

Systems

**IBM 3740 Data Entry System
IBM 3741 Data Station
IBM 3742 Dual Data Station
Reference Manual**

IBM

Preface

This publication is a reference manual for customer applications personnel and key entry supervisory personnel who wish specific information about the IBM 3741 Data Station and the IBM 3742 Dual Data Station.

Information in this manual pertains to both the 3741 and 3742 unless specified otherwise. Chapter 1 presents a general overview of the 3740 system and the 3741 and the 3742, listing the standard functions and features available. Chapter 2 presents information about the IBM Diskette. Chapter 3 deals with operating characteristics in terms of data flow, modes of operation, disk unit, and buffers. Chapter 4 defines the display unit and the keyboard. Chapters 5 through 12 deal with specific details about functions and features, and programming information required by them. Appendix A gives a list of possible error codes, their causes, and possible recoveries.

First Edition (January 1973)

Changes are continually made to the specifications herein; any such changes will be reported in subsequent revisions or Technical Newsletters.

A Reader's Comment Form is at the back of this publication. If the form is gone, address your comments to IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901.

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IBM 3740 Data Entry System

SYSTEM OVERVIEW

The IBM 3740 Data Entry System is a family of products that satisfies a variety of key entry requirements. The 3740 system is equally adaptable to centralized, decentralized, and remote key entry environments. Original records are entered much like they are on a standard keypunch. The characters are entered in temporary storage as they are keyed and written on the disk after the complete record has been keyed.

A key element of the 3740 system is a magnetic recording medium, the IBM diskette. This disk is an economical means of storing data and replaces the standard punched card. One disk holds 1898 records, roughly the equivalent of one box of 80-column cards. Furthermore, the disk can be used over and over, and data that has been entered on the disk can be easily corrected and updated, thus eliminating the rekeying of entire records and the scrapping of cards.

The 3740 system devices are:

- **IBM 3742 Dual Data Station:** Designed for data entry use in a centralized transcription location.
- **IBM 3741 Data Station Models 1 and 2:** Designed for data entry use as a stand-alone station in a decentralized or remote location as well as in a centralized transcription area.
- **IBM 3747 Data Converter:** Designed to convert data entered on magnetic disk by the data stations to magnetic tape for use by other 9-track systems and to convert data from magnetic tape to disk for updating by the 3740 system.
- **IBM 3713 Printer:** Designed to attach to the 3741 to provide hard copy output.

Thus, as shown in Figure 1, the IBM 3740 is actually an integrated data entry system answering today's requirements for data entry in various operating environments.

In a centralized transcription environment, a typical installation includes a number of IBM 3742 Dual Data Stations for recording data on diskettes. An IBM 3747 Data Converter would be included to convert the data to one-half inch, 9-track tape for processing by the host central processing unit.

In a decentralized transcription environment, several IBM 3741 Data Stations would be located throughout a business site. For instance, one station might be in the parts distribution department and used by the inventory clerk to enter part movement information. Other stations might be in manufacturing departments where requests for parts are entered by a control person. A diskette would be sent to other departments or to a location having a converter.

In a remote environment, a typical situation would include one or more IBM 3741 Data Stations at various offsite locations, or, if the work load is heavy, IBM 3742 Dual Data Stations. Perhaps parts are distributed from a warehouse to several divisions of a company located miles apart. The inventory data would be entered via the data station on disk as transactions occurred. Periodically the data would be transmitted to the warehouse via an IBM 3741 Data Station Model 2 with binary synchronous communications.

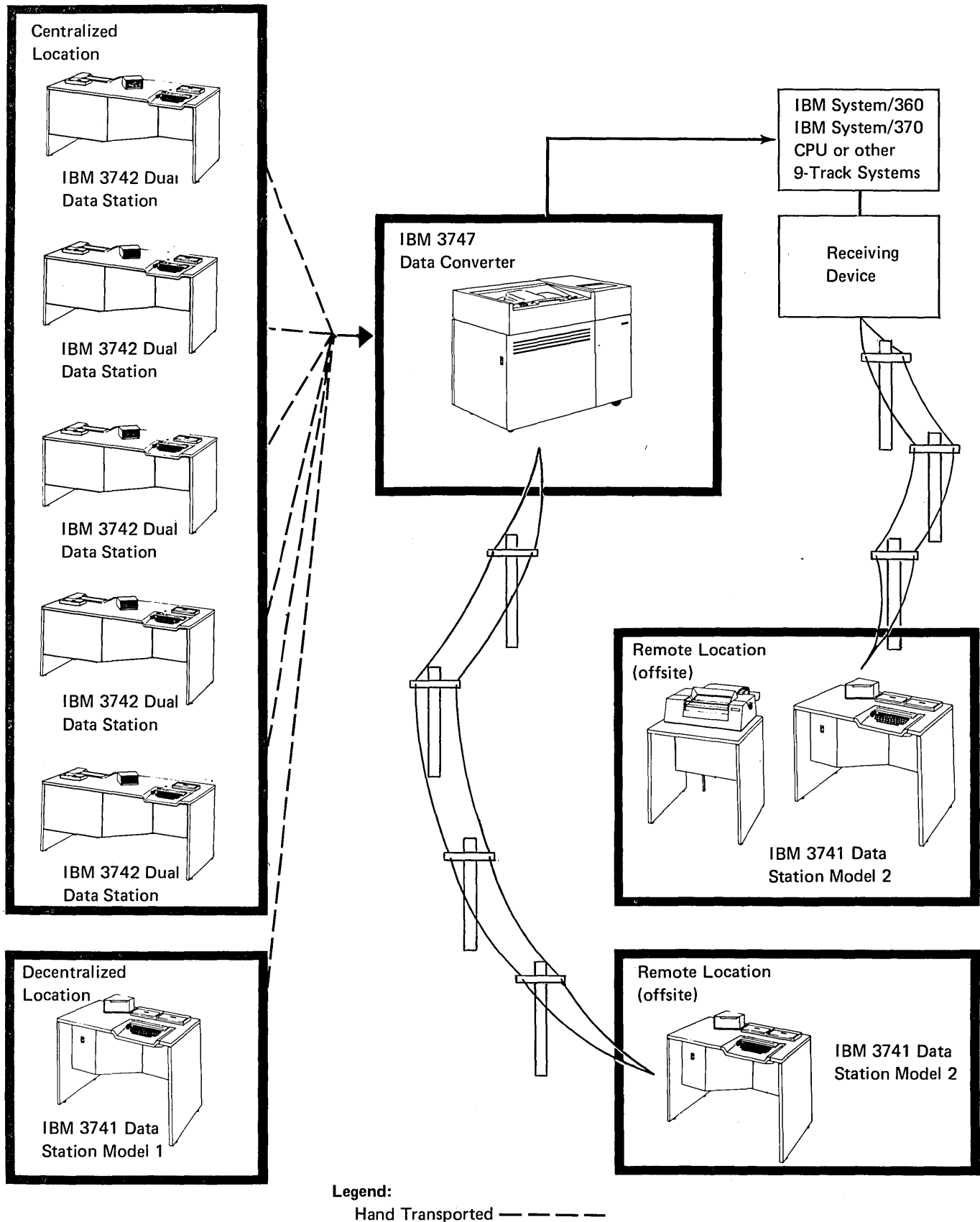


Figure 1. An Integrated Data Entry System

IBM 3741 Data Station and IBM 3742 Dual Data Station Overview

The IBM 3741 Data Station Model 1 (Figure 2) is a stand-alone device with one operator station, which has one keyboard unit, one display unit, one or two disk units, and a control unit. In addition, the Model 2 is equipped with a binary synchronous communications adapter.

The IBM 3742 Dual Data Station (Figure 3) is a stand-alone device with two operator stations, each with its own keyboard and disk unit. The 3742 has only one control unit and one shared display unit.

For a listing of standard functions and features available on each of the data stations, see Figure 4. For detailed information about these functions and features, see the appropriate index references.

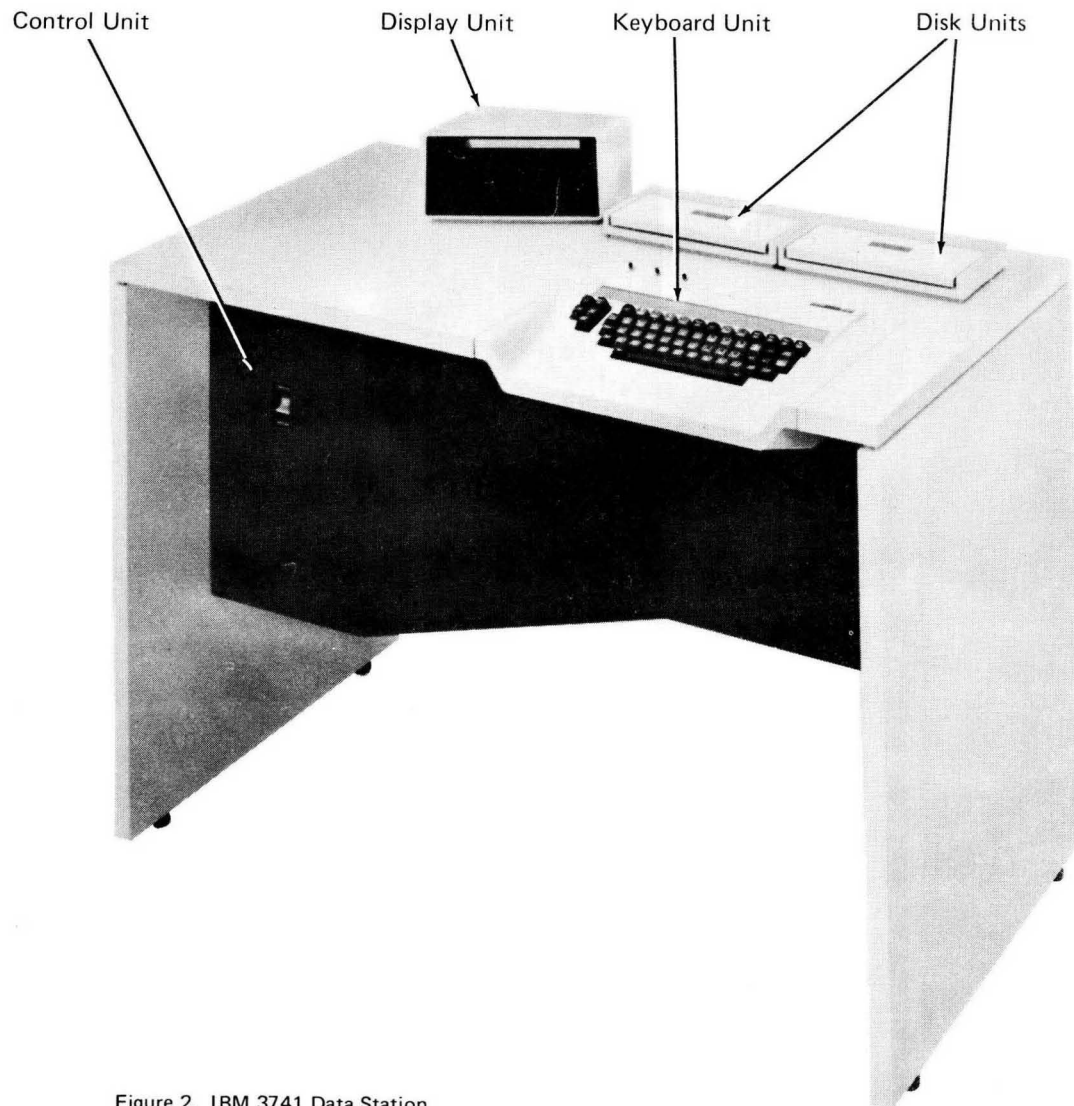


Figure 2. IBM 3741 Data Station

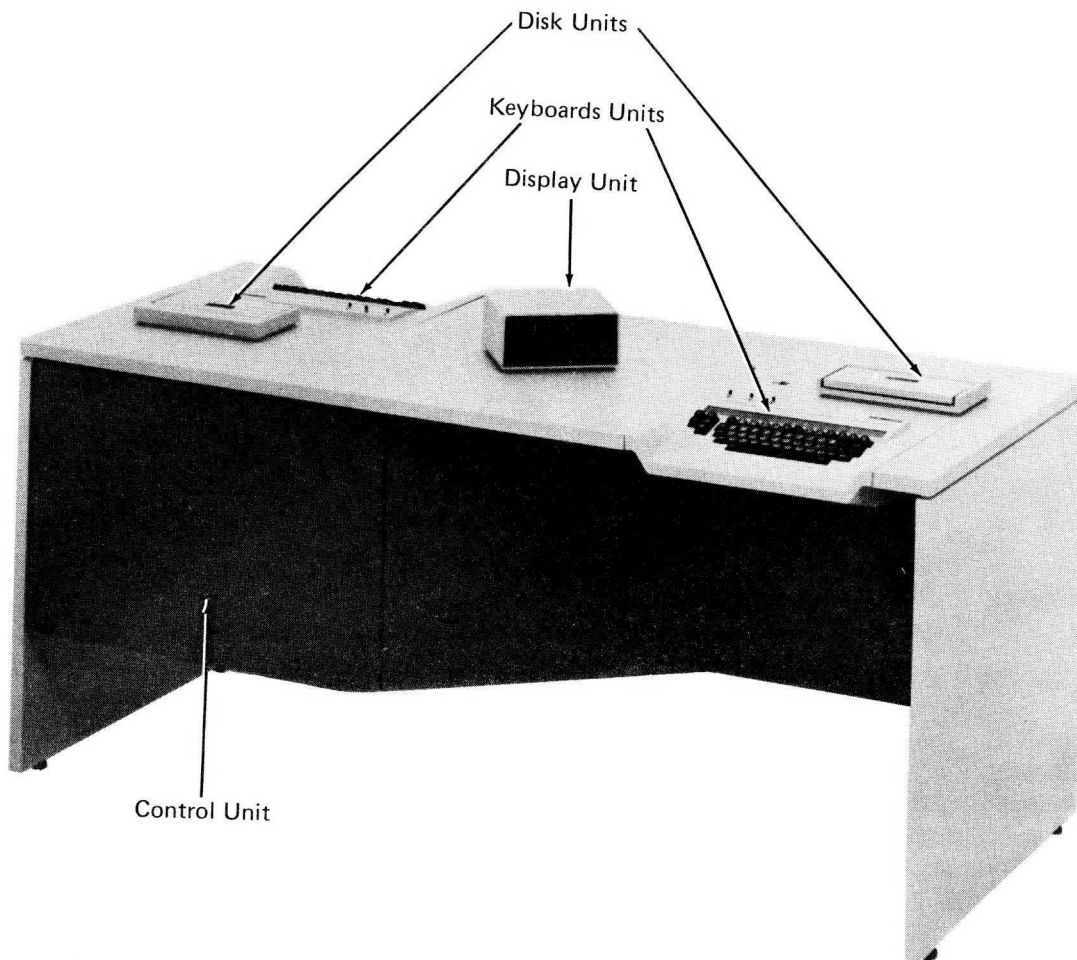


Figure 3. IBM 3742 Dual Data Station

Standard Function or Feature	IBM 3741 Data Station, Models 1 and 2	IBM 3742 Dual Data Station
Entering and updating records	Standard	Standard
Search on record address	Standard	Standard
Search on sequential content	Standard	Feature
Search on content	Standard	Feature
Search on end of data	Standard	Standard
Program chaining	Standard	Standard
Operator guidance	Standard	Not available
Levels of program control (per operator station)	Ten standard	Six standard; four additional available with a feature
Record length	Standard 1 to 128 characters	Standard 80 characters Feature 1 to 128 characters
Verify	Feature	Standard
Production statistics	Feature	Standard
Self-checking number (modulus 10 and 11)	Feature	Feature
Offline field totals	Feature	Feature
Online field totals	Feature	Not available
Disk copy	Feature	Feature
Disk initialization	Feature	Feature
Second disk attachment	Feature	Not available
Printer	Feature	Not available
Binary synchronous communications:	Standard on the 3741 Model 2 and not available on Model 1	Not available
Keylock	Feature on Model 2	Not available
Terminal identification	Feature on Model 2	Not available
Synchronous clock	Feature on Model 2	Not available
Operator identification card reader	Feature on Model 2	Not available

Figure 4. Standard Functions and Available Features

Chapter 2. IBM Diskette

The IBM diskette (Figure 5) is a flexible Mylar* disk contained within a protective cartridge about 8.0 inches square. Data is recorded and read serially on the disk in the same way data is processed on magnetic tape. Records can be accessed directly as with system-attached magnetic disk drives. The diskette falls between the punched card and one-half inch magnetic tape in terms of data storage capacity and functional characteristics. It combines the small batch data storage properties of punched cards with many of the features of one-half inch magnetic tape and has the added advantage of direct access. In addition, the diskette fits easily into the procedures of most punched card installations, replacing cards with minimum changes required. When compared to the punched card, the disk has the following advantages.

- Reusability to reduce media cost.
- Ease of erasure and error correction.
- Very favorable ratio of size and weight to data stored. One small disk can usually hold the entire day's output from the typical key entry station.
- Improved data readout speeds. This speed is advantageous when either the 3741 Model 2 or 3747 data converter is attached to a data processing system via communications.
- The ability to easily back up and reread data for retransmission in case of communication errors.
- Portability and mailability of useful quantities of data.
- Machine-assisted direct access to offline batch data files.

DISK LAYOUT

The disk unit reads and writes on only one side of the disk. The physical layout of the disk is shown in Figure 6. Each disk is divided into an index track and 73 data tracks or circles similar to the grooves on a record. The track is divided into 26 sectors. Thus, any data record can be located by an address consisting of a track number and a sector number. Twenty-six records of up to 128 characters each can be written on each track. The capacity of the disk is 1898 data records.

*Trademark of E I duPont de Nemours & Co., Inc.

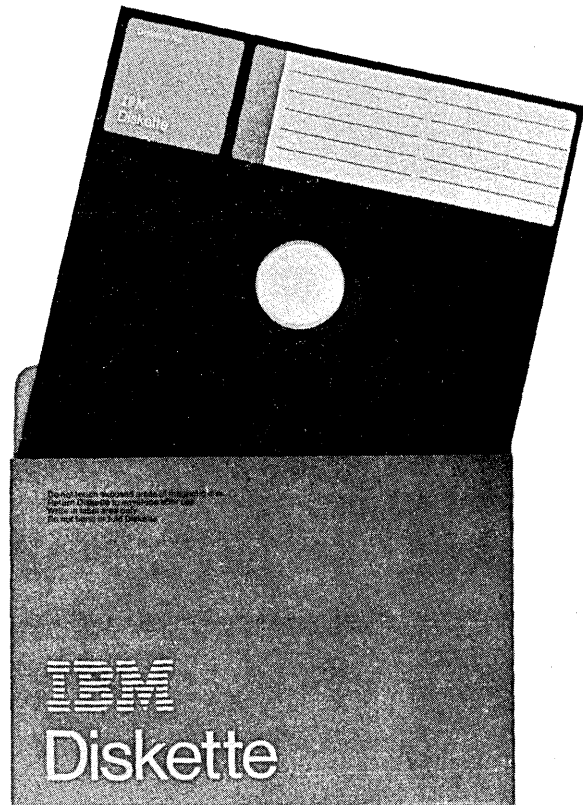


Figure 5. IBM Diskette

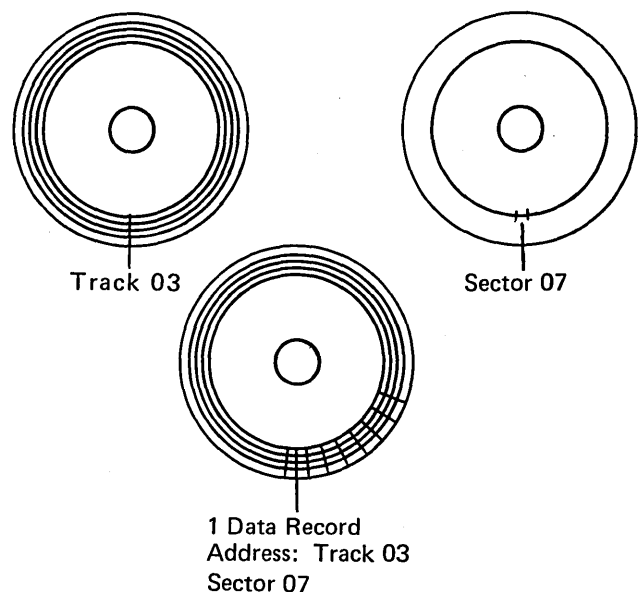


Figure 6. Physical Disk Layout

Each of the 26 sectors has a sector identification field and a data field. A field is a predefined number of data positions designated for a specific use. The identification field contains the track number and sector number. The identification fields are prerecorded for the entire disk during an initialization process and are not rewritten or changed during normal disk use. The data field has space for one physical record. The maximum record length, called physical record length, is always 128 characters. However, the logical record length on the 3741 can be anywhere from 1 to 128 characters. On the standard 3742, the logical record length is always 80 characters; a variable length logical record of 1 to 128 characters is available as a feature.

Index Track Layout

The first track on a disk, called the index track and numbered 00, contains a maximum of 26 records for system or data set information. All remaining tracks (01 through 73) can be used for data records.

Each record on the index track has a logical record length of 80 characters and a physical record length of 128 characters. The index track format is shown in Figure 7. The first seven sectors of the index track may contain system information or information about the diskette, such as the location of tracks that have developed errors in use. The remaining sectors (08-26) may contain data set labels, which are used to define the data sets resident on the disk.

Sector	Contents After Writing
Sector 1	80 blanks
Sector 2	80 blanks
Sector 3	Position 1: machine test character for a write test
Sector 4	80 blanks
Sector 5	Positions 1-5: ERMAP; positions 6-80: blanks If 1 or 2 bad tracks were specified, positions 7 and 8 indicate the first bad track and position 9 contains a 0; positions 11 and 12 indicate the second bad track and position 13 contains a 0.
Sector 6	80 blanks
Sector 7	Volume label: positions <div style="text-align: center;"> <div>1 2 3 4 5 6 7 8 9 10 11 12</div> <div>V O L 1 I B M I R D</div> <div>Volume ID</div> <div>↑</div> <div>Accessibility — Any nonblank character means disk is not accessible</div> <div>-----76 77 78 79 80</div> <div>-----b-----b-----w</div> <div>12 through 76 contain blanks</div> <div>↗</div> <div>Sector sequence information</div> </div>
Sectors 8-26	Data set labels

Figure 7. Index Track Layout

Index Track Data Set Labels

Sectors 8 through 26 of the index track are used primarily as data set labels. A data set label defines pertinent information about a data set on the disk such as beginning of extent (BOE), end of data (EOD), end of extent (EOE), and the record length for the data set. For exact layout of the data set label, see Figure 8.

Position by Position Representation of Data on the Index Track in Any One Sector of Sectors 8-26.		
Field Name	Position	Purpose
Header 1	1-4	Label identifier for system application; must be HDR1.*
	5	Reserved
Data set name	6-13	User name for data set
	14-22	Reserved
Record length	23-27	Logical record length*
	28	Reserved
Beginning of extent (BOE)	29-33	Identifies the address of the first sector of the data set. Positions 29 and 30 contain the track number, position 31 must be 0, positions 32 and 33 contain the sector number.*
	34	Reserved
End of extent (EOE)	35-39	Identifies the address of the last sector reserved for this data set.*
	40	Reserved
Bypass data set	41	The IBM 3747 data converter requires that this field contain a B or a blank. If a B is present, the data set is ignored. If a blank is present, the data set is processed. This coding allows the user to store programs and data on the same disk.
Accessibility	42	This field must contain a blank in order for processing to take place.
Write protect	43	If this field contains a P, the disk can be read only. Otherwise this field must be a blank, in which case both reading and writing are permitted.

* Indicates an entry required by the 3740 system.

Figure 8 (Part 1 of 2). Data Set Label Layout

Position by Position Representation of Data on the Index Track in Any One Sector of Sectors 8-26.		
Field Name	Position	Purpose
Multivolume indicator	44	Reserved
	45	A blank in this field indicates a data set is not continued on or from another diskette; a C indicates a data set is continued on another diskette; an L indicates the last diskette on which a continued data set resides. **
	46-72	Reserved
Verify mark	73	This field must contain a V or a blank. V indicates the data set has been verified.
	74	Reserved
End of data	75-79	Identifies the address of the next unused sector.
	80	Reserved

**When preparing data for conversion by the 3747, check the *IBM 3747 Data Converter Reference Manual*, GA21-9153, for the interpretation of the multivolume byte.

Figure 8 (Part 2 of 2). Data Set Label Layout

Chapter 3. Data Station Operating Information

The entering, updating, verifying or finding of data on a disk is performed by the data stations using different modes of operation. The sequence of operations performed by the control unit within the data station is directly dependent upon the mode in which the station is functioning. Buffers store and transfer data within the station to allow communication between the keyboard, disk, and display. Each mode of operation is unique, and, therefore, the use of buffers, keys, and the information displayed is different for each mode.

The mode of operation is indicated by a code displayed on the status line of the display unit. Some of the modes of operation for the 3741 and 3742 and their corresponding display codes are:

Mode	Display Code
Enter	E
Update	U
Verify	V
Field correct	C
Search	S
Read index	X
Modify	M
Field totals (offline)	F

BUFFERS

Buffers are used to communicate with the keyboard, display, and disk. The buffers are the current record buffer, previous record buffer, hold buffer, and several format buffers.

The current record buffer stores data characters as they are keyed or receives records that are read from disk during update mode. Data information displayed on the screen is from the current buffer.

The previous record buffer normally contains the last completed record. Data is written on the disk from this buffer and can also be duplicated and placed in the current record buffer.

The hold buffer is used to store the next record to be processed when verifying data or to store a mask used during search operations.

MODES OF OPERATION

Enter Mode (E)

Enter is the most basic mode of operation. Enter mode can be selected from the index track only; an M error results if enter mode is selected when in any other position on the disk. Enter mode is used to write new information on the disk. To select the enter mode, press FUNCT SEL lower and then press ENTER.

As the operator keys a record, the data is stored in the current record buffer until the record is completed. When a record advance occurs, the completed record is transferred to the previous record buffer. While the next record is being keyed into the current record buffer, the previous record is written on the disk.

The data flow is summarized in Figure 9. When enter mode is selected, the disk is positioned at BOE; the current record buffer and the previous record buffer are set to blanks. The station is then ready to accept data keyed into the current record buffer.

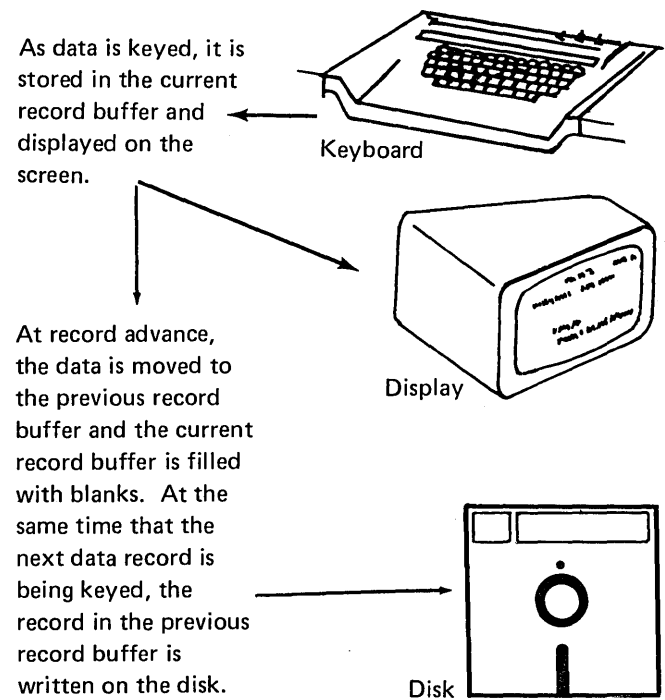


Figure 9. Data Flow for Enter Mode

Update Mode (U)

Use the update mode to read records from the disk for review or modification. To select the update mode, press FUNCT SEL lower and then press UPDATE.

Data flow is summarized in Figure 10. Update mode can be selected from the read index, search, or verify mode. If update is selected from the index track, the disk is positioned at BOE; if update is selected from the verify mode, the record at the current disk address is reread. Selecting the update mode from the enter mode results in an M error. However, the mode automatically changes to the update mode when record backspacing occurs during the enter mode. The search mode also automatically changes to update mode at the end of a search operation. A Y error occurs if update mode is selected when the end-of-data address equals the beginning-of-extent address; in other words, when the data set is empty.

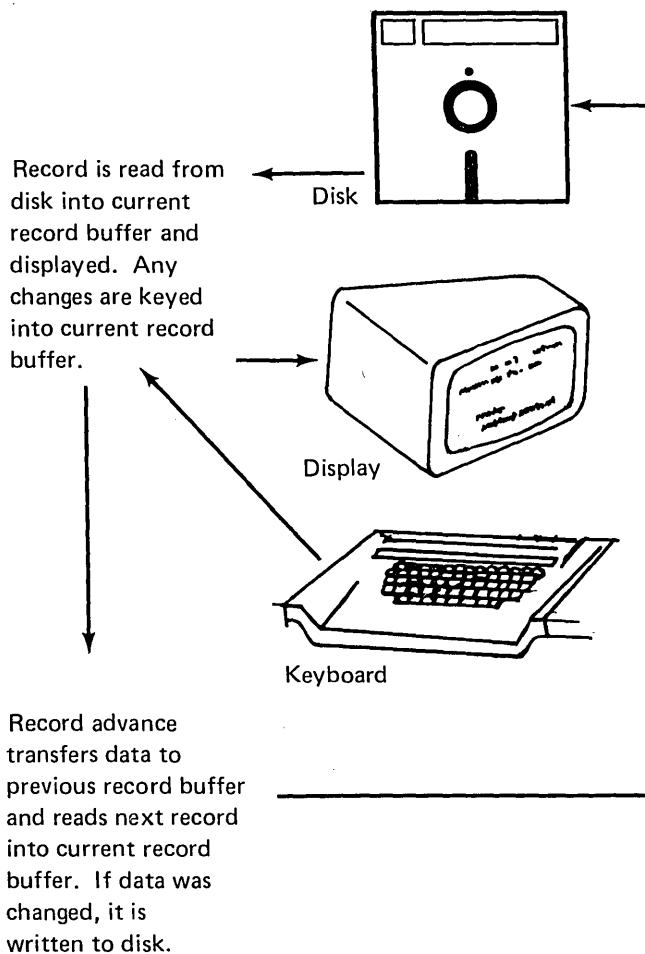


Figure 10. Data Flow for Update Mode

If record advance reaches EOD during update mode, the mode of operation automatically changes to enter mode. However, an auto return to index track is performed if the data set is protected by a write protect byte in the label (a G error is displayed) or if the data set is full (an E error is displayed).

Verify Mode (V)

Use the verify mode to check the accuracy of data records already on the disk and to make corrections to the records when errors are found. The process of verifying data is similar to that of entering data. As the data for a record is rekeyed from the source document, each character is automatically compared with the corresponding character in the record in the current record buffer. If the characters do not compare, a V error occurs.

To select the verify mode, press FUNCT SEL lower and then press VERIFY. Select the verify mode from read index or update mode. For data flow, see Figure 11. When verify mode is selected from read index mode or update mode, the previous record buffer is automatically filled with blanks, and the first non-deleted record is read into the current record buffer.

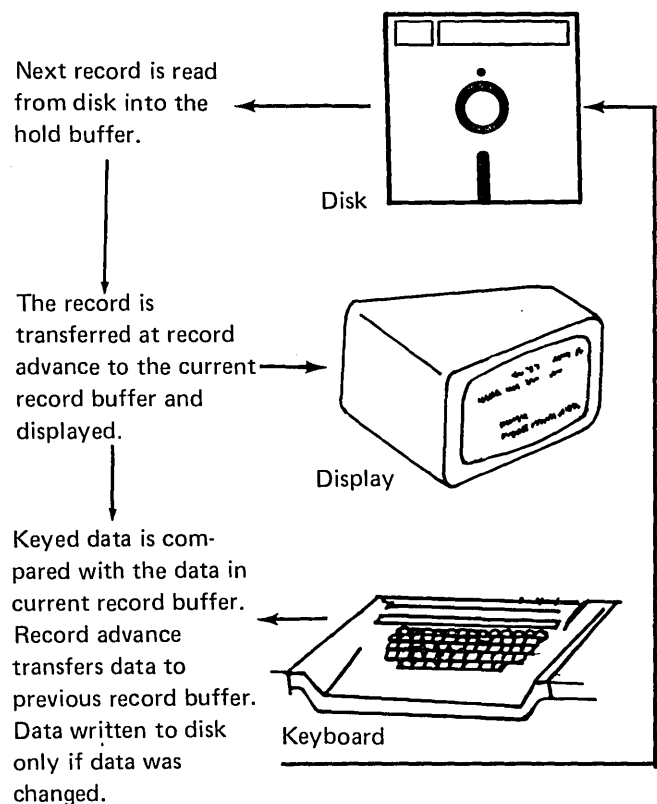


Figure 11. Data Flow for Verify Mode

Error Correction

If a character keyed while verifying is not the same as the corresponding character in the current record buffer, the following occur:

1. The keyboard locks.
2. A V error code is displayed on the status line.
3. The cursor stops under the position in error.
4. The entire record is displayed.

Use RESET to reset the error condition and then correct the character in error.

The first character key following the error is accepted if the character keyed agrees with either the character in the current record buffer or the character that caused the error. If the first character key pressed following the error is not accepted, a verify error is again displayed. The correction process is continued until all corrections have been made to the record.

Record Advance

When a record advance is performed on a corrected record, the record is rewritten on the disk as corrected. If there were no corrections to the record, it is not rewritten during record advance. If no verification or correction to a record has taken place and the cursor is in the first manual position of the record, pressing REC ADV causes a record advance function to occur without verification of the record. Pressing REC ADV when the cursor is in other than the first manual position of a record causes all remaining manual fields to be verified as blanks; remaining auto dup fields are verified and bypass fields are bypassed.

Skip Functions

If SKIP is pressed or a programmed skip field is encountered during verification, the entire field or the remainder of the field is checked for blanks. If a nonblank character is encountered, the cursor stops in that position, the skip action terminates, and a V error is displayed. After pressing RESET, the nonblank character can be replaced with a blank by pressing SKIP. The station then continued to check the rest of the field for blanks.

Display

During verification, the data record is displayed up to but not including the cursor position. However, the *entire* record is displayed (1) after the record is moved into the current record buffer, (2) after a record backspace operation, or (3) when an error occurs. The keystroke following the RESET key returns the normal verify display mode.

Verification Code

After the last record in a data set has been verified, a verification code (V) is automatically inserted in the verify field of the data set label, the mode of operation changes to a read index mode, the data set label is displayed, an E alert is displayed, and program level 0 is selected.

Duplication Functions

Pressing DUP or entering a programmed duplication field during data verification causes the rest of the field to be verified automatically. The characters of the record in the current record buffer are compared with the corresponding characters in the previous record buffer. If one of the characters in the record disagrees with the corresponding character in the previous record buffer, a verify error is posted. After RESET is pressed, the character from the previous record buffer can be inserted into the current record buffer by pressing DUP. The device then continues comparing the field.

When using the auxiliary duplication feature, the characters in the record are compared with the corresponding characters in the program buffer 4.

Right-Adjust Fields

If a right-adjust field is encountered while verifying data, the cursor stays in the first position of the field until the first data key is pressed. The fill characters are compared depending on the field definition characters, and then the first data character keyed is compared with the first nonfill character in the field. If the characters do not agree, a V error occurs.

To exit from the right-adjust field after verifying the last character in the field, press either RIGHT ADJ or the dash (-) key. RIGHT ADJ and the dash key also verify the field's sign, unless the field is alphabetic. (The dash key is used to verify a numeric field having a minus sign.) If the right-adjust field is alphabetic, the last character in the field is verified in the same way as a character in any other position in the field.

If a verification error occurs while verifying the sign of a right-adjust field, an X error is displayed. The sign can be changed by two depressions of RIGHT ADJ or the dash key.

Press RIGHT ADJ or the dash key, if applicable, to exit from every programmed right-adjust field. Press the key even when one right-adjust field immediately follows another and when right-adjust fields contain all fill characters. Failure to press RIGHT ADJ or the dash key at the end of a right-adjust field causes an error on the next data keystroke.

When a right-adjust field is the last field in an 80-character record on the 3742 or a 128-character record on the 3741 or 3742 with the 128 feature and the field has been verified but RIGHT ADJ has not yet been pressed, the cursor position indicator is 129 for the 3741 or 3742 with the 128 feature, or 81 for 3742, and the cursor is not displayed.

In verify mode, RIGHT ADJ or the dash key should be used only when the cursor is in the first position of the right-adjust field (to verify a zero or a blank field) or when the field is full (the cursor will have moved to the first position of the next field). If these keys are pressed when the cursor is in any other position, an R error occurs.

Signs

If the units position of a numeric right-adjust field contains a negative number (D zone), the sign and the value of the field are verified separately. The first keystroke for the units position verifies the digit. If the character is corrected, only the digit portion is changed. The sign (D zone) is not affected. To exit from the field, use the dash key. The dash key also verifies the sign.

If the units position of a right-adjust field has a D zone (dash) but the field is alpha, the entire character is compared. If corrected, the entire character is changed. Exit from the field using RIGHT ADJ. To verify a dash character in a numeric right-adjust field, press ALPHA SHIFT with the dash key.

Hexadecimal Data

Verify hexadecimal data in the same way it is entered:

1. Press HEX.
2. Press two character keys corresponding to the hexadecimal digits wanted. The character is verified after the last keystroke for that character.

Field Correct Mode (C)

Field correct mode may be used to correct an entire field with a minimum number of keystrokes. The field correct mode can be selected from the verify mode only. To select the field correct mode, press FIELD COR. The cursor moves to the first position of the current field, and the field can be rekeyed as if in the enter mode. When the end of the field is reached, the cursor then moves back to the first position of the field and the mode changes to verify.

Selecting field correct mode when not in verify mode or while processing a programmed auto field in verify mode results in an M error. FIELD ADV and CHAR ADV are valid in the field correct mode. The field correct mode changes back to the verify mode when a field or character backspace moves the cursor out of the current field.

Search Mode (S)

Use search mode to:

- Search on record address from read index, update, or enter mode.
- Search to end of data from read index or update mode.
- Search on content from read index or update.
- Search on sequential content from read index, update, or enter mode.

For data flow information, see Figure 12.

Note: After pressing any search key, but before pressing REC ADV, the search operation can be canceled by pressing FUNCT SEL lower and RETURN TO INDEX or by pressing FUNCT SEL lower and UPDATE.

Search on Record Address

To search for a record in a data set, key its track and sector location. The track and sector address specified can be the beginning-of-extent address, the end-of-data address minus one, or the address of any record between these two addresses. Select the search mode to do a search by record address operation from the read index, update, or enter mode. Selecting the search by record address function from any other mode causes an M selection error.

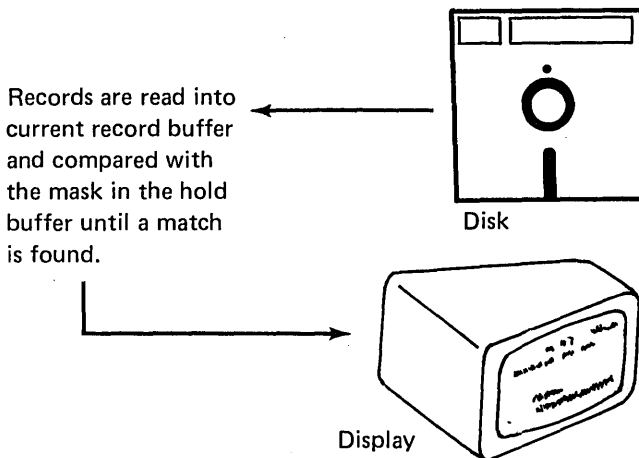
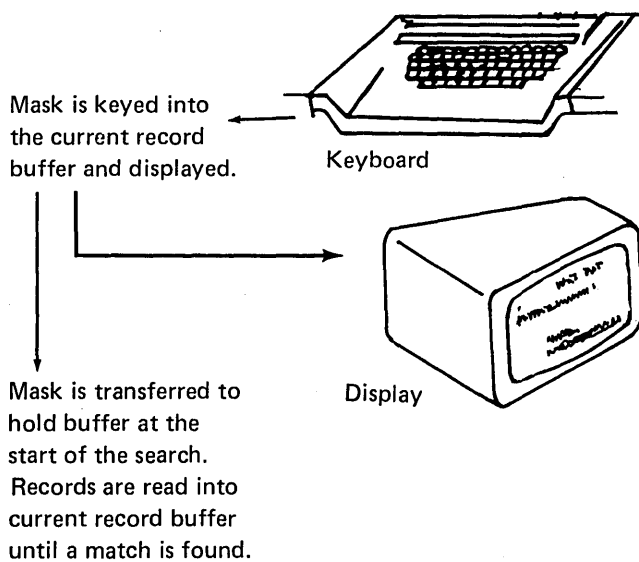


Figure 12. Data Flow for Search Mode

To search on record address:

1. Press FUNCT SEL lower.
2. Press SEARCH ADDRESS. Pressing this key puts the keyboard in the numeric shift, blanks the current record buffer, moves the cursor to position 1, and selects program level 0.
3. Enter the address of the record you are searching for in positions 1 through 5 of the current record buffer. The address must be in the format TTOSS where T is the track number and S is the sector number. For example, 07011 is the address of a record at track 07, sector 11.
4. Press REC ADV to start the search.

The search stops on the record address specified. The record at the specified address is displayed. The current record buffer and the previous record buffer are equal at the end of the search and the mode changes to the update mode.

An I error is displayed if the search address is specified incorrectly, if the address is greater than or equal to the end-of-data address or less than the beginning-of-extent address for the data set, or if the address is on the index track. If an invalid address was entered, the cursor moves to the first position of the data line on the display screen.

If a search address operation is attempted on an empty data set, a Y error occurs. If a seek or no record found error occurs during a search to record address operation, the data station returns to the data set label.

Search to End of Data

To search to the last record of a data set (end-of-data address minus one), press FUNCT SEL lower and then press SEARCH EOD. Select the search to the end-of-data function from the read index, enter, or update mode. Selecting it from any other mode gives an M error.

When the search is completed, the current disk address is set equal to the last record in the data set and the record is displayed. The contents of the previous record buffer is set equal to the current record buffer and the mode of operation changes to update. If this search operation is selected when the end-of-data address equals the beginning-of-extent address, a Y error occurs. If a seek or no record found error occurs during a search, the data station returns to the data set label.

Search on Content

Use search on content to find records that are identified by the content of specified character positions. The specification of the identifying characters and their positions is called a mask. The mask can be any one or more positions of a record and may include the entire record. The mask character positions do not need to be contiguous. The search will stop only on a record that contains an exact match between the record and the search mask. The blank character is used to identify positions that are not included in the mask; therefore, the blank cannot be used successfully as a character within a mask. For example, if a certain field in a record contains AB $\overline{1}$ CD and the search mask AB $\overline{1}$ CD is used, the search will stop on the first record that contains AB in the first two positions of the field and CD in the last two positions of the field. Any of the 256 characters might be in the third position of the field.

Searching by content is accomplished in a forward direction, beginning with the next record. The records contained in the current sector and all previous sectors are not checked.

Select the search on content function from the read index or update mode. Selecting this function from any other mode causes an M error to occur. To search on content function:

1. Press FUNCT SEL lower and SEARCH CONTENT. The record currently in the hold buffer is transferred into the current record buffer and displayed on the display screen for review or modification.
2. Key the search mask into the current record buffer. Do this by modifying the mask that was just transferred into the current record buffer or by blanking the current record buffer and entering new data. Also, the mask that was just transferred into the current record buffer as the mask can be used without changing it.

Note: On the 3742 with the 128 feature the search mask includes all 128 characters. The operator must be certain that the portion of the record not displayed is correct. To blank the current record buffer, press FUNCT SEL lower and DELETE REC. Blank characters in a mask indicate the position is not compared during the search operation.

3. Press REC ADV to start the search. The search stops when the data station finds the record containing the data being searched for (search mask), and the record is displayed. To continue searching for records using the same mask, press FUNCT SEL lower, SEARCH CONTENT, and REC ADV in that order. Do not reenter the search mask.

Following a search operation, the current record buffer and the previous record buffer contain the same data. If the entire data set has been searched and no record found, the search stops and an S error is displayed.

If a deleted record is read during a search on content and the data in the deleted record does not match the mask, the search continues and a deleted record warning 6 appears momentarily on the status line. However, if the data in the deleted record matches the mask, the search stops and the deleted record is displayed.

For example, to search a data set for all records containing the part number AB126 in positions 15-19, perform a search on content using AB126 as the search mask. Use the following procedure:

1. Press FUNCT SEL lower and SEARCH CONTENT. The record currently in the hold buffer is transferred into the current record buffer.
2. Press FUNCT SEL lower and DELETE REC to blank the current record buffer.
3. Key the part number AB126 in positions 15-19 of the current record buffer.
4. Press REC ADV to start the search.

When the data station finds the first record containing AB126 in positions 15-19, the search stops and the record is displayed. To find the next record containing AB126, repeat steps 1 and 4. If the search cannot find a record in that data set that contains AB126 in positions 15-19, the search stops and an S error is displayed.

Search on Sequential Content

Search on sequential content is similar to search on content, but is faster. Use search on sequential content only when the records in a data set are arranged so that the search fields are in ascending order (the search field of each succeeding record must have a higher value than the preceding record). Having the search fields in ascending order permits faster searching because of the skipping of records.

Search on sequential content operates in either a forward or backward direction; therefore, if the search is started from within a data set at a track and sector address higher than the location of the specified record, the search operation will locate the specified record.

If a search fails to find the record sought, an S error is displayed. Failure to find a record can occur even though the record is in the data set if one or more records do not meet the requirement of ascending order. Therefore, after a search failure, a search content may be initiated using the same search mask. To do this, first return to the index track in order to search through the entire data set.

Select search on sequential content from the read index, enter or update mode. To select this search:

1. Press FUNCT SEL lower and SEARCH SEQ CONTENT. The record currently in the hold buffer is transferred into the current record buffer and displayed.
2. Press FUNCT SEL lower and DELETE REC to blank the screen.
3. Key the search mask into the current record buffer.
4. Press REC ADV to start the search.

When the record is found, it is displayed.

Read Index Mode (X)

The read index mode displays records on the index track representing the volume label, the data set labels, and other system data. A special procedure is required to write or delete records in this mode. For data flow, see Figure 13.

The 3741 or 3742 checks to see if the following conditions have been met in the data set label:

1. The beginning-of-extent address is less than track 01, sector 01.
2. The end-of-extent address is greater than track 74, sector 26.
3. The end-of-extent address is less than the beginning-of-extent address.
4. The end-of-data address is greater than the end-of-extent address plus 1.
5. The end-of-data address is greater than track 75, sector 01.
6. The sector is 00 or greater than 26.
7. The record length is equal to 0 or greater than 128 for the 3741 or the 3742 with the 128 feature or is not equal to 80 for the 3742.
8. The third character of the record address of beginning of extent, end of extent or end of data is other than 0.
9. The last record read and currently displayed is from track 00, sectors 1 through 7.

10. The fourth position of the header 1 field is a number other than 1.
11. The record has been deleted.

When a header 1 record in sectors 08 through 26 is read, the 3741 or 3742 checks the first eight conditions in the previous list. If any of these conditions exist, a B error is displayed.

When update, verify, enter, or search mode is attempted from the index track, all 11 conditions are checked. If any one of the 11 conditions is present, a B error is displayed.

Modify Mode (M)

Use the modify mode to write data or to delete records on the index track. Key the record to be written, then select modify by pressing FUNCT SEL lower and M. The modify mode can be selected from the read index mode only; if it is selected from another mode, an M error occurs. No other mode can be selected from the modify mode. DELETE REC, RESET, and REC ADV are the only valid keys in the modify mode. All others give an F error. The mode reverts to read index after the first keystroke following the selection of modify mode.

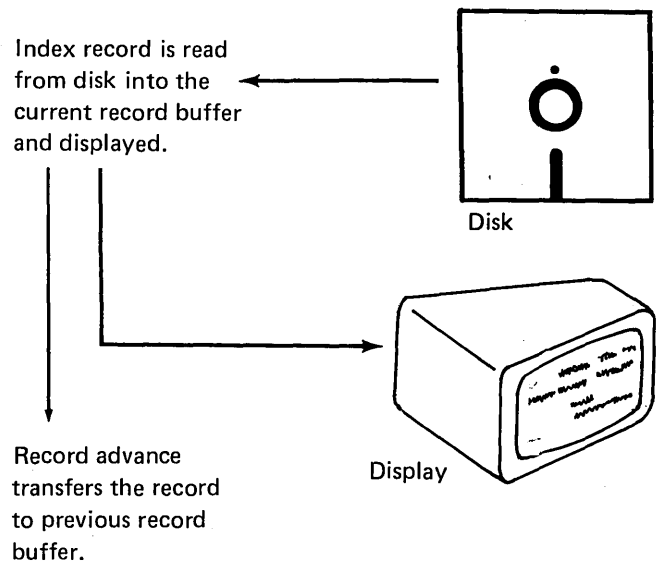


Figure 13. Data Flow for Read Index Mode

Field Totals Mode (F)

Select field totals mode to perform offline field totals from the read index or update modes.

STARTING INFORMATION

When the 3741 or 3742 power is turned on, the current record, previous record, and hold buffers are filled with blanks, and the program buffers are filled with N's. The status line displays the machine-not-ready disk status (N), the read index mode (X), program level 0, and current disk address 00000. All other positions on the status line are blank.

Closing the cover on the diskette that has been inserted changes the disk status to wait (W). The volume label is read, but it is not displayed, and the accessibility field in the volume label is checked. If the accessibility field is not blank, the disk cannot be processed, an A error is displayed, and the 3741 or 3742 waits for the disk to be removed.

A write test is made; if not successful, ?? is displayed in position 9 and 10 of the status line. If all previous tests have been successful, sector 08 is read.

RECORD ADVANCE OPERATION

Use REC ADV during read index mode to read the next record on the index track. The contents of the current buffer are transferred to the previous record buffer unless the current record buffer contains a deleted record. The current disk address is incremented by one.

Pressing REC ADV during modify index mode writes the record displayed in the current sector.

Pressing REC ADV during search mode starts one of the search operations.

Pressing REC ADV during enter mode:

1. Transfers the record from the current record buffer to the previous record buffer skipping all manual fields and executing all automatic fields.
2. Writes the record on disk.
3. Adds one to the end-of-data address and the current disk address.
4. Sets the current record buffer to blank.
5. Moves the cursor to the first manual field position.

Using this key when at end of extent:

1. Gives an E error.
2. Selects program level 0.
3. Selects read index mode.
4. Displays the data set label.

Pressing this key in update mode (if data was entered):

1. Transfers the contents of the current record buffer to the previous record buffer.
2. Reads the next record into the current record buffer and moves the cursor to the first manual position of the record.
3. Replaces the old record on the disk with contents of previous record buffer.
4. Increases the current disk address by 1.

If data has not been entered since the current record was read, REC ADV performs all of the preceding steps except step 3. The mode changes to enter when record advancing reaches the EOD address.

Pressing REC ADV during verify mode causes the station to check for blanks in all remaining manual fields and automatically verify all trailing auto fields. If no verification error occurs, verification is completed. The present record is moved into the previous record buffer. The record in the hold buffer is then moved to the current buffer and displayed. The current disk address increases by 1, and the next record is read into the hold buffer.

If a verification error occurs, the cursor stops at the column that caused the error. When verification is complete and corrections to the record have been made, pressing REC ADV causes the record to be written on the disk. If no corrections are made, the record is not rewritten. If REC ADV is pressed when the cursor is in the first manual position of a record, the current record is not verified, except when a modification to the present record has been made.

An alternate method of record advance in enter mode can be selected by pressing FUNCT SEL lower and then R. A dash will appear in position 39 in the status line. The record advance function in enter mode is changed so that skip and duplicate fields that follow the position of the cursor at the time of record advance are not executed. To return the machine to the normal mode, press FUNCT SEL lower and K. Inserting a disk or turning the power on will also establish the normal mode.

DELETED RECORDS

Every nondeleted record on a disk has a data address mark immediately preceding the data characters; this address mark is not displayed. For a deleted record, this address mark is changed to a control address mark which identifies the record as being deleted. Deleted records normally have a D written in the first data position. To delete a record and preserve the data in the first position, press FUNCT SEL lower and then simultaneously press DELETE REC and NUM SHIFT. To delete records on the index track, modify index mode must be used.

Mode Considerations for Deleted Records

Enter Mode: Pressing DELETE REC during enter mode blanks the current record buffer and positions the cursor at the first manual position. The previous record buffer is unchanged.

Update Mode: If, during update mode selection from the index track, a deleted record is read into the current record buffer, the previous record buffer will contain the same deleted record. If a deleted record is in the current record buffer when a record advance occurs during update mode, the record is not transferred to the previous record buffer. If a deleted record is encountered during record backspacing, the previous record buffer is not changed.

When deleting a record, the first character is changed to a D in the current record buffer, and the remainder of the content in the current record buffer remains unchanged. A beep occurs when the delete function is complete. The cursor is positioned at the first manual position displaying the deleted record.

Verify Mode: When selecting verify mode from the index track, the first nondeleted record in the data set is read into the current record buffer.

If verify mode is selected from update or verify mode and the currently displayed record is a deleted one, the next nondeleted record is read into the current record buffer. In either case, the previous record buffer is blanked.

When a record advance occurs and a deleted record is in the hold buffer (next sequential record is deleted), the next nondeleted record is read into the current record buffer by-passing all deleted records encountered. If a deleted record is encountered during record backspacing, the deleted record is read into the current record buffer with the previous record buffer unchanged.

When deleting a record, the contents of the previous record buffer remains unchanged and a record advance function is performed.

Search Mode: Pressing DELETE REC during search mode blanks the current record buffer and positions the cursor at the first manual position. The previous record buffer and the record at current disk address are unchanged. If the search operation terminates on a deleted record, both the current and previous record buffers contain the deleted record.

CE MODE

CE mode is used by the customer engineer when testing or troubleshooting the equipment. This manual does not describe how this mode works or how it is used but merely points out how it is entered and how to get out of the mode.

Pressing FUNCT SEL lower followed by the " key puts the machine in the CE mode. The status line displays CER in positions 38, 39 and 40.

Pressing RESET several times returns the machine to the index mode with the label from sector 08 displayed. After the machine leaves CE mode, the program buffers of the 3741 may be changed and therefore should be checked. The EOD and verify mark of the data set label that was current when the CE mode was entered may be in error and should be checked.

DISPLAY

Station status information, data, and program information are displayed for operator use on a display screen. On the 3741, the station uses six 40-character lines of display. Line 1 indicates station status. Lines 2, 3, 4, and the first eight positions of line 5 display either data or program information, depending upon the display mode selected. The last 30 positions of line 5 and line 6 are used for the operator guidance feature. Figure 14 shows information on the display screen. On the 3742, each operator station uses three 40-character lines of display: line 1 for station status and lines 2 and 3 for data or program information. Figure 15 lists status line positions for both the 3741 and the 3742.

The 3742 uses one line for displaying status, leaving only two 40-character lines for data. In order to view 128 characters of data in two lines, scrolling capability was incorporated into the 128 feature. Scrolling changes the portion of the 128-character record that is displayed. Three display modes are used.

Display mode A shows characters 1 through 40 on the first data display line and characters 41 through 80 on the second line. Display mode B shows characters 41 through 80 on the first line and characters 81 through 120 on the second line. Display mode C shows characters 81 through 120 on the first line and characters 121 through 128 on the second line.

The choice of display mode is controlled by the position of the cursor. When the cursor moves forward from character position 80 to 81, the display changes from mode A to mode B. Moving the cursor from position 120 to 121 changes the display from mode B to mode C. Moving the cursor beyond position 128 (to 000) does not change the display. When a record advance occurs, the display returns to mode A unless the cursor is moved, by means of leading automatic fields, past position 80.

When the cursor moves backward from position 121 to 120, the display changes from mode C to mode B. Moving the cursor from position 81 to 80 changes the display from mode B to mode A.

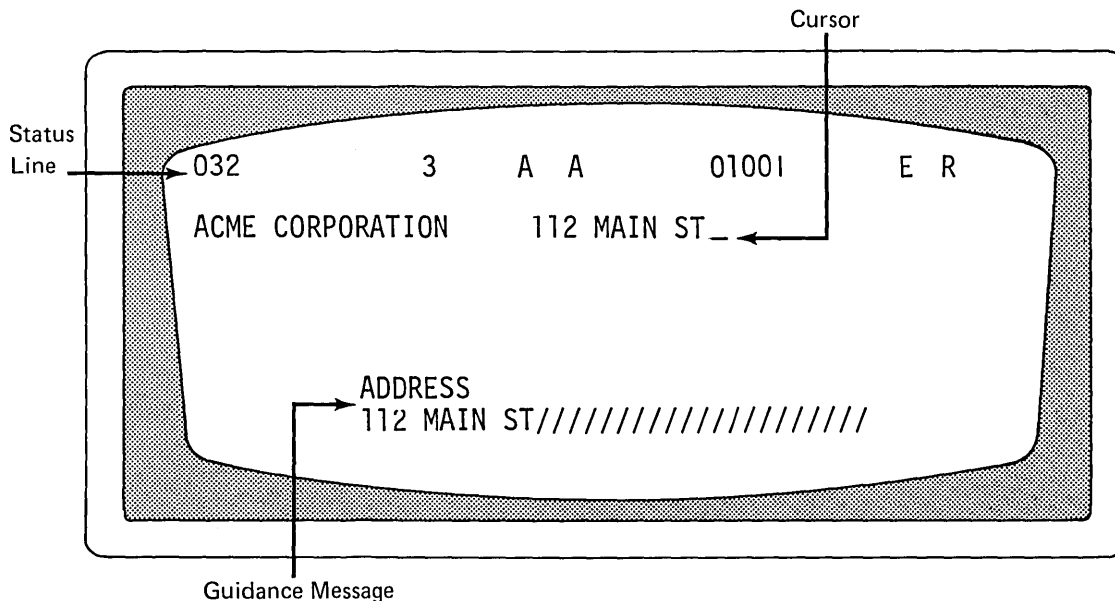


Figure 14. Display Unit with Operator Guidance

Display Position	Meaning
1-3	Indicates the particular position in a record that is being processed. This is the position occupied by the cursor. The first position of a record is 01 for the 3742 and 001 for the 3741 or 3742 with 128 feature.
7-8	Codes displayed in position 7 indicate a functional error such as a keying error. Codes displayed in position 8 indicate a disk error such as a read error.
9-10	Codes displayed in these positions indicate a write failure.
12	Number of the program level used for data formatting.
17	Field definition character indicating type of field (for example, alpha).
20	Program shift character.
25-29	Current disk address indicator.
31-35	Disk 2 — current disk address.
38	Indicates the machine mode in which the data station is currently operating. Most frequently used modes and their codes are: E — Enter U — Update V — Verify C — Field correct S — Search X — Read index M — Modify
39	A dash indicates the machine is using the alternate procedure for record advance.

Figure 15 (Part 1 of 2). Line 1, Device Status Line

Display Position	Meaning
40	Indicates the current status of the disk. The codes are: N — Not ready (disk not loaded) W — Wait R — Ready

**For error code listing, see Appendix A.

Figure 15 (Part 2 of 2). Line 1, Device Status Line

The 128 feature includes a scroll forward (SCRL FWD) key and a scroll backward (SCRL BKWD) key. Pressing SCRL FWD moves the display from mode A to mode B or from mode B to mode C. Pressing SCRL FWD while in mode C moves the cursor to column 000.

Pressing SCRL BKWD while in mode C changes the display to mode B. Pressing SCRL BKWD while in mode B changes the display to mode A. Pressing SCRL BKWD while in mode A positions the cursor to the first manual position of the record.

KEYBOARD

The 3742 keyboard is shown in Figure 16; the 3741 keyboard is shown in Figure 17. The data keys provide a means of keying 64 different displayable characters. Using the HEX key, all 256 EBCDIC codes can be keyed. In addition to the data keys, there are two function select keys, three switches, a group of special keys, and two rows of labels. Using the keys and switches in specific sequences controls various data station operations by selecting certain functions and machine modes.

Switches

The functions of the three switches on the keyboards are listed in Figure 18.

Function Select Keys

The two FUNCT SEL keys redefine the top row of keys to perform the functions noted on the two rows of labels just above the keys. The lefthand FUNCT SEL key lettered in green is associated with the upper set of labels, which are also green. The righthand FUNCT SEL key lettered in white is associated with the lower set of labels, which are also white.

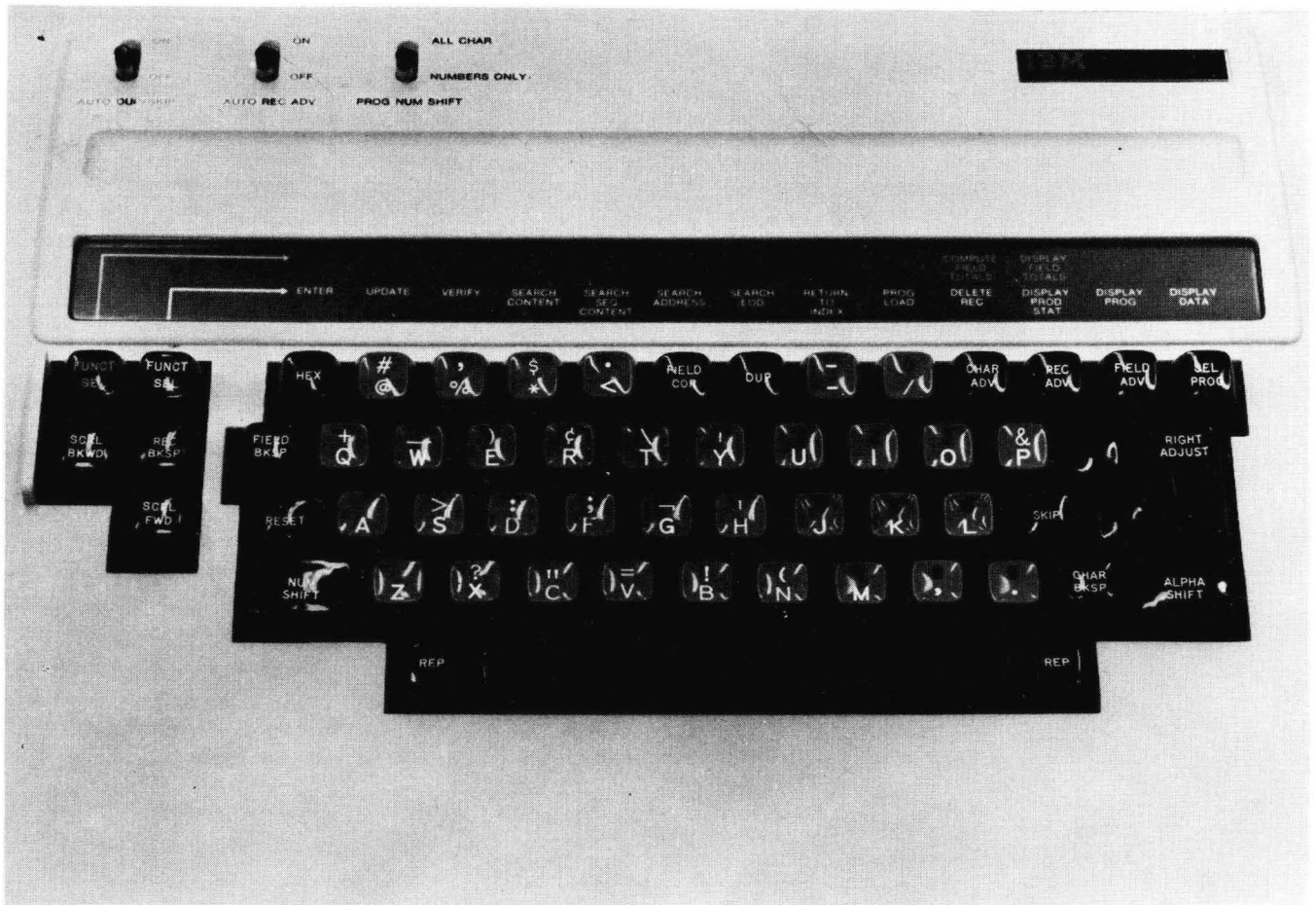


Figure 16. 3742 Keyboard with 128 Feature

Character Keys

All character keys except A and Z have dual character capability, as indicated on the key, provided by two shifts, alpha and numeric. Normally the shift is determined by the active program; however, pressing the alpha or numeric keys overrides the program shift selection.

Function Keys

Function keys, used alone or in combination with other function keys or character keys, define a specific function or feature operation to the 3741 or 3742.

ALPHA SHIFT: Use this key to override programmed numeric shift. Simultaneously hold down ALPHA SHIFT and the desired character key.

CHAR ADV: Use this key to move the cursor forward one position without changing the data stored in the present position. This key is invalid in verify mode, giving an L error.

CHAR BKSP: Use this key to return the cursor to the previous manual position. If the cursor is in the first manual position of a record, the CHAR BKSP is ignored, except in verify mode where leading auto fields are re-executed.

COMM: Use this key to place the 3741 Model 2 in communications mode.

COMPUTE FIELD TOTALS: Use this key to perform offline field totals in read index or update mode.



Figure 17. 3741 Keyboard (Model 1)

COPY: Use this key simultaneously with NUM SHIFT to perform the disk copy functions.

DASH: Use this key in a numeric right adjust field instead of the right adjust key to insert a negative sign in the units position of the field, in addition to performing the right adjust function.

DISK 2 REC ADV: Use this key to read the next sequential record from disk 2 or to perform search operations on disk 2. This key is invalid when the disk is positioned at track 00, sector 26. If a disk 2 record advance is the first disk 2 operation after the second disk has been inserted, the data set label at track 00, sector 08 is displayed. An E alert is displayed if this key is pressed when already at the last record of the data set. All disk 2 record advance operations end with the disk 2 address displayed and the cursor in position 1 of the record.

DISK 2 REC BKSP: Use this key to read and display the previous record from disk 2. The disk 2 record backspace operation ends with the disk 2 address displayed and the cursor at position 1 of the record. If a disk 2 record backspace is the first disk 2 operation after the second disk has been inserted, the data set label at track 00, sector 08 is displayed.

DISK 2 RETURN TO INDEX: Use this key to read and display the data set label associated with the current data set on disk 2. If a disk 2 return to index is the first disk 2 operation after the second disk has been inserted, the data set label at track 00, sector 08 is displayed.

DISPLAY DATA: Use this key to display the data in the current record.

Switch	Function
AUTO DUP/SKIP	When in the OFF position, all skip and dup fields are treated as manual fields. When in the ON position, skip and dup fields are handled as programmed.
AUTO REC ADV	When in the ON position and either the end of the logical record or an E in the program is encountered, the data that has been keyed is automatically written on disk.
PROG NUM SHIFT	This switch is active only when under program numeric shift control. When in the NUMBERS ONLY position, only the characters 0 through 9, dash (—), space, and plus (+) are valid. When in the ALL CHAR position, there is no character restriction.

Figure 18. Switch Functions

DISPLAY FIELD PROG: Use this key to display up to 30 characters of the current program field in the last 30 positions of line 5 on the display screen.

DISPLAY FIELD TOTALS: Use this key to display the three field total accumulators when the cursor is at the beginning of a field. To remove the field totals data from the display and redisplay the data record, press RESET or R. R resets the accumulators to zero; RESET does not.

DISPLAY FIELD NAME: Use this key to display up to 30 characters of a prompting message in the last 30 positions of line 5 on the display screen.

DISPLAY PROG: Use this key to display the current program.

DISPLAY PROD STAT: Use this key to display production statistics in read index or enter mode.

DELETE REC: Use this key during update and verify modes to delete records on the disk. Use it during read index, enter, or search mode to blank the display.

DUP: Use this key in the enter or update mode to copy data already entered in the previous record. Pressing DUP and NUM SHIFT at the same time causes auxiliary duplication of data from program buffer 4. In both cases, data is copied from the present field position to the end of the field. In a right-adjust or self check field, this key is only valid in the first position.

Press this key in verify mode to automatically verify the data in the present field position to the end of the field. The characters in the current record buffer are compared with the corresponding characters in the previous record buffer. If the characters differ, the cursor stops in the position that is different, and a V error occurs.

ENTER: Press this key from the index track to enter a new data set.

FIELD ADV: Use this key to move the cursor to the first position of the next manual field without changing the data in the field from which the advance is made. FIELD ADV is invalid in verify mode, giving an L error.

FIELD BKSP: Use this key to move the cursor back to the first position of the current field. If the cursor is already in the first position of the current field, the key moves the cursor back to the first position of the previous manual field. Field backspacing over a record boundary is not permitted. If it is attempted, no action occurs except that in verify mode the leading auto fields are executed.

FIELD COR: Use this key during the verify mode to save time when making several corrections to a field. Pressing this key changes the mode of operation from verify to field correct. The cursor moves to the first position of the current field. The record is displayed up to, but not including, the cursor position. After the entire field is keyed, the cursor returns to the first position of the field, and the machine returns to verify mode.

HEX: Use this key to enter any one of the 256 EBCDIC codes. Press HEX followed by two hexadecimal digits; repeat this for each two hexadecimal digits. The hexadecimal digits are 0 through 9 and A through F. Hexadecimal D can be entered by pressing the dash (-) key.

NEW LINE: Use this key to skip to a new line on the printer.

NUM SHIFT: Use this key to override programmed alpha shift or to override the PROG NUM SHIFT switch when in the NUMBERS ONLY position. Simultaneously hold down NUM SHIFT and the desired character key.

PRINT REC: Use this key to print the record currently being displayed. After the printing is complete, the 3741 returns to the mode of operation being used before pressing PRINT REC.

PRINT TO EOD: Use this key to print an entire data set or to print from the current disk position to EOD. If the 3741 is in the read index mode, the entire data set is printed. This key is invalid in the verify mode. Pressing this key in the enter mode changes the mode to read index and displays the data set label of the current data set being entered.

PROG LOAD: Use this key to store new programs and to store auxiliary duplication data for program level 4. Press FUNCT SEL lower, PROG LOAD, and then a number corresponding to a program key.

REC ADV: Use this key to move to the next sequential record.

REC BKSP: Use this key to move the cursor back to the first manual position of the current record. If the cursor is already in the first manual position of the current record, the cursor moves back to the first manual field of the previous record. The previous record buffer is made equal to the current record buffer. Pressing REC BKSP in enter mode changes the mode to update mode.

Pressing REC BKSP from the beginning-of-extent address results in no action. Record backspacing in the field correct mode causes an L error. Record backspacing in the search mode is limited to the current record.

RESET: Use this key to reactivate the keyboard when keyboard lockout (the keyboard is made inoperative) occurs. To correct disk errors, hold down NUM SHIFT and press RESET. Use RESET in any mode of operation to cancel the following:

1. A search content or search sequential content function while the search is taking place.
2. A pending program selection or program load operation.
3. A modify index function.
4. A hex keying sequence.
5. Functional error.
6. Function select.

RETURN TO INDEX: Use this key to change to read index mode. Pressing RETURN TO INDEX causes the following actions:

1. Returns to current data set label.
2. Displays the current data set label.
3. Makes the contents of the previous record buffer equal to the contents of the current record buffer.
4. Updates the end-of-data address field in the data set label if a record has been entered.
5. Inserts a blank in the verify mark field if a record has been written in enter mode or changed in update mode.
6. Selects program level 0.

The EOD field in the data set label is not updated if the end-of-data address is equal to the beginning-of-extent address when RETURN TO INDEX is pressed. This protection is needed in case enter mode is selected by accident. If this happens, press RETURN TO INDEX. This protects the EOD field in the data set label until the first record has been released in the enter mode. When the end-of-data processing is completed, a beep occurs to indicate the completion of the function.

RIGHT ADJ: Use this key to exit from a programmed right-adjust field. RIGHT ADJ is valid only for fields programmed as right-adjust fields. Pressing RIGHT ADJ shifts the characters keyed in the field up to the current cursor position to the right field boundary and inserts fill characters to the left of the first keyed character. The fill characters are either zeros or blanks depending on the field definition character.

SEARCH ADDRESS: Use this key to search for a record by record address.

SEARCH CONTENT: Use this key to search by content.

SEARCH SEQ CONTENT: Use this key to search sequential content.

SEARCH EOD: Use this key to search to the last record recorded in a data set.

SEL PROG: Use this key to select the program level desired in conjunction with keying a 0 through 6 on the 3742, or a 0 through 9 or A on the 3741 and the 3742 with the 128 feature.

SKIP: Use this key to enter blanks into the remaining positions of the present field. In a right-adjust or self-check field, this key is invalid after the first position.

SCRL FWD: This key is only contained on a 3742 with the 128 feature. Use this key to move the displayed portion of the record forward.

SCRL BKWD: This key is only contained on a 3742 with the 128 feature. Use this key to move the displayed portion of the record backward.

TAB: Use this key with the print feature for formatting.

UPDATE: Use this key to change to update mode.

VERIFY: Use this key to change to verify mode.

Chapter 5. Programming Information

Programs similar to those used on the IBM 029 Card Punch can be written to control data set format. Programs are entered on disk using the same procedures used to enter data. Normally, programs are stored in a different data set than data. Programs are loaded into the program buffer from the current record buffer. Programs can be entered into the current record buffer from either the keyboard or from disk.

The 3741 and the 3742 with the 128 feature provide storage for up to ten different programs, numbered 1 through 9 and A. The 3742 stores up to six programs, numbered 1 through 6. The number of the program being used is displayed in the status line. When operating under manual control, program level 0 is displayed in the status line.

PROGRAM CODING

The first character in each field, called a field definition character, defines the type of field and indicates where each field begins. The field definition character of the field being processed is displayed. If a field is more than one position long, the first definition character is followed by the appropriate field continuation characters.

An E character normally follows the last program definition or continuation character. Programs that are 80 characters long for the 3742 or that are 128 characters long for the 3741 or the 3742 with the 128 feature do not use the E character.

When the cursor reaches a position containing an E character in the program, a record advance occurs if the AUTO REC ADV switch is on. If this switch is off, the following characters in the status line are changed: the field definition character is set to E, the field continuation character is blanked, and the position indicator is set to 00 on the 3742 and 000 on the 3741 or 3742 with the 128 feature. Keying in position 00 or 000 causes a T error.

For a list of field definition characters and their meanings, see Figure 19. For other character code meanings, see Figure 20.

LOADING A PROGRAM

To load a program:

1. Press PROG LOAD.
2. Press the key indicating the program buffer where the program is to be loaded. This can be any number 1 through 6 on the 3742 or any number 1 through 9 or A on the 3741 or the 3742 with 128 feature.

The contents of the current record buffer are then loaded into the selected program buffer; then the current record buffer is filled with blanks, and program level 0 is selected.

To cancel a program load function, press RESET. An M error is posted in verify or field correct modes.

SELECTING A PROGRAM

To select a program for data entry, press SEL PROG and the numeric key corresponding to the number of the program buffer containing the program you want to use. This can be any number 0 through 9 or A on the 3741 or the 3742 with 128 feature, or any number 0 through 6 on the 3742. Pressing any key other than a valid program buffer number gives a P error.

In order to select a program, both the program currently being used and the program being selected must be in the first position on a field or the end of a record. If the current program is not at the start of a field or the end of a record, an O error is displayed; if the program to be selected is not at the start of a field or the end of a record, a P error is displayed. The program in control does not change. If a program is selected at end of record condition, a record advance function occurs after the program has been selected.

Field Definition Characters	Keyboard Shift	Meaning
N	Numeric	Numeric field
A	Alpha	Alphabetic field
B	—	Unconditionally bypass the field
J	Numeric	Right adjust numeric field with blank fill characters
R	Numeric	Right adjust numeric field with zero fill characters
I	Alpha	Right adjust alphameric field with blank fill characters
D*	Numeric	Automatically duplicates
U*	Alpha	Automatically duplicates
S*	Numeric	Automatically skips
K*	Alpha	Automatically skips
V	Numeric	Bypass numeric field during verify mode only
W	Alpha	Bypass alphabetic field during verify mode only
X	Numeric	Bypass right adjust numeric field with zero fill characters during verify mode only
Y	Numeric	Bypass right-adjust numeric field with blank fill characters during verify mode only
Z	Alpha	Bypass right-adjust alpha field with blank fill characters during verify mode only
H	Numeric	Self-check, modulus 10 field
C	Numeric	Self-check, modulus 11 field
F*	Numeric	Self-check, modulus 10 skip field
G*	Numeric	Self-check, modulus 11 skip field
L*	Numeric	Self-check, modulus 10 duplicating field
M*	Numeric	Self-check, modulus 11 duplicating field
Any fields definition character followed by 1, 2, or 3	—	Field totals entry

*These are automatic fields only with the AUTO/DUP switch on.

Figure 19 (Part 1 of 2). Field Definition Characters

Field Definition Characters	Keyboard Shift	Meaning
Any B field followed by 4, 5, or 6	—	Field totals readout field
Any B field followed by 7, 8, or 9	—	Field totals readout and reset field

Figure 19 (Part 2 of 2). Field Definition Characters

Character	Keyboard Shift	Meaning
— (dash)	Numeric	Continuation character for numeric fields
. (period)	Alpha	Continuation character for alphameric fields
E	Not applicable	Indicates the end of the program

Figure 20. Additional Character Codes

DISPLAYING A PROGRAM

On the 3741 the program in control can be displayed on lines 2, 3, 4, and the first eight positions of line 5 on the screen by pressing FUNCT SEL lower and DISPLAY PROG. On the 3742, only lines 2 and 3 can be used for program display.

To display the field in the program being processed in the last 30 positions of line 5 on the display screen, press FUNCT SEL upper and the DISPLAY FIELD PROG. If the field is longer than 30 characters, only the first 30 characters of the field are displayed.

MODIFYING A PROGRAM

To modify an existing program, press FUNCT SEL lower, ALPHA SHIFT or NUM SHIFT, and DISPLAY PROG. The current program is then placed in the current record buffer and program level 0 is selected. The program can now be modified by keying. To reload this program, follow the standard reloading procedure. In verify or field correct mode, this procedure gives an M error.

PROGRAM CHAINING

Program chaining is used where records having different formats are being processed in sequence and corresponding programs are to be selected automatically. The next program is to be selected when record advancing is indicated by the appropriate program number in position 80 of the current program for 3742 and position 128 for 3741 or 3742 with the 128 feature. When record backspacing, the program number is indicated in position 79 of the current program for 3742 and position 127 for 3741 or 3742 with the 128 feature. The program selection occurs at the termination of the current record.

Acceptable characters for program chaining are numbers 0 through 6 for 3742 and 0 through 9 and hex FA (corresponding to program level A) for 3741 and 3742 with 128 feature. If the program chaining characters specified are part of the programmed field, the characters are treated as numeric continuation characters.

If program chaining is used on the 3741 with the field totals feature, there must be at least one field continuation character between the field definition character and the chaining characters. Otherwise the chaining characters will be interpreted as field totals characters in addition to performing their chaining function.

OPERATOR GUIDANCE

On the 3741 operator guidance assists the operator by displaying information on the last 30 positions of lines 5 and 6. Line 5 displays the current program field or a prompting message. Line 6 displays the data entered into the current field up to the cursor position. The remaining positions within the field are indicated by the slash character (/). The prompting messages may be up to 30 characters long and are stored in the even numbered program buffers. Each prompting record is associated with the program in the next lower numbered program buffer; that is, the prompting record stored in program buffer 2 is associated with the program stored in program buffer 1. The maximum number of prompting records is five, and they are stored in program levels 2, 4, 6, 8, and A.

The first character of a prompting record must be the delimiter character, asterisk (*). Each prompting message consists of the characters to be displayed followed by the same delimiter character. Every program field must have a corresponding prompting message in the prompting record. If no message is desired, then the message in the prompting record will contain only the two delimiter characters (delimiter characters are not displayed).

Chapter 6. Production Statistics

Production statistics is standard on the 3742 and a feature on the 3741. Production statistics provide statistics on data production for use in measurement of workload, analysis of errors, and job accounting. Three counters are used to accumulate totals on:

- Number of keystrokes
- Number of records processed
- Number of characters corrected during the verify mode (includes all characters keyed in field correct mode).

COUNTERS

Keystroke Counter

This 6-position counter (000,000 to 999,999) counts every keystroke, except the following, in all modes of operation.

1. RESET.
2. Keystrokes with a pending error condition except - (dash) or & when used to reset a self-check error.
3. R key when used to restore the display after displaying production statistics.
4. Field totals.
5. Any keystrokes during disk copy, print, communications, offline field totals, or search.
6. Any FUNCT SEL key sequence.

When the keystroke counter reaches 999,999, the counter is reset to 000,000. No overflow condition is indicated.

Record Counter

The record counter counts the number of records processed in the enter, update, and verify modes. Record advances in the update mode are not counted unless data has been entered into the current record buffer. Record advances in the verify mode are not counted if performed

from the first manual position of the record. The record counter counts to a maximum of 065,535. When the counter reaches 065,535, it is reset to 000,000. No overflow condition is indicated.

Verify Correction Keystroke Counter

This counter counts the number of characters corrected during the verify modes or entered during field correct mode except when a sign is changed on a numeric right-adjust field or when a dash or ampersand is used to override a self-check error. The verify correction keystroke counter counts to a maximum of 065,535. When the counter reaches 065,535, it is reset to 000,000. No overflow condition is indicated.

DISPLAYING PRODUCTION STATISTICS

To display the keystroke, record, and verify correction keystroke counters during index mode, press FUNCT SEL lower and DISPLAY PROD STAT. The counters are displayed in the first 21 positions with a blank between each counter. The record count is displayed in columns 2-7, the keystroke count in columns 9-14, and the verify correction keystroke count in columns 16-21.

Press RESET to redisplay the data set label or press R to redisplay the data set label and zero the counters. The cursor is returned to position 1 of the record.

To display the counters in enter mode, the following conditions must be true:

1. Must be under program level 0.
2. No data has been entered into the current record buffer and no leading auto dup/skip fields have been executed in the current record.
3. On the 3741 or the 3742 with the 128 feature, record length is 21 or greater.

When production statistics are displayed in enter mode, the cursor is positioned in column 22. The statistics can be written by pressing REC ADV. Production statistics counters cannot be reset in enter mode.

Field totals can be used for batch auditing, a process sometimes referred to as hash totals, or for other applications where totals are required, such as summing the prices of individual items on an invoice to obtain the total order cost. Two or more fields within a record can be added and read out into a summary field in the same record or a following record (crossfooting).

Field totals can be done (1) online on the 3741 during the process of entering, updating, or verifying records, or (2) offline, in a separate scan of a batch of records, on either 3741 or 3742.

ONLINE FIELD TOTALS

Three 19-digit accumulators are provided with this feature. Data can be algebraically summed in these accumulators from specified fields in any or all records in a batch. The summation is under control of the program; the program specifies that a field is to be summed and in which of the three accumulators the sum will be placed. Field total fields are identified by following a field definition character with a 1, 2, or 3 which specifies which of the three accumulators is to be used. The second and third positions after the field definition character may be used to cause the field to be accumulated in two or three accumulators. The low-order 14 digits of a field total field are added into a specified accumulator. If overflow beyond 19 digits occurs in an accumulator, it will not be indicated.

In addition to the numbers 0 through 9, a field total field may include any of the 256 EBCDIC codes. All codes with the low-order four bits of the codes equal to 0 through 9 accumulate with numeric values 0 through 9. All other codes accumulate with a numeric value of zero. All fields in which the units position codes have the high-order four bits equal to B or D are considered negative. All other fields are considered positive.

In online field totals, the accumulators are reset to zero only when the power is turned on, when a reset is accomplished by pressing the R key with field totals displayed, or when entering a field in a record that is programmed as a read out and reset field. A good practice is to display field totals and reset the accumulators before starting an online field totals operation.

During an online field totals operation, the amount that is added to an accumulator in a given field is equal to the change that occurs in that field from the time the cursor comes into the field until the cursor leaves the field. In enter mode, when the cursor comes into a field, the field is always blank and its numeric value is zero; therefore, the amount added to the accumulator is equal to the amount entered. In update or verify mode, the amount added is zero unless the field is modified, and, if so, the amount added is the algebraic difference obtained by subtracting the initial amount of the field from the final amount of the field.

The accumulators represent the field totals operations to the most advanced record written on disk and any operations on the current record being processed. When deleting a record or backspacing to a previous record from a partially entered, updated, or verify-corrected record, all accumulated fields are algebraically subtracted from the specified accumulators.

Displaying Field Totals

Field totals accumulators can be displayed when the cursor is at the beginning of a field by pressing DISPLAY FIELD TOTALS. Any data currently being displayed is removed from the screen, and the amounts currently residing in the accumulators are displayed. At this point the system accepts only two keys, RESET and R. Pressing R removes the field totals display, displays the data set label, and resets all accumulators to zero. Pressing RESET removes the field totals display and displays the record, but does not reset the accumulators.

Read Out/Reset Fields

In enter mode, the numbers 7, 8, and 9 following a bypass field definition code, B, cause the specified accumulator(s) to be read out into the field and reset. Accumulator 1 is specified by 7, accumulator 2 by 8, and accumulator 3 by 9. In update and verify modes, the amount in the accumulator is added to the amounts that already exist in the field.

Online Field Total Restrictions

To ensure the accuracy of the field total in the accumulator, remember the following restrictions:

- When using more than one program to process a record, all programs used must have identical field total fields.
- When deleting a record or backspacing to a previous record from a partially entered, updated, or verified record, select the same program for deleting and backspacing over the record that was used to create that record.
- A field programmed to have the contents of an accumulator read into it must be preceded by at least one programmed manual field and must not be followed within the same record by a field totals field relating to that accumulator.
- Backspacing over a previous record with a field programmed to have an accumulator read into it is not allowed.
- After updating a record, deleting a record, or correcting a record in the verify mode, all succeeding fields programmed to accept an accumulator total that were affected by the operation must be executed. To execute this field total operation, record advance to the record that the accumulator is to be read into, select the correct program level, and field advance over the field that is to contain the total.
- In update mode, a field that is to have a total read into it is not executed if REC ADV is pressed before the cursor enters that field.
- Selection of second disk functions, communications functions, and print functions other than print record should be avoided to maintain online field total integrity.
- Program load functions should be done under program level 0 to maintain online field totals integrity.

Example

The transactions for one day of business are:

Item Number	Item Cost
31621	1621
10897	734
41621	1621
10021	121
21100	1100
Total Cost	5197

Each transaction record contains the item number and item cost. Each item sold is considered one transaction. After the transaction records are entered, the operator must determine if any of the transactions were skipped during the entering process. To do this the cost field must be pre-computed, and programmed as a field totals field, and the total cost from the accumulator must be read into a summary record. Then the field totals total can be compared with the precomputed total cost. If the totals are equal, all the transactions were entered. If the totals are not equal, the larger total can be subtracted from the smaller total to determine which transaction was skipped or duplicated. For example, if the field totals total is 4463, subtracting 4463 from 5197 gives 734 which indicates that the transaction for item number 10897, cost 734, was not entered on the disk.

To use the cost as a field totals field to be accumulated in accumulator 2, use the following program:

N----R2-----E

To read accumulator 2 into the summary record and reset the accumulator to zero, use the following program for the summary record:

N----B8-----E

OFFLINE FIELD TOTALS

The offline field totals feature is used to obtain totals from records that have already been entered, updated, or verified. The offline field totals feature uses the three 19-digit accumulators to add, under program control, data in specific fields into the assigned accumulator. A field total may include any number 0 through 9 and any one of the 256 EBCDIC characters. All codes with low-order four bits equal to 0 through 9 are added with a value 0 through 9. All other codes have the value of 0. All fields in which the units positions codes have the high-order four bits equal to a B or D are negative fields.

In addition to the field totals capability available with the online fields total feature, the offline field totals feature allows the user to read field totals from an accumulator into a record without resetting the accumulator.

Selecting Offline Field Totals

The offline field totals feature can be selected from the read index or update mode. When this feature is selected, the mode changes to field totals and an F is displayed on the status line. On the 3742, selecting field totals mode or field totals display from either station prevents the use of the other keyboard.

To perform offline field totals:

1. Insert disk and close cover.
2. Load the programs and mask statements needed to obtain the field totals.
3. If in the update mode, position the disk to the first record to be used in the field totals operation.
4. Turn AUTO REC ADV switch on for automatic record advancing.
5. Press FUNCT SEL upper and COMPUTE FIELD TOTALS.

The accumulators are reset to zero, and the field totals operation begins. Records are processed under control of the program specified in the mask statements. Field definition characters are ignored, except those followed by a number. Field totals fields are identified by following a field definition character with a 1, 2, or 3 which specifies which of the three accumulators is to be used.

The low-order 14 digits of a field totals field are added into the specified accumulators. Overflow beyond 19 digits in an accumulator is not indicated. Deleted records are bypassed. Disk errors and invalid mask statement errors stop the field total operations.

If AUTO REC ADV is turned off, the field totals operation stops, and the record following the last record processed is displayed. Press REC ADV to process the record displayed and advance to the next record. Pressing RESET during a field totals operation changes the mode to update mode.

At the end of a field total operation, the accumulators retain the field totals. If the end-of-data address is reached, the data set label is displayed, and the mode changes to read index mode.

Mask Statements

A mask statement causes a particular program to be selected to process a particular type of record. The mask statement has either of the following formats:

<FCCCWM1,M2,M3

<FCCCNM1,M2,M3

The characters in the mask statement format have the meanings listed in Figure 21.

The mask statement 1010WA,B,C means that the data record is processed by the offline field totals program in program buffer 1 if position 010 of the data record contains either A, B, or C.

The mask statement 1010NA,B,C means that the data record is processed by the offline field totals program in program buffer 1 if position 010 of the data record does not contain either A, B, or C.

The & can be used in a mask statement to perform a logical AND function. For example, the mask statement 1001WA,B&010WZ means that the data record is processed by the field totals program in program buffer 1 if position 001 of the data record contains an A or B and position 010 of the record contains Z.

Characters	Meaning
<	This character identifies the program as a field totals mask format and must be in the first position of every program buffer used for mask statements.
F	The F stands for any character 1 through 9 or A on the 3741 or on the 3742 with the 128 feature or any character 1 through 6 on the 3742. The character indicates which field totals program is to be selected if this mask statement is satisfied.
CCC	CCC stands for a 3-digit position number indicating the position of the data record that is to be compared with the mask. <div style="margin-left: 100px;"> (001 – 080) 3742 (001 – 128) 3741 or 3742 with 128 feature </div>
W or N	W indicates that the position in the record must contain the character used in the mask in order for the search to be satisfied. N indicates that the record position must not have the mask character.
M	M stands for the character with which the record position is to be compared. This is called the mask. A comma (,) must separate mask characters.

Figure 21. Mask Statement Format Characters

If more than one mask statement is specified in a program buffer, each mask statement must be separated by a semi-colon (;). The last character in a program buffer must be either a colon (:) or a period (.). The colon indicates that the mask statements are continued in a higher numbered program buffer. When a colon is specified after a W, N, or comma, the colon is treated as a mask character. The period indicates the end of the last mask statement. A program number followed by a period indicates an unconditional program selection.

If none of the mask statements are satisfied by the data record, the data record is not processed by the field totals program.

Displaying Offline Field Total Accumulators

To display the contents of the field total accumulators on the display screen while in field totals mode, do the following:

1. Turn AUTO REC ADV off.
2. Press FUNCT SEL upper.
3. Press DISPLAY FIELD TOTALS.

The data currently being displayed on the display screen is then replaced by the data in the accumulators.

To remove field totals data from the display screen and redisplay the data that was replaced by the field totals, press either RESET or R. Pressing R also resets the accumulators to zero. Pressing RESET does not change the accumulators. All other keys are inoperative when field totals are displayed.

Writing Field Totals into Records on Disks

After accumulating field totals in the accumulators, the contents of the accumulators can be written into a field in the record on disk. To do this, program the field in the record into which the total is to be read with the field definition character B followed by a 4, 5, 6, 7, 8, or 9. If 4, 5, or 6 is specified, the accumulator is not reset. If 7, 8, or 9 is specified, the accumulator is reset to zero. A 4 or 7 specifies accumulator 1, a 5 or 8 specifies accumulator 2, and a 6 or 9 specifies accumulator 3.

If the field in the record that the accumulated total is to be read into is shorter than the accumulated total, only the low-order digits of the accumulator are read into the field. If the field in the record is larger than the accumulated total (19 digits), the total is right adjusted in the field and the remainder of the field is filled with zeros.

Example

An offline field totals operation is to be performed on a data set that contains several different kinds of records. The field totals operation to be performed depends upon the content of the records.

Figure 22 shows the field totals operation to be performed for each record type. If the record type indicated by the first column in the figure contains the data indicated by the second column, the operation in the third column needs to be performed.

Depending upon the type of record, one of four different types of field total operations are performed:

1. Add a field to both accumulators 1 and 2.
2. Add the field to accumulator 2 only.
3. Read the contents of accumulator 1 into the current record buffer and reset the accumulator.
4. Add the field to accumulator 3.

Four different programs are required to do these operations. This example used program buffers 1-4 for these programs. Program buffer 1 contains the program to add the field in positions 30-35 of the data record into accumulators 1 and 2. To program a field as a field totals field, use any field definition followed by 1, 2, or 3 to indicate the accumulator. All field definition characters in the program except those used by field totals fields are ignored.

In this example all fields except the field totals field are programmed as bypass fields. The program in program buffer 1 is:

B-----N12---E
 Field totals field
 in positions 30-35

Program buffer 2 contains the program to add the field in positions 30-35 of the data record into accumulator 2. The program in program buffer 2 is:

B-----N2---E
 Field totals field
 in positions 30-35

Program buffer 3 contains the program for the record that accumulator 1 is to be read into. The accumulator is read into positions 1 through 10 of the record. The program also causes accumulator 1 to be reset to zero. The program in program buffer 3 is:

B7-----E
 Field that accumulator 1 is read into

Program buffer 4 contains the program to add the field in positions 30-35 of the record in accumulator 3 if the conditions to use the programs in program buffers 1 through 3 are not satisfied. The program in program buffer 4 is:

B-----N3---E

Type of Data Record	Contents	Desired Operation
1	A in position 10 and B or C in position 25	Add the field in positions 30-35 of the record to accumulators 1 and 2.
2	Numbers in position 50	Add the field in positions 30-35 of the record to accumulator 2.
3	Blanks in positions 50 through 55	Read the contents of accumulator 1 into the record in positions 1-10 and reset accumulator 1.
4	All records that do not satisfy the conditions of the other 3 types of records	Add the field in positions 30-35 of the record to accumulator 3.

Figure 22. Field Total Operations

To cause the program that is to process each record type to be selected automatically, write mask statements. Each mask statement indicates the conditions that must be satisfied before a program is selected. The mask statements for this example begin in program buffer 5. Each mask statement is separated by a semicolon. The colon is used at the end of program buffers 5 and 6 to indicate that the mask statements are continued in the next program buffer. The mask statements follow:

Program Buffer 5

<1010WA&025WB,C

Selects program level 1 if position 10 contains an A and position 25 contains a B or a C.

;2050W0,1,2,3:

Selects program level 2 if position 50 is numeric. This mask statement is continued in program buffer 6.

Program Buffer 6

<,4,5,6,7,8,9;3050Wb&051Wb&052Wb&053Wb&

Continued from program buffer 5

Selects program level 3 if positions 50-55 are blank. (The b represents a blank space.) This mask statement is continued in program buffer 7.

Program Buffer 7

<054Wb&055Wb;4.

Continued from program buffer 6

Selects program level 4 if another program level has not been selected.

Dual disk capability is obtained on the 3741 by means of an additional disk drive provided by the second disk feature. On the 3742, dual disk capability is obtained on the primary station by disabling the secondary station and controlling the secondary station's disk from the primary station (the primary station has the power on switch).

The purpose of second disk operations is to permit the following:

1. Duplicating a disk in order to have more than one copy or to salvage data from a disk that has developed a defect.
2. Merging records from a disk with records from the keyboard.
3. Pooling the data from several disks onto one disk.
4. Extended program storage; programs can be loaded into the program storage buffers from the second disk without removing the primary disk.
5. Expanded storage for use with the communications feature.

DUAL DISK PREPARATION ON 3742

For dual disk preparation, do the following:

1. Make sure that a disk is loaded in the secondary station and that the secondary station is in the index mode.
2. On the secondary station, press FUNCT SEL lower and then press A. An A will appear in the status line in position 36 and the keyboard will be inactive. Disk 2 operations on the primary station now control this disk.

To return the 3742 to normal two-station operation:

1. Press FUNCT SEL lower on the primary station.
2. Press the A character.

DUAL DISK OPERATION ON THE 3741 AND 3742

After insertion of a disk in the second disk drive, the first of any of the following operations activates disk 2, positions disk 2 at track 00, sector 08, and displays the sector 08 label.

- DISK 2 REC ADV
- DISK 2 REC BKSP
- DISK 2 RETURN TO INDEX

The address of disk 2 is displayed at the righthand end of the status line in positions 31 through 35. The address is posted or changed only when disk 2 operations are performed. Insertion and removal of disk 2 are not monitored by the machine and therefore inserting a disk does not post a disk 2 address or remove an existing disk 2 address; likewise, removing disk 2 does not cause the existing disk 2 address to be removed from the display. Keying FUNCT SEL lower and the A key will remove the existing disk 2 address.

Disk 2 is read but not written on (except on 3741 in the communications mode). Disk 2 is controlled by the following keys:

- DISK 2 REC ADV
- DISK 2 REC BKSP
- DISK 2 RETURN TO INDEX
- COPY
- The regular search keys with the numeric shift key held down

SEARCH OPERATIONS ON THE SECOND DISK

The following procedures are used to search on disk 2:

1. Press FUNCT SEL lower.
2. Hold down the NUM SHIFT key and press SEARCH CONTENT, SEARCH SEQ CONTENT, or SEARCH ADDRESS.
3. Press FUNCT SEL lower and DELETE to clear the display and key the search data or address.
4. Press FUNCT SEL upper and then DISK 2 REC ADV.

After the first content search, subsequent searches by content using the same search mask can be accomplished as follows:

1. Press FUNCT SEL lower, hold down NUM SHIFT, and press SEARCH CONTENT.
2. Press FUNCT SEL upper and DISK 2 REC ADV.

COPY

Copying is always done from disk 2 to disk 1.

Copy All or Part of Disk 2

This copy function copies disk 2 onto disk 1, beginning with the sector in track 00 where disk 1 is positioned. The last record is copied from the sector located at the end of extent (EOE) of the label at which disk 2 is positioned at the start of the copy function.

Each record is copied into the corresponding track and sector address; that is, the record from track 02, sector 14 of disk 2 will be copied into track 02, sector 14 of disk 1. All records will be copied regardless of content, including deleted records, records outside of defined extents, and normal data records between the beginning of extent (BOE) and the end of data (EOD).

To copy disk 2 to disk 1, do the following:

1. Insert the disk to be copied from in the disk 2 drive.
2. Insert the disk to be copied onto in the disk 1 drive.

3. Position disk 1 on the index track to the sector where copying should begin. For a full disk copy, position the disk to sector 01.
4. Position disk 2 to the label that contains the end of extent (EOE) where copying is to stop. For a full disk copy, position to the label with the highest value of EOE.
5. Press FUNCT SEL upper; then hold down NUM SHIFT and simultaneously press COPY (starts the copying operation).
6. When copying is completed, press FUNCT SEL lower and then RETURN TO INDEX.

Copy All or Part of a Data Set

The primary purpose of this function is to pool data from two or more disks onto one disk by adding data from disk 2 to the end of the data already recorded on disk 1. A sequence of such copies can involve loading several disks into the disk 2 drive and pooling the work of several operators onto one disk. Deleted records are not copied.

To copy all or part of a data set, do the following:

1. Insert a disk in the disk 2 drive.
2. Insert a disk in the disk 1 drive.
3. Position disk 1 at the address where copying is to begin by either:
 - a. Pressing FUNCT SEL lower, then ENTER to position disk 1 at the beginning of extent (BOE).
 - b. Pressing FUNCT SEL lower, SEARCH EOD, and REC ADV to position disk 1 at the end of data (for pooling).
4. Position disk 2 on the label of the data set where copy is to begin or on the first record to be copied.
5. Press FUNCT SEL upper; then hold down NUM SHIFT and press COPY. Copying stops when the last record in the data set has been copied.
6. When the copy operation has finished, press FUNCT SEL lower, then RETURN TO INDEX.

Copy Up to a Specified Record on Disk 2

This function can be used to merge records from disk 2 with records that are keyed from the keyboard. It can be used to insert missing records or added records into a data set. All records except deleted records are copied up to, but not including, the specified record. At the end of the copy function, the specified record is displayed.

To copy up to a specified record on disk 2, do the following:

1. Insert a disk in the disk 2 drive.
2. Insert a disk in the disk 1 drive.
3. Position disk 1 at the address where copying is to begin either:
 - a. Pressing FUNCT SEL lower, then ENTER to position disk 1 at the beginning of extent (BOE).
 - b. Pressing FUNCT SEL lower, SEARCH EOD, and REC ADV to position disk 1 at the end of data (for pooling).
4. Position disk 2 on the label of the data set where copy is to begin or on the first record to be copied.
5. Press FUNCT SEL lower; then hold down NUM SHIFT and press SEARCH CONTENT or SEARCH ADDRESS and key the search mask (either an address or record content).
6. Press FUNCT SEL upper; then hold down NUM SHIFT and press COPY (starts the copying).

Handling Disk Errors that Occur While Copying All or Part of Disk 2

Recovery

When a disk error occurs, the copy function stops. The display flashes and a numeric error is displayed in the status line.

For a 2, 4, or 5 error:

1. Record the disk address (disk 1 and disk 2 have the same address in this copy mode).
2. Hold down NUM SHIFT and press RESET to continue copying.
3. When copying is finished, use station 1 in update mode to correct the defective record located at the address recorded in step 1.

For a 3 error:

1. Record the disk address.
2. Hold down NUM SHIFT and press RESET to continue copying.
3. After the copying has finished, use station 1 in update mode to correct all sectors of the track recorded in step 1.

Termination Without Recovery

To terminate with disk errors without recovery, hold down ALPHA SHIFT and press RESET. Both disks return to the index track.

Chapter 9. Disk Initialization

All disks are initialized before they are shipped to a customer. Reinitializing should be avoided unless necessary; it is required only if:

1. The disk was exposed to a strong magnetic field.
2. A defect occurred in one or two tracks. In this case, initialization can be used to take the bad track(s) out of service and add one or two tracks from the spare area.
3. A sector sequence other than the sequence existing on the disk is needed.

The purpose of initialization is:

1. To write identification fields, one for each sector in all active tracks on a disk.
2. To write the bad track code in defective tracks. The maximum permissible number of bad tracks is two.
3. To write a record in each sector of each active track. All records are filled with the blank character except in track 00.
4. To write 80-character records in track 00.

After the track is written, sectors 1 through 4 and 6 contain 80 blanks each. Sector 5 contains ERMAP followed by 75 blank characters. If one or two bad tracks were specified, the number of the first bad track will be in positions 7 and 8 of sector 5 with a zero in position 9, the number of the second bad track will be in positions 11 and 12 of sector 5 with a zero in position 13. Sector 7 contains VOL 1 in positions 1 through 4, the volume ID in positions 5 through 10, the sector sequence code is in positions 77 and 78, a W in position 80, and blanks in all remaining positions of the first 80.

Sector 8 contains the following data set labels:

HDR1 in positions 1-4

DATA in positions 6-9

080 or 128 depending on the input specification in positions 25-27

01001 in positions 29-33

73026 in positions 35-39

01001 in positions 75-79

blank in all other positions

Sectors 9 through 26 contain deleted records with the following content:

DDR1 in positions 1-4

DATA in positions 6-9

Sector number in positions 10-11

080 or 128 in positions 25-27

74001 in positions 29-33

73026 in positions 35-39

74001 in positions 75-79

Blank in all other positions

As a final step, disk initialization checks the disk to see that it is written correctly.

INITIALIZATION PROCEDURE

The disk to be initialized must be in the index track. On the 3742 be sure the second disk drive does not contain a disk.

To initialize the disk, do the following:

1. Load disk.
2. Press FUNCT SEL lower, then DELETE.
3. Key the following data:

Volume ID in positions 1-6

Sector sequence in positions 7-8 (normally left blank)

Bad track 1 in positions 9-10

Bad track 2 in positions 11-12

Blank in positions 13-14

Blank for record length of 080 in position 15

L for record length of 128 in position 15
4. Press FUNCT SEL lower, then press the 2 key.

Any or all of the data in step 3 may be left blank. If the volume ID is left blank, the volume ID will be written as a blank field. If the sector sequence is left blank, the sequence of sectors will be in numeric order (1, 2, 3, . . . 25, 26). If no bad tracks are listed, the initialization operations will scan the disk to find any defective tracks marked with the bad track code. When one or two bad tracks are specified, initialization operations do not check for the bad track code and will try to initialize all other tracks.

When the initialization process is complete, the disk is positioned at track 00 and the label in sector 08 is displayed unless errors were encountered. In case of errors, the following will be displayed:

- Bad tracks that have been marked with the bad track code are displayed in the first data line. Positions 9 and 10 show the first bad track; 11 and 12 show the second bad track.
- Tracks that showed errors when checked are shown in data line 2 beginning in cursor position 41. Each track shown is written with three characters followed by a space. The first two characters indicate the track number and the third character indicates the type of error encountered:

I = Missing ID field
C = CRC error
S = Deleted record

Only 10 tracks with errors can be displayed; the first error encountered in a track is displayed.

If errors are displayed after initialization, the initialization was not successful. The disk should be removed to clear errors and initialization tried again until a successful operation occurs. If particular tracks show persistent errors in successive retries, those tracks should be considered defective. Initialization can be retried by specifying those tracks in the keyed data of step 3. Since the maximum number of bad tracks that can be specified is 2, disks with persistent errors in more than two tracks cannot be used.

DISK CHECKING

The initialization feature provides a means of checking a disk for tracks marked with the bad track code and for tracks exhibiting errors. The procedure for checking is as follows:

1. Load the disk.
2. Press FUNCT SEL lower and DELETE REC
3. Press FUNCT SEL lower
4. Press the I character

At the end of the scan, a report is posted on the display in the same format as used for reporting errors after initializing. If errors are reported, the disk should be checked repetitively and only tracks that show persistent errors in repeated operations should be considered bad.

Chapter 10. Self-Check Feature

The self-check feature provides a method for checking the entry in numeric fields that contain a precomputed self-check digit. The self-check digit is the last digit in the field, and has been precomputed by using either of two algorithms, modulus 10 or modulus 11.

Self-check fields are specified in the program by the use of the following characters:

- H — Modulus 10
- C — Modulus 11
- F — Modulus 10 skip
- G — Modulus 11 skip
- L — Modulus 10 dup
- M — Modulus 11 dup

Fields defined by the characters F and G act as skip fields when the AUTO/DUP/SKIP switch is on and as manual self-check fields when the AUTO/DUP/SKIP switch is off. Fields defined by the characters L and M act as dup fields when the AUTO/DUP/SKIP switch is on and as manual self-check fields when it is off.

When dup or skip and self-check are combined in a field, the self-check is performed after the auto function. If a self-check error is found, turn off the AUTO/DUP/SKIP switch to backspace, and correct the self-check number.

Blank fields check correctly in the enter mode, but cause a C error in verify mode. This allows a self-check field to be skipped in enter mode and entered later in verify mode.

Numerals 0 through 9 and all other characters with the values 0 through 9 in the low-order hex digit are totaled by the low-order hex digit value. All other characters are totaled as the value zero.

If self-check errors occur, three methods of error recovery are:

1. Press RESET to unlock the keyboard and remove the error condition. This permits entry of a new character or backspacing to correct a preceding character.
2. Press the dash key with either shift key to (a) remove error condition, (b) overscore the units position with the high order hex D, and (c) exit from the field.
3. Press NUM SHIFT and the & key to (a) remove error condition, (b) overscore the units position with the high order hex C, and (c) exit from self-check field.

COMPUTING THE SELF-CHECK DIGIT

Modulus 10

Modulus 10 can be computed for any number from 2 to 127 digits long. To compute modulus 10, do the following:

1. Multiply the units position and every alternate position of the basic number, excluding the self-check digit, by 2.
2. Add the digits in the products to the digits in the basic number that were not multiplied.
3. Subtract the sum from the next higher number ending in zero.

The difference is the self-check digit.

For example:

Basic number	6	1	2	4	8
Units position and every alternate position of basic number	6		2		8
Multiply	12		4		16
Digits not multiplied		1		4	
Add	$1+2+1+4+4+1+6=19$				
Next higher number ending in 0					20
Subtract					-19
Self-check digit					1

Modulus 11

To compute modulus 11, do the following:

1. Assign a weighting factor to each digit position of the basic number. These weighting factors are 2-7, 2-7, etc. starting with the units position of the number, excluding the self-check digit, and progressing toward the high-order digit.
2. Multiply each digit by its weighting factor.
3. Add the products.
4. Divide this sum by 11.
5. Subtract the remainder from 11.

The difference is the self-check digit.

For example:

Basic number	1	2	3	4	5
Weighting factors	6	5	4	3	2
Multiply	6	10	12	12	10
Add	$6+10+12+12+10=50$				
Divide	$50 \div 11 = 4$ plus a remainder of 6				
Subtract	$11-6=5$				
Self-check digit	5				

Chapter 11. Communications

The teleprocessing capability of the IBM 3740 System allows the orderly transfer of data from one location to another using communication facilities. The data is transferred as binary coded characters. In addition, control characters are required with each message to delimit various portions of the message and control its transmission.

The IBM 3740 Data Entry System telecommunications facilities enable the user to send and receive binary synchronous data over common carrier facilities or

equivalent facilities. The BSC adapters used by the 3740 perform all functions necessary to establish line connections, exchange identification sequences, send and receive data, and perform terminations and disconnect procedures.

Teleprocessing Bibliography

Figure 23 lists the publications that contain detailed teleprocessing information appropriate to the system and language support being used.

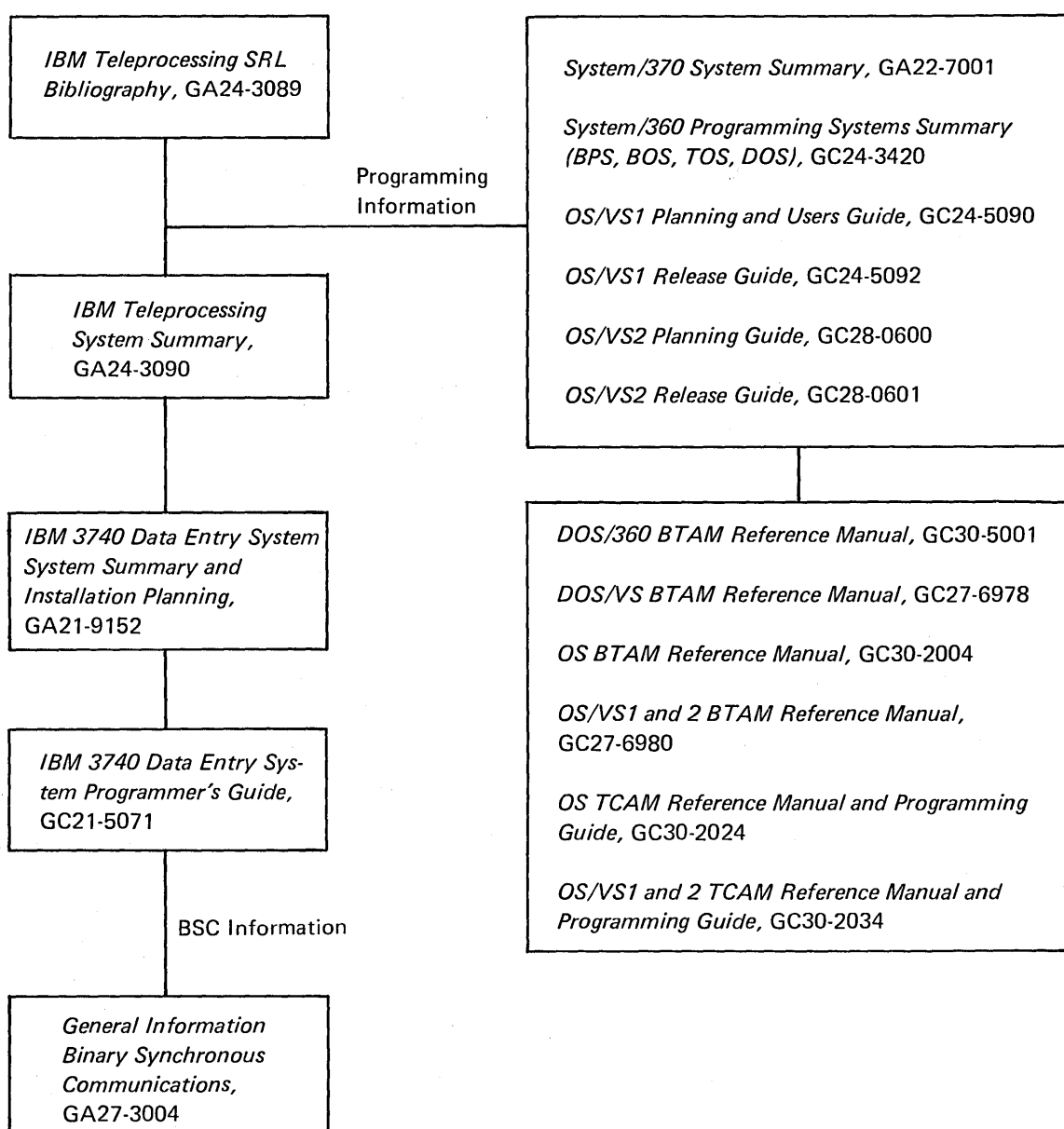


Figure 23. Teleprocessing Bibliography

PROGRAMMING SUPPORT

Teleprocessing programming support will be provided for the 3741 Model 2 by the following access methods and operating systems:

System/370

DOS/VS BTAM
OS/VS1 BTAM
OS/VS2 BTAM
OS/VS1 TCAM (level 4)
OS/VS2 TCAM (level 4)

System/3 Disk Systems

RPG II

In addition to this programming support, the 3741 Model 2 can communicate with either a 3747 with BSCA or another 3747 Model 2.

The 3741 Model 2 is transparent to the teleprocessing support which exists in System/360-370 DOS BTAM and System/360-370 OS BTAM and TCAM. The 3741 Model 2 is transparent through the device classes of BSC1 and BSC2 in the previously listed access methods.

Because of this capability, the following support is provided:

System/370

DOS BTAM
OS BTAM
OS TCAM (level 5)

System/360

DOS BTAM
OS BTAM
OS TCAM (level 5)

Communications with System/360-370 can be via an:

- IBM 2710 Data Adapter Unit
- IBM 2703 Transmission Control Unit
- IBM 3705 Communications Controller

In addition, communication with System/370 can take place via an Integrated Communications Adapter (ICA).

In BTAM and TCAM, the terminal designation is BSC1 or BSC2 depending on whether a nonswitched or switched facility is being used. In System/3 RPG II, the terminal designation is BSCA on the file description specification and is blank in the remote device field of the telecommunications specifications.

The 3741 Model 2 is supported as a standard BSC terminal for point-to-point communications on switched or non-switched facilities. Operation is half-duplex, synchronous, serial-by-bit, serial-by-character. The BSC allows data transmission using EBCDIC directly as the communications line code.

Networks

The 3741 can use a switched or nonswitched network for point-to-point communication. See Figure 24.

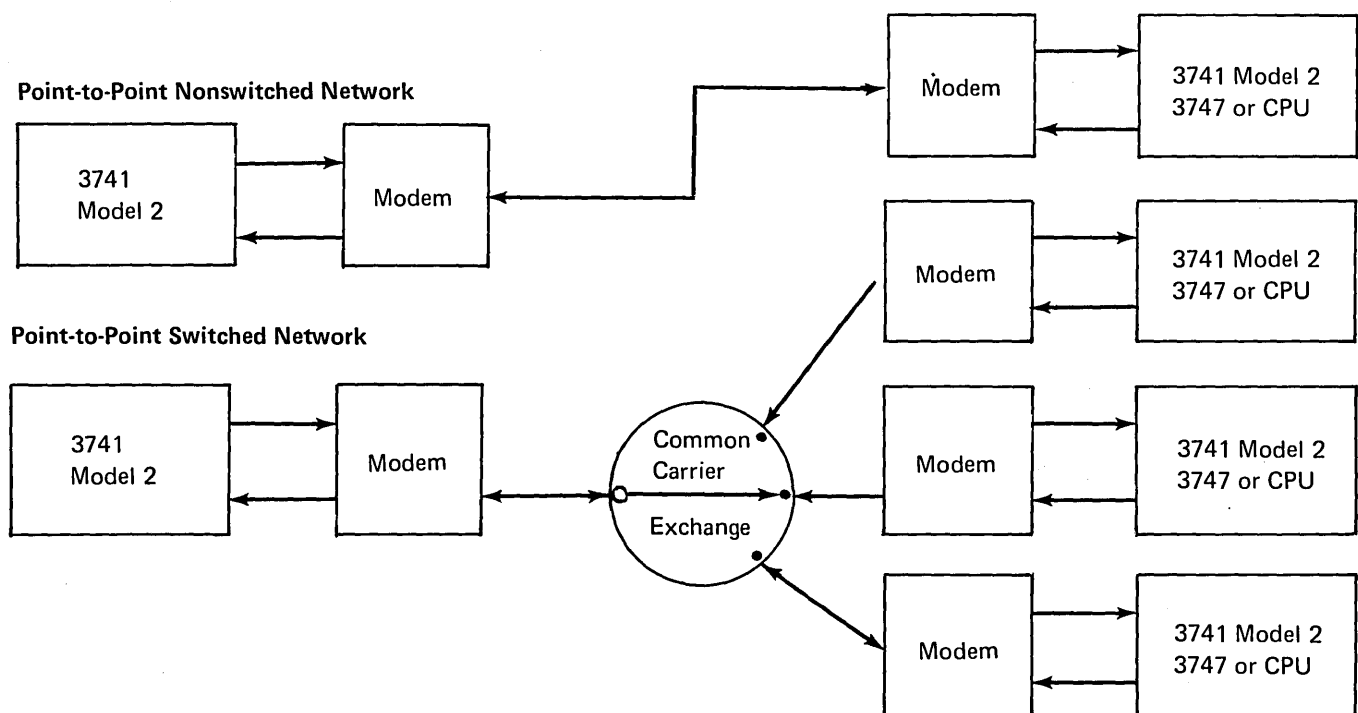


Figure 24. Point-to-Point Telecommunications Networks

Nonswitched Common Carrier, Voice Grade

A nonswitched, point-to-point network consists of dedicated, private, or leased communication lines that connect the 3741 Model 2 with the remote terminal or CPU (central processing unit). On a nonswitched network, the terminals are physically connected: that is, the circuits making up the communication lines are continuously established for predetermined time periods during which data may be transmitted over the lines. Since the terminals are continuously connected, no dialing is required.

Switched Common Carrier

A switched network allows the 3741 Model 2 to communicate with many other terminals or CPUs without requiring dedicated communication lines. The terminals are connected by access lines to the common carrier exchanges servicing their respective locations. A complete and continuous data path is established between terminals only for the period of time in which data transmission takes place. The connection is established by dialing the telephone number of the remote terminal or CPU.

Communications Facilities

The 3741 Model 2 operates in half-duplex mode via appropriate modems over the following networks:

- Switched common-carrier network at 1200, 2000, or 2400 bps.
- Nonswitched common-carrier, voice-grade, private-line data channels (or equivalent privately owned facilities) at 1200 or 2400 bps.

Note: The grade of channel and type of channel conditioning must be as specified by the modem supplier.

The private-line channels may be half-duplex or duplex, point-to-point. Although the 3741 Model 2 operates in half-duplex mode, duplex private-line facilities are recommended to minimize line-turnaround times. Refer to the publications, *General Information Binary Synchronous Communications*, GA27-3004, and *IBM Teleprocessing Systems Summary*, GA24-3090, for additional information pertaining to communications facilities.

The modem required by the 3741 Model 2 may be supplied by IBM, the common carrier, or the customer and must be identical on both ends of the network. The modem interface must conform to the electrical characteristics as specified by EIA Standard RS-232C and be operationally compatible with the 3741 Model 2 modem interface. Attachment is made via a modem interface cable that is terminated by a 25-pin modem connector plug. The following circuits described in RS-232C are used by the 3741 Model 2:

Connector Pin	RS232C Designation	Circuit Description
1	AA	Protective ground
2	BA	Transmitted data
3	BB	Received data
4	CA	Request to send
5	CB	Clear to send
6	CC	Data set ready
7	AB	Signal ground (common return)
15**	DB	Transmit signal element timing
17**	DD	Receiver signal element timing
20	CD	Data terminal ready
22	CE	Ring indicator

**Used only when operating with synchronous modems.

Additional modem-interface information is available from your IBM representative.

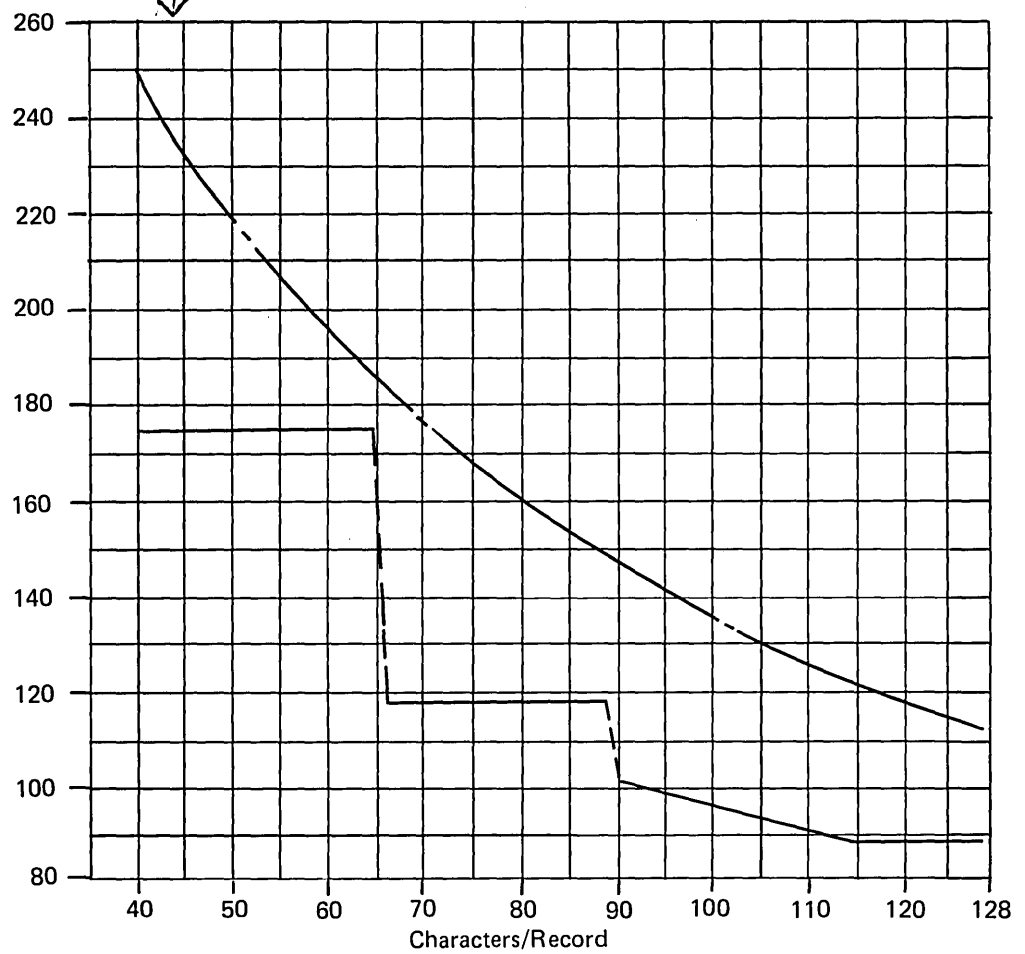
Communications Throughput

Figure 25 illustrates the typical number of records that can be processed per minute as a function of record size, line facility, and modem speed. Actual throughput is affected by:

- Record sequence on the disk
- Modem type used
- Modem turnaround strapping options
- Disk latency (rotational time required for the record to advance to the read head)

Facility – Nonswitched
Baud Rate – 2400 bps

Records/
Minute



Facility – Switched
Baud Rate – 2400 bps

Records/
Minute

Transmit — — — —
Receive —————

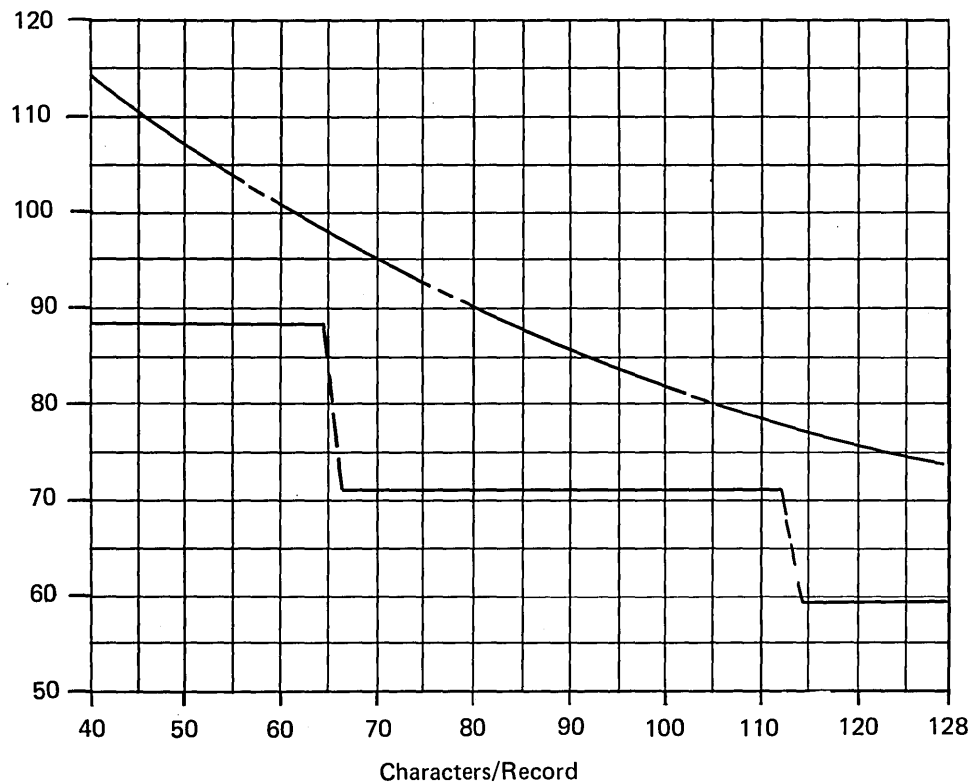
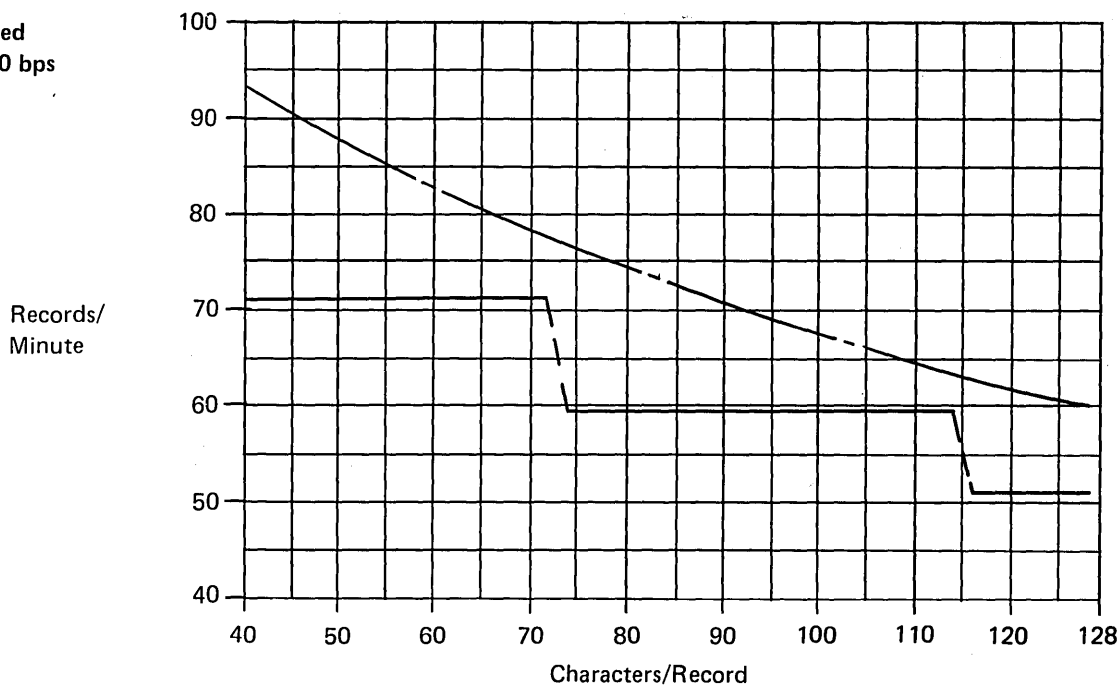


Figure 25 (Part 1 of 3). 3741 BSC Throughput

Facility — Switched
Baud Rate — 2000 bps



Facility — Nonswitched
Baud Rate — 1200 bps

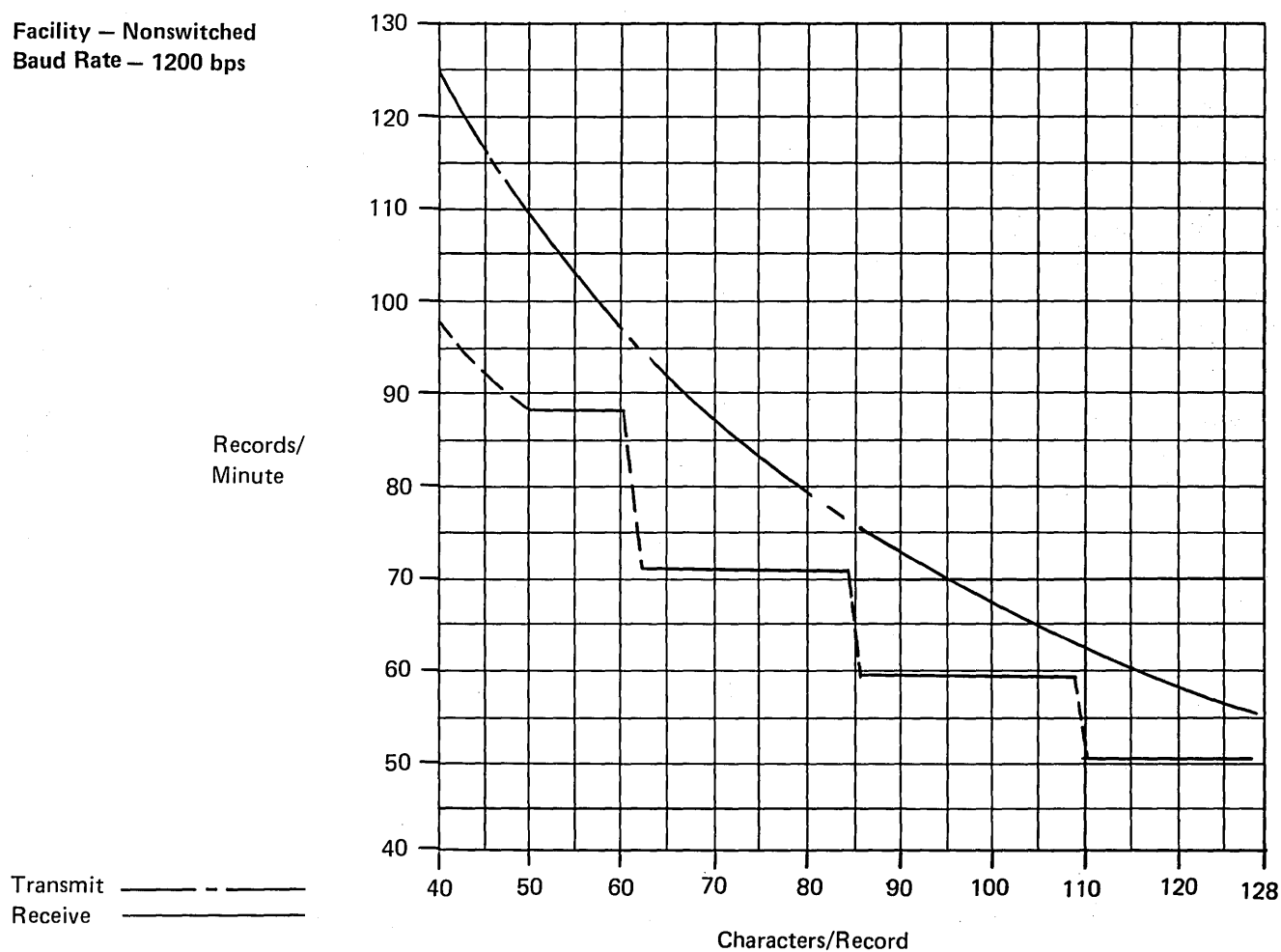


Figure 25 (Part 2 of 3). 3741 BSC Throughput

Facility — Switched
Baud Rate — 1200 bps

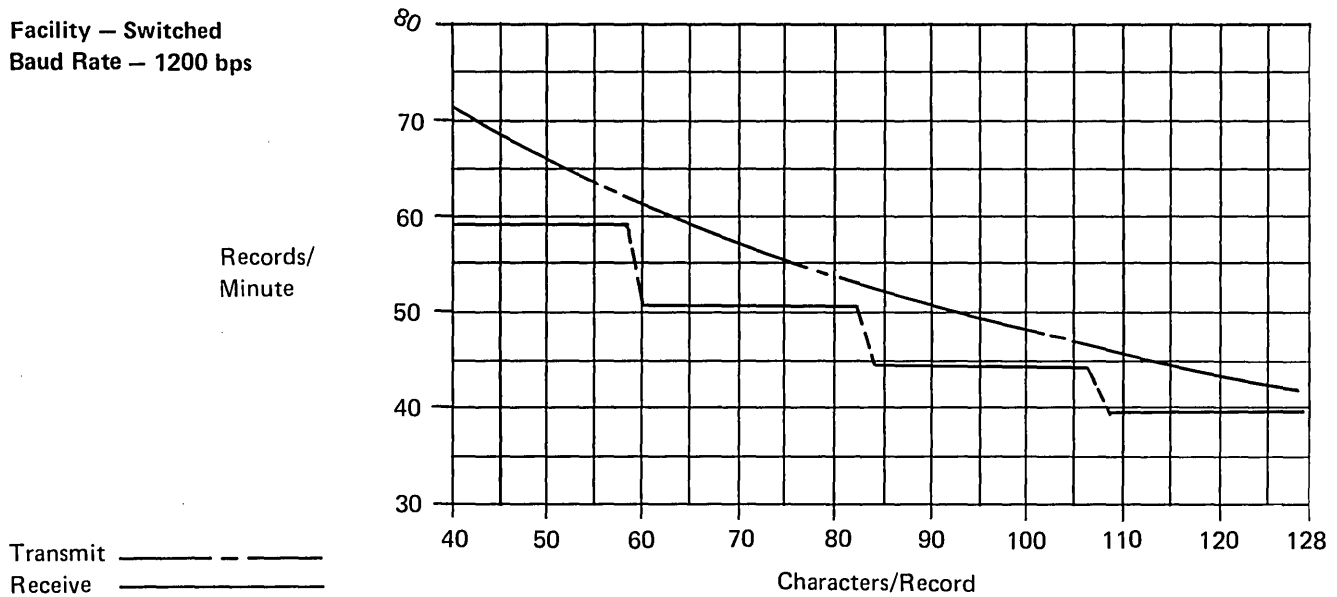
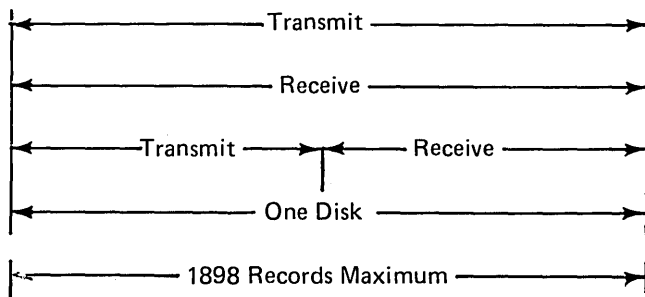


Figure 25 (Part 3 of 3). 3741 BSC Throughput

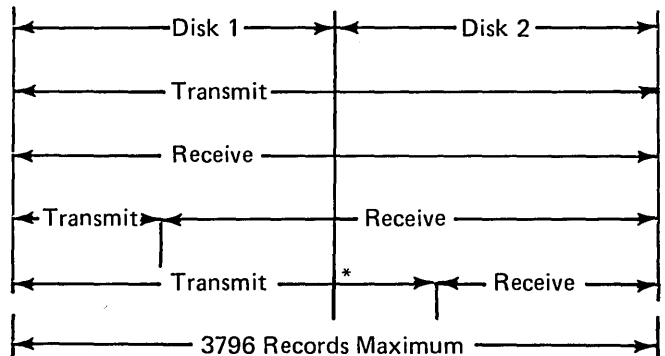
Throughput is particularly affected while in the receive mode due to the disk read check after a disk write. Customers desiring to optimize teleprocessing should try adjusting those parameters (where appropriate) to achieve best available throughput.

3741 Transmission Modes

The 3741 can transmit all the information on a disk, receive the information on a disk, or transmit the information on part of a disk and then receive information on the rest of the disk. The 3741 cannot receive information and then transmit. All transmit and receive segments can consist of single or multiple data sets.



With the second disk feature, the same functions offered with one disk are available with the two disk system. However, when operating in the combined transmit/receive mode and transmitting from disk 2, the data can only be a continuation of a previous data set on disk 1:



*This data must be a continuation of the data set on disk 1.

FEATURES

Synchronous Clock Feature

The synchronous clock feature provides business machine clocking of the data onto and off of the transmission line. The bit rate for this feature is 1200 bps which should be used only when the attached modem does not provide such clocking. The terminal that the 3741 Model 2 is communicating with must also be equipped with business machine clocking.

Terminal Identification Feature

The terminal identification feature transmits a 4-character terminal identification sequence and compares a received identification sequence with a keyed-in sequence.

Transmitting the Terminal Identification Sequence

The BSC terminal transmits a 4-character identification sequence when initiating a line bid or when responding to a line bid on a switched network.

If the 3741 is the calling station, the first transmission on a switched network after a connection has been established is the following sequence:

```
PPPSS      EP
AAAYYTABCNA
DDDNN      QD
```

If the 3741 is the called station, the first transmission after receiving a line bid is the following sequence:

```
PPPSS      A P
AAAYYTABCC0A
DDDNN      K D
```

If the terminal is not prepared to receive a line bid, the following sequence is transmitted:

```
PPPSS      NP
AAAYYTABCAA
DDDNN      KD
```

The terminal type character T is the lowercase v (hex 'A5').

A 3-character sequence will be a factory-installed sequence assigned by IBM from a master list. The master list consists of characters from all positions of the EBCDIC code set with the exception of SOH, STX, ETX, EOT, ENQ, ACK, DLE, NAK, SYN, ETB, US, NUL, DEL, and EO.

Remote Terminal Identification Compare

This function compares an operator keyed sequence of characters to a terminal identification sequence received on the communications line. The transmission or reception of data begins after the received terminal identification sequence matches character for character and has the identical length as the keyed sequence.

The operator keys the remote terminal identification sequence while the station is in the update or read index mode. A sequence of up to 15 characters must be positioned with the first character in position 1 of the current record buffer and the cursor in the next position following the last character of the sequence. If the cursor is left in the first position, indicating that no characters have been keyed, the BSC terminal accepts any remote terminal identification sequence of up to 15 characters, and the transmission or reception of data occurs as though the terminal identification feature were not installed. If the cursor is left in a position indicating that more than 15 characters have been keyed, an error is displayed after FUNCT SEL and COMM are pressed.

After the identification sequence is completed, the BSC terminal is placed in one of the communication modes by pressing FUNCT SEL, COMM, and the desired mode key. The keyed remote terminal identification sequence is transferred to another buffer and erased from the display. This sequence is stored as long as the terminal is in a communications mode.

When the terminal is the calling station, the identification sequence of the response to its line bid is compared with the operator keyed sequence. If the sequences match and the response is positive, the terminal prepares to transmit or receive data blocks. If the sequences match and the response is negative, the terminal disconnects. If the sequences do not match, the terminal retransmits its line bid up to 14 times before disconnecting.

When the terminal is the called station, the remote terminal identification sequence of the received line bid is compared to the operator keyed sequence. If the sequences match, the terminal gives a positive response and prepares to transmit or receive data blocks. If the sequences do not match, the terminal does not respond, but does continue to look for a valid sequence.

Operator Identification Card Reader Feature

This feature is used to read an operator identification card and transmit the information to a CPU that is programmed to accept only valid sequences. This feature can be bypassed if the 3741 terminal is transmitting to another terminal.

When the 3741 terminal is in one of the transmit modes, a letter B is displayed next to the mode indicator. The operator must then insert the identification card into the card reader. After the card has been read, the B is erased and the terminal is ready to transmit; if an error is detected, no action is recorded and the card may be read again.

Keylock Feature

This feature controls the use of the communication mode. In the locked position communication mode cannot be used and in the unlocked position it can be used. The 3741 terminal can also be locked in a communications mode permitting communication with a remote terminal. However, once the 3741 is removed from COMM, the key must be used to permit re-entry. Also, if the first or second disk is removed, communications mode is discontinued.

OPERATING PROCEDURES

An overview of the general operating paths is shown in Figure 26. Procedures pertaining to modem keys may vary depending on the modem type installed.

Figure 27 illustrates the status indicators displayed on the CRT display status line during BSCA operation.

COMMUNICATION MODES

Figure 28 summarizes the effect of disk label status on data sets in the various BSCA modes. The following further explains the individual BSCA modes.

Transmit Mode (T)

The transmit mode will be used to transmit data from one disk or two disks (if the second disk feature is installed) to a remote location. After loading the disks to be transmitted, an operator can place the 3741 terminal in a transmit mode by pressing FUNCT SEL upper, COMM, and T. A T will then be displayed on the status line of the CRT display to indicate the transmit mode.

When the 3741 is in transmit mode, it can be connected to the telephone line through modem, and subsequently transmit data from the disk to the remote location.

The procedure in the previous paragraph was for transmitting one or two disks in their entirety. If the operator desires to start transmission from any position on the first disk, he can position the disk to any record of any data set with normal key entry operations, and subsequently start the transmission of data from that point.

If transmission occurs with no errors, a TT is displayed on the display's status line to indicate a completed transmission. If a disk error, invalid data set label, or a transparency error occurs, TI will be displayed in the display's status line to indicate an incompleting transmission. If the mode indicator is TT or TI, the 3741 will not automatically answer a telephone call. If the mode indicator remains T (as it would if a line check, remote abort, or message aborted error occurred), the 3741 will answer a telephone call and will retransmit the data beginning at the same place as the original call.

If the customer intends to use any transmit mode, he must not write as data a % character in position 1 of sector 01001 since this unique condition is reserved for initiating a BSCA diagnostics procedure.

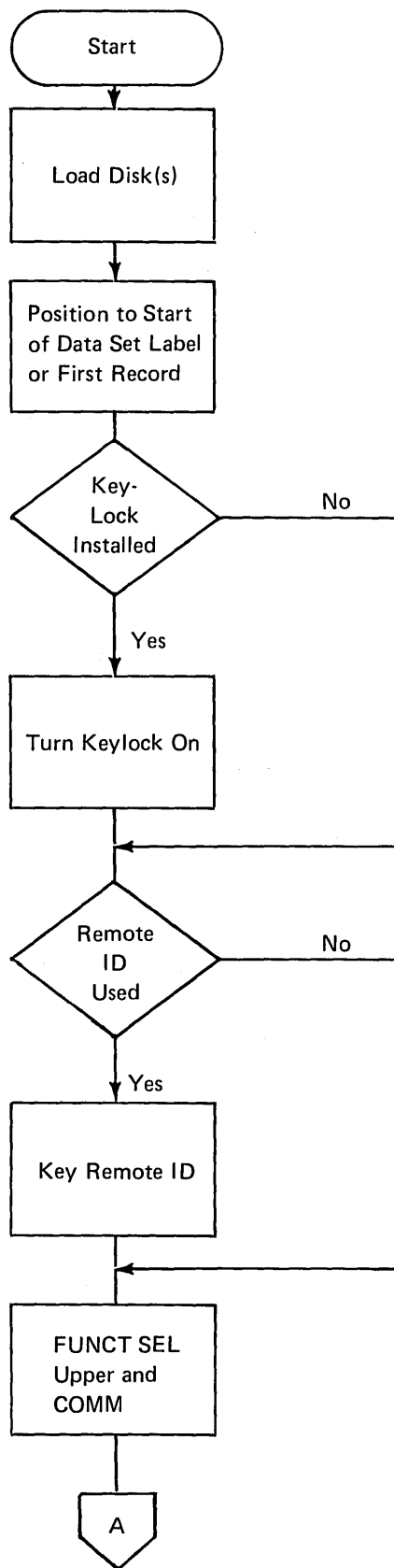


Figure 26 (Part 1 of 3). Operator Procedure Overview

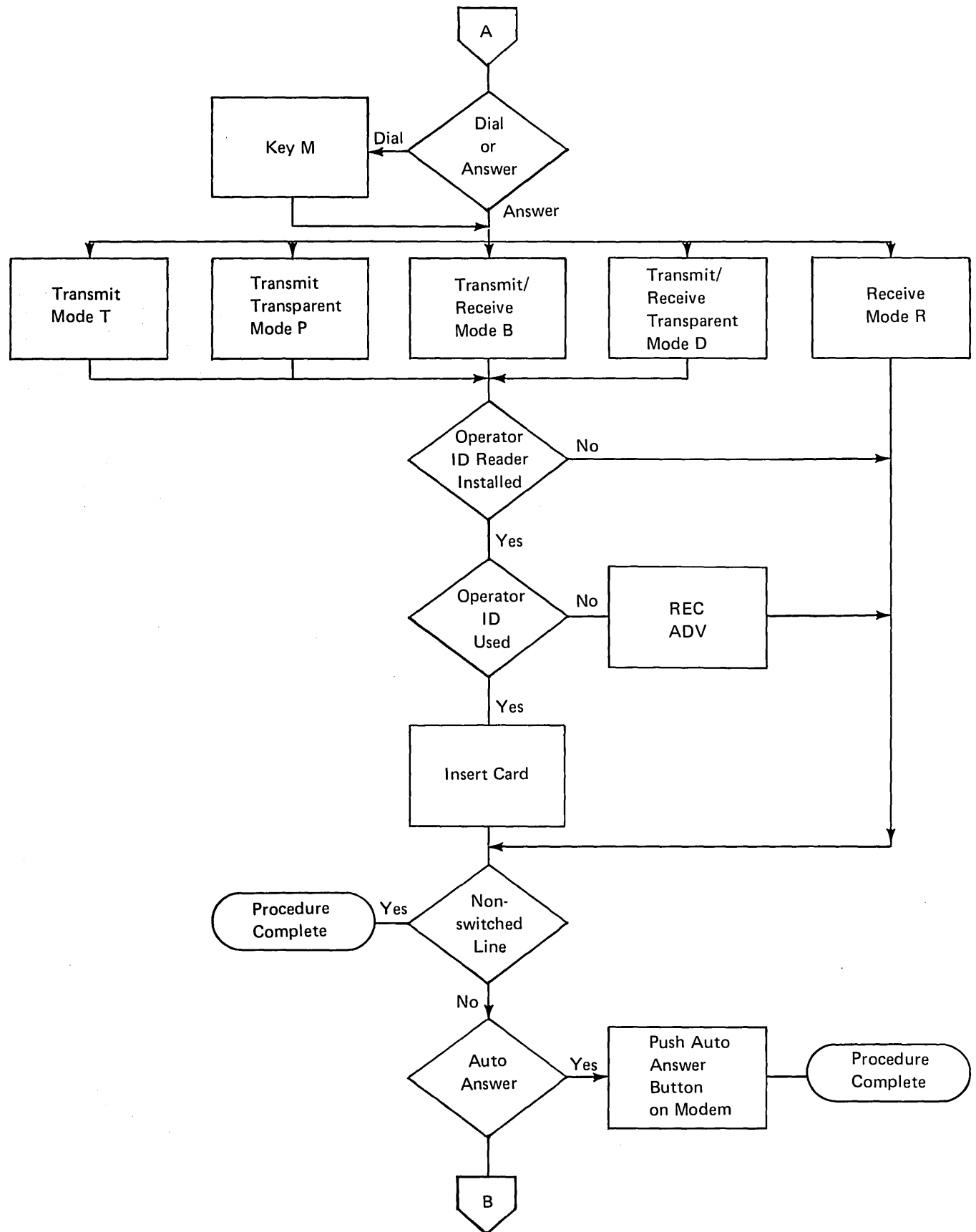


Figure 26 (Part 2 of 3). Operator Procedure Overview

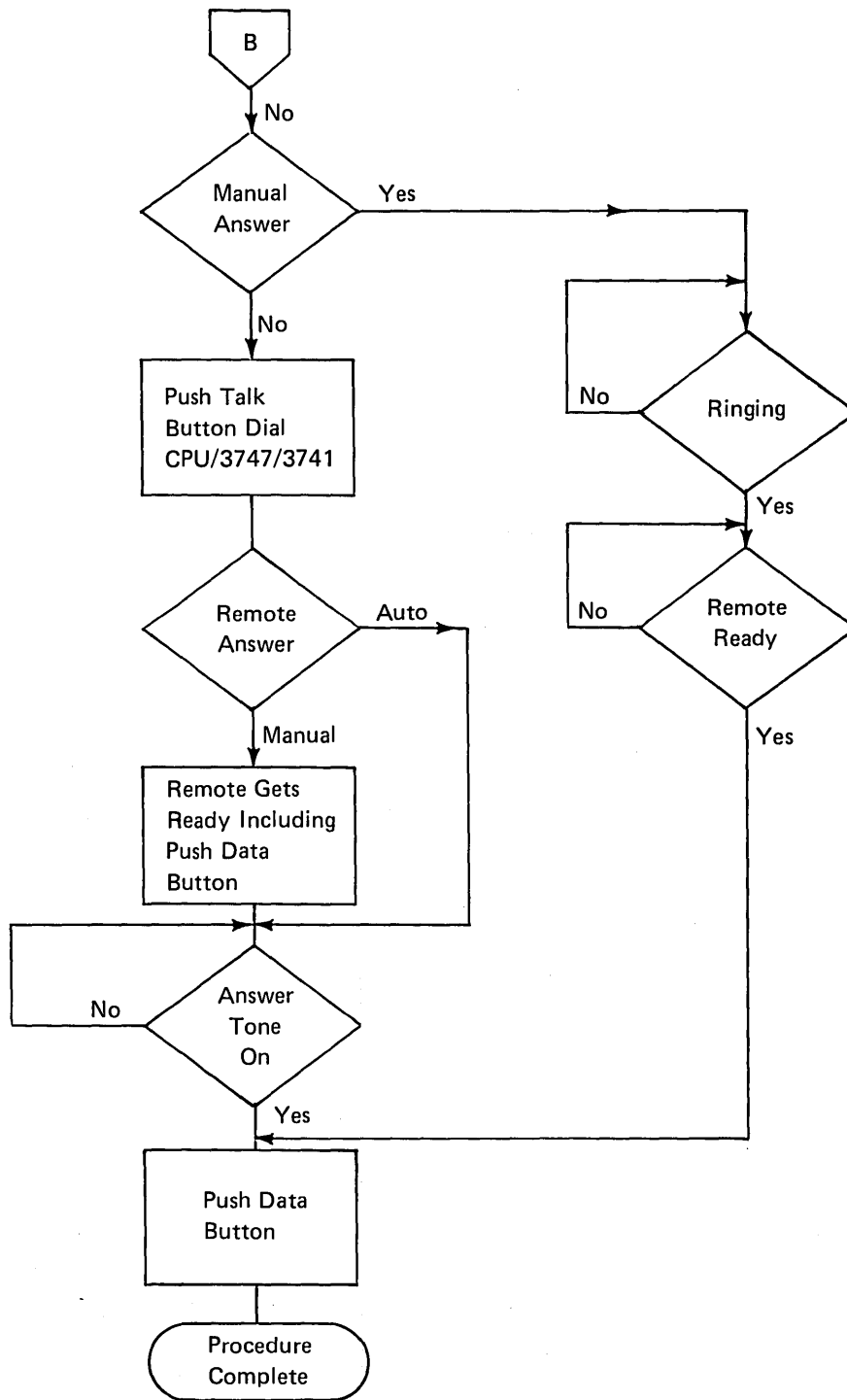
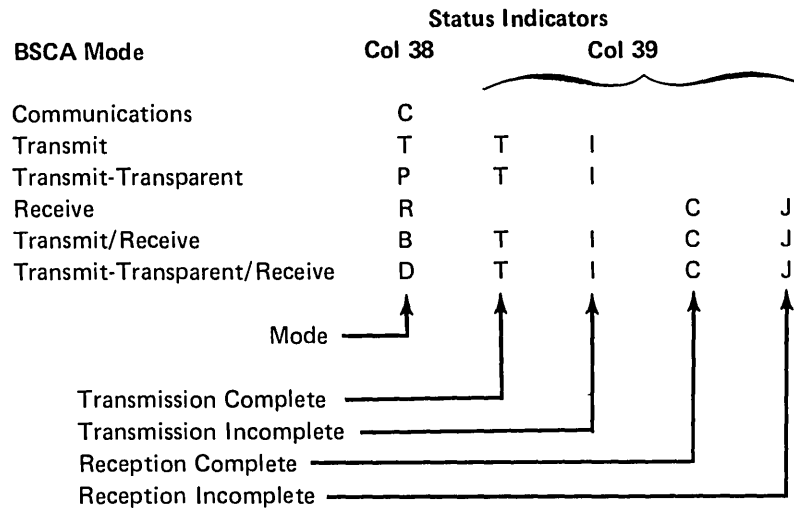


Figure 26 (Part 3 of 3). Operator Procedure Overview



Note: During BSC operations, line 6 of the CRT displays diagnostic information that is used by the Customer Engineer during trouble calls.

Figure 27. Status Indicators on Status Line of CRT Display During BSCA Operations

			Transmit/Receive			
			On Disk 1		On Disk 2	
Disk Data Set Label	Transmit	Receive	Transmitting	Receiving	Transmitting	Receiving
HDR1 Label: <ul style="list-style-type: none"> Must have a 1 in position 4 of label Must have valid extents and record length Must be accessible Must not be deleted Must not be bypassed 	Will transmit	Will receive	Will transmit	Will not receive because it was transmitted	Will transmit if continuation from previous disk	Will receive after last transmitted data set
Bypassed Label: <ul style="list-style-type: none"> Must have a 1 in position 4 of label Must be accessible Must not be deleted Must have a "B" in column 41 	Will not transmit	Will receive	Will not transmit	Will receive after last transmitted data set	Will not transmit	Will receive
Deleted/Non HDR1 Label: <ul style="list-style-type: none"> The label is deleted or does not have a 1 in position 4 	Will not transmit	Will not receive	Will not transmit	Will not receive	Will not transmit	Will not receive

Figure 28. BSCA Modes

Transmit-Transparent Mode (P)

The transmit-transparent mode is used to transmit over the communications lines all 256 EBCDIC bit combinations as data. After loading the disks, an operator can place the 3741 in a transmit-transparent mode by pressing FUNCT SEL upper, COMM, and P. A P will then be displayed on the status line of the CRT display to indicate the transmit-transparent mode.

This mode of operation is identical to the transmit mode with the exception that data is transmitted in transparent mode. PI indicates an incompleting transparent transmission; PT indicates a completed transparent transmission.

Receive Mode (R)

The receive mode is used to receive data from a remote location and store that data on one disk or two disks (if the second disk feature is installed). After loading the disks, an operator can place the 3741 in receive mode by pressing FUNCT SEL upper, COMM, and R. An R will then be displayed on the status line of the CRT display to indicate the receive mode.

The 3741 can then be connected to the telephone line through a modem and subsequently receive data from the remote location and store it on the disk(s).

Data records received with an STX are received in the non-transparent mode; records received with a DLE STX are received in the transparent mode.

The labels for the data set to be received must be valid HDR1 (or bypassed) labels and must not be deleted. The BSCA feature will modify the following fields of the label:

Record Length: The record length is determined from the length of the first record received in the data set if the disk was positioned on the data set label when the operator selected communications mode. If the disk was positioned on a record within the data set, the record length is determined by the record length specified in the corresponding label.

Beginning of Extent: The beginning of extent (BOE) is not changed on the label of the first data set received and is made equal to the end of data (EOD) of the previous data set for all succeeding data sets received. (See Figure 29 for summary of extents generated during receive mode operation.)

End of Extent: The end of extent (EOE) address is made equal to the record address of the last recorded record.

End of Data: The end of data (EOD) is made equal to the end of extent plus 1, except when a null data set is received. In this case, the end of data and end of extent are made equal to the beginning of extent address.

Multivolume Indicator: The multivolume indicator of the first disk is changed to a C (continued data set) when the overflow of the first disk is written on the second disk. The multivolume indicator of the second disk is changed to an L to indicate the last disk of a continued data set. All other label information is left unchanged.

	BOE	EOD	EOE
First received data set on first disk	BOE of the label	BOE + number of records received	EOD - 1 (if null data set, EOD)
Succeeding data sets on first or second disk	Previous EOD	BOE + number of records received	EOD - 1 (if null data set, EOD)
First data set following a transmitted data set on first or second disk	Previous EOE + 1	BOE + number of records received	EOD - 1 (if null data set, EOD)
First received data set on second disk	01001	BOE + number of records received	EOD - 1 (if null data set, EOD)

Figure 29. 3741 Model 2 Generated Extents while in Receive Mode

If the operator desires to start recording received data from any position on the first disk, the operator can position the disk to any record of any data set with normal key entry operations, and subsequently start receiving and recording data from that disk position.

If one or two disks of data are received with no errors, an RC is displayed on the display's status line to indicate a completed reception of data.

If a disk error occurs or if the disk(s) is full, then RJ will be displayed on the display's status line. The 3741 will not automatically answer a telephone call if the mode indicator indicates RC or RJ. The operator must intervene and correct or bypass the error condition to continue receiving data.

If the mode indicator remains R (as it would if a line check, remote abort, or wrong length check occurred), the 3741 will answer a telephone call and will receive the data beginning at the same place as the original call.

Note: STX or DLE STX in non-transparent text or DLE STX (when not immediately preceded by a DLE) in transparent text will be recognized as control characters and will be deleted from the text. Other BSC products may not prohibit the transmission of these control characters in text even though such characters are not supposed to be in text

Transmit/Receive Mode (B)

The transmit/receive mode of operation is used to transmit data and receive data without operator intervention. After loading the disk(s), an operator can place the 3741 in a transmit/receive mode by pressing FUNCT SEL upper, COMM, and B. A B will then be displayed on the display's status line to indicate the transmit/receive mode.

The 3741 can then be connected to the telephone line through a modem. When the connection has been made, data will be transmitted beginning with the first disk until all index positions of disk one have been interrogated for possible transmission. A C in the multivolume indicator will allow transmitting the continuation of the data set on disk two. A BT is indicated in the mode indicator position on the display's status line indicating a completed transmission. For the first received data set, the beginning of extent of the next label is set to one more than the end of extent of the last data set transmitted unless the last EOE is equal to 73026. The BOE of disk two is always forced to 01001. Now data can be received and recorded on the disks on the same or subsequent telephone call in the same manner as for the receive mode.

When the 3741 has received all of the data transmitted to it, it will display BC to indicate a completed transmission and reception of data.

If a disk error or a transparency error has occurred during the transmission portion of this mode, the 3741 will indicate a BI in the mode indicator position of the display's status line. If a disk error or a disk full condition occurs during the receive portion of this mode of operation, a BJ is indicated in the mode indicator position of the display's status line. The operator must intervene to correct or bypass the error condition.

If the mode indicator remains B (as it would if a line check, remote abort, or message aborted error occurred), the 3741 will answer a telephone call and will retransmit the data beginning at the same place as the original call. If the mode indicator remains BT (as it would if a line check, remote abort, or wrong length check occurred), the 3741 will answer a telephone call and will receive the data beginning at the same place as the original call.

The receiving of data can occur on the same or subsequent telephone call. The receiving of data can take place on the same telephone call only when the 3741 is in communication with a CPU.

Transmit-Transparent/Receive Mode (D)

The transmit-transparent/receive mode of operation is used to transmit data in the transparent mode and receive data without operator intervention.

After loading the disk(s), an operator can place the 3741 in a transmit-transparent/receive mode by pressing FUNCT SEL upper, COMM, and D. A D will then be displayed on the display's status line to indicate the transmit-transparent/receive mode.

This mode of operation is identical to the transmit/receive mode with the exception that data is transmitted in the transparent mode. DT, DI, DJ, and DC have meanings corresponding to BT, BI, BJ and BC in the transmit/receive mode.

COMMUNICATIONS EXAMPLE

Figure 30 illustrates the status of a disk on a single disk drive 3741 Model 2 before teleprocessing is initiated. In this example, two key-entry data sets are to be transmitted to the remote CPU and two additional data sets (printer jobs) are to be received from the CPU. Disk labels 00011 and 00012 have been set up (via bypass status) to be used for the two printer job data sets.

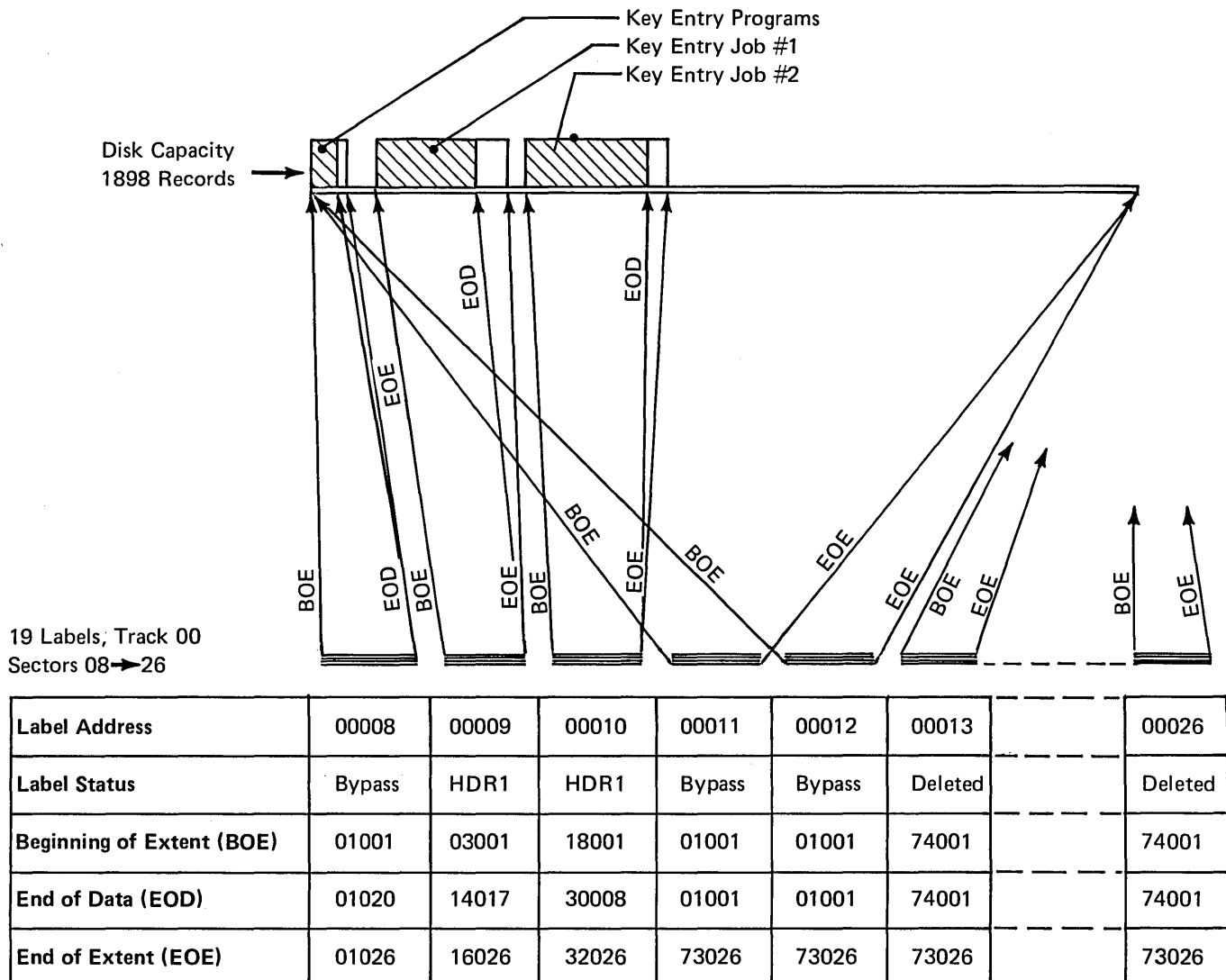


Figure 30. BSC Transmit/Receive Example (Before Teleprocessing Initiated)

Figure 31 illustrates the status of the disk after the transmit/receive mode teleprocessing function was completed. Note that key entry programs (for example) may be stored on the disk without being affected by teleprocessing.

LINE TERMINATION AND ERROR CONDITIONS

Termination of the Data Call

On switched lines, a data call is terminated when a disconnect sequence is received, when a disconnect timeout occurs, or when RESET is pressed. Pressing RESET takes the 3741 out of a communications mode of operation. The end of

data and end of extent are updated (see Figure 29) under the following conditions:

- If a disconnect sequence is received and either:
 1. The mode is R, RC, BT, BC, DT, or DC.
 2. The mode is RJ, BJ, or DJ; and a disk full error has occurred.
- If a disconnect timeout has occurred and either:
 1. The mode is R, RC, BT, BC, DT, or DC.
 2. The mode is RJ, BJ, or DJ; and a disk full error has occurred.

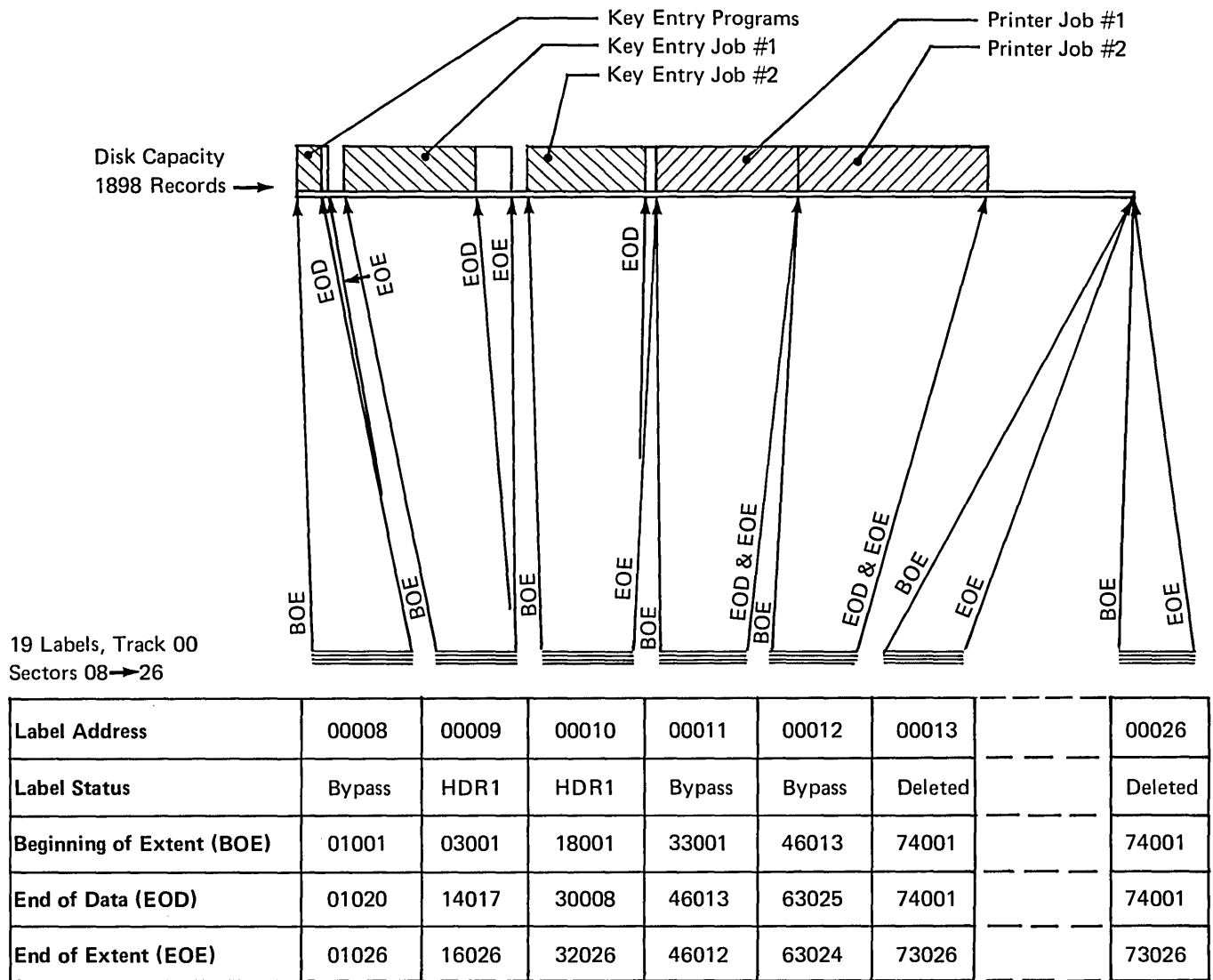


Figure 31. BSC Transmit/Receive Example (After Teleprocessing Completed)

If the mode is T, P, R, B, BT, or DT, the disk is positioned at the original position before transmission or reception took place, and the modem is conditioned to automatically answer a telephone call if it is in an auto answer mode. If the mode is TT, TI, PT, PI, RC, RJ, BI, BJ, BC, DI, DJ, or DC, the modem is not conditioned to answer a telephone call.

BSCA Error Conditions and Indications

Characters in parentheses indicate what is displayed in the error indicator position of the display's status line.

Transparency Check (T)

This error condition occurs when the 3741 is in a transmit (T) or a transmit/receive (B) mode, and one of the following characters is read from disk: SYN, EOT, DLE, NAK, ENQ, ETB, ETX, ITB, STX, or SOH. The 3741 sends ENQ in place of the data link control character, and then follows the response with an EOT.

Line Check (C)

A line check occurs when seven receive timeouts or 15 line bid timeouts on a switch network have occurred during the transmitting or receiving of data. If the 3741 is on switched lines, it disconnects from the line. If the terminal is on nonswitched lines, it goes into a control mode, monitoring the line for line bids.

Remote Abort (R)

A remote abort occurs when an EOT or a disconnect sequence is received as a response to a data transmission block, or following a response sent after receiving a data transmission block that did not end with ETX.

On nonswitched or switched lines, an EOT causes the 3741 to go into control mode, monitoring for line bids. On switched lines, a disconnect sequence or a disconnect timeout causes the 3741 to disconnect from the telephone line.

Message Aborted (Q)

A message aborted condition occurs after four consecutive negative responses have been received as responses to the same data transmission block. The 3741 sends an EOT following the fourth negative response.

Received Line Bid (V)

Whenever the 3741 is in the control mode and has received a line bid when in a RJ, BJ, DJ, TI, BI, DI, or PI mode, the terminal responds with a negative response and indicates a received line bid indication.

Wrong-Length Check (W)

Whenever the 3741 has received the first data block of a data set with zero characters or with more than 128 characters, or has received succeeding data blocks of different length within the same data set, the terminal indicates a wrong-length check and transmits an EOT as a response to the data block.

Negative Bid Response (X)

Whenever the 3741 receives a negative response or disconnect sequence as a response to a transmitted line bid, the terminal indicates a negative bid response.

BSCA Disk Errors

If any of the following disk errors occur when the 3741 is transmitting or receiving data, it will abort by transmitting an EOT:

- Read
- Write
- Length
- Seek
- No record found

BSCA Setup Error (H)

This error condition results when the communications mode is selected and one of the following conditions exist:

- The terminal ID feature is installed and the cursor is positioned past column 16 of the current record buffer.
- The keylock is locked.

BSCA Disk(s) Full (D)

This error results from one of the following conditions:

- Whenever all available record positions have been recorded into.
- Whenever no valid data set labels exist to receive into.
- Whenever the last data set of the transmission is transmitted and a continued data set is indicated.

Data Set Not Ready (I)

Whenever the 3741 detects that the data set ready status has been lost, the terminal indicates a data set not ready error.

Operator Initiated Termination (S)

Whenever the reset key is used to terminate a BSCA operation, an S is displayed temporarily while the 3741 is transmitting a status message.

BSCA Received Data Block (U)

This error results when a remote station sends a data block and the 3741 is in transmit mode.

Track and Sector Indicators

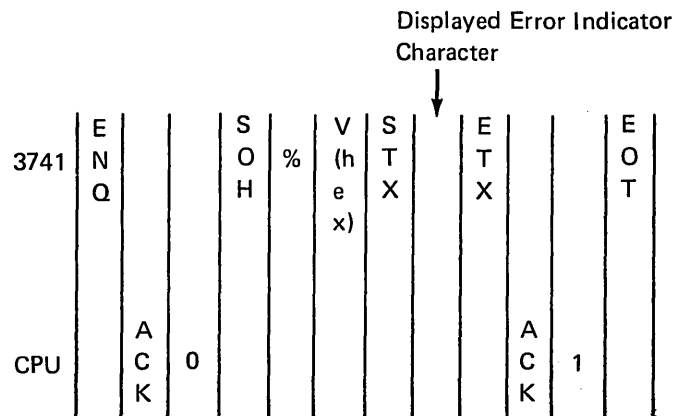
The track and sector number indicator on the display's status line has the following meanings:

Modes	Indicates Address Position of:
T, B, P, D	Next record after the last acknowledged record transmitted.
TT, PT	00026 or, if the last data set was continued, the last record transmitted from disk 1. Always 00026 on disk 2.
R, BT, DT	Next record after the last acknowledged record received.
R, BT, DT with remote abort error condition; RC, BC, DC	Label of the last data set received.
RJ, BJ, DJ with disk full error	Label of the last data set received if the remote terminal is a 3741 or a 3747.
	Label of the last data set received or next valid label if the remote device is a CPU.
R, BT, DT with wrong-length check or TI, RJ, BI, BJ, PI, DI, DJ	Record in which the error occurred.

Status Message Format

A status message is sent to the remote station after the 3741 has responded negatively to a remote station's line bid request or after the 3741 has prematurely terminated a transmission or reception of a message. In transmit mode (T, P, B, or D), this occurs when a transparency check, disk error, line check, received data block error, disk full error, or message aborted (after transmitting a block four times) condition has been encountered. In receive mode (R, BT, or DT), this occurs when a wrong length check, disk(s) full, line check, or disk error condition is encountered. Also, a status message is sent when RESET is used to abort the transmission or reception of data.

The status message is sent with the following line control format:



Chapter 12. IBM 3713 Printer

USES

In many applications data originated at a remote site is processed at a centralized computer location, and reports or other documents that are based upon the processed data are used at the remote site. If time is not important and the source documents can be spared at the remote site, they may be mailed to the central site, keypunched, processed, and reports printed and mailed back to the originating site.

However, if time is important, the 3741 Model 2 with attached 3713 printer may be used to key the data at the remote site and transmit it to the central computer for processing over night. After processing, output reports are created and transmitted back to the remote site for storage on diskette and for offline printing.

The following examples illustrate some of the advantages of using a printer in this type of application.

Improved Customer Service: Retail chain store orders may be keyed on 3741's at a regional warehouse, transmitted periodically to the central office computer for a run against consolidated inventory files, and picking slips transmitted to the appropriate shipping warehouse for offline printing on the 3713.

Reduced "Float" of Funds in the Mail: In the example above, invoices can be transmitted to the warehouse for printing and mailing when the goods are shipped, resulting in prompt billing and reduced cash "float."

Better Business Control: Labor cost data may be keyed on a 3741 at a construction site, transmitted to a central computer for analysis and cost distribution, and management reports sent back to the site for printing there. The timely receipt of cost analysis by site management permits corrective management action before cost overruns occur.

HARDWARE

The IBM 3713 Printer (Figure 32) is available as a feature attachment on the 3741. It enables the 3741 to prepare hard copy from disk offline. The matrix printer has a maximum rate of 40 characters per second and a maximum line length of 128 characters. Three different pin feed platens, with pin-to-pin widths of 12-1/2, 13-1/8, or 13-7/8 inches are available. Forms with a maximum thickness of 0.018-inches (6-part-forms) may be used, but for optimum feeding and stacking, IBM recommends using no more than three parts.

Adjustable Margins Feature

An adjustable margins feature permits the use of nine additional platen widths ranging from 7-1/2 to 11-1/2 inches pin-to-pin. By manually repositioning margin stops and interchanging platens, the customer can use the variety of printer forms his applications require.

Forms Stand Feature

This feature permits placing continuous forms on a stand above floor level, and provides for stacking them after printing.

FUNCTIONS

Printer Modes

The 3713 can print in four different modes (each with or without printer format control):

- Print record--the current buffer data is printed.
- Print data set--the current data set is printed.
- Print under search content--the records found within the current data set under search on content are printed.
- Print under search address--the record found under search on address is printed.

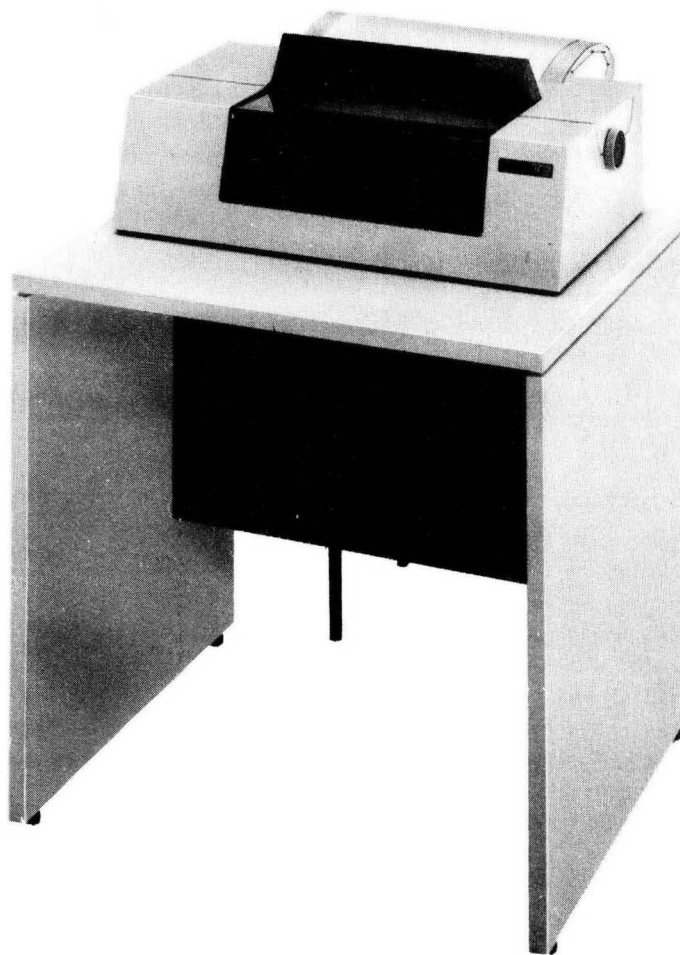


Figure 32. IBM 3713 Printer

Printer Formatting

The format of output on the printer can be controlled in one of two ways:

1. Local format control--the location having the printer can write printer format programs and load these programs into the program level buffers of the 3741.
2. CPU format control--the transmitting station (usually a central computer) can send printer control characters intermixed with data. The printer control characters determine the format of the output.

The choice of format control method depends on the user's requirements. Local format control would probably be selected if:

- Control and flexibility of print formatting is desired at local site.
- CPU output reprogramming can be avoided.

CPU format control would probably be selected if:

- Maximum teleprocessing efficiency is important (accomplished by eliminating unprinted blanks, zeros, etc. and by packing data into large transmission blocks).
- Maximum data storage on disk (s) is desired.
- Central control of printer formatting is desired.

Local Format Control

With local format control, the operator loads the printer format programs into the program level buffers just as key entry programs are loaded. Up to nine formats can be loaded at one time (program levels 1 through 9). One other program level (A) is reserved for horizontal and vertical forms control and the printer format program selector character.

Program Level A: The character in position 1 of program level A defines the method of selecting the printer format program. Figure 33 summarizes the effect of position 1 on printer format program selections.

Character in Position 1 of Program Level A	Meaning
:	Printer format program is manually selected.
%	Printer format program level is defined by the character in position 001 of each data record.
: with program level 0 selected	Records are printed one record per line with no format control.
% with position 001 of the data record containing a zero or a non-numeric character	Record is printed with no format.
+	Printing formatted by control characters in data stream. See following section on <i>CPU Format Control</i> .
All other characters	Records are printed one record per line with no format control.

Figure 33. Printer Format Program Selection

The characters in positions 2 through 128 specify tab stop positions and VFC (vertical forms control) "skip to" positions. Thus, it's possible to format printer forms up to 128 print positions wide and 128 print lines long. Since the VFC characters are superimposed over the horizontal tab stop characters in program level A, additional characters representing both a tab stop position and VFC position are necessary. Figure 34 lists the characters defined for this purpose. Figure 35 shows an example of horizontal tab and VFC character superimposition. The line 16 "skip to 2" character combined with the position 16 tab character requires a K in position 16 of program level A.

	No Tab Character	With Tab Character
No VFC character	(blank)	T
Skip to initial position on form set	1	J
Skip to 2	2	K
Skip to 3	3	L
Skip to 4	4	M
Skip to 5	5	N
Skip to 6	6	O
Skip to 7	7	P
Skip to 8	8	Q
Skip to 9	9	R
End of form*	E	F

* Character is inserted in the position that is one greater than the number of available print lines per form; that is, if form is 10" long (60 print lines per form), the E or F is inserted in position 61.

Figure 34. Program Level A: Horizontal Tab and Vertical Forms Control Characters

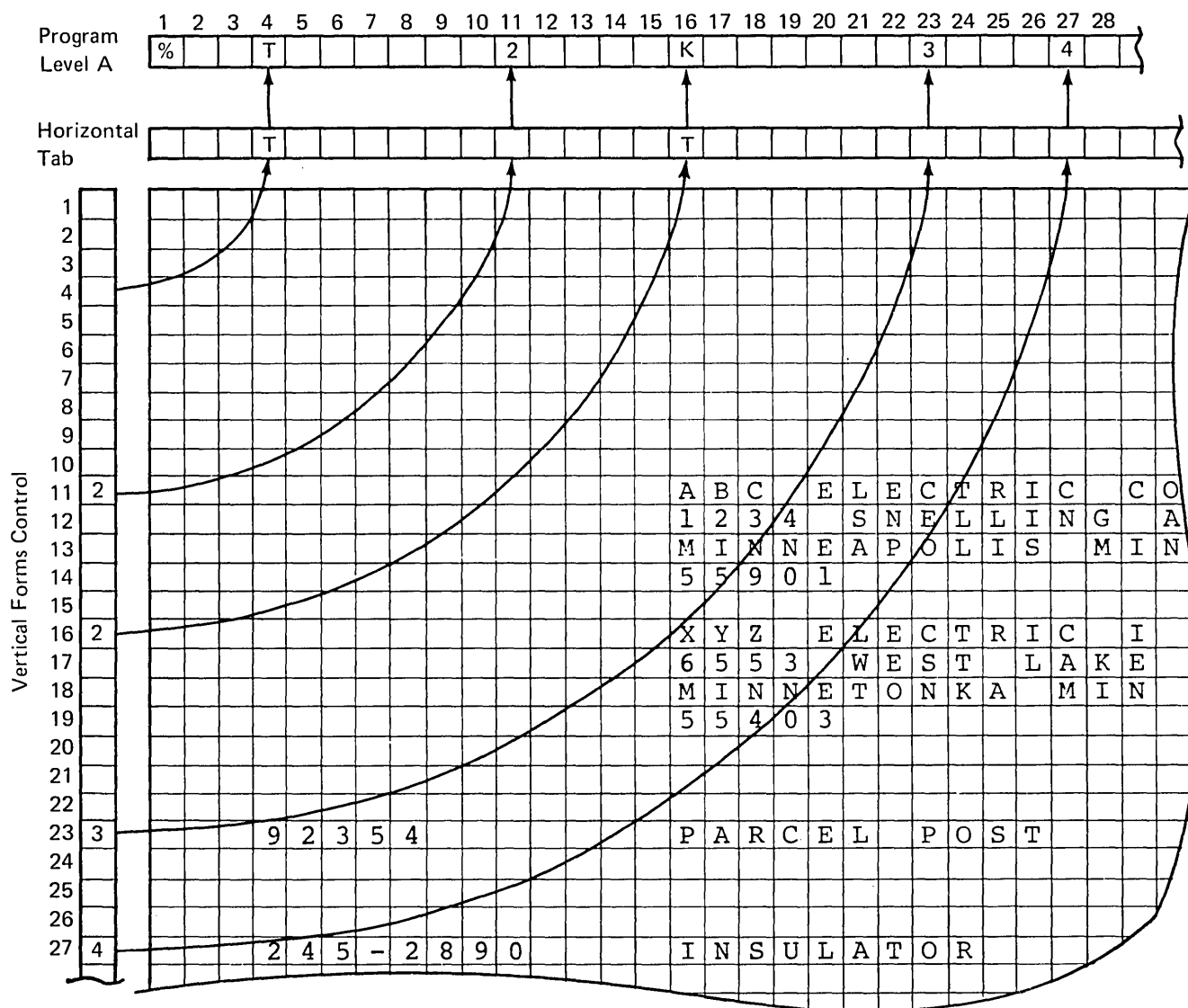


Figure 35. Program Level A Example

Printer Instruction Set: The characters appearing in the selected printer format programs (program levels 1 through 9) have the following meanings:

Character Meaning

- A** Print data field: Loads the print buffer from the record with the number of characters specified by the number preceding the A format characters.
- B** Print data field with suppression of leading zeros: Loads the print buffer from the record with the number of characters specified by the number preceding the B format character, but loads blanks instead of leading zeros.

Character

Meaning

- Z** Print data field with substitution of asterisks for leading zeros: Loads the print buffer from the record with the number of characters specified by the number preceding the Z format character, but loads asterisks (*) instead of zeros.
- D** Print signed data fields: Loads the print buffer from the record with the number of characters specified by the number preceding the D format character, and follows that field with a blank if the last character from the record does not have a D zone. If the last character from the record has a D zone, loads the last character with an F zone and follows the field with a minus sign.

Character	Meaning
X	Prints blanks: Loads the print buffer with the number of blanks specified by the number preceding the X format character.
Y	Skips characters from the record: Skips over, with no action, the number of characters in the record specified by the number preceding the Y format character.
F	Reverse skip characters from the record: Skips over, in reverse direction (towards position 1) with no action, the number of characters in the record specified by the number preceding the F format character. (<i>Note:</i> It is not permissible to skip beyond record boundaries.)
T	Tab stop: Loads the print buffer with blanks up to but not including the next tab stop position. The number preceding the T format character determines the number of tab functions that are to be executed.
C	Carriage return/line feed: Prints the contents of the print buffer and then performs the number of carriage return/line feeds as specified by the number preceding the C format character. This character must be used at the end of every print line.
S	Vertical skip: Vertically spaces until the number preceding the S format character is found in program A. Continuous vertical spacing results if the number is not found in program A. A 1S will also stop in position 001 of program A.
R	Read next record: The R format character is used when more than one record is to be formatted with one program level. The remaining unformatted characters of the previous record are bypassed with no action. The R character initiates the the printing of the print buffer if characters were stored in it and the print record key was used. It does not read the next record when the print record key is used.

Character	Meaning
Q	Terminates printer program: This printer format control character must be used at the end of every printer program. It reads the next record, terminates the formatting, and returns the format control to position 001 of the selected program.
N	No-op: This character must be used in the first position of a manually selected printer format. It prevents an error condition from occurring when this printer format is manually selected.

If a control symbol is preceded by a blank or another control symbol, a 1 is assumed to precede the control symbol.

Figure 36 shows an example of 10 data records residing on the 3741 disk. Figure 37 shows an example of the desired formatted printer output, and Figure 38 shows a set of printer format programs which accomplish this objective.

When the print data set mode is initiated, position 1 of program level A is examined to determine the method of printer format program selection. The % instructs the 3741 to read the next record ("sold to"), examine position 1, and branch to that program level (program level 1) for printer format instructions. Figure 38 provides a step-by-step description of the formatting of the first record.

CPU Format Control

With CPU format control, the operator only loads program level A prior to initiating printing. As was shown in Figure 33 a (+) in position 1 of program level A instructs the printer to accept control characters imbedded in the data stream. Characters in positions 2 through 128 in program level A provide the same function in either local or CPU format control.

Printer Instruction Set: The following printer format control characters (Figure 39) can be recognized in the data stream:

Figure 40 shows an example of four data records residing on the 3741 disk. These records include the necessary data stream printer control characters such that after loading program level A (Figure 41) the resultant printer output is identical to that previously shown in Figure 37.

Record Type (ie go to this program level for print format instructions)							
Name		Address		City/State		Zip Code	
Sold to	1ABC ELECTRIC CO	1234 SNELLING AVE	MINNEAPOLIS MINN.	55401			
Ship to	1XYZ ELECTRIC INC	6553 WEST LAKE	MINNETONKA MINN.	55403			
Miscellaneous	292354 PARCEL POST	21961404028006/07/72					
Detail 1	3245-2890INSULATOR	000002000.730001.4600092354					
Detail 2	3917-0214RELAY	000001012.300012.3000092354					
Detail 3	3258-1478BATTERY	000006001.010006.0600092354					
Detail 4	3369-2587CHOKE	000010002.470024.7000092354					
Detail 5	3987-6543HEAT SINK	000003012.050036.1500092354					
Detail 6	3654-3210GENERATOR	000002003.620007.2400092354					
Totals	40087.91070.40107.87010.700188.970276.88						

Character Position

112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081



E L B A R I S A

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CUSTOMER NO.	SHIPPED VIA	CUST. ORDER NO.	INVOICE NUMBER	INVOICE DATE
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PART NUMBER	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
245-2890	INSULATOR	2	.73	1.46
917-0214	RELAY	1	12.30	12.30
258-1478	BATTERY	6	1.01	6.06
369-2587	CHOKE	10	2.47	24.70
987-6543	HEAT SINK	3	12.05	36.15
654-3210	GENERATOR	2	3.62	7.24

TOTAL THIS INVOICE ∇ 87.91

PREVIOUS BALANCES

70.40	+	107.87	+	10.70	=	188.97
60 DAYS & OVER		30 DAYS		CURRENT		

TOTAL BALANCE DUE

276.88

Figure 37. Sample of Desired Formatted Output

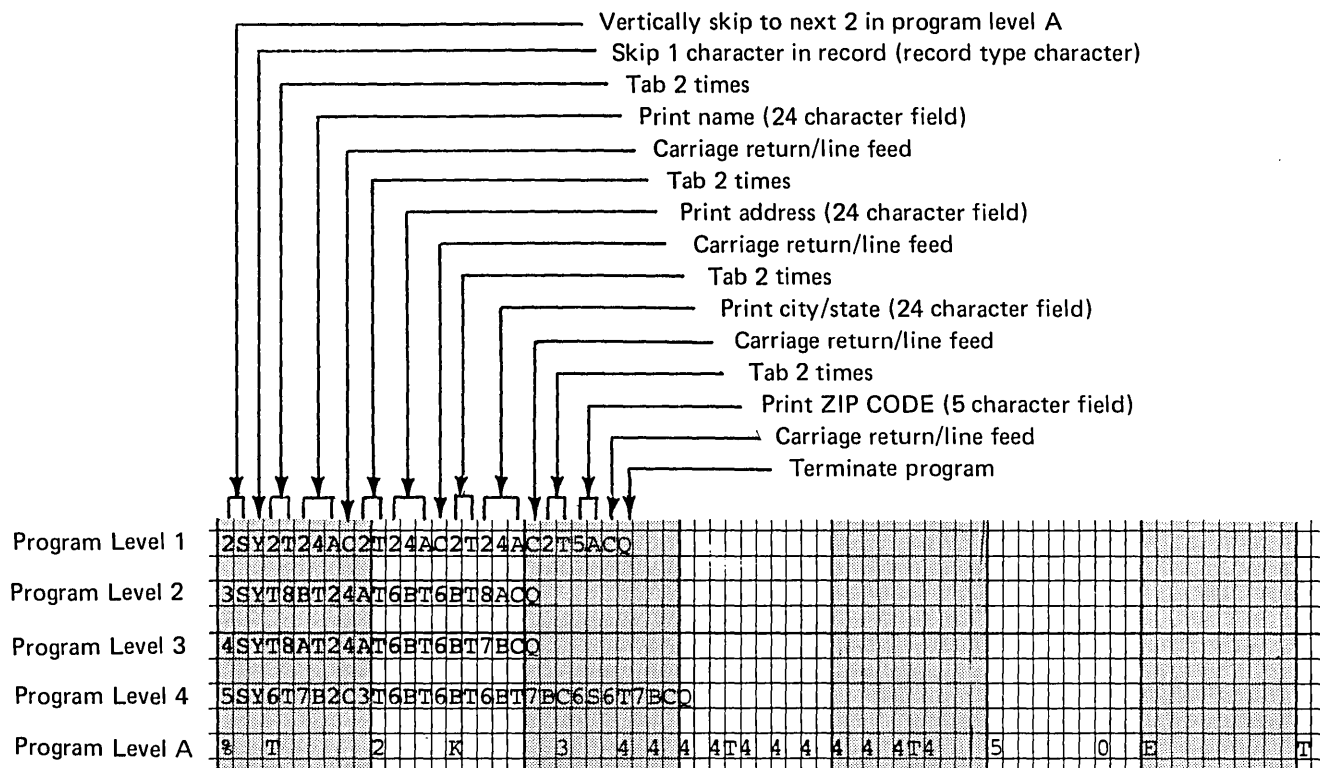


Figure 38. Sample Printer Format Programs

Control Function	Control Characters*	Meaning
Tab (HT)	'05'	Tab to the next tab stop in program A.
New line (NL) or line feed (LF)	'15' '25'	Execute a carriage return/line feed function.
Escape (ESC) A	'27'A	Skip to code 1 in program A**
Escape (ESC) B	'27'B	Skip to code 2 in program A
Escape (ESC) C	'27'C	Skip to code 3 in program A
Escape (ESC) D	'27'D	Skip to code 4 in program A
Escape (ESC) E	'27'E	Skip to code 5 in program A
Escape (ESC) F	'27'F	Skip to code 6 in program A
Escape (ESC) G	'27'G	Skip to code 7 in program A
Escape (ESC) H	'27'H	Skip to code 8 in program A
Escape (ESC) I	'27'I	Skip to code 9 in program A

Note 1: The last ESC function is executed by the next new line or line feed control character.

Note 2: If the print buffer is filled with 128 characters and the next character is not a new line, line feed character, or ESC sequence, a carriage return/line feed function and a pending escape are performed.

*Numbers in the column are hexadecimal notations.

**An ESCA will also stop in position 001 of Program A

Figure 39. Data Stream Printer Control Characters

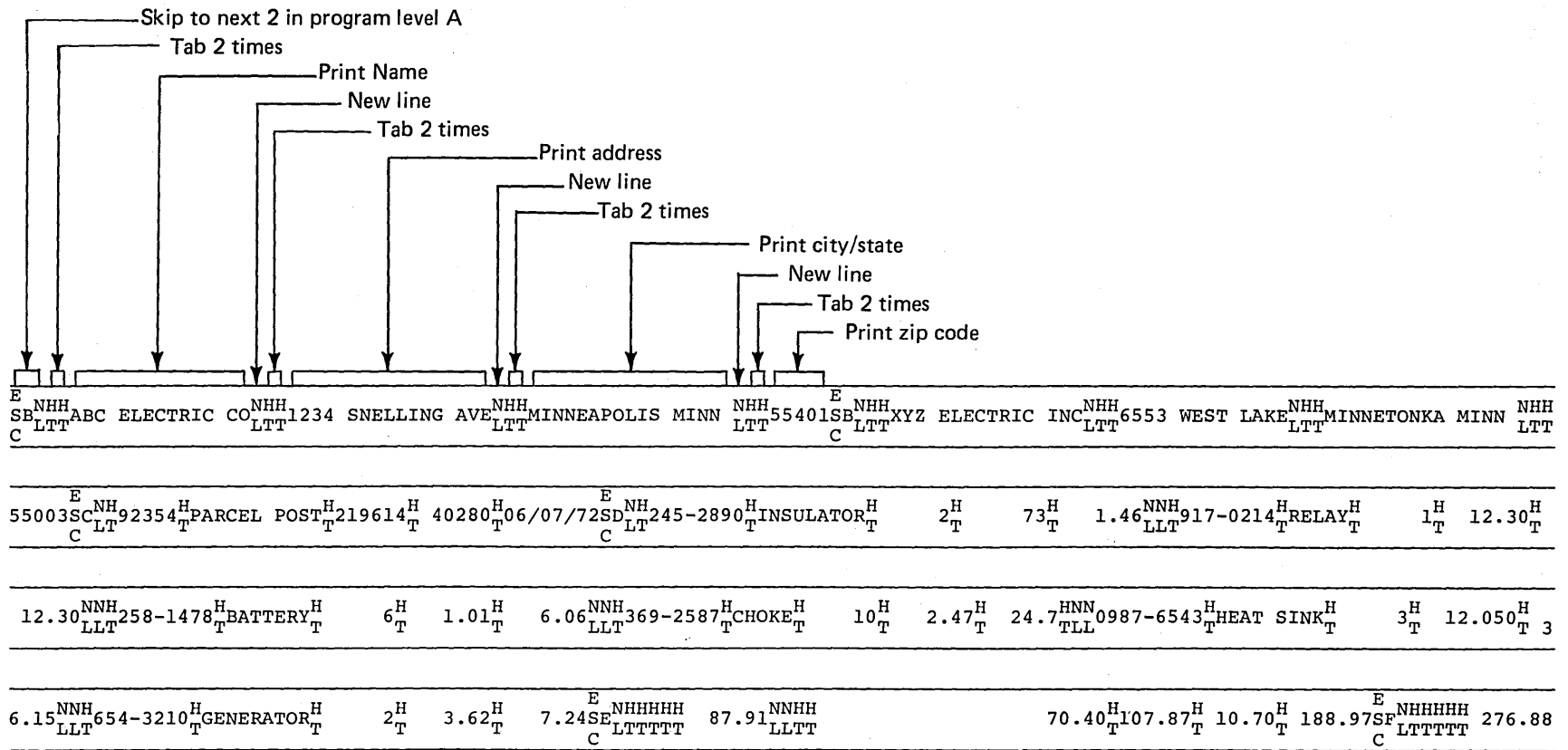
[illegible]

Figure 41. Program Level A

Code	Type	Causes	What To Do
A	Not accessible	The accessibility field in the data set or volume label has a non-blank character.	Remove the disk.
B	Incorrect label	BOE is less than track 01, sector 01.	Reset and correct BOE.
		EOE is greater than track 74, sector 26.	Reset and correct EOE.
		EOD is greater than EOE+1.	Reset and correct EOD and/or EOE.
		EOE or EOD is less than BOE.	Reset and correct EOE and/or EOD.
		Record length is not equal to 80 on the 3742, or is equal to 0 or greater than 128 on the 3741 or on the 3742 with 128 feature.	Reset and enter correct length in positions 23 through 27.
		BOE, EOE, or EOD sector is 00 or greater than 26.	Reset and enter correct sector.
		The third position in BOE, EOE, or EOD is non-zero.	Reset and insert zero.
		One of the following conditions existed when a mode selection was attempted from track 00:	
		— The current sector is 01 through 07.	Reset and press REC ADV to locate desired label.
		— Position 4 in the label doesn't contain a 1.	Reset and rewrite the label with a 1 in position 4 of label.
		— The label displayed is deleted.	Reset, key an H in position 1, and rewrite the label.
C	Self-check	The self-check digit doesn't compare properly.	Reset and correct error.
		The self-check field is blank in verify (V) mode.	Reset, select field correct mode and enter the field.

Code	Type	Causes	What To Do
D	Disk 2 not ready	The disk 2 drive isn't ready when disk 2 REC ADV is pressed.	Reset and make disk 2 ready.
E	End of extent	Attempt was made to read from disk 2 beyond the last record in the data set.	Reset and continue on another data set or disk.
		Attempt was made to record advance on disk 1 beyond EOE.	Reset and modify EOE in label.
		The disk has been positioned on the index track after the last record in the data set has been verified.	Reset.
		EOE was encountered on disk 1 during copy operation.	Reset and modify EOE in label or continue on another disk.
F	Function not available	The selected function isn't available.	Reset and rekey FUNCT SEL and appropriate key or keys for desired function.
		The second disk setup is improper.	Prepare second disk.
G	Write protect	Enter (E) or verify (V) mode is selected with the data set protected.	Reset and inspect label.
		Attempt was made to write on the disk in update mode with the data set protected.	Reset, return to index, and inspect label.
		At last record in data set in update (U) mode and attempt was made to record advance with the data set protected.	Reset and inspect label.
H	Copy setup	After pressing COPY:	
		— The disk 2 address is less than track 00, sector 08.	Reset and advance to proper disk 2 address.
		— Disk 2 isn't ready	Reset and press DISK 2 RETURN TO INDEX.
		— COPY wasn't pressed in conjunction with the numeric shift key.	Reset and press the numeric shift key in conjunction with COPY.
		Disk 1 is on track 00, but disk 2 isn't on track 00.	Reset and press DISK 2 RETURN TO INDEX. Then position disk 2 to the correct label.
		SEARCH SEQ CONTENT was pressed in copy setup.	Reset and select proper function.

Code	Type	Causes	What To Do
I	Search address	The search address contains a non-decimal character or the third position is non-zero.	Reset and enter the correct address.
		The search address isn't within the extents of the data set.	Reset and enter the correct address.
J	Print to EOD	EOD was encountered on current data set and the data is continued on another disk.	Reset and insert next disk in sequence.
K	Keying	Uppershift A or Z was pressed.	Reset and press the correct key.
		PROG NUM SHIFT is set to numbers only and in program numeric field and the character keyed isn't 0 through 9, dash, space, plus.	Reset and press the correct key or set PROG NUM SHIFT to all characters.
		One of the two keys pressed following the hex isn't a hex character.	Reset and press the hex key and the two hex characters.
L	Incorrect function	SCRL FWD, SCRL BKWD, CHAR ADV, or FIELD ADV was pressed in verify (V) mode.	Reset and press appropriate key.
		REC BKSP or REC ADV was pressed in field correct (C) mode.	Reset and press appropriate key.
		DISPLAY PROD STAT was pressed when not on track 00 or in enter (E) mode.	Reset and select appropriate function.
M	Mode selection	Search, offline field totals, print to EOD, or copy was attempted from verify (V) or field correct (C) mode.	Reset and reselect correct mode.
		Copy was attempted from update (U) mode.	Reset and reselect correct mode.
		Search on content was attempted from enter (E) mode.	Reset and reselect correct mode.
		Enter (E), modify index (M) or initialize (I) mode was attempted from other than index (X) mode.	Reset and reselect correct mode.

Code	Type	Causes	What To Do
M	Mode selection (continued)	Verify (V) mode from enter (E) or search (S) mode.	Reset and reselect correct mode.
		Field correct (C) mode was attempted with one of the following conditions: 1. Not in verify (V) mode 2. While in an auto dup/skip field 3. When currently at the end of the record	Reset and reselect correct mode.
		Update (U) mode was attempted from enter (E) mode or from search (S) mode when search was selected from enter (E) mode.	Reset and reselect correct mode.
		Communications mode was attempted from verify (V), enter (E), or search (S) mode.	Reset and reselect correct mode.
		Search on content was attempted from update (U) mode when currently on the last record in the data set.	Reset and reselect correct mode.
		DISPLAY PROG was pressed in conjunction with either shift key in verify (V) or field correct (C) mode.	Reset and reselect correct mode.
		Disk initialize was attempted under one of the following conditions: 1. From the secondary station 2. When the primary station isn't on the index track 3. When the secondary station has a disk inserted	Reset, select primary station, and remove disk from secondary station.
		Program select was attempted in field correct (C) mode.	Reset and reselect correct mode.
N	Keyboard overrun	Program load was attempted in verify (V) mode or field correct (C) mode.	Reset and reselect correct mode.
		Keying rate exceeded machine capacity.	Reset and continue.

Code	Type	Causes	What To Do
O	Operation	Program select was selected when the cursor isn't at the beginning of the field.	Reset and position cursor.
		RIGHT ADJ was pressed not in a right adjust field except at the end of the record.	Reset and press correct key.
		SKIP, DUP, or REC ADV was pressed in a right adjust field and not at the first position of the field.	Reset and position cursor.
		SKIP, DUP or REC ADV was pressed in a self-check field and not at the first position of the field.	Reset and position cursor.
		DISPLAY FIELD TOTALS was pressed not at the beginning of the field.	Reset and position cursor.
		DISPLAY PROD STAT was attempted not under program level zero or in enter (E) mode and the data had been entered into the current record.	Reset, selection program 0 and reselect function.
P	Program	The key following SEL PROG or PROG LOAD isn't a program number.	Reset and rekey sequence.
		A new program was selected while not at a field begin character.	Reset and position cursor on field beginning or change program.
		Incorrect Program was selected.	Reset and modify program or reselect program.
Q	Field totals	No . (period) or digit follows the program character.	Reset and rewrite the control statement.
		The position number is greater than 80 for the 3742 or 128 for 3741 or 3742 with 128 feature.	Reset and rewrite the control statement.
		No N or W follows the position number.	Reset and rewrite the control statement.
		An invalid character follows the mask (must be ,;:.&).	Reset and rewrite the control statement.
		Program 1 through 6 on 3742 or 1 through A on the 3741 or 3742 with 128 feature is not specified in the mask statement.	Reset and rewrite the control statement.

Code	Type	Causes	What To Do
Q	Field totals (continued)	No "<" sign was found in the first position of any program buffer.	Reset and rewrite the control statement.
R	Right adjust	Data key was pressed after the right adjust field was filled.	Reset and press RIGHT ADJ or FIELD BKSP and reenter field.
		Data key was pressed after all characters have been verified.	Reset and press RIGHT ADJ.
		A mismatch occurred on a fill character for a right adjust field	Reset and correct the program.
		RIGHT ADJ or - (dash) was pressed at the start of a field that isn't all fill characters or contains the wrong type of fill character. The error occurs when the first non-fill character is encountered.	Reset and, if the dash and RIGHT ADJ are correct, do field correct.
		RIGHT ADJ or dash (-) key was pressed before all characters in the field have been verified.	Reset and correct field.
S	Search	The mask didn't match any record during a search on content or search on sequential content operation.	Reset and inspect search mask and data set label.
T	Truncation	Attempt was made to enter data beyond the logical record length.	Reset and backspace or advance to next record.
		RIGHT ADJ was pressed at the end of the record.	Reset and advance to next record or backspace to field within record.
		DISPLAY PROD STAT was pressed in enter (E) mode and the record length is less than 21.	Reset, return to index, and inspect label.
U	Printer	Printer has run out of forms or the hardware has failed.	Reset and check forms.

Code	Type	Causes	What To Do
V	Verify mismatch	A mismatch occurred between the current data keystroke and the data character in the record.	Reset and key correct character.
		A nonblank character was found during a skip operation or during a record advance operation in any of the following manual or skip fields.	Reset and correct character if necessary.
		A mismatch occurred between the characters in the current record and the corresponding character in the previous record in a duplicate operation.	Reset and correct character if necessary.
W	Printer format	Invalid printer format character was used.	Correct format.
X	Right adjust sign	A sign mismatch occurred at the end of a right adjust field in verify (V) mode.	Reset and press RIGHT ADJ or dash (-) key depending on corresponding sign.
Y	Empty data set	Verify (V), update (U) or search (S) mode was attempted when BOE equals EOD.	Reset and inspect label for desired data set.
Z	Last record write error	In enter (E) or update (U) mode, the write error occurred when performing a record advance and at EOE.	Reset, search EOD, and inspect record displayed. Update the record if necessary and record advance to rewrite record.
		In verify (V) mode, the write error occurred when performing a record advance on the last record of the data set.	Reset, search EOD, select verify mode and reverify record if necessary and record advance to rewrite record.
0	Early disk removal	Disk was removed while the disk operations are in process.	Insert disk and press NUM SHIFT with RESET. Inspect and modify label if incorrect.

Code	Type	Causes	What To Do
0	Early disk removal (continued)	Disk was removed while not on track 00.	Write down the current disk address in the status line, insert disk, and press NUM SHIFT and RESET (will position the disk on track 00, sector 08). If in enter mode when disk was removed, modify the corresponding label with EOD set to the recorded address. If not in enter mode but had been since leaving track 00, set EOD equal to EOE and search for the last record entered. Record advance, write down current disk address, return to index, and modify the label with EOD set to the recorded address.
1	Length	The record read from disk did not have a logical record length of 80 for 3742 or did not equal the length specified in the data set label.	Numeric shift and reset, return to index, and inspect label for proper data set and extents.
2	No record found	No record corresponding to the current disk address could be found.	Numeric shift and reset, and retry operation.
3	Seek	No track corresponding to the current disk address could be found.	Numeric shift and reset, and retry operation.
4	Read	The record at the current disk address could not be read.	Numeric shift and reset, and retry operation.
5	Write	The record could not be written to disk.	Numeric shift and reset. Record backspace, enter data, and record advance.
6	Deleted record	The 6 code indicates that the current record is a deleted record. A 6 may appear momentarily in the error position of the status line during operations where deleted records are passed automatically such as SEARCH CONTENT, DISK COPY, COMMUNICATIONS. This should not be interpreted as an error. It merely indicates the passing of a deleted record.	Numeric shift and reset.
??	Write test	Data cannot be written on the disk.	Numeric shift and reset, then reload the disk.

DISK INITIALIZATION ERRORS

Code	Type	Causes	What To Do
,	Input specification	Track 00 is specified as a bad track. Sequence is greater than 13. A character other than 0-9 or blank was entered or an odd number of characters entered in positions 7-12. Positions 78-99 were specified incorrectly.	Reset** and correct error.
=	Bad track specification	Bad tracks are not entered in ascending sequence.	Reset** and reenter in ascending sequence.
*	Bad tracks	More than two bad tracks are on the disk.	Reset** and retry disk initialization. If error persists, discard disk.
(Write error	Disk error occurred while initializing the disk.	Reset** and retry initialization.

**Initialization errors are not reset by the reset key. The disk is removed and reinserted. Then the initialization setup must be done over.

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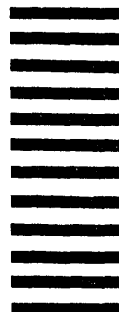
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