File No. 1447-03
Form A24-3031-3

IBM Systems Reference Library

IBM 1447 Console

This reference publication contains a detailed description of all models of the IBM 1447 Console. Indicator lights, keys, dials and switches are described, as well as operation of the console I/O printer. Specific models of the IBM 1447 Console can be attached to the following systems:

- IBM 1240 Bank Data Processing System
- IBM 1401 Data Processing System
- IBM 1440 Data Processing System
- IBM 1460 Data Processing System

The required and available special features, including the IBM 1050 components, are also discussed.

Programming considerations for the 1447, when used with a 1050 system, are also included.

Major Revision, December 1964

This SRL publication, A24-3031-3, is a major revision of, and obsoletes, A24-3031-2.

Copies of this and other IBM publications can be obtained through IBM Branch Offices
Address comments concerning the content of this publication to IBM Product Publications, Endicott, New York 13764

Contents

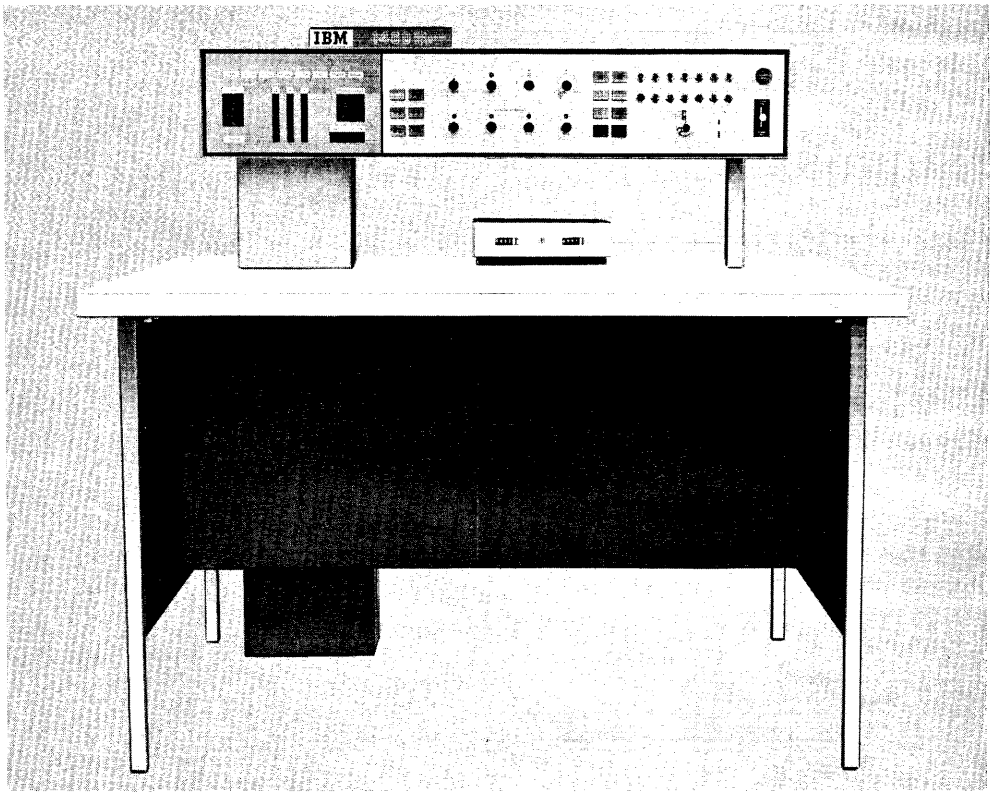


Figure 1. IBM 1447 Console, Model 1

The IBM 1447 Console, Model 1, can be attached to the IBM 1240, 1440, or 1460 systems.

The 1447 Model 1 (Figure 1), containing operating keys, lights, and switches, is designed to give the operator external control for setting up and checking system operation. Several features facilitate program testing.

The left side of the console panel shows the data as it moves from one system component to another (address registers, character registers, and storage addresses).

Special lights indicate operating conditions of the processing and disk units, the card read-punch, and the printer. If certain errors are detected while the system is running, a red light on the console comes on to show which unit requires attention.

The operator can display the contents of any storage location and control the course of program execution by setting sense switches in an ON or OFF position, if the program has been designed to take advantage of this flexibility.

The main power supply for the system is controlled by switches on the console. A special switch disconnects all power from the system in case of emergency.

A mode switch facilitates machine operation and program testing by permitting:

1. Single-cycle operation for detailed examination of program functions.
2. The display of the contents of a particular storage area.
3. The manual change of the contents of any address register or storage location.
4. The contents of storage to be printed with word-mark identification.
5. The scanning of storage for invalid characters.
6. The operator to stop execution of the program at a predetermined point. This provides an opportunity to bypass program steps that have already proved accurate and to stop at instruction areas that need to be examined step by step.

Indicator Light Panel

The indicator light panel (Figure 2) uses back-lighting to display data. The bit configuration of each character in each logical element is shown in binary-coded decimal form (including the check-bit status in all elements and the word-mark status in all elements but the Op register). The data is displayed one character at a time. A parity or validity check condition at any display location is indicated by a red light in the legend directly above the character display that caused the check condition.

Some IBM 1447 Console lights and controls pertain to specific models or special features. These are listed in the order shown on the operating panel. The parity and validity check conditions that turn on some of the lights on the indicator light panel are shown in Figure 3.

Tape Light

This light comes on whenever a tape-check condition occurs during a tape-read or tape-write operation. The check condition also turns on the tape-transmission error indicator. The status of this indicator must be tested by a BRANCH IF TAPE TRANSMISSION ERROR INDICATOR ON instruction — B (III) L. The indicator and the associated light are reset off by the next tape read or write operation.

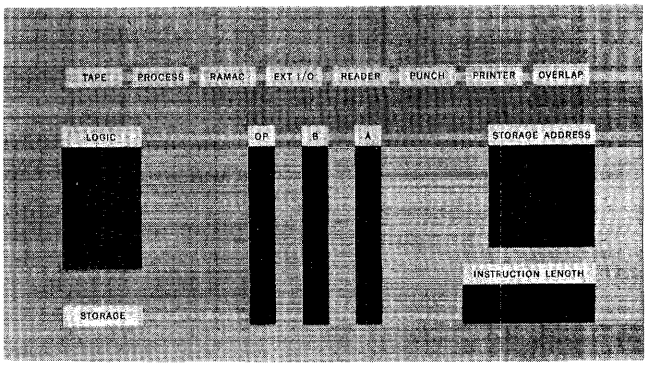


Figure 2. Indicator-Light Panel

LIGHTS ON WHEN STOPPED	UNIT	TYPE OF CHECK	MACHINE STOPS — CHECK STOP SWITCH ON INDICATOR LIGHT PANEL ON	STORAGE-ADDRESS REGISTER (STAR) CONTAINS	RESET BY	REMARKS
Process A-Register Check Reset	A-Register	Parity	End of Cycle in Which Check Is Detected		Check Reset Key	A-Register Contents in Error Still on Display
Process B-Register Check Reset	B-Register	Parity	End of Cycle in Which Check Is Detected	Address Location That Was Read into the B-Register	Check Reset Key	B-Register Contents in Error Still on Display in B-Register
Process Logic Check Reset	Logic	Validity	End of Cycle in Which Check Is Detected	Address Location That Was Read into on That Cycle	Check Reset Key	The Bit Combination That Causes the Check Is in the Storage Unit and Is Not on Display in the Logic Area.
Process Storage Check Reset	Storage	Parity	End of Cycle in Which Check Is Detected	Address of Invalid Character	Check Reset Key	A Check Indicates That an Even-Bit Combination Was Read into Storage
Process Op-Register Check Reset	Op Register	Parity and Validity	End of Cycle in Which Check Is Detected	Any Address	Check Reset Key	Checked Every Process Cycle
Process Storage-Address Check Reset	Storage Address Register	Parity and Validity	End of Cycle in Which Check Is Detected	Bit Combination That Caused the Error	Check Reset Key	The Check Is Made after the Full Address Has Been Entered
Process Storage-Address Check Reset		Wrap-Around		Depends upon the Operation Being Performed and the Modification	Check Reset Key	Can Be Modified by +1 or -1

NOTE: If any of the above checks occur (except for a storage-address check condition) during an I/O operation, that operation is completed before the system stops.

Figure 3. Processing-Unit Check Conditioning

The light is also turned on if the tape-select switch is not in the N-position, or if a tape drive is selected but not ready.

Process Light

This light and its associated process-check indicator turn on whenever a process-check condition occurs in the processing unit. This condition also stops the system when the check-stop switch is on. The light and the process-check indicator are reset off by pressing the check-reset key. System operation is resumed by pressing the start key.

The process light also comes on whenever a process-check condition occurs in the processing unit and the check-stop switch is off. The process-check indicator is also turned on, but the machine does not stop. The light remains on until it is turned off either by pressing the check-reset key or executing a BRANCH IF PROCESS CHECK INDICATOR ON (with check-stop switch off) instruction — B (III) %. The process-check indicator remains on until this branch operation is executed.

This light cannot be turned off by a BRANCH instruction — B (III) % if either the Op light or the storage-address light is on. These errors indicate conditions in the program or the CPU, beyond which correct processing is unlikely.

RAMAC® Light

This light comes on whenever a check condition occurs in one of the IBM 1301 Disk Storage or 1311 Disk Storage Drives. An associated check indicator in the processing unit is also turned on. The light and its associated check indicator are turned off either by pressing the start-reset key or when the next disk-storage instruction is executed.

Ext I/O Light (External Input/Output)

This light is under control of the input/output units (or the feature) attached to the system through either the serial I/O adapter or the expanded serial I/O adapter. The light comes on when one unit or the feature requires operator attention. The light turns off

when the condition requiring attention is satisfactorily corrected. Refer to the appropriate Systems Reference Library publication for the external input/output unit concerned.

Reader Light (1240/1440)

This light comes on when:

1. The reader is selected but not ready.
2. A read register check occurs.
3. A reader validity check occurs.
4. A reader or punch validity check occurs.*

Reader Light (1460)

This light comes on when:

1. The reader is selected but not ready (stacker full, read-feed jam or feed failure, or file-feed delay).
2. A reader-check (hole-count) error occurs.
3. A reader-validity error occurs.

Punch Light (1240/1440)

This light comes on when:

1. The punch is selected but not ready (stacker full or jam).
2. A punch-validity error occurs.
3. A punch error occurs.*
4. A punch check error occurs.

* The items indicated by an asterisk under the headings *Reader Light (1240/1440)* and *Punch Light (1240/1440)* refer to machines manufactured before Feb. 29, 1964.

Punch Light (1460)

This light comes on when:

1. The punch is selected but not ready (out of cards, stacker full, or punch-feed jam).
2. A punch-check (hole-count) error occurs.

Printer Light

This light comes on when:

1. The printer is selected but not ready.
2. A printer error occurs.

Note: The reader, punch, and printer lights on the console indicate the system area in error. If the machine stop was caused by a functional condition (out of cards, forms jam, etc.), operator attention will be required at the unit giving the trouble.

If the machine stop (I/O check-stop switch on) was caused by an operational condition (print check, validity, etc.), the error light can be turned off with the check-reset key on the 1447 console. System operation is resumed by pressing the unit start key.

If the I/O check-stop switch is off, the console error light will remain on until a branch on an I/O error instruction is executed.

Reader error branch d-modifier	?
Punch error branch d-modifier	!
Printer error branch d-modifier	‡

Depending on which CPU the 1447 is attached to, it may be necessary to press the reset key on the system unit causing the stop.

Overlap Light (1460)

During an overlap cycle, this light comes on whenever a process-check condition occurs in the processing unit. The system stops when the check-stop switch is on. Ordinarily, the process light is also on, indicating the type of failure. If an A-register check condition occurs during a tape-overlap cycle, however, only the overlap light comes on. It remains on until either the check-reset key is pressed or a BRANCH IF PROCESS CHECK INDICATOR ON (with check-stop switch off) instruction — B (III) % is executed. The system is restarted by pressing the start key.

Logic Light

This light comes on when a check condition occurs during the cycle used to store the adder output. The system also stops if the check-stop switch is on. The light remains on until the check-reset key and the start key are pressed to restart the system.

OVF (Overflow) Light

This light, below the logic light, comes on when an arithmetic overflow condition occurs in the machine. The overflow condition also turns on an overflow indicator. Both the light and the indicator remain on until the status of the indicator is tested by a BRANCH IF OVERFLOW INDICATOR ON instruction — B (III) Z. Executing this branch instruction turns off both the light and the indicator.

B ≠ A Light

This light, below the logic light, comes on when the B-field and the A-field contents are not equal during a compare operation. It also comes on when an unequal-address compare condition occurs during automatic checking of the sector address in storage with the sector address on the disk. These unequal conditions also turn on an unequal-compare indicator. The status of

this indicator can be tested by a BRANCH IF UNEQUAL COMPARE INDICATOR ON instruction – B (III)/. The light and the indicator remain on until they are turned off by either the next compare or the next disk-storage operation.

B = A Light

This light, below the logic light, comes on when the B-field and the A-field contents are equal during a compare operation, or when the addresses are equal during a disk-storage address-compare operation. These equal conditions also turn on the equal-compare indicator. The status of this indicator can be tested by a BRANCH IF EQUAL COMPARE INDICATOR ON instruction – B (III) S. The light and the indicator remain on until they are turned off by the next compare operation or the next disk-storage operation.

B > A Light

This light, below the logic light, comes on when the value of the B-field is greater than the value of the A-field, or when the A-field is shorter than the B-field (during a compare operation), or when the address in storage is the greater address during a disk-storage address-compare operation. These conditions also turn on a high-compare indicator. The status of this indicator can be tested by a BRANCH IF HIGH COMPARE INDICATOR ON instruction – B (III) U. The light and the indicator remain on until they are turned off by the next compare operation or the next disk-storage operation.

B < A Light

This light, below the logic light, comes on when the value of the B-field is less than the value of the A-field (during a compare operation), or when the sector address on the disk is the greater address during a disk-storage address-compare operation. These conditions also turn on the low-compare indicator. The status of this indicator can be tested by a BRANCH IF LOW COMPARE INDICATOR ON instruction – B (III) T. The light and the indicator remain on until they are turned off by the next compare operation or the next disk-storage operation.

Bit-Display Lights

At the end of a B-cycle, these lights display the bit configuration of the sum of the characters being processed in the arithmetic operation.

Storage Light

This light comes on when a character is read into core storage and a parity-check condition occurs. The light remains on until it is turned off by pressing the check-reset key. The system is restarted by pressing the start key.

Op (Operation Register) Light

This light comes on when the operation register detects that the character in the register is an incorrect (invalid) operation code. The light blocks below this light indicate the BCD coding and the check-bit status of the character in the operation register. The light remains on until it is turned off by pressing the check-reset key. This light cannot be reset by the PROCESS CHECK TEST BRANCH instruction – B (III) %.

B (B-Register) Light

This light comes on when the B-register detects that the character in the register is of incorrect (even-bit) parity. The light blocks below this light indicate the BCD coding and the check-bit and word-mark status of the character in the register. The light remains on until it is turned off by pressing the check-reset key.

A (A-Register) Light

This light comes on when the A-register detects that the character in the register is of incorrect (even-bit) parity. The light blocks below this light indicate the BCD coding and the check-bit and word-mark status of the character in the register. The light remains on until the check-reset key is pressed.

Storage-Address Light

This light comes on when the storage-address register detects that one or more characters in the register are of incorrect parity or that the address in the register is invalid. The light blocks below this light display the address characters that caused the check condition. The light remains on until the check-reset key is pressed. This light cannot be reset by the PROCESS CHECK TEST BRANCH instruction – B (III) %.

Instruction-Length Lights

These lights indicate which character of an instruction is being read out of storage during an instruction cycle.

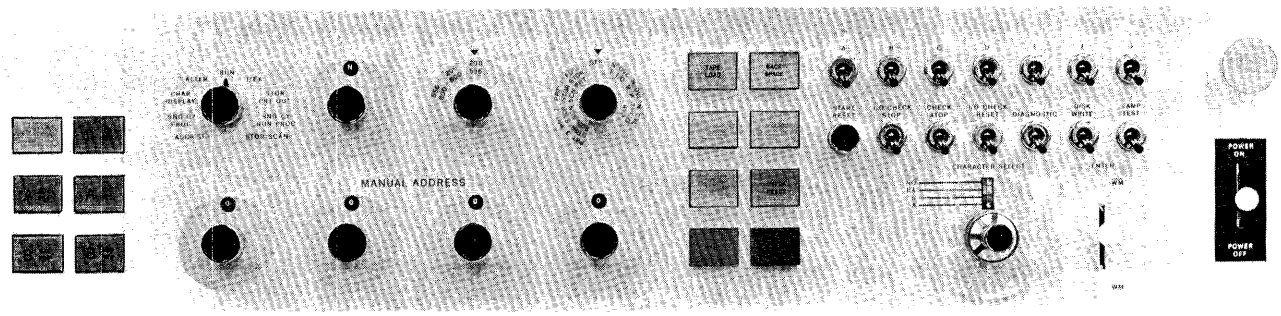


Figure 4. Operating Panel on the IBM 1447 Console

Operating Panel

The operating panel (Figure 4) contains the keys, lights, switches, and dials used by the operator to control the system. Some IBM 1447 lights and controls pertain only to certain models, or are used with certain special features.

O-Add Reg Key (1460)

The O-address register key light is used in conjunction with the Processing Overlap special feature. The key is lighted when pressed. It displays the O-address register contents in the storage address indicator lights.

When processing stops at the end of an individual cycle involving the overlap feature, the key is lighted and the storage-address block shows the address of the last character read out from (or read into) core storage in the overlap mode.

The O-address register key light may turn on at the same time as any other address-register key lights. Pressing any address-register key light turns off the O-address register key light, and pressing this key light turns off any other key light.

I-Add Reg Key

This key is lighted when pressed. It displays the I-address register contents in the storage-address indicator lights. If the system stops during an I- (instruction) cycle, I-ADD REG remains lighted and the storage-address indicator lights display the last I-address that addressed core storage.

A-Add Reg Key

This key is lighted when pressed. It displays the A-address register contents in the storage-address indicator lights. If the system stops during the A-portion of an E- (execution) cycle, A-ADD REG remains lighted and the storage-address indicator lights display the last A-address that addressed core storage.

B-Add Reg Key

This key is lighted when pressed. It displays the B-address register contents in the storage-address indicator lights. If the system stops during the B-portion of an E- (execution) cycle, B-ADD REG remains lighted and the storage-address indicator lights display the last B-address that addressed core storage.

A-Aux Reg Key

This key is lighted when pressed. It displays the A-auxiliary register contents in the storage-address indicator lights. The A-auxiliary register is part of the multiply-divide special feature. If the system stops during the A-auxiliary portion of an E- (execution) cycle, A-AUX REG remains lighted and the storage-address indicator lights display the last A-auxiliary address that addressed core storage.

B-Aux Reg Key

This key is lighted when pressed. It displays the B-auxiliary register contents in the storage-address indicator lights. The B-auxiliary register is part of the multiply-divide special feature. If the system stops during the B-auxiliary portion of an E- (execution) cycle, B-AUX REG remains lighted and the storage-address indicator lights display the B-auxiliary address that addressed core storage.

Manual Address

The four dials labeled *Manual Address* are used to set up an address to be entered in an address register, or select a storage location for display or alteration with-

out disturbing the contents of the address registers. These switches are effective only when the mode switch is set to one of these positions:

1. Address Stop
2. Alter
3. Character Display
4. Storage Printout
5. Storage Scan.

Mode Switch

The mode switch selects the nine modes of machine operation.

Run. When the mode switch is set to RUN, the system operates under stored-program control.

Address Stop. When the system is operating in this mode, program execution stops when the program arrives at the core-storage address specified by the manual address switches. This switch setting is commonly used in program-testing operations. Program execution stops at the specific address of an instruction in the program, except for input or output operations.

I/EX. When the mode switch is set to I/EX (Instruction/Execution), the system reads out one complete instruction from core storage when the start key is pressed, and then stops. This is called the *instruction phase.*

When the start key is pressed again, the system executes the instruction previously read out, and then stops. This is called the *execution phase.*

Subsequent start-key operation results in the system initiating alternate instruction and execution phases. When an operation does not require an execute phase, the next phase is the I-phase associated with the next instruction.

Single-Cycle Process. When the system is operating in this mode, each start-key operation causes the system to execute one storage cycle and advance through the instruction or execution cycles of the program one character (storage cycle) at a time. (All execution cycles of an I/O operation are executed at one time.) The mode switch may not be moved from the SINGLE CYCLE position if the system is at I-op of a CONTROL CARRIAGE instruction, or at I-5 of a BRANCH IF CARRIAGE OVERFLOW instruction.

Single-Cycle Non-Process. When the system is operating in this mode, each start-key operation causes the system to execute a modified storage cycle and advance through the instruction or execution cycles of the program one character (storage cycle) at a time. The normal storage-cycle operation is modified so that no data enters core storage from the A-register or from the logic unit. The data enters core storage from the B-register only. This mode of operation allows the system operator to observe arithmetic operation results, one character at a time, in the logic-display lights without altering the original B-field data.

Storage Scan. When the mode switch is set to STORAGE SCAN, holding down the start key causes the system to start reading data out of the core storage, beginning at the address set in the manual address switches, and continuing until the start key is released. If a character of incorrect parity is detected in core storage, the system stops and the check light associated with the check condition turns on. The address of the core-storage position that contains this character is displayed in the storage-address display lights. The B-register displays the contents of the core-storage position that caused the check condition.

Storage Printout. When the system is operating in this mode, a block of core storage is printed. The IBM 1403 can print a block of either 100 or 132 characters. The IBM 1443 can print a block of either 120 or 144 characters. The two high-order manual address dial switches select the desired block of storage. The two low-order switches must be set to 01, unless the system is equipped with the print-storage special feature. The system interlocks if the two low-order address switches are not set to 01 and the system is not equipped with print storage.

Pressing the start key initiates the printout operation. After the line is printed, an automatic print cycle prints *one* on the line below and in the positions corresponding to those that contain word marks. If additional print outs are required, the new (initial) core-storage address must be placed in the manual address switches.

The manual-address dials and the start key must be left undisturbed while a storage printout operation is in progress.

A storage error occurs if an attempt is made to print out the last 100-band of storage on a 1440 or 1460 system. If this information is required, it must be moved to another area of core storage, using a series of load Op commands.

Char Display. When the mode switch is set to CHAR DISPLAY (Character Display), pressing the start key initiates a B-register display of the contents of the core-storage address specified by the manual address switches. This operation does not alter the I-, A-, and B-address registers.

With the mode switch set to this position, pressing the type key on the IBM 1447 Model 2 or 4 initiates a

printout on the console I/O printer of the contents in core storage, beginning with the address set in the manual address switches. In this operation, word marks are printed as inverted circumflexes preceding the characters with which they are associated. The operation is stopped by pressing the stop key on the console. The stop key must be pressed before the start key is pressed.

Alter. When the mode switch is set to ALTER, the operator can manually change the contents of the I-, A-, or B-address register or any core-storage position. To change the contents of an I-, A-, or B-address register, the operator must:

1. Set the manual address switches to the desired address.
2. Press the appropriate address-register key light.
3. Press the start key. The selected address register should indicate the new address.

To change the contents of a specific core-storage position, the system operator must:

1. Set the manual address switches to the desired core-storage address.
2. Select the bit configuration desired with the character-select dial.
3. Operate the enter key to enter the selected bit configuration with or without a word mark.

The contents of adjacent core-storage positions can be changed by initiating an alter-plus-one mode of operation when the mode switch is set to ALTER.

Once the alter-plus-one mode is set up, the core-storage address automatically advances by plus one at the end of each alter cycle.

To set up an alter-plus-one mode of operation, the system operator must:

1. Set the manual address switches to the desired core-storage address.
2. Press the B-address register key light.
3. Press and hold the start key.
4. Operate the enter key.
5. When the enter key returns to its neutral position, release the start key.

The system is now ready to operate in its alter-plus-one mode.

To enter the new characters in the desired core-storage positions, the system operator must:

1. Select the bit configuration desired with the character-select dial.
2. Operate the enter key to enter the selected bit configuration with or without a word mark.

Tape Select

During programmed operation, this dial is set to N (normal position). To select a particular tape unit for a manual operation, such as backspacing, set this switch to the number that corresponds to the tape unit.

Note: See *Tape Load* and *Diagnostic Switch* sections.

Tape Density (1460)

This three-position dial controls the low- and high-density rates of the IBM 729 Magnetic Tape Units, Models V and VI, attached to the 1460 system. The three settings are 200-556, 200-800, and 556-800. The tape unit assumes the recording density designated by the switch.

The IBM 729 II, 729 IV, and 7330 Magnetic Tape Units operate at either 200 or 556 characters per inch regardless of the setting of the tape-density switch.

Auxiliary Mode (1460)

This dial can be set to any one of six positions.

Off. This is the normal setting. In this position, the switch has no effect on system operation.

Full Storage Print. This position is used, in conjunction with the mode switch, to print the contents of all storage positions. When the mode switch is set to STORAGE PRINT OUT and the start key is pressed, printing starts with core-storage position 001 and continues until all core-storage positions are printed. Word marks print as *ones* under the corresponding data positions during the following print operation.

A block of 132 characters is printed. However, the last 32 positions printed on each line are repeated at the beginning of the next line of data. For example, core-storage positions 101-132 print at the end of the first line and at the beginning of the second line.

Print-Storage Scan. This position is used, in conjunction with the STORAGE SCAN setting of the mode switch, to scan the standard print area in core storage (positions 201-332) and the 132 special print-storage positions. When the mode switch is set to STORAGE SCAN and the start key is pressed, scanning begins at core-storage position 201 and at print-storage position 001. Scanning continues through the 132 positions of each area. During this scanning operation, the contents of the standard print area are displayed in the B-register, and the contents of the special print-storage area are displayed in the A-register.

If an error is found in either register, the scanning operation stops. Otherwise, it stops at position 332. After an error stop, resetting the error indication and pressing the start key continues the scan operation.

The other three positions of this switch prevent input/output operations from being performed in the overlap mode. These positions are used primarily by IBM Customer Engineers.

Tape I/O. This switch setting prevents magnetic tape or serial input/output operations from being performed in the overlap mode.

R/P. This switch setting prevents card (Read/Punch) operations from being performed in the overlap mode.

Tape I/O R/P. This switch setting prevents tape, serial input/output, or card operations from being performed in the overlap mode.

Sense Switch A

Sense switch A is a standard feature. It controls last-card operations by making a BRANCH IF INDICATOR ON (d-character A) instruction cause a branch operation when the last card in the reader has passed the reading station.

The six additional sense switches (B, C, D, E, F, and G) are available (special feature).

Emergency-Off Switch

In an emergency, pulling this switch disconnects all power within the system. The switch must be manually reset by a Customer Engineer before power can be restored to the system.

Start-Reset Key

This key resets the system so that the operator can initiate a restart. It does not reset the inquiry channel (if buffered), the address registers, or core storage.

The inquiry channel is reset by pressing the type key and the start-reset key simultaneously.

Note: The system must be stopped before the start-reset key is pressed.

I/O Check-Stop Switch

When this switch is on, the system stops at the completion of any input or output operation in which a check condition was detected. When this switch is off, the system does not stop, and all check-condition detection must be accomplished by executing the applicable BRANCH IF INDICATOR ON instruction.

Check-Stop Switch (Process)

When this switch is on, the system stops when a processing-unit check condition is detected. When the switch is off, the system stops for a processing-unit check condition only when the Op register, one of the address registers, or an input/output operation is involved.

I/O Check-Reset Switch

This switch resets check conditions sensed in an I/O unit when the I/O check stop switch is off. It is used primarily by Customer Engineers.

Diagnostic Switch

When this switch is on, characters are read into core storage just as they appear on the disk or tape record, without parity-correction. If a character having incorrect parity is transferred into core-storage, the system stops. The B-storage address register shows the storage location of the error, and the B-register displays the error character as it was read from the disk or tape.

When this switch is off, the parity of all data characters is corrected (by the addition or deletion of a C-bit). This does not mean the character is now accurately transferred as it was originally written on the disk. A programmed operation (BRANCH ON ERROR instruction) must be performed to determine if the disk record was satisfactorily read.

This switch may be used to find the character(s) in error, as follows:

1. Turn the diagnostic switch on.
2. Set the mode switch to I/EX.
3. Read in the suspected record under program control.
4. Turn the mode switch to STORAGE SCAN. Press the start key to scan core storage to the parity error.
5. If an error existed in the record, the system will stop. The address of the error will be shown in the B-storage address register. The B-register will display the contents of the error location.
6. The error can now be corrected at the discretion of the operator. *Note:* More than one core-storage position may be in error.
7. Restore all controls to normal. If the error has been satisfactorily corrected, or if the error position was of no consequence to the program being run, the job can be restarted at this point. *Note:* The parity must have been corrected.

Note: If the 1460 is being operated in overlap mode for this instruction, the record may be read incorrectly.

Disk-Write Switch

The disk-write switch, by preventing the writing of test data on permanent records in disk storage, facilitates program testing on any system equipped with disk storage. When the switch is on, all normal disk-storage operations can be performed.

When the switch is off, all disk-storage instructions except WRITE DISK and WRITE DISK WITH WORD MARKS are performed normally. When these instructions are encountered in a stored program, the OFF position prevents the data transfer from core storage to disk storage. The automatic comparison between the record address in core storage and the address on the disk record is performed, however, and the unequal-address-compare indicator turns on if an unequal condition occurs.

Note: A WRITE DISK CHECK instruction must be performed following a write operation, regardless of the disk-write switch setting. Since the record data in core storage is not written on the disk when the switch is off, a check condition occurs during the following write-disk operation.

Lamp-Test Switch

Operating this switch turns on all the IBM 1447 Console lights for a visual check of lamp circuits. Do not operate this switch while a job is in progress.

Tape Load (1240/1440)

This key is used to load a program stored on tape, into core storage.

When the tape-load key is pressed, the tape unit specified by the tape-select dial is selected, and the tape data starts entering core storage at position 001. The operation continues until an interrecord gap (IRG) is sensed. Then an automatic branch back to core-storage position 001 occurs, and the instruction beginning in position 001 is executed.

The setting of the tape-select dial has priority over any programmed tape operations. For example, although a program can be loaded from any tape unit (selected as either 1 or 2), subsequent programmed tape operations will affect the tape unit whose address matches that set by the tape-select dial.

A programmed halt should follow a tape-load operation. This allows the operator time to reset the tape-select dial to the N-position.

Tape Load (1460)

The tape-select dial must be set to the N position. Tape-unit 1 is automatically selected. The program loaded from the tape begins in core-storage location 001. When the IRG is read, the program executes instructions, starting at location 001.

Backspace (Tape)

When the tape-select dial is set for a specific unit, pressing this key backspaces the tape in the specified tape unit until an interrecord gap is reached.

Type Key Light (Model 2 or 4)

The type key light used with the IBM 1447 Model 2 contains both a white and a red light. The white light glows when the console I/O printer is selected to operate. The red light glows when the inquiry-clear indicator turns on. (The light turns off when the indicator is reset off.)

The operation that results from pressing the type key depends upon the mode of system operation. When the system is operating in:

1. RUN, pressing the type key sets the inquiry-request (Q) latch on.
2. CHAR DISPLAY, pressing the type key initiates an I/O printer print out of core storage, beginning at the core-storage address specified in the B-address register.
3. ALTER, pressing the type key allows any character keyed on the printer to enter the core-storage address specified in the B-address register.
4. The inquiry channel is reset by pressing the type key and the start-reset key simultaneously.

1448 Check-Reset Key (Model 4)

This key is used to reset a 1448 error from the console. Refer to the Systems Reference Library publication, *IBM 1448 Transmission Control Unit*, A24-3010.

Program-Load Key (1240/1440)

The program-load key is pressed to initiate a program-load routine. Before pressing it, follow this procedure:

1. Reset the system.
2. Card read-punch #1 must be ready.
3. Set the mode switch to RUN.

Pressing the program-load key then causes:

1. Selection of card read-punch #1 for reading.
2. Reading of eighty card columns into core-storage positions 001 through 080.
3. A word mark to be placed in core-storage position 001.
4. (After the previous steps are completed,) the program to branch to core-storage position 001.

Check-Reset Key Light

Any check condition detected by the processing-unit check circuits lights this key. Either the key must be pressed or a BRANCH IF PROCESS CHECK INDICATOR ON instruction must be executed to turn off the light and reset the checking circuits. (See *Process Light.*)

Start Key

The start key is used to initiate or resume operation after a manual, programmed, or automatic stop. The operation that results from pressing START depends upon the mode-switch setting. When the mode switch is set to:

1. RUN or ADDRESS STOP, pressing the start key starts program execution.
2. SINGLE-CYCLE PROCESS, pressing the start key one time causes the system to execute one cycle of the program.

Before the start key can restart program execution after a process-check condition is detected, the check-reset key must be pressed if the check-stop switch was set on.

Stop Key Light

Pressing this key stops program execution as soon as the execution phase of the current instruction is completed.

The light turns on when a programmed stop operation is executed and turns off when program execution begins again (start-key operation).

1448 Start-Reset Key (Model 4)

This key performs the same functions for the 1448, that the normal start-reset key performs for the CPU.

Character-Select Dial

The character-select dial is a two-dial concentric switch. It is used by the operator to select the character to be entered into core storage when the enter key is pressed. The outer dial is used to select the group of four characters having a common numeric-bit configuration. The inner dial is then used to specify the zone-bit configuration associated with the desired character.

Enter Key

The enter key, a lever-action key, automatically returns to a neutral (central) position after operating. When the key is operated upward, the character (without an associated word mark) specified by the character-select dial enters the core-storage position specified by the storage-address register. When the key is operated downward, the specified character (with an associated word mark), enters the specified core-storage position. Parity control is automatic. Use care to prevent *bounce.* This will ensure correct word-mark insertion.

Power On/Off Switch

Operating this switch turns the main power supply for the system on and off. The switch is operated downward to turn power off, and operated upward to turn power on. After being operated, the switch automatically returns to a central position.

The IBM 1447 Console, Model 2, with the IBM 1447 Model 2 Inquiry Unit (Figure 5) has all the operating keys and lights of the Model 1, plus the input/output printer. It can be attached to the IBM 1240, 1440, or 1460 systems.

Console I/O Printer

The console I/O printer combines a keyboard of 64 characters and a pin-feed platen (special feature) with the advantages of a carriageless printer. The single printing element moves horizontally when printing, no longer subjecting forms to horizontal carriage movement. This printing method results in an output rate of 14.8 characters per second.

Margins, tab stops, and ribbon shift (color) are set manually by the operator. When the printing element reaches the right-hand margin, an automatic carrier-return and line-feed operation is executed. Printing is suspended during this operation and during any tabulation operation. This printer can print up to 130 characters per line without the pin-feed platen, and up to 128 characters per line with the pin-feed platen feature (10 characters per inch).

The printing of either ten or twelve characters per inch must be specified by the customer. Vertical spacing of six or eight lines per inch must also be specified by the customer. This vertical spacing then can be manually altered with a double-space setting, resulting in either three-instead-of-six or four-instead-of-eight lines per inch.

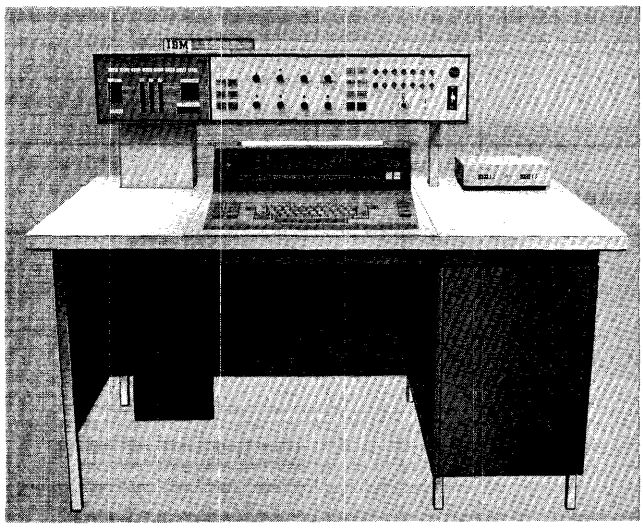


Figure 5. IBM 1447 Console, Model 2

Printer Forms

The console I/O printer can:

1. Print on cut forms
2. Feed and stack continuous pin-feed forms
3. Feed continuous-roll single-thickness paper.

With the pin-feed special feature installed, form width (pin to pin) can be 6, 7½, 8, 9, 10, 10⅛, 11¼, 11½ or 13⅛ inches. The form width must be specified for each pin-feed platen.

The maximum form width is 15 inches. The maximum length of a printer line is 13 inches.

When using continuous forms, the forms are placed on the forms platform. The form is then inserted in a slot between the console printer and the table, and then inserted in the console printer.

The printed forms are stacked on the portion of the console inquiry station table behind the console printer.

Keyboard

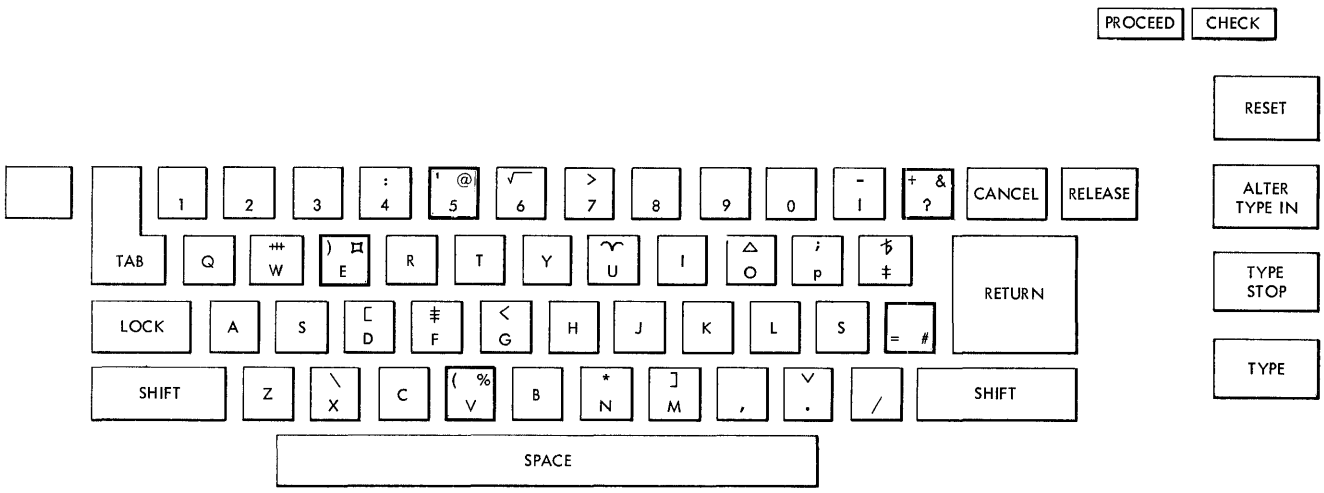
The console I/O printer keyboard (Figure 6) is not mechanically connected to the printer mechanism. Seven keys on the keyboard are function keys initiating space, cancel, release, carrier return and line feed, tab, shift, and shift lock.

Some of these function keys also transmit specific characters when they are pressed. The function keys and the characters they transmit are:

Function Key	*Character*	*BCD Coding*
Space	no character	C
Carrier Return		
Line Feed	]	C B 8 4 1
Tabulate	[	A B 8 4 1

Functional-Control Characters

Besides being able to print 64 characters, the console printer can execute various printer functions when the



NOTE: Characters on left side of key are the H arrangement; characters on right side of key are the A arrangement.

Figure 6. Console Printer Keyboard

specific functional-control characters are sent from the system in the move mode. The characters designated as functional-control characters and the printing functions they initiate are:

Character	*BCD Coding*	*Printer Function*
blank	C	Space
]	CB841	Carrier Return Line Feed
[	AB841	Tabulate

These characters can be printed when they are transmitted in the load mode, but the printer function is *not* executed.

Five keys on the 1447 keyboard offer a choice of two special characters each (Figure 6). The 1447 is equipped with two interchangeable print elements, one containing print-arrangement A and the other print-arrangement H. The operator can change the print element to provide the special-character printing required by the program. Internal coding is not affected when the print element is changed.

Word-Mark Key

When the period (.) key is pressed in upper shift, a word mark (inverted circumflex) is printed. Transmission of the word mark with its associated character depends upon the operation being performed.

Cancel Key

The cancel key is used to inform the system that the message should be disregarded. The key operation:

1. Sets the inquiry-clear (*) latch on in the system.
2. Turns on the red type light on the console.
3. Inserts a C-bit in core storage.
4. Initiates a carrier-return and line-feed operation.
5. Disconnects the printer from the system.

Release Key

The release key is used to end a printer-to-system operation. When in normal shift status, the key operation:

1. Inserts a group-mark with word-mark in core storage.
2. Initiates a carrier-return and line-feed operation.
3. Disconnects the printer from the system.

(When the release key is pressed during an alter operation, the group-mark with word-mark is not sent to the system.)

Shift and Shift-Lock Keys

The shift and shift-lock keys are used to enter uppercase characters. The shift status must be restored to normal (lower case) before the release key is pressed.

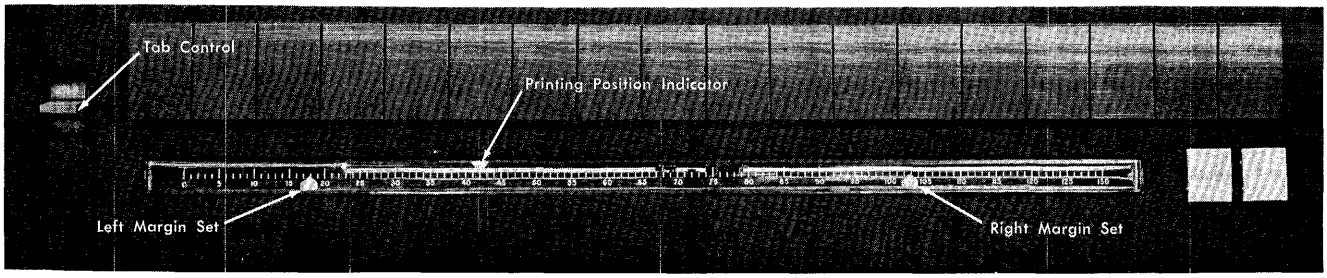


Figure 7. Margin Stops

Console I/O Printer Keys and Levers

Tab Control (Clear and Set)

To clear tab settings, tab to each stop and press the CLR (or top) of the tab control (Figure 7). To set a tap stop, position the carriage to the desired point on the writing line and press the SET (or bottom) of the tab control.

Margin Stop

The margin stops limit the length of the line to be typed. To set the margin stops:

1. Lift the I/O printer cover.
2. Space until the position indicator is at desired location of new margin.
3. Push the margin stop toward the typewriter, and align the red mark on the margin stop with the typing position indicator.

To set the left margin stop, push in the left margin stop and slide it to the desired position on the margin guide.

Multiple-Copy Control Lever

To compensate for additional copies, move the multiple-copy control lever toward the rear of the printer (Figure 8). This adjusts the platen so that the printing element will strike squarely on the form. Paper weight and number of copies will determine the setting of this control. Normally, set the multiple-copy control lever on the second marking for one original with three carbon copies, and on the third marking for one original with five carbon copies.

Line-Space Lever

This lever controls the line-space movement of the platen (Figure 8). The line-space lever can be set for either single or double space.

Paper-Release Lever

Move the paper-release lever (Figure 8) forward to position or remove forms.

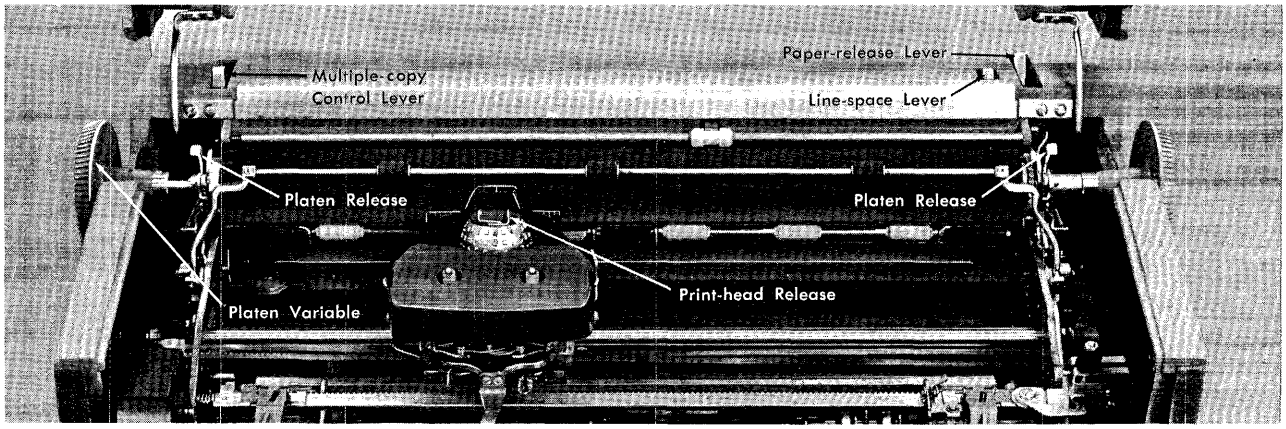


Figure 8. Impression and Form Controls

Platen Variable

This control, operated by pressing in on the left end of the platen, allows the platen to rotate freely. The platen variable is useful after reinserting a page for correction or addition.

Ribbon and Platen Procedures

Ribbon Reversal

Open the top cover of the console printer by grasping the center of the cover and pulling up and away from the printer. To close the cover, lower it and press lightly. The cover will snap shut.

Reverse the ribbon direction by moving the ribbon-reverse lever (Figure 9) to the opposite side of the ribbon cartridge.

Ribbon Installation (Figure 9)

1. Open the cover over the print element.
2. Position the carrier near the center of the carrier rod.
3. Shift the ribbon-change lever to the right, and raise the ribbon guide.
4. Lift the ribbon cartridge vertically off the carrier ribbon posts.
5. Ease the ribbon through the slots in the ribbon guides.
6. Insert a pencil in the cartridge hole, and turn the cartridge in the direction of the arrow. Rewind any excess ribbon.

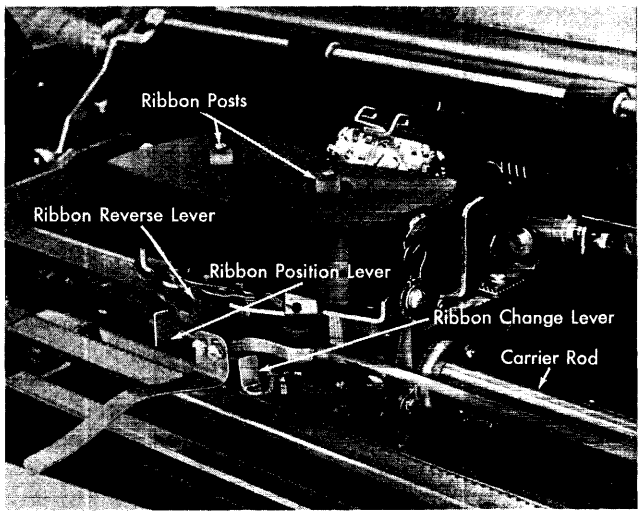


Figure 9. Console Printer Ribbon

7. Hold the new ribbon cartridge with the exposed length of ribbon toward the platen.
8. Slide the ribbon down through the slots in the ribbon guides.
9. Position the cartridge on the cartridge posts, and press down firmly.
10. Rewind any excess ribbon by turning either cartridge post in the direction of the arrow.
11. Move the ribbon-change lever to the left to lower the ribbon guide into the typing position.

Platen Removal and Replacement (Figure 8)

1. Move the paper-release lever forward.
2. Move the paper bail forward.
3. Lift the cover.
4. Press the platen spring and lift the platen.

The feed rolls are now accessible. Clean the platen, feed rolls and bail rolls periodically to assure proper paper feeding and to prevent roll marking. There is no need to remove the metal deflector.

To replace the platen, position it with the ratchet teeth to your right. Center the end plate in the groove in the platen shaft, and press down until it clicks into place.

Console I/O Printer Operation

The console I/O printer furnishes an input to the attached system in three ways, and provides output from the system in two ways. The various input/output operations are:

1. Console-initiated input to system
2. Program-initiated input to system
3. Console-inquiry operation
4. Console-initiated output from system
5. Program-initiated output from system.

Console-Initiated Input to the System

The following procedure is used to set up a data-transfer from the console I/O printer into the system:

1. Stop the machine.
2. Set the manual address switches to the initial address of the area that will receive the data.
3. Turn the mode switch to ALTER.
4. Press the B-address register key.

5. Press the start key. This places the address specified in the manual address switches in the B-address register.
6. Press the type key. This places the console and the system in read status and lights the white portion of the type key light.
7. Type data on the console I/O printer. Before each character sent is stored, that core-storage position is cleared of all bits, including the WM bit. The character can be sent with or without word marks, making the operation a type of manual load operation.
8. The operator ends the operation by pressing the release key. This key operation initiates a carrier-return and line-feed operation and releases the read-status interlock (which returns the system to normal processing), but does not insert a group-mark with word-mark in core storage.

Program-Initiated Input to the System

The stored program can set up a console-printer-to-core-storage transfer by executing a READ FROM 1447 CONSOLE instruction — M/L (%T0) (BBB) R. The A-address specifies the console printer. The B-address specifies the initial core-storage position of the area where the input data will be stored. The d-character R specifies a read operation, and turns on the white type light.

The console operator types the data on the console printer, and the characters enter core storage, beginning at the location specified by the B-address portion of the instruction.

If the operation takes place in the move mode (M Op-code), word marks cannot be entered from the console printer into core storage. Any word marks already in the area that accepts the message will remain there.

If the operation takes place in the load mode (L Op-code), word marks can be entered from the console printer into core storage when the word-mark key is pressed. Any word marks already in the area that accepts the message will be removed.

The operator enters a word mark by pressing the shift key and the word-mark key. The upper case (word-mark position) of the period key prints an inverted circumflex. The next character printed will enter a core-storage position and have a word mark associated with it.

The release key enters a group-mark with word-mark in core storage, stops the data transfer, and causes a carrier-return and line-feed operation. The stored program continues processing.

Console Inquiry

The following procedure is used to initiate a console-inquiry operation:

1. The operator presses the type key while the program is running. This sets the inquiry request (Q) latch in the system ON.
2. The stored program branches to the inquiry subroutine after it tests the Q-latch and finds it on.
3. The inquiry subroutine contains a READ FROM 1447 CONSOLE instruction — M/L (%T0) (BBB) R. The A-address specifies the console printer. The Q-latch is turned off and the white type light is turned on. The B-address specifies the initial core-storage position of the area where the console-inquiry data will be stored. The d-character R specifies a read operation.
4. The operator types the data on the console printer, and the characters enter core storage, beginning at the location specified by the B-address of the instruction. Word marks are handled as described under *Program-Initiated Input to System.*
5. When the complete inquiry message is correctly entered in core storage, the operator ends the operation by pressing the release key. This operation inserts a group-mark with word-mark in the next core-storage position, initiates a carrier-return and line-feed operation, and advances the system to the next instruction.

Input-Operation Check Conditions

The four check conditions that can occur during an input operation are:

1. Operator keying mistake
2. Input message exceeds core-storage area capacity
3. 1447-detected parity check
4. System-detected parity check.

Operator Keying Mistake

When the operator makes a keying mistake, he can instruct the system to disregard the message. This is accomplished by pressing the cancel key. The key operation sets the inquiry-clear (*) latch on in the system and turns on the red type light, inserts a C-bit in core storage, initiates a carrier-return and line-feed operation, and disconnects the printer from the system.

Input Message Overflow

When the input message exceeds the core-storage area capacity:

1. The group-mark with word-mark in core storage prevents any further data transfer.
2. The inquiry-clear (*) indicator in the system comes on.
3. The red type light on the console comes on.

1447-Detected Parity Error

A parity error detected by the 1447:

1. Turns on the inquiry-clear (*) indicator in the system.
2. Positively resets off the A-register error latch. Any parity error detected in the 1447 will reach the A-register and would, normally, turn on the error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.
3. Turns on the red type light on the console.

System-Detected Parity Error

A parity check detected by the A-register turns on the A-register error latch and stops the system. The parity is corrected, and the character is stored in core storage with the correct parity.

Console-Initiated Output from the System

The following procedure is used to set up a data transfer from the system:

1. Stop the machine.
2. Set the manual address switches to the initial address of the core-storage area that contains the data to be sent to the console.
3. Turn the mode switch to CHARACTER DISPLAY.
4. Press the B-address register key.
5. Press the start key. This places the address specified in the manual address switches in the B-address register.
6. Press the type key. This places the console and the system in a write status, and the printing operation begins automatically.
7. Printing continues until the stop key is pressed. Pressing this key also releases the write-status interlock, which allows the system to return to normal processing and returns the carrier to the left-hand margin, causing a line-feed operation.

Program-Initiated Output from the System

The stored program can set up data transfer from core-storage to the console I/O printer by executing a WRITE ON 1447 CONSOLE instruction M/L (%T0) (BBB) W. The A-address specifies the console printer and turns on the white type light. The B-address specifies the initial core-storage position of the data message that will be sent to the console printer. The d-character W specifies a write operation.

The data reads out of core storage, beginning at the address specified in the instruction and continuing until a group-mark with word-mark is encountered. The group-mark with word-mark ends the operation, but does not print. A carrier-return operation, with an associated line-feed operation, occurs, and the system advances to the next instruction.

If the end of a printed line is reached before the group-mark with word-mark is sensed, printing is suspended, and a carrier-return and line-feed operation is executed. When the carrier reaches the left-hand margin, the printout operation continues.

When a console-printer write operation is executed in the move mode, word marks are ignored. The character with an associated word mark is printed as a character only. Functional-control characters cause the specified carrier movement on the console printer, but the characters do not print.

When a console-printer write operation is executed in the load mode, the word marks are printed. The word mark (inverted circumflex) is printed before the associated character is printed. Functional-control characters are also printed. The carrier movement specified by the character does not occur when the write operation is executed in the load mode.

Output-Operation Check Conditions

The two check conditions that can occur during an output operation are:

1. System-detected parity check
2. 1447-detected parity check.

System-Detected Parity Error

A parity error detected by the B-register turns on the B-register error latch and stops the system at the end of the printout operation. The character in error is printed as an underscore (__).

1447-Detected Parity Error

A parity error detected by the 1447 circuitry:

1. Turns on the inquiry-clear (*) indicator in the system.

2. Turns on the red type light on the console.
3. Depending on the BCD coding involved, some other character may be printed.

Condition Indicators

Two indicators reflect the various system-1447 conditions that occur. The status of these indicators is checked by the system when it executes a BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character. The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

The Q-indicator normally signifies that the console I/O printer has a message to send to the system. The indicator turns on during a console-inquiry operation when the console operator presses the type key on the console.

*Inquiry-Clear (d-character *)*

This indicator and its associated red type light on the 1447 console turn on:

1. When the console operator makes a keying mistake and instructs the system to disregard the message (by pressing the cancel key).
2. When the input message exceeds the core-storage area capacity.
3. When the 1447 circuitry detects a parity check during the 1447-to-core-storage transfer.
4. When the 1447 circuitry detects a parity check during the core-storage-to-1447 transfer.

IBM 1447 Console, Model 3

The IBM 1447 Console, Model 3 (Figure 10), provides the 1401 system user with a fast means of communication. All the advantages of the IBM 1407 Console Inquiry Station, plus the increased printout speed of 14.8 characters per second, provides the console operator with an efficient and time-saving method of inquiry and reply.

Before the 1447, Model 3, can be attached to a 1401 system, the IBM 1409 Console Auxiliary (Figure 11) and the 1409 adapter special feature must be installed.

The Model 3 does not have the indicator panel or the operator panel. These panels are located on the 1401 processing unit. Several additional keys and lights, located on the printer keyboard, are used during I/O printer operations. The additional keys and lights are:

Proceed Light

The proceed light glows when the console I/O printer is selected to operate.

Check Light

The check light glows when the inquiry-clear indicator is turned on.

Reset Key

The reset key is used with the type key, on a 1447 Model 3 having buffer storage. The reset key is not required on the unbuffered model.

Alter Type-In Key

When the CPU mode switch is set to ALTER, this key must be pressed to allow storage entry of keyboard information. Characters enter storage starting at the address indicated by the B-storage address register.

Type Stop Key

This key is used to terminate a character-display type-out operation.

Type Key

During *manual* operation, the type key initiates a storage type-out operation, beginning with the address indicated by the CPU B-storage address register. The CPU mode switch must be in alter mode.

During *programmed* operation, the type key is used to perform the following functions.

Buffer: The type key initiates request to the buffer. CPU selection of the 1447 permits keyboard entry into the buffer. Press the release key to turn on the inquiry-request (Q) latch.

Buffer and Polling: The type key initiates a request to the buffer. Subsequent CPU selection of the 1447 being polled allows keyboard information to enter buffer storage.

Unbuffered: The type key turns on the inquiry-request (Q) latch. CPU selection (by a branch on Q and a read Op) allows the operator to enter information from the keyboard.

Unbuffered and Polling: This initiates the turn-on of the Q-latch when the 1447 is polled.

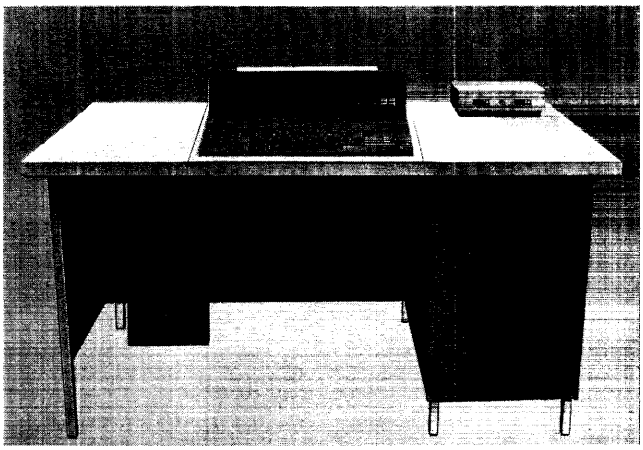


Figure 10. IBM 1447 Console, Model 3

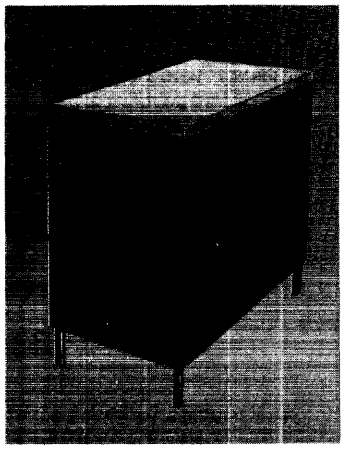


Figure 11. IBM 1409 Console Auxiliary

The IBM 1447 Console, Model 4, (Figure 12) has all the functions and capabilities of a 1447, Model 2, plus the lights, keys, and switches needed to operate an IBM 1448 Transmission Control Unit. This console can be attached to the IBM 1240, 1440, or 1460 systems.

With the 1448 attached to the system, the manual address switches and the power-on switch have additional functions. A new section of display lights on the indicator panel, a 1448 start-reset key, and a 1448 check-reset key are added to complete the necessary controls.

Manual Address

The two manual address switches (units and tens) address a given data or control character in core buffer. To do this, set the units and tens switches to the line number with which the character is associated (the inner numbers refer to the 1448). The control character for a given line can be addressed by setting the line number in the units and tens switches.

Power On/Off Switch

This switch turns the main power supply for the system and the 1448 off and on. The switch is operated upward to turn power off, and downward to turn power on. After being operated, the switch automatically returns to a central position.

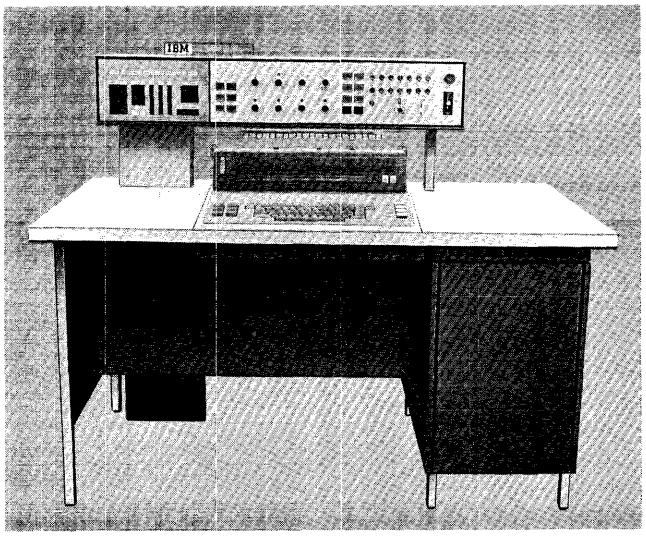


Figure 12. IBM 1447 Console, Model 4

Display Lights

These back-lighted indicators (Figure 13) provide information about the location and bit configuration of data as it stands in storage.

Status. This light comes on to indicate a parity error in status or an invalid-processor status. The other display lights in this column refer to the status of the system:

PAR (Parity)
TSM (Transmit)
REC (Receive)
ESA (End of Storage Area)
CTL (Control)
CK (Check)
IDL (Idle)
EOB (End of Block)
RDY (CPU is Ready)

Check. This light comes on to indicate a data parity error. The other display lights in this area include:

LRC comes on to indicate a longitudinal redundancy check at the end of a transmission.

OVL (Overflow) comes on to indicate that a 1448 buffer overflow occurred because the program exceeded the maximum allowable noninterruptable interval, or because of a processor-stop condition.

STATUS	CHECK
PAR	LRC
TSM	OVL
REC	RNG
ESA	OS
CTL	SQ 1
CK	SQ 2
IDL	REQ
EOB	INT
RDY	

Figure 13. Indicator-Panel Display Lights (1448)

RNG comes on when transmission of an invalid address occurred for the message-storage area.

OS (Out of Step) comes on to indicate that at the end of the scan operation, the 1448 was not at the last channel address.

SQ1 and SQ2 indicate the sequence of line-control operations

REQ (Request) indicates the request for interrupt is on.

INT (Power Interlock) comes on to indicate that power is not on, and that the dataset equipment for the addressed line is not ready to operate.

NOTE: For automatic-calling lines, the INT light will be on from the end of one call until the establishment of a connection to the remote terminal for the next call.

1448 Start-Reset Key

This key resets the complete IBM 1448 system.

1448 Check-Reset Key

This key resets the IBM 1448 error indicators.

IBM 1026 Transmission Control Unit

The IBM 1026 Transmission Control Unit is an economical means of entering numeric, alphabetic, and special-character data directly into the IBM 1240, 1401, 1440, or 1460 Data Processing Systems from a half-duplex multipoint communication line. As many as four 1026 units can be attached to a data processing system. Information can be transmitted on a half-duplex line in either direction, but in only one direction at a time. This IBM Tele-processing system component directs and regulates the flow of data, and provides compatibility among terminals and processing and exchange devices.

The 1026 transmission control unit operates with most of the controls that the IBM 1448 uses, except that it can handle only one line. The four instructions used are four of the instructions that are used with the IBM 1448 Transmission Control Unit:

ENABLE INTERRUPT

ENABLE INTERRUPT AND BRANCH

DISABLE INTERRUPT

DISABLE INTERRUPT AND BRANCH

When a 1026 is installed with a 1447, the following programming examples must be considered.

To write to the 1447 console:

```
WCONSO   SBR    EXITW+3    Save return to main line.
U6SEL    CU     6          Select 1026 channel.
         BIN    U6SEL, □   Branch if buffer busy.
         WCP    TYPEW      Write to console printer.
EXITW    B      0          Branch to main line.
TYPEW    DA     1X100, G   Typeout I/O storage area.
                1, 1
```

To read from 1447 console:

```
RCONSO   SBR    EXITR+3    Save return address to
                           main line.
W1       CU     6          Select 1026 channel.
         WCP    POLST      Poll the console.
         BIN    W1,*       Branch if error.
W2       CU     6          Select 1026 channel.
         BIN    R1, Q      Branch if service request.
         B      W2         Branch if no service re-
                           quest.
R1       RCP    TYPER      Read from console.
EXITR    B      0          Return to main line.
TYPER    DA     1X200, G   Type-in I/O area.
                1, 1
POLST    DCW    @A0@, G    Console polling list.
```

The polling count is stored in the first position of the read-in I/O area.

For additional information, refer to the SRL publications, *IBM 1026 Transmission Control Unit,* Form A24-3244, *IBM 1401 Data Processing System,* Form A24-3067, and *IBM 1440 Data Processing System,* Form A24-3116.

Sense Switches (Models 1, 2, 4)

Six additional sense switches can be installed. (Switch A is standard and is used to control last-card operations.) The six additional switches (B, C, D, E, F, and G) can provide external control over the stored program.

The BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character tests the specified switch setting and causes a branch to the I-address if the switch is on.

Pin-Feed Platen (Models 2, 3, 4)

A pin-feed platen is available for the 1447 in a choice of nine widths. The pin-to-pin widths are: 6, 7½, 8, 9, 10, 10⅛, 11¼, 11½, and 13⅛ inches. The maximum printing line for the 13⅛-inch platen is 128 characters (10 characters per inch).

1051 Model 1 Attachment

With this feature, it is possible to attach a modified IBM 1050 Data Communications System to a data processing system, through the IBM 1447 Console (Model 2, 3, or 4) attached to that processing system.

Besides the attachment feature, an IBM 1051 Control Unit, Model 1, is required. The modified 1050 system can contain these IBM 1050 components: two printers, one reader, and one punch.

1050 component operation is the same as in a 1050 system. Refer to *IBM 1050 Data Communications System* (A24-3020) for operational and special-feature information.

The reader-1 switch associated with the IBM 1051 must be set OFF to execute a *1050-system-to-processing-system operation.* The punch switch must be in the CPU position.

The reader-1 switch associated with the IBM 1051 must be set OFF to execute a *1050-system off-line operation.* The punch switch must be in the CPU position.

If the system sends a message to the 1050 system when the switches are set OFF:

1. The inquiry-clear (*) latch is set ON in the system.
2. The red type light is turned on.
3. The system advances to the next instruction.

Modified 1050-System Operation

There are two ways that the locally connected IBM 1050 components can act as input/output to the attached system. These operations are:

1. 1050-initiated input to the system.
2. Program-initiated output from the system.

1050-Initiated Input to the System

A 1050-initiated input to the system is accomplished when:

1. The operator readies the 1050 system.
2. A procedure located in the stored program polls the local station to see if it wants to send information to the system. The subroutine starts by executing a WRITE ON 1447 CONSOLE instruction — M (%T0) (BBB) W.

   When the local 1050-terminal system is attached to the system, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area that contains the terminal-component-identifying information. The d-character specifies a write operation.
3. The initial core-storage position specified in the WRITE instruction B-address contains an end-of-transaction © character (tape mark in BCD code).
4. The core-storage position next to the © position contains a letter B, which designates the local 1050 terminal.
5. The core-storage position next to the letter B contains a component-select code of zero.
6. The group-mark with word-mark in the core-storage position next to the zero ends the operation.
7. When the 1050 system is readied for sending and this *polling* instruction is executed, the inquiry-request (Q) indicator is set ON in the system, and the system is allowed to execute the next instruction.
8. The next instruction should be a BRANCH IF INQUIRY REQUEST INDICATOR ON — B (III) Q. The stored program branches to the inquiry subroutine after it tests the Q-latch and finds it on.

9. The inquiry subroutine contains a READ FROM 1447 CONSOLE instruction – M/L (%T0) (BBB) R. When IBM 1050 components are attached to a system through a 1447 console and the 1051, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area where the input data will be stored. The d-character specifies a read operation.
10. The Q-latch is turned off, and the white type light is turned on.
11. The operator starts to key information (or the reader unit starts automatically).
12. The input message is transmitted until a Ⓑ or Ⓒ character is received by the system. The Ⓑ is stored as a record mark in core storage; the Ⓒ is stored as a tape mark in core storage.
13. When either the Ⓑ or Ⓒ character is received, the operation ends, and the system is released and allowed to continue processing.

Note: When a modified 1050 system is attached to the system, the 1447 must also be polled before a 1447 request will be honored. The 1447 is identified by a letter A and the terminal component identifying message is Ⓒ A0 ≠ (ⒸA ≠ if buffered).

Input-Operation Check Condition

The one check condition that can occur during this operation is a detected parity check during the input-component-to-core-storage transfer.

A parity check detected during the input-component-to-core storage transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Positively resets the A-register error latch off. All detected parity checks will reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.

Program-Initiated Output from the System

An output from the system is accepted by one of the locally attached 1050 components when:

1. The stored program executes a WRITE ON 1447 CONSOLE instruction – M/L (%T0) (BBB) W. When IBM 1050 components are attached to a system through the 1447, the A-address specifies the inquiry channel. The B-address specifies the initial core-storage position of the area that contains the output data to be sent. The d-character specifies a write operation.
2. The initial core-storage position specified in the WRITE instruction contains an address select Ⓢ character (comma in BCD code).
3. The core-storage position next to the Ⓢ position is a letter B, which designates the local 1050 system.
4. The core-storage position next to the letter B contains a home-component select code. Refer to *IBM 1050 Data Communications System* (A24-3020) for details.
5. The core-storage position next to the home-component select code contains a Ⓓ character (pound sign in BCD code).
6. The text follows the Ⓓ character in core storage, and is transmitted to the output unit(s) until a group-mark with word-mark is sensed in core storage.
7. The group-mark with word-mark ends the operation and the stored program continues processing.

Note: If the initial core-storage position (Step 2) does not contain the address select character, the contents of the specified core-storage area will print out on the console printer. The group-mark with word-mark at the end of the area will end the operation.

Output-Operation Check Conditions

The two check conditions that can occur during an output operation are:

1. A system-detected parity check.
2. A detected parity check during the core-storage-to-output-component transfer.

System-Detected Parity Check. A parity check detected by the system B-register turns on the B-register error latch and stops the system. The rest of the message is transmitted.

Core-Storage-to-Output-Component Transfer Error. A parity check detected during the core-storage-to-output-component transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Prints or punches whatever character the BCD coding specifies.
4. Parity is automatically corrected, and the character is stored.

Condition Indicators

Two indicators reflect the IBM 1050 component core-storage conditions that occur. The status of these indicators is checked by the system when it executes a

BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character. The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

This indicator is set ON when the 1050 system has been readied, and a 1050-initiated input to the system is begun.

*Inquiry-Clear (d-character *)*

This indicator and its associated red type light on the 1447 console are turned on:

1. When a parity check is detected during the input-component-to-core-storage transfer.
2. When a parity check is detected during the core-storage-to-output-component transfer.

Buffer Feature

The buffer feature provides the attached system with a buffered area between the system and the attached IBM 1447 Console. It can also act as a buffer between a local 1050 system and up to 25 distant IBM 1050 Data Communications Systems.

This feature is a 210-position buffer located between the 1447 console and the attached system core storage. All data transmitted between core storage and the 1447 passes through the buffer. Input data enters the buffer from the various input components, and then moves into core storage under stored-program control. (The stored program continues processing until all the input data is in the buffer.)

The stored program transfers output data from core storage to the buffer. It is then automatically sent to the specified output component. While the buffer-to-output-component operation is taking place, the stored program is free to continue processing.

There is one way that the console I/O printer acts as an input to the attached system and one way that either the console I/O printer or the other attached output units act as an output from the system. The operations are:

1. Console-inquiry operation
2. Program-initiated output from system.

Console-Inquiry Operation

The following procedure is used to initiate a console inquiry operation and then cause the data transmission to take place:

1. The console operator presses the type key while the program is running.
2. The white type key light comes on when the buffer is ready to accept the inquiry data.
3. The keyboard unlocks when the white type light comes on.
4. The buffer-busy indicator is also set ON when the white type light comes on.
5. The console operator types the data on the console printer, and the characters enter the buffer area.
6. The console operator ends the operation by pressing the release key. This:
   a. Inserts a group-mark with word-mark in the next sequential position of the buffer (if less than 209 characters have been sent to the buffer).
   b. Initiates a carrier-return and line-feed operation.
   c. Turns off the white type light.
   d. Locks the keyboard.
   e. Sets the inquiry-request (Q) latch ON in the system.
7. The stored program branches to the inquiry subroutine after it tests the Q-latch and finds it on.
8. The inquiry subroutine contains a READ FROM 1447 CONSOLE instruction — M/L (%T0) (BBB) R. The A-address specifies the buffer. The B-address specifies the initial core-storage position of the area where the data from the buffer will be stored. The d-character specifies a read operation.
9. The data transfer begins automatically and continues until either:
   a. The group-mark with word-mark in the specified core-storage area is sensed, or,
   b. A group-mark with word-mark in the buffer is sensed.
10. When the group-mark with word-mark is sensed:
    a. The operation ends.
    b. The buffer-busy indicator is turned off.
    c. The system advances to the next instruction.

Inquiry-Operation Check Conditions

The five check conditions that can occur during console-inquiry operation are:

1. Console operator keying mistake.
2. 1447- or buffer-detected parity check during a 1447-to-buffer transfer.
3. Buffer-detected parity check during buffer-to-core storage transfer.

4. System-detected parity check.
5. Input message exceeds core-storage area capacity.

Operator Keying Mistake. When the console operator makes a keying mistake, the system is instructed to disregard the message. This is accomplished when the operator presses the cancel key. The key operation:

1. Sets the inquiry-clear (*) latch on in the system when the message transfers from the buffer to the system.
2. Turns on the red type light on the console.
3. Inserts a C-bit in core storage.
4. Initiates a carrier-return and line-feed operation.
5. Disconnects the printer from the system.

1447- or Buffer-Detected Parity Check during 1447-to-Buffer Transfer. A parity check detected by the 1447 or buffer circuitry during the 1447-to-buffer transfer:

1. Turns on the inquiry-clear indicator in the system.
2. Turns on the red type light on the console.

Buffer-Detected Parity Check during Buffer-to-Core-Storage Transfer. A parity check detected by the buffer circuitry during the buffer-to-core-storage transfer:

1. Turns on the inquiry-clear indicator in the system during the buffer-to-core-storage transfer.
2. Turns on the red type light on the console.
3. Positively resets off the A-register error latch. All detected parity checks reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off, and the system does not stop.

System-Detected Parity Check. A parity check detected by the A-register turns on the A-register error latch and stops the system. The parity is corrected, and the character is stored in core storage with the correct parity.

Input Message Overflow. When the input message exceeds the core-storage-area capacity:

1. The group-mark with word-mark in core storage ends the message transfer.
2. The inquiry-clear indicator in the system comes on.
3. The red type light on the console turns on.

Program-Initiated Output from the System

The following procedure is used to set up a program-initiated output from the system (could be an inquiry reply), and then causes the data transmission to take place:

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M/L (%T0) (BBB) W. The A-address specifies the buffer, and turns on the white type light. The B-address specifies the initial core-storage position of the area that contains the output data to be sent. The d-character specifies a write operation.

   The buffer-busy indicator should be tested with a branch instruction (d-character □) before executing a write instruction.
2. The data reads out of core storage, beginning at the address specified in the instruction, and reads into the buffer until a group-mark with word-mark is encountered. (The group-mark with word-mark is transferred to the buffer.) The buffer-busy indicator comes on at the beginning of the data transfer.
3. As soon as the core-storage-to-buffer data transfer is completed, the system is released so that it can continue processing, and the printout operation starts automatically.
4. The printout operation continues until the group-mark with word-mark in the buffer is encountered.
5. The group-mark with word-mark ends the printout operation, but does not print.
6. A carrier-return, and associated line-feed, operation occurs.
7. The buffer-busy indicator turns off.
8. The white type light turns off.

Output-Operation Check Conditions

The five check conditions that can occur during an output operation are:

1. System-detected parity check.
2. Buffer-detected parity checks during core-storage-to-buffer transfer.
3. Message in core storage exceeds buffer capacity.
4. Buffer-detected parity check during buffer-to-1447 transfer.
5. 1447-detected parity check during buffer-to-1447 transfer.

System-Detected Parity Check. A parity check detected by the system B-register turns on the B-register error latch and stops the system. The message is not printed.

Buffer-Detected Parity Check during Core-Storage-to-Buffer Transfer. A parity check detected by the buffer circuitry during the core-storage-to-buffer transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. The message printout operation does not occur.

Output Message Overflow. A core-storage message that exceeds buffer capacity:

1. Turns on the inquiry-clear indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. The message printout operation does not occur.

Buffer-Detected Parity Check during Buffer-to-1447 Transfer. A parity check detected by the buffer circuitry during the buffer-to-1447 transfer:

1. Turns on the inquiry-clear indicator in the system when the check is detected. (The buffer-busy indicator remains on, and the inquiry-request indicator is turned on.)
2. Turns on the red type light on the console.
3. Prints the character that caused the parity check as an underscore (_).

1447-Detected Parity Check during Buffer-to-1447 Transfer. A parity check detected by the 1447 circuitry during the buffer-to-1447 transfer:

1. Turns on the inquiry-clear indicator in the system when the check is detected. (The buffer-busy indicator remains on, and the inquiry-request indicator is turned on.)
2. Turns on the red type light on the console.
3. Prints whatever character the BCD coding specifies.

Condition Indicators

Three indicators reflect the various 1447-buffer conditions that occur. The status of these indicators is checked by the system when it executes a BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character. The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

The Q-indicator is normally used to signify that the inquiry message is in the buffer and is waiting for further processing. The indicator is turned on:

1. When the release key is pressed (after the buffer is loaded).
2. During a printout operation when a parity-check condition is detected during the operation. The buffer-busy indicator remains on, and the inquiry-clear indicator is also turned on.

Either the next READ CONSOLE or the next WRITE CONSOLE instruction will turn the latch off.

Buffer-Busy (d-character □)

This indicator is turned on:

1. Whenever data is transferred into, transferred out of, or stored in, the buffer.
2. Whenever the inquiry-request (Q) indicator is on.

The indicator is automatically set OFF at all other times.

This indicator should be tested before executing a WRITE instruction.

*Inquiry-Clear (d-character *)*

This indicator and its associated red type light on the 1447 console are turned on:

1. During the 1447-to-buffer message transfer when a 1447- or buffer-detected parity check occurs.
2. During the buffer-to-core-storage message transfer after the operator initiates a cancel operation.
3. During the buffer-to-core-storage transfer when the input message exceeds the core-storage-area capacity.
4. During the core-storage-to-buffer message transfer when the buffer circuitry detects the parity check.
5. When the message in core storage exceeds the buffer capacity.
6. During the buffer-to-1447 message transfer when either the 1447 or the buffer circuitry detects the parity check. (In this instance, the buffer-busy indicator remains on and the inquiry-request indicator is turned on.)

The specific condition is determined by the branch instruction placement in the stored program.

Remote-Terminal Attachment Feature (Unbuffered)

This feature allows the attachment of up to 24 remote-located IBM 1050 Data Communications Systems to the attached data processing system. With the appropriate dataset equipment, information can be transmitted in either direction on a half-duplex line, but in only one direction at a time.

This remote terminal attachment enables the data processing system to transmit data to, and accept transmitted data from, a number of outlying locations. Thus, the data processing system becomes a central processing point for all the remote stations on the communications line.

See *General Information, Remote Terminal Attachment Feature* and *Programming Considerations* sections.

Polling with the Remote-Terminal Attachment

Each terminal is given the opportunity to transmit data to the system. This method of transmission control permits stations on the line to transmit without competing for the line. Only one-block messages are allowed.

Each remote terminal is assigned a letter (C-Z). The 1447 is assigned the letter A, the local terminal is assigned the letter B. Each input component at each terminal is assigned a numeric component-select code.

The following procedure is used to initiate a polling operation:

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M (%T0) (BBB) W. When remote terminals are attached to the system, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area that contains the terminal-component identifying information. The d-character specifies a write operation.
2. The inital core-storage position contains an end-of-transmission (C) character (tapemark in BCD code). The core-storage position next to the (C) position contains the letter that identifies which of the 26 possible terminals will be involved in the operation. The core-storage position next to the terminal-identification position contains a zero that selects any input component at the specified terminal. A group-mark with word-mark follows the component-select code position.
3. The write operation moves this data onto the line, and the stored program suspends operation to wait for a response from the terminal.
4. When the stored program receives the affirmative response, the system is released and allowed to execute the next instruction. The inquiry-request (Q) indicator is also set on at this time.
5. The stored program branches to the inquiry subroutine after it tests the Q-latch and finds it on.
6. The inquiry routine contains a READ FROM 1447 CONSOLE instruction -- M (% T0) (BBB) R. When remote terminals are attached to the system, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area where the input data from the specified terminal component will be stored. The d-character specifies a read operation.
7. The input is transmitted from the specified terminal component until either an end-of-block (B) or an end-of-transmission (C) character is received by the system. (C) prevents the LRC, but does not set the inquiry-clear indicator.
8. When the (B) character is received, a longitudinal redundancy check (LRC) operation is executed.
9. If the LRC operation is executed satisfactorily, the terminal is disconnected and released from the line.

   If the LRC operation is not executed satisfactorily, the terminal is disconnected and released from the line, and the inquiry-clear (*) indicator in the system is turned on.

   After the LRC compare, a (D) is sent to the remote terminal whether or not an LRC error exists.

Notes: If the initial core-storage position (Step 2) did not contain an end-of-transaction (C) character, but contained an address select (S) character followed by the letter B, then one of the local IBM 1050 components will be involved in the operation. If this core-storage position does not contain a (C) or an (S), the contents of the specified core-storage area will print out on the console printer. A group-mark with word-mark at the end of the area will end the operation.

If no response, or any response other than an affirmative response (Step 4), was received from the terminal component, the system is released, and the inquiry-request indicator remains off. The procedure is repeated to poll each terminal.

Polling-Operation Check Conditions

The check conditions that can occur during the read portion of a polling operation are:

1. A detected parity check during the remote-terminal input-component-to-core-storage transfer.
2. An LRC check condition to the LRC operation.
3. A time-out condition occurs.

Input-Component-to-Core-Storage Transfer Error. A parity check detected during the remote-terminal input-component-to-core-storage transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Positively resets the A-register error latch off. All detected parity checks reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.

LRC Check Condition to an LRC Operation. A negative response to an LRC operation:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.

Time-Out Condition. Provisions are made to disconnect the remote terminal and allow the processor to proceed, if the elasped time between two successive characters exceeds 15 seconds. This condition turns on both the inquiry-clear (*) indicator and the red type light on the console.

Addressing with the Remote-Terminal Attachment

When the system addresses a terminal, it calls to determine if the specified terminal component(s) is ready to accept a message.

Each remote terminal is assigned a letter (C-Z). The 1447 is assigned the letter A, the local terminal is assigned the letter B. Each output component of each terminal is assigned a numeric component-select code.

The following procedure is used to initiate an addressing operation, and then cause the data transmission to take place.

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M (%T0) (BBB) W. When remote terminals are attached to the system, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area that contains the terminal-component identifying information. The d-character specifies a write operation.
2. The initial core-storage position contains an address-select Ⓢ character (comma in BCD code).
3. The core-storage position next to the Ⓢ position contains the letter that identifies which of the 26 possible terminals will be involved in the operation.
4. The core-storage position next to the terminal identifying letter contains a component-select code. Refer to *IBM 1050 Data Communications System* (A24-3020) for details.

   After the stored program moves this data onto the line, it suspends operation and awaits a response from the remote terminal to determine if the I/O device is in a ready state. An affirmative response will allow the processor to transmit the message. (See *Note* following this section).
5. The core-storage position next to the component-select code contains a Ⓓ character.
6. The text follows the Ⓓ character in core storage, and is transmitted to the output unit(s) until an EOB Ⓑ character is sensed in core storage.
7. The EOB Ⓑ causes a longitudinal redundancy check (LRC) operation to be executed.
8. The group-mark with word-mark ends the operation, and the stored program continues processing.

Note: If the initial core-storage position (Step 2) did not contain an address-select Ⓢ character, the contents of the specified core-storage area will print out on the console printer. A group-mark with word-mark at the end of the area will end the operation.

If no response, or any response other than an affirmative response (Step 4), was received from the terminal component, the line is disconnected and the system is released and allowed to continue processing and an error is indicated.

Addressing-Operation Check Conditions

The check conditions that can occur during an addressing operation are:

1. A system-detected parity check.
2. A detected parity check during the core-storage-to-terminal output-component transfer.
3. Addressed device not ready.
4. A negative response, or no response, to the LRC operation.

System-Detected Parity Check. A parity check detected by the system B-register turns on the B-register error latch and stops the system at the end of the printout operation.

Core-Storage-to-Terminal Output-Component Transfer Error. A parity check detected during the core-storage-to-terminal output-component transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Prints or punches whatever character the BCD coding specifies. (Even parity causes a hyphen to print, or an X-zone character to punch.)

Addressed Device not Ready. If no response, or any response other than affirmative, was received from the terminal component, the line is disconnected, and the system is released and allowed to continue processing. This condition turns on the inquiry-clear indicator (*) and the red type light on the console.

Negative Response or No Response to LRC. Any response, other than affirmative, to an LRC operation, causes the inquiry-clear indicator and red type light to come on.

Condition Indicators

Two indicators reflect the various system-terminal conditions that occur. The status of these indicators is checked by the system when it executes a BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character. The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

The Q-indicator is normally used to signify that an input component has a message to send to the system. The indicator is turned on during a polling operation when the system receives an affirmative response from the polled input component.

*Inquiry-Clear (d-character *)*

This indicator and its associatd red type light on the 1447 console are turned on:

1. When a parity check is detected during the terminal input-component-to-core-storage transfer.
2. When a negative response results from an LRC operation at the end of the input-message transfer.
3. When a parity check is detected during the core-storage-to-terminal input-component transfer.
4. Polling time-out condition.
5. Addressed device not ready.
6. Negative result from LRC at the end of addressing or polling.

Remote-Terminal Attachment Feature (Buffered)

When the buffer feature and the remote-terminal attachment feature are combined, there are several changes in the operation. These changes are discussed in the polling and addressing operations.

See *Programming Considerations* and *General Information, Remote-Terminal Attachment Feature* sections.

Polling Terminals (with Buffer)

Instead of having to poll each terminal input unit separately, the system can poll all the terminal input units in one operation. This is accomplished by using a polling list, which is a series of letters corresponding to the terminals in their polling sequence. The polling list starts with a Ⓒ character and ends with a group-mark with word-mark. Each terminal is assigned a letter (A-Z). The 1447 is assigned the letter A, the local terminal is assigned the letter B, and the remote terminals are assigned the letters C-Z.

The following procedure is used to initiate a polling operation:

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M (% T0) (BBB) W. When the buffer is between the system and the I/O units, the A-address specifies the buffer, instead of the console printer. The B-address specifies the initial core-storage position of the area that contains the polling list. The d-character specifies a write operation.
2. The initial core-storage position contains an end-of-transaction Ⓒ character (tapemark in BCD code). The core-storage position next to the Ⓒ position contains the letter that identifies which one of the 26 possible terminals will be polled first. The following core-storage positions contain the other terminals to be polled with a Ⓒ character preceding each terminal letter. A group-mark with word-mark follows the last terminal select position. For example: Ⓒ A Ⓒ B Ⓒ C ≡.
3. The write operation moves the polling list into the buffer until a group-mark with word-mark is sensed.
4. The group-mark with word-mark stops the polling-list transfer and releases the system so it can continue processing.
5. The polling operation automatically begins as soon as the complete polling list arrives in the buffer. Each terminal is called to permit the terminal to transmit data to the system. The Ⓒ that begins the polling list automatically moves onto the transmission line. The first terminal-identifying letter in the polling list follows the Ⓒ onto the line and is, in turn, followed by a buffer-generated zero. After transmitting these three characters, the buffer suspends operation until it receives a response, or the two-second time-out occurs.

6. When the buffer receives the affirmative response, the buffer automatically erases the polling list, and moves the terminal-identifying character into buffer-position one. The buffer then begins to accept the message from the terminal. The message transfer continues until an end-of-block (B) character is received by the buffer.
7. When the (B) is received:
   a. The inquiry-request (Q) indicator is set ON in the system, and the associated character is placed in the buffer. The terminal component is not released from the line at this time.
   b. A longitudinal redundancy check (LRC) operation is executed.
8. When the LRC operation is executed satisfactorily, the terminal is disconnected and released from the line, and a (D) answer is sent.
   If the LRC operation is not executed satisfactorily, the terminal is disconnected and released from the line, and the inquiry-clear indicator in the system will be turned on during the buffer-to-core-storage message transfer.
9. A BRANCH IF INQUIRY REQUEST INDICATOR ON instruction must be executed so that the stored program will branch to the inquiry subroutine and transfer the message in the buffer.
10. The inquiry subroutine executes a READ FROM 1447 CONSOLE instruction — M (%T0) (BBB) R. When a buffer is between the system and the I/O units, the A-address specifies the buffer instead of the console printer. The B-address specifies the initial core-storage position of the area where the message data from the buffer will be stored. The d-character specifies a read operation.
11. The message from the 1447 console is transmitted from the buffer until either a group-mark with word-mark is sensed in core storage or a record mark is sent from the buffer.
12. The polling operation ends, and the system is released and allowed to continue processing.

Notes:

1. If the initial core-storage position (Step 2) did not contain an end-of-transaction (C) character, but contained an address select (S) followed by the letter B, one of the local IBM 1050 components will be involved in the operation. If this core-storage position does not contain a (C) or a (S), then the contents of the specified core-storage area will print out on the console printer. A group-mark with word-mark at the end of the area will end the operation.
2. No response, or any response other than an affirmative response (Step 6), causes the buffer to go to the next terminal-identifying letter in the polling list. When the end of the polling list is reached, the buffer automatically goes back to the beginning of the polling list.
3. After the complete message is correctly received in the system (Step 11), the polling list must be sent back to the buffer, because it has been erased in buffer (Step 6).

Polling-Operation Check Conditions

The check conditions that can occur during this operation are:

1. A detected parity check during the terminal-input component-to-buffer transfer.
2. An LRC check condition to an LRC operation.
3. A buffer-detected parity check during the buffer-to-core-storage transfer.
4. A system-detected parity check.
5. The input message exceeds core-storage-area capacity.
6. A time-out condition.

Terminal-Input Component-to-Buffer Transfer Error. A parity check detected during the terminal input component-to-buffer transfer:

1. Turns on the inquiry-clear (*) indicator in the system during the buffer-to-core-storage transfer.
2. Turns on the red type light on the console.
3. Positively resets the A-register error latch off. All detected parity checks reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.

LRC Check Condition. A negative response to an LRC operation:

1. Turns on the inquiry-clear indicator in the system when the check is detected.
2. Turns on the red type light on the console.

Buffer-Detected Parity Check during the Buffer-to-Core-Storage Transfer. A parity check detected by the buffer circuitry during the buffer-to-core-storage transfer:

1. Turns on the inquiry-clear indicator in the system during the buffer-to-core-storage transfer.
2. Turns on the red type light on the console.
3. Positively resets the A-register error latch off. All detected parity checks reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.

System-Detected Parity Check. A parity check detected by the A-register turns on the A-register error latch and stops the system. The parity is corrected, and the character is stored in core storage with the correct parity.

Input-Message Overflow. When the input message exceeds the core-storage-area capacity:

1. The group-mark with word-mark in core storage ends the message transfer.
2. The inquiry-clear (*) indicator in the system comes on.
3. The red type light on the console turns on.

Time-Out Condition. Provisions are made to disconnect the remote terminal and allow the processor to proceed, if the interval between two successive characters exceeds 15 seconds. This condition turns on the inquiry-clear indicator and the red type light on the console.

Addressing Terminals (with Buffer)

When the system addresses a terminal, it calls to determine whether the specified terminal component is ready to accept a message. Each terminal is assigned a letter (B-Z). The letter B is reserved to designate the local terminal. Each output component of each terminal is assigned a numeric component-select code.

The following procedure is used to initiate an addressing operation and then cause the data transmission to take place.

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M (%T0) (BBB) W. The A-address specifies the buffer. The B-address specifies the initial core-storage position of the area that contains the terminal-component identifying information. The d-character specifies a write operation.
2. The initial core-storage position contains an address-select (S) character (comma in BCD code). The core-storage position next to the (S) position contains the letter that identifies which one of the 25 possible terminals will be involved in the operation. The core-storage position next to the terminal-identification position contains the digit that specifies which output component at the specified terminal will be involved in the operation. A (D) character follows the component-select code, and the data follows the (D) character. The data is followed by a group-mark with word-mark.
3. The write operation moves this data into the buffer. The data transfer continues until a group-mark with word-mark is sensed.
4. The group-mark with word-mark is stored in the buffer, and the data transfer ends.
5. As soon as the complete message is correctly stored in the buffer, the system is released so it can continue processing.
6. At the same time as Step 5, the buffer automatically moves the terminal-identifying information onto the transmission line, and then suspends operation until it receives a response.
7. When the buffer receives the affirmative response, the data transmission to the specified terminal component begins. The data transmission continues until a group-mark with word-mark in the buffer is sensed.
8. Before the group-mark with word-mark is sensed, a (B) initiates a longitudinal redundancy check (LRC) operation.

   If the LRC operation is not executed satisfactorily, the inquiry-clear (*) and the inquiry-request (Q) indicators in the system are set ON. (The buffer-busy indicator remains ON.)

   If the LRC operation is executed satisfactorily, the buffer-busy indicator is turned off.
9. The group-mark with word-mark :
   a. Ends the operation.
   b. Releases the terminal.

Notes:

1. The buffer-busy indicator should be tested before executing a WRITE instruction (Step 1). This test indicates whether the buffer is already busy accepting an input message.
2. If the initial core-storage position does not contain an (S), the contents of the specified core-storage area will print out on the console printer. A group-mark with word-mark at the end of the area will end the operation.
3. If no response, or any response other than an affirmative response (Step 7), was received from the terminal component, the line is disconnected, and the system is released and allowed to continue processing.

Addressing-Operation Check Conditions

The six check conditions that can occur during an addressing operation are:

1. A system-detected parity check.
2. A buffer-detected parity check during core-storage-to-buffer transfer.
3. A message in core storage exceeds the buffer capacity.
4. A detected parity check during buffer-to-terminal output-component transfer.
5. A negative or no response to an LRC operation.
6. A negative response to the address.

System-Detected Parity Check. A parity check detected by the system B-register turns on the B-register error latch and stops the system. The message is not printed.

Buffer-Detected Parity Check during Core-Storage-to-Buffer Transfer. A parity check detected by the buffer circuitry during the core-storage-to-buffer transfer:

1. Turns on the inquiry-clear indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Sets up the circuitry that stops the message transfer operation.

Output-Message Overflow. A core-storage message that exceeds buffer capacity:

1. Turns on the inquiry-clear indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Sets up the circuitry that stops the message-transfer operation.

Buffer-to-Terminal Output-Component Transfer Error. A parity check detected during the buffer-to-terminal output-component transfer:

1. Turns on the inquiry-clear indicator in the system when the check is detected. (The buffer-busy indicator remains on, and the inquiry-request indicator is turned on.)
2. Turns on the red type light on the console.
3. Prints or punches whatever character the BCD coding specifies.

Negative or No Response to an LRC Operation. A negative response to an LRC operation:

1. Turns on the inquiry-clear and inquiry-request indicators in the system. (The buffer-busy indicator also remains on.)
2. Turns on the red type light on the console.

Condition Indicators

Three indicators reflect the various system remote-terminal conditions that occur. The status of these indicators is checked by the system when it executes a BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character.

The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

The Q-indicator is normally used to signify that an input component has a message to send to the system. The indicator is turned on:

1. During a polled operation when the buffer receives a (B) from the polled-terminal input component.
2. When a parity check is detected by the buffer circuitry during the buffer-to-terminal output-component transfer. (The inquiry-clear indicator is turned on.)
3. When a negative response to an LRC operation occurs.

Buffer-Busy (d-character □)

This indicator is turned on:

1. Whenever data is transferred into, transferred out of, or stored in, the buffer.
2. During the buffer-to-terminal output-component transfer, and remains on if a negative response to an LRC operation occurs.
3. Whenever the inquiry-request indicator is on.

Note: If a BRANCH IF BUFFER BUSY INDICATOR ON instruction is executed during a polling operation, the polling operation ends before the next terminal is polled.

*Inquiry-Clear (d-character *)*

This indicator and its associated red type light on the 1447 console are turned on:

1. During the buffer-to-core-storage transfer after a parity check is detected during the terminal-input component-to-buffer transfer.
2. During the buffer-to-core-storage transfer after a negative response results from an LRC operation at the end of the input-message transfer.
3. When a buffer-detected parity check occurs during the buffer-to-core-storage message transfer.
4. When the input message exceeds the core-storage-area capacity.
5. When a parity check is detected by the buffer circuitry during the core-storage-to-buffer transfer.
6. When the message in core storage exceeds the buffer capacity.
7. When a parity check is detected by the buffer circuitry during the buffer-to-terminal output-component transfer.
8. When a negative response to an LRC operation occurs.

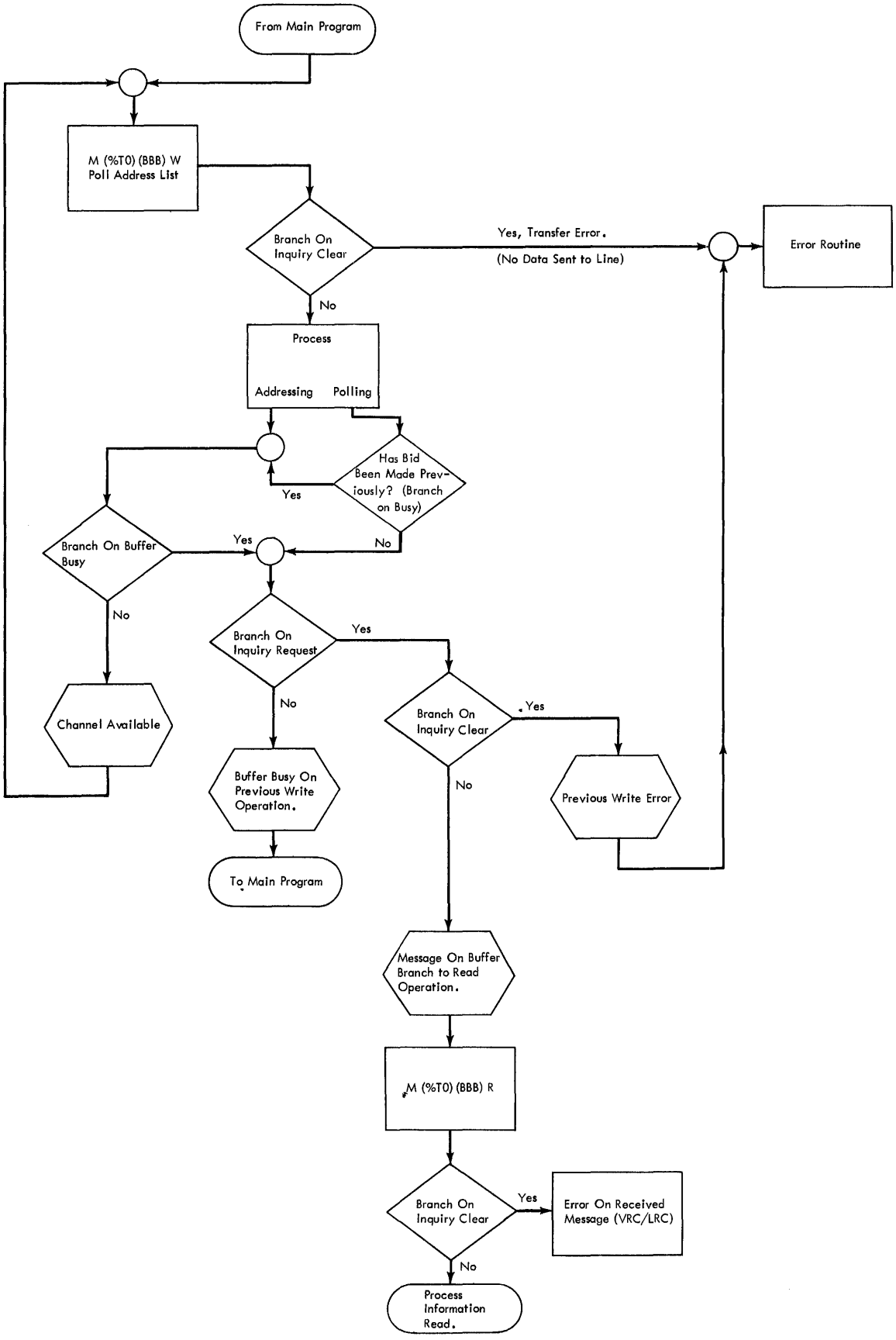


Figure 14. Programming Routine

Programming Routine

Figure 14 illustrates a typical program segment for use with an IBM 1447 having remote terminals attached.

Programmed-Write to a Terminal

Figure 15 shows the general functions of a programmed-write to a terminal. The following list refers to the flowchart numbers that appear in the figure.

1. Core-storage-to-buffer transfer, using the instruction — M (%T0) (BBB) W. The buffer-busy indicator (□) is turned on at the end of the instruction. The inquiry-request (Q) indicator is reset OFF, if it had been ON. The inquiry-clear (*) indicator must have been reset OFF before the transfer operation begins. The BBB field appears as follows:

   Ⓢ D9 Ⓓ text EOB ≠

   For the console first-character, the circle-S character will be deleted, and text will start immediately.

2. CPU-to-buffer transfer error.

2.1 Disconnect inquiry channel on CPU-to-buffer transfer error. (Message not sent to the terminal.) The buffer-busy (□) indicator is reset OFF, and the inquiry-clear (*) indicator is set ON. The inquiry-clear (error) indicator can be reset by a BRANCH ON ERROR instruction to step 1.

3. Branch if the terminal is not ready. The address (Ⓢ D9) is sent to determine if the terminal is on-line and ready to receive. The circle-S is actually changed to a circle-C, and the Ⓒ is then sent to the terminal.

4. Buffer-to-terminal transfer. If the terminal is ready, the message (Ⓓ text EOB LRC character) can be sent. *Note*: A vertical redundancy check (VRC) can set the error indicator before the end of the message. The LRC is made after the EOB.

5. Branch if VRC or LRC error. If an error occurred, branch to disconnect terminal. The terminal sends an Ⓝ character at this time.

5.1 Disconnect inquiry channel and set the inquiry-clear (error) and inquiry-request indicators ON. The buffer-busy indicator remains on. *Note:* The status indicators are reset as follows:

Buffer-Busy: By resetting Q

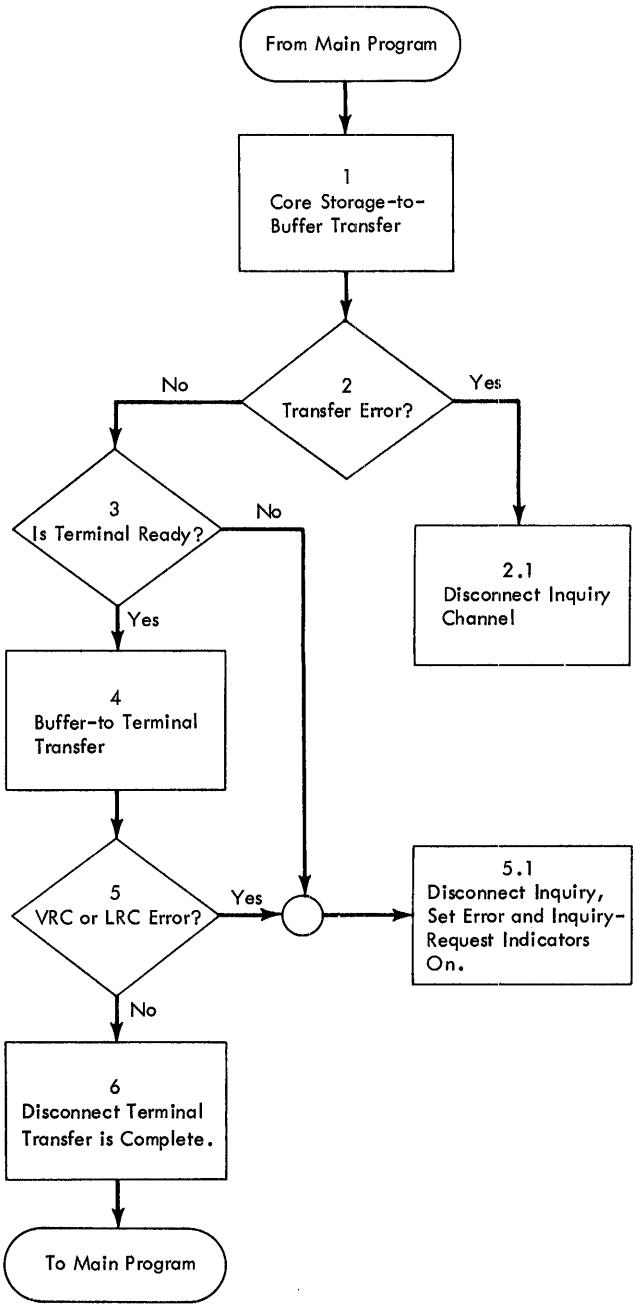


Figure 15. Programmed Write to a Terminal

Inquiry-Request: By the next inquiry read or write operation.

Inquiry-Clear (error): By the next BRANCH ON ERROR instruction.

6. If there was no error in this phase of the transmission, the message transfer is satisfactorily complete. The inquiry channel is disconnected, and the buffer-busy indicator is reset. *Note:* No indicators are left ON. The terminal sends a (Y) character to indicate that it has satisfactorily received a complete message. The terminal must be re-polled if more text is to follow.

Polling and Receiving Operation

Figure 16 is a flowchart of a polling and receiving operation. The following list refers to the flowchart numbers that appear in the figure.

1. Load polling list and transfer core-storage data to the buffer, using the instruction: M (%T0) (BBB) W. The buffer-busy indicator is turned on during this operation. The BBB field is:

   (C) C (C) D - - - - (C) Z≠

2. Branch on error, CPU-to-buffer transfer.

2.1 Disconnect the inquiry channel. Inhibit polling. Discontinue branching to polling routine. Reset the buffer-busy indicator, and set the inquiry-clear (error) indicator. The error indicator can then be reset by a BRANCH ON ERROR instruction.

3. The 1447 sends out the next polling address in the form: (C) D 0 - - - - etc. Branch on terminal response (or lack of it).

3.1 (N) answerback character, or time-out condition if there is no response.

3.2 Program bid. If the program specifies termination of polling, it would now execute a BRANCH ON BUFFER BUSY instruction.

3.3 Polling is terminated after (N) or a time-out condition to polling occurs. The inquiry-channel and the buffer-busy indicators are reset. *Note:* An additional BRANCH ON BUFFER BUSY instruction is necessary to insure that the channel has been completely disconnected, before it is reused.

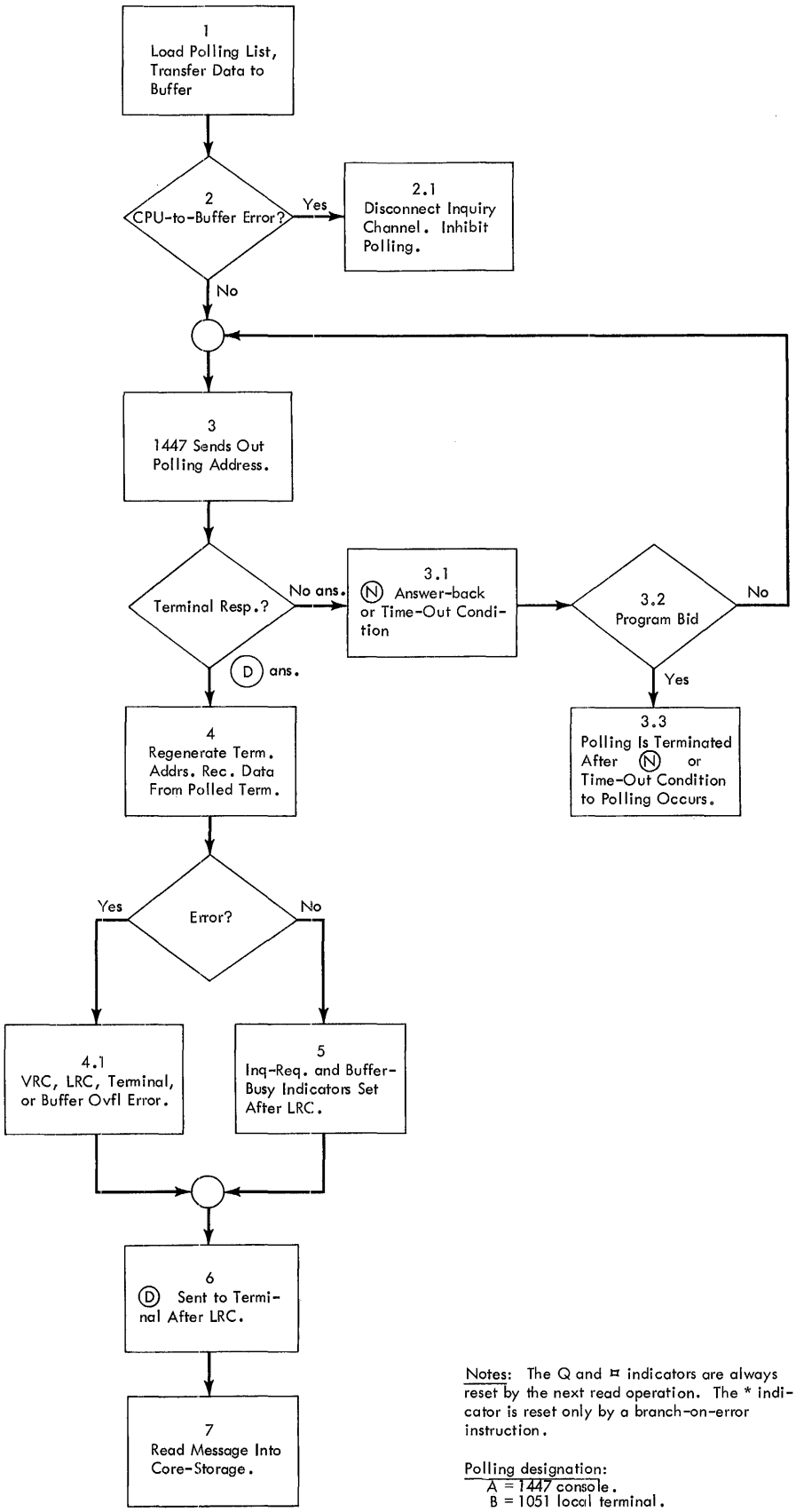
4. The terminal address is regenerated in the first position of the buffer (replacing the (C) character in the buffer. The terminal should send a (B) character at the end of the message. If a (C) character is sent, there will be no LRC. The (C) character *does not* set the error indicator. The program must test for this condition.
   Receive data from the polled terminal.
   Branch on transmission error.

4.1 VRC, LRC, terminal, or buffer-overflow error conditions. Inquiry-request and buffer-busy indicators are set ON at the end of the message. *Note:* Although an error was incurred, the error indicator was not allowed to turn on until the following inquiry-read operation (which resets both the inquiry-request and buffer-busy indicators). After the read operation, a BRANCH ON ERROR instruction is necessary to reset the error indicator.

5. Inquiry-request and buffer-busy indicators are set ON after the LRC. *Note:* The next inquiry-read instruction resets both the inquiry-request and buffer-busy indicators.

6. A (D) character is sent to the terminal after the LRC, regardless of the check condition. The (D) character puts the terminal in receive mode, and locks its keyboard. If an error (VRC or LRC) has occurred, the terminal must be addressed, and an error message sent to it.

7. The instruction: M (%T0) (BBB) R, reads the message into core-storage, and resets the inquiry-request and buffer-busy indicators (which were set during the read operation, if an error occurred).



Notes: The Q and ¤ indicators are always reset by the next read operation. The * indicator is reset only by a branch-on-error instruction.

Polling designation:
A = 1447 console.
B = 1051 local terminal.

Figure 16. Polling and Receiving Flowchart

The Remote-Terminal Attachment feature on the IBM 1447 Console allows the data processing system to control up to 24 remotely located IBM 1050 Data Communications Systems. Data passing between the data processing system and the data communications system must pass through an IBM 1447 Console, Model 2, 3, or 4. With the appropriate dataset equipment, information can be transmitted in either direction on a half-duplex line. Half-duplex operation permits transmission in only one direction at a time. Remote-terminal attachment operation is possible either with or without the buffer feature installed. The buffer feature allows processing while the buffer performs the operation. With this feature, the data processing system becomes a central processing point for all the remote stations on the communications line.

An IBM 1051, Model 1, with a master-station option, is required at the processing-unit terminal. The 1051, Model 1, makes both home-loop and line-loop operation available. This unit either receives information from the data processing system and sends it to the line, or receives data from the line and sends it to the processing unit. The 1447 serves as Reader-1 and Punch-1 for the 1050 master station.

Data Flow

All data passes through the 1447. The 1447 can print the data on its own printer or send it to the local 1050 terminal. The local 1050 terminal either sends the data to one or more of its own output units, or transmits it through the dataset to one of the remote terminals. Data being sent to the system can originate at the remote-terminal input units, the local-terminal input units, or the 1447 keyboard.

Terminal Addresses

Each terminal is assigned a permanent station address. The 1447 is assigned the address A, the local 1050 terminal is assigned B, and the remote terminals are assigned C-Z.

Each component at each line 1050 terminal is assigned a numeric-component recognition code. These codes serve two purposes. The codes designating input components signal the station to send data. Codes designating output units notify the terminal to prepare to receive. The line component-recognition characters for addressing are:

Character	*Unit Selected*
1	Printer 1
2	Printer 2
3	Punch 1
4	Punch 2
9	Any or all output components of the addressed terminal.

The line component-recognition characters for polling are:

Character	*Unit Selected*
5	Keyboard
6	Reader 1
7	Reader 2
0	Any one input component of the polled terminal (common polling character).

The local 1050 terminal uses a slightly different set of component-recognition characters. The home component-recognition characters for addressing are:

Character	*Unit Selected*
1	Select Printer 1
2	Select Printer 2
4	Select Punch 2
5	Deselect Printer 1
6	Deselect Printer 2
8	Deselect Punch 2

The input components of the local terminal (keyboard 2 and reader 2) have direct control lines to the 1447. These lines are sampled during polling to determine if the local terminal has data for the processing unit.

1447 Printer Keyboard Polling

To prevent contention for the buffer, the 1447 printer keyboard must be polled to enter data locally. If the type key on the 1447 has been pressed, an A-readout on the second cycle of polling turns on the inquiry-request indicator. This indicator (Q latch) signals the buffer to accept data from the printer keyboard.

Longitudinal Redundancy Check (LRC)

In sending data over transmission lines, bits can be dropped or extra bits picked up in such a pattern that the VRC (parity) check operates correctly. To detect this kind of error, the 1050 system includes a longitudinal redundancy check. The LRC check is usually made at the end of the transmission. An EOB (Ⓑ) character is sent to signal the end of the transmission. The LRC character is sent immediately after the EOB. When the local 1050 terminal is receiving, the remote terminal sends the LRC character at the end of each block. If the LRC character does not match the LRC count of the local terminal, the inquiry-error latch is turned on. When the local terminal is sending, it sends the LRC character after the EOB. If the remote terminal does not send a positive answer to the LRC character, the inquiry-error latch turns on. The inquiry-error latch can be tested by the program to check that all data was received correctly.

The home-terminal station-address character is transmitted to the home terminal as the prefix character. Input and output for the local terminal transfers through the home register.

The local 1050 master terminal always sends a Ⓓ (positive answer) to the remote station LRC character.

Programming, Remote-Terminal Attachment Feature

The remote-terminal feature performs two operations: sending and receiving.

The 1050 master terminal is set up as follows:

Switch	*Setting and purpose*
Attend/Unattend	Attend or unattend
Prtr 1	Send/Receive (monitors transmissions to the remote terminals) or home
Prtr 2	Home (serves as an output unit for the local terminal) or Send/Receive
Rdr 1	Off (connects the 1447 to the 1050 system)
Rdr 2	Home
Pch 1	Off (connects the 1447 to the 1050 system)
Pch 2	Home (serves as an output unit for the local terminal)
System	Program
KB	Home (when ready to send data, otherwise off).

Remote-Terminal Operations

Buffered Polling

Polling is a check to see if a particular terminal wishes to send data. In buffered polling, a polling list is stored and the processing unit is released. After the processing unit is released to continue processing, the 1447 reads the polling list and polls the listed terminals. When a positive response is received from a terminal, the 1447 erases the buffer, writes the station-address character in the first-character position of the buffer, and writes the data received from the remote terminal on the buffer.

If no positive response from *any* polled terminal, polling continues until a positive response is received. This function does not tie up the processing unit, of course, but does eliminate the necessity of re-issuing the polling instructions until they are again required.

Programming

Buffered polling requires three instructions to complete the operation. These instructions store the polling list in the buffer, check for a positive response to polling, and read the data into core.

The first instruction is a normal WRITE ON CONSOLE instruction, M %T0 BBB W. This operation reads out the polling list at BBB to the buffer. The polling list takes the form Ⓒ, address character, Ⓒ, address character, Ⓒ. . . . . ⌯.

Example: Ⓒ A Ⓒ B Ⓒ E Ⓒ F ⌯.

The second instruction is a BRANCH ON INQUIRY REQUEST (B III Q). This instruction checks for a positive response to polling.

The third instruction (a READ FROM CONSOLE instruction, M %T0 BBB R) is reached from the I-address of the second instruction. It reads the data from the terminal into core storage.

Polling can be interrupted by BRANCH ON BUFFER BUSY instruction (B III □). The first BRANCH ON BUFFER BUSY instruction prevents the buffer from polling the next terminal. If a positive response was received from the last terminal polled, the buffer ignores this interrupt signal and accepts the data being sent. The second branch instruction is used to check if the buffer is receiving data before attempting to write on it.

Unbuffered Polling

In unbuffered polling, no polling list can be stored. The processing unit can poll only one terminal from each instruction. The processing unit reads out the polling instruction, character-by-character, and cannot be released until the polling is finished.

Programming

The instruction for beginning unbuffered polling is the same as the instruction for buffered polling, M %T0 BBB W. The polling characters are stored at the BBB address and take the form Ⓒ, station-address character, component-recognition character, group-mark with word-mark.

Example: Ⓒ H6 ≒.

The next instruction after the polling instruction must be a BRANCH ON INQUIRY REQUEST instruction (B III Q) to a READ FROM CONSOLE instruction (M %T0 BBB R). This is necessary because if the polled-terminal has data for the processing system, it immediately begins to send the data after it sends the positive response. If the READ FROM CONSOLE instruction is *not* executed in time, characters may be lost from the transmission.

Operation

The unbuffered polling operation is performed the same as a buffered polling operation, with these exceptions:

1. The polling characters read directly from core storage.
2. The third character is sent as the component-recognition character stored in the field instead of as a 0.
3. The station-address character is not stored as the first character of the data unless it is sent from the terminal.
4. The GMWM at the end of the polling characters ends polling.

Addressing Operation

The addressing operation tests the terminal to see if it is ready to receive. Unlike the polling operation, the addressing operation can address more than one terminal at a time. Buffered and unbuffered addressing operations operate in the same manner, so both will be discussed at the same time.

In addressing, the processing unit reads out an addressing field to the line and waits for a response from the addressed terminal. If a positive response is received, the processing unit sends the data to the addressed terminal. The difference between buffered and unbuffered operation is that the addressing characters and data are stored in the buffer, and the processing unit is released while the buffer transmits the addressing characters and data.

If a negative response or no-response to the addressing character is received, an error is indicated, and an immediate DISCONNECT is forced.

Programming

An addressing operation requires only one instruction instead of the three required for polling. The instruction format is the same as for polling, M %T0 BBB W.

The addressing characters at the BBB address designate the addressing operation. The first four characters of the B-field are Ⓢ, station-address character, component-recognition character, Ⓓ. The data characters follow the addressing characters in the B-field. The next-to-last character in the B-field must be a Ⓑ if LRC checking is desired. If no LRC check is desired, the next-to-last character is a Ⓒ. The last character in the B-field must be a GMWM.

Example: Ⓢ F1 Ⓓ *TEXT* Ⓑ ≒.

Remote-Terminal Addressing Operation

The data flow for an addressing operation is the same as the data flow for a polling operation before the response to polling is received. In addressing, after the response is received, the 1447 continues to transmit instead of receive.

Error Conditions and Condition Indicators

Because error conditions force other condition indicators, both the error indications and the condition indicators are discussed at the same time.

In a remote-terminal application, the 1447 error-checking and control extends to the remote terminals. Because a buffered polling operation stores a polling list in the buffer, polls from the buffer, and receives data from the remote terminal with one instruction, the difference between an error in the write operations for the buffer and the read operations from the remote terminal must be detectable.

Consider a buffered polling operation. VRC (parity) errors can occur during transfer of the polling lists to the buffer, or during the polling operation itself. These errors are detected only by the 1447 checking circuits. Three kinds of errors can occur while the buffer is receiving data.

1. VRC errors
2. LRC errors
3. Time-out errors. If a character is not received within the time limit of the preceding character, an error occurs.

During addressing only *write* errors can occur. These errors can be caused by:

1. VRC error
2. LRC error
3. Addressed terminal not ready. This error is caused by a negative response to addressing, or no-response to addressing, within 2 seconds.

In an unbuffered system, only one operation (read or write) can be performed from each instruction. The error latch is turned on immediately by an error in an unbuffered system.

Condition indicators for remote-terminal 1447's are the same as for 1447's without the remote-terminal systems. Note that during a write operation, in a buffered system the error latch turns on the inquiry-request latch, which in turn sets the buffer-busy latch.

Remote 1050 Functions

Because the 1447 must disconnect and transfer each block of data to the processing unit, the interaction between the 1447 and the remote 1050 terminal differs considerably from normal 1050-to-1050 operation. For example, assume that a 1050 remote terminal has a three-block message to send to the processing unit. The blocks must not exceed 209 characters for a buffered system.

The processing unit sends its polling characters, (C) E0 to the remote terminal. The remote terminal, being in a ready status, replies with a positive response to the polling ((D)), and follows with the text. The text operation is halted by the transmission of a (B), which turns on the resend light, inhibits the reader, and forces readout of the LRC character. The 1447 receives the message and replies with a positive answerback to LRC, (D). The (D) answerback causes the remote terminal to:

1. Reset the resend latch.
2. Inhibit printing of the answerback.
3. Drop the EOB latch and reset the LRC send latch.
4. Interlock the keyboard.
5. Reset the line reader.
6. Select all receiving units.

These operations leave the remote terminal in a receiving status waiting for the processing unit to send a message.

Now the processing unit looks at the message and determines whether to:

1. Repoll the remote terminal and request the next block, if the message was received without error and does not require an answer.
2. Inform the remote terminal that the message was received in error.
3. Answer the message. The processing unit addresses the remote terminal and sends the answer.

The processing unit senses the (C) and through programming decides what to do next. Normally it would rewrite the polling list on the buffer and proceed with the next station. Due to the programmers individual requirements and varied applications, the method of reestablishing the polling list varies with each program.

Line-Control Characters

Some of the characters represented on the 1447 keyboard take on special meaning and symbols in remote-terminal operation. These are called *line-control characters*. Figure 17 shows these symbols, their meaning, and the corresponding 1447 characters.

DESCRIPTION	SYMBOL	BIT CONFIGURATION	TYPE CHARACTER
End of Transaction (EOT)	(C)	C8421	√ (tape mark)
End of Address (EOA)	(D)	821	# (number sign)
Negative Response (Control)	(N)	B	- (hyphen)
Positive Response (Control)	(Y)	BA821	. (period)
Negative Response (Text)	(n)	B	- (hyphen)
Positive Response (Text)	(y)	BA821	. (period)
Positive Response (Inquiry)	(d)	821	# (number sign)
End of Block (EOB)	(B)	*CA842	‡ (record mark)
Address Select	(S)	CA821	, (comma)
Shift Up	<	BA842	<
Shift Down	>	842	>
Backspace	;	CB842	; (semicolon)
Red Ribbon Shift	prefix A	**A8421, BA1	⧺A
Black Ribbon Shift	prefix B	**A8421, BA2	⧺B
Line Feed	prefix C	**A8421, CBA21	⧺C
Double-line Feed	prefix D	**A8421, BA4	⧺D

* This character is translated from (B) to a record mark when it is received from the line. The record mark is translated to (B) when transmitted to the line.

** The prefix ⧺ must be transmitted before the alphabetic character to cause this action at the terminal.

Figure 17. Line-Control Characters

Sample Program Loop for Troubleshooting

The following program allows a looping operation for troubleshooting to determine, for instance, if a problem is caused from line difficulty or locally.

Instr. #	*Instr. Addr.*	*Instruction*
1	001	M %T0 500 W
2	009	B 018 Q
3	014	B 009 (buffered system. B 001 for an unbuffered system)
4	018	M %T0 200 R
5	026	L 400
6	030	M %T0 196 W
7	038	B 038 □
8	043	/ 299
9	047	B 001
	196	,
	197	station-address character (*Example:* C)
	198	component-recognition character (*Example:* 9)
	199	#
	500	polling list: *Buffered Example:* Ⓒ A Ⓒ B Ⓒ C ⫩ *Unbuffered Example:* Ⓒ C 0 ⫩
	400	⫩

The first instruction writes the polling list at 500 on the buffer, if the 1447 is buffered. If no buffer is installed, the system polls the terminal designated by the characters at address 500. The second instruction branches to the read operation when a positive response to polling is encountered. The third instruction keeps the processing unit checking for a positive response to polling in a buffered system. In an unbuffered system, this instruction causes the processing unit to repoll the terminal. The fourth instruction reads the data from the terminal into core storage. The fifth instruction places a GMWM at the end of the data read in from the terminal. The sixth instruction sends the received data to the terminal output units designated by the contents of storage positions 197 and 198. The seventh instruction is effective only for buffered machines. It forces the system to loop until the buffer is free. If the system is not equipped with the buffer feature, this branch instruction does not affect the operation at all. The eighth instruction clears the read-in area. The ninth instruction completes the loop. Error conditions are detected visually.

Note that specific polling lists must be used, depending on whether the system is equipped with the buffer feature.

Index

IBM

Technical Newsletter

File No. 1447-03

Re: Form No. A24-3031-3

This Newsletter No. N24-0305

Date: April 15, 1965

Previous Newsletter Nos. None

To bring your copy of the IBM 1447 Console, Form A24-3031-3 up to date, please insert the attached replacement and supplemental pages as indicated.

Page
11
12
21 through 21.8
22
23
24
25
26
45
46

A vertical line to the left of the text indicates where changes were made on revised pages.

This sheet should be filed with your IBM 1447 Console publication to indicate that it contains the most recent changes and additions.

IBM Corp., Product Publications Dept., Endicott, N. Y. *13764*

PRINTED IN U.S.A.

N24-0305 (A24-3031-3)

printout on the console I/O printer of the contents in core storage, beginning with the address set in the B-storage address register (see *Alter* section). In this operation, word marks are printed as inverted circumflexes preceding the characters with which they are associated. The operation is stopped by pressing the stop key on the console. The stop key must have been pressed before the start key was pressed to initiate the *character-display* operation.

Alter. When the mode switch is set to ALTER, the operator can manually change the contents of the I-, A-, or B-address register or any core-storage position. To change the contents of an I-, A-, or B-address register, the operator must:

1. Set the manual address switches to the desired address.
2. Press the appropriate address-register key light.
3. Press the start key. The selected address register should indicate the new address.

To change the contents of a specific core-storage position, the system operator must:

1. Set the manual address switches to the desired core-storage address.
2. Select the bit configuration desired with the character-select dial.
3. Operate the enter key to enter the selected bit configuration with or without a word mark.

The contents of adjacent core-storage positions can be changed by initiating an alter-plus-one mode of operation when the mode switch is set to ALTER.

Once the alter-plus-one mode is set up, the core-storage address automatically advances by plus one at the end of each alter cycle.

To set up an alter-plus-one mode of operation, the system operator must:

1. Set the manual address switches to the desired core-storage address.
2. Press the B-address register key light.
3. Press and hold the start key.
4. Operate the enter key.
5. When the enter key returns to its neutral position, release the start key.

The system is now ready to operate in its alter-plus-one mode.

To enter the new characters in the desired core-storage positions, the system operator must:

1. Select the bit configuration desired with the character-select dial.
2. Operate the enter key to enter the selected bit configuration with or without a word mark.

Tape Select

During programmed operation, this dial is set to N (normal position). To select a particular tape unit for a manual operation, such as backspacing, set this switch to the number that corresponds to the tape unit.

Note: See *Tape Load* and *Diagnostic Switch* sections.

Tape Density (1460)

This three-position dial controls the low- and high-density rates of the IBM 729 Magnetic Tape Units, Models V and VI, attached to the 1460 system. The three settings are 200-556, 200-800, and 556-800. The tape unit assumes the recording density designated by the switch.

The IBM 729 II, 729 IV, and 7330 Magnetic Tape Units operate at either 200 or 556 characters per inch regardless of the setting of the tape-density switch.

Auxiliary Mode (1460)

This dial can be set to any one of six positions.

Off. This is the normal setting. In this position, the switch has no effect on system operation.

Full Storage Print. This position is used, in conjunction with the mode switch, to print the contents of all storage positions. When the mode switch is set to STORAGE PRINT OUT and the start key is pressed, printing starts with core-storage position 001 and continues until all core-storage positions are printed. Word marks print as *ones* under the corresponding data positions during the following print operation.

A block of 132 characters is printed. However, the last 32 positions printed on each line are repeated at the beginning of the next line of data. For example, core-storage positions 101-132 print at the end of the first line and at the beginning of the second line.

Print-Storage Scan. This position is used, in conjunction with the STORAGE SCAN setting of the mode switch, to scan the standard print area in core storage (positions 201-332) and the 132 special print-storage positions. When the mode switch is set to STORAGE SCAN and the start key is pressed, scanning begins at core-storage position 201 and at print-storage position 001. Scanning continues through the 132 positions of each area. During this scanning operation, the contents of the standard print area are displayed in the B-register, and the contents of the special print-storage area are displayed in the A-register.

If an error is found in either register, the scanning operation stops. Otherwise, it stops at position 332. After an error stop, resetting the error indication and pressing the start key continues the scan operation.

The other three positions of this switch prevent input/output operations from being performed in the overlap mode. These positions are used primarily by IBM Customer Engineers.

Tape I/O. This switch setting prevents magnetic tape or serial input/output operations from being performed in the overlap mode.

R/P. This switch setting prevents card (Read/Punch) operations from being performed in the overlap mode.

Tape I/O R/P. This switch setting prevents tape, serial input/output, or card operations from being performed in the overlap mode.

Sense Switch A

Sense switch A is a standard feature. It controls last-card operations by making a BRANCH IF INDICATOR ON (d-character A) instruction cause a branch operation when the last card in the reader has passed the reading station.

The six additional sense switches (B, C, D, E, F, and G) are available (special feature).

Emergency-Off Switch

In an emergency, pulling this switch disconnects all power within the system. The switch must be manually reset by a Customer Engineer before power can be restored to the system.

Start-Reset Key

This key resets the system so that the operator can initiate a restart. It does not reset the inquiry channel (if buffered), the address registers, or core storage.

The inquiry channel is reset by pressing the type key and the start-reset key simultaneously.

Note: The system must be stopped before the start-reset key is pressed.

I/O Check-Stop Switch

When this switch is on, the system stops at the completion of any input or output operation in which a check condition was detected. When this switch is off, the system does not stop, and all check-condition detection must be accomplished by executing the applicable BRANCH IF INDICATOR ON instruction.

Check-Stop Switch (Process)

When this switch is on, the system stops when a processing-unit check condition is detected. When the switch is off, the system stops for a processing-unit check condition only when the Op register, one of the address registers, or an input/output operation is involved.

I/O Check-Reset Switch

This switch resets check conditions sensed in an I/O unit when the I/O check stop switch is on. It is used primarily by Customer Engineers.

Diagnostic Switch

When this switch is on, characters are read into core storage just as they appear on the disk or tape record, without parity-correction. If a character having incorrect parity is transferred into core-storage, the system stops. The B-storage address register shows the storage location of the error, and the B-register displays the error character as it was read from the disk or tape.

When this switch is off, the parity of all data characters is corrected (by the addition or deletion of a C-bit). This does not mean the character is now accurately transferred as it was originally written on the disk. A programmed operation (BRANCH ON ERROR instruction) must be performed to determine if the disk record was satisfactorily read.

This switch may be used to find the character(s) in error, as follows:

1. Turn the diagnostic switch on.
2. Set the mode switch to I/EX.
3. Read in the suspected record under program control.
4. Turn the mode switch to STORAGE SCAN. Press the start key to scan core storage to the parity error.
5. If an error existed in the record, the system will stop. The address of the error will be shown in the B-storage address register. The B-register will display the contents of the error location.
6. The error can now be corrected at the discretion of the operator. *Note:* More than one core-storage position may be in error.
7. Restore all controls to normal. If the error has been satisfactorily corrected, or if the error position was of no consequence to the program being run, the job can be restarted at this point. *Note:* The parity must have been corrected.

Note: If the 1460 is being operated in overlap mode for this instruction, the record may be read incorrectly.

2. Turns on the red type light on the console.
3. Depending on the BCD coding involved, some other character may be printed.

Condition Indicators

Two indicators reflect the various system-1447 conditions that occur. The status of these indicators is checked by the system when it executes a BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character. The indicator names, the d-characters that test the indicators, and the conditions that set the indicators are:

Inquiry-Request (d-character Q)

The Q-indicator normally signifies that the console I/O printer has a message to send to the system. The indicator turns on during a console-inquiry operation when the console operator presses the type key on the console.

*Inquiry-Clear (d-character *)*

This indicator and its associated red type light on the 1447 console turn on:

1. When the console operator makes a keying mistake and instructs the system to disregard the message (by pressing the cancel key).
2. When the input message exceeds the core-storage area capacity.
3. When the 1447 circuitry detects a parity check during the 1447-to-core-storage transfer.
4. When the 1447 circuitry detects a parity check during the core-storage-to-1447 transfer.

Form A24-3031-3
Page Added 4/15/65
By TNL N24-0305

IBM 1026 Transmission Control Unit

The IBM 1026 controls data transfers between IBM 1030 Data Collection Systems or IBM 1050 or 1060 Data Communication Systems and an IBM 1401, 1440, 1460, or 1240 system. It also can handle data transfers between IBM 1070 Process Communication Systems and IBM 1440 or 1460 systems.

The IBM 1026 Transmission Control Unit is a single-line communication device. Each unit can serve a number of terminals on one line, and as many as four units can serve a data processing system. One line serves as many as 26 IBM 1050's (25 only on first line with a console), 24 IBM 1030's, 25 IBM 1070's, or multiple IBM 1060's. Nominal speed is 14.8 characters per second (cps) for the IBM 1050 and 1060 Data Communications Systems.

An IBM 1026 can serve terminals of various speeds. Nominal speed for the IBM 1030 is 60 characters per second. Nominal speed for the 1070 is 14.8 cps with the 1071 Model 1, or 66.6 cps with the 1071 Model 2.

The cable connection makes the 1026 an integral part of the associated data processing system, and for many functions they become interdependent.

Information from the line enters the 1026 serial-by-bit, serial-by-character. The 1026 assembles the bits into characters, and characters into messages. When necessary, characters are translated to Binary Coded Decimal (BCD) odd-parity interchange code. The 1026 handles blocks of 208 data characters.

The exchange of information between the 1026 and the CPU is initiated by a read/write (M %T0 BBB R/W) instruction from the program in the associated data processing system. The 1026 is in synchronism with the system when exchanging data.

All transmission is centralized through the 1026. The IBM 1026 Transmission Control Unit is an economical means of entering numeric, alphabetic, and special-character data directly into the IBM 1240, 1401, 1440, or 1460 Data Processing Systems from a half-duplex multipoint communication line. Information can be transmitted on a half-duplex line in either direction, but in only one direction at a time. This IBM Teleprocessing system component directs and regulates the flow of data, and provides compatibility among terminals and processing and exchange devices.

Mode Switch

This three-position toggle switch has the following functions:

- The bottom (Reset) position provides a means of resetting the 1026 controls after system power has been turned on.
- The center (1026) position allows normal 1026 operations.
- The top (1447) position allows the processing unit to address the 1447 console directly.

IBM 1026 Instructions

The IBM 1026 Transmission Control Unit uses the following instructions, as described in the *IBM 1440 System Operation Reference Manual,* Form A24-3116:

SELECT LINE (U 6, U 7, U 8, and U 9)
SELECT DIGITAL TIME UNIT (IBM 1032) (U 0)
SELECT REQUEST-SERVICE INDICATOR (U #)
BID OPERATION (U 5)
READ FROM IBM 1026 (M/L %T0 BBB R)
WRITE TO IBM 1026 (M/L %T0 BBB W)
ENABLE INTERRUPT (K >)
ENABLE INTERRUPT AND BRANCH (K III >)
DISABLE INTERRUPT (K <)
DISABLE INTERRUPT AND BRANCH (K III <)
BRANCH IF REQUEST-SERVICE INDICATOR ON (B III Q)
BRANCH IF BUFFER-BUSY INDICATOR ON (B III □)
BRANCH IF INQUIRY-CLEAR INDICATOR ON (B III *)
BRANCH IF TIME-EMITTER INDICATOR ON (B III])

The load mode (L) READ and WRITE instruction are effective only for the 1447 console.

IBM 1026 Programming Considerations

If it is desired to send the word marks to the console, messages must be sent with a load instruction. Note, however, that in load mode the console-printer functions of carriage return, tab, and space do not occur. In this case, these functional characters print rather than cause the corresponding functions to occur.

When a 1026 is installed with a 1447, the following programming examples must be considered.

To write to the 1447 console:

```
WCONSO  SBR   EXITW+3   Save return to main line.
U6SEL     U6            Select 1026 channel #1.
          BIN   U6SEL, □  Branch if line-1 buffer busy.
          WCP   TYPEW     Write to console printer.
EXITW     B     0         Branch to main routine.
TYPEW     DA    1X100, G  Storage type-out area.
                1, 1
```

To read from 1447 console:

```
RCONSO  SBR   EXITR+3   Save return address to main
                        line.
W1        U6            Select 1026 on line 1.
          WCP   POLST     Poll the console.
          BIN   W1,*      Branch if error.
W2        U6            Select 1026 on line 1.
          BIN   R1, Q     Branch if service request.
          B     W2        Loop if no service request.
R1        RCP   TYPER     Read from console.
EXITR     B     0         Return to main routine.
TYPER     DA    1X200, G  Type-in I/O area.
                1, 1
POLST     DCW   @A0@      Console Polling list.
          DCW   @≡@       Group mark word mark.
```

The polling count is stored in the first position of the read-in I/O area.

For additional information, refer to the SRL publications, *IBM 1026 Transmission Control Unit,* Form A24-3244, *IBM 1401 Data Processing System,* Form A24-3067, and *IBM 1440 Data Processing System,* Form A24-3116.

IBM 1026 Programmed Operations

The 1026 is controlled by the program. When a line needs service, the service-request indicator comes on or (on a system with interrupt) the program receives an interrupt. A select instruction, followed by a test of the indicators for each line, determines which line is to be serviced. As each line is selected, the interrupt or service-request signal is removed, but the conditions causing the action are retained. Status indicators remain set until a move instruction is issued for that line. Every move, branch, or bid instruction or group of instructions for a given line must be preceded by the select instruction for that line. The program can initiate *five* different operations on a line, all by means of the write instruction.

1. Poll Operation

A poll operation can be initiated after any interrupt status. This operation gives each terminal, including the console on the first line (console station address is A), an opportunity to transmit to the 1026. A polling operation is terminated by either a terminal transmitting or by a record mark in the polling list. If it is desired to recycle through the polling list, then that list can be terminated with a group-mark with word-mark that initiates restart of the polling list. A polling list can have one of the following forms:

Ⓒ A1 B1 C1 ..... (+) ≡
Ⓒ A0 B0 C0 ..... (+) ≡
Ⓒ ABCD ..... (+) ≡

In the first case, the A1 refers to component 1 at terminal A. In the second case, any component ready to send transmits. In the third case, applicable to 1030 lines, no components are selected.

2. Text Response

The text response can be initiated only after a REC-EOB or REC-EOB-CHECK status. This operation sends the text response to the terminal. If the terminal is an IBM 1050 Data Communications System terminal or an IBM 1070 terminal, it can then transmit any more data that is available. The program goes to IDLE status after the answerback from any other terminal. Text responses are either (y) or (n) followed by a group-mark with word-mark or a record-mark. Note that IDLE status means that the operation has been completed.

3. Transmit Operations

Addressing

When a message is to be sent to a terminal, the program selects the line over which the transmission is to take place, tests the status indicators, and issues a write command in this format:

Ⓒ Ⓢ B3 Ⓓ TEXT +

This operation can be initiated after any interrupt condition. It selects the terminal and sends the message if the terminal can accept it.

Multiple-Block Transmissions

If the terminal is a 1050 and it has been previously selected, additional blocks of data can be transmitted by writing text followed by a record mark in the buffer. This operation can take place only after the 1026 has gone to TRANSMIT-EOB or TRANSMIT-EOB-CHECK status. The terminal is still selected in either status.

Inquiry Reply

After the 1026 is in RECEIVE-EOB status on a 1050 line, a reply to an inquiry can be sent to the terminal because it is still selected. The reply is written into the buffer in the following format:

ⓓ TEXT ≠

Transmission to Console

The 1026 can transmit to the console only when the line is in control mode. The format for a console message is:

TEXT ≠

The first character of text must not be Ⓒ or Ⓢ. The status goes to TRANSMIT-EOB or TRANSMIT-EOB-CHECK when the operation is completed.

4. Idle Operation

This operation can be initiated after any interrupt condition. It results from writing a Ⓒ followed by a record mark into the buffer. It resets all terminals on the line to control mode. When it is completed, the 1026 goes to IDLE until further program action.

5. Bid Operation

To transmit on a polling line, the program must issue bid instruction U5 after selecting the line. If the bid is successful, the 1026 responds with CONTROL-EOB, and transmission can start. If the 1026 responds with CONTROL-EOB-CHECK, the contents of the 1026 buffer must be read to determine the cause of the check condition. If the first character in the CPU I/O area is a Ⓒ, the check condition is due to a terminal's failure to respond to a poll. If the first character is not a Ⓒ, a text time-out has occurred. Normal programmed error procedures should be implemented if the text time-out has occurred. If neither CONTROL-EOB nor CONTROL-EOB-CHECK are the 1026 responses, then transmission cannot start. The bid instruction is the only instruction that can be issued while the 1026 is polling.

Transfer Checking

Data transfers between the 1026 and the data processing system during the read and write instructions can be checked by a BRANCH ON INQUIRY CLEAR INDICATOR instruction immediately after the write or read instruction. If an error has occurred during the transfer, the inquiry-clear indicator is set.

The 1026 will not accept a write instruction if it is not ready (POWER OFF, etc.). If a write instruction is issued and power in the 1026 is off, the processing unit stops.

Polling List

The polling list, stored in the data processing system, consists of C followed by the terminal-and-component address for each terminal, and ends with a record mark or a group-mark with word-mark.

Ⓒ E0 F0 G0 ..... ≠

When a group-mark with word-mark terminates the list (no end-of-polling-list indication is desired), the polling list automatically restarts when the group-mark with word-mark is sensed.

Because the IBM 1030 Data Collection System has no component address, its polling list has no component addresses.

Ⓒ BCDE ..... ≠

To send the polling list to one of the 1026 lines, the program issues a select instruction with the d-modifier for the particular line. The program then issues a WRITE ON 1026 instruction (M %T0 BBB W) which transfers the polling list stored at address BBB to the selected 1026 line.

Securing the Line

To secure a line, the program selects the line and follows with a WRITE ON 1026 instruction. Instead of sending a polling list, it sends Ⓒ ≠ to the line, which closes the line to traffic until the 1026 is instructed to activate the line. The record mark causes an end-of-polling-list to indicate the line has been secured.

Console Operation

The IBM 1447 Console, when attached to the CPU via the 1026, must be programmed differently from the conventionally attached 1447 Console Printer. The method of controlling the 1447 (attached via the 1026) is described in this section.

Polling

The console is polled in the same way as any other terminal. The operator requests an inquiry by pressing the type key. When the console address (A or A0) is then read out of the buffer, the poll count is stored and the console keyboard is unlocked. If a request was not initiated by the operator (type key not pressed), the 1026 times out (polling time-out of 522 milliseconds) and proceeds to the next address. Once a console request has been honored by the 1026, the console is selected until the operator presses either the release key or the cancel key. Note that the 1026 does not time out (text time-out) against the console as it does against terminals on the communications line.

The console can send word marks to the 1026. If it is desired to read these word marks, then the CPU program must secure data from the 1026 with a load instruction instead of a move instruction.

A console message is terminated with a group-mark with word-mark rather than with the EOB character.

One of the following statuses occurs as a result of console response to polling:

- Receive EOB. This status indicates that a good message has been received from the console.
- Receive EOB Check. This is the status that results when the message received from the console had an error in it, or the operator terminated the message by pressing the cancel key.
- Buffer Check. This indicates that the message from the console exceeds 208 data characters. The first position of the message to the 1026 buffer is the output of the poll counter. Then, 208 data characters (maximum) can be sent to the 1026. Finally, the last character sent is the group-mark with word-mark that is generated when the operator presses the Release key.

Addressing

No addressing is required when transmitting from 1026 to console. However, the line must be in control mode. If it is not in control mode, then a terminal on the line is still selected and a message intended for the console will go down the line to the selected terminal. The format for a console message is:

TEXT ≠

The status indicators go to either TRANSMIT-EOB or TRANSMIT-EOB-CHECK when the operation is completed.

IBM 1026 Control Operations

The IBM 1026 with a data processing system:

1. Controls communication lines (centralized multidrop half-duplex and point-to-point half-duplex) and terminals.
2. Controls bit-to-character and character-to-message assembly.
3. Controls message-to-character and character-to-bit distribution.
4. Controls terminal and component selection and polling.
5. Controls 14.8 to 66.6 character-per-second transmission speeds.
6. Controls an IBM 1447 Console Model 2 or 3.
7. Provides a method of connecting the CPU to data sets, and hence to the communications lines.

For each multipoint (more than one terminal) line, a polling list is stored in system core storage. The data processing system transfers the polling list to the 1026 buffer by a move-mode WRITE instruction. The 1026 then polls the terminals on its communication line by sending onto the line a Ⓒ followed by the terminal addresses and component addresses (if required).

Status conditions are indicated by the various on and off combinations of three status indicators in the data processing system: INQUIRY REQUEST (Q), BUFFER BUSY (□), and INQUIRY CLEAR (*). Each 1026 line has its own three status indicators.

The Q-indicator also serves as a request-service latch by coming on when the 1026 requires service. A select instruction from the CPU selects this indicator.

Line Control

In this section, the control character descriptions are grouped as follows:

1. Transmission by 1026 of polling and addressing characters.
   a. Terminal responses to polling.
   b. Terminal responses to addressing.

Description	Symbol	Processor Bit Configuration	Processor Character
End of Transaction (EOT)	Ⓒ	C-8-4-2-1	√ (tape mark)
Address Select (Control)	Ⓢ	C-A-8-2-1	, (comma)
End of Address (EOA)	Ⓓ	8-2-1	# (pound sign)
Negative Response (Control)	Ⓝ	B	- (hyphen)
Positive Response (Control)	Ⓨ	B-A-8-2-1	. (period)
Negative Response (Text)	ⓝ	B	- (hyphen)
Positive Response (Text)	ⓨ	B-A-8-2-1	. (period)
Positive Response (Inquiry)	ⓓ	8-2-1	# (pound sign)
End of Block (EOB)	Ⓑ	A-8-2	‡ (record mark)

Figure 9.1 DPS Line-Control Characters

2. Characters that signify the end of a block or of an entire transaction.
   a. Answerbacks to end-of-block or end-of-transaction characters (from 1026 to terminal).
   b. Answerbacks to end-of-block or end-of-transaction characters (from terminal to 1026).
3. Time-outs.
   a. Text.
   b. Polling answerbacks.
   c. Addressing answerbacks.

Certain control characters are described more than once because they apply to different types of operations. Figure 9.1 is a list of the data processing system line control characters.

Transmission of Polling and Addressing Characters

End of Transaction (EOT)—Symbol (C)

Upon receipt of this signal, all terminals go to or remain in line-control mode. All terminals in selected status go to a nonselected status. When originated by a terminal in TRANSMIT status, EOT indicates that the terminal is ending its transmission.

Poll-Address Characters

The poll-address characters are the alphabetic characters A to Z. A separate alphabetic character is assigned to each terminal on the channel. On a point-to-point channel, any character A to Z can be used to give a terminal permission to transmit.

The 1026 is capable of transmitting one- or two-character polling-address characters so that any variations of polling (such as component polling) that fall within the limitations of a two-character polling address can be accommodated. The character-A is reserved as the poll address for the 1447 on the first line.

Component Polling. To poll individual components at the station, the alphabetic poll-address character or characters are followed by a digit, 1 through 9, to indicate the component. In the case of a general station address or poll for any component at the station, the address is the alphabetic poll-address characters followed by the digit zero.

Address Select—Symbol (S)

This symbol is an indication that the characters following (from the 1026) are addressing characters until the EOA (End-of-Address) signal is sent. In cases where addressing or component selection is required, address-select is the positive response to polling. However, because the 1026 is centralized half-duplex, address-select is not allowed as a start-of-transmission character.

Address Characters

Address characters are the alphabetic characters A through Z. The same alphabetic characters used as poll-address characters are assigned as a terminal's individual-address character. In addition the symbol / can be assigned as a broadcast address character, and/or the letters Z, Y, X, W, etc. can be assigned as group-address characters for predetermined groups of terminals. The terminals must be arranged so that only one terminal in a group responds to the text-verification request (EOB). Because the 1026 is accommodating only centralized half-duplex in the multidrop case, it does not require an address because all messages are directed to it.

Component-Select Characters. Component-select characters are the digits 0 through 9. In combination with the address characters, they select a given component in the terminal, as determined by the predetermined assignment of numbers to the terminal components. The digit nine is used to address a station equipped with component selection when a specific device is not being addressed. In this case, over-all system and individual terminal-operating procedures determine which device is to accept the message.

End of Address (EOA)—Symbol (D)

The EOA character changes the mode of all terminals from control mode to text mode. Error triggers and LRC counters are reset at terminals that are in the

TRANSMIT and SELECTED status. The EOA signal is not included in the following LRC count. Selected terminals then start printing and/or punching. The text characters following the EOA characters are passed into the CPU when it is a selected terminal. Because the 1026 has no address character, the EOA signal is used to start transmissions into the 1026.

The 1026 enters all characters following the EOA into the delay-line buffer. To indicate to the CPU which terminal is originating the message, the setting of the poll counter is entered into the delay line preceding the message.

Responses to Polling

The characters listed in this section are used by a terminal in response to a polling sequence from the 1026. These responses are not delayed by the terminal.

Negative Response—Symbol (N)

The negative-response character indicates that the terminal has no traffic to send at this time.

The 1026 transmits the next sequence in the polling list upon receipt of the negative-response character from a terminal in response to polling.

End of Address (EOA)—Symbol (D)

The end-of-address character is used as a positive response to polling and is used to start a transmission to the 1026.

Responses Other Than (D) or (N)

In the event that the response to polling is not recognized as either an EOA or negative-response character (due to transmission or hardware difficulties), the 1026 assumes that the response was an EOA. The result of this assumption is that the 1026 continues to receive. The status indicators indicate a text time-out, if the terminal sends a negative-response character that is not recognized as such by the 1026. Otherwise, receipt of the message characters stops the text time-out operation.

Responses to Addressing

The characters listed in this section are used to indicate terminal status in response to addressing characters transmitted by the 1026.

Negative Response—Symbol (N)

In reponse to an addressing character, the negative-response character indicates that the terminal is not ready to accept a transaction. When the 1026 receives the negative-response character in response to addressing, it stops transmitting characters of that message to the line. This condition is indicated to the CPU through the three status indicators.

Note: In the case of multi-component addressing, the 1026 treats a negative-response character response from *any* component in the manner described in the foregoing text.

Positive Response—Symbol (Y)

The positive-response signal, when used as an answer-back if a terminal is addressed, means *ready.* The 1026 sends the message to the terminal when it receives the positive-response character in response to addressing.

Responses Other Than (Y) or (N)

In the event that the response to addressing is not recognized as a negative-response or positive-response character (due to transmission or hardware difficulties), the 1026 reacts as though this were the (N) and halts transmission. This condition is indicated to the CPU by the three status indicators.

End of Transaction and End of Block Characters

End of Transaction (EOT)—Symbol (C)

The EOT signal is an indication that the transaction has been completed, and that use of the line for this transaction is completed. All terminals go from text mode to line-control mode. The 1026 indicates the receipt of an EOT from the terminal to the program through the three status indicators. The 1026 automatically generates an EOT, and transmits it to the line whenever a polling time-out occurs.

End of Block (EOB)—Symbol (B)

This symbol indicates the end of a unit block or section of text. It is the request for acknowledgment and permission to continue the transmission, if more is to follow. It is the request for a check verification (i.e; in the case of LRC, it is an indication that the next character is the LRC character, and that a verification is desired). The EOB character is included in the LRC count. The EOB character defines a block of data that can be handled, verified, resent, etc. The transmitting device, upon detecting this character, must stop and wait until an acknowledgment is received before resuming transmission.

Answerback from Terminal to 1026

The 1026, when transmitting, recognizes the EOB character and stops and waits for a verification from the terminal. If the line in question has LRC checking, the 1026 transmits the EOB character followed by the LRC character, and then stops. (The LRC character is generated and sent by the 1026.) The terminal delays the answerback to the 1026 until it is ready to accept another block of information. The purpose of delaying the answerback is to interlock the 1026 and CPU while the terminal is executing mechanical operations, preparing for more data such as card feed, which requires more than one character time.

If the terminal, after delaying the answerback to the 1026 for completion of mechanical operations, runs out of cards or forms, it sends the proper answerback to the 1026. The 1026 then takes the proper action as a result of the answerback. If the action taken by the 1026 consists of the transmission of a new block of information, the terminal prohibits the answerback to the 1026 after the EOB, indicating to the 1026 that the message was not received by the terminal.

Positive Answerback — Symbol (y). The answerback to the 1026 should be a positive-answerback character to indicate that the block was received correctly by the terminal. Upon receipt of the positive-answerback character from the terminal, the 1026 indicates the condition to the processing unit through the three status indicators.

Negative Answerback — Symbol (n). To indicate that an error has been detected in a block, the terminal sends a negative-answerback character to the 1026. The 1026, upon receipt of the negative-answerback character from the terminal (in response to text), indicates the condition to the processing unit through the three status indicators.

Answerback from the 1026 to Terminal

The terminal, when transmitting, recognizes the EOB characters. Depending on whether it is equipped with LRC checking, it stops after the EOB or after transmitting the LRC character, and waits for the reply from the 1026. The terminal is prevented from transmitting again until it receives a reply from the 1026. The CPU indicates to the 1026 when to reply to the terminal. Thus, the 1026 is prevented from answering the terminal until the CPU is ready to accept another transmission. The CPU, via a move instruction, sends the answerback character to the terminal. The CPU can indicate to the terminal the results of a CPU format check on the incoming transmission by the answerback character it sends to the 1026.

Positive Answerback—Symbol (y) *or* (d) *(Inquiry).* In the general case, the 1026 sends a positive-answerback character (y) to indicate receipt of a good message in respect to both transmission-checking and format-checking. It also indicates that the 1026 is ready to receive another block of data.

In the case of an inquiry transaction, the 1026 sends a d character to indicate to the terminal that the incoming record was received correctly, and that now the 1026 is sending the responding transaction.

Negative Answerback—Symbol (n). The 1026 always sends a negative-answerback character to a terminal to indicate a message has not been received correctly for any reason. Whether the 1026 returns the line to control mode after transmitting the negative-answerback character depends on the application.

Time-Outs

The 1026 provides time-outs to prevent system tie-ups because of faulty conditions.

Text Time-Out

The text time-out is used to prevent system tie-ups once a terminal has started transmitting to the 1026. Therefore, paper-tape breaks, card jams, or failure of operator to transmit an EOB character when manually keying, do not hold up all the terminals sharing the same line.

The text time-out is also used when the 1026 is awaiting the text response to a message transmitted from a terminal. It is also used after the 1026 has sent a text response to a 1050 terminal, and is awaiting more data or the EOT.

The 1026 does not time out against itself when it is transmitting. The duration of the text time-out is 22.6 to 23 seconds.

An optional Text Time-Out Suppression Feature is available. This feature is intended for use by those systems in which IBM 1050 terminals are operated in conversational mode. This feature suppresses the text time-out, allowing the 1050 terminal operator more time to generate messages to the 1026.

If the operator at the 1050 failed to generate a character to the line within the 22.6- to 23-second text time-out, the 1050 terminal would have to be repolled to continue transmission. The Text Time-Out Suppression Feature prevents the text time-out from causing the disconnect. All 1050 terminals attached to a 1026 that has this feature must have the 1050 Text Time-Out Suppression Feature.

Polling Answerback Time-Out

After the 1026 has transmitted a polling address to a terminal, it expects a reply in not more than 522 milliseconds. If it doesn't receive the reply in this time, it transmits an EOT on the line, and polls the next terminal.

Addressing Answerback Time-Out

The 1026 expects a reply to an address-selection sequence within 2.1 seconds after sending it.

IBM 1447 Console, Model 3

The IBM 1447 Console, Model 3 (Figure 10), provides the 1401 system user with a fast means of communication. All the advantages of the IBM 1407 Console Inquiry Station, plus the increased printout speed of 14.8 characters per second, provides the console operator with an efficient and time-saving method of inquiry and reply.

Before the 1447, Model 3, can be attached to a 1401 system, the IBM 1409 Console Auxiliary (Figure 11) and the 1409 adapter special feature must be installed.

The Model 3 does not have the indicator panel or the operator panel. These panels are located on the 1401 processing unit. Several additional keys and lights, located on the printer keyboard, are used during I/O printer operations. The additional keys and lights are:

Proceed Light

The proceed light glows when the console I/O printer is selected to operate.

Check Light

The check light glows when the inquiry-clear indicator is turned on.

Reset Key

The reset key is used with the type key, on a 1447 Model 3 having buffer storage. The reset key is not required on the unbuffered model.

Alter Type-In Key

When the CPU mode switch is set to ALTER, this key must be pressed to allow storage entry of keyboard information. Characters enter storage starting at the address indicated by the B-storage address register.

Type Stop Key

This key is used to terminate a character-display type-out operation.

Type Key

During *manual* operation, the type key initiates a storage type-out operation, beginning with the address indicated by the CPU B-storage address register. The CPU mode switch must be in alter mode.

During *programmed* operation, the type key is used to perform the following functions.

Buffer: The type key initiates request to the buffer. CPU selection of the 1447 permits keyboard entry into the buffer. Press the release key to turn on the inquiry-request (Q) latch.

Buffer and Polling: The type key initiates a request to the buffer. Subsequent CPU selection of the 1447 being polled allows keyboard information to enter buffer storage.

Unbuffered: The type key turns on the inquiry-request (Q) latch. CPU selection (by a branch on Q and a read Op) allows the operator to enter information from the keyboard.

Unbuffered and Polling: This initiates the turn-on of the Q-latch when the 1447 is polled.

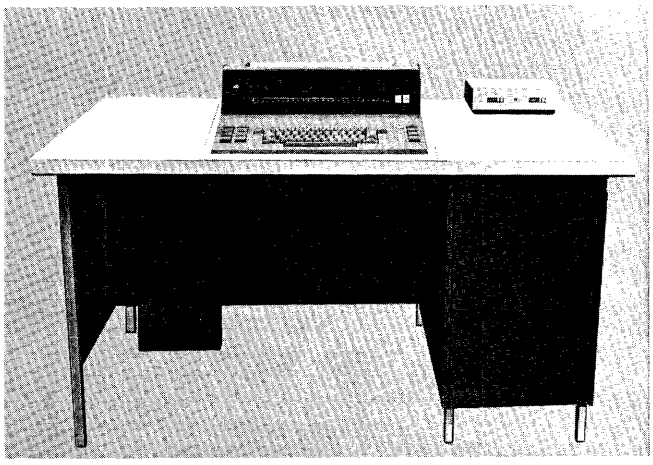


Figure 10. IBM 1447 Console, Model 3

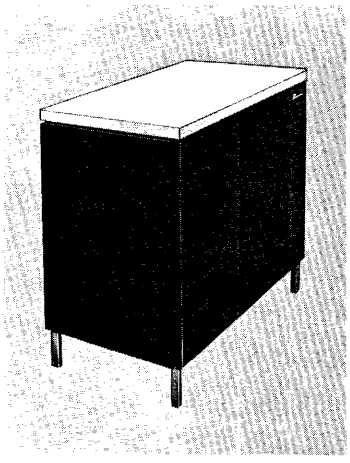


Figure 11. IBM 1409 Console Auxiliary

The IBM 1447 Console, Model 4, (Figure 12) has all the functions and capabilities of a 1447, Model 2, plus the lights, keys, and switches needed to operate an IBM 1448 Transmission Control Unit. This console can be attached to the IBM 1240, 1440, or 1460 systems.

With the 1448 attached to the system, the manual address switches and the power-on switch have additional functions. A new section of display lights on the indicator panel, a 1448 start-reset key, and a 1448 check-reset key are added to complete the necessary controls.

Manual Address

The two manual address switches (units and tens) address a given data or control character in core buffer. To do this, set the units and tens switches to the line number with which the character is associated (the inner numbers refer to the 1448). The control character for a given line can be addressed by setting the line number in the units and tens switches.

Power On/Off Switch

This switch turns the main power supply for the system and the 1448 off and on. The switch is operated upward to turn power off, and downward to turn power on. After being operated, the switch automatically returns to a central position.

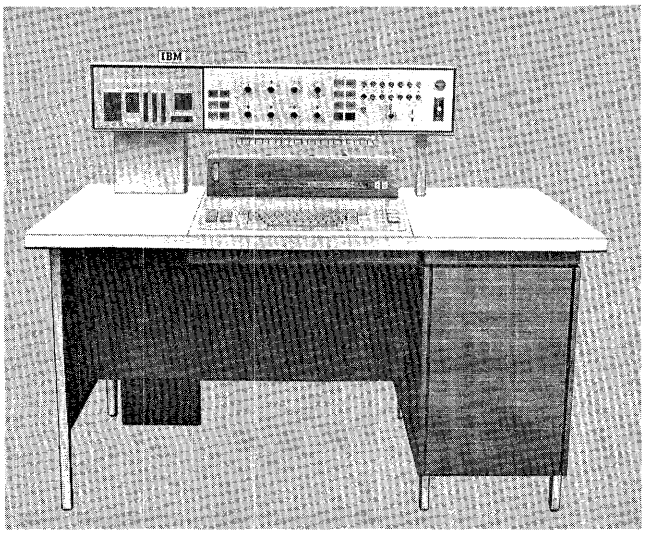


Figure 12. IBM 1447 Console, Model 4

Display Lights

These back-lighted indicators (Figure 13) provide information about the location and bit configuration of data as it stands in storage.

Status. This light comes on to indicate a parity error in status or an invalid-processor status. The other display lights in this column refer to the status of the system:

PAR (Parity)
TSM (Transmit)
REC (Receive)
ESA (End of Storage Area)
CTL (Control)
CK (Check)
IDL (Idle)
EOB (End of Block)
RDY (CPU is Ready)

Check. This light comes on to indicate a data parity error. The other display lights in this area include:

LRC comes on to indicate a longitudinal redundancy check at the end of a transmission.

OVL (Overflow) comes on to indicate that a 1448 buffer overflow occurred because the program exceeded the maximum allowable noninterruptable interval, or because of a processor-stop condition.

STATUS	CHECK
PAR	LRC
TSM	OVL
REC	RNG
ESA	OS
CTL	SQ 1
CK	SQ 2
IDL	REQ
EOB	INT
RDY	

Figure 13. Indicator-Panel Display Lights (1448)

RNG comes on when transmission of an invalid address occurred for the message-storage area.

OS (Out of Step) comes on to indicate that at the end of the scan operation, the 1448 was not at the last channel address.

SQ1 and SQ2 indicate the sequence of line-control operations

REQ (Request) indicates the request for interrupt is on.

INT (Power Interlock) comes on to indicate that power is on, and that the dataset equipment for the addressed line is ready to operate.

1448 Start-Reset Key

This key resets the complete IBM 1448 system.

1448 Check-Reset Key

This key resets the IBM 1448 error indicators.

Special Features

Sense Switches (Models 1, 2, 4)

Six additional sense swiches can be installed on the IBM 1447 Models 1, 2, or 4. (Switch A is standard and is used to control last-card operations.) The six additional switches (B, C, D, E, F, and G) can provide external control over the stored program.

The BRANCH IF INDICATOR ON instruction — B (III) d with the proper d-character tests the specified switch setting and causes a branch to the I-address if the switch is on.

Pin-Feed Platen (Models 2, 3, 4)

A pin-feed platen is available for the 1447 in a choice of nine widths. The pin-to-pin widths are: 6, 7½, 8, 9, 10, 10⅛, 11¼, 11½, and 13⅛ inches. The maximum printing line for the 13⅛-inch platen is 128 characters (10 characters per inch).

1051 Model 1 Attachment

With this feature, it is possible to attach a modified IBM 1050 Data Communications System to a data processing system, through the IBM 1447 Console (Model 2, 3, or 4) attached to that processing system.

Besides the attachment feature, an IBM 1051 Control Unit Model 1, is required. The modified 1050 system can contain these IBM 1050 components: two printers, one reader, and one punch.

1050 component operation is the same as in a 1050 system. Refer to *IBM 1050 Data Communications System* (A24-3020) for operational and special-feature information.

The reader-1 switch associated with the IBM 1051 must be set OFF to execute a *1050-system-to-processing-system* operation. The punch-1 switch must be in the CPU ON position.

The reader-1 switch associated with the IBM 1051 must be set to the LINE or HOME position to execute a *1050-system off-line* operation. The punch-1 switch must be in either the LINE or HOME position.

1. The inquiry-clear (*) latch is set ON in the system.
2. The red type light is turned on.
3. The system advances to the next instruction.

Modified 1050-System Operation

There are two ways that the locally connected IBM 1050 components can act as input/output to the attached system. These operations are:

1. 1050-initiated input to the system.
2. Program-initiated output from the system.

1050-Initiated Input to the System

A 1050-initiated input to the system is accomplished when:

1. The operator readies the 1050 system.
2. A procedure located in the stored program polls the local station to see if it wants to send information to the system. The subroutine starts by executing a WRITE ON 1447 CONSOLE instruction — (M % T0 BBB W).

   When the local 1050-terminal system is attached to the system, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area that contains the terminal-component-identifying information. The d-character specifies a write operation.
3. The initial core-storage position specified in the WRITE instruction B-address contains an end-of-transaction (C) character (tape mark in the BCD code).
4. The core-storage position next to the (C) position contains a letter B, which designates the local 1050 terminal
5. The core-storage position next to the letter B contains a component-select code of zero.
6. The group-mark with word-mark in the core-storage position next to the zero ends the operation.
7. When the 1050 system is readied for sending and this *polling* instruction is executed, the inquiry-request (Q) indicator is set ON in the system, and the system is allowed to execute the next instruction.
8. The next instruction should be a BRANCH IF INQUIRY REQUEST INDICATOR ON — (B III Q). The stored program branches to the inquiry subroutine after it tests the Q-latch and finds it on.

9. The inquiry subroutine contains a READ FROM 1447 CONSOLE instruction — M/L (%T0) (BBB) R. When IBM 1050 components are attached to a system through a 1447 console and the 1051, the A-address specifies the inquiry channel instead of the console printer alone. The B-address specifies the initial core-storage position of the area where the input data will be stored. The d-character specifies a read operation.
10. The Q-latch is turned off, and the white type light is turned on.
11. The operator starts to key information (or the reader unit starts automatically).
12. The input message is transmitted until a Ⓑ or Ⓒ character is received by the system. The Ⓑ is stored as a record mark in core storage; the Ⓒ is stored as a tape mark in core storage.
13. When either the Ⓑ or Ⓒ character is received, the operation ends, and the system is released and allowed to continue processing.

Note: When a modified 1050 system is attached to the system, the 1447 must also be polled before a 1447 request will be honored. The 1447 is identified by a letter A and the terminal component identifying message is Ⓒ A0 ≠ (ⒸA ≠ if buffered).

Input-Operation Check Condition

The one check condition that can occur during this operation is a detected parity check during the input-component-to-core-storage transfer.

A parity check detected during the input-component-to-core storage transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Positively resets the A-register error latch off. All detected parity checks will reach the A-register and would, normally, turn on the A-register error latch and stop the system. In this instance, the error latch is kept off and the system does not stop.

Program-Initiated Output from the System

An output from the system is accepted by one of the locally attached 1050 components when:

1. The stored program executes a WRITE ON 1447 CONSOLE instruction — M/L (%T0) (BBB) W. When IBM 1050 components are attached to a system through the 1447, the A-address specifies the inquiry channel. The B-address specifies the initial core-storage position of the area that contains the output data to be sent. The d-character specifies a write operation.
2. The initial core-storage position specified in the WRITE instruction contains an address select Ⓢ character (comma in BCD code).
3. The core-storage position next to the Ⓢ position is a letter B, which designates the local 1050 system.
4. The core-storage position next to the letter B contains a home-component select code. Refer to *IBM 1050 Data Communications System* (A24-3020) for details.
5. The core-storage position next to the home-component select code contains a Ⓓ character (pound sign in BCD code).
6. The text follows the Ⓓ character in core storage, and is transmitted to the output unit(s) until a group-mark with word-mark is sensed in core storage.
7. The group-mark with word-mark ends the operation and the stored program continues processing.

Note: If the initial core-storage position (Step 2) does not contain the address select character, the contents of the specified core-storage area will print out on the console printer. The group-mark with word-mark at the end of the area will end the operation.

Output-Operation Check Conditions

The two check conditions that can occur during an output operation are:

1. A system-detected parity check.
2. A detected parity check during the core-storage-to-output-component transfer.

System-Detected Parity Check. A parity check detected by the system B-register turns on the B-register error latch and stops the system. The rest of the message is transmitted.

Core-Storage-to-Output-Component Transfer Error. A parity check detected during the core-storage-to-output-component transfer:

1. Turns on the inquiry-clear (*) indicator in the system when the check is detected.
2. Turns on the red type light on the console.
3. Prints or punches whatever character the BCD coding specifies.
4. Parity is automatically corrected, and the character is stored.

Condition Indicators

Two indicators reflect the IBM 1050 component core-storage conditions that occur. The status of these indicators is checked by the system when it executes a

Index

IBM 1447 Console
A24-3031-3

• Is the material:	*Yes*	*Satisfactory*	*No*
Easy to read?	☐	☐	☐
Well organized?	☐	☐	☐
Fully covered?	☐	☐	☐
Clearly explained?	☐	☐	☐
Well illustrated?	☐	☐	☐

• How did you use this publication?

As an introduction to the subject ☐
For additional knowledge of the subject ☐

• Which of the following terms best describes your job?

Customer Personnel		*IBM Personnel*	
Manager	☐	Customer Engineer	☐
Systems Analyst	☐	Instructor	☐
Operator	☐	Sales Representative	☐
Programmer	☐	Systems Engineer	☐
Trainee	☐	Trainee	☐
Other _____		Other _____	

• Check specific comment (if any) and explain in the space below:
(*Give page number*)

☐ Suggested Change (Page) ☐ Suggested Addition (Page)
☐ Error (Page) ☐ Suggested Deletion (Page)

Explanation:

Space is available on the other side of this page for additional comments.
Thank you for your cooperation.

A24-3031-3

Staple

Fold

Fold

FIRST CLASS
PERMIT NO. 170
ENDICOTT, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY . . .

IBM Corporation
P. O. Box 6
Endicott, N. Y. 13764

Attention: Product Publications, Dept. 171

Fold

Fold

Cut Along Line

IBM 1447 Printed in U. S. A. A24-3031-3

Additional Comments:

IBM

International Business Machines Corporation

Data Processing Division

112 East Post Road, White Plains, N. Y. 10601