to receive a data character. Before each bit is put into the low-order bit position of the 1270 Assemble/Disassemble section, the section is shifted forward one bit position in the high-order direction. Each bit of the character is received in this manner until the Assemble/Disassemble section signals stop time. Stop time occurs when the bit count equals one less than the code level selected for a line adapter. During receive operations, the 1270 provides a time-out of 28 seconds or less between data characters, provided a READ command has been accepted by the 1270.

The time-out process is interrupted by a received start bit and is reset and restarted at the following stop time. If the time-out completes before a start bit is received, the READ command is terminated. When a positive response is received from the terminal for a READ command, the 1270 begins a data transfer action. If the terminal fails to respond with data within approximately three seconds, a time-out is recorded, and the READ command is terminated.

COMMANDS

A 1270 equipped for asynchronous communications implements up to 17 channel commands. The 1270 start/stop terminal control features and applicable channel commands are listed in Table 4-1.

TABLE 4-1. START/STOP COMMANDS

COMMAND	HEX CODE	IBM TYPE I T.C.	ASCII T.C.	CODE CONVERT I T.C.	CODE CONVERT II T.C.	ASCII CHECKING T.C.	IBM TYPE III T.C.
WRITE	01	X	X	X	X	X	X
BREAK	OD	X	X	X	X	X	--
WRITE BREAK	41	--	--	--	--	--	X
DIAGNOSTIC WRITE	05	--	--	--	--	--	X
WRAP	05	X	X	X	X	X	--
POLL	09	X	--	--	X	X	X
DIAL	29	X*	X*	X*	X*	X*	--
READ	02	X	X	X	X	X	X
READ CLEAR	42	--	--	--	--	--	X
DIAGNOSTIC READ	06	--	--	--	--	--	X
PREPARE	06	X	X	X	X	X	--
INHIBIT	0A	X	X	X	X	X	X
SET MODE	23	--	X	X	X	X	--
ENABLE	27	X	X	X	X	X	--
DISABLE	2F	X	X	X	X	X	--
SENSE	04	X	X	X	X	X	X
I/O NO-OP	03	X	X	X	X	X	X

*Requires Autocall feature

Transmit-Type Commands

WRITE

Bytes are transferred onto the addressed communication line four at a time, except at the end of a message that terminates with less than four bytes (when the channel signals a stop after the message has been completed). Since four bytes or code characters are requested by the 1270 each time its data buffer needs service, the average data-transfer rate from the channel to the 1270 is determined by the bit rate of the communication facility.

If the 1270 is receiving data from a communication line and a WRITE command is issued to the same line, the command is accepted, but may be ended immediately with Channel End, Device End, and Unit Exception status bits posted. Various other unusual ending conditions set the Channel End, Device End, and Unit Check status bits along with the appropriate bit in the sense field. These are: bad parity on Bus Out, which will set the Bus Out bit; a VRC check, which will set the Data Check bit; an Echo Check, which will set the Equipment Check bit; a BREAK signal received on the appropriate type of line, which will set the Intervention Required bit; and finally, if a data set is inoperative, the Intervention Required sense bit also is set.

If the data transfer is completed normally, the command is ended with Channel End and Device End Status.

BREAK

The BREAK command is used to terminate the transmission of a current message from a remote terminal so that the 1270 can transmit a message. When this command is accepted, a space signal is transmitted on the addressed communication line. The byte count in the CCW indicates the length of the space signal in character times. The BREAK is valid for asynchronous terminal controls. On synchronous lines, this command is rejected as invalid.

WRITE BREAK

This command, with a byte count of 1000 (3E8 hex), is used with the IBM Type III Terminal Control feature to perform automatic error recovery. The WRITE BREAK command should be used only when an attached display terminal will not respond to normal commands (READ, WRITE, etc.). During the execution of a WRITE BREAK command, all normal write operations are performed except: (1) the attached communication line is held at a continuous space, (2) no control characters are decoded, and (3) intervention required conditions are inhibited from setting Channel End, Device End, and Unit Check status bits. Loss of data may result through use of the WRITE BREAK command. To reduce the possibility of data loss, a READ CLEAR command, with a byte count of 960 (3C0 hex), should precede the WRITE BREAK.

DIAGNOSTIC WRITE

The DIAGNOSTIC WRITE command is used only with the IBM Type III Terminal Control feature. Execution of this command causes the terminal control to perform essentially all normal write operations; however, data is not placed on the attached communication line. The last character

(usually the LRC character) is placed in the diagnostic register. The DIAGNOSTIC WRITE command is ended by an Interface Stop signal or via the ETX ending sequence.

WRAP

The WRAP command is used with all 1270 asynchronous terminal control features except the IBM Type III Terminal Control feature. On acceptance of this command, the 1270 wraps the output of the addressed line to the input of the line with the lowest line address in the 1270. This command is executed in an identical manner to a WRITE and the error conditions are the same.

POLL

On acceptance of the POLL command by the IBM Type I Terminal Control, ASCII Checking Terminal Control, or Code Convert II Terminal Control feature; the 1270 requests two, three, or four characters from the channel. The first or second characters are the station address and the third is an ENQ or O followed by an index character (any graphic). The 1270 then generates an EOT and transmits the address characters from the channel, while buffering the index character, which indicates the current position within the polling list. The 1270 then waits for a response from the terminal.

Acceptance of a POLL command by the Type III Terminal Control feature causes the 1270 to request four characters from the CPU: the first character is the address of the IBM 2848; the second character is the address of the Display Station attached to the 2848; the third character is the command code for the function to be performed by the addressed Display Station; the fourth character is the index byte, indicating the current position within the polling list. The 1270 will generate and transmit an EOT, then transmit the two address characters and the command character. An EOT will be inserted before every IBM Type III Terminal Control feature polling sequence.

The remainder of the polling operation is the same for IBM Type I Terminal Control, ASCII Checking Terminal Control, Code Convert II Terminal Control and IBM Type III Terminal Control features.

If a negative reply is received, the 1270 requests the next polling characters from the channel. If a positive reply is received, the 1270 sets Channel End, Device End, and Status Modifier and the channel program chains to a READ command.

There are four possible responses to a POLL command, each of which initiates a different action in the 1270.

1. Positive response.
2. Negative response.
3. No response.
4. The received character is not recognized as either a negative or positive response.

The action taken with each response is as follows:

1. Status Modifier is set in the status byte and the command is ended by the 1270. The channel program then skips a CCW and chains to a READ command and the index character is returned to the channel.

2. The 1270 requests three or four more characters from the channel and transmits only the first two or three characters, then waits for a terminal response.

3. A three-second time out is completed and the 1270 ends the command with a Unit Check bit set in the status byte and a Time-out bit set in the sense byte.

4. The command ends with Unit Check set in the status byte and Data Check set in the sense byte.

Any time the 1270 receives a negative response to a POLL command, the polling operation is continued by requesting the next group of characters.

DIAL

The DIAL command is used with the Autocall feature when the program desires to originate a call over a switched network. When the 1270 accepts the DIAL command, bytes are transferred through the Autocall Adapter to the automatic calling equipment. They are transferred from the channel to the 1270 in groups of up to four digits, parallel by byte, (normal transfer of data). This command is very similar to a WRITE command, except that the characters are transferred to the Automatic Calling Unit rather than a data set.

Receive-Type Commands

READ

Bytes are accepted from the addressed communication line by the TCU and are then transferred to the channel each time Data Buffer-2 is filled with four characters, or at the end of a message. This command is terminated at the end of a message by setting of Channel End, Device End, and if the user selects the appropriate plugging option, the Unit Exception bits in the status field. These bits are set when the 1270 receives a Ⓒ from the communication line while in text mode; when in control mode either a Ⓒ or an Ⓝ (only for IBM control) causes the Channel End, Device End, and Unit Exception bits to be set. Otherwise, the command is ended normally with Channel End and Device End.

READ CLEAR

This command is used in the IBM Type III Terminal Control feature to minimize the possibility of lost data resulting from a WRITE BREAK command. The READ CLEAR command, with a byte count of 960 (3C0 hex), should precede the WRITE BREAK command. All basic read functions are performed during execution of READ CLEAR except that received control characters are treated as data characters.

DIAGNOSTIC READ

The DIAGNOSTIC READ command is used to transfer the character in the diagnostic register to the CPU. This command is used only with the IBM TYPE III Terminal Control feature. The first character

sent to the CPU is the character stored in the diagnostic register. As the first character is shifted out of the diagnostic register, an ETX character is shifted in. The ETX character will be sent to the CPU as a second character for certain cases as described in the IBM TYPE III Terminal Control feature description provided in this section.

PREPARE

The PREPARE command can be implemented by all 1270 asynchronous terminal control features except the IBM TYPE III Terminal Control feature.

This command is normally used in a contention type communications system to notify the processor when data is arriving. It is also useful to check for the Break signal, to indicate when a Break or elongated space signal ends (the line returns to Mark). When a valid start bit is detected by a line instructed to PREPARE, a character is assembled. If at stop-bit time, the line is at Mark (which indicates the line has returned to the normal idle condition or that a character has been received), the command is terminated with Channel End and Device End status. The character assembled is not transferred to the multiplexer channel. Exception to this is with USASCII or USASCII Checking Terminal Control, which would transfer a character. If the line was at space at stop-bit time, the 28-second line time-out is started. If the line returns to Mark before the time-out is complete, this command is terminated with Channel End and Device End status. If the line does not return to Mark before completion of this time-out, then the PREPARE command is terminated with Channel End, Device End, and Unit Check status, and the Time-out sense bit is set (indicating an open-line condition).

No data transfer occurs under PREPARE, and no characters received during its execution are transferred to the processor. However, line control characters received under this command continue to be recognized (as they are under READ) and they perform their normal function.

INHIBIT

On acceptance, the 1270 performs normal READ operations except that time-outs are inhibited.

Control Commands

SET MODE

The SET MODE command is used to select and de-select the Autopad feature. This command is valid only on start/stop communication lines not selected by the Code Convert II and IBM TYPE III Terminal Control feature plugging options. A SET MODE command fetches one byte (the SET MODE data byte) of control information from main storage to select or de-select the Autopad feature. If bit 1 of the SET MODE data byte is a 1, the Autopad feature is selected. If bit 1 of the SET MODE data byte is a 0, the Autopad feature is de-selected.

ENABLE

When this command is accepted, data terminal ready is set within the line adapter of the addressed communication line and request-to-send is set for full-duplex modems. No data transfer occurs.

DISABLE

On acceptance of this command, the 1270 resets the data terminal ready within the line adapter of the addressed communication line. No data transfer occurs. This command resets Autospeed and initializes Dual Speed.

SENSE

On acceptance of this command, the 1270 returns a single byte to the channel from the sense field. This byte defines the condition of the addressed communication line.

I/O NO-OP

This command is treated as a "control immediate" and no operation is performed by the 1270. Channel End and Device End are transferred in the Status byte. No access is made to the 1270 storage unless the multiplexer channel stacks the status response. This command does not reset the sense field.

Exception Commands

SADZERO, SADONE, SADTWO, SADTHREE

These commands are treated as I/O NO-OPS when decoded by the 1270. They are accepted by the 1270 to permit programming compatibility between the IBM 2702 and the Memorex 1270.

Status-Byte Conditons

A status byte provides an indication to the processor of the specific condition of the 1270. The status byte is automatically sent to the channel:

1. As a status response by the 1270 each time a command is received and before use of this command by the 1270.
2. To inform the CPU program of the 1270 status following the termination of each 1270 command operation.

Initial Status Conditions

The 1270 responds to initial command selection by sending a status byte to the multiplexer channel with the following exceptions:

1. Power is down on the 1270.

2. The 1270 is off-line for testing.

3. The address coming from the multiplexer channel has incorrect parity.

Any of the following status conditions can be presented to the multiplexer channel during the initial selection sequence:

1. All zeros (normal)

   This status is set in response to operations initiated by a Start I/O instruction or command chaining, and indicates that the 1270 has accepted a command.

2. Busy, Status Modifier, and Control Unit End

   This status indicates a temporary 1270 control unit busy. The 1270 is busy for up to 300 microseconds when performing a reset.

3. Unit Check

   This status is set in response to operations initiated by a Start I/O instruction; it indicates that the command issued to the 1270 will not be executed because it is invalid or has improper parity. This condition is further defined by the sense byte.

4. Channel End and Device End

   This status serves as an unconditional response to the I/O NO-OP, SADZERO, SADONE, SADTWO, and SADTHREE commands.

Ending Status Conditions

The following status conditions can be presented to the channel at the end of a 1270 command execution:

1. Channel End and Device End

   This status indicates that the current command has been brought to a normal end and the 1270 is free to accept another command. These two conditions always appear together in the 1270 as a single status condition.

   Channel End and Device End status has special meaning for the following commands:

   ENABLE. When this command is issued to a line in a switched network, this status indicates that the connection to the terminal has been established through the network. This status is indicated if a Halt I/O is issued to a line that is executing ENABLE and the data set is "off-hook" before data terminal ready can be reset.

   PREPARE. This status indicates that the addressed line started to receive; the line went to space long enough to be recognized as a true start bit and then returned to Mark (the normal state of the line). However, if this command was terminated by Halt I/O, this status would indicate that the command was successfully aborted and the line never went to space.

2. Channel End, Device End, and Unit Exception

   The conditions that cause this status to be signalled depend on both the type of line and terminal control involved, as well as the particular command that was issued. It will never be signalled for DISABLE, BREAK, or SENSE. For the remaining commands, this status indication is influenced by the type of terminal control involved, as follows:

   READ or INHIBIT. IBM Terminal Control feature--this status is signalled if Ⓒ (EOT) or Ⓝ (Negative reply) is received while the addressed line is in control mode and executing either of these commands. It is also optionally set any time a Ⓒ is received. ASCII Terminal Control feature--this status means that the EOT Character was received while executing either of these commands.

   WRITE or POLL. This status is signalled if a WRITE or POLL command is issued to a line while the line is receiving data. Execution of the command is terminated immediately.

   PREPARE. If Halt I/O is issued to a line that is executing PREPARE, and the line has started to receive (a true start bit was detected) but the ending status has not yet been signalled, then this status is signalled at the normal ending point for this command, after the line returns to Mark.

   ENABLE. This status is signalled if Halt I/O is issued to a line that is executing ENABLE and the call has not yet been answered (data set ready is off). Data terminal ready is reset.

   WRAP. This status is signalled if a WRAP command is issued to a line while the line is receiving data.

3. Channel End, Device End, Unit Exception, and Unit Check

   The conditions that cause this status to be signalled are a combination of the conditions that cause the command to end with Channel End, Device End, and Unit Exception status plus one or more of the error conditions that cause sense bits to be set. A SENSE command should be issued to the unit address in order to determine the error condition. The conditions that can be signalled are listed under "Sense-Byte Conditions." This status can be signalled only when ending WRAP, READ, WRITE, PREPARE, ENABLE, INHIBIT, or POLL.

4. Channel End, Device End, and Unit Check

   This status indicates that the current command has been ended by an error or an unusual condition. A SENSE command must be issued to the addressed unit to further define these conditions.

5. Channel End, Device End, and Status Modifier

   This status is set for the POLL command when a positive response character is detected.

TERMINAL CONTROL STATUS BYTE CONDITIONS AND CAUSES

Status byte conditions for the various types of terminal controls and commands are listed in Table 4-2.

TABLE 4-2. STATUS BYTE CONDITIONS AND CAUSES (Page 1 of 3)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE	CODE CONVERT TERM CONTROL COMMAND	CAUSE
Channel End, Device End					
DISABLE	Private Line--DTR was reset	DISABLE	Private Line--DTR was reset	DISABLE	Private Line--DTR was reset
	Switched Line--DSR was dropped		Switched Line--DSR was dropped		Switched Line-DSR was dropped
ENABLE	Full Duplex or Switched Line--CTS is active	ENABLE	Full Duplex or Switched Line--CTS is active	ENABLE	Full Duplex or Switched Line--CTS is active
	Half Duplex--DSR is active		Half Duplex--DSR is active		Half Duplex--DSR is active
	Private--immediate end		Private--immediate end		Private--immediate end
PREPARE	A full character has been received	PREPARE	A full character has been received	PREPARE	A full character has been received
READ READ INHIBIT	a) a Halt I/O has been issued by channel	READ READ INHIBIT	a) a Halt I/O has been issued by channel	READ READ INHIBIT	a) a Halt I/O has been issued by channel
	b) an ending character such as those plugged on ASCII Term Control		b) an ending character has been received		b) an ending character has been received
WRITE	a) stop issued by channel	WRITE	a) stop issued by channel	WRITE	a) stop issued by channel
	b) Halt I/O issued		b) Halt I/O issued		b) Halt I/O issued
			c) B and LRC character sent		c) B and LRC character sent

NOTES:

DTR - Data Terminal Ready (CD in Bell Sytem circuit nomenclature)
DSR - Data Set Ready (CC in Bell System circuit nomenclature)
CTS - Clear to Send (CB in Bell System circuit nomenclature)

TABLE 4-2. STATUS BYTE CONDITIONS AND CAUSES (Page 2 of 3)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE	CODE CONVERT TERM CONTROL COMMAND	CAUSE
SENSE	a) sense byte successfully sent to channel	SENSE	a) sense byte sucessfully sent to channel	SENSE	a) sense byte sucessfully sent to channel
		POLL	Halt I/O or stop issued by channel	POLL	Halt I/O or stop issued by channel
DIAL	a connection has been established	DIAL	a connection has been established	DIAL	a connection has been established
Busy					
----	a test I/O has been issued to a line that has a command stored in ram (NOTE: busy can be set by channel if this UCW [Unit Control Word] is active; i.e., shared UCW's)	----	a test I/O has been issued to a line that has a command stored in ram (NOTE: busy can be set by channel if this UCW is active)	----	a test I/O has been issued to a line that has a command stored in ram (NOTE: busy can be set by channel if this UCW is active)
Channel End, Device End, Status Modifier					
		POLL	a Ⓓ response is received from terminal	POLL	an STX response is received from terminal
Channel End, Device End, Unit Check					
All Commands	any sense bit is set	All Commands	any sense bit is set	All Commands	any sense bit is set
Channel End, Device End, Unit Check, Unit Exception					
----	one of the conditions that set CE, DE, and UE plus a sense bit is set	----	one of the conditions that set CE, DE, and UE plus a sense bit is set	----	one of the conditions that set CE, DE, and UE plus a sense bit is set

TABLE 4-2. STATUS BYTE CONDITIONS AND CAUSES (Page 3 of 3)

USASCII TERM CONTROL COMMAND		IBM TERM CONTROL COMMAND		CODE CONVERT TERM CONTROL COMMAND	
Channel End, Device End, Unit Exception					
ENABLE	Halt I/O on a switched line before connection is made	ENABLE	Halt I/O on a switched line before connection is made	ENABLE	Halt I/O on a switched line before connection is made
READ	(ASCII Term Control Plugging) EOT or Opt 1 character received	READ	a) (IBM TERM Control Plugging) EOT character received b) An Ⓝ response from a terminal to an addressing or polling sequence when executed with WRITE or READ commands (NOTE: does not occur on N responses to polling using a POLL command)	READ	
PREPARE	Halt I/O issued from channel before a start bit was detected on received data	PREPARE	Halt I/O issued from channel before a start bit was detected on received data	PREPARE	Halt I/O issued from channel before a start bit was detected on received data
DIAL	Halt I/O issued by channel before all digits have been received	DIAL	Halt I/O issued by channel before all digits have been received	DIAL	Halt I/O issued by channel before all digits have been received
WRITE	WRITE command issued to a line that has detected a start bit (RCV1 on)	WRITE	WRITE command issued to a line that has detected a start bit (RCV1 on)	WRITE	WRITE command issued to a line that has detected a start bit (RCV1 on)

SENSE BYTE CONDITIONS

The sense byte is transferred to the host processor, via the multiplexer channel, only when a SENSE command is issued. Bit positions within the byte are set by the following sense conditions:

Bit Position (within the Sense Byte)	Sense Conditions
0	Command Reject
1	Intervention Required
2	Bus Out Check
3	Equipment Check
4	Data Check
5	Over-run
6	Lost Data
7	Time Out

Four of these sense bits (2, 3, 5, 6) are set independent of the specific terminal control associated with the addressed line. The other four sense bits (0, 1, 4, 7) are associated with the terminal control for the line. Sense byte conditions and causes are listed in Table 4-3.

The sense information pertaining to the previous I/O operation is reset by the next command addressed to a line (except for I/O NO-OP, Halt I/O, Text I/O, and SENSE).

TABLE 4-3. SENSE BYTE CONDITIONS AND CAUSES (Page 1 of 5)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE
Bit 0, Command Reject			
	Not a valid command for 1270		Not a valid command for 1270
POLL	No jumper on Data Buffer Control or MC4	POLL	No jumper on Data Buffer Control or MC4
AD PREP or SEARCH	Not a valid command for this terminal control	AD PREP or SEARCH	Not a valid command for this terminal control
DIAL	No jumper on I/O cmd or TC and speed select	DIAL	No jumper on I/O cmd or TC and speed select
Bit 1, Intervention Required			
WRITE POLL WRAP	Private line and CTS does not rise in 28 seconds	WRITE POLL WRAP	Private line and CTS does not rise in 28 seconds
READ WRITE BREAK POLL PREPARE	a) private or half duplex, DSR is down b) full duplex and switched, CTS is down	READ WRITE BREAK POLL PREPARE	a) private or half duplex, DSR is down b) full duplex and switched, CTS is down
DIAL	At completion of DIAL command, DSR is down (8-second time out)	DIAL	At completion of DIAL command, DSR is down (28 sec.)

NOTES:
CTS - Clear to Send (CB - Bell System)
DSR - Data Set Ready (CC - Bell System)

TABLE 4-3. SENSE BYTE CONDITIONS AND CAUSES (Page 2 of 5)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE
READ WRITE WRAP POLL	Received data is at a space at stop bit time	READ WRITE WRAP POLL	Received data is at a space at stop bit time
WRITE	Received data at space for 2 consecutive stop bit times (NOTE: also sets Data Check)	WRITE	Received data at space for 2 consecutive stop bit times (NOTE: also sets Data Check)
Bit 2, Bus Out Check			
Any Command	I/O Bus Out was even parity while command out, address out, or service out was active	Any Command	I/O Bus Out was even parity while command out, address out, or service out was active
Bit 3, Equipment Check			
All Com-mands	1270 already has a command	All Com-mands	1270 already has a command
ENABLE	a) DTR failed to turn on b) SD at space c) SSD at space d) full duplex line and RS is down	ENABLE	a) DTR failed to turn on b) SD at space c) SSD at space d) full duplex line and RS is down
DISABLE	DTR or RS failed to reset	DISABLE	DTR or RS failed to reset

NOTES:
RS - Request to Send (CA - Bell System)
DTR - Data Terminal Ready (CD - Bell System)
SD - Send Data (BA - Bell System)
SSD - Supervisory Send Data (SBA - Bell System)

TABLE 4-3. SENSE BYTE CONDITIONS AND CAUSES (Page 3 of 5)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE
WRITE POLL WRAP	a) RS failed to turn on b) Bit failure between Adapter Gates & AD	WRITE POLL WRAP	a) RS failed to to turn on b) bit failure between Adapter Gates & AD
DIAL	If the following are not true: a) dial tone delay state DTR=0 BO=1 CD=0 b) connection wait state DTR=1 BO=1	DIAL	If the following are not true: a) dial tone delay state DTR=0 BO=1 CD=0 b) connection wait state DTR=1 BO=1
Bit 3, Data Check			
READ READ INHIBIT	a) Received data is a space at stop bit time b) If parity jumper inserted and character of opposite parity is received	READ	a) In Mode 1, an Ⓝ was received b) In Mode 3 (Poll Rev), character other than Ⓓ or Ⓝ received c) In Mode 2, LRC character received does not compare with character built d) An even parity character received e) Received data is at a space at stop bit time
		WRITE POLL WRAP	An even parity character is transmitted

NOTES:
CD - Carrier Detect
BO - Busy Out

TABLE 4-3. SENSE BYTE CONDITIONS AND CAUSES (Page 4 of 5)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE
Bit 5, Overrun			
READ READ INHIBIT	DB1, and DB2 are full and another character is received (NOTE: channel is not servicing 1270 fast enough)	READ READ INHIBIT	DB1, and DB2 are full and another character is received (NOTE: channel is not servicing 1270 fast enough)
Bit 6, Lost Data			
READ READ INHIBIT	a) While transferring data to the channel, a response to service in is either command out (stop) or address out (interface disconnect) b) a character has been received and a halt I/O is issued by the channel c) DB1 and DB2 are full and another character is received, then a READ command is issued by channel	READ READ INHIBIT	a) While transferring data to the channel, a response to service in is either command out (stop) or address out (interface disconnect), b) a character has been received and a halt I/O is issued by the channel c) DB1 and DB2 are full and another character is received, then a READ command is issued by channel
DIAL	DIAL command issued to a busy line	DIAL	DIAL command issued to a busy line

NOTES:
IFDR - Interface Data Register
DB1 - Data Buffer-1
DB2 - Data Buffer-2

TABLE 4-3. SENSE BYTE CONDITIONS AND CAUSES (Page 5 of 5)

USASCII TERM CONTROL COMMAND	CAUSE	IBM TERM CONTROL COMMAND	CAUSE
Bit 7, Time Out			
DISABLE	DSR failed to reset (28 seconds)	DISABLE	DSR failed to reset (28 seconds)
ENABLE	CTS failed to become active (28 seconds) (FD only)	ENABLE	CTS failed to become active (28 seconds) (FD only)
WRITE	CTS failed to become active (switched half duplex)	WRITE	CTS failed to become active (switched half duplex)
READ	No data received in 28 seconds	READ	3-second time out for Mode 0 or 28-second time out for Mode 2
PREPARE	Line is at space for 28 seconds	PREPARE	Line is at space for 28 seconds
POLL	Mode 3 (Poll Rcv) no data received for 3 seconds	POLL	Mode 3 (Poll Rcv) no data received for 3 seconds
DIAL	Call is completed. No answer for 45 seconds (No CD)	DIAL	Call is completed. No answer for 45 seconds (No CD)

NOTE:
FD - Full Duplex

TERMINAL CONTROL FEATURES

The 1270 operates with the following start/stop terminal control features:

- IBM TYPE I Terminal Control
- USASCII Terminal Control
- Code Convert I Terminal Control (Ia and Ib)
- Code Convert II Terminal Control
- IBM TYPE III Terminal Control
- USASCII Checking Terminal Control

At least one terminal control feature is required for each 1270. A maximum of four Asynchronous Terminal Control features are allowed in addition to a Synchronous Terminal Control feature which handles both USASCII and EBCDIC.

IBM TYPE I Terminal Control Feature

The IBM Type I Terminal Control feature provides the controls necessary for the attachment of a wide variety of terminals such as the IBM 1050, 1060, 2740, and 2741 Terminals. The relationship between the 1270 and the IBM System 360/370 byte structure in servicing these terminals is illustrated in Figures 4-1 through 4-4.

In the six-bit BCD transmission code, S represents the shift bit. A logical one identifies the uppercase; a logical zero represents the lowercase. The B bit is the first bit transmitted after the start bit. An odd-parity (check) bit is transmitted following the one bit. Each received character is checked for odd vertical parity.

The up-shift and down-shift characters are automatically deleted from the received data stream, the last shift character received is noted and an eighth bit, S, is inserted to indicate the appropriate character to the System 360/370. On outgoing data, the S (shift) bit is removed and noted. A change in this S bit automatically causes insertion of the appropriate shift character (up-shift or down-shift) into the outgoing data stream before sending the data character. The C (check) bit in the character indicates the correct odd-parity count; a logical one if the bit count of the character is even; a logical zero if the bit count of the character is odd.

Vertical redundancy check (VRC) and longitudinal redundancy check (LRC) are provided. Any error detected sets the Data Check bit within the sense byte. A Data Check does not cause immediate termination of the current command.

Polling and Addressing

Polling and addressing of the 1050, 1060, or 2740 terminals are performed by a WRITE and a READ command or POLL command preceded by a Start I/O instruction. When polling, command chaining is utilized so that the READ command and the allocated storage are ready to receive the incoming data. In the first case (a WRITE and a READ command), on sending out polling characters (provided by the

		00				01				10				11				0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Second 4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0		8	@		Ⓝ			h		*	¢		Ⓝ			H	
0001	1	Space			y		q	&		Space			Y		Q	+		
0010	2	1			z		r	a		=			Z		R	A		
0011	3			/		j			i		(	?		J			I	
0100	4	2					MZ	b		<						B		
0101	5		O	s		k			PZ		)	S		K				
0110	6		Ⓓ# EOA	t		l			Ⓨ		Ⓓ" EOA	T		L			Ⓨ	
0111	7	3			,		$	c					I		!	C		
1000	8	4			By-pass		Re-store	d		:			By-pass		Re-store	D		
1001	9		PN	u		m			PF		PN	U		M			PF	
1010	A		RS	v		n			Horiz Tab		RS	V		N			Horiz Tab	
1011	B	5			LF		CR/ LF	e		%			LF		CR /LF	E		
1100	C		Up-shift	w		o			Down Shift		Up-shift	W		O			Down -Shift	
1101	D	6			Ⓑ EOB		Back-space	f		–			Ⓑ EOB		Back-space	F		
1110	E	7			Pre-fix		Idle	8		>			Pre-fix		Idle	G		
1111	F		Ⓒ EOT	x		p			Del		Ⓒ EOT	X		P			Del	

0	1	2	3	4	5	6	7

Channel Interface Byte

S	B	A	8	4	2	1	C

Terminal Code Structure

Start	B	A	8	4	2	1	C	Stop

Transmitted and Received Character

These codes perform no function in the IBM 1050 System, but are valid data codes. They are not printable.

S bit position 0 (lower case) or 1 (upper case) inserted on receive or deleted on transmit by TCU.

EXAMPLES OF POLLING AND ADDRESSING

Mode		1050
1050 Polling		
00	Ⓒ →	Resets Terminals
00	A →	Terminal Address
00	5 →	Component Select Code for Keyboard
00	← Ⓝ	Negative Reply
00	Ⓒ →	Reset, Resume Polling
00	8 →	Terminal Address
00	6 →	Component Select Code for Reader 1
10	← Ⓓ	Reader Ready to Start Message
10	← TEXT	Message
10	← Ⓑ	End of Block
10	← LRC	Check Character Generated by 1050
10	Ⓨ →	Positive Message Received (No data check)
00	← Ⓒ	End of Transmission

EXAMPLES OF POLLING AND ADDRESSING

Mode		1050
1050 Addressing		
00	Ⓒ →	Reset Terminals
00	A →	Terminal Address
00	1 →	Component Select Code for Printer 1
00	← Ⓨ	Terminal Ready to Receive
01	Ⓓ →	End of Address
01	TEXT →	Message
01	Ⓑ →	End of Block
01	LRC →	Check Character Generated
01	← Ⓝ	Negative Message Received (detected a data check)
01	TEXT →	Message Repeated (Program Controlled)
01	Ⓑ →	End of Block
01	LRC →	Check Character Generated
01	← Ⓨ	Positive Message Received (No data check)
00	Ⓒ →	End of Transmission (Reset)

1050 Line Control Characters

Char.	Hex	Altern. Design.	Meaning
Ⓑ	BD/3D	EOB	End of Block
Ⓒ	9F/1F	EOT	End of Transmission
Ⓓ	96/16	EOA	End of Address
Ⓝ	C0/40	No	Negative Response
Ⓨ	F6/76	Yes	Positive Response

1050 Component Select Codes

Polling	Addressing
5 Keyboard	1 Printer 1
6 Reader 1	2 Printer 2
7 Reader 2	3 Punch 1
0 Any input	4 Punch 2
	9 All Output

0	1	2	3	4	5	6	7	
Shift S	B	A	8	4	2	1	Check	S/360 Bit Positions
								PTTC/EBCD 1050 Bits

Start	B	A	8	4	2	1	Check C	Stop	Transmitted and Received Characters.

Figure 4-1. IBM 1050 Code Structure

		00				01				10				11				0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Second 4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0		8	Add		(N)			H									
0001	1	Space			Y		Q	+										
0010	2	1			Z		R	A										
0011	3		9	/		J			I									
0100	4	2					Mes-sage	B										
0101	5		0	S		K			Re-store									
0110	6		(D)# EOA	T		L			(Y)									
0111	7	3			,		S	C										
1000	8	4					.	D										
1001	9			U		M			Sub-tract									
1010	A			V		N			Horiz Tab									
1011	B	5			LF		CR	E										
1100	C			W		O												
1101	D	6			(B) EOB			F										
1110	E	7					Idle	G										
1111	F		(C) EOT	X		P			Del									

Bit position 0 is automatically set to zero

0	1	2	3	4	5	6	7

Channel Interface Byte

B	A	8	4	2	1	C

Terminal Code Structure

Start	B	A	8	4	2	1	C	Stop

Transmitted and Received Character

EXAMPLES OF POLLING AND ADDRESSING

	Mode	1060	
1060 Polling	00	(C) →	Terminal Reset
	00	A →	Terminal Address
	00	6 →	Component Select (Keyboard)
	00	← (N)	Not Ready
	00	A →	Terminal Address
	00	8 →	Component Select (Keyboard 2)
	10	← (D)	End of Address
	10	← TEXT	Message
	10	← (B)	End of Block
	10	← LRC	Checking Character Generated by the 1060
	10	(Y) →	Positive Reply
	00	(C) →	End of Transmission (Reset)

	Mode	1060	
1060 Addressing	00	(C) →	Reset Terminals
	00	A →	Terminal Address
	00	3 →	Component Select (Printer 2)
	00	← (Y)	Positive Reply (Ready to receive)
	01	(D) →	End of Address
	01	TEXT →	Message
	01	(B) →	End of Block
	01	LRC →	Check Character Generated by the 1270
	01	← (Y)	Positive Reply (Message OK)
	00	(C) →	End of Transmission (Reset)

Figure 4-2. IBM 1060 Code Structure

		00				01				10				11				0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Second 4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0		8	@		(N)			h		•	¢		(N)			H	
0001	1	Space			y		q	&		Space			Y		Q	+		
0010	2	1			z		r	a		=			Z		R	A		
0011	3		9	/		i			i		(	?		J			I	
0100	4	2						b		< o						B		
0101	5		0	s		k					)	S		K				
0110	6		(D) # EOA	t		L			(Y) •		" + (D)	T		L			(Y)	
0111	7	3			(S) ,		$	c		;			,		!	C		
1000	8	4			By-pass		Re-store			:			By pass		Re-store	D		
1001	9		PN	u		m			PF		PN	U		M			PF	
1010	A			v		n			Horiz Tab			V		N			Horiz Tab	
1011	B	5			LF See Note		NL (CRLF)	e		%			LF See Note		NL (CRLF)	E		
1100	C		Up-shift	w		o			Down shift		Up-shift	W		O			Down shift	
1101	D	6			(B) EOB		Back space	f		'			(B) EOB		Back space	F		
1110	E	7			Pre-fix		Idle	g		> "			Pre-fix		Idle	G		
1111	F		(C) EOT	x		p			Del			X		P			Del	

0	1	2	3	4	5	6	7	

Channel Interface Byte

S	B	A	8	4	2	1	C	

Terminal Code Structure

Start	B	A	8	4	2	1	C	Stop		

Transmitted and Received Character

NOTE: In the 2741, LF (Line Feed) performs the Attention function instead of the indexing functions, while the terminal is transmitting. LF performs the indexing functions in receive.

These characters, while not used by the IBM 2740/2741, are provided for PTTC/BCD and PTTC/EBCD programming considerations with the IBM 1050.

S bit position 0 (lower case) or 1 (upper case) inserted on receive or deleted on transmit by TCU.

PTTC/EBCD characters are shown above dashed line. PTTC/BCD characters are shown below dashed line.

EXAMPLES OF POLLING AND ADDRESSING

2740 POLLING

Mode		2740 Mod. 1 & 2
00	(C) →	Resets Terminals
00	A →	Terminal Address
00	SP →	Space Character
10	← (D)	End of Address
10	← TEXT	Message
10	← (B)*	End of Block
10	← LRC*	Check Character Generated by the 2740
10	(Y)* →	Positive Reply
00	← (C)	End of Transmission

* Used only on 2740 equipped with VRC/LRC checking feature.

2740 ADDRESSING

Mode		2740 Mod. 1 Only
00	(C) →	Resets Terminals
00	(S) →	Address Select
00	A →	Terminal Address
00	SP →	Space Character
00	← (Y)	Positive Reply (Ready to Receive)
01	(D) →	End of Address
01	TEXT →	Message
01	(B) →	End of Block
01	LRC* →	Check Character Generated
01	← (Y)*	Positive Reply (Message OK)
00	(C) →	End of Transmission

* Used only on 2740 equipped with VRC/LRC checking feature.

2740 MOD. 2 ADDRESSING

Mode		2740 Mod. 2
00	(C) →	Resets Terminals
00	(S) →	Address Select
00	A →	Terminal Address
00	SP →	Space Character
00	← △	(Sense Char.)
00	← (Y)	Positive Reply (Ready to Receive)
01	(D) →	End of Address
01	TEXT →	Message
01	(B)* →	End of Block
01	LRC* →	Check Character Generated
01	← (Y)*	Positive Reply (Message OK)
00	(C) →	End of Transmission

*Used only on 2740 equipped with VRC/LRC checking feature.

2740 LINE CONTROL CHARACTERS (EBCD)

Char	Hex	Alternate Desig.	Meaning
(B)	BD/3D	EOB	End of Block
(C)	9F/1F	EOT	End of Transmission
(D)	96/16	EOA	End of Address
(N)	C0/40	No	Negative Response
(S)	B7/37	SOA	Start of Address; used only addressing
(Y)	F6/76	Yes	Positive Response
(d)	96/16	INQUIRY	Positive Response Terminal goes to Receive

△ Note:

1st or Sense Char.	2nd Char.	Significance
1	(N)	Terminal is in Enter mode. A message is being entered into the buffer.
2	(N)	Terminal is in Bid mode and has a message to send.
4	(N)	Terminal is performing a "buffer print" operation while in communication mode.
8	(N)	Terminal is in Local mode.
9	(N)	Terminal is in Communication mode, but is without paper.
@	(N)	Terminal is in Communication mode, but document device is open.

When the terminal is capable of receiving a message or responds with the 'Sense' character, (Y) answer back, the Sense character will indicate the state of the last message received or transmitted.

1st or Sense Char	2nd Char.	Significance
Space	(Y)	No failure detected for the last message received.
/	(Y)	Electronic failure on last message received.
S	(Y)	I/O hardware failure for last message received.
U	(Y)	Line VRC error for last message received.
Y	(Y)	Terminal Line Parity error induced by terminal on a transmitted message.

Figure 4-3. IBM 2740/2741 BCD Code Structure

		00				01				10				11				0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Second 4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0		4	t		!			/		$	T		°			?	
0001	1	Space			l	j	o			Space			L		O	J		
0010	2	1			h		s	g		±			H		S	G		
0011	3		0	x		m			y		)	X		M			Y	
0100	4	2						=		@						+		
0101	5		z	n		.					Z	N		.				
0110	6		(D) 9	u		v			-		(	U		V			—	
0111	7	3			b		w	f		#			B		W	F		
1000	8	5						p		%						P		
1001	9			e		'						E		"				
1010	A			d		r			Horiz Tab			D		R			Horiz Tab	
1011	B	7			LF		CR LF	;		&			LF		CR LF	:		
1100	C		Up-shift	k		i			Down-shift		Up-shift	K		I			Down-shift	
1101	D	6					Back-space	q		¢					Back-space	Q		
1110	E	8					Idle	,		.					Idle	,		
1111	F		(C) EOT	c		a					(C) EOT	C		A				

0	1	2	3	4	5	6	7

S/360 Bit Positions

S	B	A	8	4	2	1	C

Correspondence Code Bits

Start	B	A	8	4	2	1	C	Stop

Transmitted and Received Character

S bit position 0 (lower case) or 1 (upper case) inserted on receive or deleted on Transmit by TCU.

EXAMPLES OF OPERATING SEQUENCE, TRANSMIT OR RECEIVE

2741	
← (D)	Power On
← (C)	Attention Key
(D) →	End of Address
Text (if any) →	Message
(C) →	End of Transmission
← (D)	EOA
←	Text Message
← (C)	EOT

This sequence must be followed for transmit or receive.

Figure 4-4. IBM 2740/2741 Correspondence Code Structure

program), chaining occurs to a READ command and a time out begins. At this point, the IBM TYPE I Terminal Control feature preempts the 28-second time out with a 3-second short time out. The 1270 interrupts the CPU program if an Ⓝ character is received or if a time out occurs. Unit Exception is set in the unit status byte if Ⓝ is received. Unit Check is set in the unit status byte if a time out occurs. The Time-out bit is set in the sense field; a Status Modifier if a positive response is received from the terminal.

If no response or an incorrect response is received, the command is ended with Unit Check status and the appropriate sense indication. If all terminals have been polled and no positive response has been received, the command ends normally. The program is required to follow each address with an index character which is returned to the processor upon a positive response from the terminal.

During addressing, command-chaining to a READ command is used to provide for receiving the Ⓝ or Ⓨ character. Ⓝ sets Unit Exception in the status byte, as in polling, to interrupt the CPU program. Ⓨ causes a normal end which can be command-chained to the WRITE command. See Figures 4-1 through 4-4 for line-control sequence examples.

Character Recognition Summary

The following characters are recognized during transmit operations:

1. Ⓒ, which sets control mode and resets check-character (LRC) accumulator.

2. Ⓓ, which sets text-out mode and initiates LRC accumulation. Ⓓ is recognized if the line is in transmit direction and in control mode or text-in mode. This character has no control effect if transmitted while a line is in text-out mode. It is treated as a normal data character.

3. Ⓑ, which sets LRC sequence. Termination of the WRITE command is initiated by Ⓑ.

4. In text-out mode and down-shift (a 0 in the shift control bit), any character with the S bit on causes the line to set a 1 in the shift control bit.

5. In text-out mode and up-shift (a 1 in the shift bit), any character with the S bit OFF causes the line to send the down-shift character and resets the shift control bit.

6. A pad character (DF) from the channel causes all marks to be transmitted for one complete character time. The 1270 can be plugged to recognize the pad character by terminal control.

The following characters are recognized during READ operations:

1. Ⓒ, as end-of-transmission, which sets control mode and End, and if plugged, Unit Exception status in the addressed line.

2. Ⓓ, which is recognized when the subject line is in control mode or poll mode and causes the text-in mode to be set and LRC accumulation to be initiated. The Ⓓ is not included in the LRC accumulation. When in the received direction, and when not in control mode, Ⓓ is treated as a normal data character and is included in the LRC accumulation.

3. Ⓑ, which sets the LRC control sequence. The next received character will be checked against the accumulated LRC before the READ command is terminated.

4. Ⓝ, which sets End and Unit Exception when in control mode. Data Check is set when Ⓝ is received and the operation is in text-out mode.

5. Ⓨ, which sets End during control mode and text-out mode.

6. Up-shift, which sets up-shift (1 in the S bit) if the line was in down-shift (0 in the S bit); if the line was already in up-shift or in control mode, this character has no effect. In any case, the terminal control inhibits transfer of this character to the data word, removing it from the incoming data stream, although it is included in the accumulated LRC character if the line is in text-in mode while receiving.

7. Delete (BA8421 C) is removed from any incoming data stream because its transfer is inhibited by the terminal control. However, this character is included in the accumulated LRC character if the line is in text-in mode.

8. Idle (B8421) is removed from any incoming data stream because its transfer is inhibited by the terminal control. However, this character is included in the accumulated LRC character if the line is in text-in mode.

USASCII Terminal Control Feature

The USACII Terminal Control feature provides for the attachment of Memorex 1240 and 1250 Communication Terminals, and 1280 Cassette Communications terminals at speeds of up to 1200 bps, and models 33, 35, and 37 Teletypewriter terminals to the 1270. Operation is point-to-point and, generally, on a dial-up basis. Teletype transmission speed is 110 bps for Models 33 and 35, and 150 bps for the Model 37. The code used is the eight-bit-data-interchange code which is related to the System/360 and System/370 interface as shown in Figure 4-5.

Line Control

On input, or during read-type operations, the following five characters optionally may be recognized by the 1270:

ACK - Causes End status to be posted.

WRU - "Who are you" which causes End status to be posted.

XON - "Transmitter on" which causes End status to be posted.

XOFF - "Transmitter off" which causes End status to be posted.

EOT - "End of transmission" which causes End and, if plugged, Unit Exception status to be posted.

In addition to these five characters, two additional characters, one of which may also post Unit Exception, are available as plugging options.

Delete - When the No-Delete option in the USACII Terminal Control feature is plugged, the transfer of delete characters (all marks) to the I/O channel is inhibited during all read-type operations. If the No-Delete option is not plugged, delete characters are transfered to the I/O channel.

		00				01				10				11				0,1
Second		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0	Null			Form Feed		Line Feed				Horiz Tab	WRU		EOM			Shift In	
0001	1	Null		EOT	Form Feed	EOA	Line Feed		Shift Out	SOM	Horiz Tab	WRU	Re turn	EOM	Vert Tab	Bell	Shift In	
0010	2		H	D		B			N	A			M		K	G		
0011	3	@	H	D	L	B	J	F	N	A	I	E	M	C	K	G	O	
0100	4		(	$		"			.	!			-		+	,		
0101	5	SP	(	$	,	"	*	&	.	!	)	%	-	#	+	,	/	
0110	6																	
0111	7																	
1000	8																	
1001	9																	
1010	A	P			\		Z				Y	U		S			←	
1011	B	P	X	T	\	R	Z	V	↑	Q	Y	U	]	S	[	W	←	
1100	C	0			<		:				9	5		3			?	
1101	D	0	8	4	<	2	:	6	>	1	9	5	=	3	;	7	?	
1110	E																	
1111	F																Del	

0	1	2	3	4	5	6	7

Channel Interface Byte

1	2	3	4	5	6	7	8

Terminal Code Structure

Start	1	2	3	4	5	6	7	8	Stop	Stop

Transmitted and Received Character

When two codes are shown for a single character, the marked indication denotes the bit configuration due to the parity bit being held in Mark Hold state. The companion bit configuration has even parity.

Line Control Characters

Char.	Hex	Meaning
WRU	A1	Who are you? WRU or Dial requests identification (ID).
XON	89	Transmitter On.
XOFF	C9	Transmitter Off.
EOT	21	End of Transmission.
DEL	7F	Delete

Example of Point to Point, Dial Up (Switched Network)

Keyboard Attended

TTY		
Dial TTY	→	WRU Function.
	← ID, ACK*	Identification code and go-ahead signal.
Text	→	Message sent.
XOFF	→	End of text.
CR, LF, DEL, XOFF	→	Go-ahead TTY
	← Text	Message sent.
	← XOFF	End of text.
Text	→	Message sent.
XOFF, EOT	→	End of text, End of Transmission

Keyboard Unattended

TTY		
Dial TTY	→	WRU Function.
	← ID, ACK*	TTY gives identification code and go-ahead signal.
Text	→	Message Sent.
XOFF, WRU	→	Go-ahead signal to TTY.
	← ID, ACK*	TTY identification and go-ahead.
Text	→	Message sent.
XOFF, EOT	→	Transmission is finished, go on-hook.

*XON was used prior to 1/67.

Figure 4-5. Eight-Level TWX Code Structure

Break - A Line Break signal (a space level on the line for two successive character times) can be detected during transmission. Detection of a Line Break signal will terminate any write-type operation with Channel End. Device End, and Unit Check status, and Intervention Required sense bits set.

Code Convert I Terminal Control Feature

The Code Convert I Terminal Control feature is an asynchronous terminal control used in conjunction with the Memorex 1240 Terminal and IBM software. Code Convert I consists of two types of printed circuit cards; Code Convert Ia and Code Convert Ib. Code Convert Ia is a USASCII to BCD converter (see Figures 4-6 and 4-7 for code conversion) and Code Convert Ib is a USASCII to Correspondence Code converter (see Figures 4-8 and 4-9 for code conversion). The purpose of the Code Convert I Terminal Control feature is to convert incoming USASCII code from a Memorex 1240 Terminal to BCD or Correspondence Code; and convert outgoing BCD or Correspondence Code from the System 360/370 Multiplexer Channel to USASCII code. The Autopad feature is included as part of the Code Convert I Terminal Control feature. Autopad enhances system throughput by automatically controlling the time between transmission of line feed characters and deleting pad characters inserted in the data stream for the line or carriage return sequences of the terminal.

Code Convert I (READ Command)

When Code Convert I accepts a READ command, it starts a 28-second time-out. At the start of the first character received, Receive 1 and Receive 2 control bits are set. Receive 1 indicates that a start bit has been detected in received data. Receive 2 indicates the detected start bit is valid. The detection of a valid start bit enables incoming data bits of the character being received from the attached terminal to be serially shifted into the A/D-1 register.

If the character after carriage return is not line feed, the character will be lost since it is not stored in core.

Code Convert I (PREPARE Command)

At the start of the first character sent from the terminal, Receive 1 and Receive 2 control bits are set to indicate a valid start bit was detected. The Ⓓ character is inhibited from being loaded into the data buffer by the PREPARE command.

Code Convert I (WRITE Command)

This command enables the Code Convert I Terminal Control feature to receive data and control characters from the channel via the data buffer.

When a Ⓒ character is received from the data buffer, it is converted to an EOT (end of transmission) character and loaded into A/D-1. Receiving the Ⓒ character also sets Mode 0 (Control Mode) and ends execution of the WRITE command.

CODE CONVERT Ia - USASCII TO IBM BCD

ASCII		BCD	
CHAR	HEX	CHAR	HEX
NUL	00		FF
SOH	81	Ⓢ	37
STX	41	EOA	16
ETX	C0	EOB	3D
EOT	21	EOT	1F
ENQ	A0		FF
ACK	60	Ⓨ	76
BEL	E0		FF
BS	11	BS	5D
HT	90	HT	7A
LF	50	LF	3B
VT	D1	VT	54
FF	30	FF	34
CR	B1	CR	5B
SO	71	BY	38
SI	F0		FF
DLE	09		FF
DC1	88	RES	58
DC2	48	PN	19
DC3	C9	RS	1A
DC4	28	PF	79
NAK	A9	Ⓝ	40
SYN	69		FF
ETB	E8	EOB	3D
CAN	18		FF
EM	99		FF
SUB	59		FF
ESC	D8	PRE	3E
FS	39		FF
GS	B8		FF
RS	78		FF
US	F9		FF

ASCII		BCD	
CHAR	HEX	CHAR	HEX
SP	05	SP	0]
!	84	!	D7
"	44	"	8E
#	C5	#	16
$	24	$	57
%	A5	%	8B
&	65	&	61
'	E4	'	8D
(	14	(	93
)	95	)	95
*	55	*	90
+	D4	+	E1
,	35	,	37
-	B4	-	40
.	74	.	76
/	F5	/	23
0	0C	0	15
1	8D	1	02
2	4D	2	04
3	CC	3	07
4	2D	4	08
5	AC	5	0B
6	6C	6	0D
7	ED	7	0E
8	1D	8	10
9	9C	9	13
:	5C	:	88
;	DD	;	87
<	3C		FF
=	BD	=	82
>	7D		FF
?	FC	?	A3

ASCII		BCD	
CHAR	HEX	CHAR	HEX
@	03	@	20
A	82	A	E2
B	42	B	E4
C	C3	C	E7
D	22	D	E8
E	A3	E	EB
F	63	F	ED
G	E2	G	EE
H	12	H	F0
I	93	I	F3
J	53	J	C3
K	D2	K	C5
L	33	L	C6
M	B2	M	C9
N	72	N	CA
O	F3	O	CC
P	0A	P	CF
Q	8B	Q	D1
R	4B	R	D2
S	CA	S	A5
T	2B	T	A6
U	AA	U	A9
V	6A	V	AA
W	EB	W	AC
X	1B	X	AF
Y	9A	Y	B1
Z	5A	Z	B2
[	DB		FF
\	3A	±	96
]	BB	¢	A0
^	7B		FF
_	FA	_	C0

ASCII		BCD	
CHAR	HEX	CHAR	HEX
`	06	°	84
a	87	a	62
b	47	b	64
c	C6	c	67
d	27	d	68
e	A6	e	6B
f	66	f	6D
g	E7	g	6E
h	17	h	70
i	96	i	73
j	56	j	43
k	D7	k	45
l	36	l	46
m	B7	m	49
n	77	n	4A
o	F6	o	4C
p	0F	p	4F
q	8E	q	51
r	4E	r	52
s	CF	s	25
t	2E	t	26
u	AF	u	29
v	6F	v	2A
w	EE	w	2C
x	1E	x	2F
y	9F	y	31
z	5F	z	32
{	DE		FF
|	3F	,	B7
}	BE		FF
~	7E	.	F6
DEL	FF	DEL	FF

Figure 4-6. Code Convert Ia - USASCII to IBM BCD

CODE CONVERT Ia - IBM BCD TO USASCII

BCD		ASCII	
CHAR	HEX	CHAR	HEX
SP	01	SP	05
1	02	1	8D
2	04	2	4D
3	07	3	CC
4	08	4	2D
5	0B	5	AC
6	0D	6	6C
7	0E	7	ED
8	10	8	1D
9	13	9	9C
0	15	0	0C
EOA	16	#	C5
PN	19	DC2	48
RS	1A	DC3	C9
	1C		00
EOT	1F	EOT	21
@	20	@	03
/	23	/	F5
s	25	s	CF
t	26	t	2E
u	29	u	AF
v	2A	v	6F
w	2C	w	EE
x	2F	x	1E
y	31	y	9F
z	32	z	5F
FF	34	FF	30
Ⓢ,	37	,	35
BY	38	ENQ	A0
LF	3B	LF	50
EOB	3D	ETX	C0
PRE	3E	ESC	D8

BCD		ASCII	
CHAR	HEX	CHAR	HEX
Ⓝ -	40	-	B4
j	43	j	56
k	45	k	D7
l	46	l	36
m	49	m	B7
n	4A	n	77
o	4C	o	F6
p	4F	p	0F
q	51	q	8E
r	52	r	4E
VT	54	VT	D1
$	52	$	24
RES	58	DC1	
CR/LF	5B	CR	B1
BS	5D	BS	11
IDLE	5E		00
&	61	&	65
a	62	a	87
b	64	b	47
c	67	c	C6
d	68	d	27
e	6B	e	A6
f	6D	f	66
g	6E	g	E7
h	70	h	17
i	73	i	96
	75		00
Ⓨ.	76	.	74
PF	79	DC4	28
HT	7A	HT	90
	7C		00
DEL	7F	DEL	FF

BCD		ASCII	
CHAR	HEX	CHAR	HEX
SP	81	SP	05
=	82	=	BD
o	84	'	06
;	87	;	DD
:	88	:	5C
%	8B	%	A5
'	8D	'	E4
"	8E	"	44
*	90	*	55
(	93	(	14
)	95	)	95
±	96	\	3A
PN	99	DC2	48
RS	9A	DC3	C9
	9C		00
EOT	9F	EOT	21
¢	A0	]	BB
?	A3	?	FC
S	A5	S	CA
T	A6	T	2B
U	A9	U	AA
V	AA	V	6A
W	AC	W	EB
X	AF	X	1B
Y	B1	Y	9A
Z	B2	Z	5A
FF	B4	FF	30
,	B7	I	3F
BY	B8	S0	71
LF	BB	LF	50
EOB	BD	ETX	C0
PRE	BE	ESC	D8

BCD		ASCII	
CHAR	HEX	CHAR	HEX
Ⓝ_	C0	_	FA
J	C3	J	53
K	C5	K	D2
L	C6	L	33
M	C9	M	B2
N	CA	N	72
O	CC	O	73
P	CF	P	0A
Q	D1	Q	8B
R	D2	R	4B
	D4	VT	D1
!	D7	!	84
RES	D8	DC1	88
CR/LF	DB	CR	B1
BS	DD	BS	11
IDLE	DE		00
+	E1	+	D4
A	E2	A	82
B	E4	B	42
C	E7	C	C3
D	E8	D	22
E	EB	E	A3
F	ED	F	63
G	EE	G	E2
H	F0	H	12
I	F3	I	93
	F5		00
Ⓨ.	F6	~	7E
PF	F9	DC4	28
HT	FA	HT	90
	FC		00
DEL	FF	DEL	FF

Figure 4-7. Code Convert Ia - IBM BCD to USASCII

CODE CONVERT Ib - USASCII TO IBM CORRESPONDENCE

ASCII		CORRES	
CHAR	HEX	CHAR	HEX
NUL	00		FF
SOF	81		FF
STX	41	EOA	16
ETX	C0		FF
EOT	21	EOT	1F
ENQ	A0		FF
ACK	60		FF
BEL	E0		FF
BS	11	BS	5D
HT	90	HT	7A
LF	50	LF	3B
VT	D1	VT	54
FF	30	FF	34
CR	B1	CR	5B
SO	71	BY	38
SI	F0		FF
DLE	09		FF
DC1	88	RES	58
DC2	48	PN	19
DC3	C9	RS	1A
DC4	28	PF	79
NAK	A9		FF
SYN	69		FF
ETB	E8		FF
CAN	18		FF
EM	99		FF
SUB	59		FF
ESC	D8	PRE	3E
FS	39		FF
GS	B8		FF
RS	78		FF
VS	F9		FF

ASCII		CORRES	
CHAR	HEX	CHAR	HEX
SP	05	SP	01
!	84	!	40
"	44	"	C9
#	C5	#	87
$	24	$	90
%	A5	%	88
&	65	&	8B
'	E4	'	49
(	14	(	96
)	95	)	93
*	55	*	8E
+	D4	+	E4
,	35	,	6E
-	B4	-	76
.	74	.	45
/	F5	/	70
0	0C	0	13
1	8D	1	02
2	4D	2	04
3	CC	3	07
4	2D	4	10
5	AC	5	08
6	6C	6	0D
7	ED	7	0B
8	1D	8	0E
9	9C	9	16
:	5C	:	EB
;	DD	;	6B
<	3C		FF
=	BD	=	64
>	7D		FF
?	FC	?	F0

ASCII		CORRES	
CHAR	HEX	CHAR	HEX
@	03	@	84
A	82	A	CF
B	42	B	B7
C	C3	C	AF
D	22	D	AA
E	A3	E	A9
F	63	F	E7
G	E2	G	E2
H	12	H	B2
I	93	I	CC
J	53	J	E1
K	D2	K	AC
L	33	L	B1
M	B2	M	C3
N	72	N	A5
O	F3	O	D1
P	0A	P	E8
Q	8B	Q	ED
R	4B	R	CA
S	CA	S	D2
T	2B	T	A0
U	AA	U	A6
V	6A	V	C6
W	EB	W	D7
X	1B	X	A3
Y	9A	Y	F3
Z	5A	Z	95
[	DB		FF
\	3A	±	82
]	BB	°	C0
^	7B		FF
_	FA	_	F6

ASCII		CORRES	
CHAR	HEX	CHAR	HEX
`	06	¢	8D
a	87	a	4F
b	47	b	37
c	C6	c	2F
d	27	d	2A
e	A6	e	29
f	66	f	67
g	E7	g	62
h	17	h	32
i	96	i	4C
j	56	j	61
k	D7	k	2C
l	36	l	31
m	B7	m	43
n	77	n	25
o	F6	o	51
p	0F	p	68
q	8E	q	6D
r	4E	r	4A
s	CF	s	52
t	2E	t	20
u	AF	u	26
v	6F	v	46
w	EE	w	57
x	1E	x	23
y	9F	y	73
z	5F	z	15
{	DE		FF
|	3F	,	EE
}	BE		FF
~	7E	.	CE
DEL	FF	DEL	FF

Figure 4-8. Code Convert Ib - USASCII to IBM Correspondence

CODE CONVERT Ib - IBM CORRESPONDENCE TO USASCII

CORRES		ASCII	
CHAR	HEX	CHAR	HEX
SP	01	SP	05
1	02	1	8D
2	04	2	4D
3	07	3	CC
5	08	5	AC
7	0B	7	ED
6	0D	6	6C
8	0E	8	1D
4	10	4	2D
0	13	0	0C
z	15	z	5F
9	16	9	9C
PN	19	DC2	4B
RS	1A	DC3	C9
	1C		00
EOT	1F	EOT	21
t	20	t	2E
x	23	x	1E
n	25	n	77
u	26	u	AF
e	29	e	A6
d	2A	d	27
k	2C	k	D7
c	2F	c	C6
I	31	I	36
h	32	h	17
FF	34	FF	30
b	37	b	47
BY	38	SO	71
LF	3B	LF	50
	3D		00
PRE	3E	ESC	D8

CORRES		ASCII	
CHAR	HEX	CHAR	HEX
!	40	!	84
m	43	m	B7
.	45	.	74
v	46	v	6F
'	49	'	E4
r	4A	r	4E
i	4C	i	96
a	4F	a	87
o	51	o	F6
s	52	s	CF
VT	54	VT	D1
w	57	w	EE
RES	58	DC1	88
CR/LF	5B	CR	B1
BS	5D	BS	11
IDLE	5E		00
j	61	j	56
g	62	g	E7
=	64	=	BD
f	67	f	66
p	68	p	0F
;	6B	;	DD
q	6D	q	8E
,	6E	,	35
/	70	/	F5
y	73	y	9F
	75		00
-	76	-	B4
PF	79	DC4	28
TAB	7A	HT	90
	7C		00
DEL	7F	DEL	FF

CORRES		ASCII	
CHAR	HEX	CHAR	HEX
SP	81	SP	05
±	82	\	3A
@	84	@	03
#	87	#	C5
%	88	%	A5
&	8B	&	65
¢	8D	'	06
*	3E	*	55
$	90	$	24
)	93	)	95
Z	95	Z	5A
(	96	(	14
PN	99	DC2	48
RS	9A	DC3	C9
	9C		00
EOT	9F	EOT	21
T	A0	T	2B
X	A3	X	1B
N	A5	N	72
U	A6	U	AA
E	A9	E	A3
D	AA	D	22
K	AC	K	D2
C	AF	C	C3
L	B1	L	33
H	B2	H	12
FF	B4	FF	30
B	B7	B	42
BY	B8	SO	71
LF	BB	LF	50
	BD		00
PRE	BE	ESC	D8

CORRES		ASCII	
CHAR	HEX	CHAR	HEX
0	C0	]	BB
M	C3	M	B2
.	C5	.	74
V	C6	V	6A
"	C9	"	44
R	CA	R	4B
I	CC	I	93
A	CF	A	82
O	D1	O	F3
S	D2	S	CA
VT	D4	VT	D1
W	D7	W	EB
RES	D8	DC1	88
CR/LF	DB	CR	B1
BS	DD	BS	11
IDLE	DE		00
J	E1	J	53
G	E2	G	E2
+	E4	+	D4
F	E7	F	63
P	E8	P	0A
:	EB	:	5C
Q	ED	Q	8B
,	EE	,	35
?	F0	?	FC
Y	F3	Y	9A
	F5		00
_	F6	_	FA
PF	F9	PF	28
TAB	FA	HT	90
	FC		00
DEL	FF	DEL	FF

Figure 4-9. Code Convert Ib - IBM Correspondence to USASCII

Code Convert II Terminal Control Feature

The Code Convert II Terminal Control feature allows the 1270 to attach to a Memorex 1242 Communication Terminal or a 1280 Cassette Communication Terminal. During a READ operation, the Code Convert II Terminal Control converts received data from USASCII to BCD. (See Figure 4-10) During data transmission, the Code Convert II Terminal Control converts outgoing data from BCD to USASCII (See Figure 4-11). Even vertical parity is generated on all transmitted data and checked on all received data. Longitudinal redundancy check (LRC) is also provided.

Polling

The POLL command sends a hardware-generated EOT character as the first character sent to the terminal. The first entry in the poll list is then sent and a three-second time out is started waiting for an answer. If any character other than EOT is received, the POLL command is ended. If the character received is an STX, the 1270 sets End and Status modifier. If the received character is neither EOT nor STX, the 1270 sets End and Unit Check in the status byte and Data Check in the Sense byte. The polling sequence may be three or four character polls by hardware plug option. The poll format is one or two address characters, a space (which is converted to an ENQ), and an index character. The index character is not sent to the terminal, but is returned as the first character after a positive response.

Character Recognition Summary

The following characters are recognized, converted, and/or acted on as listed in each communication line mode operating during the transmit operation:

1. Ⓢ, Start of Address:

   If in Text-Out mode (mode 1), Ⓢ = USASCII comma.
   If in Control mode (mode 0) or Poll mode (mode 3), Ⓢ = USASCII NULL.

2. Ⓓ, End of Address:

   Text-Out mode = USASCII pound sign.
   All other modes = USASCII STX.
   If in Control mode, Text-Out is set and the LRC accumulation reset to zero.

3. SP, Space:

   Text-Out mode = USASCII space.
   All other modes = USASCII ENQ.

4. Ⓨ, Positive Response:

   Text-Out mode = USASCII period.
   All other modes = USASCII ACK.

5. Ⓝ, Negative Response:

   Uppercase Text-Out mode = USASCII underscore (_).
   Lowercase Text-Out mode = USASCII dash (-).
   All other modes = USASCII NAK.

CODE CONVERT II - USASCII TO IBM BCD

ASCII		BCD	
CHAR	HEX	CHAR	HEX
NUL	00		00
SOH	81	Ⓢ	37
STX	82	EOA	16
ETX	03	EOB	3D
EOT	84	EOT	1F
ENQ	05		00
ACK	06	Ⓨ	76
BEL	87		00
BS	88	BS	5D
HT	09	HT	7A
LF	0A	LF	3B
VT	8B	VT	54
FF	0C	FF	34
CR	8D	NL	5B
SO	8E	BY	B8
SI	0F		00
DLE	90	°	A0
DC1	11	RES	58
DC2	12	PN	19
DC3	93	RS	1A
DC4	14	PF	79
NAK	95	Ⓝ	40
SYN	96		00
ETB	17	Ⓑ	3D
CAN	18		00
EM	99		00
SUB	9A		00
ESC	1B	PRE	3E
FS	9C		00
GS	1D		00
RS	1E		00
US	9F		00

ASCII		BCD	
CHAR	HEX	CHAR	HEX
SP	A0	SP	01
!	21	!	D7
"	22	"	8E
#	A3	#	16
$	24	$	57
%	A5	%	8B
&	A6	&	61
'	27	'	8D
(	28	(	93
)	A9	)	95
*	AA	*	90
+	2B	+	E1
,	AC	,	37
-	2D	-	40
.	2E	.	76
/	AF	/	23
0	30	0	15
1	B1	1	02
2	B2	2	04
3	33	3	07
4	B4	4	08
5	35	5	0B
6	36	6	0D
7	B7	7	0E
8	B8	8	10
9	39	9	13
:	3A	:	88
;	BB	;	87
<	3C		00
=	BD	=	82
>	BE		00
?	3F	?	A3

ASCII		BCD	
CHAR	HEX	CHAR	HEX
@	C0	@	20
A	41	A	E2
B	42	B	E4
C	C3	C	E7
D]	44	D	E8
E	C5	E	EB
F	C6	F	ED
G	47	G	EE
H	48	H	F0
I	C9	I	F3
J	CA	J	C3
K	4B	K	C5
L	CC	L	C6
M	4D	M	C9
N	4E	N	CA
O	CF	O	CC
P	50	P	CF
Q	D1	Q	D1
R	D2	R	D2
S	53	S	A5
T	D4	T	A6
U	55	U	A9
V	56	V	AA
W	D7	W	AC
X	D8	X	AF
Y	59	Y	B1
Z	5A	Z	B2
[	DB		00
\	5C		00
]	DD		00
^	DE		00
_	5F	_	C0

ASCII		BCD	
CHAR	HEX	CHAR	HEX
`	60	¢	84
a	E1	a	62
b	E2	b	64
c	63	c	67
d	E4	d	68
e	65	e	6B
f	66	f	6D
g	E7	g	6E
h	E8	h	70
i	69	i	73
j	6A	j	43
k	EB	k	45
l	6C	l	46
m	ED	m	49
n	EE	n	4A
o	6F	o	4C
p	F0	p	4F
q	71	q	51
r	72	r	52
s	F3	s	25
t	74	t	26
u	F5	u	29
v	F6	v	2A
w	77	w	2C
x	78	x	2F
y	F9	y	31
z	FA	z	32
{	7B		00
|	FC	|	B7
}	7D		00
~	FE		00
DEL	FF	DEL	FF

0	1	2	3	4	5	6	7	S/360 Bit Positions
C	7	6	5	4	3	2	1	USASCII Bit Positions

Start	1	2	3	4	5	6	7	C	Stop	Transmitted or Received Char.

NOTE:
ITB = US (IF) Stick = X011XXXX
Even Parity on the Data transmitted from the 1270 TCU.

Figure 4-10. Code Convert II - USASCII to IBM BCD

CODE CONVERT II - IBM BCD to USASCII (TEXT MODE)

BCD		ASCII	
CHAR	HEX	CHAR	HEX
SP	01	SP	A0
1	02	1	B1
2	04	2	B2
3	07	3	33
4	08	4	B4
5	0B	5	35
6	0D	6	36
7	0E	7	B7
8	10	8	B8
9	13	9	39
0	15	0	30
Ⓓ#	16	#	A3
PN	19	DC2	12
RS	1A	DC3	93
	1C	BELL	87
Ⓒ	1F	EOT	84
@	20	@	C0
/	23	/	AF
s	25	s	F3
t	26	t	74
u	29	u	F5
v	2A	v	F6
w	2C	w	77
x	2F	x	78
y	31	y	F9
z	32	z	FA
FF	34	FF	0C
Ⓢ,	37	,	AC
BY	38	ENQ	05
LF	3B	LF	0A
EOB	3D	ETX	03
PRE	3E	ESC	1B

BCD		ASCII	
CHAR	HEX	CHAR	HEX
Ⓝ -	40	-	2D
j	43	j	6A
k	45	k	EB
l	46	l	6C
m	49	m	ED
n	4A	n	EE
o	4C	o	6F
p	4F	p	F0
q	51	q	71
r	52	r	72
VT	54	VT	8B
$	57	$	24
RES	58	DC1	11
NL	5B	CR	8D
BS	5D	BS	88
IDLE	5E	NULL	00
&	61	&	A6
a	62	a	E1
b	64	b	E2
c	67	c	63
d	68	d	E4
e	6B	c	65
f	6D	f	66
g	6E	g	E7
h	70	h	E8
i	73	i	69
	75	BELL	87
Ⓨ.	76	.	2E
PF	79	DC4	14
HT	7A	HT	09
	7C	BELL	87
DEL	7F	DEL	FF

BCD		ASCII	
CHAR	HEX	CHAR	HEX
SP	81	SP	A0
=	82	=	BD
¢	84	'	60
;	87	;	BB
:	88	:	3A
%	88	%	A5
'	8D	'	27
"	8E	"	22
*	90	*	AA
(	93	(	28
)	95	)	A9
±	96	STX	82
PN	99	DC2	12
RS	9A	DC3	93
	9C	BELL	87
EOT	9F	EOT	84
°	A0	DLE	90
?	A3	?	3F
S	A5	S	53
T	A6	T	D4
U	A9	U	55
V	AA	V	56
W	AC	W	D7
X	AF	X	D8
Y	B1	Y	59
Z	B2	Z	5A
FF	B4	FF	0C
!	B7	¬	FC
BY	B8	SO	8E
LF	BB	LF	0A
EOB	BD	ETX	03
PRE	BE	ESC	1B

BCD		ASCII	
CHAR	HEX	CHAR	HEX
Ⓝ_	CO	_	5F
J	C3	J	CA
K	C5	K	4B
L	C6	L	CC
M	C9	M	4D
N	CA	N	4E
O	CC	O	CF
P	CF	P	50
Q	D1	Q	D1
R	D2	R	D2
	D4	VT	8B
!	D7	!	21
	D8	DC1	11
NL	D8	CR	8D
BS	DD	BS	88
IDLE	DE	NULL	00
+	E1	+	2B
A	E2	A	41
B	E4	B	42
C	E7	C	C3
D	E8	D	44
E	EB	E	C5
F	ED	F	C6
G	EE	G	47
H	F0	H	48
I	F3	I	C9
	F5	BELL	87
Ⓨ.	F6	.	2E
PF	F9	DC4	14
HT	FA	HT	09
	FC	BELL	87
DEL	FF	DEL	FF

Figure 4-11. Code Convert II - IBM BCD to USASCII (Text Mode)

6. Ⓑ, End of Block:

   In all modes = USASCII ETX.
   The LRC accumulation is sent as the next character after ETX and End are sent to the channel.

7. Ⓒ, End of Transmission:

   In all modes = USASCII EOT which sets the line to Control mode.

8. NL or CR/LF, converted to USASCII CR character in all modes.

During a transmit operation, Text-Out mode is set with the transmission of the first STX and reset with EOT. A hardware-generated STX character is transmitted as the first character of all blocks while in the Text-Out mode.

During receive operations all characters after the first STX in each block are included in the LRC. Received data is checked for even parity. The following control characters are recognized, converted, and/or acted on as listed in each mode during the read operation:

1. NULL - Is deleted from data stream.

2. STX - Start of Text:

   If in Control mode or Poll mode, the STX character sets Text-In mode (mode 2) and resets LRC accumulation to zero. If in Text-In mode, STX is converted to # sign.

3. EOT - End of Transmission:

   Sets Control mode and in all modes except Poll mode causes End to be set. Unit Exception (via plug option) may also be set with End.

4. ETX - End of Text:

   Causes the next character received to be compared with the LRC, and then End signalled with appropriate sense.

5. ACK - Positive Acknowledgement:

   Sets End in all modes except Text-In mode. In Text-In mode, ACK is converted to BCD period.

6. NAK - Negative Acknowledgement:

   Sets End and Unit Exception in Control mode. If in Text-Out mode, NAK sets End and Data Check and is converted to BCD Ⓝ. In Text-In mode, NAK is converted to dash.

7. CR - Carriage Return:

   Is converted to a BCD new line character and sets the shift bit. A CR must be used only in a two-character sequence of CR LF during read operation. The LF character is deleted.

8. DELET:

   Is deleted from the data stream. While in a READ operation, the first STX sets Text-In mode and an EOT resets Text-In mode.

While in Text-In mode, the first character of each block or READ command should be STX and is deleted from the data stream and the LRC accumulation is reset. The read time out is 28 seconds. The poll receive time out is three seconds.

Control Bits With Unique Functions

SHIFT BIT

The shift bit is set on recognition of an NL character during the transmit operation. During a read operation, the shift bit is set by recognition of a CR character. The CR character is followed by an LF character. Setting the shift bit during a transmit operation causes an LF character to be generated and sent. Setting the shift bit during a read operation causes the LF character to be deleted. The shift bit is reset after one character time during transmit or read operations.

DELETE STX

Delete STX is set:

1. When going into Text-In or Text-Out mode.
2. After the first character of each block or command when in Text-In mode.
3. With the first character of each block or command when in Text-Out mode.

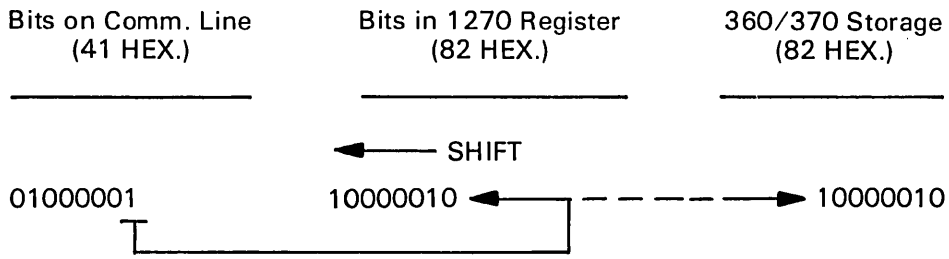
If delete STX is not set when in text mode, the next character received is deleted from the data stream or the next character sent is a hardware-generated STX. Delete STX is reset by recognition of EOT or ETX during read or write operations.

USACII Checking Terminal Control Feature

The USACII Checking Terminal Control feature operates with terminal devices that use USASCII communication code. Operation is point-to-point, on a dial-up basis, using half-duplex mode. The communications line can be either switched or private. The format for a USASCII checking message is shown in Figure 4-12. Text length of the message is variable.

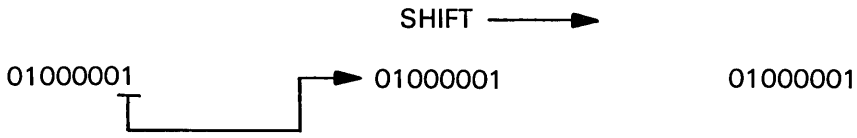
This terminal control feature differs from USACII Terminal Control feature in three ways. First it uses an LRC (Longitudinal Redundancy Check), as shown at the bottom of Figure 4-12; second, it does not have the same options for ending characters; and third, data bits are shifted in and out of the A/D register in reverse order.

For example, the letter "A" would be transmitted as follows under USACII Terminal Control.



Bits are transferred from the communications in a prescribed order (the first bit transferred is underlined). The 1270 register accepts the first bit in its low order position, shifts left one position and then accepts a new list in the low order position. After all eight bits (seven data and one parity) are structured in the register, the entire character is transferred in parallel to the central processing unit.

The same example under USACII Checking Terminal Control is:



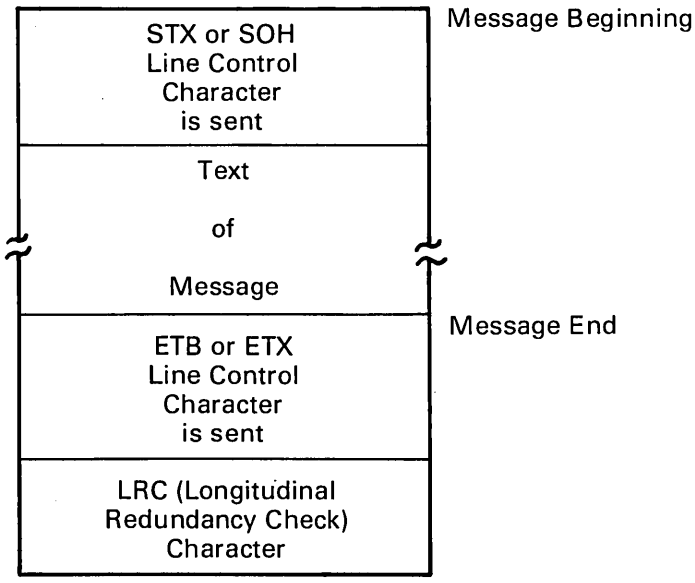


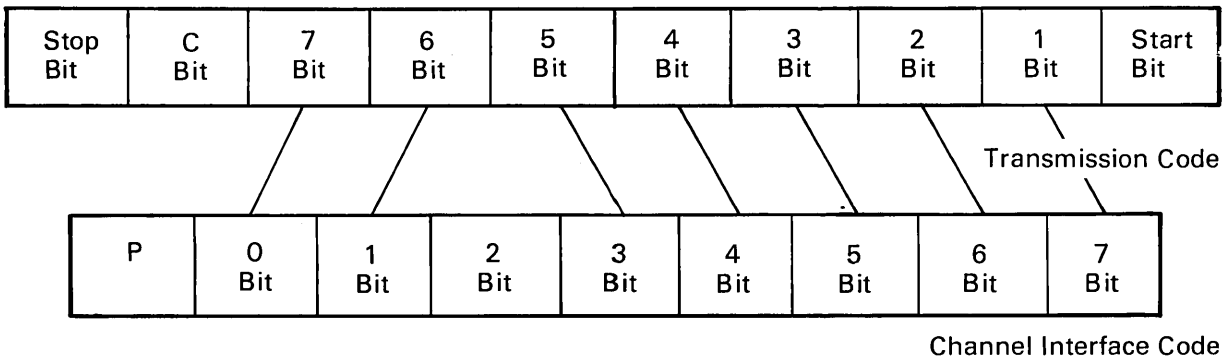
Figure 4-12. USASCII Checking Message Format

IBM TYPE III Terminal Control Feature

The IBM TYPE III Terminal Control feature is used with IBM 2260 and 2265 Terminal Display Units that allow a user to store, retrieve, and display data from the host CPU. The 2260 works in conjunction with a 2848 display control, and the 2265 works with a 2845 display control. The display units operate in asynchronous mode at data transmission speeds of up to 9600 bps.

Line communication between the 1270 and the display system is controlled by six of the USASCII communication control characters. The six control characters, used singly or in groups, establish and control the flow of information between the host processor and the display system.

An additional character, CAN (cancel), and a format effector (LF) are also used. The ten-bit format for USASCII character codes is used. The conversion between the channel interface code and the transmission code is as follows:



As each USASCII character is transmitted from the 2848 controller adapter, it is converted from a seven-bit code to an eight-bit byte which can be sent to main storage. Position 2 of the channel interface code (pictured above) is set to the same value as position seven. The extra bit is removed for transmission to the 2848.

Line Control Characters

Character	I/O Interface 01234567	Hex	Transmission Code 1234567C	Hex
SOH	00000001	01	10000001	81
STX	00000010	02	10000010	82
ETX	00000011	03	00000011	03
EOT	00000100	04	10000100	84
ACK	00000110	06	00000110	06
NAK	00010101	15	10010101	95
CAN	00011000	18	00011000	18

Control Character Description

WRITE OPERATION

SOH (Start of Heading): This character can be sent as the first character of a control message. It is used at the beginning of an address sequence or resets the line at the beginning of a polling sequence.

EOT (End of Transmission): This character terminates the line and resets it to Control mode.

ACK (Acknowledge): This character indicates the message just received contains no errors.

NAK (Negative Acknowledgement): This character indicates the message just received contained an error. An interface stop must be issued to end the operation.

STX (Start of Text): This character sets the IBM TYPE III Terminal Control feature to Text-Out mode and begins LRC accumulation. The STX character is not included in the LRC.

ETX (End of Text): If the IBM TYPE III Terminal Control feature is in Text-Out mode, this character causes it to send the LRC immediately after the ETX and then end the operation. The ETX is included in the LRC accumulation. If the IBM TYPE III Terminal Control feature is in control mode, no LRC is transmitted and the operation is ended.

RECEIVE OPERATION

EOT: This character places the IBM TYPE III Terminal Control feature in Control mode and ends the operation. The EOT is sent to the channel.

ACK/NAK: These characters are sent to the channel and end the operation.

STX: This character places the IBM TYPE III Terminal Control feature in Text-In mode and initiates LRC/accumulation. The STX is not included in the LRC.

ETX: If the IBM TYPE III Terminal Control feature is in Text-In mode, this character indicates that the next character is the LRC. The LRC includes the ETX. The operation is ended after receipt of the LRC. If the IBM TYPE III Terminal Control feature is in Control mode or Text-Out mode, this character is sent to the channel and the operation ends.

Character Recognition

Characters recognized by the IBM TYPE III Terminal Control feature during the various operating modes are shown in Figure 4-13.

Character	Mode 0 - Control	Mode 1 - Text Out	Mode 2 - Text In	Mode 3 - Poll Rcv.	
W-EOT W-SOH W-ACK W-NAK W-ETX W-STX W-LRC	X X X X X DE, DE Set 1 ------	Set 0 Set 0 X X X Set LRC CTRL X X CE, DE	Set 0 Set 0 X X X DE, DE Set 1 -------	----------	POLL Cmd Sets Mode 0, Requests 4 Chars (A1,A2,Cmd,Ind); TC sends EOT, A1, A2 CMD-then sets Mode 3. If STX, -- is received, TC sends Ind. STX, --- To Channel.
R-EOT R-ACK R-NAK R-ETX R-STX R-LRC R-CAN R-Other Timeout	X CE,DE,UE X CE,DE X CE,DE,UE X CE,DE Set 2 ------ X No Xfer to Chan X No Xfer to Chan X CE,DE,UC,TO	Set 0 CE,DE,UE X CE,DE X CE,DE,UC,DC X CE,DE Set 2 ------ X No Xfer to Chan X No Xfer to Chan Set 0 CE,DE,UC,TO	Set 0 CE,DE,UE X CE,DE X CE,DE,UC,DC X Set LRC Ctrl X Set 0 CE,DE(UC,DC) X UC,EC X Set 0 CE,DE,UC,TO	Set 0 Req Data Serv Set 0 CE,DE Set 0 CE,DE,UE Set 0 CE,DE Set 2 CE,DE,SM Set 0 CE,DE Set 0 CE,DE Set 0 CE,DE,UC,TO	READ INHIBIT, POLL Commands
R-EOT R-ACK R-NAK R-ETX R-STX R-CAN R-NUL R-Other	X CE,DE,UE X CE,DE X CE,DE,UE X CE,DE X * * X * X *	Set 0 CE,DE,UE X CE,DE X CE,DE,UC,DC Set 0 * CE,DE Set 0 * Set 0 * UC,DC,EC Set 0 * Set 0 * UC,DC	-------	----------	DIAGNOSTIC READ COMMAND *=Next Char is ETX X=Stay in same mode.

Figure 4-13. IBM TYPE III Terminal Control Feature Character Recognition

SECTION 5.

BINARY SYNCHRONOUS COMMUNICATIONS

INTRODUCTION

The Memorex 1270, when equipped with the Synchronous Terminal Control feature, provides for the attachment of Binary Synchronous (BSC) lines, operating at speeds up to 9600 bps and 19.2, 40.8, and 50K bps with Wideband Line Adapter. Highlights of the Synchronous Terminal Control include:

- EBCDIC or USASCII transmission code.
- Transmission of data regardless of its bit structure, when operating in transparent mode.
- Multipoint operation, on leased communication networks.
- Operation on point-to-point leased communications networks using a contention system.
- Line control procedures conforming to IBM Binary Synchronous conventions.
- Autopolling as a standard feature.
- Attachment of the 1270 to the multiplexer channels of System/360 or System/370.
- Communication with another Memorex 1270 equipped with Synchronous Terminal Control, with an IBM 2703 equipped with the Synchronous Feature, with an IBM 2701 equipped with a Type II Synchronous Adapter, or with an IBM 3704/05 operating in emulation mode.
- Provision for communicating with any terminals that conform to IBM BSC conventions, such as a Memorex Model 40 or Model 50 equipped with a BSC adapter; IBM 2780, 3270, or 3735 Transmission Terminals; an IBM System/360 Model 20 with a BSC Adapter; an IBM System/360 Model 25 with the ICA Feature; IBM System/370 models equipped with the ICA Feature; or an IBM 1130 Computing System equipped with a BSC Adapter.
- Throughput improvement by the ability to transmit two packed-decimal digits in a given character timeframe.

DESCRIPTION OF BSC OPERATIONS

The Binary Synchronous Communications procedure provides a set of rules for synchronous transmission of binary-coded data. Synchronous communications, by definition, means that the receiving station on a communications channel operates in step with the transmitting station by the recognition of a specific bit pattern (sync pattern) at the beginning of each transmission. The basic control of the transmission link between two BSC stations is accomplished by the recognition of data-link control characters.

DATA-LINK CONCEPT

A data-link consists of the communication lines, modems, and other communications equipment used in the transmission of information between two or more stations. The terminal equipment making up a station can vary from a basic keyboard/printer terminal to a control unit with several input and output devices.

The communication facilities may be obtained from communication common-carriers, or equivalent facilities may be provided by the customer. The specific modem used at each end of the data link is determined by the type of data link and the operational speed of the terminal equipment at each station.

All transmission over the data link is binary-bit stream and is synchronous by bit and by character. Bit synchronism is established by the modem. Character synchronism is established after bit synchronism by the recognition of a sync pattern (two consecutive SYN characters). Once character synchronism is established between two stations involved in a given transmission, it is maintained until the transmission is terminated. Synchronism is aborted if no sync patterns or termination or turn-around control characters are detected within a pre-established time-out period.

DATA-LINK CONTROL

Control of the data-link is maintained through the use of the following control characters and sequences:

SYN	- Synchronous Idle
SOH	- Start of Heading
STX	- Start of Text
ETB	- End of Transmission Block
ETX	- End of Text
EOT	- End of Transmission
ACKO/ACK1	- Alternating Positive Acknowledgments
WACK	- Wait-Before-Transmit Positive Acknowledgment
NAK	- Negative Acknowledgment
ITB	- End of Intermediate Transmission Block
DLE	- Data-Link Escape
RVI	- Reverse Interrupt
DLE-Stick	- Data-Link Escape Stick
PAD	- Pad Sequence
ENQ	- Enquiry

Transmit Operations Using Data-Link Characters

During Binary-Synchronous Communications, transmit operations are those occurring when data is transferred from main storage to a remote station via the communication facilities. The 1270 is said to be in transmit mode when transmitting information in this direction.

The following discussion of control characters relates to the various applicable control characters as implemented by the 1270.

SYN Characters

Whenever a character is not available for transmission during the execution of a WRITE command, SYN characters are generated and inserted into the data stream as time-fill to maintain character synchronization. Block-check-character (BCC) accumulation does not include SYN characters.

The programmer can insert a SYN character whenever there is need for time-fill in the program; however, the SYN characters will be deleted by the receiving equipment involved in the data transmission. The 1270 does not transfer the time-fill (SYN) to receiving storage.

For synchronization purposes, two SYN characters are inserted into the data stream at the beginning of all WRITE operations and every second when the 1270 is transmitting. In transparent mode, a DLE SYN sequence is inserted every second.

SOH and STX Characters

The 1270 enters the text mode and initiates BCC accumulation upon detecting either SOH or STX. Any SOH or STX characters detected after the 1270 has entered the text mode are treated as non-control characters (data characters).

In any particular data block, the SOH or STX that initiated BCC accumulation is not included in the BCC accumulation; however, any ensuing STX or SOH characters in the data block are included in the BCC accumulation.

During transmission, exit from text mode is accomplished by the 1270 detecting either an ETX or ETB control character or an Interface Stop, or by the Halt I/O instruction. Because the 1270 requests multiple bytes from storage, bytes following the ETX and ETB may be transferred into the 1270 prior to the ending of the command unless a stop has been issued. These additional bytes are not transferred to the line.

ETB and ETX Characters

Upon detection of either ETB or ETX, the 1270 exits from text mode and initiates transmission of the accumulated BCC and one pad character. ETB and ETX characters are included in BCC accumulation. Transmission of the pad character is a 1270 plugging option.

EOT, ACK, WACK, and NAK Characters

These four control characters are ignored as control characters when the 1270 is operating in transmit mode.

ITB Character

This character is used to divide a message (heading or text) for error checking. The ITB does not cause a reversal of transmission direction and is followed by a BCC. After the ITB and BCC are transmitted, the 1270 resets the block-check count and starts accumulating a new BCC. The ITB character is included in BCC accumulation. All BSC stations must have the ability to receive ITB and its respective BCC.

After the first intermediate block, successive intermediate blocks need not be preceded by STX or SOH. (For transparent data, each successive intermediate block must begin with DLE STX.) If one intermediate block is heading and the next intermediate block is text, STX must precede the text block.

Normal line turnaround occurs after the last intermediate block, which is terminated by ETB or ETX (DLE ETB or DLE ETX for transparency). When one of these ending characters is received, the receiving station responds to the entire transmission. If a block-check error is detected for any of the intermediate blocks, a negative reply is sent, which requires retransmission of all intermediate blocks.

With the IMBM (plugging option) out, ITB and associated BCC are recognized and active. If plugged, and a SET MODE command is issued to turn on the IMBM mode (bit 1 on), ITB and associated BCC are recognized and active. If, however, the IMBM is plugged and the SET MODE command is not issued, the ITB is treated as a normal data character.

DLE Character

DLE is a control character used exclusively to provide supplementary line control characters, such as WACK, ACK0, ACK1, RVI, and transparent mode control characters. The sequences DLE STX, DLE ETX, DLE ITB, and DLE ETB initiate and terminate transparent text.

The first DLE, after a DLE STX in any sequence, is not included in the BCC accumulation, nor is a DLE SYN sequence included.

Any transmitted DLE followed by an end control character must be contained in a second WRITE CCW, which is command-chained to the first WRITE CCW.

RVI Control

The transmission of RVI control characters is optional. RVI characters are used in receive operations (see discussion below).

DLE-Stick Sequence

DLE-Stick will be ignored as a control sequence in transmit mode.

Pad Character

The Pad character is an all-ones character. To ensure that the last meaningful bits in a transmission are sent properly by the data set, one pad character optionally may be sent following every turnaround character. The bit configuration of a valid pad is 1111 1111; however, the 1270 only checks the first four bits that arrive (XXXX 1111).

ENQ Character

The ENQ control character is detected in data received from main storage during the execution of a POLL command. When ENQ is detected, the 1270 exits the transmit mode and enters the receive mode. The ENQ plus an index character must be the last characters in a polling sequence.

Receive Operations Using Data-Link Characters

For Binary Synchronous Communications, receive operations are those occurring when data is received from a remote station. The 1270 is considered in receive mode whenever it is not in transmit mode or poll mode.

SYN Characters

All SYN characters are deleted from the received data stream, except when in transparent text mode, by the 1270 before the received data is transferred to main storage. Any SYN characters detected by the 1270 are not included in the block-check-character accumulation.

SOH and STX Characters

The 1270 enters the text mode and initiates BCC accumulation upon detecting either SOH or STX. The SOH or STX character initially detected is not included in BCC accumulation. Any SOH or STX characters detected after the 1270 has entered the text mode are treated as non-control characters.

ETB and ETX Characters

These control characters signify that the check character is following. On a READ command, the ETX or ETB always signals End to the Channel. The BCC accumulation includes the ETB and ETX characters and the 1270 remains in receive mode.

ENQ,ACK, and NAK Characters

The detection of any one of these control characters followed by an optional pad character (all ones) will end the command with Channel End and Device End status. If the initially detected control character was followed by an invalid pad character, the 1270 will enter the invalid pad character in main storage as data, maintain character synchronization, and continue to receive.

WACK Character

WACK allows a receiving station to indicate a "temporary not ready to receive" condition to the transmitting station. It can be sent as a response to a text or heading block, selection sequence (multipoint) line bid (point-to-point with contention) or an ID (identification) line bid sequence. WACK is a positive acknowledgment to the received data block or to selection.

The normal station response to WACK is ENQ, but EOT and DLE EOT are also valid responses. When ENQ is received, the receiving station will continue to respond with WACK until it is ready to continue. Control sequences are as follows:

EBCDIC - - DLE,

USASCII - - DLE;

RVI Character

This control character is used as a positive response in place of positive acknowledgement characters ACK0 or ACK1. A receiving station will transmit an RVI character to request termination of the current transmission if a high priority message must be transmitted to the sending station; or in the case of a multipoint environment, the control station, acting as a receiver, needs to communicate with another station on the line.

When the sending station receives an RVI character, it responds by transmitting all data (possibly more than one data block) that prevents it from operating as a receiving station.

All BSC stations must be capable of receiving the RVI character, but the RVI transmission capability is optional. The character structure of the RVI control sequence is as follows:

EBCDIC -- DLE @

USASCII -- DLE<

DLE Character

This control character, followed by a defined character, initiates a control sequence if the 1270 is operating in transparent mode.

To initiate transparent mode, the 1270 monitors the incoming data for the DLE STX sequence. While in transparent mode, a DLE DLE sequence is interpreted as a normal data character with the first DLE being deleted and the second DLE being sent to main storage. The DLE SYN sequence is detected as time-fill with the DLE and SYN deleted from the data stream going to main storage. Neither the DLE nor SYN is included in the BCC accumulation. During a receive operation in transparent mode, a single DLE character followed by any character except DLE, SYN, ETB, ETX, ITB, or ENQ, sets the Data Check bit in the sense byte. Receiving continues.

A DLE, followed by end control characters ITB, ETB, ETX, or ENQ (if the ENQ is followed by a valid pad), causes the 1270 to leave transparent mode. The end character is handled the same as in normal transmission. The DLE character preceding the end character DLE SYN and the first DLE in a DLE DLE sequence are not included in the BCC accumulation.

EOT Character

The EOT with its trailing pad character will cause the 1270 to remain in receive mode. No BCC comparison is performed on the received data. Channel End, Device End, and Unit Exception status is signalled to the channel.

NOTE

EOT recognition, while in text mode, and the trailing pad are plugging options.

ITB Character

The ITB character is used to divide a message (heading or text) for error checking and is followed by a BCC. If the 1270 detects an ITB character and is not in the transparent mode, it remains in text mode and restarts the accumulation of the new BCC with the character following the BCC.

When the 1270 is in Error Index Byte mode, it checks the BCC accumulation each time an ITB is detected and passes an Error Index Byte (EIB) on to main storage following the ITB (ETB or ETX) character. If the 1270 is not in Error Index Byte mode, the EIB is not passed on to main storage and the ITB character will be treated as non-control data. The Error Index Byte (EIB) indicates the condition of the last block of received data (a non-zero content indicates a transmission error).

The EIB informs the program of data-check or overrun conditions detected while the block of data was being received. These conditions set the following bits in the EIB:

Bit Position	Condition
4	Data Check
5	Overrun

The EIB character is stored in the byte location immediately following the ITB (or ETB or ETX) character of the data block involved in the Read operation. The ITB character is used to break up a long record into shorter blocks; each block (except the last) is ended with an ITB character. The direction of transmission is not reversed following the ITB as it is following the ETX.

DLE-Stick Sequence

When the 1270 is not in text or transparent mode, DLE-Stick (followed by a valid pad character) will end a READ type command with Channel End and Device End status. Some of the defined DLE-Stick sequences are: ACK0, ACK1, WACK, and RVI. The DLE-Stick sequence will be treated like the NAK character.

Both characters must be of proper parity when USASCII parity checking is performed. All DLE sequences must be contiguous characters. If text mode is set, the DLE-Control sequence will be treated as data and included in the BCC accumulation.

DESCRIPTION OF SYNCHRONOUS TERMINAL CONTROL OPERATIONS

The Synchronous Terminal Control feature is a prerequisite to attaching any BSC capability to the 1270. Operationally, the 1270 is fully controlled by the channel program in conjunction with the data-link-control signals it receives from the remote station via the communications network and the signals it receives via the multiplexer channel attached to the main storage CPU. The 1270 performs the following functions:

1. Verifies the accuracy of data transferred between the 1270 and the remote station.
2. Scans received control characters and initiates the necessary control character sequences.
3. Responds to READ and WRITE type commands by initiating the appropriate data transfer operations.
4. Generates pad and check characters as required.
5. Provides fixed time-outs to prevent system "hang-up" and unwanted looping.

The 1270 informs the processor of its status by way of the status and sense bytes. The program interrogates each received response to determine if any further action is required. Typical responses are:

- The remote station signals EOT (end of transmission).
- Erroneous or invalid characters are transferred in either direction between main storage and the 1270, or erroneous or invalid characters are received from the remote station.
- An error in sequencing of certain commands occurs or invalid commands are attempted to be executed.
- Time-out conditions occur.

Communication Code

The Synchronous Terminal Control feature communicates in either EBCDIC or USASCII and provides circuitry for transmission-error-detection. The error detection method is determined by the transmission code used. All lines of a specific code type (independent of the number of lines and line speed used) are controlled by the Synchronous Terminal Control feature.

Extended Binary Coded Decimal Interchange Code (EBCDIC)

This eight-bit code allows transmission of 256 different bit patterns. See Figure 5-1 for EBCDIC code structure. Eleven of these bit patterns represent data-link characters assigned as line control characters. In addition, the following characters are currently assigned in EBCDIC:

		00				01				10				11				0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Second 4,5,6,7	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hex
0000	0	NUI	DLE			SP	&	-	▨								0	
0001	1	SOH	DC1					▨	/	a	j			A	J		1	
0010	2	STX	DC2		SYN			▨		b	k	s		B	K	S	2	
0011	3	ETX	DC3						▨	c	l	t		C	L	T	3	
0100	4	PF	RES		PN			▨		d	m	u		D	M	U	4	
0101	5	HT	NL		RS				▨	e	n	v		E	N	V	5	
0110	6	LC	BS		UC				▨	f	o	w		F	O	W	6	
0111	7	DEL	IL		EOT			▨		g	p	x		G	P	X	7	
1000	8		CAN					▨		h	q	y		H	Q	Y	8	
1001	9		EM						▨	i	r	z		I	R	Z	9	
1010	A	SMM	CC			¢	!		▨	:								
1011	B	VT				.	$	▨	,	#								
1100	C	FF	IFS		DC4	<	*	%	▨	@								
1101	D	CR	IGS		NAK	(	)	▨	-	'								
1110	E	SO	IRS			+	;	▨	>	=								
1111	F	SI	IUS See Note		SUB	|		?	▨	"								

0	1	2	3	4	5	6	7

EBCDIC Structure as used for Channel Interface and transmission

▨

During receive operations, the DLE character, followed by any character in columns 6 or 7, causes the command to be ended. However, only the marked characters are valid. The following DLE sequences have been defined:

'70' = ACK0
'61' = ACK1
'6B' = WACK
'7C' = RVI

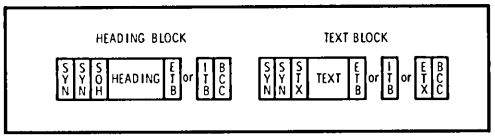
NOTE: Bit configuration '1F' performs the Intermediate Block Check (ITB) function.

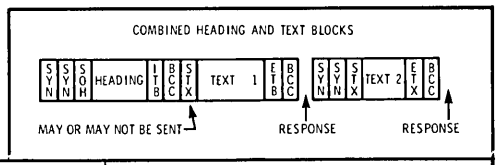
LINE CONTROL CHARACTERS

ACK	(Affirmative Acknowledge) reply to station selection, receipt of message sent.
*DLE	(Data Link Escape) provides supplementary line control expansions; control or DLE sequences.
*ENQ	(Inquiry) Interrogates terminal to status or I.D. (control). Message state; request retransmission of acknowledgement or preceding block to be ignored.
EOT	(End of Transmission) ends a transmission, all stations go to control mode; negative response to a poll.
*ETB	(End of Transmission Block) terminates a message block, indicating the message will continue. Requires a reply.
*ETX	(End of Text) terminates last block of a message. Requires a reply.
NAK	(Negative Acknowledge) indicates a message error by receiving terminal; reply to a selection sequence.
RVI	(Reverse Interrupt) sent by receiving station to terminate prematurely operation in progress.
SOH	(Start of Heading) precedes heading characters.
*STX	(Start of Text) precedes text characters.
*SYN	(Synchronous idle) used as a "fill" to maintain sync.
TTD	(Temporary Text Delay) sent by transmitting station to indicate a delay or initiate an abort in transmission.
*US/ ITB	Terminates an intermediate block of characters, BCC is sent, no line turnaround occurs.
WACK	(Wait Before Transmit Positive Acknowledge) sent by receiving station to indicate not ready to receive.

*Follows a DLE To indicate control characters while in TRANSPARENT TEXT mode.

FRAMING





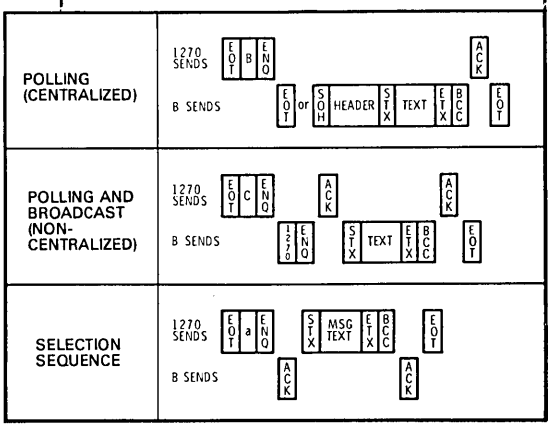


Figure 5-1. Extended Binary Coded Decimal Interchange Code

52 alphabetic characters (upper and lower case)
10 numeric characters
22 end-to-end characters
33 special graphics (including space)

EBCDIC is code-compatible with the internal code used in System/360, thus permitting maximized utilization of communications facilities and of channel-to-control-unit data paths to the 1270, CPU, and main storage. Information is stored in main storage directly as received without need for translation. For either transmission code, bit position seven of the byte in main storage is always transmitted on the communication line as the first bit. The first bit received from the transmission facility always goes to bit position seven of the byte in main storage.

United States of America Standard Code for Information Interchange (USASCII)

The USASCII Code consists of seven data bits plus an odd-parity check bit in the eighth position. USASCII provides up to 128 bit patterns, all of which have assigned characters as follows:

10 data-link characters
52 alphabetic characters (upper and lower case)
10 numeric characters
23 end-to-end characters
33 special characters (including space and delete)

USASCII characters are received by the 1270 directly as received from the communications facility. See Figure 5-2 for USASCII code structure.

Transparent Text Mode

Transparent Text mode is a standard feature used during read and write operations of text transmitted in bit-pattern structure rather than character-pattern structure as in the normal mode. Either EBCDIC or USASCII codes may be used in Transparent Text mode. This mode permits greater versatility in the range of coded data that can be transmitted, since all data, including the normally restricted data-link control characters, are treated only as bit patterns. This is particularly useful for transmitting floating-point numbers, packed-decimal data, object programs, etc.

Control Characters

Any data-link control characters transmitted during transparent mode must be preceded by a DLE to be recognized as a control function. The following sequences are recognized by the 1270 during transparent mode operation:

DLE STX

Initiates transparent mode for the text following.

Second 4,5,6,7	Hex	00				01				10				11			
0,1		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
2,3		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL	DLE	SP	0	@	P	\	p								
0001	1	SOH	DC1	!	1	A	Q	a	q								
0010	2	STX	DC2	"	2	B	R	b	r								
0011	3	ETX	DC3	#	3	C	S	c	s								
0100	4	EOT	DC4	$	4	D	T	d	t								
0101	5	ENQ	NAK	%	5	E	U	e	u								
0110	6	ACK	SYN	&	6	F	V	f	v								
0111	7	BEL	ETB	'	7	G	W	g	w								
1000	8	BS	CAN	(	8	H	X	h	x								
1001	9	HT	EM	)	9	I	Y	i	y								
1010	A	LF	SUB	*	:	J	Z	j	z								
1011	B	VT	ESC	+	;	K	[	k	{								
1100	C	FF	FS	,	<	L	\	l	¬								
1101	D	CR	GS	-	=	M	]	m	}								
1110	E	SO	RS	.	>	N	^	n	~								
1111	F	SI	US See Note	/	?	O	-	o	DEL								

First Hex

Bit Position 0 vs. Parity (ODD)

0	1	2	3	4	5	6	7	

Channel Interface Byte

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	

TCU Processor Storage Code Structure

During receive operations, the DLE character followed by any character in column 3, causes the command to be ended. The following DLE sequences have been defined:

'30' = ACK0
'31' = ACK1
'3B' = WACK
'3C' = RVI

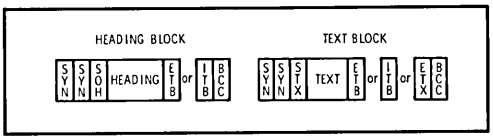
NOTE: Bit configuration '1F' performs the Intermediate Block Check (ITB) function.

LINE CONTROL CHARACTERS

ACK	(Affirmative Acknowledge) reply to station selection, receipt of message sent.
*DLE	(Data Link Escape) provides supplementary line control expansions; control or DLE sequences.
*ENQ	(Inquiry) Interrogates terminal to status or I.D. (control). Message state; request retransmission of acknowledgement or preceding block to be ignored.
EOT	(End of Transmission) ends a transmission, all stations go to control mode; negative response to a poll.
*ETB	(End of Transmission Block) terminates a message block, indicating the message will continue. Requires a reply.
*ETX	(End of Text) terminates last block of a message. Requires a reply.
NAK	(Negative Acknowledge) indicates a message error by receiving terminal; reply to a selection sequence.
RVI	(Reverse Interrupt) sent by receiving station to terminate prematurely operation in progress.
SOH	(Start of Heading) precedes heading characters.
*STX	(Start of Text) precedes text characters.
*SYN	(Synchronous idle) used as a "fill" to maintain sync.
TTD	(Temporary Text Delay) sent by transmitting station to indicate a delay or initiate an abort in transmission.
*US/ ITB	Terminates an intermediate block of characters, BCC is sent, no line turnaround occurs.
WACK	(Wait Before Transmit Positive Acknowledge) sent by receiving station to indicate not ready to receive.

*Follows a DLE To indicate control characters while in TRANSPARENT TEXT mode.

FRAMING



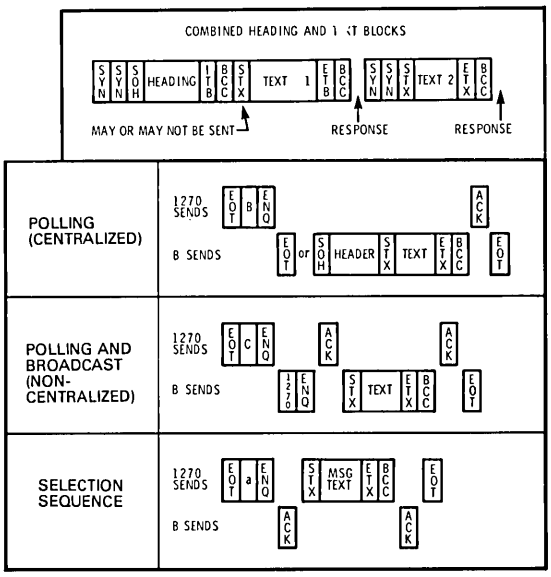


Figure 5-2. USASCII-8 BSC Code Structure

DLE ETB

Terminates a block of transparent text, returns the data-link to normal mode, and calls for a reply.

DLE ETX

Terminates the transparent text, returns the data-link to normal mode, and calls for a reply.

DLE SYN

Used to maintain sync, or as time-fill sequence for transparent mode.

DLE ENQ

Indicates "disregard this block of transparent data" and returns the data-link to normal mode.

DLE DLE

Used to permit transmission of DLE as data. One DLE is disregarded; the other is treated as data.

DLE ITB

Terminates an intermediate block of transparent data, returns the data-link to normal mode, and does not call for a reply. The block check character follows DLE ITB. If the next intermediate block is transparent, it must start with DLE STX.

Transparent-Read Operation

The 1270 enters transparent mode via the control-character sequence DLE STX. The 1270 exits from the transparent mode of operation by the detection of a DLE followed by the control characters (ETX, ETB, ENQ, or ITB). A DLE followed by an undefined control character results in the 1270 remaining in transparent mode and in the posting of sense-bit 4 (Data Check). A DLE DLE sequence causes the 1270 to remain in transparent mode with the first DLE deleted from the data sent to main storage as is every first DLE in transparent mode.

Transparent-Write Operation

Two WRITE commands are required to initiate transparent-write operations. The first WRITE command is used to transmit the data stream. This command is ended normally when the byte count equals zero. Execution of the command-chained second WRITE command causes the 1270 to exit transparent mode upon detecting one of the following control sequences: DLE ETB, DLE ETX, or DLE ITB.

Detecting either DLE ETB or DLE ETX will cause the command to end with Channel End and Device End status. If none of the three control sequences occur, the second command ends with Channel End and Device End status, and the 1270 exits transparent mode when the byte count equals zero.

The second WRITE command must be received by the 1270 within three seconds of the ending of the first WRITE command; otherwise a time-out occurs with Channel End, Device End, and Unit Check status and the Time-out sense bit (bit 7) set to one.

During transparent transmission, and while in the first WRITE command, the 1270 generates a DLE character whenever it detects a transparent-text-bit configuration that is the same bit configuration as a DLE character. This insertion of a DLE prevents the receiving station from falsely ending a block if the transparent-bit configuration is the same as transparent-ending sequence (e.g., DLE STX). The inserted DLE is deleted by the receiving station prior to placing the received message in the receiving station's main storage.

To permit a bona fide ending sequence to be transmitted, the transmitting 1270 must know when to inhibit the insertion of the DLE character under the conditions just cited. This is accomplished by the use of two WRITE commands as follows:

> The byte count of the first WRITE command is decremented to zero upon the transmission of the last byte (character) of the message. The second WRITE is command chained to the first WRITE command and contains the ending sequence. Under this second WRITE command, the 1270 does not generate a DLE upon detection of another DLE.

Programming Notes: For both read and write operations, a DLE ITB sequence causes the 1270 to exit from transparent mode, yet continue in text mode.

The 1270 sends the block-check character accumulation after ETB, ETX, or ITB and exits transparent mode.

The DLE SYN sequence is used in transparent mode in the same manner that the SYN is used in non-transparent mode. The DLE SYN sequence is not recommended for use as time-fill.

If the data following is to be in transparent mode, the DLE STX sequence must follow the ITB character.

Transmission-Code Checking

The error detection circuitry for each transmission code is incorporated in the synchronous equipment. Automatic-checking capability is provided for both transmission codes; however, the checking method employed depends on the mode of operation of the synchronous terminal control.

Figure 5-3 indicates the checking methods available.

Transmission Code	Transparent Mode	Non-transparent Mode
EBCDIC	CRC-16	CRC-16
USASCII	CRC-16	VRC/LRC (CRC-16)*

CRC = Cyclic Redundancy Check
VRC = Vertical Redundancy Check
LRC = Longitudinal Redundancy Check

*Plugging option that allows the use of CRC while operating in USASCII non-transparent mode.

Figure 5-3. Transmission Code Checking

Vertical Redundancy Check (VRC) and Longitudinal Redundancy Check (LRC)

A VRC parity check is performed on each character (including the LRC character) that is transmitted. An even longitudial parity check is performed on all data bits (not including parity bits) of the characters comprising the transmitted message block. Both the sending and receiving stations accumulate LRC during data transmission. The accumulated LRC value becomes a block-check-character (BCC). The BCC accumulated at the receiving station and the transmitted BCC are compared to determine if the transmitted data block was correctly received. An equal condition indicates correct receipt of the transmitted data block.

Cyclic Redundancy Check (CRC)

The Cyclic Redundancy Check (CRC) makes use of a circuit-implemented polynomial that treats the transmitted message as a binary number, and performs modulo 2 divide operations on this binary number (carries are not considered). Both the sending and the receiving stations generate this value individually. The transmitting station sends its generated value resulting from the modulo 2 division. Only the remainder is transmitted to the receiving station, at which point the two CRC values are compared. Equal comparison indicates accurate transmission.

BINARY SYNCHRONOUS COMMANDS

A 1270 equipped for binary synchronous communication implements up to thirteen channel commands. These commands are:

Command	Command Code (Hexidecimal)
SET MODE	23
ENABLE	27
DISABLE	2F
PREPARE	06
WRITE	01
READ	02
SEARCH	0E
ADDRESS PREPARE	1E
POLL	09
SENSE	04
DIAL	29
WRAP	05
INHIBIT	0A

SET MODE

This command is used to condition the 1270 to the operating environment required. It results in the fetching of one byte of control information from main storage to the control circuitry of the 1270.

The bit positions of the byte fetched from main storage (its location is designated by the data-address field of the SET MODE CCW) are used as follows:

Bit Position 0

Not used.

Bit Position 1

If set to 0, no Error Index Byte (EIB) will be sent to main storage following detection of an ETB, ITB, or ETX character. A plugging option is available which causes the Synchronous Terminal Control feature to treat the ITB character as normal data when bit position 1 is set to 0.

If set to 1, an EIB is generated and sent to main storage immediately following the detection of an ETB, ITB, or ETX character. Bit 4 of the EIB will be set to 1 if a data check was detected in the preceding block. Bit 5 of the EIB will be set to 1 if an overrun was detected in the preceding block. Bits 1, 2, 3, 6, and 7 of the EIB are undefined.

Bit Positions 2 thru 7

Not Used.

Programming Note: After a power-on/power-off sequence or a system reset, the SET MODE command must be used to re-establish the operating conditions controlled by the SET MODE command.

ENABLE

This command makes the 1270 operational with the selected data set or data station (depending on whether switched or private communications facilities are used). If the transmission is to be via private line, the command ends immediately, upon enabling the line, with Channel End and Device End status (CSW bits 36 and 37).

If the transmission is to be via switched network, the command ends with Channel End and Device End status when the local data set is operationally available.

This command permits the 1270 to be in condition to answer dialed "calls" from a remote station, if required. No data is transferred in either direction by this command.

DISABLE

The execution of a DISABLE command terminates (at a 3 second minimum delay) the outstanding call on a switched line. On a private line, this command ends immediately with Channel End and Device End status.

A disabled line will not answer any incoming calls, after a DISABLE command has been executed.

PREPARE

This command may be used in contention-type communications systems to indicate when data is arriving and to thus monitor the received data stream for SYN characters. The PREPARE command will be accepted only if the line has been previously enabled. No data transfer to main storage occurs during the PREPARE command execution.

The PREPARE command ends when a sync pattern has been detected and sets the Channel End and Device End status (CSW bits 36 and 37).

A READ command should be command-chained to the PREPARE command in order to transmit any ensuing data to main storage. Any SYN characters assembled by the 1270 are not transferred to main storage.

The PREPARE command should not normally be used in switched-network operation, because no time-outs are performed to protect the system against hang-up.

WRITE

The WRITE command causes the 1270 to request the transfer of data characters from main storage for transmission to a BSC-equipped remote station. One PAD and two SYN (PAD may be FF or a SYN) characters will be placed on the communication line by

the Synchronous Terminal Control feature prior to the first data character. All data and control characters (except DLE and SYN when used as fill) that are sent to the communication line, must originate in main storage.

The 1270 will continue requesting the transfer of characters from main storage until the WRITE command is ended by one of the following conditions:

1. An ETX or ETB control character is detected in the data stream (except in transparent mode).

2. The 1270 detects common-carrier equipment malfunction.

3. Count field in WRITE CCW is decremented to zero.

At the end of the WRITE command, a single pad character may optionally be sent after the last character to ensure that the data set will have time to transmit the last character before data set turnaround.

Programming Note: All WRITE commands will normally have bit 33 set to one for command chaining to a READ command to prevent loss of data. An exception to this requirement is when the WRITE command is used for sending EOT to a remote station.

READ

This command is used to transfer characters from a BSC-equipped remote station to main storage. For characters to be transferred to main storage, the line must be in character phase (i.e., must have received two consecutive SYN characters). On a Read operation, the BCC and all SYN characters are deleted, by the 1270, from the data transferred to main storage.

The READ command will end normally with Channel End and Device End status when any ETB, ETX, ACK, NAK, DLE (and associated ending follower characters), or ENQ characters are detected. If an EOT is detected, the READ command will end with Channel End, Device End, and Unit Exception status. To be recognized as valid control characters, the turnaround characters (EOT NAK ENQ) may optionally be required to be followed by a valid pad character. DLE-Stick must be followed by a valid pad character.

The READ command will end with Channel End, Device End, and Unit Check status if the following conditions occur:

Condition	Sense bit set
Count decremented to zero	6
Halt I/O issued	6
Data Check occurs	4
Overrun occurs	5
Common-carrier equipment not operational	1

NOTE

Sense-bit 6 is also set to one if data is lost because the READ command was late in being executed.

If the time interval between the sequences of single SYN's followed by a non-SYN character is greater than three seconds, or if the time interval between the acceptance of the READ command and the receipt of either SOH or STX or an End character (any of those mentioned) is greater than three seconds, the command will be ended with Channel End, Device End, and Unit Check status and the Time-out sense bit (bit 7) set to one.

INHIBIT

The INHIBIT command is the same as for a READ except no time-outs occur.

SEARCH

This command is used when the BSC-equipped 1270 is operating as a master station. The SEARCH command may be issued only after a POLL command. Since the 1270 will normally be in character phase when the SEARCH command is issued, data will be immediately transferred to main storage, starting with the last index character sent from main storage under the preceding POLL command. The index character is followed by the data being received from the communication line.

All data received before going into text mode (entry into text mode via recognition of the STX or SOH -- including the first STX or SOH) is sent to main storage. Before going into text mode, the one-second time out is utilized and the time-out condition is reset every time a new end character, STX or SOH, is detected. If the one-second time-out condition is recognized before entry into text mode, the SEARCH command ends with Channel End, Device End, and Unit Check status and the time-out bit (sense-bit 7) set to one. While in text mode, no data is sent to main storage and the 1270 monitors all data and responses. The SEARCH command ends with Channel End, Device End, and Unit Exception status upon recognition of an EOT character, or with Channel End, Device End, and Unit Check status and the time-out sense bit (bit 7) set to one if the three-second time-out occurs after entering text mode.

If the first non-SYN character received as a response to a POLL command was a master-station address, the SEARCH command chained to the POLL command ends normally when the ENQ is detected. All conditions pertaining to the READ command apply to the SEARCH command under this circumstance.

ADDRESS PREPARE (ADPREP)

This command is used when the 1270 is equipped with the Station Selection feature and is operating as a non-master station. The ADPREP command is a pseudo READ command in that the 1270 performs all of the operations of a READ command, except transferring data to main storage.

When the 1270 accepts the ADPREP command, it monitors all data received on the selected communication line. If character phase is not established (the sync pattern has not been detected on the communication line) when the ADPREP command is accepted, the 1270 initiates a three-second time out, during which it must recognize a sync pattern followed by one of the following three conditions:

1. 1270 Address - If a selection address is detected, the command will end with Channel End and Device End status, thus allowing chaining to a READ command; or if the polling address is detected, the command ends with Channel End, Device End, and Status Modifier status. This allows command chaining to a READ command other than the READ command used when the selection address is detected.

2. Text-Mode-Entry - Upon entering into text mode (as a result of recognizing STX or SOH), the 1270 will cease looking for its address until a new SYN SYN EOT sequence is detected. The 1270 monitors the data stream while in text mode, using the three-second time out for recognition of SYN characters...similar to the READ command operation, but with the exception that the ADDRESS PREPARE command does not end.

3. End-Character Recognition - The recognition of a new SYN SYN and an End character will cause the three-second time out to be reinitiated, and the 1270 will continue to monitor for a new SYN SYN and its address or an End character.

If a time out occurs or if sync is established when the ADPREP command is issued, the 1270 looks for a SYN SYN EOT sequence before any of the preceding conditions are sought.

The 1270 decodes up to two addresses. The addresses are known as the poll address and the selection address.

The poll address is the address of the 1270 when it is used in a polling operation (transmitting), while the selection address is that of the 1270 when it is used in a selection operation (receiving).

POLL

This command is a pseudo WRITE command in that the 1270 goes through the actions of a normal WRITE command until the ENQ control character is detected in the data received from main storage. The index character should always follow ENQ, and this index will be the first character sent to main storage when the positive response is received. After the ENQ has been transmitted to the line, the 1270 enters receive mode (however, Channel End and Device End are not sent to main storage). When in receive mode, the 1270 looks for the receipt of synchronizing characters. The following conditions may occur:

1. Time out - Following the transmitting of the ENQ, a three-second time out is initiated. At the end of three seconds, if the 1270 is not in character phase, the POLL command ends with Channel End, Device End, and Status Modifier status (CSW bits 36, 37, and 33).

2. Recognition of Sync Characters - If the first character following sync characters is not an EOT, the operation ends with Channel End, Device End, and Status Modifiers. If the first non-SYN character is an EOT, the 1270 returns to transmit mode and transmits the next character immediately following the last index character. An additional three or four characters are requested from the channel when required. The old index character is destroyed.

When the channel receives the Status Modifier signal, the POLL command should then chain to either a READ or a SEARCH command (depending on whether operating as point-to-point or multipoint). The first character received during the READ or SEARCH command execution is the last index character sent out from main storage in the previous poll. After the index character has been transferred to main storage, the 1270 immediately sends to main storage the data received via the communication line. If the time-out sense bit had been set during the POLL command execution, the 1270 ends the command with Channel End, Device End, and Unit Check status and with the time-out sense bit set to one.

NOTE

Polling characters must be specified in multiples of 3 or 4.

DIAL

The DIAL command is used to automatically dial a remote BSC-equipped station. This command is accepted by a 1270 equipped with the Autocall feature and an Autocall Adapter. When DIAL is executed, dial digits (bytes) are transferred from main storage through the 1270 Autocall feature to an external Automatic Calling Unit (ACU) for switching purposes.

EFFECT OF HALT I/O INSTRUCTION AND ZERO BYTE COUNT

All the commands implemented by the 1270 employ a command structure. When the byte count in the current CCW is decremented to zero, and data chaining is not specified (bit 32 set to zero), a condition known as "Interface Stop" occurs in the event additional bytes are requested. This condition signals the 1270 that no additional bytes are to be transferred between main storage and the 1270.

Various actions take place, depending on the command being executed.

SET MODE

Command ends when stop is signalled. If no error or unusual condition occurred during execution, the ending status is Channel End and Device End status (CSW bits 36 and 37).

READ

When the Interface Stop signal occurs, the channel will immediately cease transferring data. Data read but not transferred will be lost. The Unit Check status (CSW bit 38) and the Lost Data bit (sense-bit 6) are set to one.

WRITE

Stop signal indicates the last character has been transferred under the current command. The 1270 sends any characters it has buffered to the line and ends with Channel End and Device End status (CSW bits 36 and 37). If the 1270 was operating in transparent mode, it will continue in transparent synchronism by sending transparent sync idles for 3 seconds or until another WRITE command is issued. This new WRITE is used to transmit the end-of-transparent-block (DLE ETB) or end-of-transparent-text (DLE ETX) sequence.

SEARCH

The Interface Stop causes data transfer to cease and the 1270 to stop monitoring for valid addresses. Unit Check status (CSW bit 38) and Lost Data (sense-bit 6) are set to one. Part of the received data will always be lost when the Interface Stop occurs.

POLL

The stop signal indicates that the last character has been transferred from main storage to the 1270 under the current POLL command. The 1270 sends any buffered characters and ends the command with Channel End and Device End status (CSW bits 36 and 37). The 1270 waits for the reply to the poll operation before ending the command. Note that the program must ensure that the byte count is exactly as large as the poll list so that the last character transferred by the POLL command is the index character for the last poll in the list.

ENABLE, DISABLE, ADPREP, and PREPARE

No data-byte transfers occur with execution of these commands; accordingly, Interface Stop is never signalled.

SENSE

The Interface Stop signal causes this command to end immediately with Channel End and Device End status (CSW bits 36 and 37).

DIAL

The Stop signal indicates that the last dialing digit has been transferred from main storage to common-carrier dial equipment via the 1270 Autocall feature. When the 1270 Autocall feature detects Stop, it will wait for a signal from the data set (modem) indicating that the connection to the BSC-equipped remote station has been accomplished. When connection is confirmed, the DIAL command ends with Channel End and Device End status.

If the call cannot be answered at the remote station, the DIAL command ends with Channel End, Device End, and Unit Check status, and the time-out sense bit set to 1.

WRAP

The WRAP command causes the 1270 to wrap the output of the addressed synchronous communication line to the input of the line with the lowest line address in the 1270. This command is executed in an identical manner to a WRITE command and the error conditions are the same.

HALT I/O INSTRUCTION

A Halt I/O (HIO) instruction can be issued to the 1270 during the execution of a command. When HIO is issued, various actions take place, depending on the command being executed.

SET MODE

If HIO is received before the Set Mode byte has been accepted from main storage, the command ends immediately with Channel End, Device End, and Unit Exception status (CSW bits 36, 37, and 39). The 1270 is reset.

ENABLE

On a switched network, if the HIO is received when the data set is not operational (i.e., before the call has been answered), the command is ended with Channel End, Device End, and Unit Exception status (CSW bits 36, 37, and 39). Otherwise, HIO has no effect on the normal execution of the ENABLE command and the 1270 is not reset.

WRITE

HIO causes the 1270 to transmit any currently buffered characters and then terminate the command.

READ

HIO causes the command to stop transferring data to the channel. The Unit Check status (CSW bit 38) and Lost Data (sense bit 6) bits are set to one. Part of the data will always be lost when the HIO is issued during a READ command execution. The command ends immediately.

PREPARE

If HIO is issued before character phase is established, the command ends immediately with Channel End, Device End, and Unit Exception status (CSW bits 36, 37 and 39). If HIO is issued after character phase has been established, there is no effect.

ADPREP

If HIO is issued before the group, selection, or polling address is recognized, the command ends immediately with Channel End, Device End, and Unit Exception status (CSW bits 36, 37, and 39). Otherwise, the operation is not affected.

SEARCH

HIO causes the cessation of data transfer to main storage. Unit Check status (CSW bit 38) and Lost Data (sense bit 6) are set to one. The command ends immediately. Part of the data will be lost when the HIO is issued.

POLL

HIO causes the command to end immediately with Channel End and Device End status (CSW bits 36 and 37). HIO should not be used with the POLL command.

DISABLE

The HIO instruction has no effect on the DISABLE command.

SENSE

HIO causes this command to end immediately with Channel End and Device End status (CSW bits 36 and 37).

DIAL

If HIO is issued after a Stop signal has been received by the 1270 Autocall feature, the dialing operation proceeds normally.

An HIO issued before the Stop signal has been received by the 1270 Autocall feature (the entire number has not been dialed) causes the dialing operation to be aborted and the immediate ending of the DIAL command with Channel End, Device End, and Unit Exception status.

APPENDIX A.

1270 ROLLER INDICATORS

ROLLER A

A/D

Assemble/Disassemble Register used to serialize (disassemble) each byte of data received from the multiplexer channel during a Write operation for transmission to an addressed communication line. During Read operations, the Assemble/Disassemble Register assembles bytes of serial data received from an addressed communication line for transfer to the multiplexer channel.

BIT COUNT

Counts accumulated bits in the A/D register and indicates when complete characters have been transmitted or received. Count will always be one more than the A/D because the start bit is counted.

STROBE COUNT

Counts line oscillator changes and is used by A/D 2 as a sub-bit counter to determine bit length for (Asynchronous) lines.

LOSC

Indicates a change in the line oscillator.

RCV 1

(Asynchronous)--indicates that a start bit has been detected.

BSC--indicates that the first synchronous character has been received.

RCV 2

(Asynchronous)--indicates a valid start bit has been received.

BSC--indicates that a second synchronous character has been sent or received.

PREP END

Indicates that End is to be set for READ type commands.

END

Indicates that a command has ended.

HALT STK STOP

Indicates that a command has been halted or a stop has been received during data service. This bit is also used when status has been stacked by the channel.

DATA SVC

Indicates that a data transfer is required on the channel.

SHIFT

Used by the IBM Terminal Control to indicate upper-case characters. For BSC lines, this bit will be on when in intermediate block mode.

MODE

Used to indicate text or control mode, and also indicates poll answer-back mode during POLL command.

00 - Control
01 - Text Out
10 - Text In
11 - POLL Answer Back

LRC CTRL

Start/Stop--indicates that an LRC character is being sent or received.

BSC--indicates that CRC or LRC is being sent or received.

TIME-OUT CTRL

Indicates type of time-out being executed.

000 - None
001 - 1 msec
010 - 125 msec
011 - 200 msec
100 - 600 msec
101 - 1 sec
110 - 3 sec
111 - 28 sec

COMMAND

Indicates the command that is being executed.

00001 - WRITE
00010 - READ
00011 - SET MODE
00100 - SENSE
00101 - WRAP
00110 - PREPARE
00111 - ENABLE
01001 - POLL
01010 - INHIBIT
01101 - BREAK
01110 - SEARCH
01111 - DISABLE
11110 - ADDRESS PREPARE
01011 - DIAL

The following commands are unique to the IBM TYPE III Terminal Control:

10001 - WRITE BREAK
10010 - READ CLEAR
00101 - DIAGNOSTIC WRITE (in lieu of WRAP)
00110 - DIAGNOSTIC READ (in lieu of PREPARE)

ROLLER B

DATA BUFFER-1

Four bytes (A-D) used to buffer data between the A/D section and Data Buffer-2.

COUNT-1

Indicates the number of Data Buffer-1 characters received or to be transmitted.

ROLLER C

ASYC POLL

(Asynchronous)--indicates that the first character has been sent for an asynchronous poll.

BSC--indicates one of three conditions:

1. POLL ENQ has been loaded in the A/D unit.
2. The selection address has been received in Mode 3 (Poll receive mode).
3. In transparent mode, the first WRITE has been completed.

LRC

Indicates LRC accumulation.

SENSE

Contains the sense information to be presented to the channel upon receipt of a SENSE command.

TIME-OUT COUNTER

Counts time intervals for all time-outs.

DATA SET CONTROLS

Indicate status of data set controls.

COUNT-2

Indicates the number of bytes in Data Buffer-2.

ROLLER D

INTERFACE DATA REGISTER

A 32-bit register used to store data being transferred to or from the multiplexer channel.

COUNT

Indicates the number of characters to be transferred on the channel.

ROLLER E

TEST CHARACTER

Test generator character that is being received or transmitted.

STATUS

Contains the ending status information that is presented to the channel at the completion of a command. End always means Channel End/Device End.

INTERFACE CONTROL ADDRESS

Address of line for which an initial selection or ending status transfer is requested or in progress.

INTERFACE DATA ADDRESS

Address of line for which data transfer is requested or in progress.

BYTE COUNT

Count of data bytes transferred on channel.

DATA BUSY

Indicates that data transfer is requested or in progress.

READ

Indicates a read type data transfer.

COUNT

Indicates the number of characters to be transferred on the channel.

ROLLER F

I/O BUS OUT

Indicates the status of bits on Bus Out lines from the multiplexer channel.

I/O TAGS AND SELECTION CONTROLS

Indicate the status of the multiplexer control lines.

I/O BUS IN

Indicates the status of bits transmitted from the 1270 to the multiplexer channel Bus In lines.

CHANNEL INITIAL SEQUENCE

Indicates initial selection sequence from the channel.

DATA TRANSFER

Indicates that data is being transferred on the channel.

END STATUS

Ending status is being transferred to the channel.

CLOCK OUT

Indicates a clock-out from the channel.

ROLLER G

BSC CONTROL

BSC--indicates one of three conditions:

1. POLL ENQ has been loaded in the A/D unit.
2. The selection address has been received in Mode 3 (Poll Receive mode).
3. In transparent mode, the first WRITE has been completed.

Async--the first character has been sent in POLL.

FIRST SYNC DETECTED (FSD)

The first sync character has been sent or received.

DATA CHECK

Used in Intermediate Block Mode (IMBM) to generate an EIB.

OVERRUN

Used in IMBM to generate an EIB.

DELETE FROM CHECK (DFC)

Used to indicate that a character is not included in an LRC or CRC.

END CHECK

Indicates that a valid ending character has been received or sent.

CHECK CONTROL

Indicates that the 1270 is sending or receiving LRC or CRC characters.

IMBM

Indicates Intermediate Block Mode.

SELECT ANSCII

ANSCII Terminal Control has been selected for a BSC line.

TRSP IDLE

Indicates an IDLE in the first WRITE command.

DLE

1. The DLE character has been transmitted or received.
2. Used with Check Control to count CRC characters.

ESCAPE

Indicates an Escape character has been transmitted or received on dual-speed line.

PAD

Indicates a delay for a dual-speed change.

TRAN 150

ON indicates transmit bit rate is 150 bps for a dual-speed line. OFF indicates transmit bit rate is 600/1200 bps, depending on 1200 bit setting.

1200

ON indicates high bit rate is 1200 bps for a dual-speed line. OFF indicates high bit rate is 600 bps for a dual-speed line.

AUTOSPEED

000 - No selection
001 - 110 bps
010 - 134.5 bps
011 - 150 bps
100 - 300 bps
101 - 600 bps
110 - 1200 bps
111 - Autospeed

ROLLER H

CD T-1

Indicates old value of carrier detect.

STATE Y2 Y1

Indicates operational state of Autocall.

D8 D4 D2 D1 C B A B0

Indicates bit count during Autocall operation.

CC DEL STX

Indicates start of text received or transmitted for Code Convert II.

AP SEL

ON indicates Autopad is selected.

CTRL BIT

ON indicates line feed or non-printable character.

DF BIT

ON indicates pad character being removed.

TO 67

ON indicates a 67 ms time out.

TO 700

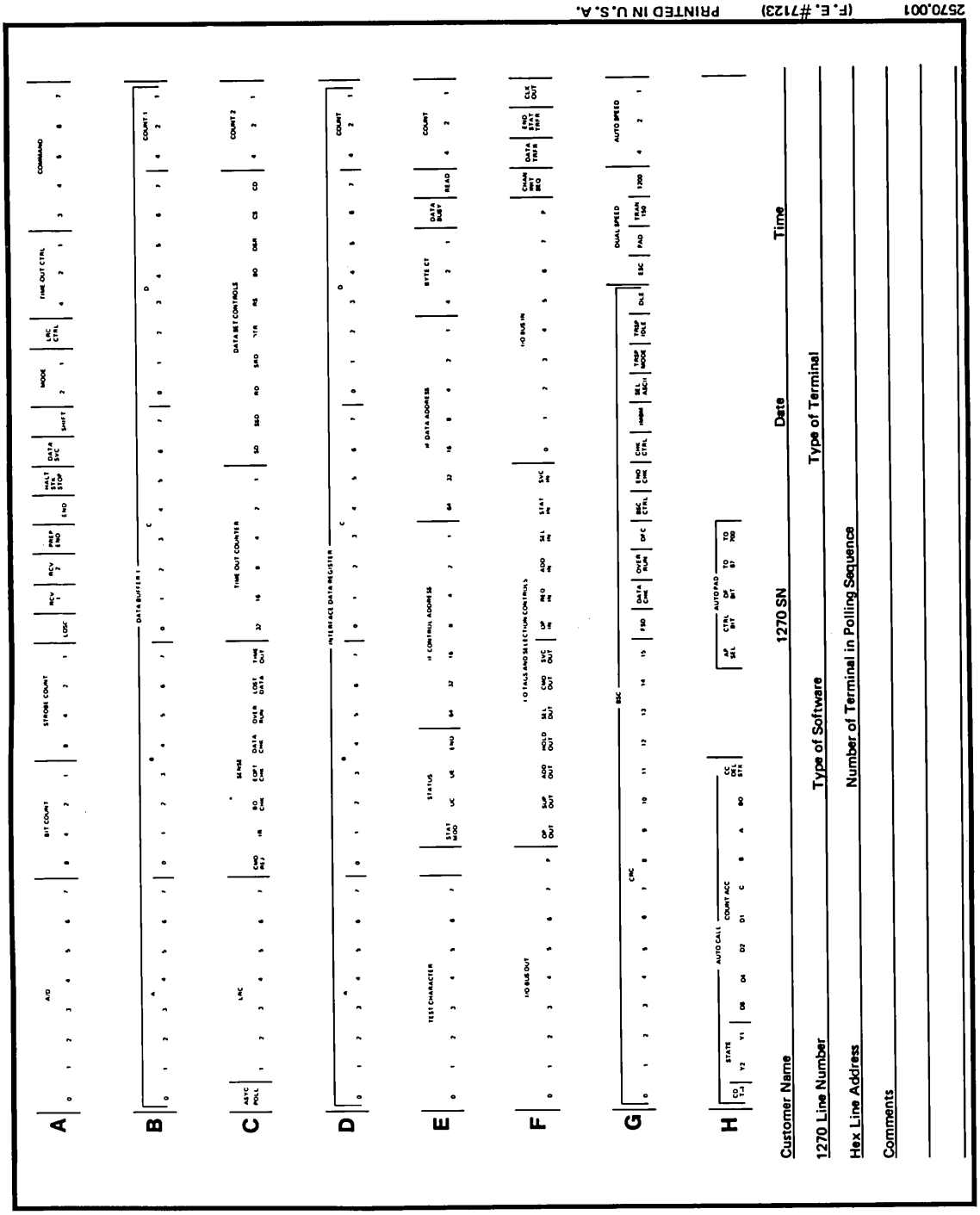
ON indicates a 700 ms time out.

MEMOREX

1270 Roller Bar Status Form

○ Light On

□ Light Blinking or Dim



2570.001 (F. E. #7123) PRINTED IN U.S.A.

Figure A-1. 1270 Roller Bar Status Form

APPENDIX B.

1270 OPERATOR CONTROLS

All operator controls and indicators are located in the upper right-hand corner of the front panel of the 1270. In addition, a test panel is located behind the front panel, allowing for the testing and monitoring of all lines attached to the 1270. The operator controls and indicators are shown in Figure B-1 and described below. The 1270 Test Panel is shown in Figure B-2.

POWER ON

When illuminated, indicates that AC power is applied to the 1270 electronics.

TEST

When illuminated, indicates that one of the attached lines is being tested.

Figure B-1. Operator Panel Controls and Indicators

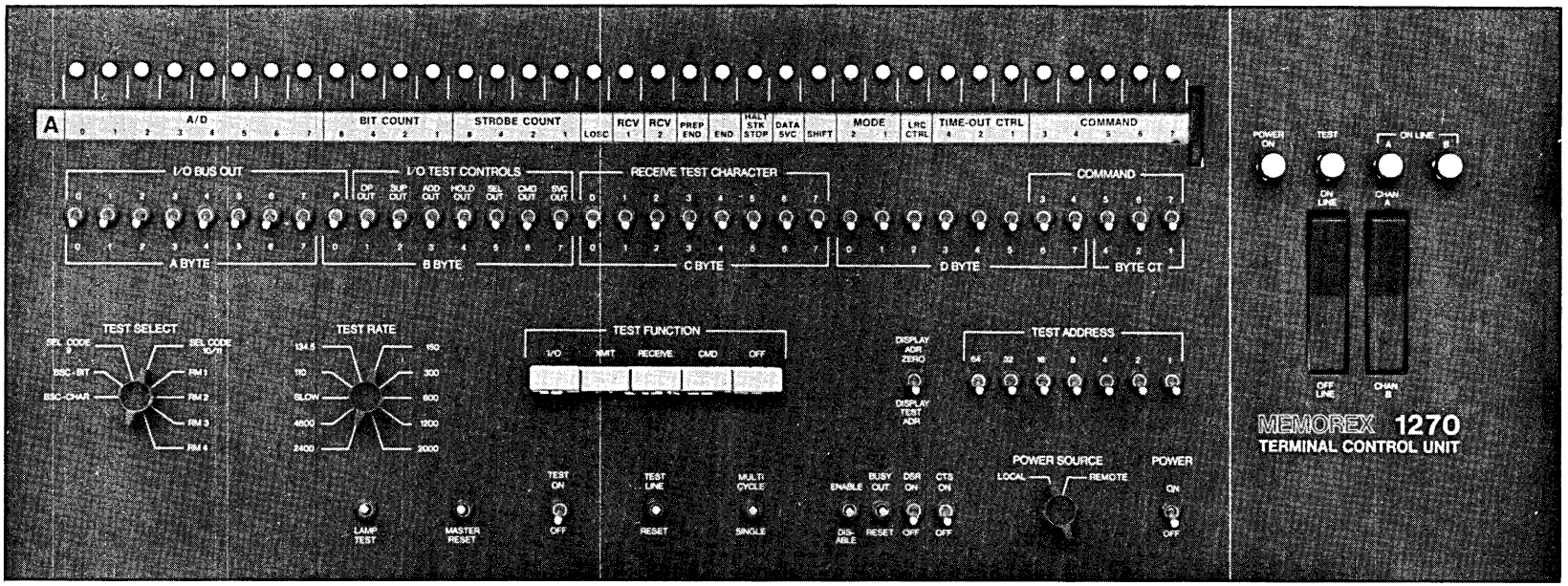


Figure B-2. 1270 Test Panel

CHAN A

When illuminated, indicates that the 1270 is currently attached to the channel designated Channel A.

CHAN B

When illuminated, indicates that the 1270 is currently attached to the channel designated Channel B.

ON-LINE/OFF-LINE

This rocker switch sets the 1270 in the On-Line or Off-Line mode. The transition from On-Line to Off-Line or Off-Line to On-Line will not be accepted unless the following conditions are met:

1. The Clock Out signal from the multiplexer channel is down.
2. There are no active commands on any of the lines attached to the 1270.
3. No command chaining has been specified.
4. Stacked or pending status is not present.

CHANNEL A/CHANNEL B

This rocker switch attaches the 1270 to the specified channel.

APPENDIX C.

1270 PLUGGING OPTIONS

MODELS AT ELC (EQUIPMENT LEVEL CONTROL) 300 AND GREATER

General

I/O Tag

Plug high or low priority.

I/O Interface

Plug single channel or alternate channel switch.

I/O Address

Plug lowest and highest channel address of machine.

MC-1

- UE, if plugged, posts Unit Exception for a line which has a WRITE command issued while receiving incoming data.
- DTR, if plugged, allows the Data Terminal Ready line to reset when a switched line is prematurely disconnected or when the Data Set Ready line is lost.

I/O Command

- 1270 will accept READ CLEAR and WRITE BREAK commands if the RD CLR/WRT BRK option is plugged.
- DIAL must be plugged to accept DIAL commands.
- SM must be plugged to accept SET MODE commands.
- ADDR PREP/SEARCH must be plugged to accept ADDRESS PREPARE and SEARCH commands.

MC-4

- Select CC1, CC2, USASCII Checking, or Type 3 Terminal Control.
- Select number of Polling characters for each Terminal Control. (BSC = 3 or 4; IBM TYPE 1 = 2, 3, or 4)
- Select Terminal Control for Autopad feature.
- Inhibit Reverse Channel Interrupt per Terminal Control.
- Allow 125 ms marking before end of a READ command per Terminal Control.
- Inhibit DF character to be transmitted to channel for particular Terminal Control.

TC Checking

Plugging prevents reset of Intermediate Block Mode (IMBM) on a DISABLE command.

Adapter Gates

Plug enables recognition of Reverse Channel Interrupt on all half-duplex lines.

Autospeed

- Jumper for code length and line speed for particular Terminal Control.
- Jumper to allow Autospeed character to be transmitted to memory.

Line Adapter (Terminal Control and Speed Select)

The following apply to four lines:

Bit Rate: 110, 134.5, 150, 300, 600, 1200, Auto

- If asynchronous, select one.
- If bisynchronous, do not plug.
- If Auto plugged, AUTOSPEED will select rate.

Terminal Control: TC-1, TC-2, TC-3, TC-4, USASCII, EBCDIC

- If Auto plugged, do not plug; otherwise, select one.
- If synchronous, plug USASCII or EBCDIC.

Code Level: 9, 10, 11

- If bisynchronous, do not plug.
- If IBM Terminal Control selected, must plug 9.
- If Auto plugged, do not plug.

Modem Type: Half Duplex, Dual Speed

- If not plugged, will be full duplex.
- Dual implies 1222 modem.
- If synchronous, cannot be dual.

Line Type: Private

- If not plugged, will be switched.

Dial

- If plugged, automatic dialing allowed.

Terminal Controls

USASCII

Interrupt Characters: X-ON, X-OFF, EOT, WRU, ENQ, ACK, Optional-1, Optional-2

- Any of the above can be plugged to inhibit interrupt.
- Can plug bit configuration of the optionals.
- Can plug EOT and/or one optional to set Unit Exception.
- Interrupt caused on Read-type operations only.

Parity: Odd, Even, None (for received VRC only)

Special Characters: Delete

- Plug to allow transfer during Read-type operations.

USASCII Checking

Interrupt Characters: ACK, NAK, ENQ

- Will interrupt if above are received and plug is in.

Ending:

- EOT sets end in text mode with plug.
- EOT sets UE when plugged.

Parity: Odd, Even, None.

IBM TYPE 1

Interrupt Characters: No options

- Can plug EOT to set Unit Exception.

IBM TYPE 3

No options

Code Convert (All Types)

Pluggable to inhibit or accept Unit Exception on EOT end.

BSC Control

BSC Terminal Control

Jumper allows 1270 to recognize ACK characters while in receive mode.

BSC Control

No jumper allows 1270 to recognize ITB character and perform check compare. With jumper, SET MODE command is required to set IMBM for check compare.

BSC Command

Character Recognition: EOT, EOT (transparent), ACK

- Plug to not recognize EOT in any text.
- Plug to not recognize EOT in transparent text.
- Plug to recognize ACK as valid control character (same function as NAK).

Pad Characters:

- Plug to generate valid pad character following last check character (after ETB or ETX) on WRITE command.
- Plug to require pad character following ENQ, NAK, or ACK.
- Plug to require pad character following EOT.

BSC Address

Plug for address if used as a multipoint station.

Line Interface

1221 LD1

- Plug for Echo Clamp.
- Plug for transmit level.
- Plug for two-wire or four-wire operation.

1221 LD2

- Plug for Echo Clamp.
- Plug for transmit level.

1220 B-2 Modem

- Plug for transmit level.
- Plug for originate or answer mode.
- Plug for search mode.

Autocall Adapter

Plug for full-duplex or half-duplex modem.

801 Adapter

- Plug for full or half duplex.
- Plug for fast or normal dial speeds.

CCITT Interface

Plug for United Kingdom or Continental European line discipline.

MODELS LESS THAN ELC 300 BUT GREATER THAN ELC 200

General

Plugging for the following cards is identical to those of ELC 300 cards.

- I/O Tag
- I/O Interface
- I/O Address
- Adapter Gates
- Autospeed
- Line Adapter (Terminal Control and Speed Select)

The plugging for the following cards differs.

MC 1

Jumper to determine ending when a WRITE command is issued to a line receiving data.

I/O Command

- Dial must be plugged to accept DIAL commands.
- SM must be plugged to accept SET MODE commands.
- ADDR PREP/SEARCH must be plugged to accept ADDRESS PREPARE and SEARCH commands.

Wrap Reset

No plug will allow immediate end on a READ command. Plug for 125 ms delay for end.

A/D 1

Inhibit DF character to be transmitted to channel.

Data Buffer Control

Selects number of Polling characters.

Terminal Controls

Plugging for the following cards is identical to that of ELC 300 cards.

- USASCII Terminal Control (ASCII)*
- USASCII Checking Terminal Control
- IBM TYPE 1 Terminal Control (IBM Terminal Control)*
- Code Convert Terminal Control

BSC Terminal Control

Plugging is identical to that of machines of ELC 300 and above.

*Read-type command plugging for PREP, END, time delay, 'DF' function, and Autopad must be verified.

Line Interface

Plugging is identical to that of ELC 300 and above machines for the following boards.

- 1221 LD1 Modem
- 1221 LD2 Modem
- 1220 B-2 Modem
- Autocall Adapter
- CCITT Interface

MODELS LESS THAN ELC 200

General

Plugging for the following cards is identical to those of ELC 200 cards.

- I/O Tag
- I/O Interface
- I/O Address
- MC-1
- Adapter Gates
- Autospeed
- Wrap Reset
- A/D 1
- Data Buffer Control

The plugging for the following cards differs.

I/O Command

- SM must be plugged to allow SET MODE commands.
- ADDR PREP/SEARCH must be plugged to allow ADDRESS PREPARE and SEARCH commands.

Line Adapter

There is no DIAL command on Line Adapter plugging options.

Terminal Controls

Plugging for the following cards is identical to those of ELC 200 cards.

- USASCII Terminal Control (USASCII)
- IBM Type 1 Terminal Control (IBM Terminal Control)

BSC Terminal Control

Plugging is identical to that of ELC 200 machines.

Line Interface

Plugging is identical to that of ELC 200 machines for the following boards.

- 1221 LD1 Modem
- 1221 LD2 Modem
- 1220 B-2 Modem

APPENDIX D.
INSTALLATION REQUIREMENTS

INSTALLATION REQUIREMENTS - DOMESTIC

Power Requirements

The Memorex 1270 Terminal Control Unit requires single-phase 208 VAC or 230 VAC at 60 Hz frequency. Maximum line current draw is 10 amperes.

Space Requirements

No clearance space is required on the left or right side of the 1270. Figure D-1 shows the service clearances required.

Environmental Requirements

The environmental requirements for the 1270 are:

Operating temperature	60 to 90 degrees F
Non-operating temperature	40 to 110 degrees F
Operating relative humidity	20 to 80 percent
Non-operating relative humidity	10 to 90 percent
Operating wet bulb temperature	78 degrees F
Non-operating wet bulb temperature	80 degrees F

Physical Characteristics

Weight (approximate)	600 pounds
Heat generated	3500 BTU/hour
Air flow	600 Cu.Ft./min. (CFM)

Cabling

The 1270 should be located near modems, DAA's, or telephone lines, and is usually the first control unit on the Multiplexer Channel. Cabling requirements for AC power, Multiplexer Channel, and the communications network are provided below. The numbers and types of cables are also listed.

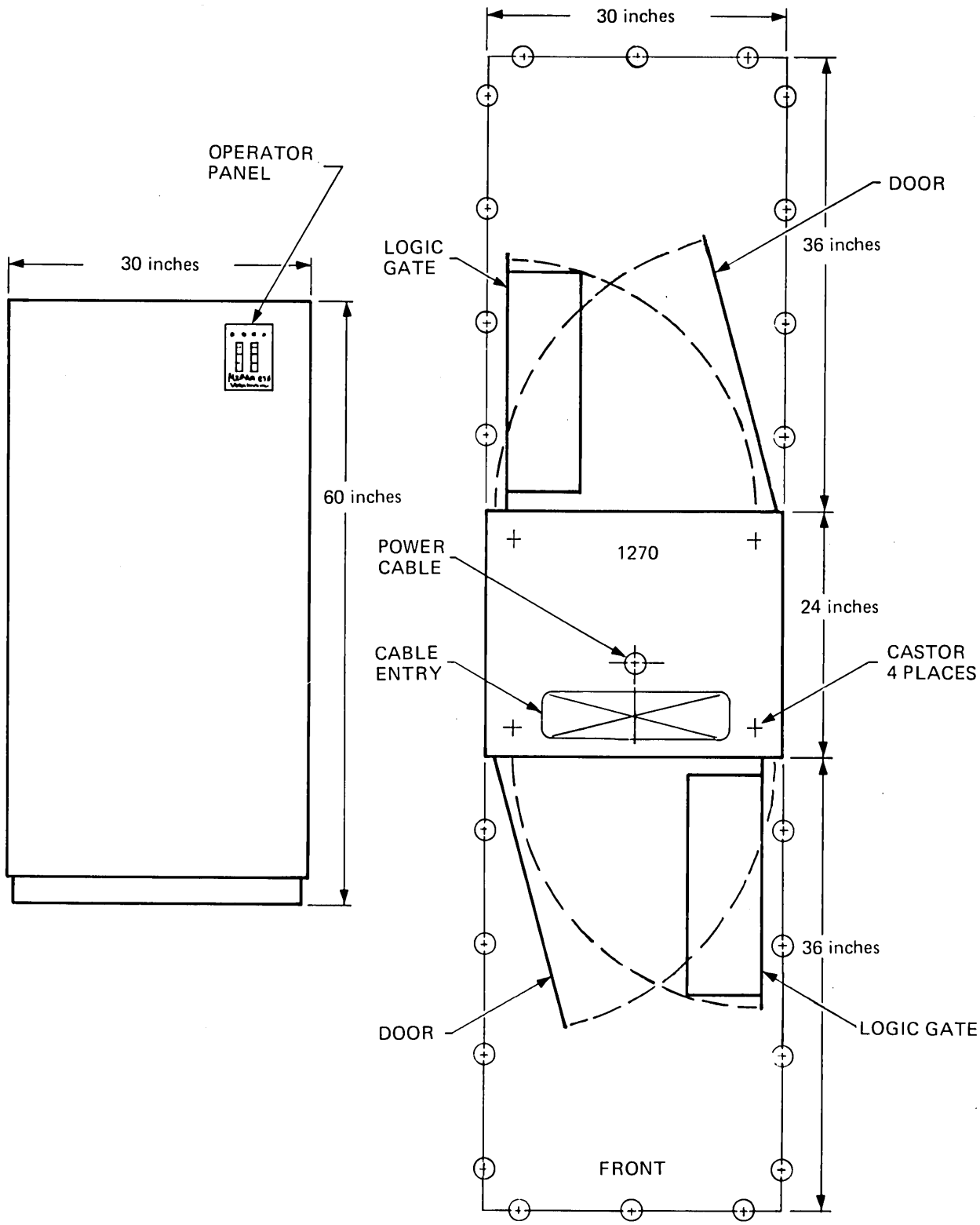


Figure D-1. Memorex 1270 Space Requirements

AC Power Cord

The 1270 requires 208/230 volts at 60 Hz frequency. Single-phase electrical power supplied on a three-wire circuit (where the third wire is equipment-ground) is required. Power cords are available in 6- or 14-foot lengths (subject to local electrical codes). Russell & Stoll equipment and part numbers are as follows:

FS-3720 Plug, and
FS-3913 In-Line Connector, or
FS-3743 Receptical

Emergency Power Off

One Emergency Power Off (EPO) cable is required between the 1270 and the channel. It is available in lengths of 15, 20, 30, 50, and 100 (maximum) feet.

Bus and Tag Lines

All control units on the channel are connected in series with BUS (data) and TAG (control) cables. Two cables of equal length (15, 20, 30, 50, and up to 200 feet) are required. Maximum cable allowable for attaching to eight control units is 200 feet. This restriction must not be violated.

Communications Network

Memorex EIA, Autocall Adapter, 801, and DAA cables which connect the 1270 to external modems or telephone lines are 45 feet in length. Up to 10 feet should be allowed for internal 1270 use.

INSTALLATION REQUIREMENTS - 50 Hz COUNTRIES

Power Requirements

The Memorex 1270 B Terminal Control Unit requires single phase 200 VAC, 220 VAC, or 240 VAC at 50 Hz frequency. Maximum current draw is 10 amperes.

General Requirements

Space and environmental requirements and physical characteristics are identical to those of the domestic 1270 (page D-1). Electrical codes for European countries should be verified for 1270 cabling requirements.

All 50 Hz machines must be equipped with CCITT Interface cards in lieu of the dual EIA interface feature. The only integral modems allowed are the LD/1 and LD/2 Limited Distance Adapters used on private lines. Other Memorex Integral Modems are not approved for European usage. The CCITT Interface is available either with or without communication line isolation circuits; however, isolation is a requirement in European countries.

When using switched facilities with non-common carrier modems, common carrier tariffs generally require that circuit protection be available through mandatory use of Data Access Arrangements. Several types of DAAs are available. The specific type required for use with Memorex Modems is the automatic type, CBT 1001B Data Coupler R with direct contact terminations. An external DC power source must also be obtained with the ADAA (Automatic Data Access Arrangement).

The dual speed feature for the 50 Hz 1270 allows operation with modems having 1200/75 or 600/75 bps speeds.

APPENDIX E.
HEXADECIMAL TO BINARY CONVERSION CHART

TABLE E-1. HEXADECIMAL TO BINARY CONVERSION (Includes decimal values 0 to 95)

HEX CODE	BINARY CODE	*	HEX CODE	BINARY CODE	*	HEX CODE	BINARY CODE	*	HEX CODE	BINARY CODE	*
00	00000000	0	40	01000000	64	80	10000000		C0	11000000	
01	00000001	1	41	01000001	65	81	10000001		C1	11000001	
02	00000010	2	42	01000010	66	82	10000010		C2	11000010	
03	00000011	3	43	01000011	67	83	10000011		C3	11000011	
04	00000100	4	44	01000100	68	84	10000100		C4	11000100	
05	00000101	5	45	01000101	69	85	10000101		C5	11000101	
06	00000110	6	46	01000110	70	86	10000110		C6	11000110	
07	00000111	7	47	01000111	71	87	10000111		C7	11000111	
08	00001000	8	48	01001000	72	88	10001000		C8	11001000	
09	00001001	9	49	01001001	73	89	10001001		C9	11001001	
0A	00001010	10	4A	01001010	74	8A	10001010		CA	11001010	
0B	00001111	11	4B	01001011	75	8B	10001011		CB	11001011	
0C	00001100	12	4C	01001100	76	8C	10001100		CC	11001100	
0D	00001101	13	4D	01001101	77	8D	10001101		CD	11001101	
0E	00001110	14	4E	01001110	78	8E	10001110		CE	11001110	
0F	00001111	15	4F	01001111	79	8F	10001111		CF	11001111	
10	00010000	16	50	01010000	80	90	10010000		D0	11010000	
11	00010001	17	51	01010001	81	91	10010001		D1	11010001	
12	00010010	18	52	01010010	82	92	10010010		D2	11010010	
13	00010011	19	53	01010011	83	93	10010011		D3	11010011	
14	00010100	20	54	01010100	84	94	10010100		D4	11010100	
15	00010101	21	55	01010101	85	95	10010101		D5	11010101	
16	00010110	22	56	01010110	86	96	10010110		D6	11010110	
17	00010111	23	57	01010111	87	97	10010111		D7	11010111	
18	00011000	24	58	01011000	88	98	10011000		D8	11011000	
19	00011001	25	59	01011001	89	99	10011001		D9	11011001	
1A	00011010	26	5A	01011010	90	9A	10011010		DA	11011010	
1B	00011011	27	5B	01011011	91	9B	10011011		DB	11011011	
1C	00011100	28	5C	01011100	92	9C	10011100		DC	11011100	
1D	00011101	29	5D	01011101	93	9D	10011101		DD	11011101	
1E	00011110	30	5E	01011110	94	9E	10011110		DE	11011110	
1F	00011111	31	5F	01011111	95	9F	10011111		DF	11011111	
20	00100000	32	60	01100000		A0	10100000		E0	11100000	
21	00100001	33	61	01100001		A1	10100001		E1	11100001	
22	00100010	34	62	01100010		A2	10100010		E2	11100010	
23	00100011	35	63	01100011		A3	10100011		E3	11100011	
24	00100100	36	64	01100100		A4	10100100		E4	11100100	
25	00100101	37	65	01100101		A5	10100101		E5	11100101	
26	00100110	38	66	01100110		A6	10100110		E6	11100110	
27	00100111	39	67	01100111		A7	10100111		E7	11100111	
28	00101000	40	68	01101000		A8	10101000		E8	11101000	
29	00101001	41	69	01101001		A9	10101001		E9	11101001	
2A	00101010	42	6A	01101010		AA	10101010		EA	11101010	
2B	00101011	43	6B	01101011		AB	10101011		EB	11101011	
2C	00101100	44	6C	01101100		AC	10101100		EC	11101100	
2D	00101101	45	6D	01101101		AD	10101101		ED	11101101	
2E	00101110	46	6E	01101110		AE	10101110		EE	11101110	
2F	00101111	47	6F	01101111		AF	10101111		EF	11101111	
30	00110000	48	70	01110000		B0	10110000		F0	11110000	
31	00110001	49	71	01110001		B1	10110001		F1	11110001	
32	00110010	50	72	01110010		B2	10110010		F2	11110010	
33	00110011	51	73	01110011		B3	10110011		F3	11110011	
34	00110100	52	74	01110100		B4	10110100		F4	11110100	
35	00110101	53	75	01110101		B5	10110101		F5	11110101	
36	00110110	54	76	01110110		B6	10110110		F6	11110110	
37	00110111	55	77	01110111		B7	10110111		F7	11110111	
38	00111000	56	78	01111000		B8	10111000		F8	11111000	
39	00111001	57	79	01111001		B9	10111001		F9	11111001	
3A	00111010	58	7A	01111010		BA	10111010		FA	11111010	
3B	00111011	59	7B	01111011		BB	10111011		FB	11111011	
3C	00111100	60	7C	01111100		BC	10001000		FC	11111100	
3D	00111101	61	7D	01111101		BD	10111101		FD	11111101	
3E	00111110	62	7E	01111110		BE	10111110		FE	11111110	
3F	00111111	63	7F	01111111		BF	10111111		FF	11111111	

* Addresses for 96 communication lines in the 1270 are assigned decimal values 0 through 95.

APPENDIX F.

EIA INTERFACE CONNECTOR PIN ASSIGNMENTS

INTRODUCTION

The EIA RS232 Modem interface specifications are used throughout the industry to provide a common interface between data terminal equipment (TCU's and terminals) and data communication equipment (modems or DAA's). The 25-pin interface plug arrangement is not, strictly speaking, a part of the standard, but has become a de facto standard through wide spread use.

ELECTRICAL CHARACTERISTICS

For data interchange circuits, the signal shall be considered in the mark (1) condition when the voltage is more negative than minus three volts with respect to Signal Ground (Circuit AB, lead 7). For space (0), the signal will be over plus three volts.

For timing and control interchange circuits, the function shall be considered ON when the voltage is more positive than plus three volts, and OFF when more negative than minus three volts.

The open circuit voltage (of drivers) on any circuit shall not exceed 25 volts in magnitude.

LEAD 1 PROTECTIVE GROUND (AA)

This lead is normally tied to the frame of the data set. It may be tied to ground at the power source, and in some data sets it is also tied to Signal Ground (pin 7).

The MRX 1270 does not have an equivalent lead at the EIA Interface.

LEAD 2 TRANSMITTED DATA (BA)

Direction: From the TCU.

This lead is used by the TCU to present a digital serial-by-bit data stream to the data set.

The TCU should hold this lead in the mark (1) condition when no data is being transmitted.

Typically, the Clear to Send lead must be ON for Transmitted Data to be operational.

On the 1270, the control panel indicator light for this lead is labelled SD (for Send Data) and can be observed to flicker while data is being transmitted.

TABLE F-1. EIA INTERFACE CONNECTOR PIN ASSIGNMENTS (Page 1 of 2)

INTERFACE CONNECTIONS REQUIRED ASYNCHRONOUS	SYNCHRONOUS	PIN NUMBER	CIRCUIT
X	X	1	AA Protective Ground
X	X	2	BA Transmitted Data
X	X	3	BB Received Data
X	X	4	CA Request to Send
X	X	5	CB Clear to Send
X	X	6	CC Data Set Ready (Interlock for BSC)
X	X	7	AB Signal Ground
X	X	8	CF Received Line Signal Detector
X	X	9	(Reserved for Data Set Testing)
X	X	10	(Reserved for Data Set Testing)
X	X	11	SA Supervisory Transmitted Data
X	X	12	SCF Secondary Carrier
X	X	13	SCB Secondary Clear to Send
X	X	14	SBA Secondary Transmitted Data (NS New Sync for BSC)
	X	15	DB Transmission Signal Element Timing
X	X	16	SBB Secondary Received Data

TABLE F-1. EIA INTERFACE CONNECTOR PIN ASSIGNMENTS (Page 2 of 2)

INTERFACE CONNECTIONS REQUIRED ASYNCHRONOUS	SYNCHRONOUS	PIN NUMBER	CIRCUIT
	X	17	DD Receiver Signal
		18	Unassigned
X	X	19	SCA Secondary Request to Send
X	X	20	CD Data Terminal (Remote Control for BSC)
		21	CG Signal Quality Detector
		22	CE Ring Indicator
		23	CH/CI Data Signal Rate Selector
		24	DA Transmit Signal Element Timing
X		25	CN Data Terminal Busy Out

LEAD 3 RECEIVED DATA (BB)

Direction: From the Data Set.

This lead is used by the data set to present a digital, serial-by-bit data stream to the TCU.

In the absence of data being received, the data set will normally hold this lead in the mark (1) condition.

Typically, the Carrier Detect lead must be in the ON condition for Received Data to be operational.

On the 1270, the control panel indicator light for this lead is labelled RD and can be observed to flicker while data is being received.

In half-duplex operations some data sets hold Received Data in the mark (1) state for a short time (50ms-150ms) after Request to Send is turned OFF. This feature is frequently referred to as Echo Clamp, and is utilized to prevent echos of the data just transmitted from being received.

LEAD 4 REQUEST TO SEND (CA)

Direction: From the TCU.

This lead is used by the TCU to condition the data set to transmit data. The modem will respond to Request to Send by presenting an ON condition on the Clear to Send lead (refer to Clear to Send description for timing considerations).

With the 1270 plugged for full duplex request to send is turned ON by the ENABLE command and should stay in the ON condition until a DISABLE command is issued.

With the 1270 plugged for half duplex, Request to Send is brought up by a WRITE, POLL, or WRAP command.

On a multipoint network utilizing data sets capable of full-duplex operation, the modems at the TCU end can be controlled as if they were either half or full duplex (full duplex is preferred for timing reasons), however, the modems at the terminals must be operated in half-duplex mode.

On the 1270 control panel, the indicator light for this circuit is labelled RS, and can be observed to pulse in phase with write operations on half-duplex lines.

LEAD 5 CLEAR TO SEND (CB)

Direction: From the Modem or DAA.

This lead is used by the modem to indicate that it is prepared to transmit data. The modem will turn ON Clear to Send from 8ms to 200ms after the TCU turns ON Request to Send. This phenomenon is usually referred to as "Clear to Send delay." In half-duplex operations, the Clear to Send delay causes about a quarter of a second to be wasted every time the line is "turned around." Clear to Send delay is utilized so that the modem will not start transmitting data while the receiving modem is holding Received Data in Echo Clamp (refer to Received Data).

On the 1270 control panel, the indicator light for this circuit is labelled CS and can be observed to pulse in phase with Request to Send for half-duplex operations.

LEAD 6 DATA SET READY (CC)

Direction: From the Modem or DAA.

When this lead is turned ON by the modem, it indicates that the modem is powered up and is in the data mode. On switched lines, Data Set Ready usually indicates that the connection has been established. On private lines, some data sets hold Data Set Ready ON at all times. If the 1270 is plugged for "switched," a DISABLE command will time out in 28 seconds if Data Set Ready does not turn OFF. Data Set Ready turning ON will end an ENABLE command except when the line is plugged for full duplex and switched (ENABLE ends immediately for FDX/PVT for asynchronous lines). For that mode of operation, the 1270 starts a 28 second timeout when Data Set Ready turns ON, and ends when Clear to Send turns ON. On the 1270 control panel, the indicator light for this circuit is labelled DSR, and can be seen to be ON when the communication line is operational.

LEAD 7 SIGNAL GROUND (AB)

This lead is used as a common signal reference (ground) for all other leads in the interface except Protective Ground. In some data sets, it is connected to Protective Ground to minimize the introduction of noise into the circuitry.

LEAD 8 DATA CARRIER DETECT (CF)

Direction: From the Modem or DAA.

When this lead is in the ON condition, it indicates that carrier is being received from the remote modem. In half-duplex service, this circuit may be turned ON for both transmitted and received carriers.

Some modems employ a threshold detection type of carrier detect circuit, which means in practice that Carrier Detect will turn ON a few milliseconds after carrier is received. Some modems also employ a "guard-time delay" to hold Carrier Detect up for a few milliseconds after loss of carrier. On the 1270, the control panel indicator light for this is labeled CD

LEAD 11 SUPERVISORY TRANSMITTED DATA (SA) (See Lead 14)

Direction: From the TCU.

On the WE/202 this lead is used to provide a path for supervisory signals. Refer to the manufacturer's literature for a description of use.

LEAD 12 SECONDARY CARRIER DETECT (SCF)

Direction: From Modem or DAA.

This circuit is equivalent to Data Carrier Detect, except that it indicates the proper reception of the secondary channel signal (carrier).

NOTES:

For the WE/202 Data Set, this lead is called Supervisory Received Data (SB). Use of this lead requires an RPQ which conditions the 1270 to interpret loss of signal on the lead as a break from the remote device.

LEAD 13 SECONDARY CLEAR TO SEND (SCB)

This lead is equivalent to Clear to Send except that it indicates The availability of the secondary transmitting channel.

NOTE:

This lead is not currently used by the MRX 1270.

LEAD 14 SECONDARY TRANSMITTED DATA (SBA) (See Lead 11)

This circuit is equivalent to Transmitted Data except that it is used to transmit data via the secondary channel.

LEAD 14 NEW SYNC (NS)

Direction: From the TCU.

Some modems used for binary synchronous communications provide the option of using this lead. It is frequently used when the modem is attached to the control station on a multipoint polled bisynchronous network. A signal on this circuit causes the modem to drop bit synchronization of its receive clock (i.e., disable Receive Clock Holdover) so that synchronization of the following message will not be interfered with.

NOTE:

Various modems require different polarities and durations of the New Sync signal.

LEAD 15 TRANSMISSION SIGNAL ELEMENT TIMING (DB)

Direction: From the Modem or DAA.

Sometimes called Serial Clock Transmitter, this lead provides a square wave bit rate clock to the TCU for use when transmitting data.

The MRX 1270 requires this signal for binary synchronous transmit operations. Normally, the transitions between the ON and OFF condition of this lead coincide with the transition between signal elements (bits) on transmitted data.

There is no indicator light on the 1270 control panel for this lead.

LEAD 16 SECONDARY RECEIVED DATA (SBB)

This lead is equivalent to Received Data except that it is used to receive data on the secondary channel.

LEAD 17 RECEIVER SIGNAL ELEMENT TIMING (DD)

Direction: From the Modem or DAA.

Sometimes called Serial Clock Receiver (SCR), this lead provides a bit rate square wave timing signal to the TCU to be used for strobing off received data bits. It is derived from the carrier signal received by the data set. The transition from ON to OFF of this lead normally indicates the center of a signal element (bit) on Received Data.

The 1270 does not have an indicator light for this lead.

LEAD 19 SECONDARY REQUEST TO SEND (SCA)

Direction: From the TCU.

This lead is equivalent to Request to Send, except that it is used to request the establishment of transmitting status on the secondary channel.

LEAD 20 DATA TERMINAL READY (CD)

Direction: From the TCU.

This lead is turned ON by the ENABLE command.

For switched lines, the Data Terminal Ready ON condition allows the data set to answer a call.

This lead must be ON (i.e., the TCU must be enabled) for any data transfer to occur.

The DISABLE command turns OFF Data Terminal Ready, which for switched lines is a signal to the modem to disconnect.

The 1270 control panel indicator light is labeled DTR, and can be observed to be ON for an active line.

LEAD 21 SIGNAL QUALITY DETECTOR (CG)

Direction: From the Modem or DAA.

This circuit is designated for the modem to indicate to the TCU that there is a high probability of error in the received data. It is not currently used by the MRX 1270.

LEAD 22 RING INDICATOR (CE)

Direction: From the Modem or DAA.

An ON condition on this circuit indicates that a ringing signal is being received on the communication channel.

LEAD 23 DATA SIGNAL RATE SELECTOR (CH/CI)

Direction: CH - From the TCU
CI - From the Modem or DAA

Signals on this circuit can be used to select one of two data signalling rates when that capability is available in the modem.

LEAD 24 TRANSMIT SIGNAL ELEMENT TIMING (DA)

Direction: From the TCU.

This lead, also called Serial Clock Transmitter External, is used to provide a bit rate clock to an unclocked data set. The MRX 1270 does not currently support this mode of operation.

LEAD 25 BUSY OUT (CN)

Direction: From the TCU.

Signals on this lead cause the modem or DAA to go on hook and the communications facility appears to be busy. Use of Lead 25 for Busy Out is a Memorex convention.

APPENDIX G.

GLOSSARY

This glossary contains terms and definitions related to the use of the Memorex 1270 Terminal Control Unit in a teleprocessing environment.

A/D
Abbreviation for the 1270 Assemble/Disassemble Unit (Register).

acoustic adapter
A type of line-interface equipment used to connect (couple) a terminal station to the communications line. A modem is also necessary for transmission to the line. An acoustic adapter provides the same functions as the exclusion key and data coupler that are a part of a data access arrangement (DAA), but without the need for direct/fixed attachment to the line.

ACA
Abbreviation for the Automatic Calling Adapter available as optional equipment for the 1270 Terminal Control Unit (TCU).

ACK
Abbreviation for the Acknowledge control character that is a part of the network control vocabulary.

ACU
Abbreviation for the Western Electric Auto Call Unit Type 801.

addressing
The process used by the TCU to select the terminal to which it will send a message.

asynchronous transmission
Transmission in which each information character is individually synchronized, usually by the use of start and stop bits.

attenuation
The decrease in amplitude that accompanies signal propagation through equipment, lines, or space; measured in decibels.

attenuation distortion
Unequal attenuation of the different component frequencies of a signal.

balanced to ground
As applied to a two-wire transmission line, both wires have the same impedance to ground.

band
A range of frequencies within two defined limits.

bandwidth
The difference, expressed in Hertz (the number of cycles per second), between the upper and lower limiting frequencies of a band.

baud
A transmission rate; a rate of one baud equals one signal element (usually a bit) per second. A baud is defined as the reciprocal of the duration in seconds, of the shortest signalling element that a channel can accommodate. (A bit rate, in bits per second, is not necessarily equal to the same number of bauds since a signal element may carry more than one bit of information; however, for a binary/two-state channel, the baud and bit rates are equal.)

BCC
Abbreviation for Block Check Character.

BEL
Bell, or alarm (control character, TTY).

bit
Contraction of binary digit, the smallest unit of information. A bit has two possible states: 1 or 0 (mark or space).

bit rate
A transmission rate, expressed in bits per second, at which information bits are transmitted.

bps
Bits per second; related, but not identical, to baud rate. See "Baud."

BS
Backspace (control character, TTY).

BSC
Abbreviation for Binary Synchronous Communications (applies to specific IBM synchronous control conventions).

calling, selective
The sequence used by a transmitting station to direct a call to one or more specifically addressed stations.

CAN
Cancel (control character, TTY).

CAW
An abbreviation for Channel Address Word.

CCITT
Abbreviation for foreign equivalence to domestic EIA.

channel
A path for electrical transmission between two or more stations or channel terminations. A channel can consist of wire, radio waves, or other suitable transmission path.

channel, full duplex
A full-duplex channel is capable of providing simultaneous transmission in both directions without turnaround delay. It is equivalent to two simplex channels.

channel, half duplex
A channel capable of providing two-way nonsimultaneous transmission.

channel, simplex
A channel that permits transmission in only one direction.

channel, voice-grade
A channel that permits transmission of speech.

channel, wideband
A channel capable of sending and receiving data at very fast bit rates (50.0 K bps).

character
The smallest unit of intelligible information. Depending on the code used to represent the information, a character may contain from six to eight bits. The decoded information may be a digit, letter, or special symbol.

circuit, multidrop/multipoint
A network or circuit connection involving multiple terminal stations on a single line, making information transmitted through the circuit and to the line available at all stations simultaneously.

code
A unified structure of symbols and rules for use in representing information.

common carrier
The Bell System or other company that furnishes communication services to the general public as regulated by the Federal Communications Commission (FCC) and appropriate state agencies.

communications, data
The transferring of information/data between two points remotely located with respect to each other.

communications equipment/device
Any hardware used in a data communications system that provides a function in transmitting or receiving messages.

communication terminals
Memorex Communcation Terminal Models 1240, 1242, 1250 and 1280.

CPS
Abbreviation for characters per second.

compatibility
A design state of harmony between communication equipment that allows a capability for their operation together either with or without certain operating conditions being met. For example, it is correct to say that the 1220-DA Modem is compatible with the W. E. Data Set Type 103A. However, for actual operation together, the 103A must be operating in the originate mode.

control characters
The characters B, C, D, Y, N, and S. The terminal control recognizes their functions dependent upon the mode the terminal control is in when they are received. Refer to Character Recognition Summary paragraphs, Section 4 for control character meanings in the various modes of operation.

CR
Carriage return (control character, TTY).

CRC
An abbreviation for Cyclic Redundancy Check.

crosstalk
A part of message-circuit noise; crosstalk is the presence of unwanted signals on a line produced from other lines adjacent to it.

CRT
An abbreviation for cathode ray tube.

CS
An abbreviation for Clear to Send.

CSW
An abbreviation for Channel Status Word.

CTS
An abbreviation for Clear to Send.

data access arrangement (DAA)
A device connecting a modem to the common carrier's dial network that provides transformer isolation from the line. A DAA is rented common-carrier equipment installed for manual talk/data transfer and a separately-contained data coupler.

data, analog
A physical representation of information that bears an exact relationship to the original information. The electrical signals on a telephone channel are analog representations of the original voice.

data, digital
Information represented by a code consisting of a sequence of discrete bits.

data coupler
A separately-contained part of a DAA; provides a transmission path from the telephone handset to the line and control signalling functions. A data coupler is sometimes incorrectly referred to as a data set.

data set
An arrangement of communication equipment that provides for coupling from terminal stations to the line; equivalent to a modem plus a DAA.

DC1
Device control 1 (control character, TTY; also DC2, DC3, DC4).

DCR
Abbreviation for Data Coupler Ready.

dedicated line
Communication facilities that are privately owned, or leased for use with only one data communication system.

DEL
Delete (control character, TTY).

demodulation
The process of converting electrical signals to code representation of printed characters.

diagnostic test
A checkout activity to identify and isolate a malfunction in equipment such as an attached terminal or line.

dial-up
The service whereby a dial telephone can be used to initiate a terminal station-to-station call.

distortion
An unwanted change in waveform that occurs between two points in a transmission system.

DLE
Abbreviation for the Data Link Escape control character that is a part of the network control vocabulary.

DSR
Abbreviation for Data Set Ready.

drop
A terminal station on a multidrop/multipoint circuit.

DTR
Abbreviation for Data Terminal Ready.

EBCDIC
Abbreviation for Extended Binary Coded Decimal Interchange Code.

EIA interface
The industry standard for the interface between terminal and communications equipments employing serial binary data interchange; specified by the Electronics Industries Association publication RS-232C.

EM
End of medium (control character, TTY).

end of message
The specific control character (EOM) or set of characters that designates the termination of a transmitted message.

ENQ
Abbreviation for the Enquiry control character that is a part of the network control vocabulary.

EOM
Abbreviation for end of message.

EOT
End of transmission (control character, TTY).

ESC
Escape (control character, TTY).

ETB
Abbreviation for the End of Transmission Block control character that is a part of the network control vocabulary.

ETX
End of text (control character, TTY).

exchange, dial
The location where all line subscribers originate their calls by dialing.

exchange, manual
The location where all calls are completed by an operator.

extended diagnostic test
A special grouping of diagnostic test, used by the computer to verify special functions of a terminal. See "Diagnostic Test."

FDX
Abbreviation for Full Duplex. See "Channel, Duplex."

FF
Form feed (control character, TTY).

frequency shift keyed
The process by which information is transmitted by discrete frequencies.

FS
File separator (control character, TTY).

FSK
Abbreviation for Frequency Shift Keyed.

full duplex
See "FDX."

function code
Any one of a set of coded non-data expressions that represents a given equipment function and that affects the performance of the function by the equipment.

GS
Group separator (control character, TTY).

half duplex
See "HDX."

handshaking
Describes the timing intervals required to collect messages in various types of service.

HDX
Abbreviation for Half Duplex. Describes a line on which signals can be transmitted or received, but not simultaneously.

hertz
Unit of frequency in cycles per second. Abbreviated Hz.

HT
Horizontal tabulation (control character, TTY).

LA
An abbreviation for Line Adapter, the IBM term for modem. Memorex, also abbreviates Line Adapter as LA, but means one of four printed circuit boards contained in the 1270 TCU that provide the interface with one or more modems or the EIA interface. The terms line adapter and modem, as used by Memorex, are not synonymous.

leased line
A transmission channel leased from a common carrier for exclusive use. The common carrier agrees through the lease to furnish communication between specific points; a specific line may or may not be leased. See "Dedicated Line." The path between the specific points is not defined and may vary.

LF
Line feed (control character, TTY).

line adapter
See "LA."

line coupler
Any standard arrangement of communications equipment that provides for coupling from terminal stations to the line. A line coupler can consist of a modem and DAA, or a standard telephone, modem and acoustic coupler. Line coupling can be provided by a data set.

LRC
An abbreviation for Longitudinal Redundancy Check.

message
The largest unit of intelligible information. A message may be continuous from start to finish or divided into separate sections. See "Character."

message verification
The process whereby the receiving station and modem verify the incoming message as being accurate. One of the reasons for dividing a message into separate sections is to provide space for the addition of verification characters.

modem
The contraction of MOdulator/DEModulator. A device or group of devices used to modulate and demodulate.

modem, integral
A modem designed for containment in Memorex communication terminals or terminal control units. An integral modem consists of either one or two printed-circuit boards and can supply the equivalent of either one or two independent modems.

modem, external
A stand-alone modem designed as a separate package. An acoustic coupler and standard telephone handset can be contained within the package.

modulation
The process whereby the characteristic of one signal (wave) is changed by another signal (wave). For FSK modulation the process consists of converting two different voltage levels of binary signals to mark and space (ones and zeroes) frequencies by the modem transmitter circuits.

multiplexing
Any means whereby two or more signals share the same communication facility or system component. For a one-way transmission of one message, the circuit between the two terminal stations can be a direct connection without multiplexing.

NAK
Abbreviation for the Negative Acknowledge control character that is a part of the network control vocabulary.

network
Remote locations connected by communication channels.

network, leased/private-line
A network employing telephone or telegraph channels that is reserved for the exclusive use of one customer. See "Leased Line" and "Dedicated Line."

NUL
Null, or all zeros (control character, TTY).

off-line
Not operating under direct control of the host system.

on-line
Operating under direct control of the host system.

passive station
A drop, present in a multipoint/multidrop circuit only, that monitors the transmission between the master station and the slave station.

point-to-point
A network connection that involves only two terminal stations, one at each end of the network.

polling
The process whereby the control station offers all other stations, one by one, the use of the line.

private line
Same as "Dedicated Line."

PSW
An abbreviation for Program Status Word.

PTTC/BCD
Perforated Paper Tape Transmission Code for Binary Coded Decimal.

RS
Record separator (control character, TTY). Sometimes used as abbreviation for Request to Send.

RTS
Abbreviation for Request to Send.

selective calling
The capability of a transmitting station to direct a call to one or more specifically designated stations.

SI
Shift in (control character, TTY).

simplex circuit
A circuit that permits transmission in only one direction.

SO
Shift out (control character, TTY).

SOH
Start of heading (control character, TTY).

SP
Space (control character, TTY).

start/stop
See "Asynchronous Transmission."

STX
Start of text (control character, TTY).

SUB
Substitute (control character, TTY).

switched line
A leased line consisting of a number of shorter transmission lines connected through the common carrier's switching networks. Normally used for dialed calls.

SYN
Abbreviation for the Synchronous Idle control character that is a part of the network control vocabulary.

synchronous transmission
A kind of transmission in which a block of information and non-information bits, and SYN characters, are transmitted. Transmitted characters are unrecognizable without the SYN character. Synchronous transmission is clocked to fixed-rate transmission. See "Binary Synchronous."

teleprocessing
A form of information handling in which a data processing system uses communications facilities.

terminal control unit (TCU)
Memorex Terminal Control Unit Model 1270.

terminal station
A broad term referring to Terminal Control Unit(s) and/or Communication Terminal(s).

time sharing
Participation in available computer time by multiple users, via terminals; pertaining to the interleaved use of the time of a device.

transmission
The electrical transfer of any intelligible information (character or message) from one location to another.

transmission character
See "Character."

transmission message
See "Message."

transparency
The transmission of binary data without consideration for its structure.

turnaround time
The total time required to reverse the direction of transmission in a half-duplex channel.

Unit Check
Command not acceptable to Model 1270.

US
Unit separator (control character, TTY).

USASCII
(USA Standard Code for Information Interchange). The standard code, using a coded character set consisting of 7-bit coded characters (eight bits, including parity check), used for information interchange among data processing systems, communications systems, and associated equipment. The USASCII set consists of control characters and graphic characters.

VRC
Abbreviation for Vertical Redundancy Check. VRC adds a bit to each character as needed to maintain an even or odd parity.

VT
Vertical tabulation (control character, TTY).

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