IBM 2780 COMPATIBILITY

INCOTERM® SPD® 900
REMOTE BATCH TERMINAL SYSTEMS
OPERATORS MANUAL

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2780 COMPATIBILITY

OPERATORS MANUAL

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PREFACE

This manual presents the instructions for operating the SPD 900 Remote Batch Terminal (RBT) System in an IBM 2780 environment.

Chapter One discusses the concept of emulation, the use of the SPD 10/20 computer based display terminal as the controlling element in the SPD 900 RBT system, and the range of 2780 operational modes implemented. Chapter One also lists all applicable documents.

Chapter Two describes the function and use of all operator controls and provides a complete set of step-by-step procedures for operating the SPD 900/2780 RBT in EBCDIC, ASCII and 6-bit TRANSCODE modes.

Chapter Three contains the necessary instructions for loading the emulation program, entering SPD 900/2780 emulation program configuration information and initializing the system for operation.

CHAPTER ONE

SYSTEM CONCEPT

INTRODUCTION

The INCOTERM SPD 900 Remote Batch Terminal (RBT) System emulating a conventional 2780 terminal operates directly with OS/RJE, HASP and ASP installed on 360 or 370 central processing units. SPD 900/2780 RBT systems support communications with a remote CPU as well as terminal-to-terminal communication, and supports binary-synchronous communication using EBCDIC, ASCII or 6-bit TRANSCODE at data transfer rates up to 9600 baud. The emulator version operating with EBCDIC can also operate in the transparent mode. In addition, an SPD 900/2780 RBT can connect to a multipoint line shared by other binary synchronous terminals. SPD 900/2780 RBT systems are available with 50, 200 or 400 line per minute printers, a single or dual tape cassette drive, a diskette, or an IBM compatible magnetic tape drive, as auxiliary storage, and 150 or 300 card per minute punched card readers. Card input can be EBCDIC or fieldata, with the RBT performing any required translation. An SPD 900 RBT system has as an operational base, the INCOTERM SPD 10/20 keyboard/CRT. This mini computer equipped terminal, in conjunction with connected peripherals and auxiliary storage, executes the 2780 emulation program to perform all functions of a conventional 2780 terminal.

SYSTEM OPERATION

SPD 900 RBT systems duplicate all the characteristics of the conventional 2780. In addition, the capability of the conventional 2780 terminal is further extended by the CRT display screen and keyboard which is standard with every RBT.

The ability to display message data and to enter data from the keyboard for insertion into the message provides a new level of operator control over RBT transactions. The operator can visually monitor all communication line traffic which is displayed card by card or record by record on the CRT. Also, messages designating operating and error conditions pertinent to communication line protocol and associated peripherals are instantly displayed.

Using the RBT keyboard and CRT, the operator can quickly and easily correct an existing card or record, or insert entirely new data replacing an existing card or record. In addition, operator efficiency is also increased since nearly all RBT activities including control of most peripheral operations are conducted directly from the RBT keyboard.

DUAL RBT EMULATION

As an optional operating feature, an SPD 900/2780 RBT system can emulate a second and entirely different batch or interactive terminal. In such systems a second communication line interface is used to implement the line characteristics required by the second terminal being emulated. A two position switch located at the left end of the operator table pedestal allows the RBT to be switched between alternate communications disciplines in cases where the same modem is shared.

SYSTEM COMPATIBILITY

The SPD 900/2780 RBT system is plug-to-plug compatible with conventional 2780 installations and conforms to the BSC line protocol used by 2780 terminals with EBCDIC, ASCII or TRANSCODE as the communication line code.

Like a conventional 2780 terminal, an operating SPD 900/2780 RBT system is always in one of three modes, namely: control, receive, or transmit. In the control mode, the RBT is awaiting action by the operator or by the associated CPU. When in the receive mode, the RBT is receiving data over the communication line for printing or storage in auxiliary storage. In the transmit mode data from the card reader, terminal keyboard or auxiliary storage is being transmitted over the communication line to the CPU.

SPD 900/2780 RBT VERSIONS

The SPD 900/2780 emulation program is available in three versions to implement the three operational communication line codes. These are the SPD 900/2780 E which implements EBCDIC as the line code; the SPD 900/2780 A which transmits and receives data coded in ASCII; and the SPD 900/2780 T which uses 6-bit TRANSCODE as the communication line code. These three program versions permit an SPD 900/2780 RBT system to emulate any conventional 2780 configuration performing binary synchronous communication activity. At program load time, a configuration card or data entered from the keyboard is used to define the operating environment of the program. For example, configuration information designates the type of peripherals in the pertinent system, establishes buffer formats, and defines the relationship of the RBT system to other terminals and the CPU.

The instructions necessary to the preparation of configuration information is presented in Chapter Three.

APPLICABLE DOCUMENTS

CR 150 Card Reader Operators Manual, MS7128

CR 300 Card Reader Operators Manual, MS7127

LP200/400 Line Printer Operators Manual, MS7126

CP 165 Character Printer Operators Manual (Model 101), M7131

CHAPTER TWO

OPERATION

INTRODUCTION

The discussion of SPD 900 Series RBT System operation in the role of a 2780 emulator includes an overall description of the tasks performed in the several operating modes along with detailed description of terminal control and indicators and step by step operating procedures.

TASK DESCRIPTIONS

An SPD 900 Series RBT emulating a 2780 terminal operates in two primary modes: on-line and off-line. In the on-line mode, the terminal automatically performs tasks involving the transmission and receipt of data over a half-duplex or four wire communication line. This communication line can connect a remote 360 or 370 Central Processing Unit (CPU) operating with OS/RJE, HASP, ASP or another 2780 RBT. When operating in the off-line mode, the tasks performed involve transfer of data between the terminal peripherals to implement storage media changes and hard copy output.

During both modes of operation, the operator can visually monitor data traffic as well as revise existing card images or insert new card images through the terminal keyboard and CRT.

On-Line Tasks

In the on-line mode, an SPD 900/2780 RBT performs the following tasks:

1. Transmission of card image data to a remote CPU.
2. Transmission of keyboard data as keyed to a remote CPU.
3. Receipt of data for printing from a remote CPU.

If the SPD 900/2780 RBT is equipped with an auxiliary storage device such as magnetic tape or diskette, the following on-line tasks can be performed:

1. Transmission of card image data from auxiliary storage to a remote CPU.
2. Receipt of card data from a remote CPU for input to auxiliary storage.
3. Receipt of print files from a remote CPU for input to auxiliary storage (this task cannot be performed with tape cassette auxiliary storage.)

Off-Line Tasks

Off-line mode tasks performed by an RBT include the following:

1. Listing of card data.
2. Printing of keyboard data as keyed.

If the RBT is equipped with an auxiliary storage device, the following off-line tasks can be performed:

1. Transfer of card data to auxiliary storage.
2. Transfer of keyboard data as keyed to auxiliary storage.
3. Hard copy generation by the printer from auxiliary storage.
4. Transfer of data from one tape deck to a second deck if the RBT is equipped with dual transports or from one diskette to another if auxiliary storage is made up of two diskettes.

CONTROLS AND INDICATORS

As shown in Figure 2-1, the SPD 900 terminal keyboard consists of a typewriter keyboard, a left and right-hand grouping of 12 function keys per group and eight operating indicator lights symetrically spaced above the keyboard. When operating as a 2780 RBT two of the left hand function key group will be unused, with five unused keys in the right hand group. In addition, a 2780 RBT uses seven of the eight indicator lights.

The typewriter keyboard is used by the operator to enter data for display on the terminal CRT. The left and right-hand function key groups are used to control RBT operations, with the indicator lights providing a visual terminal condition and job status reference. The left and right-hand special function key groups are identified and defined in Tables 2-1 and 2-2 with all indicators being identified and defined in Table 2-3.

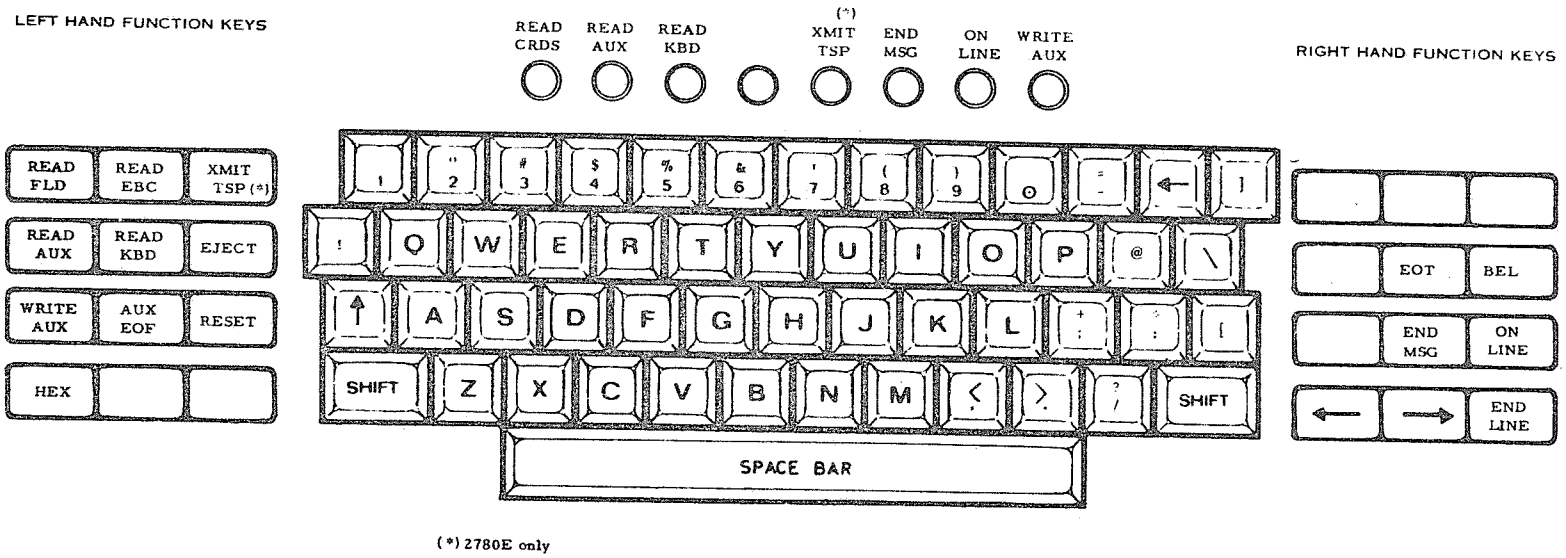

FIGURE 2-1 SPD900/2780 KEYBOARD LAYOUT

TABLE 2-1

CONTROL CHARACTERISTICS OF THE LEFT HAND

FUNCTION KEY GROUP

Special Function Key	Control Characteristics
READ FLD	READ FIELDATA This key, when pressed, starts the reading of a card deck punched in UNIVAC field data or IBM BCD code. For a listing of these punched card codes, see Appendix A.
READ EBC	READ EBCDIC This key, when pressed, starts the reading of a card deck punched in IBM EBCDIC code. See Appendix A for a listing of this code.
XMIT TSP	TRANSMIT TRANSPARENT This key controls entrance into the EBCDIC transparent mode for 2780E emulator operation only. When this key is pressed, data is transmitted in the transparent mode permitting full use of all 256 EBCDIC characters. If the RBT is in the transmit transparent mode (XMIT TSP indicator lit, see Table 2-3), pressing this key removes the RBT from the transmit transparent mode. If the RBT is not in the transmit transparent mode, pressing the XMIT TSP key places it in this mode.

TABLE 2-1
(cont.)

Special Function Key	Control Characteristics
READ AUX	READ AUXILIARY STORAGE Pressing this key initiates reading from auxiliary storage starting at the location currently under the read head and stopping at the end-of-file (EOF).
READ KBD	READ KEYBOARD Pressing this key initiates reading of keyboard data as entered. In the on-line mode, the data keyed is displayed and transmitted to the remote CPU. In the off-line mode keyboard data is transferred, as keyed, to auxiliary storage. This key must be pressed each time a new line is entered.
EJECT	Pressing this key ejects the printer forms to the top of the next page.
WRITE AUX	WRITE AUXILIARY STORAGE This key controls writing into auxiliary storage in both the on-line and off-line modes. If the RBT is in the WRITE AUX mode (WRITE AUX indicator lit, see Table 2-3), pressing this key removes the RBT from the write mode. If the RBT is not in the write mode, pressing this key places it in the write mode.

TABLE 2-1
(cont.)

Special Function Key	Control Characteristics
AUX EOF	AUXILIARY STORAGE END OF FILE Pressing this key causes an end-of-file mark to be immediately written at the current position of the read head.
RESET	This key, when pressed, re-initializes the 2780 emulator program, clears all data buffers, and resets the communication line.
HEX	HEXADECIMAL Any EBCDIC code can be entered by pressing this key and keying the hexadecimal equivalent of the desired code from the keyboard.

TABLE 2-2
CONTROL CHARACTERISTICS OF THE
RIGHT HAND FUNCTION KEY GROUP

Special Function Keys	Control Characteristics
EOT	END OF TRANSMISSION This key may be pressed while receiving data to abort the reception and reset the communication line. It is used to interrupt reception in a terminal-to-terminal environment or in some terminal-to-CPU environments (some versions of HASP).
BEL	BELL This key is used to initiate audible signals between RBTs and is used to signal a remote terminal operator that voice communication is being requested by the operator of the calling terminal.
END MSG	END MESSAGE This key is used to terminate a message when transmitting to the CPU.
ON LINE	This key is used to place the RBT in the on-line or off-line state. The RBT is in the on-line state when the ON LINE indicator (Table 2-3) is lit.
←	LEFT CURSOR Pressing this key moves the displayed cursor one character position to the left during data entry from the keyboard. If held down, the cursor continues to move to the left until the key is released or the start of line is reached.

TABLE 2-2 (cont.)

Special Function Keys	Control Characteristics
→	RIGHT CURSOR Pressing this key moves the displayed cursor one character position to the right during data entry from the keyboard. If held down, the cursor continues to move to the right until the key is released or the end of line is reached.
END LINE	This key is used during data entry from the keyboard to terminate the keyed line. When this key is pressed, the line of data keyed is transferred to the CPU, to auxiliary storage or to the printer, depending on the operation being performed.

TABLE 2-3

KEYBOARD INDICATOR LIGHT FUNCTIONS

Indicator	Function
READ CRDS	READ CARDS: this indicator lights during the reading of punched cards.
READ AUX	READ AUXILIARY STORAGE: this indicator lights during the reading of data from auxiliary storage.
READ KBD	READ KEYBOARD: when lit, indicates that the RBT is ready to accept data entry from the keyboard.
XMIT TSP	TRANSMIT TRANSPARENT: when lit indicates that data will be transmitted to the CPU in the transparent mode.
END MSG	END MESSAGE: when lit, indicates that the END MSG key has been pressed and stays lit until the message has been terminated.
ON-LINE	ON LINE: when lit, indicates that the RBT is operating in the on-line mode. When not lit, the RBT is off-line.
WRITE AUX	WRITE AUXILIARY STORAGE: this indicator lights when the RBT is in the WRITE AUX mode. When lit, incoming card data is written into auxiliary storage instead of being printed.

CARD FORMATS

The primary form of high volume data input to the SPD 900/2780 RBT is 80 column Hollerith-punched cards. As indicated by the special function keys READ EBC and READ FLD (see Table 2-1), the RBT accepts Hollerith cards punched in EBCDIC, fieldata, or IBM BCD code and performs all necessary conversions. A listing of the character set for each code type along with the equivalent column punches are presented in Appendix A.

DISPLAY FORMATS

The CRT screen displays seven information lines with 64 character positions in each line. The first line is reserved for operator status messages. This status message information can help the operator monitor data traffic as well as serve as a basis for data entry control and operator intervention decisions.

The next four lines of the display are reserved for the last four records received by the RBT to be printed or stored in the auxiliary storage. These four lines are rolled upward on the display one line at a time as each new line of data is received and inserted at the bottom. Since each displayed line contains 64 character positions, only the first 64 character positions of each record are displayed. These lines permit the operator to verify the progress of received data.

The remaining two lines serve to present each record of out-going data. The first line contains the first 64 character positions, with the remaining 16 character positions being presented in the first 16 positions of the second line. These lines are used in two ways:

1. During normal input from cards or from auxiliary storage in either on-line or off-line modes. These two lines display the last record received by the RBT from the card reader, to permit operator monitoring and verification of data input progress.

2. During data entry from the keyboard, these two lines display data as it is actually entered, with the next character position in each line being visually indicated by the cursor.

STATUS INFORMATION

The status information line consists of six fields which identify the emulator version being executed, present line protocol messages, provide error messages for the operator, and indicate the column number of the currently keyed character. The details on each of these fields are listed in Table 2-4

TABLE 2-4

STATUS INFORMATION FIELDS

Field Name	Status Function
SPD900/2780xE, 2780xA, or 2780xT	This 13 character field serves to identify the specific 2780 emulator program version currently being executed by the RBT. The letter x designates specific peripheral support: for example, C designates tape casette.
MODE:X	The sixth character in this field (indicated by the letter X) presents a single character designating the current operating mode of the RBT: C for Control Mode, R for receive mode or T for transmit mode.
SEND:X	The sixth character in this field (indicated by the letter X) presents a single character message whose meaning is dependent on the operating mode of the terminal (see Tables 2-5 and 2-6).
RCV:X	The fifth character in this field (indicated by the letter X) presents a single character message whose meaning is dependent on the operating mode of the terminal (see Tables 2-5 and 2-6).

TABLE 2-4
(cont.)

Field Name	Status Function
C=NN	This four character field designates the column number (NN=01 to 80) of the next character entered from the keyboard. This field is relevant only when entering data from the keyboard. (See READ KBD function key listed in Table 2-1).
ERR: 14 Characters	This 18 character field presents blinking error messages for operator attention and action. When RBT operation is proceeding normally, the 14 message characters in this field will be blank. The error messages displayed in this field are defined in Table 2-7.

RBT/OPERATOR COMMUNICATION

Messages concerning communication line protocol are displayed by the line monitor which is formed by the MODE, SEND and RCV fields. The line monitor is a unique feature of SPD 900 RBTs, which automatically provides a real-time display of the communication line state and messages and acknowledgements as required by communication line protocol. These messages and acknowledgements provide the operator with a continuous "window" on the progress of data transfer operations.

During normal operation, the RBT will be in one of three modes as designated by the sixth character of the MODE field:

1. Control Mode - C
2. Receive Mode - R
3. Transmit Mode - T

The operational purpose of each of these modes along with the specific messages and acknowledgements pertinent to operation in each mode are described below.

Control Mode

In the control mode the RBT is in a standby condition. In this mode, data is neither being received or transmitted. However, the communication line is automatically monitored for messages and acknowledgements and for conditions requiring transmission of messages and acknowledgements. The messages and acknowledgements displayed in the line monitor SEND or RCV fields when the RBT is in the control mode are listed and described in Table 2-5 along with the corresponding BSC protocol form.

TABLE 2-5

MESSAGES AND ACKNOWLEDGEMENTS DISPLAYED IN THE SEND AND RECEIVE FIELDS DURING CONTROL MODE

RBT Message Mnemonic	Corresponding BSC Protocol	Meaning of Message
Q	ENQ	I have data to transmit, can you go into receive mode and accept my transmission?
S	SELECTION	I have data to transmit to your site, can you go into receive mode and accept my transmission? (This message appears only in the RCV field and applies only to multi-point installations.)
P	POLL	Is there data at your site ready for transmission? If there is, enter transmit mode and send the data. (This message appears only in the RCV field and applies only to multipoint installations).
0	ACK 0	I can accept data, please initiate transmission.
W	WACK	Wait, I cannot receive data at this time. However, please try again immediately.

TABLE 2-5
(cont.)

RBT Message Mnemonic	Corresponding BSC Protocol	Meaning of Message
E	EOT	I cannot accept transmission, return to control mode. Note that the SPD900/2780 replies EOT to an ENQ received while in off-line mode. The message will be received normally as soon as on-line mode is entered.
B	BEL	Sound audible alarm. This message is used only for terminal to terminal communication, usually to request voice communication.

Receive and Transmit Modes (Text Mode)

The RBT displays single character control messages in the RCV or SEND fields to keep the operator abreast of activity on the communication line. The messages displayed in these fields during data transfer operations are symmetrical; that is each message has the same meaning in both the receive and transmit modes with the meaning, in all cases, defined in terms of the sender. The messages and acknowledgements displayed in the RCV or SEND fields when the RBT is in receive or transmit mode are listed and described in Table 2-6 along with the corresponding BSC protocol form.

TABLE 2-6

CONTROL MESSAGES DISPLAYED

IN SEND OR RCV FIELDS DURING RECEIVE AND TRANSMIT MODES

RBT Message Mnemonic	Corresponding BSC Protocol	Meaning of Message
Q	ENQ	I did not understand or receive your response to my last message, please send it again.
T	STX	Here is a block of text.
X (2780E only)	DLE STX	Here is a block of text in transparent mode.
E	EOT	Return to control mode (end of transmission to RBT). This message is sent as part of the orderly completion of text transmission to the RBT. This message is also sent prior to completion of a transmission when the receiver has incorrectly received a block of text and the resulting error cannot be corrected without operator intervention. (See the paragraph titled "Error Messages" in this chapter.)

TABLE 2-6
(cont.)

RBT Message Mnemonic	Corresponding BSC Protocol	Meaning of Message
0 or 1	ACK 0, 1	Acknowledge correct receipt of last text block. The numeral zero is displayed for acknowledgement of receipt of even numbered text blocks, and numeral one for odd numbered text blocks. This alternation permits lost/duplicate block error checking.
W	WACK	I received the last block of text correctly, but please wait by sending Q until I am ready which will be indicated when I send the appropriate 0 or 1 acknowledge. (As an example of the use of this message: A Q-W loop may be used to wait for the printer to become ready.)
D	TTD	Wait, I do not have the next text block ready due to a hardware delay. (The proper response to this message is N.)

ERROR MESSAGES

The CRT screen error field ERR: provides for display of various error conditions requiring operator intervention. Table 2-7 describes each error message along with the specific action to be taken by the operator.

When the error messages READY PRINTER or TAPE STALLED occur during on-line operation, the RBT automatically sends an EOT message (see Table 2-5).

TABLE 2-7

ERROR MESSAGES

Displayed Message	Operator Action
CONFIG ERROR	There is an error in the format of the configuration parameters. Refer to Chapter Three and re-enter the configuration information correctly.
INCOMPLETE=N	This message is displayed as data is being sent over the communication line from the SPD 900/2780 RBT if the receiver prematurely encodes EOT in response to an error condition. The character N represents the number of cards read but not transmitted by the RBT. (This message is similar to the CTR lights on a 2780.) Although exact recovery procedures can depend on the specific RBT configuration, the operator generally has two options: 1. Re-read the number of cards indicated by the value of N. 2. Start the job again from the beginning.
INPUT ERROR	An error has occurred while reading cards or when reading from auxiliary storage.

TABLE 2-7
(cont.)

Displayed Message	Operator Action
INPUT ERROR (cont'd.)	CARD READER Refer to operator's manual for pertinent card reader CR150 or CR300 (see Applicable Documents Chapter One) and clear the card reader error condition. To resume operation, ready the card reader and press one of the function keys READ EBC or READ FLD, whichever is applicable. AUXILIARY STORAGE Check that the storage media (tape or disk) is correctly loaded. Refer to the operator's manual for the pertinent auxiliary storage (see "Applicable Documents", Chapter One) and clear the auxiliary storage error condition. To resume operation, press the READ AUX function key.
INPUT REQUIRED	This message indicates that a transmission being sent from the RBT over the communication line is incomplete. If there is more data to send, the operator should initiate the transmission by pressing the appropriate function key (READ FLD, EBC, AUX, or KBD). If there is no more data to transmit, press the END MSG function key to terminate the message.

TABLE 2-7
(cont.)

Displayed Message	Operator Action
INVALID CHAR	The card or auxiliary storage record just read contains an invalid character, or incorrect parity, or a character dropout has occurred. The card or record containing the error is automatically displayed on the CRT 80-column display lines normally used to display data entered from the keyboard. In addition, the RBT automatically enters the READ KBD state and the invalid character or characters are replaced on the displayed line by blinking question marks. The operator can correct such errors in one of four ways: 1. Correct the invalid character by positioning the cursor over the character position to be corrected using the ← and → function keys, then keying the correct character. Press the END LINE function key to transmit the corrected line and resume message processing by pressing the appropriate function key. 2. Press READ KBD and enter a replacement line then resume reading. (READ KBD erases the previous data.) 3. Correct the invalid card by repunching then press READ EBC or READ FLD, whichever is pertinent, to input the card. 4. Press READ EBC or READ FLD as required to bypass the erroneous card.

TABLE 2-7
(cont.)

Displayed Message	Operator Action
READY CARD RDR	This message is displayed when the operator attempts to read cards (with READ EBC or READ FLD key activated) and the card reader is not ready. Note that the card reader requires a four second warm-up delay before pressing the appropriate function key. To clear this error, ready the card reader and wait four seconds before pressing the READ EBC or READ FLD function key.
READY PRINTER	This message indicates that the printer is in a not-ready condition. Refer to the operator's manual for the LP200 and LP400 line printers (see "Applicable Documents", Chapter One), determine the cause of the not-ready condition and clear it.
TAPE STALLED	This message specifies that the output cassette on the tape cassette drive is stalled. To restore tape operation, check for the following conditions: 1. That a casette is in place and the receiver door is latched. 2. That the cassette is correctly loaded and not WRITE PERMITTED (track B plug in place.) 3. That the tape drive is in AUTO mode as required.

OPERATING PROCEDURES

Operating procedures for the RBT, which are minimal, describe all on-line and off-line tasks and use of the editing capability of the RBT keyboard and CRT. Note that the RBT does not have the equivalent of the 2780 mode switch. The design of the SPD 900/2780 RBT system is such that the functions of the 2780 mode switch are performed automatically. Specific correspondence between the 2780 mode switch and RBT operation are detailed in Appendix B. All controls and indicators referenced in these procedures are described in Tables 2-1, 2-2, and 2-3. All status information messages referenced are described in Tables 2-4, 2-5, 2-6, and 2-7.

ON-LINE OPERATION

When operating on-line, the tasks performed by the RBT involve the transmission and receipt of data messages to and from the CPU. These tasks along with the peripherals necessary to perform each task are listed in Table 2-8. A data message consists of a card deck or an auxiliary storage file which consists of one or more data blocks. The two function keys EOT and BEL which are used in on-line operation, but not referenced in the various on-line procedures are described in detail in Table 2-2.

TABLE 2-8

SPD 900/2780 ON-LINE TASK SUMMARY

Task	Necessary Peripherals
Cards to Communication Line	Card Reader
Keyboard to Communication Line	
Communication Line to Printer	Printer
Auxiliary Storage to Communication Line Communication Line to Auxiliary Storage	Tape Cassette Diskette or IBM Compatible Mag Tape

Methods of sign-on for recognition by the CPU, are generally determined by the hardware configuration of the specific CPU system. However, the nature of the SPD 900 RBT system permits duplication of any normal 2780 sign-on procedure.

Establishing the Communication Line

The first step in performing on-line operations is establishing a connection with the CPU or another RBT over the communication line. Exact details of this procedure may vary with the type of modem and communication line facility involved. However, a typical procedure is presented for use with

dial-up lines and a Bell 201 modem communicating over half-duplex communication lines with a remote CPU.

1. If the system is equipped with a modem switch, make sure it is in the 2780 position.
2. Lift the telephone receiver and press the modem TALK button.
3. Dial the appropriate number.
4. When the number dialed answers with a whistling tone, press the modem DATA button.
5. Position the telephone receiver in the modem cradle.
6. Press the ON-LINE function key.
7. At this point, the ON-LINE indicator on the SPD 900 terminal will light to designate that message transfer operations over the communication line can begin.

Cards to Communication Line

In this operation, cards are read by the card reader for transfer to the CPU over the communication line. Each 80 column card read by the card reader is displayed on the last two CRT lines. The following steps describe this on-line procedure:

1. Load the punched card deck to be transferred into the card reader and ready the unit according to the instructions listed in the pertinent operator's manual. (See "Applicable Documents", Chapter One.)

NOTE

Both the CR150 and CR300 card readers require a 4 second warm-up delay before the units will read cards.

2. Check the card punch code used to prepare the subject deck (EBCDIC or Fieldata) and press the appropriate function key READ EBC or READ FLD, (see Table 2-1) to initiate reading of cards. This action will cause the READ CRDS indicator to light.

NOTE

If the RBT emulation program is the version which uses EBCDIC as the communication line code (2780E) and all 256 character codes are being used in the subject card deck, press the XMIT TSP function key to enter the transparent mode before pressing READ EBC or READ FLD.

3. To terminate a message (job) upon completion, press the END MSG function key during or after reading the last deck of cards.

NOTE

The END MSG key is similar to the END FILE key on the 2780.

Keyboard to Communication Line

This task involves data entry from the RBT keyboard to the CPU over the communication line in the same order as keyed. Each 80-character line keyed is displayed on the last two lines on the CRT. In addition, the column number of each character keyed is displayed in the CRT C field. The following steps describe this on-line procedure:

1. Press the READ KBD function key, the cursor will be displayed at the first character position of the keyboard/card display line and the column indicator set to C=01. The READ KBD indicator will also light.

NOTE

The cursor will position in the manner described in step 1, only if the RBT is properly connected to the communication line.

2. Enter data from the keyboard as required using the function keys ← and → to move the cursor to any desired position on the line being keyed.

3. As each line is completed, press the function key END LINE to place the data on the communication line, then press READ KBD in preparation for entering the next line.

NOTE

During keyboard data entry, pressing any function key other than END LINE, ← or → will abort the line. In particular, pressing READ KBD has the effect of erasing the line.

4. After the last line is entered, and END LINE pressed, press the function key END MSG to terminate data entry from the keyboard.

NOTE

The use of the keyboard for on-line data entry involves delays much greater than those associated with the card reader. Some systems may not accept such delays. Consult your INCOTERM representative if problems pertaining to on-line data entry from the keyboard occur.

The function key HEX (See Table 2-1) permits the operator to enter any character from the keyboard onto the communication line by keying the equivalent hexadecimal code from the keyboard. To enter a character using this feature, press the HEX function key then press two keyboard keys to provide the desired hexadecimal code. For example:

1. Press the HEX function key.
2. Press the keys C, 1.
3. The keys pressed in step 2 are equivalent to the EBCDIC code for uppercase A which is "C1" in hexadecimal.

Communication Line to Printer

Once the communication line has been established, the proper sign on procedures performed and the line printer placed in the ready condition, the RBT is ready to receive printed data and messages. In normal circumstances, data and messages will be received over the communication line and printed automatically with little or no operator attention.

The function key EJECT permits the operator to move forms to the next top of forms position directly from the terminal, while maintaining the printer permanently in the ready state.

With reference to the use of line printer vertical format channels, channel one may be used for the page eject function. Format channels two, three and four (or optionally channels 2 through 12) can be used in any manner desired. It should be noted, however, that if channel two is used for any function other than to define bottom-of-forms, printed data can be lost if the printer runs out of forms during a printout.

Channel one is also used for page eject by the character printer and any other channel skip results in a vertical tab. For information on readying the line printer or character printer, refer to "Applicable Documents" in Chapter One for the title of the pertinent manual.

Auxiliary Storage to Communication Line

In the SPD 900/2780 RBT, auxiliary storage can be tape cassettes, a diskette unit, or an IBM compatible magnetic tape deck. The actual operating procedure from the RBT is the same for all types of mass storage. However, those operating procedures pertinent to the peripheral device such as making the unit ready or installing or removing storage medium are detailed in the operating manual for the device. Refer to the section titled "Applicable Documents" in Chapter One for the title of the pertinent manual. The following steps describe this on-line procedure:

1. Ready auxiliary storage for reading, according to the pertinent operating manual.

2. Press READ AUX to initiate reading of data from auxiliary storage for transmission to the CPU over the communication line as indicated by the CRT display screen.

3. During or after reading the last file, press the END MSG function key to terminate the current transmission.

NOTE

If the SPD 900/2780 RBT is the version which uses EBCDIC as the communication line code, and all 256 character codes are used in the auxiliary storage file being transmitted, press the XMIT TSP function key before pressing READ AUX to enter the transparent mode.

4. When the file or files to be read from auxiliary storage have been transmitted, press the END MSG function key to terminate the job.

Reverse Interrupt

When an RVI(reverse interrupt) is received during transmission of card, keyboard, or auxiliary storage data to the CPU, the RBT will automatically send an end of message code and revert to the control mode. Normally, receipt of an RVI will be followed by a printed message requesting operator attention. To resume transmission, press the appropriate function key.

Transmission of Data From Combined Sources

Since the END MSG function key is used to terminate a message, data from several sources (card reader, keyboard or auxiliary storage) can be combined to form a single message or job. The following procedure describes a message made up from combined sources where a card within a deck must be corrected before transmission of subsequent card data and is followed by one or more files from an auxiliary storage unit such as a tape cassette.

1. Enter the new job number and control information from the keyboard.

2. Enter the first part of the card deck up to but not including the card to be modified or corrected.

3. Enter the new card image, as corrected, from the keyboard.

4. Enter the remaining cards from the card reader.

5. Enter the required data files from the tape cassette.

6. After reading of the last tape file is complete, press the END MSG function key to terminate the combined message.

Communication Line to Auxiliary Storage

Data which would be output as punched cards by a 2780 can be stored in auxiliary storage by the RBT when the system is operating on-line in the write mode (WRITE AUX indicator lit). The following procedure describes the writing of data from the communication line into auxiliary storage.

1. Ready the auxiliary storage for writing according to instructions in the pertinent operator's manual.

2. Verify that the auxiliary storage has sufficient blank storage medium to contain the file or files to be written.

3. If the WRITE AUX indicator is lit, perform step 4; if not, press the WRITE AUX function key to light the indicator and place the RBT in the write mode.

4. At this point, the first 64 character positions of each line written into auxiliary storage will be displayed on the CRT.

5. After all data has been written into auxiliary storage press the AUX EOF function key to write an end of file mark.

OFF-LINE OPERATION

The tasks performed by the SPD-900/2780 RBT when operating off-line, involve the transfer of data from one medium to another. These tasks along with the peripheral devices necessary to perform each task are listed in Table 2-9.

TABLE 2-9

SPD 900/2780 OFF-LINE TASK SUMMARY

Task	Necessary Peripherals
Cards to Printer	Card Reader and Printer
Keyboard to Printer	Line Printer or Character Printer
Cards to Auxiliary Storage	Card Reader and Tape Cassettes Diskette or IBM Compatible Mag Tape Deck
Auxiliary Storage to Printer	Tape Cassettes Diskette, IBM Compatible Mag Tape Deck or Printer
Auxiliary Storage to Auxiliary Storage	Tape Cassettes Diskette or IBM Compatible Mag Tape Deck

When operating off-line, the ON-LINE indicator light must be out. If the ON-LINE indicator is lit, press the ON-LINE function key to place the RBT in the off-line mode.

Cards to Printer

In this operation, punched card data can be listed for visual verification or for any other purpose requiring hard copy. The following steps delineate the procedure for listing punched card data:

1. Ready the line printer or character printer, whichever is being used, per instructions listed in the pertinent operator's manual.

NOTE

In cards to printer jobs, channel one (the page eject channel for the character printer) is used to space forms during printing so that 58 lines per page are printed. No other format control channel is used during off-line operations involving either printer. Pressing the EJECT key will set the forms to the top of page position and should be used instead of the equivalent printer button since pressing EJECT also resets the printer line counter.

2. If necessary, press the RESET function key to clear any previous error conditions, and make sure the WRITE AUX indicator is off.

3. Load the punched card deck to be printed, into the card reader hopper, and ready the unit per instructions listed in the pertinent operator's manual.

NOTE

Both the CR150 and CR300 card readers require a 4-second warmup period before the units will read cards.

4. Check the card punch card code used to prepare the deck (EBCDIC or fieldata) and press the appropriate function key, READ EBC or READ FLD; this action will cause the READ CRDS indicator to light.

NOTE

If the SPD 900/2780 RBT is the version which uses EBCDIC as the communication line code, and all 256 character codes are used in the subject card deck, press the XMIT TSP function key.

5. The card reader will begin reading cards along with listing of card content until the card hopper is empty.

After completion of one card batch, this procedure can be repeated to print additional card batches by merely loading more cards into the card hopper.

Keyboard to Printer

This procedure describes how data can be entered from the keyboard and immediately printed out to produce hard copy.

1. Ready the printer as described in step 1 of the Cards to Printer procedure.
2. If necessary, press the RESET function key to clear any previous error conditions, and make sure the WRITE AUX indicator is off.

3. Press the READ KBD function key; the READ KBD indicator will light, and the column indicator field on the CRT will be set to 1.

4. Enter data from the keyboard using the function keys ◄ and ► to position the cursor as desired.

5. When a line is completely entered, press the END LINE function key to initiate printing.

6. Repeat steps 3 through 5 for each line to be printed.

Cards to Auxiliary Storage

Punched card data files can be conveniently stored on mass storage media with SPD 900/2780 terminals equipped with auxiliary storage. The steps listed below describe the procedure for storage of card data.

1. Mount a blank tape cassette magnetic disk or magnetic tape reels on the mass storage device used and refer to the pertinent operator's manual for instruction to ready the auxiliary storage.

2. If necessary, press the RESET function key to clear any previous error conditions.

3. If the WRITE AUX indicator is lit, perform step 4; if not, press the WRITE AUX function key to light the indicator and place the RBT in the write mode.

4. Check the card punch code used to prepare the subject deck (EBCDIC or fieldata) and press the appropriate function key; READ EBC or READ FLD.

5. Load the punched card deck to be stored in auxiliary storage into the card reader hopper and ready the unit according to instructions listed in the pertinent operator's manual.

NOTE

Both the CR150 and CR300 card readers require a 4-second warm-up period before the units will read cards.

6. At this point, cards will be read and written into auxiliary storage until the card reader hopper is empty.

7. After the last card has been read, press the AUX EOF function key to terminate the auxiliary storage data file. If auxiliary storage is a magnetic tape deck the tape just written will be rewound automatically. If auxiliary storage is a diskette, the disk will be homed.

Keyboard to Auxiliary Storage

This procedure describes how data can be written into auxiliary storage from the keyboard.

1. Ready auxiliary storage as described in step 1 of the Cards to Auxiliary Storage procedure.
2. If necessary, press the RESET function key to clear any previous error conditions.
3. If the WRITE AUX indicator is lit, perform step 5; if not, press the WRITE AUX function key to light the indicator.
4. Perform steps 2 through 5 of the Keyboard to Printer procedure to store keyboard data line by line into auxiliary storage.
5. After the last line of data has been entered from the keyboard, press the AUX EOF function key to terminate the auxiliary storage data file. If the auxiliary storage is a magnetic tape deck, the tape just written will be rewound automatically. If auxiliary storage is a diskette, the disk will be homed.

Auxiliary Storage to Printer

With this procedure, data files in auxiliary storage can be listed to satisfy hard copy requirements.

1. Mount the tape cassette, magnetic disk or a magnetic tape reel containing the file to be printed on the mass storage device used, and refer to the pertinent operator's manual for instructions to ready the auxiliary storage.

2. Ready the printer as described in step 1 of the Cards to Printer procedure.

3. If necessary, press the RESET function key to clear any previous error conditions, and make sure the WRITE AUX indicator is out.

4. Press the READ AUX function key; the READ AUX indicator will light and auxiliary storage data file will be read and printed until the end of file is detected. If the auxiliary storage is a magnetic tape deck, detection of end of file will cause the tape to automatically rewind. If auxiliary storage is a diskette, the disk is homed.

Auxiliary Storage to Auxiliary Storage

This procedure allows the operator to copy a specific file for future use when the current file medium (magnetic tape or disk) becomes worn or is damaged. For RBT systems equipped with tape cassette or IBM compatible magnetic tape auxiliary storage, this procedure is relevant only if the RBT is equipped with dual tape decks.

1. Mount the tape cassette tape reel or magnetic disk containing the file to be read and an equivalent blank medium to be written on.

2. Ready the auxiliary storage for reading and writing according to instructions in the pertinent operator's manual.

3. If necessary, press the RESET function key to clear any previous error conditions.

4. If the WRITE AUX indicator is lit, perform step 5; if not, press the WRITE AUX function key to place the RBT in the write mode.

5. Press the READ AUX function key to initiate copying of the file.

6. When the copy is made, press the AUX EOF function key to terminate the copied file.

Note that an auxiliary storage tape is rewound or a disk is homed only after the AUX EOF function key is pressed. Therefore, by mounting a single copy tape or disk, data can be input from several sources (cards, tape, disk or keyboard) to form a single data file in auxiliary storage. Several of the pertinent procedures (Keyboard to Auxiliary Storage and Cards to Auxiliary Storage) can be combined to produce a single file which is terminated and rewound or homed when completed by pressing the AUX EOF function key.

CHAPTER THREE

EMULATOR PROGRAM LOADING AND CONFIGURING

INTRODUCTION

At initial start-up time and at any subsequent start-up time, the specific SPD 900/2780 RBT must be loaded and configured before terminal operations can begin. The emulator program version for an SPD 900/2780 RBT system is furnished by INCOTERM as either a hollerith object deck or as an object file on magnetic tape or disk. Depending on the RBT hardware configuration, the emulator program will be entered from the card reader or from auxiliary storage. Whatever medium is used to enter the program, the card deck or data file will include the required bootstrap loading. The related configuration information required by the emulator program can be entered from the keyboard or from a card reader if present. The discussion that follows presents the step-by-step procedures for performing this loading and configuration function.

PROGRAM LOADING

1. Place the card deck in the card reader hopper, or mount the tape cassette, tape reel or magnetic disk, whichever is pertinent.

2. If the 2780 emulator program is to be entered as a punched card deck from the card reader, refer to the "Enter Boot" procedure in the pertinent operators manual (see "Applicable Documents," Chapter One).

3. If the 2780 emulator program is to be entered from auxiliary storage refer to the "Enter Boot" procedure in the pertinent operators manual.

4. When the program is loaded, the program version designation (2780 E, 2780 A, or 2780 T) will be displayed in the first field of the status information line (see Table 2-4).

PROGRAM CONFIGURING

After the emulator program has been loaded, it must be configured prior to conducting RBT operations. This configuration information can be entered as a punched card from the card reader or directly from the system keyboard. Configuration information cannot be entered from auxiliary storage.

Configuration information formats for punched card or keyboard entry are listed in Table 3-1 along with a detailed definition of the content of each column.

Once the emulator program has been configured, the RBT is ready for normal operation (see Chapter Two).

Card Reader Entry

1. Punch a configuration card according to the format and definitions listed in Table 3-1 in EBCDIC or Fieldata, whichever is appropriate.
2. Place the completed configuration card in the hopper and ready the card reader as indicated by the pertinent operators manual.
3. Press the READ EBC or READ FLD function key, whichever is appropriate.

NOTE

When the emulator program is entered from punched cards, merely place the configuration card behind the object deck and press the READ EBC or READ FLD function key after the object deck has been loaded, to read the configuration card.

Keyboard Entry

1. Press the READ KBD function key.
2. Refer to Table 3-1 and enter the configuration information as required directly from the keyboard.
3. When all configuration information has been entered press the END LINE function key.

TABLE 3-1

SPD 900/2780 CONFIGURATION INFORMATION, FORMAT AND CONTENT

Column Number	Column Name	Column Content
1	Auxiliary Storage Input Channel	This column contains a single digit supplied by Incoterm or the letter N if no auxiliary storage is present.
2	Auxiliary Storage Output Channel	This column contains a single digit supplied by Incoterm or the letter N if no auxiliary storage is present.
3	Communication Channel	This column contains a single digit supplied by Incoterm which defines the I/O address of the communications channel.
4	Printer Type	This column contains one of the following letters to identify the type of printer present: L if the printer is a line printer. C if the printer is a character printer. N if a printer is not present.

TABLE 3-1 (cont.)

Column Number	Column Name	Column Content
5	Card Reader Present	This column contains one of the following letters to designate the existance of a card reader in a given RBT configuration: Y if a card reader is present (either CR150 or CR300). N if a card reader is not present.
6	Contention Priority	This column contains one of the following letters to designate the priority of the RBT system being configured: P designates a primary terminal (one second timeout) and is used when a terminal communicates with a CPU. S designates a secondary terminal (three second timeout). In terminal-to-terminal communication, one terminal should be designated P and the other S to avoid possible line contention problems.

TABLE 3-1 (cont.)

Column Number	Column Name	Column Content
7	Receive Re-try Mode	This column contains a single letter to control the number of attempts to be made by the emulator program to receive data on the communication line. The number of re-try attempts are indicated by one of the following letters: N for normal re-try mode (three attempts): used in terminal-to-terminal communication. X for extended re-try mode (15 attempts): used in terminal-to CPU communication.
8	Transmission Record Blocking	This column contains a single letter to control record block formats during data transmission over the communication line. N for normal record blocking (two records per block). M for extended record blocking, up to seven records per block (multiple record feature).

TABLE 3-1 (cont.)

Column Number	Column Name	Column Content
8 (Cont.)		The content of this column only governs the transmission of data records over the transmission line since the SPD 900/2780 has no constraints on the receiving of multiple blocked records.
9, 10	Site Selection Code (Leased lines only)	These two columns contain the hexadecimal digits representative of the site selection code for that site in multipoint installations. These columns will be blank for those RBT systems engaged in point-to-point communication activity.
11, 12	Terminal Identification	These two columns contain the hexadecimal digits representative of terminal identification in point-to-point installations. These columns will be blank if the associated CPU does not require a unique terminal identification.

APPENDIX A

SPD 900/2780 COMMUNICATION LINE

CODE TABLES

EBCDIC CODE CHART

Meaning of columns in chart

EBCDIC code	Hexadecimal code as transmitted on the communications line.
EBCDIC graphic/function	EBCDIC graphic or function. Those functions marked with * can only be used as data characters in transparent mode. With the exception of the lower case letters, the graphics are those which would be used on an EBCDIC keypunch to prepare input for use with the READ EBC key.
FLD graphic	Fieldata graphic used on a Fieldata keypunch to prepare input for use with the READ FLD key.
ASCII graphic	ASCII graphic as used on the keyboard and display and as printed by the printer.
ASCII code	Hexadecimal ASCII code equivalent used internally in the emulator and also for recording data on tape or disk.

EBC punch	Hollerith code for READ EBC.
FLD punch	Hollerith code for READ FLD.

Note: The old IBM 026 keypunch punches a subset of the fieldata code.

S2780E CODE CHART

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
00	NUL			00	12-0-1-8-9	
01	SOH			01	12-1-9	
02	STX			02	12-2-9	
03	ETX			03	12-3-9	
04	PF			9C	12-4-9	
05	HT			09	12-5-9	
06	LC			86	12-6-9	
07	DEL			7F	12-7-9	
08				97	12-8-9	
09				8D	12-1-8-9	
0A	SMM			8E	12-2-8-9	
0B	VT			0B	12-3-8-9	
0C	FF			0C	12-4-8-9	
0D	CR			0D	12-5-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
0E	SO			0E	12-6-8-9	
0F	SI			0F	12-7-8-9	
10	DLE			10	12-11-1-8-9	
11	DC1			11	11-1-9	
12	DC2			12	11-2-9	
13	DC3			13	11-3-9	
14	RES			9D	11-4-9	
15	NL			85	11-5-9	
16	BS			08	11-6-9	
17	IL			87	11-7-9	
18	CAN			18	11-8-9	
19	EM			19	11-1-8-9	
1A	CC			92	11-2-8-9	
1B				8F	11-3-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
1C	IFS			1C	11-4-8-9	
1D	IGS			1D	11-5-8-9	
1E	IRS			1E	11-6-8-9	
1F	IUS*			1F	11-7-8-9	
20	DS			80	11-0-1-8-9	
21	SOS			81	0-1-9	
22	FS			82	0-2-9	
23				83	0-3-9	
24	BYP			84	0-4-9	
25	LF			0A	0-5-9	
26	EOB*			17	0-6-9	
27	ESC			1B	0-7-9	
28				88	0-8-9	
29				89	0-1-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
2A	SM			8A	0-2-8-9	
2B				8B	0-3-8-9	
2C				8C	0-4-8-9	
2D	ENQ*			05	0-5-8-9	
2E	ACK			06	0-6-8-9	
2F	BEL			07	0-7-8-9	
30				90	12-11-0-1-8-9	
31				91	1-9	
32	SYN			16	2-9	
33				93	3-9	
34	PN			94	4-9	
35	RS			95	5-9	
36	UC			96	6-9	
37	EOT*			04	7-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
38				98	8-9	
39				99	1-8-9	
3A				9A	2-8-9	
3B				9B	3-8-9	
3C	DC4			14	4-8-9	
3D	NAK*			15	5-8-9	
3E				9E	6-8-9	
3F	SUB			1A	7-8-9	
40	space	space	space	20	no punch	no punch
41				A0	12-0-1-9	
42				A1	12-0-2-9	
43				A2	12-0-3-9	
44				A3	12-0-4-9	
45				A4	12-0-5-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
46				A5	12-0-6-9	
47				A6	12-0-7-9	
48				A7	12-0-8-9	
49				A8	12-1-8	
4A	¢	[	]	5B	12-2-8	12-5-8
4B	.	.	.	2E	12-3-8	12-3-8
4C	<	<	<	3C	12-4-8	12-6-8
4D	(	(	(	28	12-5-8	0-4-8
4E	+	+	+	2B	12-6-8	12
4F	▽	!	!	21	12-7-8	11-0
50	&	&	&	26	12	2-8
51				A9	12-11-1-9	
52				AA	12-11-2-9	
53				AB	12-11-3-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
54				AC	12-11-4-9	
55				AD	12-11-5-9	
56				AE	12-11-6-9	
57				AF	12-11-7-9	
58				B0	12-11-8-9	
59				B1	11-1-8	
5A	!	]	]	5D	11-2-8	11-5-8
5B	$	$	$	24	11-3-8	11-3-8
5C	*	*	*	2A	11-4-8	11-4-8
5D	)	)	)	29	11-5-8	12-4-8
5E	;	;	;	3B	11-6-8	11-6-8
5F	¬	≠	↑	5E	11-7-8	0-2-8
60	-	-	-	2D	11	11
61	/	/	/	2F	0-1	0-1

S2780E CODE CHART

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
62				B2	11-0-2-9	
63				B3	11-0-3-9	
64				B4	11-0-4-9	
65				B5	11-0-5-9	
66				B6	11-0-6-9	
67				B7	11-0-7-9	
68				B8	11-0-8-9	
69				B9	0-1-8	
6A				7C	12-11	
6B	,	,	,	2C	0-3-8	0-3-8
6C	%	%	%	25	0-4-8	0-5-8
6D	—	¤	←	5F	0-5-8	0-7-8
6E	>	>	>	3E	0-6-8	6-8
6F	?	?	?	3F	0-7-8	12-0

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
70				BA	12-11-0	
71				BB	12-11-0-1-9	
72				BC	12-11-0-2-9	
73				BD	12-11-0-3-9	
74				BE	12-11-0-4-9	
75				BF	12-11-0-5-9	
76				C	12-11-0-6-9	
77				C1	12-11-0-7-9	
78				C2	12-11-0-8-9	
79				60	1-8	
7A	:	:	:	3A	2-8	5-8
7B	#	#	#	23	3-8	12-7-8
7C	@	@	@	40	4-8	7-8
7D	'	'	'	27	5-8	4-8

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
7E	=	=	=	3D	6-8	3-8
7F	"		"	22	7-8	11-7-8
80				C3	12-0-1-8	
81	a			61	12-0-1	
82	b			62	12-0-2	
83	c			63	12-0-3	
84	d			64	12-0-4	
85	e			65	12-0-5	
86	f			66	12-0-6	
87	g			67	12-0-7	
88	h			68	12-0-8	
89	i			69	12-0-9	
8A				C4	12-0-2-8	
8B				C5	12-0-3-8	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
8C				C6	12-0-4-8	
8D				C7	12-0-5-8	
8E				C8	12-0-6-8	
8F				C9	12-0-7-8	
90				CA	12-11-1-8	
91	j			70	12-11-1	
92	k			71	12-11-2	
93	l			72	12-11-3	
94	m			73	12-11-4	
95	n			74	12-11-5	
96	o			75	12-11-6	
97	p			76	12-11-7	
98	q			77	12-11-8	
99	r			78	12-11-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
9A				CB	12-11-2-8	
9B				CC	12-11-3-8	
9C				CD	12-11-4-8	
9D				CE	12-11-5-8	
9E				CF	12-11-6-8	
9F				D0	12-11-7-8	
A0				D1	11-0-1-8	
A1				7E	11-0-1	
A2	s			73	11-0-2	
A3	t			74	11-0-3	
A4	u			75	11-0-4	
A5	v			76	11-0-5	
A6	w			77	11-0-6	
A7	x			78	11-0-7	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
A8	y			79	11-0-8	
A9	z			7A	11-0-9	
AA				D2	11-0-2-8	
AB				D3	11-0-3-8	
AC				D4	11-0-4-8	
AD				D5	11-0-5-8	
AE				D6	11-0-6-8	
AF				D7	11-0-7-8	
B0				D8	12-11-0-1-8	
B1				D9	12-11-0-1	
B2				DA	12-11-0-2	
B3				DB	12-11-0-3	
B4				DC	12-11-0-4	
B5				DD	12-11-0-5	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
B6				DE	12-11-0-6	
B7				DF	12-11-0-7	
B8				E0	12-11-0-8	
B9				E1	12-11-0-9	
BA				E2	12-11-0-2-8	
BB				E3	12-11-0-3-8	
BC				E4	12-11-0-4-8	
BD				E5	12-11-0-5-8	
BE				E6	12-11-0-6-8	
BF				E7	12-11-0-7-8	
C0				7B	12-0	
C1	A	A	A	41	12-1	12-1
C2	B	B	B	42	12-2	12-2
C3	C	C	C	43	12-3	12-3

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
C4	D	D	D	44	12-4	12-4
C5	E	E	E	45	12-5	12-5
C6	F	F	F	46	12-6	12-6
C7	G	G	G	47	12-7	12-7
C8	H	H	H	48	12-8	12-8
C9	I	I	I	49	12-9	12-9
CA				E8	12-0-2-8-9	
CB				E9	12-0-3-8-9	
CC				EA	12-0-4-8-9	
CD				EB	12-0-5-8-9	
CE				EC	12-0-6-8-9	
CF				ED	12-0-7-8-9	
D0				7D	11-0	
D1	J	J	J	4A	11-1	11-1

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
D2	K	K	K	4B	11-2	11-2
D3	L	L	L	4C	11-3	11-3
D4	M	M	M	4D	11-4	11-4
D5	N	N	N	4E	11-5	11-5
D6	O	O	O	4F	11-6	11-6
D7	P	P	P	50	11-7	11-7
D8	Q	Q	Q	51	11-8	11-8
D9	R	R	R	52	11-9	11-9
DA				EE	12-11-2-8-9	
DB				EF	12-11-3-8-9	
DC				F0	12-11-4-8-9	
DD				F1	12-11-5-8-9	
DE				F2	12-11-6-8-9	
DF				F3	12-11-7-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
E0				5C	0-2-8	
E1				9F	11-0-1-9	
E2	S	S	S	53	0-2	0-2
E3	T	T	T	54	0-3	0-3
E4	U	U	U	55	0-4	0-4
E5	V	V	V	56	0-5	0-5
E6	W	W	W	57	0-6	0-6
E7	X	X	X	58	0-7	0-7
E8	Y	Y	Y	59	0-8	0-8
E9	Z	Z	Z	5A	0-9	0-9
EA				F4	11-0-2-8-9	
EB				F5	11-0-3-8-9	
EC				F6	11-0-4-8-9	
ED				F7	11-0-5-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
EE				F8	11-0-6-8-9	
EF				F9	11-0-7-8-9	
F0	0	0	0	30	0	0
F1	1	1	1	31	1	1
F2	2	2	2	32	2	2
F3	3	3	3	33	3	3
F4	4	4	4	34	4	4
F5	5	5	5	35	5	5
F6	6	6	6	36	6	6
F7	7	7	7	37	7	7
F8	8	8	8	38	8	8
F9	9	9	9	39	9	9
FA				FA	12-11-0-2-8-9	
FB				FB	12-11-0-3-8-9	

S2780E CODE CHART (cont.)

EBCDIC code	EBCDIC graphic/function	FLD graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
FC				FC	12-11-0-4-8-9	
FD				FD	12-11-0-5-8-9	
FE				FE	12-11-0-6-8-9	
FF				FF	12-11-0-7-8-9	

ASCII CODE CHART

Meaning of columns in chart

ASCII	Hexadecimal ASCII code as used on the communications line.
ASCII graphic/function	Corresponding ASCII graphic or function. The function codes marked with * may not be used as data characters. The upper case codes (20-5F) are those used on the keyboard, display and printer. (Lower case codes are folded and printed as their upper case equivalents).
FLD graphic	Fieldata graphic as used on a fieldata keypunch when preparing input for use with READ FLD.
EBC graphic	EBCDIC graphic as used on an EBCDIC keypunch when preparing input for use with READ EBC.
FLD punch	Hollerith code for use with READ FLD.
EBC punch	Hollerith code for use with READ EBC.

Note: The old IBM 026 keypunch punches a subset of the fieldata code.

S2780A CODE CHART

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
00	NUL			12-0-9-8-1	
01	SOH			12-9-1	
02	STX			12-9-2	
03	ETX			12-9-3	
04	EOT*			9-7	
05	ENQ*			0-9-8-5	
06	ACK*			0-9-8-6	
07	BEL			0-9-8-7	
08	BS			11-9-6	
09	HT			12-9-5	
0A	LF			0-9-5	
0B	VT			12-9-8-3	
0C	FF			12-9-8-4	
0D	CR			12-9-8-5	

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
0E	SO			12-9-8-6	
0F	SI			12-9-8-7	
10	DLE			12-11-9-8-1	
11	DC1			11-9-1	
12	DC2			11-9-2	
13	DC3			11-9-3	
14	DC4			4-8-9	
15	NAK			9-8-5	
16	SYN			9-2	
17	ETB			0-9-6	
18	CAN			11-9-8	
19	EM			11-9-8-1	
1A	SUB			9-8-7	
1B	ESC			0-9-7	

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
1C	FS			11-9-8-4	
1D	GS			11-9-8-5	
1E	RS			11-9-8-6	
1F	US			11-9-8-7	
20	space	space	space	no punch	no punch
21	!	!	¦	12-8-7	11-0
22	"	△	"	8-7	11-7-8
23	#	#	#	8-3	12-7-8
24	$	$	$	11-8-3	11-8-3
25	%	%	%	0-8-4	0-5-8
26	&	&	&	12	2-8
27	'	'	'	8-5	4-8
28	(	(	(	12-8-5	0-4-8
29	)	)	)	11-8-5	12-4-8

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
2A	*	*	*	11-8-4	11-4-8
2B	+	+	+	12-8-6	12
2C	,	,	,	0-8-3	0-3-8
2D	—	—	—	11	11
2E	.	.	.	12-8-3	12-3-8
2F	/	/	/	0-1	0-1
30	0	0	0	0	0
31	1	1	1	1	1
32	2	2	2	2	2
33	3	3	3	3	3
34	4	4	4	4	4
35	5	5	5	5	5
36	6	6	6	6	6
37	7	7	7	7	7

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
38	8	8	8	8	8
39	9	9	9	9	9
3A	:	:	:	8-2	5-8
3B	;	;	;	11-8-6	11-6-8
3C	<	<	<	12-8-4	12-6-8
3D	=	=	=	8-6	3-8
3E	>	>	>	0-8-6	6-8
3F	?	?	?	0-8-7	12-0
40	@	@	@	8-4	7-8
41	A	A	A	12-1	12-1
42	B	B	B	12-2	12-2
43	C	C	C	12-3	12-3
44	D	D	D	12-4	12-4
45	E	E	E	12-5	12-5

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
46	F	F	F	12-6	12-6
47	G	G	G	12-7	12-7
48	H	H	H	12-8	12-8
49	I	I	I	12-9	12-9
4A	J	J	J	11-1	11-1
4B	K	K	K	11-2	11-2
4C	L	L	L	11-3	11-3
4D	M	M	M	11-4	11-4
4E	N	N	N	11-5	11-5
4F	O	O	O	11-6	11-6
50	P	P	P	11-7	11-7
51	Q	Q	Q	11-8	11-8
52	R	R	R	11-9	11-9
53	S	S	S	0-2	0-2

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
54	T	T	T	0-3	0-3
55	U	U	U	0-4	0-4
56	V	V	V	0-5	0-5
57	W	W	W	0-6	0-6
58	X	X	X	0-7	0-7
59	Y	Y	Y	0-8	0-8
5A	Z	Z	¢	0-9	0-9
5B	[	[	¢	12-8-2	12-5-8
5C	\	\	none	0-8-2	0-6-8
5D	]	]	!	11-8-2	11-5-8
5E	↑	≠	¬	11-8-7	0-2-8
5F	←	¤	—	0-8-5	0-7-8
60	`			8-1	
61	a			12-0-1	

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
62	b			12-0-2	
63	c			12-0-3	
64	d			12-0-4	
65	e			12-0-5	
66	f			12-0-6	
67	g			12-0-7	
68	h			12-0-8	
69	i			12-0-9	
6A	j			12-11-1	
6B	k			12-11-2	
6C	l			12-11-3	
6D	m			12-11-4	
6E	n			12-11-5	
6F	o			12-11-6	

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
70	p			12-11-7	
71	q			12-11-8	
72	r			12-11-9	
73	s			11-0-2	
74	t			11-0-3	
75	u			11-0-4	
76	v			11-0-5	
77	w			11-0-6	
78	x			11-0-7	
79	y			11-0-8	
7A	z			11-0-9	
7B	{			12-0	
7C	¦			12-11	
7D	}			11-0	

S2780A CODE CHART (cont.)

ASCII code	ASCII graphic/function	FLD graphic	EBC graphic	EBC punch	FLD punch
7E	~			11-0-1	
7F	DEL			12-9-7	

TRANSCODE CODE CHART

Meaning of columns in chart

Transcode code	Hexadecimal code for transcode character as used on the communications line.
Transcode graphic/function	Transcode graphic or control function. Control functions marked with * may not be used as data characters.
FLD graphic	Fieldata graphic for use in punching cards using a fieldata keypunch to be read with READ FLD.
EBCDIC graphic	EBCDIC graphic for use in punching cards using an EBCDIC keypunch to be read with READ EBC.
ASCII graphic	Corresponding ACCII graphic as used on the keyboard and display and as printed by the printer.
ASCII code	Internal ASCII code in hexadecimal as used internally by the emulator and as used for recording data on tape or disk.

EBC punch	Hollerith code for use with READ EBC.
FLD punch	Hollerith code for use with READ FLD. (Printable graphics only).

S2780T CODE CHART

Transcode code	Transcode graphic/function	FLD graphic	EBC graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
00	SOH				01	12-9-1	
01	A	A	A	A	41	12-1	12-1
02	B	B	B	B	42	12-2	12-2
03	C	C	C	C	43	12-3	12-3
04	D	D	D	D	44	12-4	12-4
05	E	E	E	E	45	12-5	12-5
06	F	F	F	F	46	12-6	12-6
07	G	G	G	G	47	12-7	12-7
08	H	H	H	H	48	12-8	12-8
09	I	I	I	I	49	12-9	12-9
0A	STX				02	12-9-2	
0B	.	.	.	.	2E	12-8-3	12-8-3
0C	¤	¤	<	<	5F	12-8-4	12-6-8
0D	BEL				07	0-9-8-7	

S2780T CODE CHART (cont.)

Transcode code	Transcode graphic/function	FLD graphic	EBC graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
0E	SUB				1A	9-8-7	
0F	ETB*				17	0-9-6	
10	&	&	&	&	26	12	2-8
11	J	J	J	J	4A	11-1	11-1
12	K	K	K	K	4B	11-2	11-2
13	L	L	L	L	4C	11-3	11-3
14	M	M	M	M	4D	11-4	11-4
15	N	N	N	N	4E	11-5	11-5
16	O	O	O	O	4F	11-6	11-6
17	P	P	P	P	50	11-7	11-7
18	Q	Q	Q	Q	51	11-8	11-8
19	R	R	R	R	52	11-9	11-9
1A	space	space	space	space	20	no punch	no punch
1B	$	$	$	$	24	11-8-3	11-8-3

S2780T CODE CHART (cont.)

Transcode code	Transcode graphic/function	FLD graphic	EBC graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
1C	*	*	*	*	2A	11-8-4	11-8-4
1D	US*				1F	11-9-8-7	
1E	EOT*				04	9-7	
1F	DLE				10	12-11-9-8-1	
20	—	—	—	—	2D	11	11
21	/	/	/	/	2F	0-1	0-1
22	S	S	S	S	53	0-2	0-2
23	T	T	T	T	54	0-3	0-3
24	U	U	U	U	55	0-4	0-4
25	V	V	V	V	56	0-5	0-5
26	W	W	W	W	57	0-6	0-6
27	X	X	X	X	58	0-7	0-7
28	Y	Y	Y	Y	59	0-8	0-8
29	Z	Z	Z	Z	5A	0-9	0-9

S2780T CODE CHART (cont.)

Transcode code	Transcode graphic/function	FLD graphic	EBC graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
2A	ESC				1B	0-9-7	
2B	,	,	,	,	2C	0-8-3	0-8-3
2C	%	%	%	%	25	0-8-4	0-8-5
2D	ENQ*				05	0-9-8-5	
2E	ETX				03	12-9-3	
2F	HT				09	12-9-5	
30	0	0	0	0	30	0	0
31	1	1	1	1	31	1	1
32	2	2	2	2	32	2	2
33	3	3	3	3	33	3	3
34	4	4	4	4	34	4	4
35	5	5	5	5	35	5	5
36	6	6	6	6	36	6	6
37	7	7	7	7	37	7	7

S2780T CODE CHART (cont.)

Transcode code	Transcode graphic/function	FLD graphic	EBC graphic	ASCII graphic	ASCII code	EBC punch	FLD punch
38	8	8	8	8	38	8	8
39	9	9	9	9	39	9	9
3A	SYN				16	9-2	
3B	#	#	#	#	23	8-3	12-7-8
3C	@	@	@	@	40	8-4	7-8
3D	NAK*				15	9-8-5	
3E	EM				19	11-9-8-1	
3F	DEL				7F	12-9-7	

APPENDIX B
CORRESPONDENCE BETWEEN 2780 MODE SWITCH SETTINGS AND SPD900/2780 OPERATION

2780 MODE SWITCH SETTINGS	SPD900/2780 CORRESPONDENCE
REC	The effect of this setting is achieved by operating in the write mode (WRITE AUX indicator on). Records will be written to the printer or to auxiliary storage (punch) according to receive component selection.
PRINT	The effect of this setting is achieved by operating with the WRITE AUX indicator off. In this case, all records will be printed irrespective of receive component selection.
PUNCH	There is no operation corresponding to this setting performed by the SPD900/2780. Output selected for the printer is always printed.
TSM	The effect of this setting is achieved by operating with the XMIT TSP indicator off. All data is transmitted in non-transparent form.
OFF-LINE	The effect of this setting is achieved by operating with the ON-LINE indicator not lit.

2780 MODE SWITCH SETTINGS	SPD900/2780 CORRESPONDENCE
XMIT TSP	The effect of this setting is achieved by operating with the XMIT TSP indicator lit: all data will be transmitted in the transparent mode.

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