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## Systems Reference Library

### IBM 2741 Communications Terminal

This reference publication describes the functional characteristics of the IBM 2741 Communications Terminal. The description is oriented toward the machine operator. The keyboard, controls, and maintenance are considered in detail. Applications, programming considerations, and communication facilities are described briefly.



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Figure 1. IBM 2741 Communications Terminal

## IBM 2741 COMMUNICATIONS TERMINAL

The IBM 2741 Communications Terminal is a remote entry and output terminal providing direct access to a computer. The terminal (Figure 1) is an IBM Selectric® typewriter with the necessary electronic controls. Each 2741 is connected to a computer by either a privately owned or a common-carrier communication line. With the IBM 2741, the power and versatility of the modern data processing system is available to the user of a simple, low-cost typewriter terminal.

One computer can service many IBM 2741 Communications Terminals (Figure 2). The maximum number of terminals depends on either the communication facilities or the capacity and equipment of the computer. The optimum number of terminals is determined by the specific application.

### Communication Terminal Concepts

The potential of the electronic data processing machine is constantly being explored. The early use of the computer in accounting applications involves one given set of information (punched in cards). A fixed series of operations was performed upon each set of data (record). If a file of cards was to be updated, the changes were also punched into cards and collated into the master file before the processing began. Then, a new file was punched by the computer. With the use of magnetic tape, three tapes were used to streamline this typical operation. The old file, the changes, and the new file were separate. Even with numerous improvements in machines and techniques, the concept of one-thing-at-a-time remains basic to most applications.

At present, the central processing unit (CPU) does, in fact, do one operation at a time. (This is an oversimplification, since separate operations may be carried on by an input or output unit, a channel, or a directly connected CPU; or these operations may be overlapped.) However, these one-at-a-time operations take place at a very high speed measured in microseconds and nanoseconds. The rapidly developing field of multiple programming is one aspect of this advance. Why wait for a card to be read? It takes about a tenth of a second. Switch to another job and work on it until the information from the card has been delivered.

Another concept applicable to usual uses of the computer is that of minimizing the requirement for human intervention. Since the machines are very fast, they need not wait for people to sense a signal, think, and react, since this will result in a time delay.

The IBM 2741 Communications Terminal is a

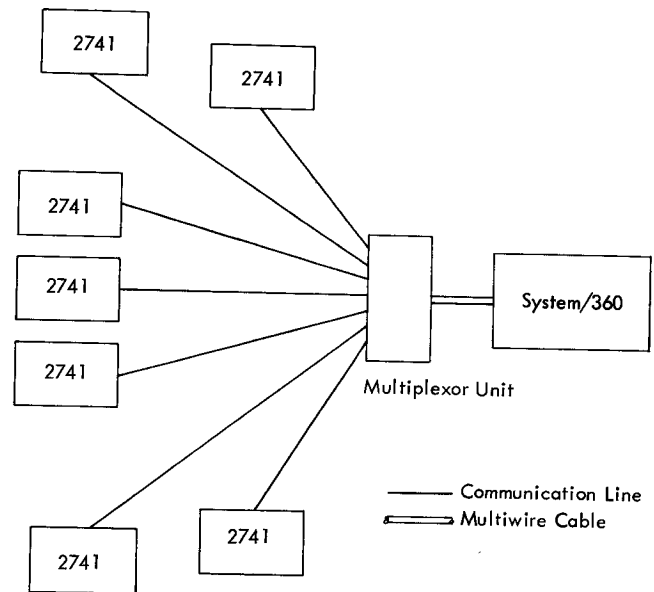


Figure 2. System Configuration

step into a new application area where these concepts are no longer applicable. The computer handles many different jobs concurrently and each step of each job is under the control of an operator.

When handling text, the computer does not calculate or analyze the "data" or text entered into it. The information coming in from many terminals is simply stored in order, with the codes defining sentences, paragraphs, charts, and space for figures. If there is an insertion or a deletion, the computer stores these. Precisely because people require a relatively long time to perform operations, the computer is able to switch electronically from terminal to terminal and keep incoming and outgoing data in order.

A request to retrieve the stored text includes format instructions. Then the computer operates upon the data. It divides the text up into lines of specified length. If right margins are to be even (justified), spaces are inserted between words in a specific pattern to accomplish this. Between servicing the other terminals and executing similar operations, the text is sent to the proper terminal at the maximum rate of the terminal.

The text handling capability of a multi-terminal computer is only one aspect of this relatively new concept: time-sharing. Many people, each at a terminal, can be using the computer concurrently. This utilizes efficiently the capabilities of the computer. Time sharing is applicable to such areas as engineering, programming, educational, and design, as well as text handling.

Without time-sharing, data is processed by per-

forming one (or a few) identical operations repeatedly on similar records of data. However, the speed and versatility of the computer are advantageous in many other fields. When the processing of smaller, more specialized jobs is limited to purely scientific installations, utilization is not high. Now, with time-sharing, a number of terminals are connected to the computer, each holding control of the computer intermittently, specialized jobs are efficiently handled. The program used to accomplish this would include a phase (routines) to keep track of the communications and whatever working phases are desired. These working phases might include a modified Fortran compiler for computation, an assembler for programming, or a library and modified input-output control phase for information retrieval.

Basic to time sharing and text handling is the idea of "man-machine conversation". An individual enters some information into the computer. The computer processes the information. This action may be formatting, computation, a search for and retrieval of additional data, or a combination of these. The result is returned to the person. In the case of text handling, the result is accumulated in the computer and may be modified. With time sharing, the computation might, for example, include the loading of a routine to solve a differential equation and the solution of that equation with a given set of parameters. Typically, the computer relieves the operator of most of the time-consuming, repetitious details associated with creative work. The output of the operator can be expected to rise in quality as well as quantity.

## APPLICATIONS

The IBM 2741 is designed to require minimum operator training. The terminal, considered by itself, is a typewriter capable of maintaining line control, encoding the characters typed, and presenting the signal to a communication channel. (See Communication Considerations and IBM 2741 Line Control sections). Therefore, the applications of this terminal are determined by the program used by the computer. Scientific computation, computer programming, document preparation, and information retrieval are some areas of time-sharing application.

### On-Line Scientific Computation

A range of approaches possible in the area of computation. The entire problem may be defined by the operator in a symbolic language such as Fortran. This method is useful when a complex equation is

not encountered frequently. Variables may be changed and a new answer obtained without reentering the equation or unchanged data. An alternate approach is to maintain in storage, routines for the solution of frequently encountered problems. The user specifies the routine and enters data. A few examples are:

- Series solution of integrals
- Determinant reduction
- Optimization formulas
- Vector analysis
- Differential equations.

### On-Line Computer Programming

Time sharing also offers a new approach to the preparation of programs. The programmer writes the program at the terminal and enters the coded program into the computer at the same time. When he is satisfied that all needed changes have been made, a source deck might be punched by the computer. Or, the coded program could be assembled, and errors discovered by the assembler reported to the terminal. An object deck may be punched after a satisfactory assembly.

Document generation may also be aided by time sharing techniques. Specialized, intermittently encountered documents, including those requiring computation, fall into this area.

Information retrieval applications of time sharing offer another method for freeing people from the time-consuming clerical aspect of creative work. The computer can replace the libraries of catalogs and, more importantly, the indexes of catalogs used to maintain reference material. A simple example is the card catalog of a library. Entries are coded by subject, author, and title. Such a method is readily adaptable to a time sharing system. This type of cataloging is common throughout the business, scientific, engineering, academic, and governmental worlds. A computer time sharing system can provide fast response, easy updating, and convenient remote inquiry.

### Text Handling

These terminals are used in a new approach to the production of large-volume transcriptions. Text handling is a specialized application of the time sharing concept. Text which has been typed and en-

tered into accessible storage is proofread and edited. The typist then revises the stored text as required with deletion and insertion facilitated by the computer. A copy of the updated draft or of parts of it may be requested from the computer after each iteration. Manual retyping of corrected drafts and final text is eliminated. Some areas of application are:

- Technical writing
- Publishing
- Proposal writing
- System and procedure documentation
- Specification writing for engineering and purchasing
- Price list
- Contract preparation and management
- Legal drafts
- Legislative bill drafts
- Sales catalog maintenance
- Computer program writing.

The 2741 and System/360 combination makes possible corrections using addressable text storage. This method increases efficiency and accuracy in the preparation of documents which may contain highly technical material. Since such text must be absolutely accurate, careful proofreading and correction are required. However, once the accurate text is stored, additions and corrections can be easily accomplished. The entire page need not be typed or proofread again. Since any original errors are easily corrected, the initial text requires less retyping. Output typically requiring accuracy and frequent updating include:

- Purchase orders
- Personnel records
- Manufacturing orders
- Engineering change orders
- Executive correspondence
- Data file maintenance.

Typed data can be stored in direct access storage when it is not being acted upon in core storage. Text retrieval would then be simple and the response fast. Controlled accuracy and increased production of prechecked form-letter statements and tables is ideal for applications such as:

- Price quotations
- Sales promotions and other form letters
- Accounts receivable follow-up
- Audit correspondence
- Acknowledgment letters.

These examples are by no means exhaustive. Any body of text or data may be more efficiently handled by entering it into a computer for storage, editing, or processing if it is desirable to:

- Format
- Edit
- Assemble
- Maintain accuracy
- Make changes over a period of time.

## IBM 2741 COMMUNICATIONS TERMINAL DESCRIPTION

The IBM 2741 Communications Terminal is the combination of a Selectric typewriter and the necessary control equipment for transmission over a communication line. The control equipment is located in the back of the typewriter stand (see Figure 3). The only control switch which is not part of the keyboard is the terminal mode switch. This switch is located on the left side of the typewriter stand. The function of this switch is described in the Modes of Operation section.

### IBM 2741 KEYBOARD

The 2741 keyboard is physically identical to the standard IBM Selectric typewriter (Figure 3). Functionally, one change has been made to the keyboard. The Selectric index key is now labeled ATTN (attention). The indexing function is initiated only by the computer.

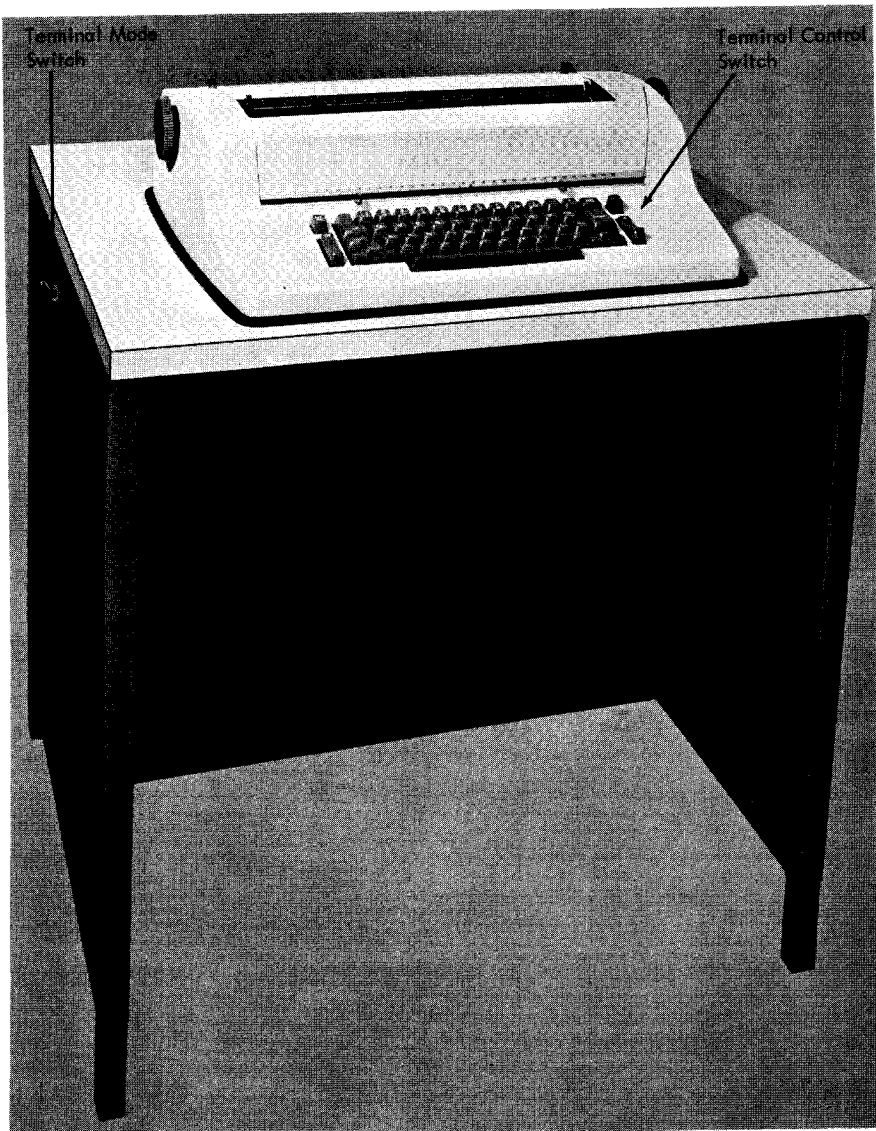


Figure 3. IBM 2741 Controls



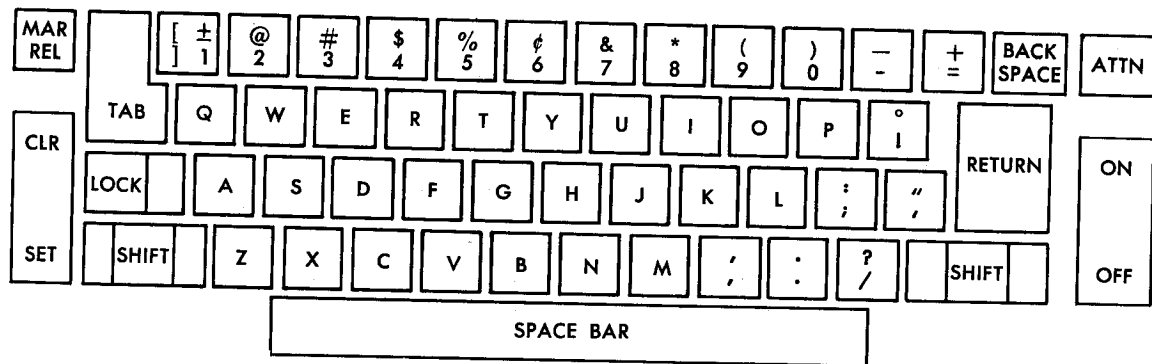


Figure 4. IBM 2741 Keyboard

#### Terminal Power Switch (ON – OFF)

This switch, labeled ON and OFF, controls the electrical power for the terminal. When ON is pressed, the power is turned on and the red area on the switch is exposed (Figure 4).

#### Tab Control

This control is similar in design to the terminal control switch. Individual tabs are set and cleared for the position indicated by pressing the appropriate part of the control. To clear all tab stops:

1. Move the carrier to the right margin.
2. Depress and hold the CLR part of the tab control.
3. Operate the carrier return.

#### Margin Release

This key releases both margins. To position the carrier to the left of the left margin, use the backspace key while holding the margin release. To type beyond the right margin, simply press the margin release key either before or when the right margin is reached. The computer cannot perform the margin release function. Therefore, no typing outside either margin should be entered into the computer if this text is to be sent back to the terminal.

#### Tab

This key moves the carrier right to the next set tab position. The tab function is independent of the right margin.

#### Shift and Shift Lock

The printing element is shifted from lower case letters, symbols, and numerals to upper case letters and symbols with the shift key. The element is locked in the upper case position with the shift lock. The lock is released by touching the shift key. When operating in communicate mode, the terminal is automatically placed in lower case shift (if necessary) at each change between transmit state and receive state. (These changes occur when the attention or carrier return keys are operated.)

#### Backspace

This key causes the carrier to move left one space. (See Special Features.)

#### Return

This key causes the carrier to move to the left margin and the carriage to space the paper either one or two lines, depending on the setting of the line space lever. In addition, the return key sends a carrier return code, followed by a Ⓢ code to the computer if the terminal is in communicate mode.

#### Attention

This key performs two different functions, depending upon the mode of the terminal. If the terminal is in local mode, the attention key is used to test the terminal. A separate test of each key may be made to be sure the transmission circuits are operable.

When in communicate mode, this key causes a Ⓢ to be sent to the computer.

If the interrupt special feature is installed, the

attention key has a third function. This function is active only in communicate mode and only in the receive state. The operation of the attention key under these conditions causes a 200 ms signal to be transmitted, indicating that the operator wishes to interrupt the computer. In the transmit state, this key retains its standard function, sending a © to the computer.

### Margin Setting

Directly above the keyboard is the typing position guide. A red indicator moves along this guide as the carrier moves, indicating the position of the carrier. The margin stops are set by pushing them in and moving them to the desired position on the typing position guide.

### Space Bar

This bar moves the carrier one space right when pressed. This movement is independent of the right margin stop.

## Typewriter Controls

### Paper-Release Lever

The paper-release lever, located on the right side behind the platen, releases feed-roll pressure for positioning or removing paper. (See Figure 6.)

### Line-space Lever

A two-position linespace lever permits a choice of single or double-line spacing. This lever is located on the right side of the carriage and to the left of the paper-release lever.

### Multiple-Copy Control Lever

A 5-position, multiple-copy control lever positions the platen forward and back to compensate for additional copies and to ensure that the typing element strikes squarely on the paper. This lever is located at the left side of the carriage and behind the platen.

### Platen Knobs

Turning either of these knobs rotates the platen forward or back for manual positioning of forms. Pressing in the left platen knob allows the platen to be rotated freely in either direction for variable registration of forms.

### Paper Bail

The paper bail holds the paper against the platen. To insert paper, move the bail forward by grasping one of the tabs located on either end of the bail. The three bail rollers may be moved to any position on the bail.

### Paper Guide

A paper guide mounted on the left side behind the platen facilitates inserting paper by aligning the left side of the paper. This guide may be moved to accommodate margin adjustments for the paper size used.

### Line Gage and Card Holder

The line gage and card holder aids in inserting and registering paper because of the center guide-line and side calibrations provided for proper horizontal and vertical alignment. This guide is also used to hold small cards in place for typing.

### Ribbon-Reverse Lever

This lever permits the operator to manually reverse the direction of the ribbon before the end of the ribbon. The ribbon automatically reverses when either end of the ribbon is reached. This black lever is located directly below the center and slightly in front of the ribbon cartridge. (See Figure 7.)

### Ribbon-Position Lever

This 4-position lever (left to right) permits the ribbon to be positioned so that either the bottom (red), middle (red-black), or top (black) section of the ribbon is used. The fourth position (extreme right) is used for cutting stencils. With single colored ribbons, periodic repositioning of this lever extends the life of the ribbon and permits the used portions of the ribbon fabric to be re-inked. This black lever

is located directly below and slightly in front of the left-center portion of the ribbon cartridge.

#### Ribbon-Change Lever

Moving this lever to the extreme right lifts the ribbon guides and permits easy removal of the ribbon and ribbon cartridge. This black lever is located directly below and slightly in front of the right-center portion of the ribbon cartridge.

#### Impression Control Lever

This red lever, located to the right of the print element, controls the striking force of the element. Stencils require light impression while multiple copies require heavy impression. To change the setting, push the lever slightly to the right and slide it to the desired number — one to five (light to heavy impression). For most routine typing, a setting of three is satisfactory.

## SPECIAL FEATURES

### TYPAMATIC KEYS

A typamatic feature is available for the IBM 2741. With this feature installed, the space bar, backspace key, and hyphen/underscore keys are typamatic. If one of these keys is operated normally, the corresponding function occurs once. If the key is pressed and held, the action is repeated until the key is released.

### INTERRUPT

The Interrupt special feature enables the operator to interrupt the computer while the computer is transmitting. The attention key is active when the terminal is receiving if this feature is installed. To cause an interrupt, the operator presses the attention key. This causes a 200 ms signal to be transmitted. This signal causes the computer to transmit a  $\textcircled{C}$ , placing the terminal in the transmit state and causing the keyboard to unlock.

This feature requires full-duplex communication facilities, with the Western Electric 103A or 103F data sets, or equivalent.

### DIAL-UP

The Dial-up special feature allows the IBM 2741 to be attached to the common-carrier switched network rather than a customer owned or a leased private communication line. A Western Electric 103A Data Set (or equivalent) is used to attach the terminal to the common-carrier network.

To establish the connection with the computer, the terminal operator dials on the data set the number of the computer. To terminate the connection, the operator turns off the terminal power switch.

GENERAL OPERATION

The simplicity of operation of the IBM 2741 means that the user need not be trained to use a computer. Anyone who types can use this device. The user's attention is devoted to the content of the material not the operation of the machine. The details of machine operation are under the control of the computer. Simple request sequences are used to specify the operation desired. The request sequences and possible operations are determined by the program which controls the computer.

MODES OF OPERATION

The 2741 Communications Terminal has two modes of operation: communicate mode and local mode. The mode of the terminal is controlled by terminal mode switch which is located on the left side of the typewriter stand (see Figure 3).

When in local mode, the terminal is disconnected from the communication line to the computer. The terminal can be used for typing, just as any other Selectric typewriter. Nothing can be transmitted or received.

When switched to communicate mode, the terminal is in a control-receive state. Automatically, the print element is shifted to lower case, if necessary, and the terminal goes to the communicate-transmit state. A (D) code is sent to the computer and the keyboard unlocks. The operator may now type whatever requests and text are desired.

The basic indication of the terminal state (transmit or receive) is the keyboard. The keyboard is locked whenever the terminal is not in transmit state. Receive-control is a momentary state in which the keyboard is locked and the terminal is waiting for a (D) from the computer. The (D) code places the terminal in a receive state. An automatic lower case shift occurs in the receive-control state if required.

IBM 2741 LINE CONTROL

Line control becomes effective on the 2741 as soon as the terminal power switch is turned on and the terminal mode switch is set to communicate. The terminal is automatically put in the transmit state and a (D) code is sent. The operator may transmit by keying as on a typewriter.

Terminal transmission ends when the terminal transmits a (C). When the attention key is operated, a (C) is sent. When the carrier return key is pressed, a carrier return code followed by a (C) code is sent. The transmission of either code places the terminal in the receive-control state. The keyboard is locked.

When the computer transmits a (D) code, the terminal is placed in the receive state. Any valid character code received from the computer causes printing.

The receipt of a (C) code from the computer causes the terminal to switch to transmit mode. The keyboard is unlocked and the terminal automatically transmits a (D).

Figure 5 shows a typical line control sequence. The sequence may be ended only by the terminal. The operator terminates line control by switching to local mode or by turning the terminal power switch off.

PROGRAMMING CONSIDERATIONS

The operations available to the IBM 2741 user are determined by the program which controls the computer. The facilities of the computer may be made available to the 2741 user. Computation, high-speed printing, card punching, or magnetic tape writing of stored information may be included in the program.

The computer must be programmed to service many terminals. As the typist composes (or copies) at his own speed, the characters are entered into storage. When information is transmitted to the terminal, the computer "types" at the maximum

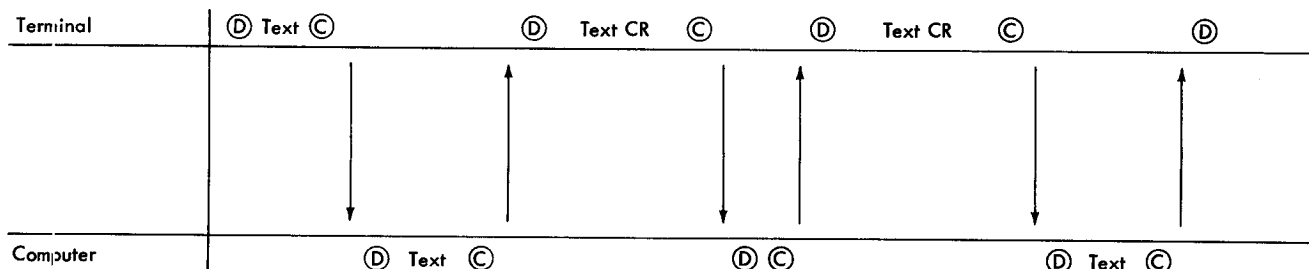


Figure 5. IBM 2741 Line Control

speed of the terminal. There must be a method of sandwiching (interleaving) these terminal service functions between the time devoted to whatever data manipulation is required by the application.

The extent of the program is limited by the size of the computer. A highly developed program for publishing, for example, might accept rough drafts, facilitate editing, and finally print out pages with two columns, justified margin, page numbers, running feet, and spaces for figures. Another program might handle engineering specifications, purchase orders, technical manuals, and new computer programs.

The particular printing element being used by the terminal is also of concern to the programmer. For instance, on the Courier 72 print element, the digit 1 and the ± symbol replace the ] and the [ respectively on the Manifold 72 element. One approach to this situation is to define a change-of-print-element code sequence in which the operator informs the computer of the print element being used.

#### Timing Considerations

The program must allow time for the mechanical functions of the terminal to take place. This is done by inserting idle codes for the time required. Any code which is ignored by the terminal may be used. Common practice is to use the BCD idle code, CAB8421.

The number of idle codes required for each mechanical operation is as follows where N is the number of idle codes required, and T is the number of inches of carrier travel, and with any fraction of an inch considered a whole inch.

Carrier return:	$N = T + 1$
Tab:	$N = T + 1$
Index:	$N = 1$

If the program uses the opportunity to transmit when offered by the © which follows each carrier return, time must be allowed for the carrier return to be completed before transmission begins.

## OPERATOR INFORMATION — IBM SELECTRIC TYPEWRITER

### Print Element Replacement

The removal and replacement of a printing element requires only seconds. To accomplish this:

1. Check the printer to ensure that it is in lower-case shift. When in lower-case shift, the arrow on the print element points toward the platen. If in upper-case shift, press the shift key to release the shift lock.
2. Turn the terminal power switch off.
3. Raise the top cover.
4. Press the spring levers on top of print element (Figure 6).
5. Lift the print element off the element post.
6. Press the spring levers (of the replacement print element) together firmly and place on the element post. The arrow on the print element must point toward the platen.

7. Release the spring levers. They will click when in proper position. The print element is now locked in position for printing.

### Ribbon Replacement

The IBM Selectric Ribbon Cartridge permits quick, clean ribbon changing in a matter of seconds. To remove and replace a ribbon:

1. Turn terminal power switch on and tab or space the carrier to the center of the line.
2. Turn the terminal power switch off and lift the top cover.
3. Move the ribbon change lever to the extreme right to raise the ribbon guide.
4. Lift the ribbon cartridge straight up and ease the ribbon out of the slots in the ribbon guide.

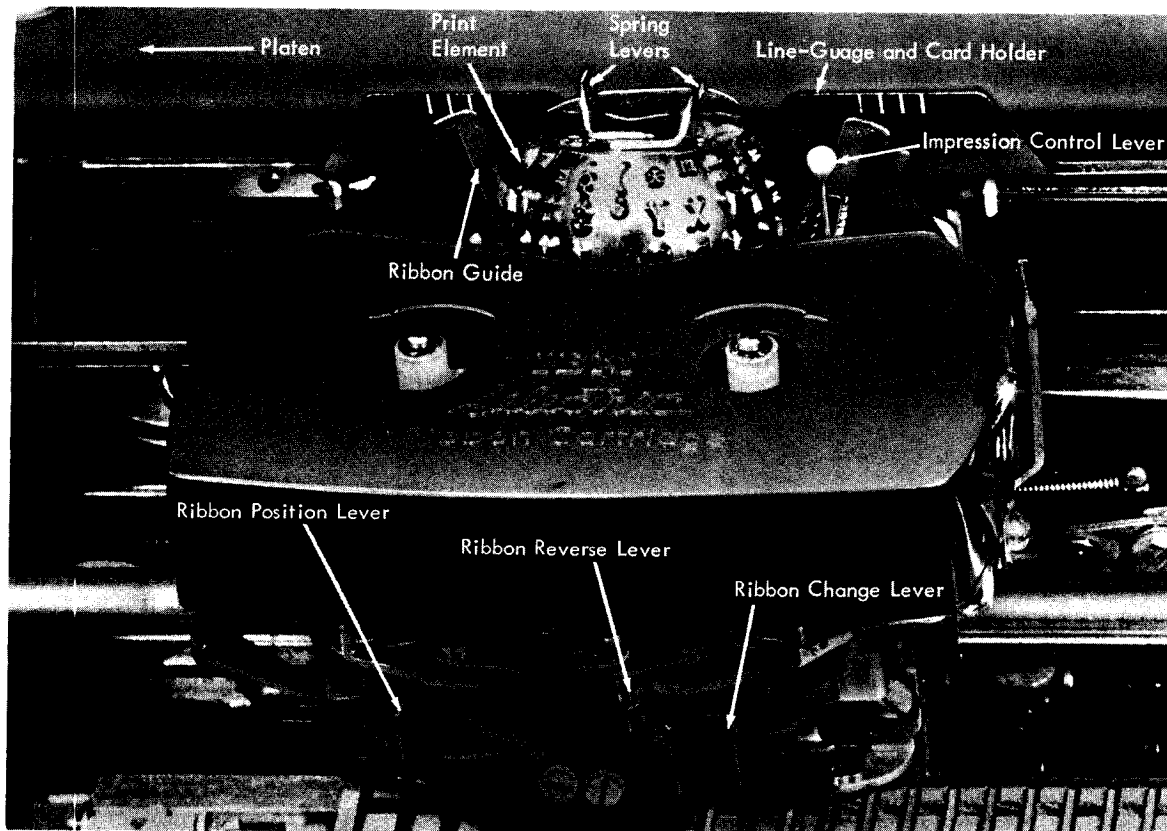


Figure 6. Selectric Ribbon Controls

5. Rewind the excess ribbon by inserting a wooden pencil in either of the cartridge holes and turn in the direction of the arrow.
6. Position the new cartridge with the exposed ribbon facing the platen.
7. Slide the ribbon through the slots in the ribbon guide.
8. Position the cartridge on the cartridge posts and press into place.
9. To rewind excess ribbon, turn either cartridge post in the direction of the arrow.
10. Move the ribbon change lever to its extreme left position. This lowers the ribbon guide into proper typing position.

#### Platen Removal

To remove the platen for changing or cleaning:

1. Turn the terminal power switch off.
2. Lift the top cover.
3. Move the paper release lever and the paper bail toward the operator.

4. Press the platen latches at both ends of the platen assembly (Figure 7) and lift the platen out.

#### Platen Replacement

1. Position the ratchet teeth to the right.
2. Center the end plate in the groove in the right end of the platen shaft. Press the platen into position, and check for a click when it locks.

#### Cleaning the Print-Element

Two specially designed brushes are available from IBM for cleaning the IBM 2741. They are the dual-purpose brush, and the print element brush. To clean the print element:

1. With the terminal power switch on, set the print-element carrier in lower case.
2. Turn the terminal power switch off.
3. Remove the print element.
4. Clip the print element to the end of the dual-purpose brush.
5. Brush away from you and toward the top of the print element, using the element brush.

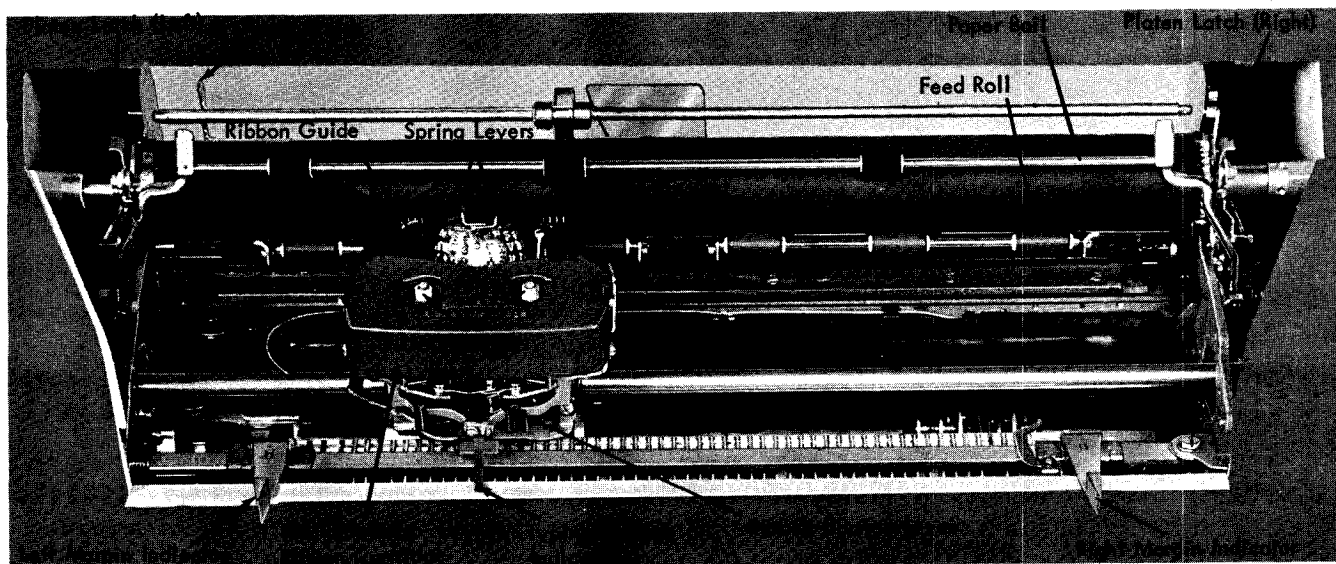


Figure 7. Selectric Carrier and Platen Controls



## GLOSSARY OF TERMS

Some of the terms used in the data processing and communication fields have specialized meanings. The following definitions may be useful.

Data Set: a modulation-demodulation device used to connect business machines to communication lines.

Dedicated Line: a communication line devoted to one user, that is, not part of a switched network.

Demodulation: the conversion of audio frequency signals from a communication line to digital signals for a business machine.

Direct access storage: in data processing, a storage medium for data in which the data is available for immediate retrieval, that is, not serial access storage.

Full duplex: a communication channel capable of transmitting in both directions simultaneously.

Half duplex: a communication channel capable of transmitting in both directions, but in only one direction at a time.

Modem: another name for a data set.

Modulation: the conversion of digital signals from a business machine to audio frequency signals for transmission over communication lines.

On Line: associated with a processor either directly or through a transmission control unit. The physical connection can be accomplished by either multiwire cable or a communication line.

Program: the series of instructions, meaningful for a computer's control unit, that define, step by step, the operation of the computer for the solution of a given problem.

Terminal: a machine or group of machines capable of generating and/or receiving signals to be transmitted on and/or received from a communication line.

## COMMUNICATION CONSIDERATIONS

The IBM 2741 Communications Terminal communicates with the computer on either a privately owned or a common carrier communication line. One communication line is required for connecting each 2741 to the computer.

Privately Owned Communication Lines

## Line Adapter (Leased Line)

This special feature permits the customer to attach his privately owned, on-premise communication line to an IBM 2741 terminal. The line adapter feature (installed within the 2741) provides the necessary signal modulation and demodulation to accommodate a communication line of up to 8 miles in length.

## Line Adapter (Local Use)

A customer can attach his privately owned, on-premise communication line to an IBM 2741 terminal with this line adapter installed. This feature provides the necessary signal modulation and demodulation to accommodate a communication line of up to 4.75 mi. with the single 2741 attached. The line adapter is installed entirely within the 2741.

## Line Adapter (Unlimited Distance)

This feature permits the customer to attach his privately owned line or a communication-company leased private line to an IBM 2741. This line adapter feature (installed within the 2741) provides the necessary signal modulation and demodulation to accommodate a communication line of any length.

## Line Adapter (Shared Line)

This feature permits attachment of the IBM 2741 to the customer's privately-owned communication line or a common-carrier leased private line. This

line adapter provides the necessary signal modulation and demodulation for data communication on one of four available sub-channels which this line adapter can utilize within any standard telephone line of voice-grade quality or better. Thus, one telephone line can provide four separate channels for simultaneous data transmission between terminals. Interconnected terminals must however, be assigned to the same channel.

Common-Carrier Communication Facilities

The communication facilities may be either half-duplex or full-duplex. If IBM Line Adapters are used on a leased private line, half duplex capabilities are available. If common-carrier data sets are used on either type of communication line, full duplex capabilities are available. However, simultaneous transmission by both the computer and the terminal is possible only with the interrupt special feature. With this exception, the line control scheme of the IBM 2741 is half duplex.

Leased Private Communication Line

A 2741 may be attached to a leased private common-carrier line by an IBM Line Adapter or by a common-carrier data set. The common-carrier data set used is the Western Electric 103F data set (or equivalent).

Common-Carrier Switched Network

If the dial-up special feature is installed, the IBM 2741 is attached to the common-carrier switched network by a Western Electric 103A data set (or equivalent).

CODE CHART

The code used by the IBM 2741 with any standard Selectric print element is shown in Figure 8.

The EOT code (CAB8421) is the end-of-transmission code, shown as (C) in the line control shorthand form. The (D), EOA, end-of-address code is not a unique code, as is (C). The (D) code (CAB8421) is the pound sign, #. This code prints if the terminal is in a transmit or receive state. The same code is a line control signal, (D), if the terminal is in a control state.

Digit Bits				Zone Bits				A	B	A	B	A	B	A	B
				0	0	1	0	0	1	1	1	1	1		
8	4	2	1	LC	UC	LC	UC	LC	UC	LC	UC	LC	UC	LC	UC
0	0	0	0	SP	SP	t	T	l	o	j	J				
0	0	0	1	1	1	±	x	X	m	M	g	G			
0	0	1	0	2	@	n	N	.	.	=	+				
0	0	1	1	3	#	u	U	v	V	f	F				
0	1	0	0	5	%	e	E	'	"	p	P				
0	1	0	1	7	&	d	D	r	R	;	:				
0	1	1	0	6	ç	k	K	i	I	q	Q				
0	1	1	1	8	*	c	C	a	A	,	,				
1	0	0	0	4	\$	L	L	o	O	/	?				
1	0	0	1	0	)	h	H	s	S	y	Y				
1	0	1	0	z	Z										
1	0	1	1	9	(	b	B	w	W	-	-				
1	1	0	0												
1	1	0	1				LF		CR/LF		TAB				
1	1	1	0		UC				BKSP		LC				
1	1	1	1		EOT										

Figure 8. Code Chart (Standard Selectric Print Element)



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## GLOSSARY OF TERMS

Some of the terms used in the data processing and communication fields have specialized meanings. The following definitions may be useful.

Data Set: a modulation-demodulation device used to connect business machines to communication lines.

Dedicated Line: a communication line devoted to one user, that is, not part of a switched network.

Demodulation: the conversion of audio frequency signals from a communication line to digital signals for a business machine.

Direct access storage: in data processing, a storage medium for data in which the data is available for immediate retrieval, that is, not serial access storage.

Full duplex: a communication channel capable of transmitting in both directions simultaneously.

Half duplex: a communication channel capable of transmitting in both directions, but in only one direction at a time.

Modem: another name for a data set.

Modulation: the conversion of digital signals from a business machine to audio frequency signals for transmission over communication lines.

On Line: associated with a processor either directly or through a transmission control unit. The physical connection can be accomplished by either multiwire cable or a communication line.

Program: the series of instructions, meaningful for a computer's control unit, that define, step by step, the operation of the computer for the solution of a given problem.

Terminal: a machine or group of machines capable of generating and/or receiving signals to be transmitted on and/or received from a communication line.

## COMMUNICATION CONSIDERATIONS

The IBM 2741 Communications Terminal communicates with the computer on either a privately owned or a common carrier communication line. One communication line is required for connecting each 2741 to the computer.

Privately Owned Communication Lines

## Line Adapter (Leased Line)

This special feature permits the customer to attach his privately owned, on-premise communication line to an IBM 2741 terminal. The line adapter feature (installed within the 2741) provides the necessary signal modulation and demodulation to accommodate a communication line of up to 8 miles in length.

## Line Adapter (Local Use)

A customer can attach his privately owned, on-premise communication line to an IBM 2741 terminal with this line adapter installed. This feature provides the necessary signal modulation and demodulation to accommodate a communication line of up to 4.75 mi. with the single 2741 attached. The line adapter is installed entirely within the 2741.

## Line Adapter (Unlimited Distance)

This feature permits the customer to attach his privately owned line or a communication-company leased private line to an IBM 2741. This line adapter feature (installed within the 2741) provides the necessary signal modulation and demodulation to accommodate a communication line of any length.

## Line Adapter (Shared Line)

This feature permits attachment of the IBM 2741 to the customer's privately-owned communication line or a common-carrier leased private line. This

line adapter provides the necessary signal modulation and demodulation for data communication on one of four available sub-channels which this line adapter can utilize within any standard telephone line of voice-grade quality or better. Thus, one telephone line can provide four separate channels for simultaneous data transmission between terminals. Interconnected terminals must however, be assigned to the same channel.

Common-Carrier Communication Facilities

The communication facilities may be either half-duplex or full-duplex. If IBM Line Adapters are used on a leased private line, half duplex capabilities are available. If common-carrier data sets are used on either type of communication line, full duplex capabilities are available. However, simultaneous transmission by both the computer and the terminal is possible only with the interrupt special feature. With this exception, the line control scheme of the IBM 2741 is half duplex.

Leased Private Communication Line

A 2741 may be attached to a leased private common-carrier line by an IBM Line Adapter or by a common-carrier data set. The common-carrier data set used is the Western Electric 103F data set (or equivalent).

Common-Carrier Switched Network

If the dial-up special feature is installed, the IBM 2741 is attached to the common-carrier switched network by a Western Electric 103A data set (or equivalent).

CODE CHART

The code used by the IBM 2741 with any standard Selectric print element is shown in Figure 8.

The EOT code (CAB8421) is the end-of-transmission code, shown as Ⓞ in the line control shorthand form. The Ⓧ, EOA, end-of-address code is not a unique code, as is Ⓞ. The Ⓧ code (CAB8421) is the pound sign, #. This code prints if the terminal is in a transmit or receive state. The same code is a line control signal, Ⓧ, if the terminal is in a control state.

Digit Bits				Zone Bits							
				A	B	A	B	A	B	A	B
				0	0	1	0	0	1	1	1
8	4	2	1	LC	UC	LC	UC	LC	UC	LC	UC
0	0	0	0	SP	SP	t	T	!	o	j	J
0	0	0	1	Ⓧ	Ⓧ	x	X	m	M	g	G
0	0	1	0	2	@	n	N	.	.	=	+
0	0	1	1	3	#	u	U	v	V	f	F
0	1	0	0	5	%	e	E	'	"	p	P
0	1	0	1	7	&	d	D	r	R	;	:
0	1	1	0	6	ç	k	K	i	I	q	Q
0	1	1	1	8	*	c	C	a	A	,	,
1	0	0	0	4	\$	L	L	o	O	/	?
1	0	0	1	0	)	h	H	s	S	y	Y
1	0	1	0	z	Z						
1	0	1	1	9	(	b	B	w	W	-	-
1	1	0	0								
1	1	0	1				LF		CR/LF		TAB
1	1	1	0		UC				BKSP		LC
1	1	1	1		EOT						

Figure 8. Code Chart (Standard Selectric Print Element)



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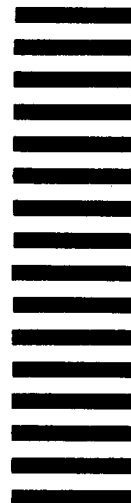
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