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TC-71
COMMUNICATIONS
TERMINAL
SPECIFICATION

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1. Introduction

The TC 71 Communications Terminal provides the capabilities of the standard Selectric Typewriter with the added convenience and flexibility of a communications terminal.

The TC 71 is available as a keyboard entry terminal either buffered or unbuffered as well as a receive only printer.

The TC 71 can be configured to be compatible to the following devices:

- (a) IBM 2740-1
- (b) IBM 2740-2
- (c) IBM 2741

When used as a receive only printer, the TC 71 is completely self contained. When used as a data entry device, a companion TC 11 Data Keyboard is required.

The TC 71 series of machines are designed to be used for the transmission or reception of data over communications lines from/to another terminal or a computer. Modes of operation cover conversational data exchange, on-line message composition and transmission, message composition into a buffer and then transmission, real time received message printout, and buffered received message printout.

The terminals utilizing the TC 11 may be used off-line as typewriters. The keyboard is the IBM Selectric* type whose superior qualities enable easy typing.

2. Functional Description

2.1 TC 71 Communication Terminal, (IBM 2740-1 Compatible)

The TC 71 is designed to be compatible with the IBM 2740-1 as a keyboard printer terminal combining the TC 71 and TC 11. It is shown in Figure 1.

2.1.1 Types of Operation

Point-to-point with another compatible terminal over a direct or dialed communications line.

Point-to-point with a computer over a direct or dialed communications line.

Multidrop with a computer over a full or half-duplex communications line. Up to forty terminals may be multiplexed on the same line.

2.1.2 Application Areas

When operating in "Local" mode, the performance of the TC 71 is similar to a Selectric* typewriter. When in "Communicate" (Data Entry) mode, the characters not only print locally but also are transmitted over a communication line to either print at another terminal or enter the memory of a computer through its multiplexor. This mode of operation enables the following:

- Intracompany Communication
- Remote Inquiry & Reply With a Computer
- Intracompany Correspondence
- Executive Correspondence

2.1.3 Communication Facilities & Interface

The TC 71 unbuffered unit transmission speed is 134.5 baud maximum (limited by the 15 cps TC 71 printer). The baud rate may be selected from 75 baud up to the maximum.

The terminal may be equipped with an internal, under the cover, data set, with an RS 232 EIA interface, or TC 905 modem distributor interface.

The internal data sets available are W. E. 103 compatible or W. E. 202 compatible and can operate over a leased, private or switched network.

2.1.4 Line Control Signals

In terminal operations with a multiplexor or other terminals, a control discipline is required on the communication

line. This discipline is called line control, and one of its functions is to prevent two or more stations from attempting to use the line simultaneously (line contention).

The line control signals (EOA, EOT, EOB, Yes, No, SOA, and Inquiry) are represented in a short-hand form (D), (C), (B), (Y), (N), (S), and (d) respectively. This form is used in programming, as well as in communications and line control discussions. Also, the terms "response" and "answer" are used in a restricted manner. These terms and signals are defined in the following:

Answer. The negative, positive, or no answer at all to a check (VRC or LRC) following an EOB.

Response. The negative, positive, or no response at all to addressing or polling.

(D) -- EOA (Pound Sign Character). Signal indicates:

1. The Data Entry Key has been pressed and the transmission of text data is to follow. This pertains to point-to-point operation or broadcast operation without the station control feature installed.
2. An end-of-address, with text data to follow. This is used in multiplexor operations with the station control feature installed. This signal starts the LRC counter at both the sending and receiving terminals. The EOA signal is not included in the following LRC check.
3. Positive response to a poll from the multiplexor.

(C) --EOT. This signal indicates an end-of-transmission, and resets the LRC counters at both sending and receiving terminals.

(B) --EOB. This signal indicates the end-of-a-unit-block of text. This is used when the checking feature is installed and is followed by the LRC character. This provides an LRC check comparison at the receiving terminal with the EOB character included in the check.

(Y) --Positive Response, Yes (Period Character). When this is received, it indicates:

1. A positive response to an address.
2. A positive answer to an EOB/LRC sequence when the checking feature is installed.

(N) --Negative Response, No (Hyphen Character). When this is received, it indicates:

1. A negative response to an address.

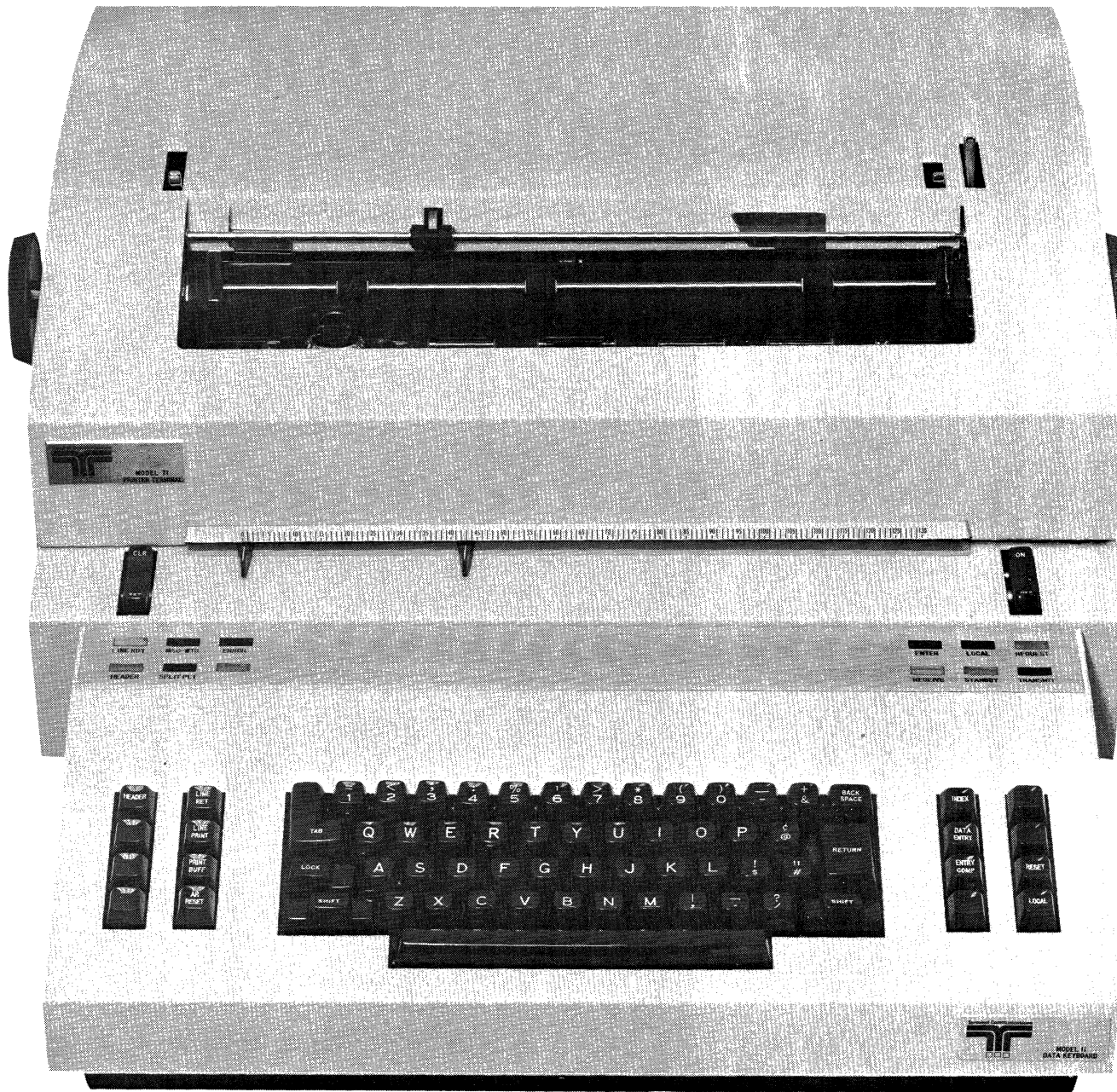


Figure 1: TC 71 COMMUNICATIONS TERMINAL/TC11 KEYBOARD
(IBM 2740-1/2740-2 Compatible)

2. A negative response to a poll.
3. A negative answer to an EOB/LRC sequence when the checking feature is installed. Either the hyphen or underscore character is printed as an indication of this condition.

Ⓢ -- SOA (Comma Character). This is used to indicate a start-of-address condition, and is used when the station control feature is installed.

Ⓞ -- Positive Answer, Inquiry (Pound sign character). This signal is used in a multiplexor operation as a positive answer to an EOB/LRC sequence from the terminal. At this time, the terminal switches to a receive status. The character associated with this signal is not printed.

2.1.5 Line Control & Line Codes

The TC 71 utilizes PTTC/EBCD and PTTC/BCD for both line control and data as standard. Other codes are available upon special quotation.

2.1.6 Control Switches & Indicators

The following switches are standard for the TC 71 and are located on the TC 11:

Local-Depressing the Local Key will place the terminal in off-line typewriter status. The local switch is only effective if the terminal is not in transmit or receive modes. Local is reset by another depression of the local key or by depressing the Reset Key.

Data Entry--This key is used by the operator to initiate the transmission of data. Its depression results in the sending of a start of message character (Ⓞ) and in the terminal shifting to transmit mode. The key is only active if the TC 71 is in standby mode.

Entry Complete--When this key is depressed, the terminal will send an end of transmission character (Ⓢ) and go to standby mode. The key is only active if the TC 71 is in transmit mode.

Reset--The Reset Key is provided as the means by which error conditions are reset and a general machine reset is performed. If an error condition is indicated by the error light, depressing the Reset Key results only in resetting the error condition and the error light. If the error indicator is not on, key depression causes a general machine reset.

Index-This key is actually an extension of the keyboard and functions the same as a typewriter Index Key on an unbuffered machine. On a buffered machine it causes an index character to be generated from the keyboard logic, which is stored in the buffer.

The following switches are located on the TC 11 but are installed only when the associated feature is installed in the machine:

Cheek Entry-Present only when the record checking feature is installed. Activating this key results in an end of block character (ⓑ) transmitted. This is automatically followed by a longitudinal redundancy character (LRC) after which the TC 71 waits for a reply. The key is active only if the terminal is in transmit mode.

* Dial Disconnect-This key is installed when the terminal is to be connected to the dialed network and thus has the dial feature installed. The key permits the terminal to be disconnected from the line provided the terminal is not in transmit mode.

* Interrupt-The interrupt feature allows the operator to indicate to the computer that the message the computer is sending is to be terminated. The key is only operative if the TC 71 is in receive status. Interrupt is only installed for full-duplex, terminal to computer applications.

* Forms Feed-Depressing this key will cause a forms feed to occur if the forms feed select switches are not set at zero.

The following switches are located under the TC 11:

Light Test-This is a toggle switch which when set to the "on" position will test all indicator bulbs except the split platen indicator by turning them on.

Master/Diagnostic -This toggle switch is used to indicate master on machines that have the Station Control feature installed. When in the "on" position, the switch designates the terminal as the master for a given group. There can be only one master per group. A master address cannot be used as a terminal address on the same line. If the station control feature is not installed (i.e. the terminal is point-topoint), the switch is used to activate an internal machine diagnostic. The diagnostic is active when the switch is in the "off" position.

Transmit Control-This toggle is present when the TC 71 has the Transmit Control feature installed. When in the "on" position, the feature is activated.

*Feature Optional

Auto EOB-This three position switch is installed on those terminals that have the Auto EOB feature. The switch is used to disable the feature (off) or designate that the terminal is being used in a terminal to terminal hook-up (T-T) or in a terminal to multiplexor (processor) hook-up (T-M).

The following switches are located on the TC 71 printer:

Power On/Off-This switch controls all terminal power. When power is turned on the terminal, the terminal will normally go to standby mode. It will be prevented from doing this if an interlock condition exists such as out of paper.

Out of Paper-When the out of paper contact makes, the terminal drops status and leaves the mode it is in (except local). Operation cannot be resumed until paper is fed into the printer.

Tab Clear/Set-This switch is used by the operator when setting or clearing tab stops.

Set-up-The Set-up Switch performs the same function as the out of paper switch. It is a toggle switch and is used to insure that printing will not take place while the operator is inserting or adjusting paper, etc.

Forms Feed Number Select-This is a set of three rotary digit switches which are used to set the number of lines per form. The switches are present only when the forms feed feature is installed. Setting the switches to all zeroes is equivalent to disabling the feature.

The following indicators are located on the TC 11:

Local-This indicator is lit whenever the terminal is placed in local mode for use as a typewriter.

Request-The Request Indicator will turn on when the operator depresses the Data Entry key, provided conditions are such that the terminal is ready to go into transmit mode. The indicator goes off when the TC 71 goes into transmit mode.

Receive-The TC 71 Receive Indicator denotes that the terminal is in receive mode. The light will stay on solid while data is being received. If record checking is installed, the light blinks when the LRC answerback is transmitted.

Transmit-The Transmit Indicator signifies that the terminal is in transmit mode. It will be solid during this mode. If record checking is installed, the light will blink while the TC 71 is awaiting the reply to the EOB, LRC characters that it sent. If station or transmit control is installed, the light will blink whenever a poll or address answer is sent to the CPU.

Standby-This indicator will normally be on if the TC 71 has status and the data set has detected the presence of carrier. If the dial feature is installed, a line connection is not necessary for the light to be on (i.e. no carrier).

Message Waiting-The Message Waiting Light will be illuminated whenever the TC 71 is unable to go into receive mode and has received a line control sequence which would normally put the terminal in receive mode. The light goes off when the condition which caused it to come on is eliminated.

Error-The Error Indicator will be lit whenever an error condition is detected. Detectable error conditions are:

- a. Internal keyboard error.
- b. Receive parity error.
- c. Negative reply or transmission to an EOB, LRC, sequence when the record checking feature is installed.
- d. Printer Overflow i.e. printer unable to print or complete printing present character before next character arrives.

Line Ready-This light is illuminated when the terminal detects the presence of carrier on the line. If the Dial feature is installed, the terminal must also be in Standby mode for the light to be on.

Alarm-An alarm is installed in the TC 11 and will be sounded for the following conditions:

- a. Any time the terminal receives a (C) character but cannot go into receive mode.
- b. Record Checking-A negative reply or transmission to an EOB, LRC sequence.
- c. Station Control-A negative response by the terminal to an address from the processor.
- d. Transmit Control--When the terminal sends a (D) character to the processor in response to a poll.

2.1.7 Terminal Operation--Basic

Basic Terminal (Point to Point Operation)--The basic TC 71 will be in standby mode when it is inactive but has status. Status is defined as the terminal being in condition to transmit or receive. This means that paper is in the printer, the machine is not in local, and the data set is able to communicate. When the operator wishes to send data, the Data Entry Key is depressed. This results in a start of message character (Ⓓ) transmitted and the transmit light turned on. The Request Light is on between the time that the data entry key is depressed and the time that the TC 71-1 goes into transmit mode. Normally, in the basic machine, this will be too brief to be visible. The operator now transmits the message. When it is desired to end the transmission, the Entry Complete Key is activated. An end of transmission character (Ⓒ) is sent and the TC 71 returns to Standby mode.

The terminal will go into receive mode if it has status, is in standby mode and receives a Ⓓ character. Once in receive, it will accept all data until a Ⓒ character is received. At that time, the TC 71 will revert to standby mode.

The keyboard is locked when the terminal is in receive or when in Standby mode or if the paper contact indicates that the machine is out of paper. The keyboard unlocks for Transmit mode and Local mode.

If the terminal receives a Ⓓ character while it is in Local mode or while it does not have status, the message waiting light will be turned on and the alarm will sound. The terminal will go to Receive and print the message if the condition causing the alarm is corrected before the character following the Ⓓ is received. If not, the terminal reverts to Standby mode when status is regained.

All data entering the terminal is checked for parity. Thus bad parity for received data will result in the error light turning on and a hyphen printed in place of the character. The Error light is also turned on if an internal keyboard error occurs while in either Transmit or Local modes. The keyboard is locked as well in this case. Depressing the reset key will reset both error conditions. For the receive parity condition, however, the key should not be activated until after the terminal leaves Receive mode. If not turned off by the operator, the Error light will be reset at the beginning of the next received message.

2.1.8 Terminal Operation With Features

The following section describes the special features available on the TC 71 and the terminal operation which occurs as a result of these features:

Record Checking Feature

When the record checking feature is installed, an additional check called a longitudinal redundancy check (LRC) is performed on transmitted or received data.

The message is ended with an end of block (EOB B) character followed by an LRC character. The unit receiving the EOB, LRC determines the validity of the received data. It will then send an answer back, in the form of a character, to the transmitting unit. The answer back character can be any of the following:

- Ⓨ Yes--the message was good, operator may proceed.
- Ⓝ No--Error in the message.
- Ⓒ Terminal ends transmission and goes to Standby mode. This is generally employed after repeated transmission tries have resulted in errors.
- Ⓓ Terminal goes out of Transmit mode and into Receive mode. This is generally used only if the message was good. It is a convenient way of operating in a conversational mode and it eliminates line contention problems, i. e. problems that arise when both the terminal and the processor attempt to transmit a message at the same time.

The TC 71 can transmit only the Ⓨ and Ⓝ replies. A processor can transmit all four. When the TC 71 is transmitting data, the check is initiated (EOB, LRC sent) only when the operator depresses the Check Entry Key (or with auto EOB installed, with a carriage return--see below). If the operator does not wish to have the message checked, the message may be ended in the usual manner by depressing the End Entry Key. When receiving data, the TC 71 will perform the check and transmit the answer back only if it receives the EOB,LRC. If it receives a Ⓒ instead, it will go out of Receive.

When the TC 71 sends a Ⓝ answer back to a received message, a hyphen will be printed and the Error light will turn on. The light is automatically turned off when the next message is received or when the operator depresses the Reset Key. When the TC 71 receives a Ⓝ reply to an EOB,LRC that it transmitted, the Error Light will turn on, the alarm will sound, and the keyboard will lock. The operator must depress the Reset Key before further operation can occur.

Auto EOB Feature

The Auto EOB feature may only be installed when the Record Checking feature is installed. The feature is activated by a three position switch located under the TC 71 (terminal)

to multiplexor, off, terminal to terminal). When the switch is set to either T-M or T-T, a carriage return will cause the normal EOB,LRC checking sequence to take place. If the transmitting terminal receives a (N) response to the EOB,LRC a carriage return automatically occurs at that terminal. If the switch is in the T-M position, a carriage return will cause the normal EOB,LRC checking sequence to take place. If the transmitting terminal receives a N response to the EOB,LRC a carriage return automatically occurs at that terminal. If the switch is in the T-T position, the carriage return is automatically transmitted as well.

When the switch is set to the off position, the Check Entry Key must be manually operated to initiate a record check.

Dial Up Feature

Dial up operation is essentially the same as basic point-to-point operation except that a line connection must be established before transmission can occur. When the connection is established, the Line Ready indicator is turned on. The indicator turns off whenever the terminal goes into Transmit or Receive modes or when the line connection is terminated. The connection is dropped by use of the Dial Disconnect key, or if status is lost. If an automatic disconnect feature is supplied, in the data set, operating the Disconnect Key, disconnects both ends of the line.

Transmit Control Feature

This feature permits a multiplexor to control the send or receive status of a remote terminal. The feature is only for use on point-to-point installations. With the feature activated, the terminal shifts to Transmit status and sends a (D) only when it has received a special two-character control code (/space). The alarm is also turned on to alert the operator that transmission of text can begin. After a (C) code is transmitted, the terminal reverts to Standby status. If no transmission occurs from the terminal for a period of 15 seconds while in Transmit mode, the terminal times out and reverts to Standby status. In addition if the terminal fails to receive a carrier signal due to a faulty line (on data sets where the carrier detect lead is present), the terminal will time out after 15 seconds and revert to a Non-Status condition.

Provided with this feature is a Transmit Control switch located under the TC 11. The switch permits the operator to enable or disable the Transmit Control feature. When in the off position, transmit operation is the same as regular point-to-point except for the 15 second time-out. The time-out is still active if the terminal is

in Transmit mode and fails to transmit for 15 seconds. However, in addition to reverting to Standby status, the TC 71 will automatically transmit a (C) signal.

If the terminal is polled while it does not have status, the TC 71 will send a (D) character, sound the alarm and start the 15 second timeout. If status is gained within the 15 seconds, the terminal will go to Transmit mode. The timeout continues until a character is sent or until 15 seconds elapses.

Receive mode and receive operation are unaffected by this feature.

Station Control Feature

This feature provides the terminal with the ability to be addressed (a signal indicating "prepare to receive," or to be polled (a signal indicating "prepare to send"). This allows many terminals (up to 40) to be attached to the same communication line. The line may be a leased private line or a privately owned line.

Each terminal on a line is assigned a single character identification code (either alphabetic A-Z, numeric 0-9, or five additional special characters namely @, -, \$, ., and &). This character, followed by a space character forms a two character polling or addressing sequence which permits each TC 71 on a given line to recognize its unique station identification. When this recognition occurs, the terminal participates in either a transmitting or receiving operation. A receiving operation is differentiated from a transmitting operation in that a special character (S) precedes the two character identification sequence. No terminal on the line can transmit or receive unless it first receives its two character identification code.

In addition to the primary identification character, two additional identification characters are specified. The first is the Group Address. Each terminal in a specified group will be assigned this character. It must not be a character used as a primary address by any terminal in the group.

When this identification code is received, it signifies that all terminals in the group are to prepare to receive the same message at the same time. One terminal (and only one) in the group is designated group master by positioning the Master Switch located under the TC 11 to the "on" position. The group master is the only terminal in the group that makes the necessary responses for this "group call" to the processor.

The second additional identification set is called "all-call" and is a / space. This says that all terminals on the line will receive the same message at the same time. Only one terminal on the entire line is selected all call master. This terminal is the only one that makes the necessary responses for an "all call" to the processor. The all call master is selected by means of a jumper located on the line control logic board.

If a Group or All Call message is sent, and the Checking feature is installed, only the master or all call terminal will show any indication during the receive check answer-back sequence.

With the station control feature installed, the TC 71 will not respond to a poll or address until the processor sends a (C) character out on the line. All terminals on the line that have status will prepare to respond when this character is received. The processor may then poll or address a particular terminal (the difference being the S character as discussed above). The terminal so selected must answer the processor with a character which signifies whether or not the terminal is ready to either transmit (if polled) or receive (if addressed). When polled, the answer is a (N) for not ready and (D) (followed) by text) if ready. When addressed, the answer is a (Y) code for ready and a (N) code for not ready. A terminal will not be ready to transmit if it does not have status or if the Data Entry Key has not been depressed (Request light on). A terminal will not be ready to receive if it does not have status. The (N) answer to an address results in the message waiting light on and the alarm sounding.

A transmit or receive operation is normally terminated by the transmitting machine sending a (C) character. At that point, the processor will be free to address or poll other terminals. Any time there is no transmission from a terminal in transmit mode for a period of 15 seconds, a time out occurs and the terminal reverts to Standby status. In addition, if the terminal fails to receive a carrier signal (on data sets where the carrier detect lead is present) the terminal will time out after 15 seconds and revert to a non-status condition.

2.1.9 Timing Considerations

Time Out-Conditions

The TC 71 will time out whenever any of the following conditions exist:

If no data has been transmitted over the line for an interval of 15 seconds by a terminal in Transmit status

(with the Station Control feature installed). The terminal will return to a Standby status and no code is transmitted.

If no data has been transmitted over the line for an interval of 15 seconds by a terminal in Transmit status (with the Transmit Control feature installed). If the Transmit Control Switch is set to the MTC position, the terminal reverts to a Standby status and no EOT (C) code is transmitted. If the Transmit Control Switch is set to the Off position, an EOT (C) code is transmitted and the terminal reverts to a Standby status.

If the Dial-up feature is used and the line connection is lost, the terminal returns to standby status. If the Dial-up feature is used and the terminal has the Transmit Control feature installed, loss of the line connection for a period of 15 seconds causes the terminal to disconnect from the line and no code is transmitted.

Delay Conditions

When power is initially turned on, the terminal requires a delay of 0.53 seconds in order to reset the various circuits to Home position. Following the delay, the terminal is switched to a Standby status with only the control circuits active. The keyboard is locked and the typewriter motor is not running.

Typewriter Delay Conditions

The following formula is used to calculate the elapsed time (in milliseconds) when the typewriter is performing a carrier return and line feed operation (CR/LF), or a tabulate (tab) operation.

$$(1.5 + T) \times 67.5 = \text{Elapsed time in milliseconds}$$

T = The number of inches of carrier travel.

The number of idle codes required for each mechanical operation is as follows, where N is the number of codes required, and T is the number of inches of carrier travel. Round off the result to the next whole number.

Carrier return: $N = T + 1.5$

Tab: $N = T + 1.5$

Index: $N = 1$

The keyboard speed will vary according to the operator's typing ability, with the maximum speed not to exceed 14.8 cps (characters per second).

2.2 TC 71 Communication Terminal, (IBM 2740-2 Compatible)

The TC 71, Figure #2, is designed to be compatible with the IBM 2740-2. It is a buffered keyboard printer terminal capable of transmission speeds up to 1800 baud. It may be operated as a buffered transmit, unbuffered receive terminal; a buffered transmit, buffered receive terminal; or as a buffered transmit, buffered receive (with overlapping print) terminal.

2.2.1 Types of Operation

Point-to-point with another TC 71 compatible terminal over a direct or dialed communications line.

Point-to-point with a computer over a direct or dialed communications line.

Multidrop with a computer over a half or full-duplex communications lines. Up to forty terminals may be multi-dropped on the same line.

2.2.2 Application Areas

The TC 71 enables key input from the typewriter keyboard to be printed, stored in a buffer, visually verified, and subsequently transmitted to either another terminal or to a multiplexor at a computer center. Buffer sizes up to 4095 positions are available. In addition to its use as an off-line secretarial device, the TC 71 is applicable to the following business functions:

- Payment
- Journal Entry
- Inquiries
- Administrative Messages
- File Updating
- Renewals

The presence of a buffer provides the following advantages:

- * Enables faster transmission speeds.
- * Manual entry is reduced.
- * Data can be visually verified prior to transmission.
- * Assurance of clean copy output.
- * Ease in correction of keying errors.
- * Automatic retransmission (w/Record Checking Feature).
- * Greater flexibility in selection of communication facilities.

2.2.3 Communication Facilities Interface

The TC 71 transmission speed is Start/Stop over a communication line up to 1800 baud. Local rate is up to 9600 baud. The baud rate may be selected from 75 baud up to the maximum.

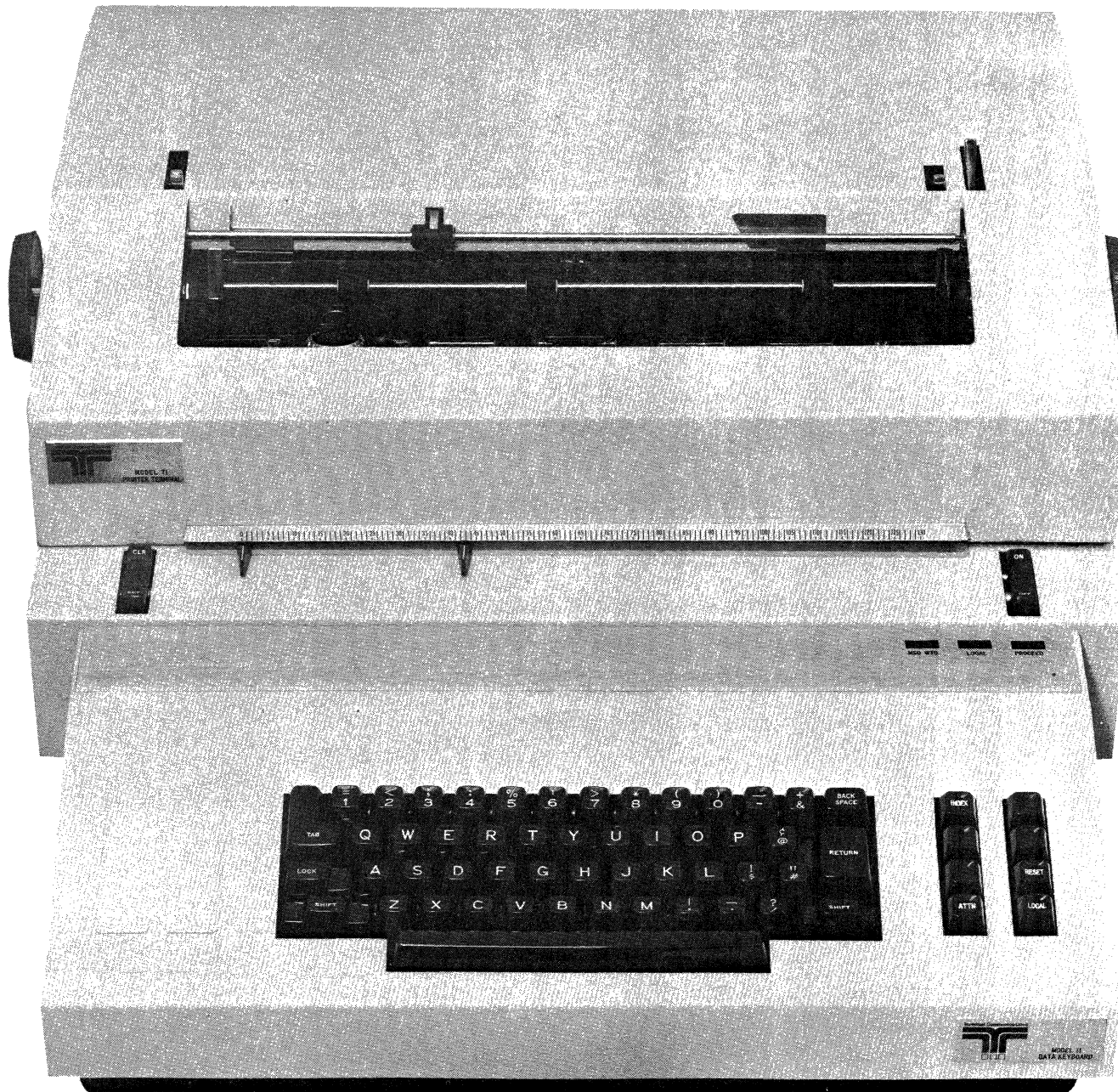


Figure 2:

TC 71 COMMUNICATIONS TERMINAL/TC 11 KEYBOARD
(IBM 2741 Compatible)

The terminal may be equipped with an internal, under the cover, data set, with an RS 232 EIA interface or a TC 905 modem distributor interface.

The internal data sets available are W. E. 103 compatible or W. E. 202 compatible and can operate over a Leased, Private or Switched network.

2.2.4 Line Control Signals

The line control signals for the TC 71 are identical to those in 2.1.4 with the exception that (Y) and (N) responses during addressing operations are actually two character responses with a first character indicating the specific definition of the terminal's status. This exception applies only if Station Control is featured on the terminal.

There are four prefix characters used in conjunction with the (Y) answer. They are as follows:

(S)(Y) I/O failure on last message received.

(U)(Y) Line VRC error during last message received.

Space Y No error stored.

/(Y) Electronic hardware failure on last message received.

There are six prefix characters used in conjunction with the (N) answer. They are as follows:

1 (N) The TC 71 is in Enter mode and is not in Local mode.

2 (N) The Entry Complete key has been depressed. The terminal is waiting to be polled.

4 (N) The buffer is printing out and the terminal is not in Local mode.

8 (N) The TC 71 is in Local mode.

9 (N) The printer is out of paper (the out of paper switch is made).

@ (N) The document device is down (if that feature is installed).

The prefix (N) answer results in the Message Waiting light on and the alarm sounding.

Any time there is no transmission from a terminal in Transmit mode for a period of 15 seconds, a time out occurs. The terminal reverts to Standby status and a (C) character is sent to the CPU.

2.2.5 Line Control and Line Codes

The TC 71 utilizes EBCD for both line control and data as standard. Other codes are available upon special quotation.

2.2.6 Control Switches & Indicators

The following switches are standard for the TC 71 and are located on the TC 11:

Local--Depressing the Local Key will place the terminal in Off-Line mode. This means that the keyboard and printer are active and the terminal is not prepared to transmit or receive. The Local switch is only effective if the terminal is not in Transmit or Receive mode. Local is reset by another depression of the Local Key or by depressing the Reset key.

Data Entry--When this key is depressed, the machine will go into Enter mode unless the terminal is in Transmit or Receive modes or the data set is not ready (if the Dial feature is installed, data set ready is not required for the Data Entry Key to be active). In this mode, the keyboard, printer and buffer are active and the machine is ready to operate over the communication line when put into Transmit mode (if it is not in local mode).

Entry Complete--This key is used by the operator to initiate the transmission of data from the buffer to the line. Its depression results in the sending of a Start Of Message character (D) and in the terminal shifting to transmit mode. The key is only active if the TC 71 has status and is not in Receive mode. Status is defined as the terminal being in a condition to transmit or receive. This means that paper is in the printer and the data set is able to communicate.

Reset--The Reset Key is provided as the means by which error conditions are reset and a general machine reset is performed. If an error condition is indicated by the Error Light, depressing the Reset Key results only in resetting the error condition and the Error Light. If the Error indicator is not on, key depression causes a general machine reset.

Index--This key is actually an extension of the keyboard and causes an Index character to be generated from the keyboard logic.

Header--The operator may protect a portion of the buffer from being written over in Receive mode or easily being changed when in Enter mode by depressing this key. The result is to store the present address position so that when the TC 71 goes into Enter or Receive modes, the address register is preset to that address instead of to zero. Any portion (always starting at zero) up to the full buffer size may be so protected. The header protection is reset by depressing the key again. The key is only active in Enter or Local mode.

Print Buffer--This key, which is active only in Enter or Local mode, will cause the buffer contents to be printed from the first position to the present address position, unless the Line Print Key is depressed before and while the Print Buffer Key is depressed. The present address position becomes the message end unless the Line Print Key is depressed, as described above. If the Line Print Key is used with the Print Buffer Key as described, printout will occur from the present buffer position until an End condition is sensed. The End condition will be a previously caused message end or the buffer end. The print out may be stopped at any time by depressing the Print Buffer Key again. The position at which the printing stops will effectively become the new end of the message.

Line Return--The Line Return Key is used to back the buffer up to the first character of the present line. The key is only active in Enter or Local mode.

AR Reset--This key is used to restore the address register to the first buffer position. The key is operative only in Enter or Local mode. It also results in the present buffer position becoming the message end.

*NOTE: If the AR Reset Key is depressed after a header has been selected, the address register will be set to the next buffer position after the last header position. Aside from deselecting the header, the operator can work inside the header area only by backspacing or line returning into it or depressing the Print Buffer Key a second time while the header area is being printed.

Line Print--This key is active in Enter or Local mode only after the AR Reset Key is activated. It becomes inactive again when any other terminal or operator action takes place or the buffer position where the AR Reset Key was depressed is reached. The key will cause the buffer to print out to and perform the next carrier return stored in the buffer. Depressing the Line Print Key will also inhibit (and reset) the 15-second Enter mode timeout.

The following switches are located on the TC 71 but are installed only when the associated feature is installed on the machine:

Dial Disconnect--This key is installed when the terminal is to be connected to the dialed network and thus has the Dial Feature installed. The key permits the terminal to be disconnected from the line, provided the terminal is not in Transmit mode.

Interrupt--The interrupt feature allows the operator to indicate to the computer that the message the computer is sending is to be terminated. The key is only operative if the TC 71 is in Receive status. Interrupt is only installed for full-duplex, terminal to computer applications.

Forms Feed--Depressing this key will cause a forms feed to occur if the forms feed select switches are not set at zero.

The following switches are located under the TC 11:

Light Test--This is a toggle switch which when set to the "on" position will test all indicator bulbs except the split platen indicator by turning them on.

Master/Diagnostic--This toggle switch is used to indicate master on machines that have the Station Control feature installed. When in the "on" position, the switch designates the terminal as the master for a given group of terminals. There may be only one master per group. If the Station Control feature is not installed (i.e. the terminal is point to point), the switch is used to activate an internal machine diagnostic. The diagnostic is active when the switch is in the "off" position.

Transmit Control--This toggle is present when the TC 71 has the Transmit Control Feature installed. When in the "on" position, the feature is activated.

The following switches are located on the TC 71 Printer:

Power On/Off--This switch controls all terminal power. When power is turned on, the terminal will normally go to Standby mode. It will be prevented from doing this if an interlock condition exists such as Out Of Paper.

Out of Paper--When the Out Of Paper contact makes, the terminal drops status and leaves the mode it is in (except Local). Operation cannot be resumed until paper is fed into the printer.

Tab Clear/Set--This switch is used by the operator when setting tabs or clearing tab stops.

Set-Up--The Set-up Switch performs the same function as the Out of Paper switch. It is a toggle switch and

is used to insure that printing will not take place while the operator is inserting or adjusting paper, etc.

Forms Feed Number Select--This is a set of three rotary digit switches which are used to set the number of lines per form. The switches are present only when the Forms Feed Feature is installed. Setting the switches to all zeroes is equivalent to disabling the feature.

Document Device Down--This switch is present when the Document Device Feature is installed. When the device is down, the terminal is inhibited from going into Receive mode.

INDICATORS--The following indicators are located on the TC 11:

Local--This indicator is lit whenever the terminal is placed in Local mode.

Request--The Request Indicator will turn on when the operator presses the Entry Complete Key, provided conditions are such that the terminal is ready to go into Transmit mode. The indicator goes off when the TC 71 goes into Transmit mode.

Enter--The Enter Indicator denotes that the terminal is in Enter mode and that the data entered by the operator will be stored in the buffer. The light is activated by the Data Entry Key. The light will blink when the operator is entering data within 8 of 15 characters of the end of the buffer (8 for buffer sizes less than 511).

Receive--The TC 71 Receive Light indicates that the terminal is in Receive mode. The light will stay on solid while data is being received. If Record Checking is installed, the light blinks when the LRC answerback is transmitted.

Transmit--The Transmit Indicator signifies that the terminal is in Transmit mode. It will be on solid during this mode. If Record Checking is installed, the light will blink while the TC 71 is awaiting the reply to the EOB, LRC characters that it sent. If Station or Transmit Control is installed, the light will blink whenever a poll or address answer is sent to the CPU.

Standby--This indicator will normally be on if the TC 71 has status and the data set has detected the presence of carrier. In addition, if the Station Control feature is installed, the light goes off when the terminal goes into Enter mode. If the Dial Feature is installed, a line connection is not necessary for the light to be on (i.e., no carrier).

Header --The Header Indicator is on when Header Protect has been activated by use of the Header Key.

Message Waiting--The Message Waiting Light will be illuminated whenever the TC 71 is unable to go into Receive mode and has received a line control sequence which would normally put it in that mode. The light goes off when the condition which caused the light to turn on is eliminated.

Error--The Error Indicator will be lit whenever an error condition is detected. Detectable error conditions are:

- * Internal keyboard error.
- * Operator attempt to store more characters than the buffer can hold.
- * Buffer or printer overflow.
- * Receive parity error.
- * Negative reply or transmission to an EOB,LRC sequence when the record checking feature is installed.
- * (C) reply to an EOB,LRC sequence when the record checking feature is installed.
- * Operator attempt to backspace past the first buffer position.

Line Ready--The light is illuminated when the terminal detects presence of carrier on the line. If the Dial Feature is installed, the terminal must also be in Standby mode for the light to be on.

Split Platen--This light will be on if the split platen feature is installed and the platen has been split.

2.2.7 Terminal Operation--Basic

Enter--A machine will be in Enter mode when the Data Entry Key has been depressed and the machine is not in Transmit or Receive mode, paper is in the printer, and the data set is able to communicate.

Each time the terminal goes into Enter mode, the buffer returns to the first position. When in Enter mode, the operator will be able to type into the buffer, print back and edit the buffer contents and set or reset the header. Edit operations are performed as follows:

1. Perform a change in the present line: (a) The operator may use the Backspace Key which will decrement the address register (the backspace character is only stored in the buffer when it is received from the line). (b) The operator may depress the Line Return Key. This will back the buffer up to the first character of the present line. She may then retype the entire line.
2. Perform a change on some previous line: (a) The operator may depress the AR Reset Key which will cause the present buffer address to be remembered as the message ending and the buffer to back up to the first position. Now use the Line Print Key and successively print out each line until the desired line to be changed is printed. Use Backspace or the Line Return Key as described above.

If the change consisted of more than correcting one character, the rest of the message should be retyped. If not, the Line Print Key should be depressed (and held), and then the Print buffer key depressed. This will cause the rest of the message to print out up to the previously denoted end and thus the buffer to move to the message end. (b) The operator may depress the Print Buffer Key. This will cause the present buffer address to be remembered as the message ending, and the buffer contents starting with the first position to be printed out. When the line to be changed is printed, depress Print Buffer again which will cause the printing to stop. Proceed as explained above.

3. Retrieve a buffered message which was previously stored (i.e., when the TC 71 was in receive mode or from previous enter mode). Depress Print Buffer and Line Print at the same time (as described above in 2). This will cause the entire message to print out up to the previous denoted end and thus the buffer to move to that position. The operator may now use the message as if she had just entered it.

4. Start over again while still in enter mode. Depress the AR Reset Key.

Enter mode is subject to a 15 second timeout. If the terminal is not in Local and a buffer operation does not take place for 15 seconds, a timeout will occur and the terminal will leave Enter. The timeout may be reset by depressing the Line Print key. It may also be inhibited by means of a jumper on the Terminal Control logic card.

The keyboard is locked when the TC 71 (IBM 2740-2 compatible) is not in Enter or Local modes or when a printout takes place. When the machine is in Enter, it cannot receive a message. If a D is sent to the TC 71 during this mode, the Message Waiting Light will be turned on and the alarm will sound.

The terminal may be in Local mode when it is put in Enter mode. It may also be put in Local mode while in Enter mode. While in Local, the Entry Complete Key effects are inhibited.

If the operator tries to enter more characters into the buffer than it can hold, or if a keyboard hardware error occurs, the Error Light will turn on and the keyboard will lock. The last character keyed will print but will not have been entered into the buffer.

2.2.8 Terminal Operation with Features

Record Checking Feature

When the Record Checking Feature is installed, an additional check called a longitudinal redundancy check (LRC) is performed on transmitted or received data.

The message is ended with an End of Block (EOB= (B)) character followed by an LRC character. The unit receiving the EOB,LRC does a data check and decides if the received message was transmitted without error. It will then send an answerback in the form of a character, to the transmitting unit. The answerback character can be any of the following:

- (Y) Yes--the message was good.
- (N) No--error in the message.
- (C) Terminal goes out of Transmit mode.
- (D) Terminal goes out of Transmit mode and into Receive mode. This is generally used only if the message was good. It is a convenient way of operating in a conversational mode and it eliminates line contention problems, i.e., problems that arise when both the terminal and the processor attempt to transmit a message at the same time.

The TC 71 cannot transmit the (D) reply; a processor can transmit all four. When the terminal is transmitting, the EOB, LRC is initiated automatically after the last character of the buffered message. When receiving data, the terminal will perform the check and transmit the answerback only if it receives the EOB,LRC. If it receives a (C) instead, it will go out of Receive.

When the TC 71 sends a (N) or (C) answerback to a received message, the error light will turn on. The light is automatically turned off when the next message is received or when the operator depresses the reset key.

A (C) answerback is transmitted when a buffer or printer overflow condition occurs during a Receive operation and the terminal has the Prefix Station Control Feature installed. An overflow condition is defined as the inability to store or print a character before the next character is received.

When the TC 71 receives a (N) reply to an EOB,LRC that it transmitted, the Error Light will turn on. The message will automatically be retransmitted and the Error Light turned off when the next EOB,LRC is sent. If the answer is a (Y), the terminal will automatically transmit a (C) and go out of Transmit mode.

If the terminal receives a (C) reply to an EOB,LRC, the Error Light will be turned on, the alarm will sound, and the terminal will go into Standby mode. If the operator depresses the Entry Complete before any other action occurs, the terminal will go to Transmit mode, retransmit the message, and the Error Light will be reset. Note: An exception to the terminal's response to the (C) reply

occurs if the TC 71 has Station Control without prefix installed. For this case the (C) results in the TC 71 going only into Standby Mode.

If no transmission occurs from the terminal for a period of 15 seconds while in Transmit mode (hardware failure), the terminal times out and reverts to Standby status. In addition, if the terminal fails to receive a carrier signal due to a faulty line (on data sets where the carrier detect level is present), the terminal will time out after 15 seconds and revert to a non-status condition.

If the terminal is polled while it is in Enter mode or when it does not have status, (See Control Switches Section), it will send a (D) character, sound the alarm and start the 15 second timeout. If status is regained and Entry Complete depressed within the 15 seconds, the terminal will transmit the stored message.

Receive mode and receive operation are not affected by this feature.

Station Control Feature

The TC 71 may be featured so that it will reply with a two-character response when addressed by the processor (prefix station control feature). The first character (hereafter referred to as the Prefix Character) is used to denote a specific definition of terminal status or terminal error conditions. The second character is a (Y) if the terminal is ready to receive data or a (N) if the terminal is not ready to receive.

There are four prefix characters used in conjunction with the (Y) answer. They are as follows:

(S)(Y) I/O failure on last message received.

(U)(Y) Line VRC error during last message received.

Space (Y) No error stored.

/(Y) Electronic hardware failure on last message received.

There are six prefix characters used in conjunction with the (N) answer. They are as follows:

1 (N) The TC 71 is in Enter mode and is not in Local mode.

2 (N) The Entry Complete Key has been depressed. The terminal is waiting to be polled.

4 (N) The buffer is printing out and the terminal is not in Local mode.

8 (N) The TC 71 is in Local mode.

⑨ N The printer is out of paper (the out of paper switch is made).

@ N The document device is down (if that feature is installed).

The prefix N answer results in the Message Waiting Light on and the alarm sounding.

Any time there is no transmission from a terminal in Transmit mode for a period of 15 seconds, a time-out occurs. The terminal reverts to Standby status and a C character is sent to the CPU.

Buffer Receive Feature

When this feature is installed, the TC 71 will not start printing out a received message until after the terminal leaves Receive mode. Idle characters are not required to be transmitted after function codes (CR, Tab, Index) since the message is buffered. This reduces the number of transmitted characters.

The length of the transmission is not to exceed the buffer capacity. If it does and Station Control and Record Checking features are installed, a C is the answerback sent to the processor and no printout occurs. If Record Checking is not installed, the portion of the message exceeding the buffer will be lost. In both cases, the Error Light is turned on.

With this feature and Record Checking installed, only single blocks of data should be transmitted by the processor. If multiple blocks are transmitted, only the last block preceding the C code will be printed if it is correct.

Receive Print Overlap

This feature allows buffer printout to start while the terminal is still receiving data into the buffer. Thus on a relatively low speed line, the advantages of the Buffer Receive feature may be had without the disadvantage that the receive message will take as much as twice as long to store and then print.

Record Checking is not recommended with this feature since printout begins (and may end) before the check is performed. If it is installed, the message should start with a CR so that the printer will not start printing a retransmission in the middle of a line.

Buffer Expansion

The Buffer Expansion feature is available in the following character sizes: 121 thru 512, 1024, 2048, 4096. The

last position of the buffer is not available for data use and thus actual usable sizes are 120, 255, etc.

2.2.9 Timing Considerations (See 2.1.9)

Timing calculations for the TC 71 (IBM 2740-2 compatible) are similar to TC 71 (IBM 2740-1 compatible) except for character time reduction. To determine character time divide baud rate by 9 for characters per second. Divide resulting cps into 1000 for number of milliseconds per character.

2.3 TC 71 Communication Terminal, (IBM 2741 Compatible)

The TC 71 is designed to be compatible with the IBM 2741 as a keyboard printer terminal combining the TC 71 and TC 11. The TC 71 normally operates in a conversational mode communicating with a computer multiplexer over a Direct or Dialed Point to Point line.

2.3.1 Application Areas

The TC 71 (IBM 2741 compatible) is intended to satisfy system applications that require one terminal-per-line operation. These applications would include commercial time-sharing, and systems where remote terminal to local computer communication is desired.

2.3.2 Communications Facilities and Interface

The TC 71 transmission speed is 134.5 baud maximum (limited by the 15 cps TC 71 printer). The baud rate may be selected from 75 baud up to the maximum.

The terminal may be equipped with an internal, under the cover, data set or with an RS 232 EIA interface.

The internal data sets available are W. E. 103 compatible or W. E. 202 compatible and can operate over a leased, Private, or Switched network.

2.3.3 Line Control Signals

Line control signals on the TC 71 are described under 2.1.4, but since few of the TC 71 (IBM 2740-1) features are available on the TC 71-41 only the (C) and (D) are used.

2.3.4 Line Control & Line Codes

The TC 71 operates internally with the PTTC/BCD and PTTC/EBCD character code. Normal communication from and to the machine is by means of the same code. Provision is made to operate using the correspondence code, but this is on a TCPQ basis only.

2.3.5 Control Switches & Indicators

The following switches are standard for the TC 71 and are located on the TC 11:

Local--Depressing the Local Key will place the terminal in off-line, typewriter status. To return to communication status, the key must be depressed again or the reset switch must be activated.

Attention--This switch is used to terminate a Transmit operation. Depressing the Attention Key will cause the TC 71 to send an End of Transmission character (EOT) and to leave Transmit mode. The Carriage Return Key on the keyboard will cause the same action to occur with the exception that the Carriage Return Character is sent before the EOT.

Reset--The Reset Key enables the operator to perform a machine reset. Except for internal keyboard errors which lock the keyboard, this should not ordinarily be necessary. However, it is convenient in case the machine ever "hangs up."

The following switch is located under the TC 11:

Light Test--This is a toggle switch which when set to the "on" position will test the indicator bulbs by turning them on.

The following switches are standard on the TC 71 and are located on the TC 71 Printer:

Power On/Off--This switch controls all terminal power. When power is turned on, the terminal goes immediately to Transmit status unless it is prevented from doing so by an interlock.

Out of Paper--When the Out-of-Paper contact makes, the terminal drops status, leaves Receive mode or Transmit mode, and the keyboard locks. Operation cannot be resumed until paper is fed into the printer. The switch can be disabled by means of a mechanical stop.

Tab Clear/Set--This switch is used by the operator when setting up tabs.

Set-up--The Set-Up switch performs the same function as the Out-of-Paper switch. It is a toggle switch and is used to insure that printing will not take place while the operator is inserting or adjusting paper, etc.

FEATURE SWITCHES--The following switches are located on the TC 71 when the feature for which they are needed is installed:

Interrupt--The Interrupt Feature allows the operator to indicate to the computer that the message the computer is sending is to be terminated. The key is only operative if the TC 71 is in Receive status. The Interrupt key is located on the TC 11.

Forms Feed--Depressing this key, which is located on the TC 11 will cause a forms feed to occur if the forms feed select switches are not set at zero.

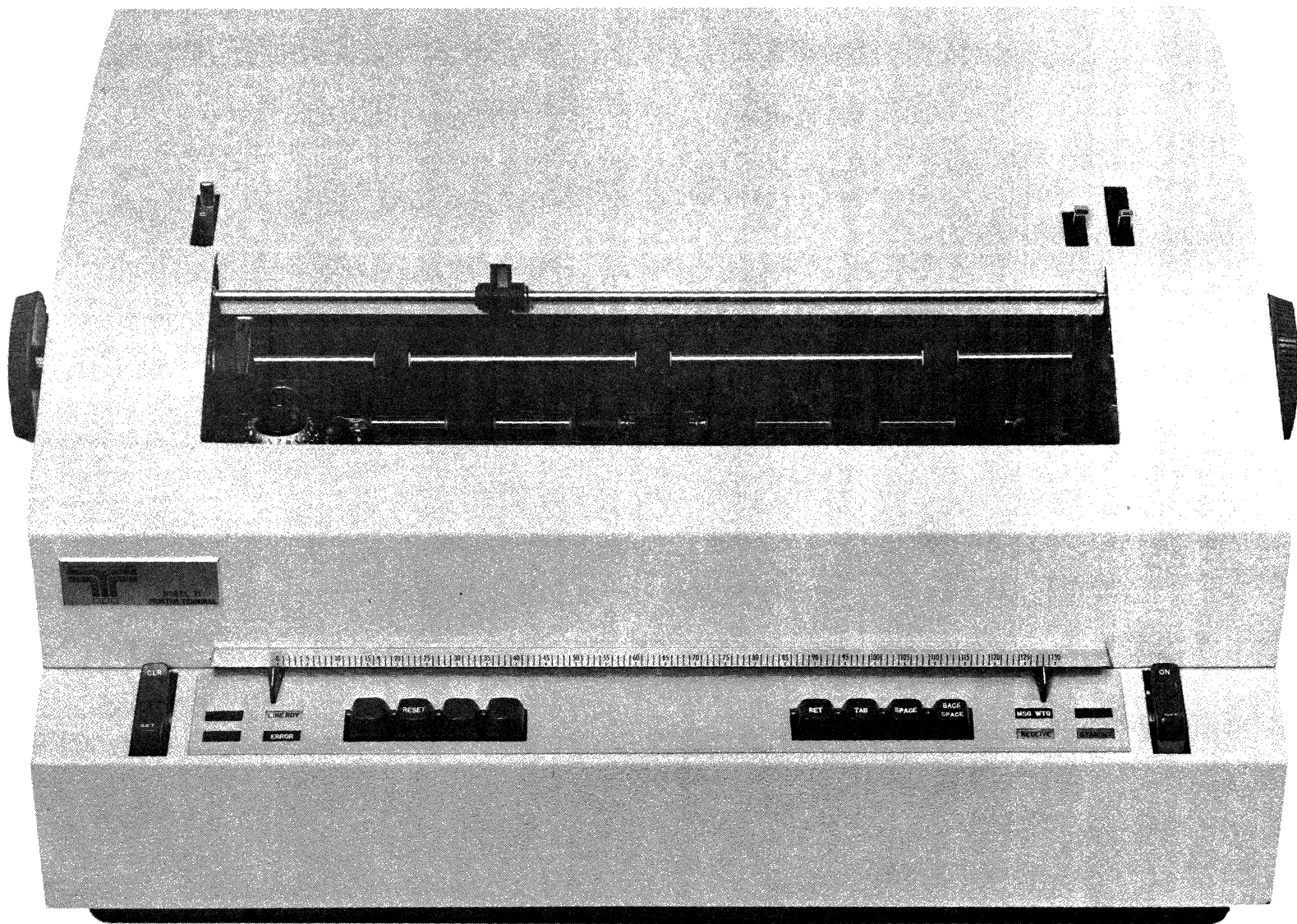


Figure 3:

TC 71 RECEIVE-ONLY TERMINAL/PRINTER

Forms Feed Number Select--This is a set of three rotary digit switches which are used to set the number of lines desired per form. Setting the switches to all zeroes is equivalent to disabling the feature. The switches are located on the TC 71.

INDICATORS--The following indicators are located on the TC 11:

Proceed--This light indicates that the machine is in transmit status and that the operator can proceed to transmit or to end transmission.

Local--This indicator is lit whenever the terminal is placed in Local mode.

2.3.6 Terminal Operation

After power is brought up and the communication line connection is established, the terminal automatically sends a Start of Message character (Ⓓ) and goes to Transmit mode. Operator keyboard entries are now transmitted to the computer. Transmission ends when either the carriage return or the Attention Key is depressed. The depression of either key results in the terminal transmitting an End of Transmission character (Ⓒ), and waiting with the keyboard locked for a reply from the computer. If the computer does not have a message to send, it will transmit a Ⓓ followed by a Ⓒ. The TC 71 goes back to Transmit mode, the keyboard unlocks, and the operator may transmit more data. If the computer does have data to transmit, it will send a D followed by the data. The computer message ends with a Ⓒ and upon receiving this, the TC 71 goes to transmit mode automatically.

If the TC 71 has the Interrupt Feature installed, a computer message to the terminal may be interrupted. This is done when the operator depresses the Interrupt Key, causing the computer to end its message immediately with a Ⓒ. Full-duplex operation is a necessary prerequisite for this feature.

2.3.7 Timing Considerations (See 2.1.9)

2.4 TC 71 Communication Terminal--Receive Only Printer

By omitting the TC 11 Keyboard the TC 71 may be made to function as a Receive Only Printer. Types of operation, communication facilities and interface, line control signals and codes and terminal operation are all the same as described under the TC 71 (IBM 2740 Model 2 compatible) sections of this manual. The various control switches and indicators are described as follows:

Control Switches

The following control switches are housed in the TC 71. The function of each has previously been discussed in CONTROL SWITCHES or the TC 71 (IBM 2740-1 & 2740-2 compatible) section of this manual:

- Reset
- Light Test
- Forms Feed
- Master

- Dial Disconnect

- Forms Feed Number Select
- Set-Up
- Out of Paper

Keyboard Replacement Switches

These switches are normally on the TC 11 keyboard. They are included on the Receive Only Printer so that the operator will be able to adjust margins and set up tabs. The switch operation causes results identical to the results obtained from a keyboard, except that the switches are always active. They should not be used when the terminal is in receive mode. The switches are:

- Carriage Return
- Backspace
- Space
- Tab

Figure 4. Point-to-Point Operation

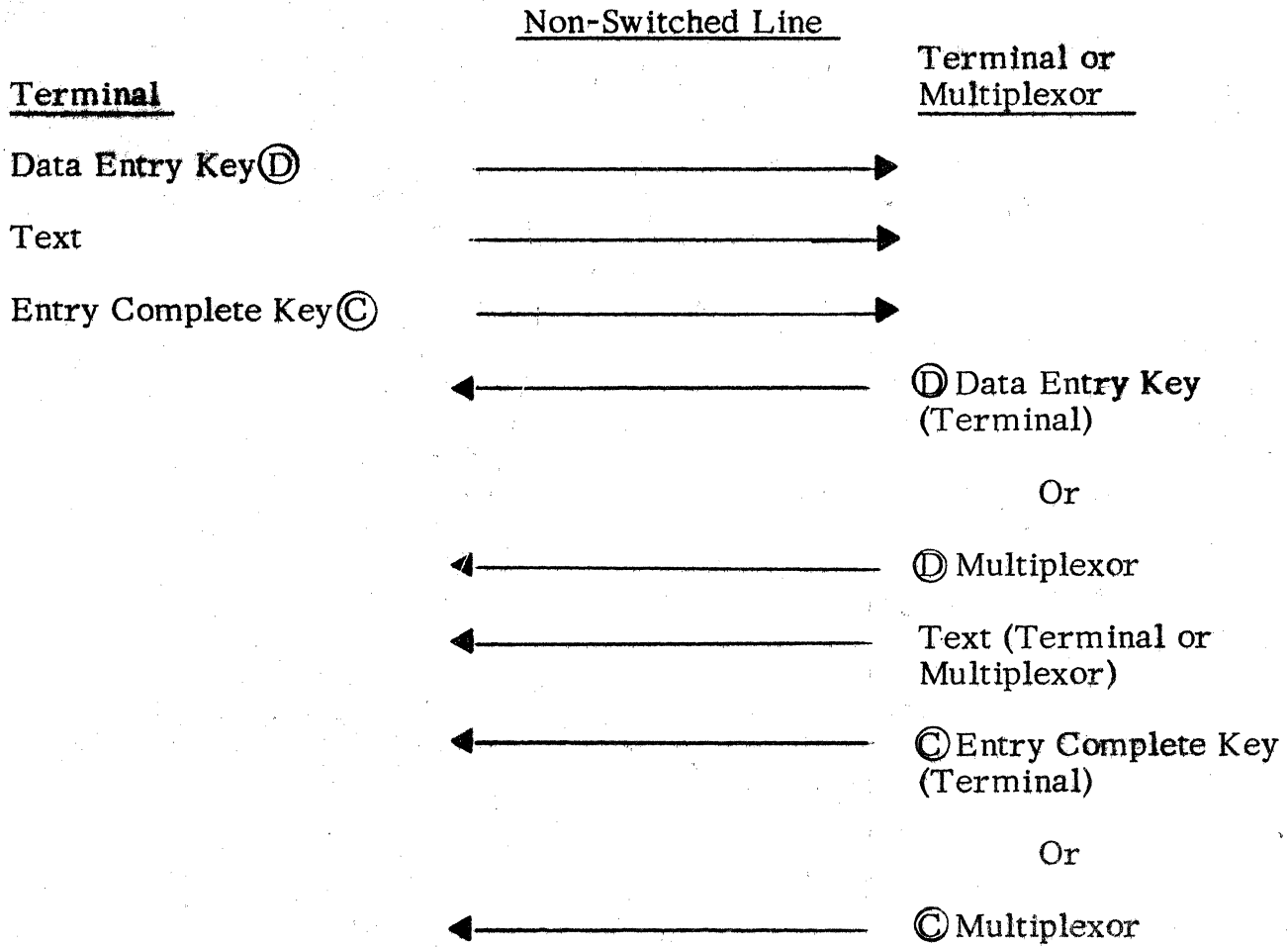


Figure 5. Point-to-Point Operation (With Checking Feature)

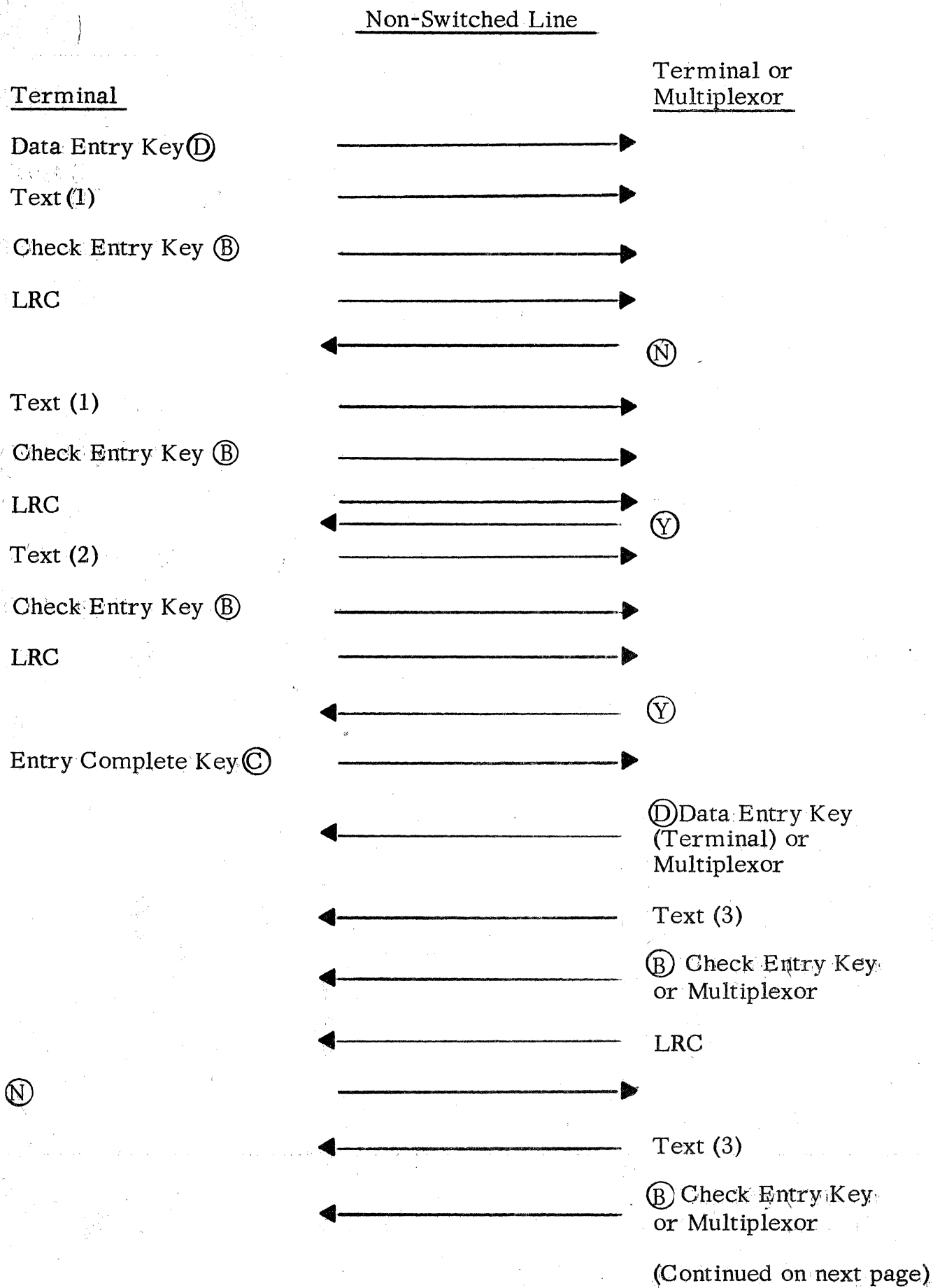


Figure 5 Continued.

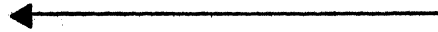
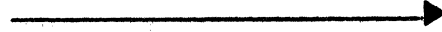
Non-Switched Line

Terminal

Terminal or Multiplexor



LRC



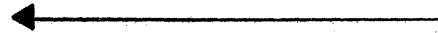
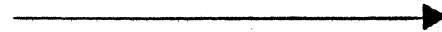
Text (4)



ⓑ Check Entry Key
or Multiplexor



LRC



ⓒ Entry Complete Key
(Terminal) or Multiplexor

Ⓨ

Ⓨ

Figure 6. Broadcast Operation (No Special Features)

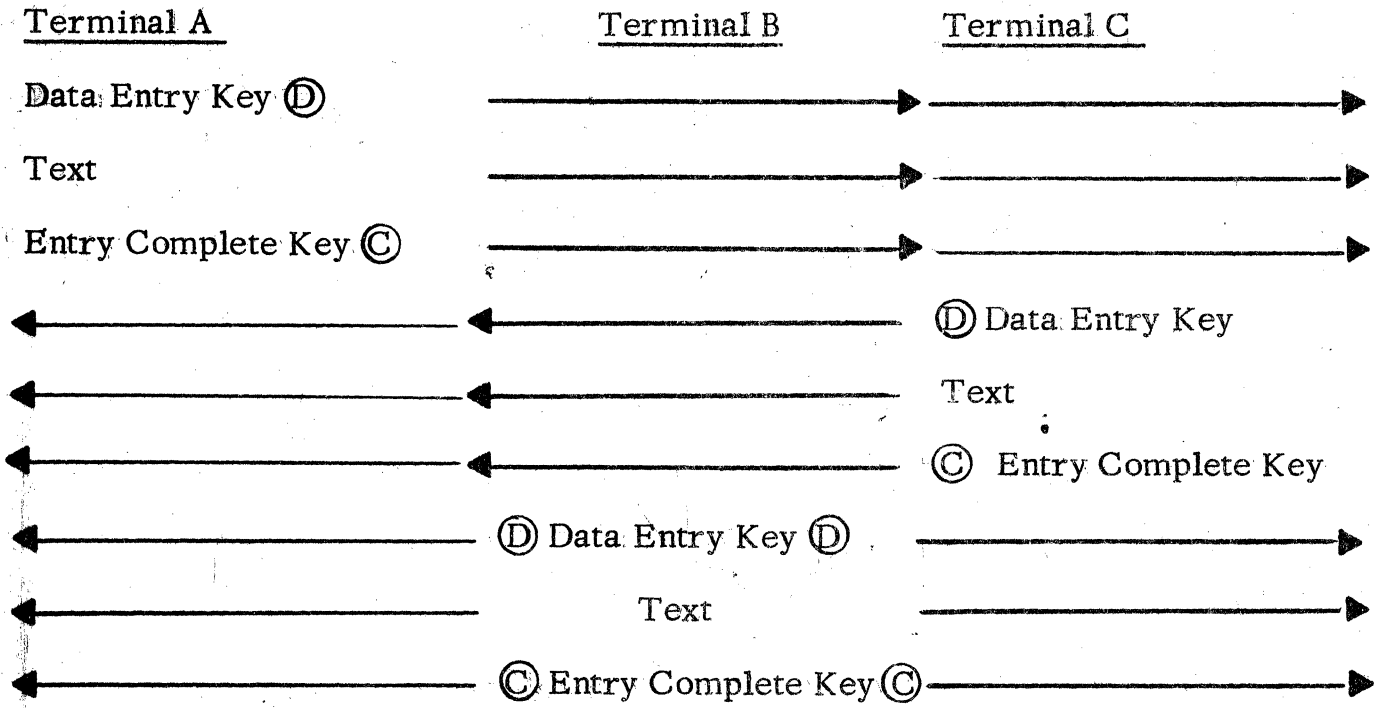


Figure 7. Dial-Up Operation (Special Feature)

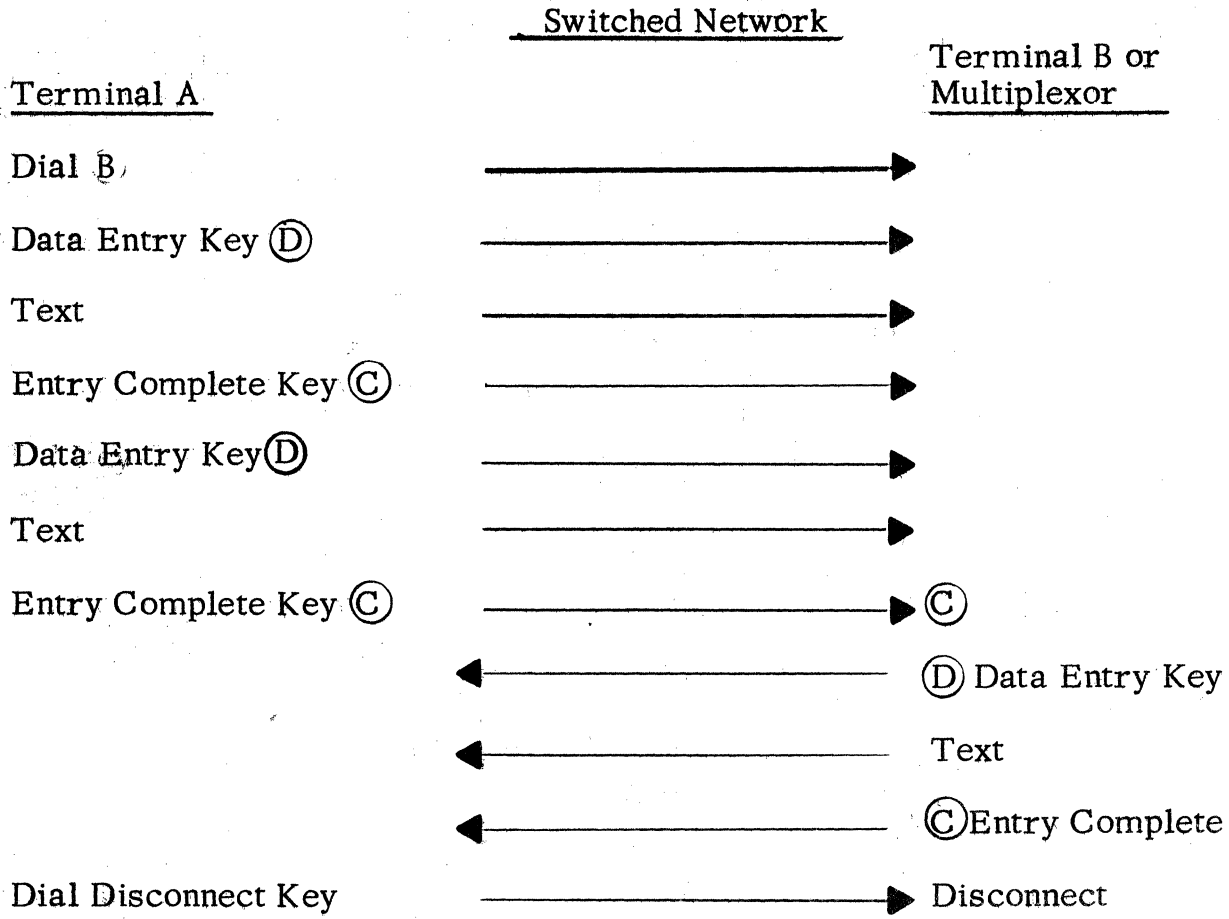


Figure 8. Dial-Up Operation with Checking (Dial-Up Adapter & Checking Special Features)

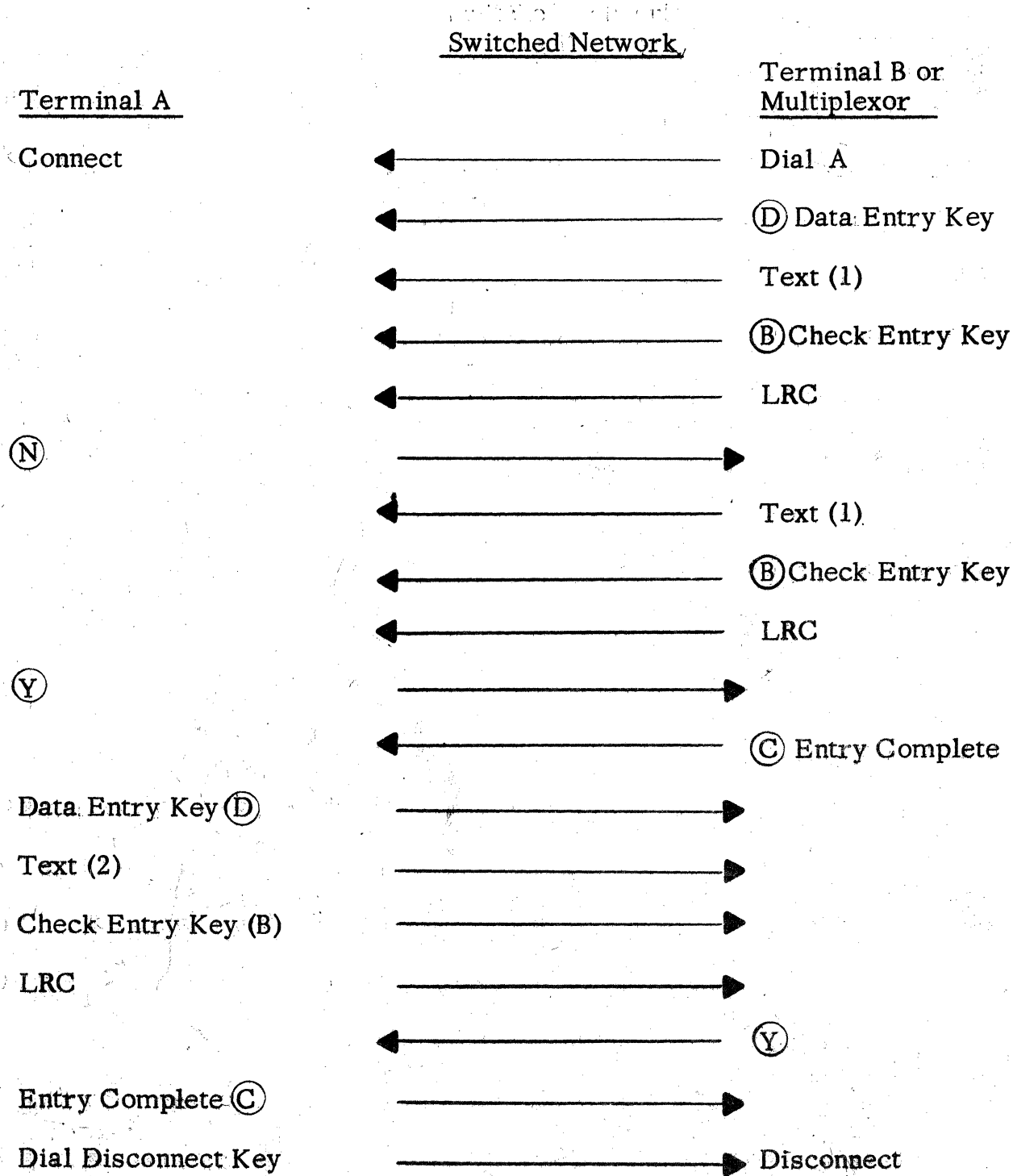


Figure 9: Multiplexor Transmit Control (Without Checking)

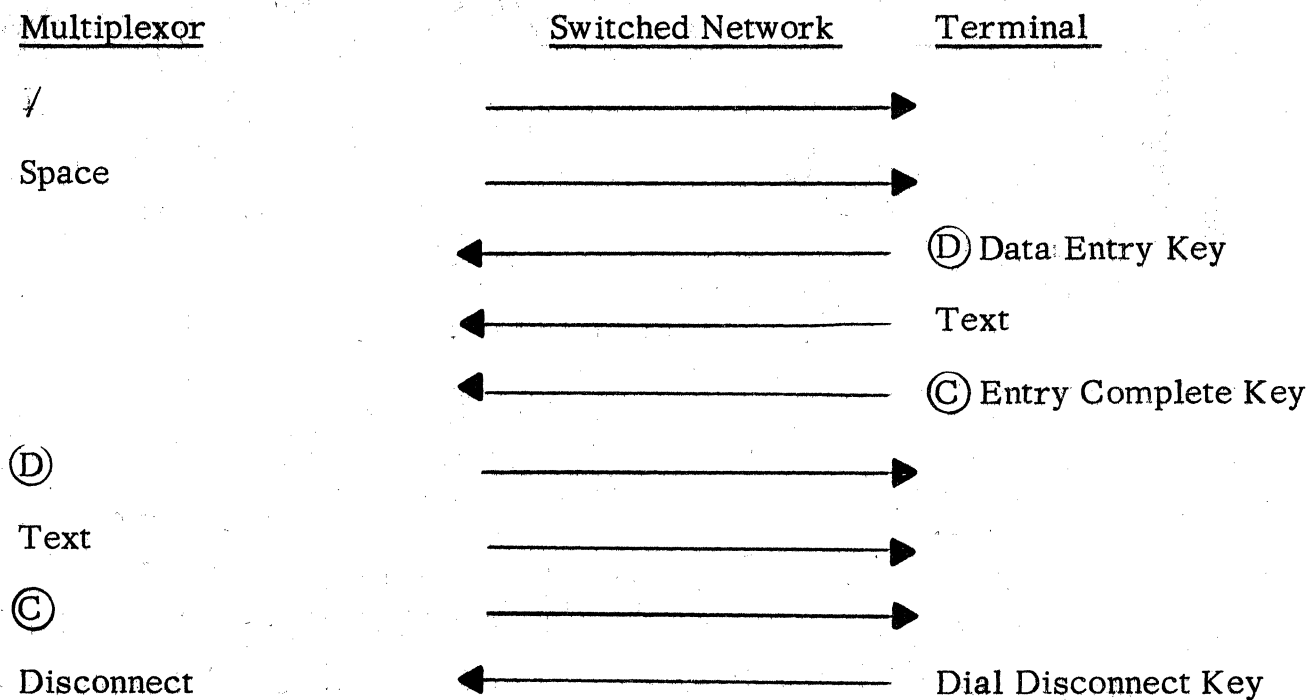


Figure 10. Multiplexor Transmit Control (With Checking Feature)

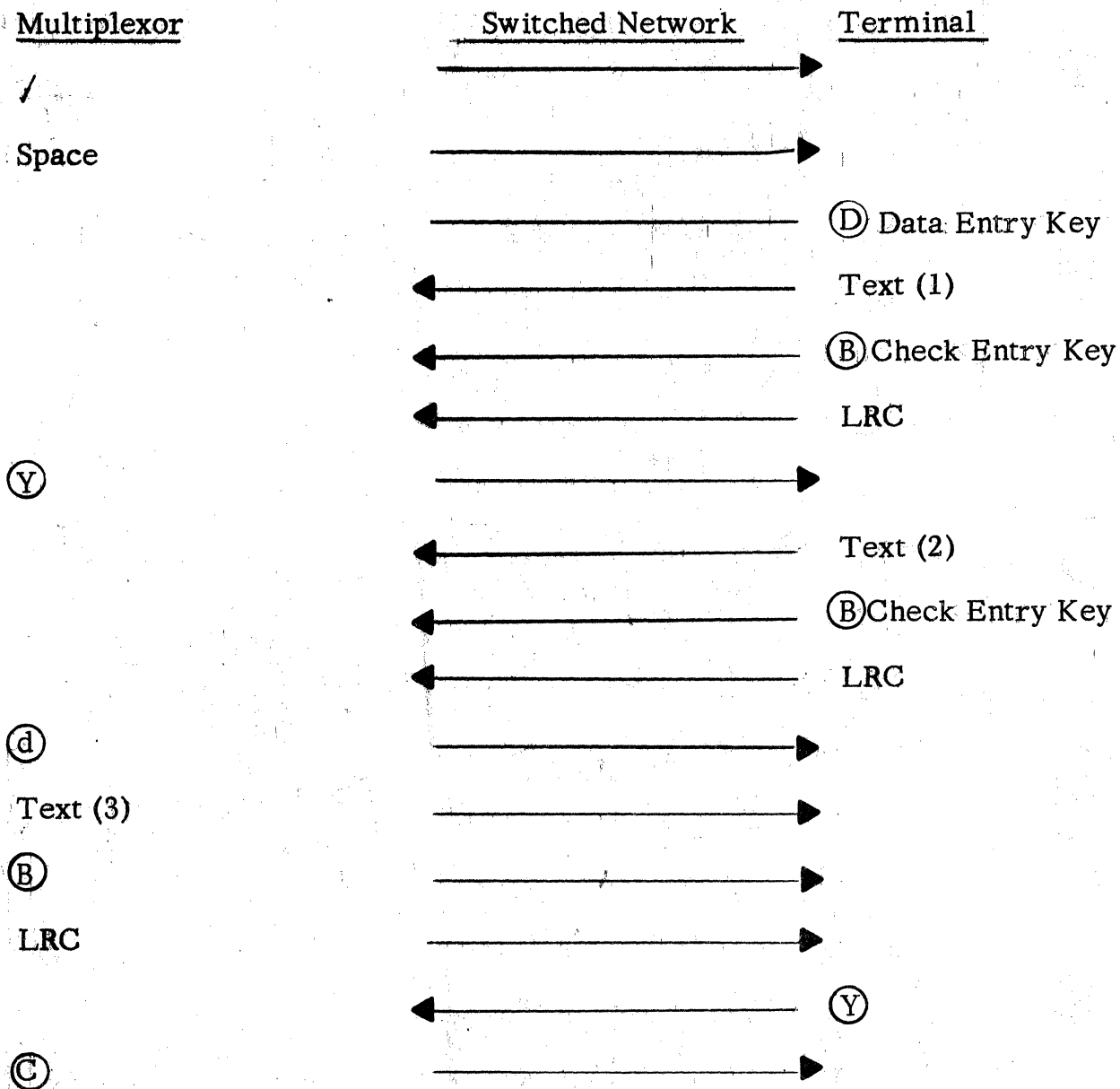


Figure 11. Station Control (Multiplexor Addressing, Without Checking)

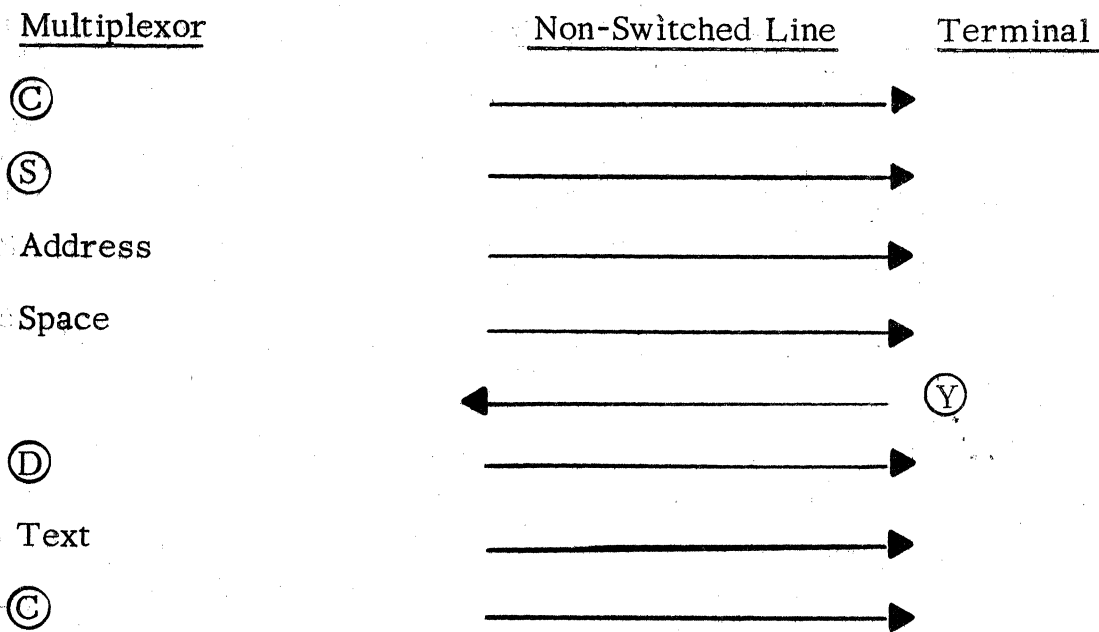


Figure 12. Station Control (Multiplexor Addressing, With Checking Special Feature)

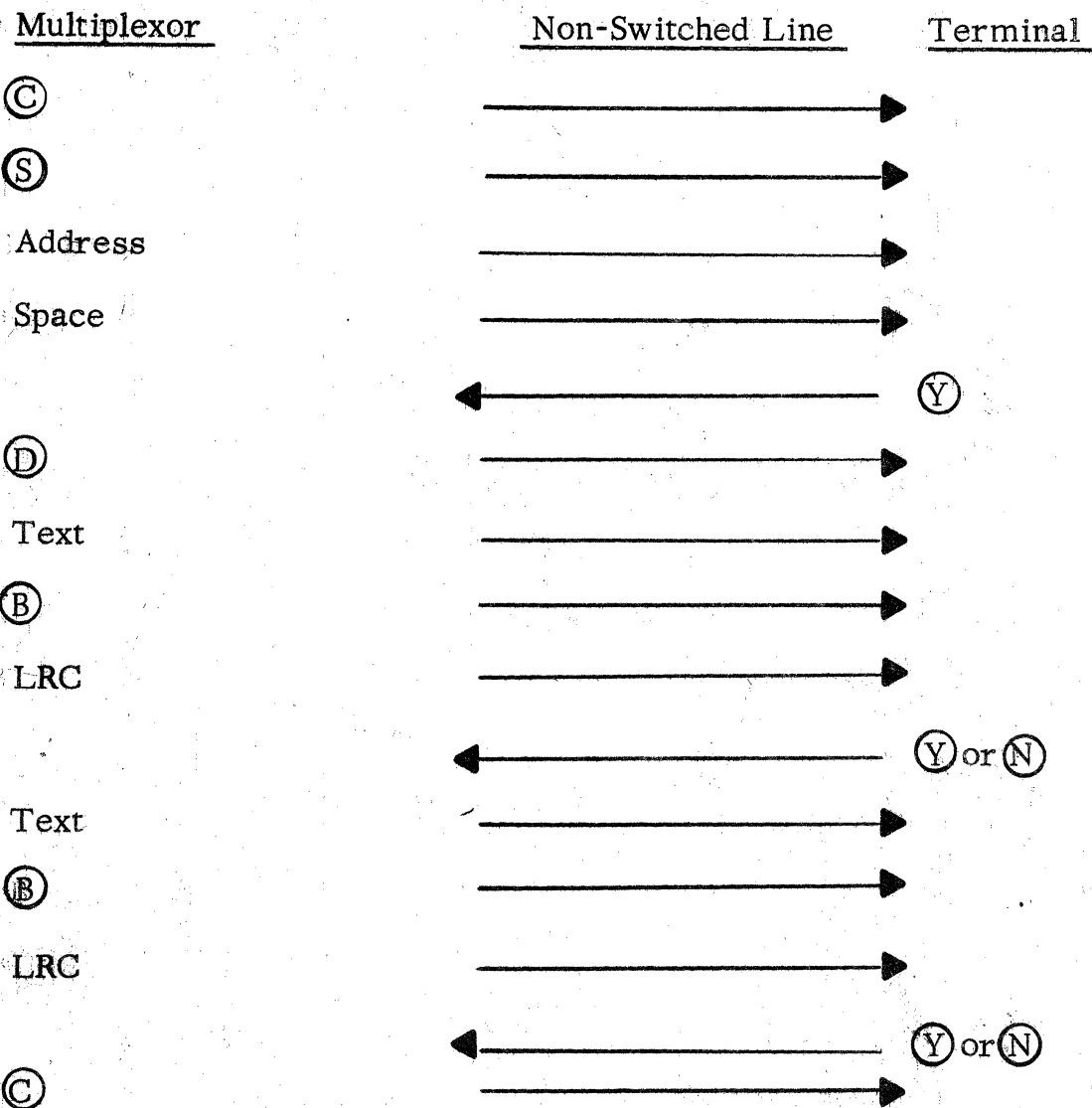


Figure 13. Station Control (Multiplexor Polling, Without Checking)

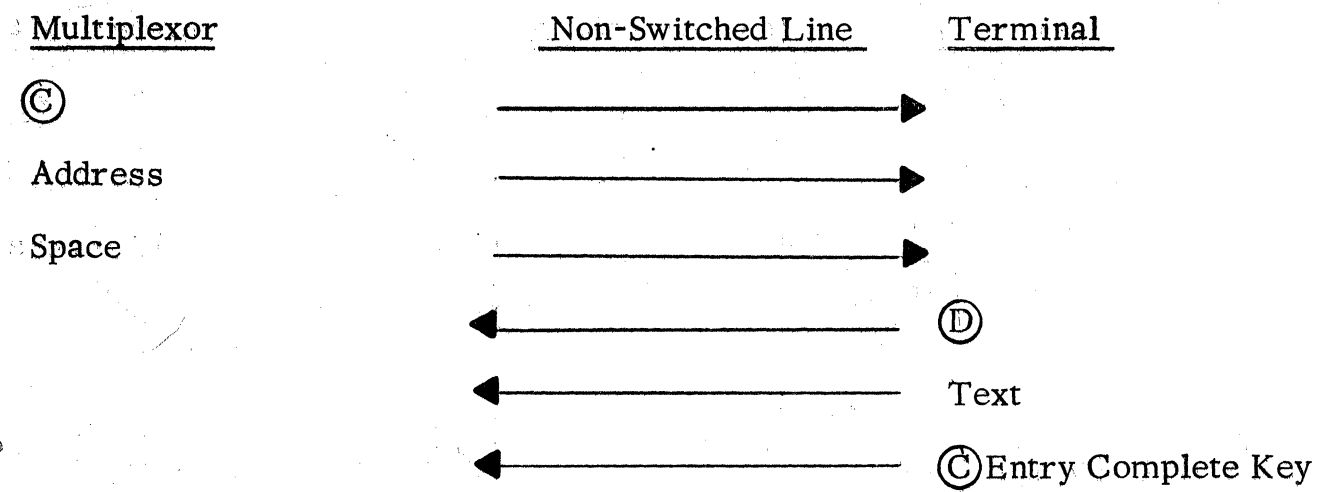


Figure 14. Station Control (Multiplexor Polling, With Checking Special Feature)

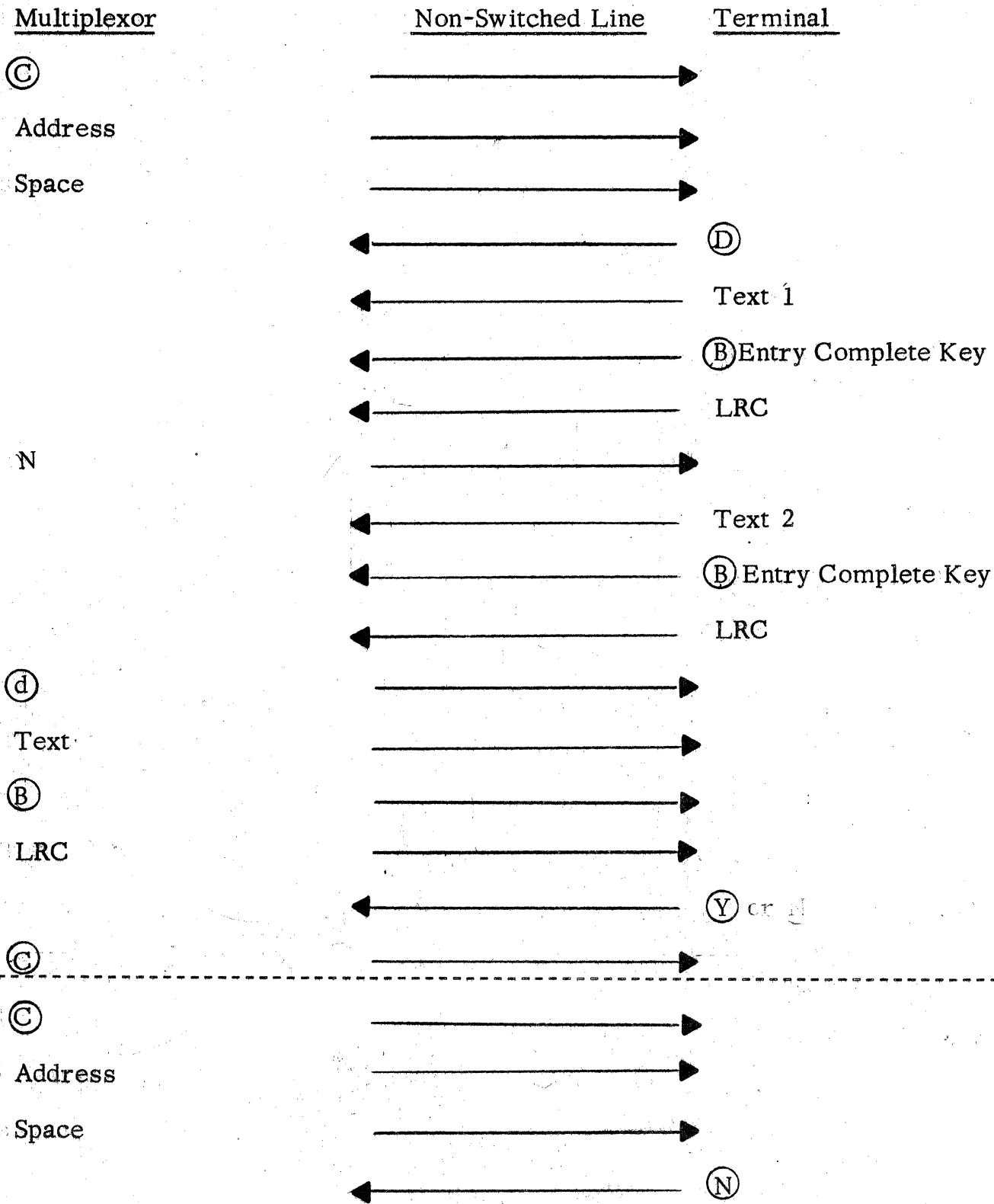


Figure 15. Addressing & Polling Operation
(No Special Features)

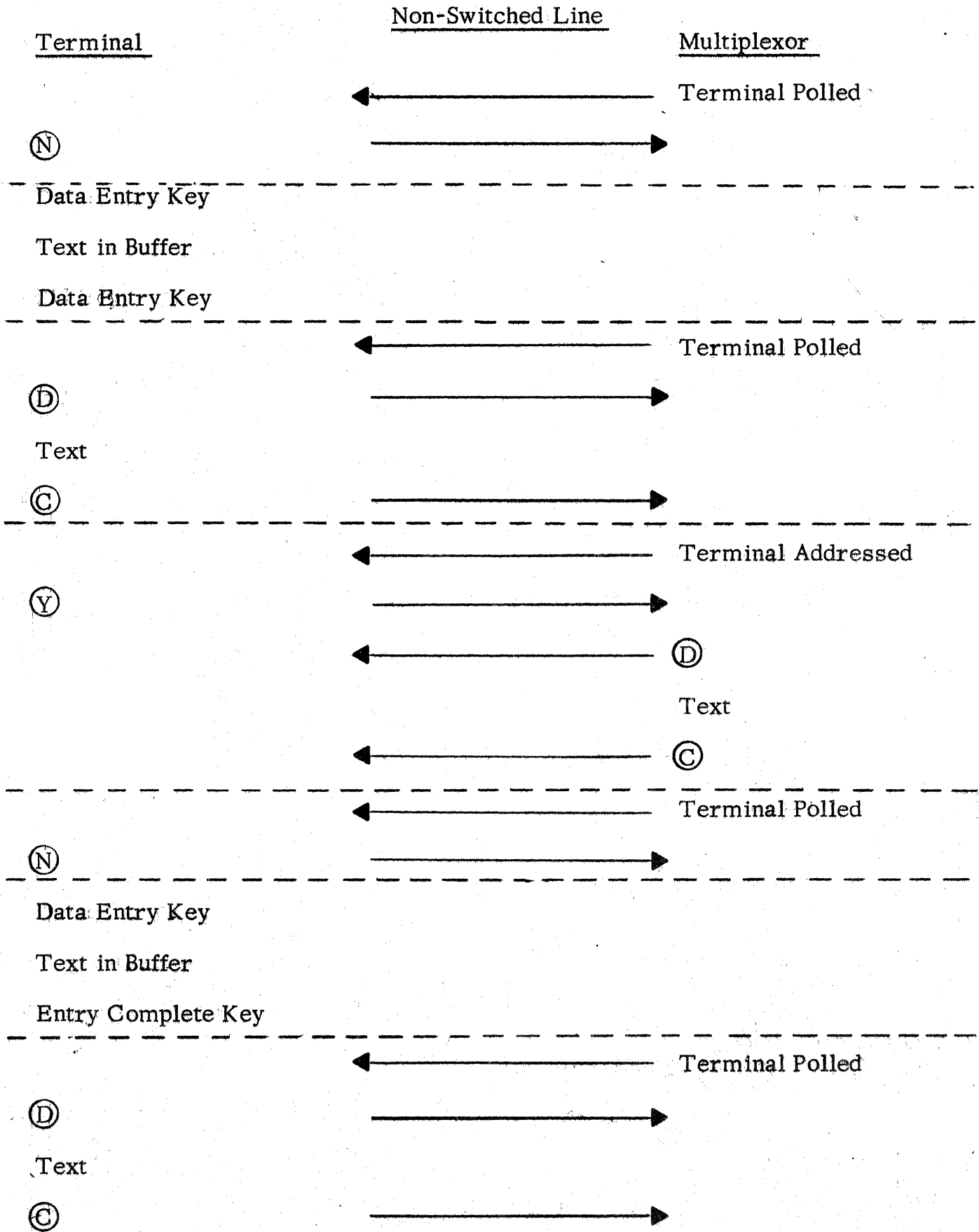


Figure 16. Addressing Operation (With Record Checking)

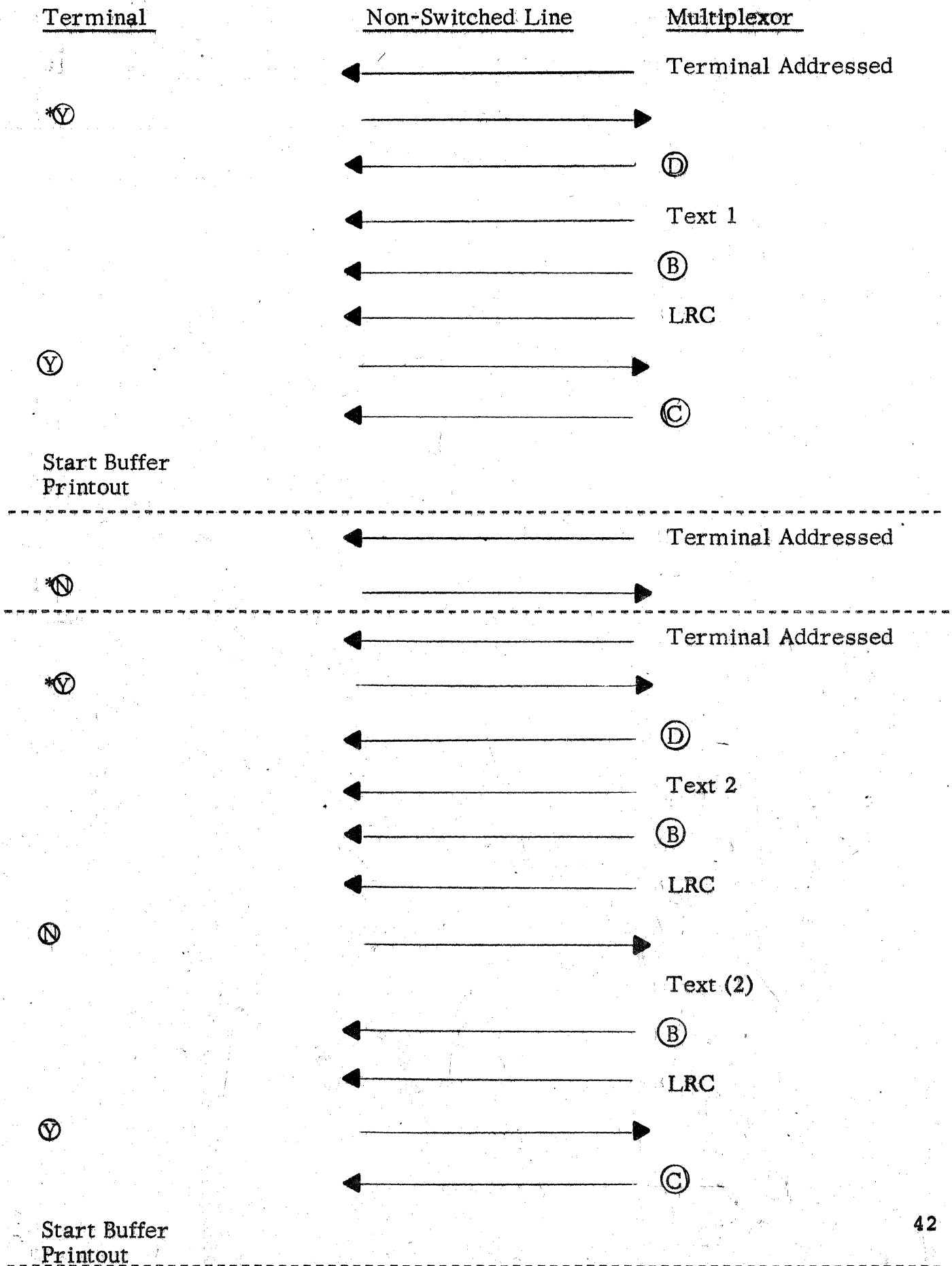
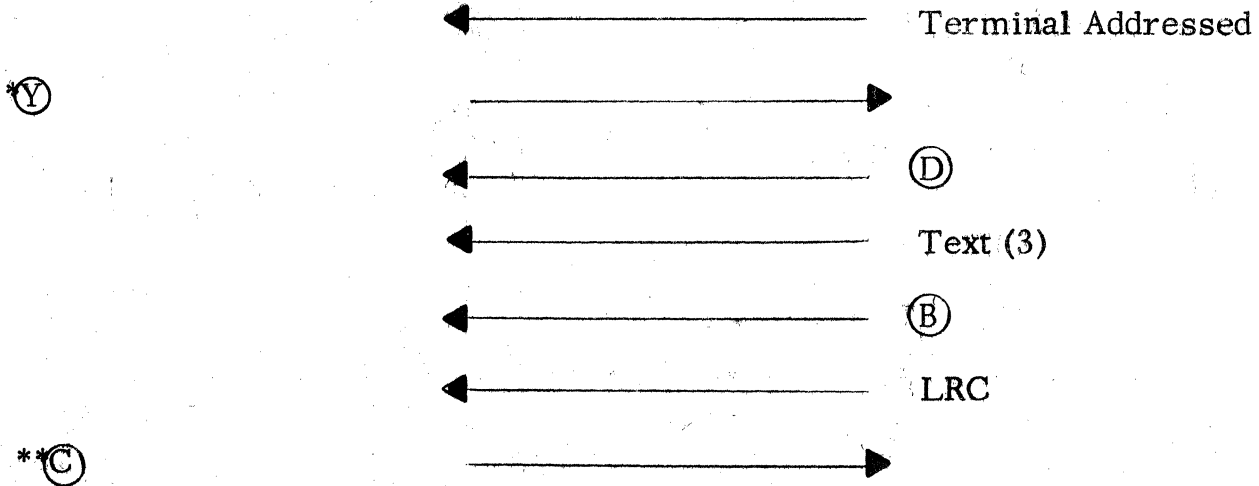


Figure 16 Cont'd.

Terminal

Non-Switched Line

Multiplexor



* Denotes "Sense Character" which defines status or error condition.

**The C is a negative answer back in this case. The contents of the buffer will not be printed.

Figure 17. Polling Operation (With Record Checking)

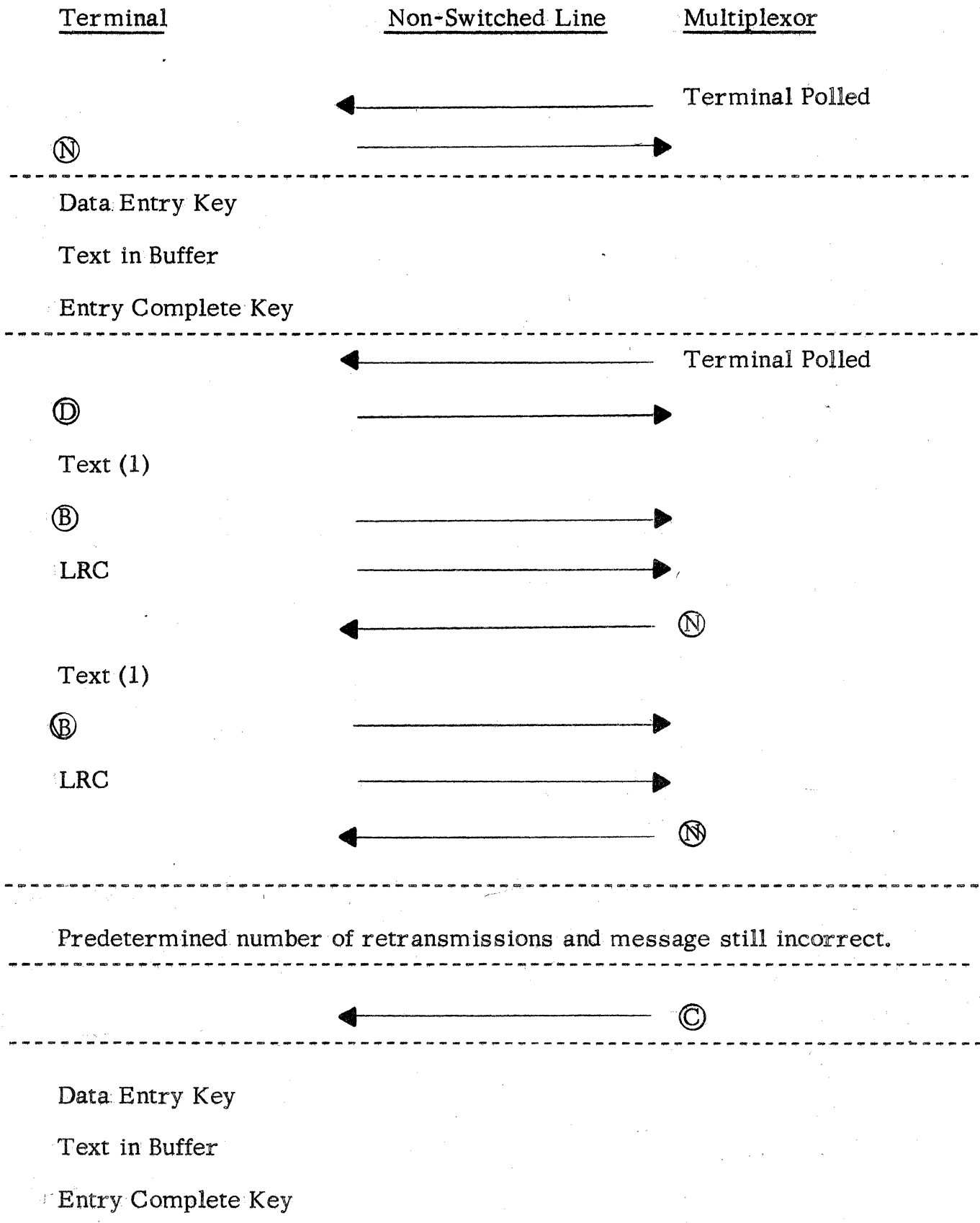
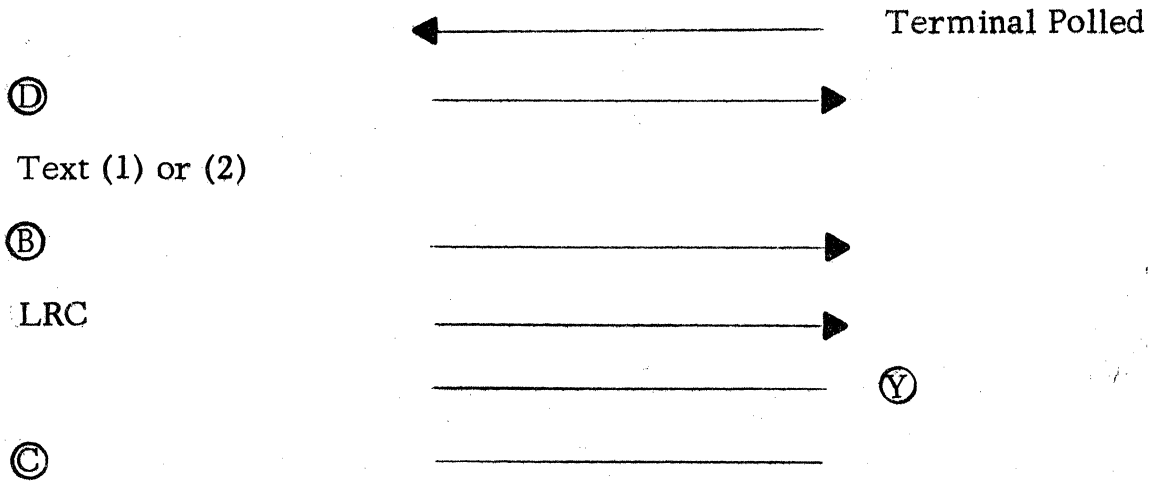


Figure 17 Continued

Terminal

Non-Switched Line

Multiplexor



Data Entry Key

Text in Buffer

Entry Complete

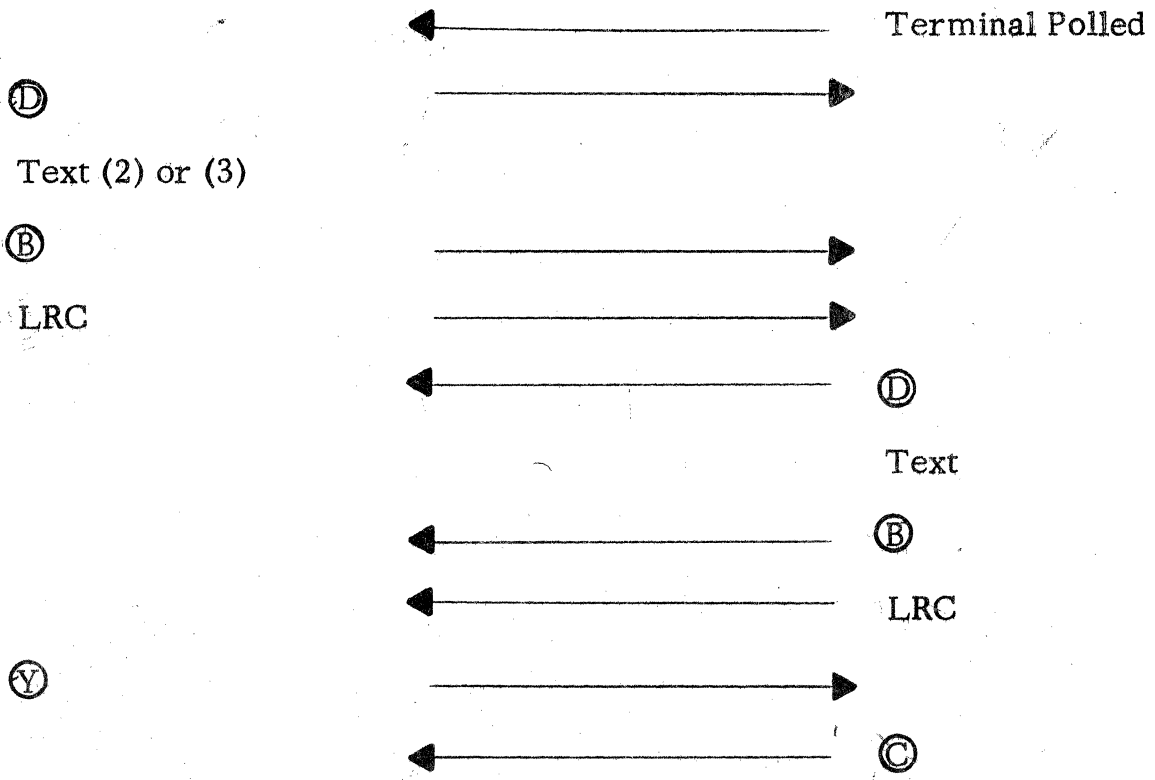
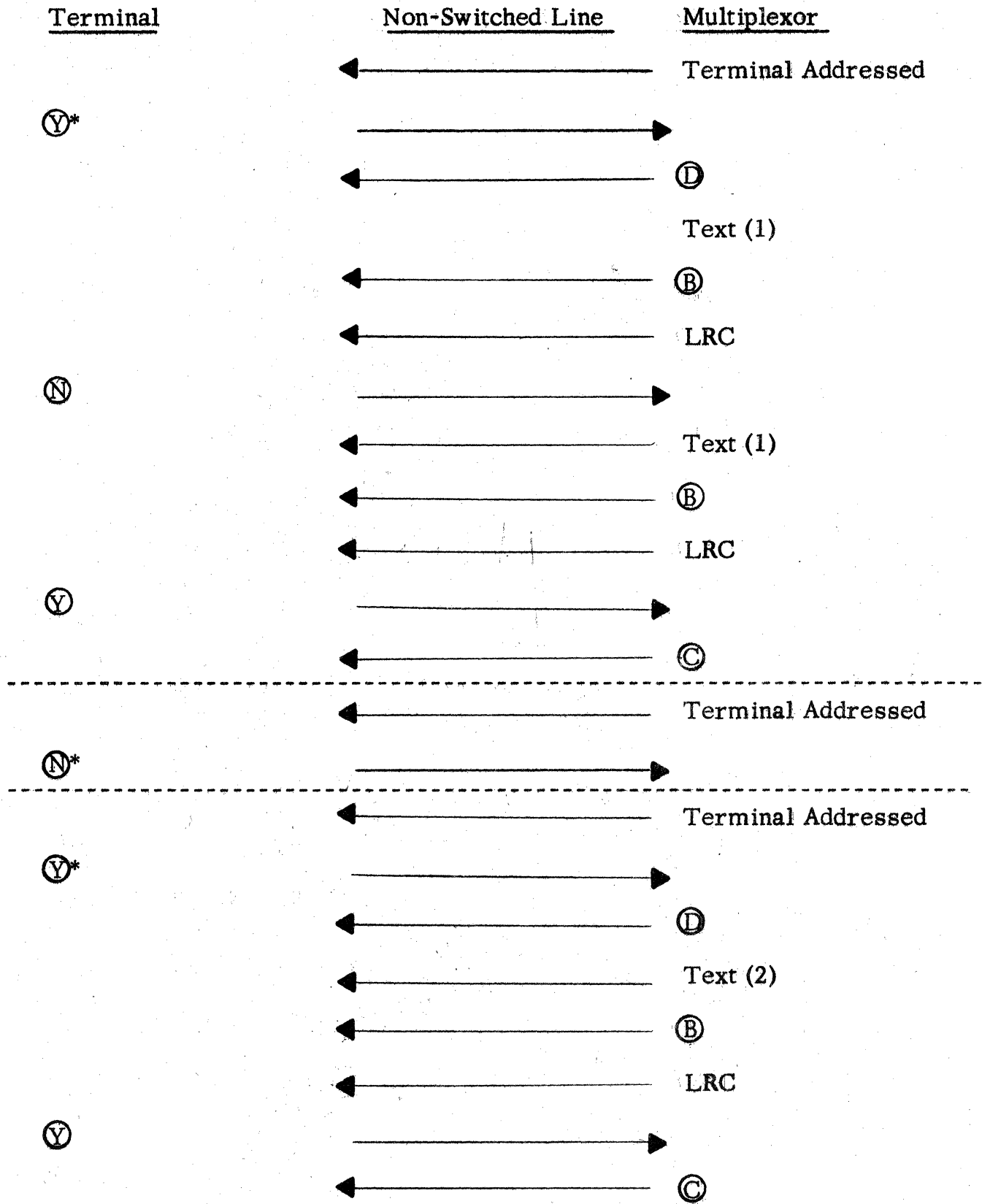
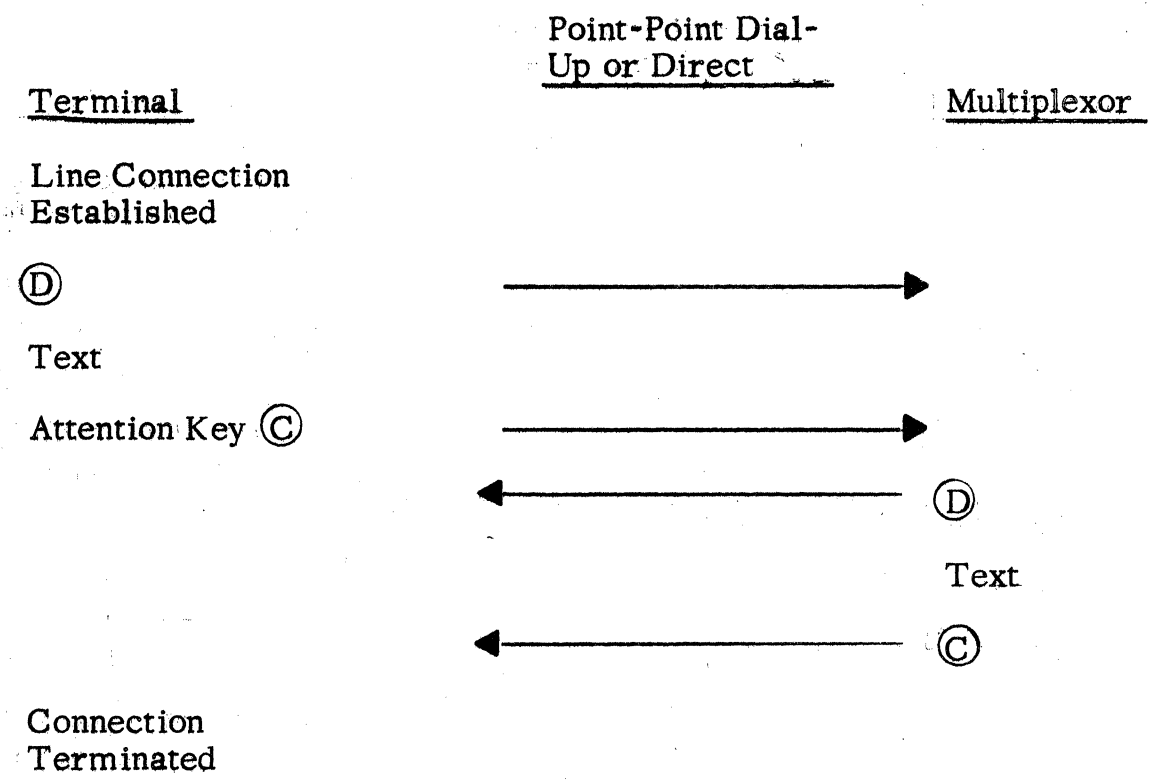


Figure 18. Addressing Operation (With Record Checking)



*Denotes "Sense Character" which defines specific terminal status.

Figure 19. TC 71 (IBM 2741 Compatible) Operation



PTTC/BCD

Lower Case				Bit Value							Upper Case			
Character Set											Character Set			
Std	A	H	Typ	B	A	C	8	4	2	1	Std	A	H	Typ
.				B	A		8		2	1	.			
S			;	B		C	8		2	1	!			;
,					A	C	8		2	1				
#	=		'				8		2	1	+	++		"
@			1/2		A						¢	Δ		1/4
&	+		=	B	A	C					+	<		+
-				B							--	\		--
/					A	C				1				?
1										1	=	>		+
2									2		°)	@
3						C			2	1				#
4								4			:		\$	s
5						C		4		1		%	(%
6						C		4	2		'	;		¢
7								4	2	1			"	&
8							8							.
9						C	8			1	(l		(
0						C	8		2)	l)
a				B	A					1				A
b				B	A				2					B
c				B	A	C			2	1				C
d				B	A			4						D
e				B	A	C		4		1				E
f				B	A	C		4	2					F
g				B	A			4	2	1				G
h				B	A		8							H
i				B	A	C	8			1				I
j				B		C				1				J
k				B		C			2					K
l				B					2	1				L
m				B		C		4						M
n				B				4		1				N
o				B				4	2					O
p				B		C		4	2	1				P
q				B		C	8							Q
r				B			8			1				R
s					A	C			2					S
t					A				2	1				T
u					A	C		4						U
v					A			4		1				V
w					A			4	2					W
x					A	C		4	2	1				X
y					A	C	8							Y
z					A		8			1				Z

PTTC/EBCD

Bit Value

Lower Case	B	A	C	8	4	2	1	Upper Case
.	B	A		8		2	1	.
\$	B		C	8		2	1	\$
,		A	C	8		2	1	,
#				8		2	1	#
@		A						@
&	B	A	C					&
-	B							-
/		A	C				1	/
1							1	1
2						2		2
3			C			2	1	3
4					4			4
5			C		4		1	5
6			C		4	2		6
7					4	2	1	7
8				8				8
9			C	8			1	9
0			C	8		2		0
a	B	A					1	A
b	B	A				2		B
c	B	A	C			2	1	C
d	B	A			4			D
e	B	A	C		4		1	E
f	B	A	C		4	2		F
g	B	A			4	2	1	G
h	B	A		8				H
i	B	A	C	8			1	I
j	B		C				1	J
k	B		C			2		K
l	B					2	1	L
m	B		C		4			M
n	B				4		1	N
o	B				4	2		O
p	B		C		4	2	1	P
q	B		C	8				Q
r	B			8			1	R
s		A	C			2		S
t		A				2	1	T
u		A	C		4			U
v		A			4		1	V
w		A			4	2		W
x		A	C		4	2	1	X
y		A	C	8				Y
z		A		8			1	Z

NOTE: The following printable codes are also used for line control codes:

B						(N) Negative Answer
8	2	1				(D) Start of Message
A	8	2	1			(S) Start of Address
B	A	8	2	1		(Y) Positive Answer

The codes below apply to both BCD and EBCD. They are not printable:

B	A	C	8	4	2	1	Meaning
		C	8	4			
	A		8	4			
B			8	4			
B	A	C	8	4			
			8	4		1	Forms Feed
B		C	8	4		1	CR/LF
	A	C	8	4		1	Index
B	A		8	4		1	Tab
			8	4	2		Upper Case
	A	C	8	4	2		EOB (B)
B		C	8	4	2		Back Space
B	A		8	4	2		Lower Case
		C	8	4	2	1	EOT (C)
	A		8	4	2	1	Prefix
B			8	4	2	1	Idle
B	A	C	8	4	2	1	
		C					Space