

SYSTEM 480

CONCEPTS MANUAL

ENTREX DATA/SCOPE



ENTREX

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CONCEPTS MANUAL

ENTREX DATA SCOPE

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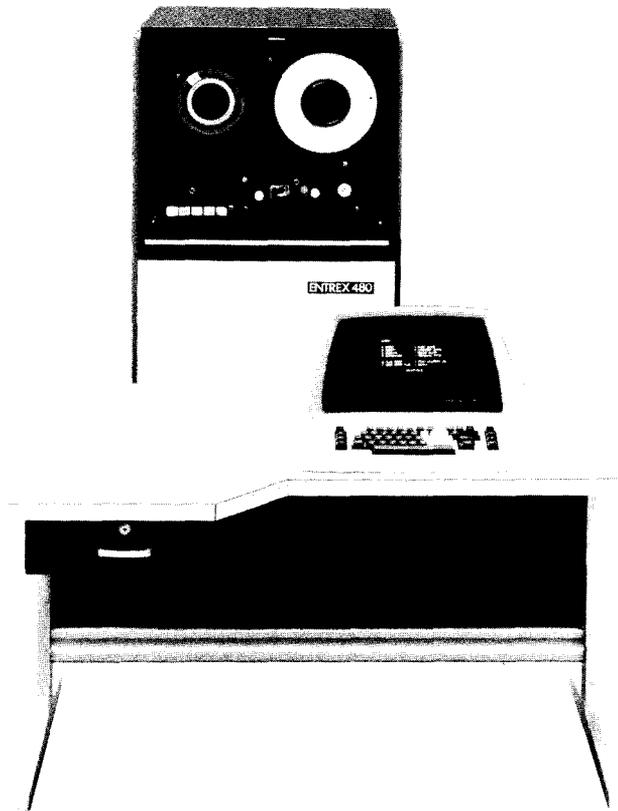
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PREFACE

This document describes the basic concepts of ENTREX's System 480 as controlled by the new software Release VII parameters. It provides the necessary information to achieve an understanding of the following:

- *DATA/SCOPE keystation*
- *Central processor*
- *Data entry methods*
- *Reformatting techniques*
- *Editing and validating checks*
- *Operating modes*
- *System management features*
- *Supervisory functions*
- *Validator language*

SYSTEM 480



-  ***KEY-TO-DISK OPERATION***
-  ***COBOL-LIKE LANGUAGE***
-  ***32 - KEYSTATION EXTENSIBILITY***
-  ***10 MILLION-BYTE CAPABILITY***
-  ***USER ORIENTATED SOFTWARE***

SECTION 1 INTRODUCTION

The ENTREX System 480 is a key-to-disk data entry system that produces accurate data for immediate processing by a large business computer. To achieve immediately usable output, System 480 integrates the capabilities of the following components:

Up to 32 DATA/SCOPE* Keystations for communication with the system, each providing:

- Video display,
- Simple, functional keyboard.

Central Control Group consisting of:

- Central processor,
- Central disk for intermediate storage,
- Magnetic tape unit for output,
- Hardware and software logic necessary to create an integrated system.

DATA/SCOPE

Each System 480 DATA/SCOPE keystation has a video display that provides an excellent means of communication between the operator and the system. Any information needed by the system, such as the name of a job about to be entered, is requested on the display. The system displays these messages to the operator in English; the operator simply answers these requests.

In addition, the display makes error correction easy and accurate. During normal data entry and verification, the operator can ignore the display just as a typist ignores the page being typed. However, if an error is suspected, the operator can glance at the screen and view the data in context to determine whether an error is present. If there is an error, it can be quickly corrected. Because the correction is also displayed, the operator can validate it immediately, resulting in greatly improved data accuracy.

The DATA/SCOPE keyboard is both easy to use, functional and is available with either a standard keypunch or conventional typewriter keyboard. Both keyboard configurations can be used with one System 480 Central Control Group.

*Trademark Entrex, Inc.

CENTRAL CONTROL GROUP

Processor

System 480 software, in conjunction with the central processor and magnetic disk, detects keying errors and source document errors as they are entered into the system. An extensive series of validity checks insures that errors are detected before they are processed by the user's business computer.

Once detected, errors can be corrected easily and quickly. Because data is validated during preparation, the need for business computer runs for further data editing is virtually eliminated.

Central Disk and Magnetic Tape

Data entered by the operator is written on the central disk for intermediate storage. Direct access to the disk allows insertion and deletion of data, as needed. System 480 processing capabilities combine with the advantages of quick access to an intermediate storage device to provide extensive data reformatting capabilities. Once data is keyed, it may be edited, merged (pooled) or sorted to a desired output sequence. The powerful output edit programs create an output file in the form of a magnetic tape ready for the user's business computer. In addition, data output may be communicated directly to a remote system (another System 480 or a business computer), or a printed copy may be generated.

Controlling Data Entry

The basic unit of data handled by System 480 is a record. A record normally consists of all data from one source document, e.g., a payroll time sheet for an employee. As each record is completed in memory, it is validated and written into an intermediate storage location on disk. Records entered as a related set are stored on the disk forming a batch. When a batch is ready for output, it can be written on magnetic tape or combined with other batches to form a file. Figure 1-1 illustrates the flow of data through System 480.

Keying of each record by the operator is controlled by an input format. An input format describes a record in terms of fields. A field is the basic unit of information within a record. It consists of a group of digits or characters (e.g., a policy number or name) that is usually processed as a logical entity by a computer program.

In addition to indicating the length of a field as well as the position on the DATA/SCOPE, the input format specifies the editing, validity checks and type of verification to be applied to each field in the record as it is entered or verified. Editing features include determining the shift of a field (alphanumeric or numeric), right justification with zero or space filling, automatic field duplicating and skipping, automatic insertion of constant data, field boundary checks, and mandatory entry and completion fields. Validity checks include numeric-only and alphabetic-only fields, range checks, batch totals, check digits, value table lookup, cross-footing, and a subtotalling capability.

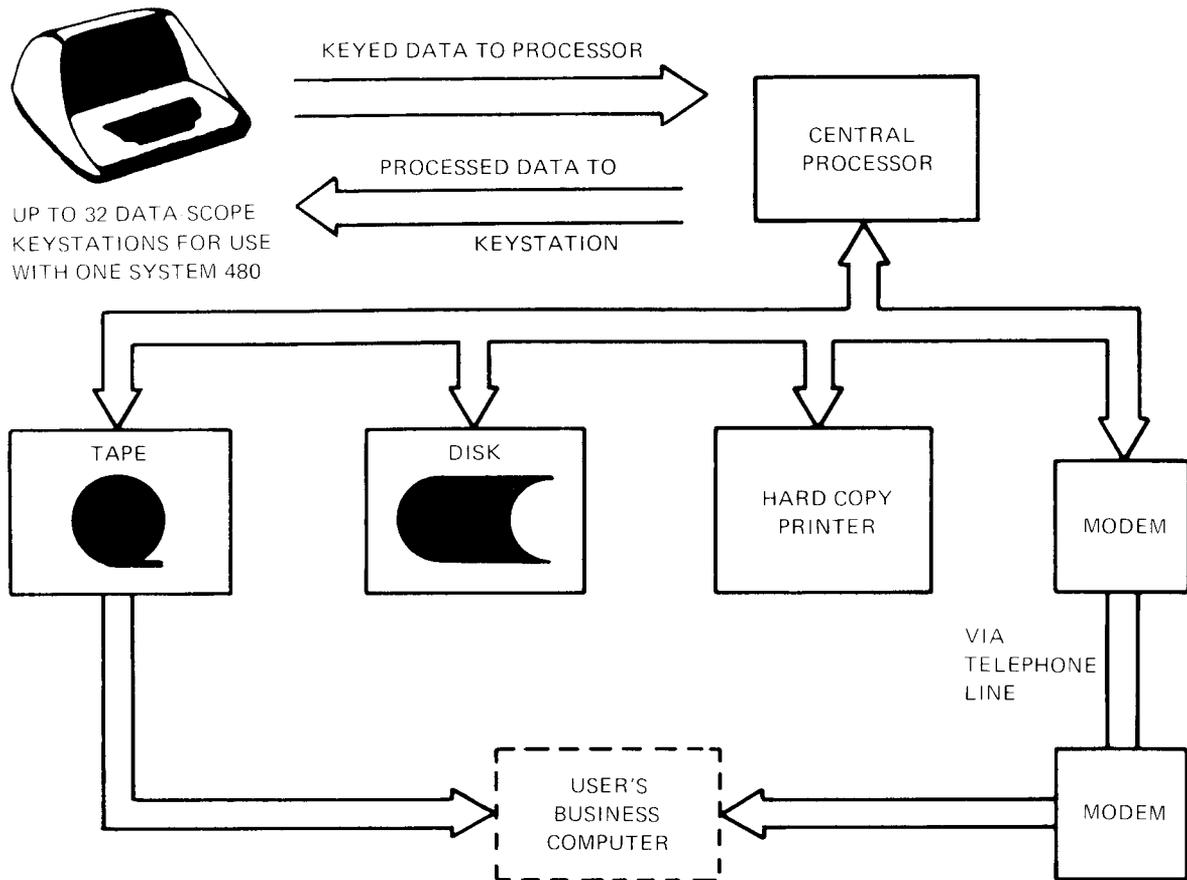


Figure 1-1. Data Flow Through System 480

Because System 480 input formats describe records on a field-by-field basis, each field can have a different combination of editing and validity checks and an appropriate degree of verification. For example, the input format can specify right justification with zero filling of unused lefthand positions for a numeric field and require verification by rekeying. For another field in the record, the record format can specify mandatory keying into the field and require visual verification only. An unlimited number of record formats can be stored in a library on disk and used by as many operators as desired. In addition, up to ten record formats may be used for one batch.

OPERATING MODES

System 480 provides five modes for the preparation of accurate data: Entry, Verify, Validate, Examine, and Update. Every operator function is performed in one of these modes.

Entry Mode

The operator selects Entry Mode when data is to be keyed from source documents into the system. Each source document is keyed as one or more

records. As each field of a record is keyed, the editing and validity checks specified for it in the record format are applied. Further, when an error is detected by the system, an error-tone sounds, the system will not accept data entry and an error message in English is displayed. The error can be quickly corrected by depressing the reset key and rekeying the data. Because the correction is displayed in context on the screen, the operator can immediately verify it.

As each record is being entered at the keyboard, it is written in the processor's memory. Completed data records are released from memory and stored on the disk. The release can be either manual or automatic. Following release of one record, entry of the next record begins. This process is repeated until the batch is keyed and stored on disk.

Verify Mode

The operator selects Verify Mode when a batch is completely entered and waiting for verification. Operator action for each field depends on the type of field verification specified in the input format. Three types of verification are available: key verification (rekeying the data), scan verification, and conditional verification (rekeying a field only if the sum of a set of fields does not equal a predetermined total). The kind of verification specified for a field depends on the degree of data complexity contained in the field and the type of validity checks applied. In addition, reverification of a *corrected* field may be specified in the input format. Verification options may be used in the following manner:

- Field 1 contains an account number. Check digit validation is displayed but not verified, because check digit validation insures the accuracy of the account number.
- Field 2 is a salesman's name. The operator verifies the entry visually.
- Field 3 is the salesman's number. The operator key verifies the number to insure its accuracy.

The result is that the operator wastes no time either rekeying or visually verifying data beyond reasonable requirements.

Validate Mode

The operator selects the validate Mode to apply the editing and validity checks specified on the Input format to data that has been read into the System 480 from a peripheral device (tape or communications). The Validate A Batch option compares data in each field with its associated field definition and places an error flag in any field that contains erroneous data.

Examine Mode

The operator selects Examine Mode to display any number of records in a batch. The records can be examined in either a forward or backward direction, or a search function can be selected to position the file at

a particular record. When one record is released from the DATA/SCOPE, the next record appears. By using the Examine Mode, an entry or verify operator can quickly examine a batch to insure that duplicate records have not been entered or that a record has not been omitted.

Update Mode

The Update Mode is useful when certain fields in a record are continuously being changed. For example, in a payroll record certain fields (employee: hours, overtime hours and job number charged) change each pay period. These fields would be prime candidates for the Update Mode. When a field is designated as an update field on the input format, the system is put in either the Entry or Verify mode.

HELP LISTS

The HELP key is the starting point for all operator and supervisor actions. When system power is turned on, the Operator HELP List is displayed at all DATA/SCOPE keystations.

To maintain simple operating procedures, while providing the greatest possible system flexibility, two HELP lists are provided.

The Operator HELP List provides all of the options for starting a new operation. The HELP Functions List provides all of the options that may be performed while a batch is active at a keystation. When the HELP key is depressed, the system displays the appropriate HELP List based on operator activity prior to requesting the list.

To select a particular HELP list option, the operator depresses the letter preceding the desired option. Depending on the option selected, the system may display requests for additional information; i.e., to start a standard job, the standard job and batch names are requested.

SYSTEM MANAGEMENT

The orderly entry, verification, editing, and output of data requires a certain amount of production and system management. System 480 provides features to simplify this task by allowing the supervisor to obtain information from any DATA/SCOPE keystation.

SUPERVISORY FUNCTIONS

Supervisory responsibilities for System 480 involve management of data flow through the system. The supervisor will be concerned with creating input formats, output programs and controlling data output. Input formats divide each record into fields by assigning the length, position and characteristics of each field on an individual basis. Included in each field description are the editing, validity checks and verification required for each field. System 480 editing capabilities include:

- Automatic functions,
- Right justification,
- Zero and space filling,
- Alphanumeric and numeric shifts,

- Field boundary checks,
- Mandatory entry field,
- Mandatory completion field.

System 480 is designed to detect source document errors and keying errors before they are processed by the user's business computer. The system provides a comprehensive set of checking features to insure that data being entered meets the necessary criteria for data processing applications. These checks include:

- Numeric-only field,
- Non-numeric-only field,
- Range checks,
- Check digits,
- Value table lookup,
- Batch balancing,
- Ascendency check.

In addition, the supervisor can specify the type of verification, if any, to be performed by the operator. Verification options range from complete key verification to sight checking and include conditional verification and mandatory reverification.

After a batch has been entered and verified, it is ready for output. The primary output medium is magnetic tape, however, the system can print data on a serial or line printer and communicate it over telephone channels to another System 480 or to a large main frame. The data output process is concerned with taking input records and producing the desired output records. Output programs are written in System 480 editor language to control the reformatting and writing of data records.

Reformatting, an integral part of data output, is the rearranging of data by field or character within and among input records to produce an output record or records with data in the required order. Depending on user application, output programs range from simple reformatting routines to powerful data generation and reformatting programs.

VALIDATOR LANGUAGE

The System 480 Validator language (a high level COBOL-like language) comprises all of the statements used to create record edit programs, batch edit programs, output programs, and sort programs. All statements are in English and can be combined to form simple programs consisting of a few statements as well as powerful edit programs with branching statements and subroutines.

Record and batch edit programs validate data that has been entered. Output programs can perform any of the functions available in record and batch edits as well as reformat data and create new data (per user requirements). Sort programs control the sorting of one or more batches according to ascending and/or descending values.

SYSTEM 480 OVERVIEW

The System 480 is the most sophisticated and powerful key-to-disk data entry system currently available.

SECTION 2 DATA/SCOPE KEYSTATION

The greatest advantage of the ENTREX System 480 over any other data entry systems is the DATA/SCOPE keystation, featuring a 480-character display screen.

The display allows the operator to view much more data than other systems. The display contains all necessary features to present both field names and new data in context as it is entered by the operator. A moving cursor indicates the position about to be entered. Should the operator key the wrong character, the mistake can be corrected by depressing the reset key; the cursor is positioned at the beginning of the field.

All keyed data in a record is displayed, but like the typist, the operator is not concerned with entered data until an error is suspected. Then, the ability to view the data saves the time spent initiating a *just entered* data display to check for an error; as is often the necessity with a *blind terminal* entry system.

KEYBOARD

ENTREX produces both the standard keypunch and typewriter keyboards.

The standard keyboard, shown in Figure 2-1, resembles the IBM 029 Keypunch Keyboard, but has the function keys necessary to operate System 480.

The alternate keyboard, shown in Figure 2-2, resembles a typewriter keyboard. In addition to the normal typewriter keys, it has the same function keys as the standard keyboard. In addition, it has a ten-key adding machine cluster, located to the right of the typewriter keys, for numeric entry.

The keyboard is the operator's sole communication with the system. No additional switches are necessary. The operator can start a job and later change to another job by depressing the HELP key and selecting the desired option from the screen.

DATA DISPLAY

The DATA/SCOPE screen displays a maximum of 480 characters which are contained in 12 lines of 40 characters each. Formatting information supplied by the system, such as field names and delimiters, and data keyed by the operator are displayed on the screen with job status information. The number of fields that can be displayed on the screen at one time depends on the screen format.

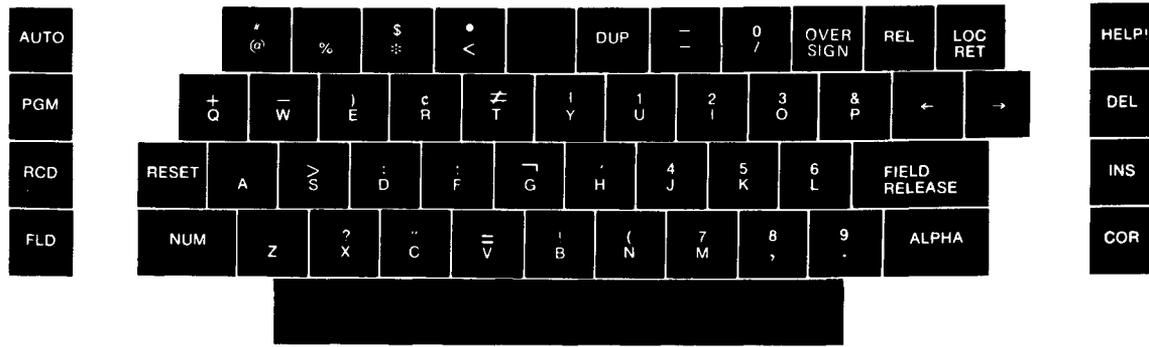


Figure 2-1 System 480 Keypunch Keyboard



Figure 2-2 System 480 Typewriter Keyboard

The top line on the screen, called the status line, displays information about the job in progress. The second line is reserved for messages to the operator; it is normally blank. The remaining ten lines contain the formatted data being entered, verified, validated, updated, or examined.

If more than ten lines are required, a scrolling technique is used. As the eleventh line is displayed, the first line rolls-up out of the viewing area. As many lines as needed can be used. Each additional line results in a top line scroll. The operator can always backspace to display information that has scrolled from the screen.

CURSOR

The cursor is a blinking rectangle of light the size of one character. Its function is to indicate where the next data character is to be placed on the display when keyed. Because the cursor blinks, it is transparent; any character in the same position as the cursor can be seen behind it.

The cursor may indicate the next position to be keyed or verified, or it can be positioned forward or backward to indicate an error to be corrected. Moving the cursor through recorded data positions does not alter the display or the data in memory.

In this document, the symbol \square is used to indicate a cursor position.

STATUS LINE

The top line of the DATA/SCOPE display presents the status of the job in progress. The following example illustrates a sample status line:

```
ENTRY AUTO PGM-8 REC-59400 FLD-0001
```

- MODES - Entry, Verify, Validate, Update, Examine.
- AUTOMATIC - An indication of whether the automatic functions of duplicating, skipping, emitting, incrementing, and automatic record release are on.
- INPUT FORMAT NUMBER - The number of the input format program controlling entry of the current record.
- RECORD COUNT - A running count of records maintained by the system. The system maintains the correct record count even if records are inserted or deleted.
- FIELD COUNT - The number of the field that the cursor is in within the current record

FORMAT CONVENTIONS

Information displayed on the screen falls into two categories: explanatory tags with field delimiters and the actual data being keyed.

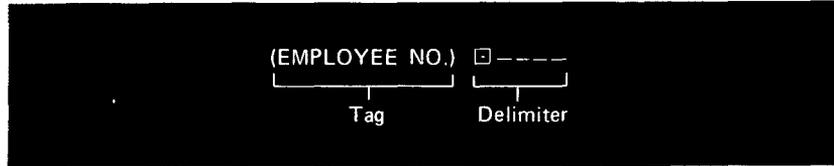
FIELD TAGS

Tags are not entered by the operator. Instead, they are stored with the input format that describes processing of a record. Each tag is automatically displayed by the system when it is ready to accept data for that field.

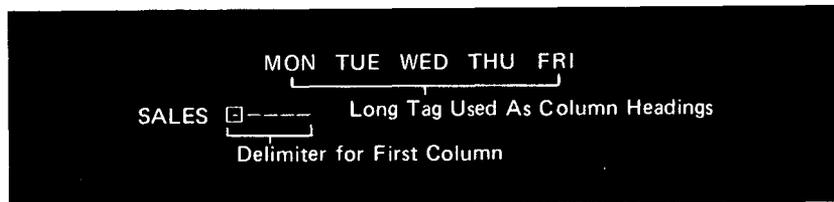
Usually, the operator sees each tag as the name of a field about to be entered. Tags can be of any length desired up to a maximum of forty tags. However, should longer lengths be required, two or more tags may be used successively with no intervening data.

FIELD DELIMITERS

For each data field, the data positions are indicated by a row of underscore characters (_). These characters form the field delimiter. During keying, the delimiter shows the length of the field as well as the number of remaining character positions to be entered.



Tags can be used to serve other purposes. A long tag can be a header for data columns, as follows:



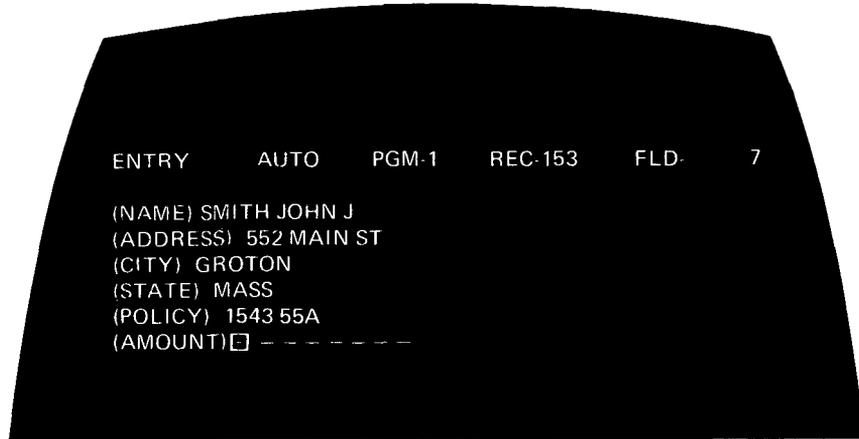
Another use for a tag is to display special keying instructions to the operator at the start of a job, as follows:



DATA LINES

The data display lines may be formatted to contain one field per line. This format allows the operator to rapidly distinguish between fields. At times, however, more than one field per line is preferable. When small fields are to be entered, having more than one field on each line may allow an entire record to be formatted on the screen at one time. Any field that extends beyond the end of a line is automatically carried to the next line.

The flexible DATA/SCOPE keystation design allows for screen formatting in any desirable fashion. The only format criterion is ease of operator understanding. The following example is a formatted screen on which data has been entered:



DATA STORAGE

While data is presented on the screen for clarity and ease of operation, it is also stored in memory and disk one character after another. Spaces used for visual aids are suppressed, and tags are not brought into memory or stored on the disk. The following example illustrates how data is stored:

On the screen:	(EMPLOYEE NO)	12724
	(PAY CLASS)	C
	(SOCIAL SEC NO)	034 32 4543
In memory:	12724C034324543	

SECTION 3 SYSTEM 480 OPERATING MODES

The System 480 utilizes five basic modes of operation: Data Entry, Data Verification, Data Validation, Data Examination and Data Updating. This Section discusses these modes in detail.

DATA ENTRY

When one of the Operator HELP List options is selected, the system automatically places the keystation in the appropriate mode for the requested operation. Start Standard Job, Start Batch and Resume Batch are options associated with data entry. When one of these options is selected, the keystation is placed in Entry Mode.

Entry is the basic operating mode of System 480. When a keystation is in Entry Mode, the operator transcribes data from source documents to the System 480 memory. The system then writes the data onto disk. As the operator keys the data, the system insures that it meets the validity requirements specified for it in the record format.

To operate in Entry Mode, the operator selects the entry option from the HELP List and starts a batch. The system displays the tag and field delimiter for the first field and waits with the cursor to indicate the first data position to be keyed by the operator, as indicated by the following example:



(RATE) □----

As the end of each field is reached, the tag for the next field is immediately displayed with its delimiter. The tag can appear on the same line as the previous data field or on the next line of the screen, depending on the record format specification. Up to ten lines of data and formatting information can be displayed on the screen at one time. If the input format contains more than ten lines, scrolling occurs. That is, the top line of the display rolls off the screen and a new line is displayed at the bottom of the screen.

After each record is completed, it is released to intermediate storage either automatically or manually using the release (REL) key. It remains on the disk until its batch is deleted by the supervisor.

Standard industry practice is followed for indicating signed (+ or -) numeric fields in a record. The operator can enter leading or trailing signs, or the OVERSIGN key can be used to place a sign on any digit of a numeric field. The oversigned number is displayed as its alphabetic equivalent. A minus zero is displayed as an exclamation mark (!) and a plus zero as a question mark (?).

Error Correction

The cursor always indicates the position at which data is about to be entered or verified. The operator has complete control over the movement of the cursor. At any time, the operator can space backwards or forward one or more characters. In this manner, correction of errors in entry mode can be accomplished with no appreciable loss of time.

Studies show that the operator is aware of a keying error as it occurs 80 to 90 percent of the time. The ability to correct the error when it occurs results in increased data accuracy. Similarly, the operator's ability to glance at suspected errors without a backspacing or displaying operation as well as the ability to immediately correct the error is a tangible benefit.

For operator convenience, moving the cursor to a character that is several positions away to correct an error is simplified by additional features of the System 480. The system provides the ability to backspace the cursor one or more fields or records with a simple keystroke.

After a correction involving backward positioning of the cursor, depression of the location return (LOC RET) key immediately returns the cursor to its former position for further data entry.

If an error cannot be corrected; i.e., the operator repeatedly receives a check digit error because the source document being entered is incorrect, the operator depresses the HELP key and selects the Flag Error option. This option flags the field as one that contains incorrect data. After selecting Flag Error, the system executes an automatic location return to position the cursor for continued data entry. Later, the batch containing the error flags can be searched and all the flagged fields can be displayed for correction.

DATA VERIFICATION

The primary goal of every good data entry system is preparation of error-free, completely edited input data in as short a time as possible. Recognizing the need for accurate, edited data, the ENTREX System 480 provides the most complete range of verification capabilities in the industry.

Four choices are available in Verify Mode: key verification, scan verification, conditional verification, and releasing records that require no verification. Because the system scans each data record on a field-by-field basis, the choice of verification can be specified separately for each record field.

To operate in Verify Mode, the operator selects Verify Batch from the Operator HELP List, and keys the name of the batch to be verified. The cursor is then positioned on the first key verify field of the batch.

Key Verification

When key verification is specified for a field, the tag of the field is displayed on the screen with the field delimiter. The following is an example:



(SOCIAL SECURITY #) □-----

The operator then rekeys the field from the source document. As each correct character is keyed, it appears on the screen.

If there is a disparity between the character in memory and the keyed character, an error signal sounds; the message *VERIFY COMPARE ERROR* is displayed, and the cursor stops at the incorrectly keyed character. The RESET key must be depressed to turn off the error signal. If the verify operator made a keying error, the correct character can be keyed after depressing RESET, and verification can continue. If the entry operator made the error, the operator corrects it using the procedures detailed in this Section under *Error Correction* and continues data entry.

If the verifying operator needs to view the data entered in the record currently being verified, to determine whether a record was omitted or keyed twice, depressing HELP and selecting the Return To Data option from the HELP Functions List causes the entire record to be displayed. Displaying the record permits the operator to determine proper corrective action.

Scan Verification

If scan verification is specified for a field, the characters in the field are not rekeyed. The cursor automatically skips to the first position of the next key verify field. The operator can visually verify the skipped fields, or keying of the next field to be verified can begin immediately.

Conditional Verification

Conditional verification is applied to fields that are used in a zero balancing operation. If the batch is out of balance, fields are key verified; if the batch is in balance, they are not rekeyed. If there is more than one balancing operation in a batch, only the out-of-balance totals are rekeyed.

Once the verifying operator corrects the total, the total automatically becomes scan verified rather than key verified, and a message is displayed to the operator stating that an out-of-balance condition has been corrected. Therefore, no time is spent verifying data that is known to be accurate.

Error Correction

The method used to correct an error detected during verification depends on whether a single character, field or record is to be corrected. The three methods are:

- Single-character errors - The operator depresses RESET if key verifying or positions the cursor if scan verifying. The operator then depresses correct (COR) and keys the desired character; at that time verification can continue.
- Multiple-character errors - After the cursor is positioned, the operator depresses the field (FLD) and COR keys and enters all the remaining characters of the field as corrections; at that time, FIELD RELEASE is depressed. During keying, the system is temporarily in Entry Mode. It returns to Verify Mode automatically when the field is released.
- Multiple-field errors - The operator depresses the record (RCD) and COR keys and enters the rest of the record. The system is in Entry Mode during rekeying of the record. When the record is released, the system returns to Verify Mode.

If the detected error is the result of omitting one or more characters in a field, it can be quickly corrected using the System 480 character insertion capability. To insert a character, the operator places the cursor in the desired position, depresses the insert (INS) key, and keys the character to be inserted. If the field is left-justified, data to the right of the inserted character is shifted automatically. If the field is right-justified, data to the left of the inserted character is shifted.

If the error is the result of keying extra characters in a field, it can be corrected using the System 480 character deletion capability. To delete a character, the operator positions the cursor on the character to be deleted and depresses the delete (DEL) key. The data remaining in the field is shifted to fill the position of the deleted character; justification of the field is considered when adjusting the field.

In addition, the character insertion and deletion capabilities can be used by the operator whenever required. It is not restricted to data verification.

Regardless of whether the operator is correcting a character, field or record, depressing FLD and COR or RCD and COR keys does not change the location of the cursor. If the cursor is at the beginning of a field, the entire field is rekeyed. If the cursor occupies a position other than the beginning of a field, correction begins at the cursor position and continues until the field is released.

Record corrections are treated similarly. If the cursor is at the beginning of the record, the record is rekeyed. If the cursor is at a position other than the beginning of the record, keying starts at the cursor position and continues until the record is released.

In addition to correcting records, it is also possible to insert and delete records. Records are inserted in sequence in the batch.

If the operator discovers an error in a source document and is unsure of how to correct it, the following steps are taken. The HELP key is depressed and the Flag Error option is selected. The system automatically flags the error and returns the cursor for conditional verification. Later, the file can be searched and all flagged fields can be displayed for correction.

DATA VALIDATION

During normal data entry operations, data keyed by an operator is subject to the checks specified in the input format. Data validation is selected to apply these editing and validity checks to data that has been read into the system from a peripheral device (tape or communications). When the Validate A Batch option is selected, the system compares data in each field with its associated field definition and places an error flag in any field that contains erroneous data. Using the Seek Error Flag option on the Operator HELP List, an operator can locate and correct all errors.

DATA EXAMINATION

The Examine Mode is used to display a batch, that is on the disk, record by record in either a forward or backward direction and to search for a specified record or set of records. All or part of a batch can be quickly checked for errors. All detected errors can be corrected by the operator without changing modes by using the procedures for error correction detailed in the discussion of data verification.

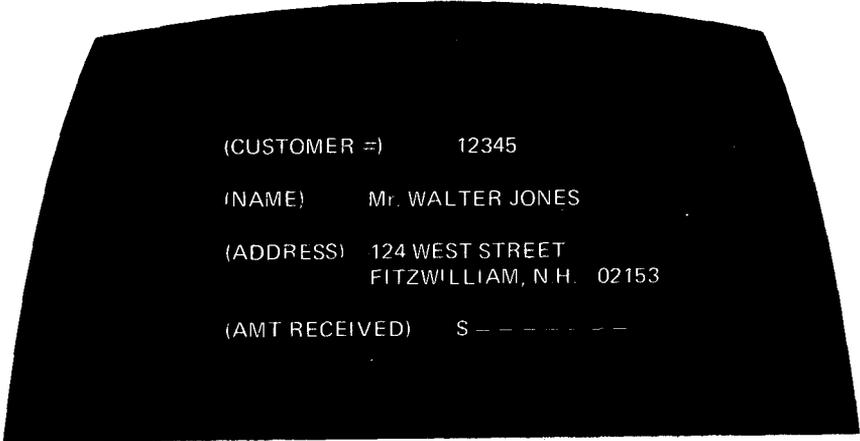
To examine data, the operator selects Examine A Batch (Operators HELP List) and enters the name of the batch containing the data to be examined.

DATA UPDATING

Updating provides the capability to update a batch periodically by entering only those fields in a record that need to be changed. The cursor stops to indicate those fields that are to be updated; all other fields are displayed, but skipped by the cursor.

Batches to be updated can be permanently maintained on the disk, or they can be kept on a magnetic tape and read to the System 480 only when updating is required.

In the following example, the only new data keyed in the record is the dollar amount:



(CUSTOMER #) 12345
(NAME) Mr. WALTER JONES
(ADDRESS) 124 WEST STREET
FITZWILLIAM, N.H. 02153
(AMT RECEIVED) \$ - - - - -

If an input format is to be used in a data updating operation, the type of updating required is specified on a field-by-field basis in that input format. Because the update function is a combination of data entry and verification, any of the following functions can be selected:

- Enter new data into the field,
- Key verify the field,
- Scan verify the field,
- Release the record automatically, if no verifying or updating is to occur.

SECTION 4 HELP LISTS

HELP is the starting point for all operator and supervisor actions. When System 480 power is turned on, all keystations present the Operator HELP List.

To maintain simple operating procedures and the greatest possible system flexibility, two HELP lists are provided:

The Operator HELP List provides all of the options for starting a new operation. The following options are available to the operator:

- Start entry of a standard job,
- Start a batch,
- Resume entry of a batch or standard job,
- Verify a batch or resume verification,
- Examine a batch,
- Update a batch,
- Validate a batch,
- Log in at a keystation (collect operator statistics),
- Display Supervisor HELP List after entering the correct password.

The HELP Functions List provides all of the operations that may be performed when a batch is active at a keystation. When a batch is active and the HELP key is depressed, the following options are available to the operator:

- Terminate the batch,
- Interrupt the batch,
- Display the error log created by a batch edit program,
- Display the batch start page containing information such as the name of the standard job and input formats used for the batch,
- Return to data for further entry, verification, validation, examination, or updating,
- Insert an error flag in a field that cannot be corrected by the operator due to a source document error,
- Perform a search operation. The search can be for an error flag, a record with a specified sequence number, field content, character sequence, or a repeat key search.

Figures 4-1 and 4-2 illustrate the Operator HELP List and the HELP Functions List, respectively.

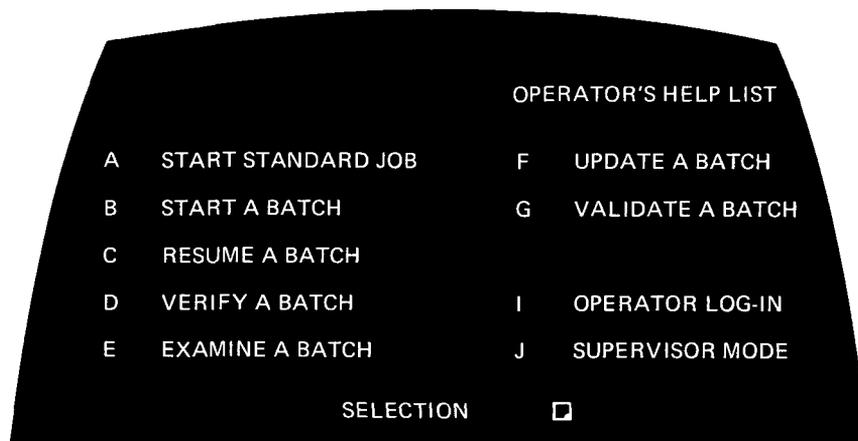


Figure 4-1. Operator HELP List

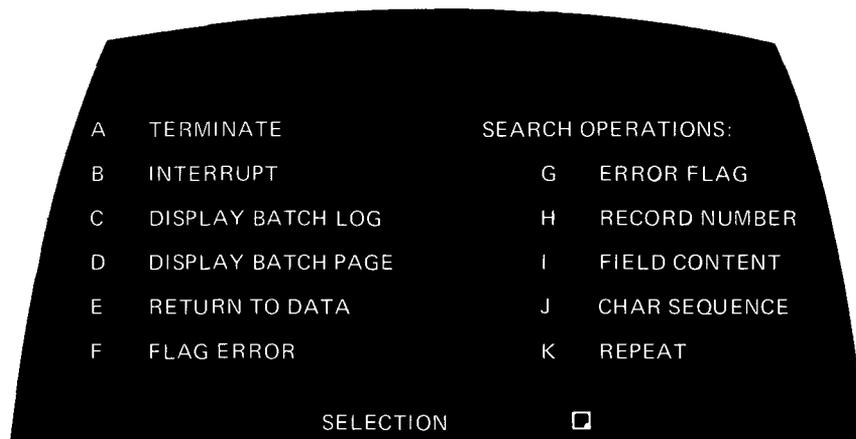


Figure 4-2. HELP Functions List

To select any of the functions listed in the HELP displays, the operator depresses the letter preceding the desired function. Depending on the option selected, the system may display requests for additional information, e.g., to start a standard job, the standard job name is requested.

OPERATOR HELP LIST OPTIONS

The Operator HELP List is displayed to the operator when the HELP key is depressed at a keystation free to start a new task. The following is an explanation of the available options.

Start Standard Job

Frequently performed data entry jobs (standard jobs) use the same input formats each time the job is keyed. A standard job is an accumulation of characteristics, i.e., the names of the input formats and editing programs required by the job.

A standard job can be started by depressing key A (START STANDARD JOB). The system prepares for data entry and requests the name of the standard job as follows:

```
START STANDARD JOB -----
```

The standard job name may then be entered using any combination of keyboard characters up to eight characters long.

The system then requests the batch name. The batch name can consist of any combination of keyboard characters up to ten characters long. When the batch name is entered, the system, through a batch name protection function, checks to insure that the name conforms to the naming conventions specified for that standard job. For example, a supervisor can specify that all batches entered using the standard job *PAYROLL* must have a batch name that begins with the letters *PA*. The system searches the system directory for the specific batch name to insure that a batch by the same name does not already exist. If a duplicate batch name is present, an error message is displayed.

If the batch name is legal, the system displays the tag and field delimiter of the first field to be keyed by the operator. The AUTO key is depressed and the keystation is ready for data entry.

Start Standard Job automatically provides the operator with all of the formats and editing programs that are manually specified in the Start Batch function, described below.

Start A Batch

Start Batch is selected if there is a requirement to enter data that has no associated standard job defined for it. It is used for one-of-a-kind or infrequently used jobs.

A batch can be started by depressing key B (START A BATCH). The system requests the name of the batch. A batch name may then be entered using any combination of alphanumeric characters up to ten characters long and depressing FIELD RELEASE if the name is less than ten characters.

The system will search the directory to insure that a batch by that name does not already exist. If the name is legal, the system requests the names of the input formats needed to enter the batch as follows:

INPUT FORMAT NAMES			
= NAME	LINKS TO	= NAME	LINKS TO
1	-----		

The system supplies sequential input format numbers under the column heading number (#). These numbers are used in the *LINKS TO* column to indicate the automatic sequence of input formats. They are also used to identify an input format when the format is manually selected by depressing the program (PGM) key and keying the appropriate number.

The input format name is entered under the heading *NAME* using any combination of alphanumeric characters up to eight characters long and depressing FIELD RELEASE if the input format name is less than eight characters. The system then checks to insure that an input format by the specified name is stored in the input format library. If the name is stored, the cursor moves to the *LINKS TO* column. If not, the message *NAME NOT FOUND IN LIBRARY* is displayed.

The column headed *LINKS TO* is used to indicate the number of the input format to be automatically called by the System 480 immediately after the one just named; i.e., the sequence of input formats is specified. If the same input format is to be used two or more times in succession, it should be linked to itself.

The operator can manually select a new record format at the beginning of any record by depressing the PGM key and entering the number of the input format to be used. In addition, the specified automatic linking of formats can be overridden by defining a conditional linkage field in the input format. When the system encounters a conditional linkage field during data entry, it uses the rightmost digit of the field as the number of the next input format to be used. In other words, the sequence of formats is based on the content of a data field. Examples of naming input formats at batch start-up are:

- If a batch has one record format for its header record (label) and the remaining records all use another record format, the following is entered:

= NAME	LINKS TO	= NAME	LINKS TO
1 HEADER	2	2 STD FMT	2

- When the batch is started, program 1 (record format HEADER) is called. When the first record is released, program 2 (record format STD FMT) is called automatically and continues to link to itself from then on.
- If a batch consists of three types of records that are always in the sequence 1,2,3,1,2,3, ... 1,2,3, enter the following:

#	NAME	LINKS TO	#	NAME	LINKS TO
1	TYPE 1	2	2	TYPE 2	3
3	TYPE 3	1			

Up to ten input formats can be used for each batch. Normally, however, fewer than ten are required. Once the desired input format has been named and linked, the unused input format portion of the display can be bypassed by depressing the release (REL) key.

The system then requests the name of the record edit program to be used to provide validity checking, thus supplementing the checks specified in the input formats. The following request for the name of the record-edit program to be used is displayed by the system:

```
RCD EDIT - - - - -
```

If record editing is to be used, the program name is entered. As with all other names, the system checks to insure that the entered name is valid. If record editing is not desired, FIELD RELEASE is depressed.

The final batch start request that is displayed is the name of the batch edit program to be used. If the batch is to be edited, the name of the desired edit program is entered. If no batch editing is to be performed, the FIELD RELEASE key is depressed to continue.

When the system displays *HIT RELEASE TO PROCEED; OTHERWISE HIT HELP*, the operator should check the batch start page to insure that the correct information has been entered. If correct, the REL key is depressed to release the batch start page and begin data entry. If the data is incorrect, the cursor is backspaced to make the desired corrections, or the HELP key may be depressed to terminate without entering data.

Resume A Batch

Resume Batch is selected to continue entry of a batch that had been started but was interrupted or terminated. Resume A Batch can be selected by depressing key C (RESUME A BATCH). The system then requests

the batch name as follows:

RESUME BATCH IN ENTRY
BATCH NAME -----

The name of the batch that is to be resumed may then be entered; the batch is resumed at the point where it was interrupted or terminated.

Verify A Batch

To Verify A Batch that has been entered or is being entered, key D (VERIFY A BATCH) is depressed. The system then requests the name of the batch to be verified. Once the name is entered, the system directory is checked to insure that a batch by that name was entered. If the batch name is correct, verification can begin.

This function is also used to resume verification of a batch which had been partially verified and then interrupted or terminated. Whenever Verify A Batch is selected, the system positions the cursor at the beginning of the next record to be verified, thus the operator need never be concerned with how much of the batch has been verified.

Examine A Batch

To select Examine A Batch, key E (EXAMINE A BATCH) is depressed. The system then requests the name of the batch to be examined. Once the name is entered, the system displays the first record.

If the record uses more than ten lines on the display, the cursor can be moved forward until the desired information is displayed. When the REL key is depressed, the first ten lines of the next record are displayed. Examine A Batch is an effective option for use with the search features included in the HELP Functions List. Once a batch is open, any form of System 480 search can be performed.

Update A Batch

To enter update information into a batch that already resides in the system, key F (UPDATE A BATCH) is depressed. Once the request for the name of the batch to be updated is answered, the update process begins. The cursor is positioned on the first field to be key verified or have new data entered.

Validate A Batch

To Validate A Batch, key H (VALIDATE A BATCH) is depressed. Once the request for the batch name is answered, the system compares the batch

data with field definitions in the input formats. If an error is detected, the field is flagged. At the completion of validation, a message, stating whether or not errors were detected, is displayed.

Operator Log-In

Operator statistics provide both summary and detail information about operator productivity. Statistics are accumulated for each operator using a four-character operator identifier.

To select Operator Log-In, key I (OPERATOR LOG-IN) is depressed. Once the operator has logged in (four-character identification) at a particular keystation, the system associates all keystrokes from that terminal with that operator until the operator logs-out.

Supervisor Mode

The Supervisor's Mode is chosen by the supervisor to convert any key-station to a supervisor station. To select the supervisor mode, key J (SUPERVISOR MODE) is depressed. The system then requests the supervisor password. The supervisor password is an exception to the general rule that everything keyed at a terminal is displayed. To preserve the security of the password, it is not displayed as it is keyed by the supervisor. If an incorrect character is keyed as part of the password, the Operator HELP List is redisplayed. In addition, the password can be changed at will by the supervisor.

HELP FUNCTIONS LIST

The HELP Functions List is displayed to the operator when the HELP key is depressed at a keystation being used for an active batch; i.e., a batch that is being entered, verified, validated, examined, or updated. The following HELP functions are available to the operator.

Terminate

To Terminate a current batch, key A (TERMINATE) is depressed. The HELP Functions List is then displayed, and the system is ready for a new option to be selected. Terminated batches can always be resumed, if desired.

If batch balancing is being used and the batch contains a balancing error, the message *BATCH OUT OF BALANCE* is displayed. When the RESET key is depressed, the Operator HELP List is displayed.

If the use of a batch editing program results in the creation of a batch log (error log), the following message is displayed:

BATCH LOG PRESENT:

A DISPLAY LOG
B RETURN TO HELP

SELECTION -

Depressing key A causes the first display of the batch log. Depressing key B causes the Operator HELP List to be displayed.

Interrupt

To Interrupt A Batch, key B (INTERRUPT) is depressed. The system saves the current location in the batch and returns to the Operator HELP List. The batch status, which can be displayed by the supervisor, will indicate that the batch is interrupted.

Display Batch Log

To Display Batch Log created by a batch edit program, key C (DISPLAY BATCH LOG) is depressed. Each entry in the log is displayed on a new line of the screen, as illustrated below:

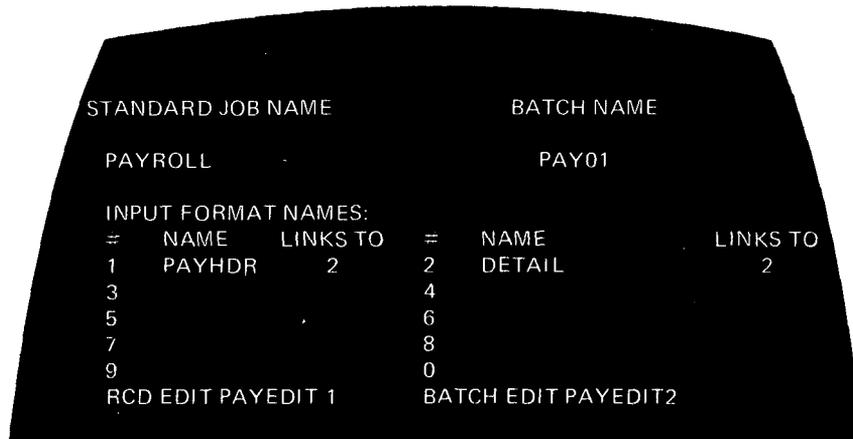
```
REC = 051 -- CROSSFOOT ERROR  
REC = 358 -- INVALID DATA IN FIELDS 11  
AND 14  
REC = 423 -- FIELDS 14 AND 15 ARE BOTH  
BLANK  
REC = 764 -- CROSSFOOT ERROR
```

Displaying the batch log is similar to Examine A Batch except that entries in the log cannot be modified, and the system ignores use of the correct (COR) key. If the batch log exceeds ten lines, depressing the FIELD RELEASE key causes the screen to scroll and the next log entry to be displayed. If the REL key is depressed, the next ten entries are displayed.

The batch log remains on the disk until the supervisor deletes the batch with which it is associated. The supervisor can display the log, write it to magnetic tape or print it whenever needed.

Display Batch Page

To Display Batch Page, key D (DISPLAY BATCH PAGE) is depressed. The batch page contains all operator required batch information. As illustrated below, the batch page contains the name of the standard job used for the batch, the batch name, the names of the input formats for the batch, and the names of the record and batch edit programs to be used.



STANDARD JOB NAME			BATCH NAME		
PAYROLL			PAY01		
INPUT FORMAT NAMES:					
#	NAME	LINKS TO	#	NAME	LINKS TO
1	PAYHDR	2	2	DETAIL	2
3			4		
5			6		
7			8		
9			0		
	RCD EDIT PAYEDIT 1			BATCH EDIT PAYEDIT2	

Return to Data

To Return To Data record that was being displayed when the HELP key was depressed, key E (RETURN TO DATA) is depressed. The cursor is then positioned at the beginning of the record. If the cursor was backspaced before the HELP key was depressed, location return (LOC RET) is depressed to reposition the cursor.

Flag Error

Flags are displayed as a number sign (#) in a field containing incorrect data. To indicate that the field being entered, verified, validated or examined, or updated is to be flagged for later correction, key F (FLAG ERROR) is depressed. This function is used to flag fields that cannot be corrected by the operator, e.g., when a source document error prevents a check digit from being validated.

Search Operations

Four types of searches and a repeat previous search function are available to the operator. A search can be performed at any time when entering, verifying, validating, examining, or updating data. The search operations are:

- Search for an error flag,
- Search for a record by number,
- Search by field content,
- Search by character sequence,
- Repeat the previous field content or character sequence search.

To position the cursor on the first or next error flag in the batch, key G (ERROR FLAG) is depressed. If the operator is at the beginning of the batch, depressing key G places the cursor on the first error flag in the batch. Because the record is displayed on the screen, the operator can make the necessary correction. Each subsequent depression of key G causes the next record in the batch containing an error flag to be displayed for correction. In this manner, all flagged records can be corrected. It is also possible to search for an error flag by depressing the RCD and (S) keys.

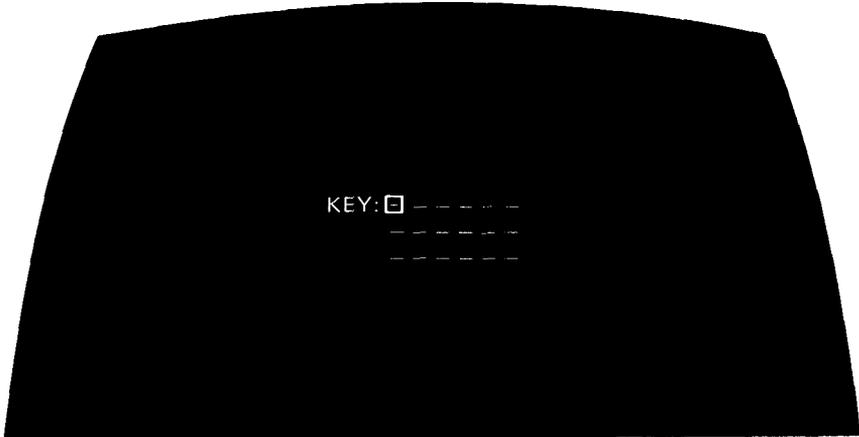
To search for a record with the specified sequential record number, key H (RECORD NUMBER) is depressed. The number of the desired record is entered in response to the following request, and FIELD RELEASE is depressed.



RECORD NO. □ - - -

The search begins, and the changing record numbers in the status line indicate the progress of the search.

To search for a record with a particular field content, key I (FIELD CONTENT) is depressed. The system then requests the desired field contents (keys) as follows:



KEY: □ - - - -
- - - - -
- - - - -

To indicate the end of the key, the first (or only) key followed by # is entered and FIELD RELEASE is depressed. In addition, entire fields must be entered as keys.

Asterisks (*) may be entered in a key to indicate nonsignificant character positions. After the key has been entered, the REL key is depressed. If the desired record is not found, the cursor is positioned at the end of the data.

To search for a string of sequential characters within a record, key J (CHAR SEQUENCE) is depressed. This search ignores field boundaries within records; a partial field can be a key or adjacent fields can be combined to form one key. Asterisks (*) may be entered in nonsignificant positions. Once all the desired keys are specified, release is depressed.

To search using the same field content or character sequence as the previous search, key K (REPEAT) is depressed. The system then displays the next record in that batch containing the key.

Searching-by-record-number operates in either a forward or backward direction from the current position in the batch. A key search operates in a forward direction only.

SECTION 5 SYSTEM MANAGEMENT FEATURES

The orderly entry, verification and output of data in any data entry department requires production and system management. System 480 provides the following features to simplify this task:

- Batch status information,
- Operator statistics,
- Batch protection,
- Standard job library,
- Command sequence library,
- Output code set library,
- Capability to display the percentage of the disk that is full,
- Tape-to-disk operations,
- Capability to write the system: current data as well as libraries to tape for history purposes.

Using these features, the supervisor can obtain desired information from any DATA/SCOPE keystation.

BATCH STATUS

By selecting Display Batch Status, the supervisor can request the status of any batch or group of associated batches on the disk. The following information is displayed for each batch:

- Name of the batch and standard job used to enter the batch,
- Elapsed times spent in the batch,
- Last mode in which the batch was open,
- Identification of the entry and verify operators as well as the date,
- An indication of whether the batch is active, interrupted or terminated,
- Number of records entered in the batch,
- Number of records verified in the batch,
- An indication of whether verification is complete,
- Number of corrections made by the verifying operator,
- Number of error flags in the batch,
- An indication of whether a batch log was created by a batch edit program,
- An indication of whether the batch has been written to tape, printed or communicated,
- Out-of-balance amounts for the incorrect balancing operations.

The status information can be displayed at any time by the supervisor, and it can be written to tape or printed. In addition, batch status may be written to tape or printed according to requested batch protection. For example, a printed status may be obtained for all PAY*** batches which have been corrected since the last output.

OPERATOR STATISTICS

System 480 operator statistics provide the supervisor with an accurate, detailed record of the performance of each operator. The supervisor can display summary information for each operator, in addition to batch-by-batch operator statistics. Operator statistics can be written to tape or printed whenever the supervisor desires to do so.

When the supervisor requests statistics for a particular operator, a page of summary information for that operator is displayed. The summary information is the total of the individual batch statistics for the operator. It provides the following information:

- Operator identification (4 alphanumeric characters).
- The following statistics for data entered by the operator:
 - Gross number of keystrokes. This number includes the use of control keys.
 - Net number of keystrokes, average all batches. Use of control keys is not included.
 - The number of hours and minutes that the operator entered data.
 - Gross number of keystrokes entered per hour.
 - Net number of keystrokes entered per hour.
- The following statistics for operator verified data:
 - Gross and net number of keystrokes, total all batches.
 - The number of hours and minutes that the operator verified data.
 - Gross and net keystroke rate.
 - The number of corrections made by the verify operator.

BATCH PROTECTION

A batch protection feature gives the supervisor a means of insuring that batches are not inadvertently written to tape or deleted. The supervisor specifies three sets of batch requirements: one for visual output (display and printer), one for nonvisual output (tape and communications), and one for deletion. The supervisor can specify whether any of the following conditions must or must not be met:

- Batch has been written to tape or communicated,
- Batch has been printed,
- Batch has been terminated,
- Batch has been verified,
- Batch contains a batch log,
- Batch has been reopened since last output,
- Batch contains error flags,
- Batch is out-of-balance.

For example, the supervisor may set output requirements so that only verified batches having no error flags are included in the output operation. Conversely, display requirements can be set so that batch status information for all out-of-balance batches can be displayed.

The supervisor selects only those requirements that apply to a particular job. The name of any batch that does not meet these requirements is displayed on the screen at the end of the output or delete operation.

In addition, batch protection provides the supervisor with a control function for the display and printout of data. Through the use of batch protection, certain portions of a batch file may be chosen by the supervisor for display or printout.

STANDARD JOB LIBRARY

The System 480 standard job library is used to maintain a description of frequently used jobs. The information needed to describe the standard job is supplied by the supervisor and stored on disk.

Each entry in the library contains batch start and output information for a job. Batch start information consists of naming requirements for the batch, input formats required, and the record and batch edit programs to be used. Output information describes the characteristics of the output file, the peripheral device required, and the output program to be used.

Because this information can be stored in the standard job library, the operator has only to request a standard job, and name the batch. Likewise, at batch output, the supervisor, using that job definition, requests the standard job and enters the name of the batch that is ready for output.

COMMAND SEQUENCE LIBRARY

A command sequence library has been included in System 480 to further simplify supervisor operations. The command sequence library provides the capability to assign a name to any specified sequence of system operations and store them on disk. The entire sequence can be executed by requesting the assigned name.

In addition to containing a sequence of operations, a command sequence can request variable information. When the system requires variable information (i.e., the names of batches to be written), a request for the desired information is displayed on the supervisor's DATA/SCOPE. As with other System 480 libraries, the command sequence library can be modified as required.

In the following example, the system is requesting the placement of a file identification in a magnetic tape header label.

(ENTER FILE ID)

□ _ _ _ _ _

The command sequence that contains the file identification request writes the tapeheader label, the appropriate batches of data, and a trailer label. All of these functions are performed by requesting execution of one command sequence.

DISK STATUS

At any time, the supervisor can request the percentage of the disk that is full. Using this information, the supervisor can determine when batches should be written to tape and deleted from the disk, or whether there is enough disk space remaining to read a large file from tape onto the disk. Although data can be written to tape whenever desired, data is normally written to tape as soon as the entry and verification operations of a group of associated batches are complete. Output operations and tape to disk operations are concurrent with normal data entry.

SYSTEM SAVES

System 480 provides the ability to take a *snapshot* of the system for history purposes. This snapshot, system save, contains all of the data, libraries and system information in the computer memory and on the disk. When required, the save can be reloaded into the system by depressing one control button. Once the save is reloaded, the system is exactly as it was when the save was taken, and any normal system operation can be performed.

CHANGE PASSWORD

Change Password is an important aspect of the supervisory functions. This feature can be selected at any time to provide the system with a new password, thus preventing unauthorized access to the Supervisor HELP List. Any password up to five characters can be specified.

SECTION 6 SUPERVISORY FUNCTIONS

Supervisory responsibilities for System 480 involve management of data flow. The two basic supervisory functions are:

- Creating input formats and output programs,
- Managing data flow through the system.

This Section describes the supervisory functions concerned with input formats.

INPUT FORMATS

An input format is a complete description of a data record keyed by the operator. The input format divides each record into fields and assigns the length, position and characteristics of each field on an individual basis. Included in each field description are the editing, validity checks and verification required for each field.

Often, more than one input format may be needed to describe all the data records of a file. Different input formats are used to enter different types of source documents, or a large source document can be subdivided and entered using several input formats.

EDITING CAPABILITIES

The input format editing capabilities provide automatic handling of data fields to insure that the operator is not required to perform repetitive tasks.

Automatic Functions

The automatic functions are those that operate when the automatic (AUTO) key is depressed; i.e., when the word AUTO is displayed in the status line, the system performs the automatic function specified for that field in the input format. These functions include: automatic duplicating, skipping, emitting (data insertion), and incrementing.

Automatic duplication copies the corresponding field of the previous record into the specified field of the current record.

Automatic incrementing causes 1 to be added to the content of the corresponding field of the previous record and the sum to be inserted in the increment field.

If auto is off when an automatic field is encountered, one of the following is displayed in the AUTO position of the status line:

- DUP - duplicated field,
- SKIP - skipped field,
- EMIT - emitted field,
- INCR - incremented field,

The automatic functions described can be performed during data entry, however, they are normally performed during the output operation to provide the most efficient system operation and disk utilization.

Right Justification

Because data that is keyed into a field does not necessarily fill the field, the input format can specify automatic right justification of data in a field. When the entry operator releases a right-justify field, data is shifted to the field's righthand boundary. Character positions to the left that do not contain keyed data are filled with zeros or spaces.

Zero and Space Filling

Regardless of whether right justification is specified for a field, an automatic fill character of zeros or spaces can be specified in the input format. A separate fill character can be designated when the field is partially keyed and released, and when the field is released without entering any data. For example, the supervisor can indicate that a field is to be right-justified with zero fill when entered, and space-filled when released without entering data. Thus, the operator need not be concerned with the appropriate fill character for different situations.

Alphanumeric and Numeric Shifts

Fields that contain primarily alphabetic or numeric data can be assigned an alpha (ALPHA) or a numeric (NUM) shift. On the keypunch keyboard, an ALPHA field requires use of the NUM shift key to enter numbers; a numeric field requires use of the ALPHA shift key to enter alphabets. On the typewriter-style keyboard, no shifting is required with the exception of certain special characters.

Numeric-only, upper-case and lower case fields are also available.

Field Boundary Check

A field boundary check prevents the operator from keying an excess of characters into the field, thereby overflowing into the next field. In addition, the depression of the FIELD RELEASE key is required before field exit is permitted.

Mandatory Entry Field

Fields designated for mandatory entry cannot be skipped during entry. At least one character must be entered into the field. Depressing FIELD RELEASE at the beginning of the field causes an error message display. In addition, if the operator attempts to release a record without keying into a mandatory field, the system prevents record release and positions the cursor at the first position of the mandatory field and displays an error message.

Mandatory Completion Field

Mandatory completion indicates that all field positions must be entered if the field is started; i.e., the field must remain blank or be filled completely with data. Depression of FIELD RELEASE anywhere, except in the first position of the field, causes an error message display. Mandatory entry and completion checks can be specified for the same field insuring that the field is both entered and completed, e.g., a social security number that must be present and complete in the data.

VALIDITY CHECKS

System 480 is designed to detect source document errors and keying errors before they are processed by the user's business computer. To achieve this, the system provides a comprehensive set of checking features to insure data being entered meets the necessary data processing application criteria. These checks are specified by individual field definitions in the input format. Each field definition may have any combination of validity checks and editing features desirable. Input formats containing such checks expand operator ability to validate data as it is entered.

Additionally, data may be checked and edited by using the editor language program (System 480's flexible, COBOL-like programming language).

Numeric-Only Field

Only the digits 0 through 9 and a minus (-) or plus (+) oversign are permitted in numeric-only fields. An error tone sounds and the error message *NUMERIC CHARACTER REQUIRED* is displayed if an attempt is made to enter any other character. However, the supervisor may, if desired, specify up to four exceptions (non-numeric characters) to be accepted by System 480 as numeric.

Alphabetic-Only Field

All alphabetic as well as special characters may be entered in the alphabetic-only field; digits 0 through 9 are excluded. An error tone sounds and an error message is displayed if an attempt is made to enter a numeric character.

Range Checks

Range checks insure that an entered number is included in, or excluded from, the specified numeric range. The input format can designate field acceptance only if it falls within the desired range, or it can specify acceptance of the number, if it is lower or higher than the specified range. This check occurs after the field is released. If the number does not meet range requirements, a *RANGE CHECK ERROR* message is displayed.

Check Digits

System 480 can validate or generate check digits using up to 15 different algorithms. The algorithms can be an industry standard, or custom designed to meet a wide variety of requirements. The system validates a check digit as the operator keys the base number. Then, as the operator keys the check digit, the system compares the keyed number with the computed number. If the two do not match, a *CHECK DIGIT ERROR* message is displayed.

When the system generates the check digit, the appropriate calculations are performed and the result is inserted in the rightmost position of the field. When check digits are calculated during entry, the business computer run that provides them can be eliminated.

In addition to validating and generating check digits, System 480 provides a multifield check digit capability. When the multifield check digit is used, two or more fields are used in the calculation of a single check digit.

Value Table Lookup

A value table is a list of all legal or illegal values that can be entered in a particular field. If the operator enters data that is not a legal value for a field, or that is listed as illegal for a field, a message explaining the error is displayed.

The list of values can be entered by an operator or supervisor, or it can be generated on a business computer and read from tape to the System 480 disk. The list can be easily updated; up to 20 value tables can be assigned at one time.

To minimize lookup time, the order of values within the table is specified. Tables can be in ascending, descending or random value order. To further minimize search time, table entries may be arranged in decreasing use frequency. To minimize table size and table lookup, a range check may be combined to eliminate table entries.

Batch Balancing

Batch balancing is the process of creating (accumulating) a records (batch) total by adding and subtracting entries in designated fields. The fields must contain only numeric entries. Once the total is accumulated, it must equal zero. If the batch does not balance, there

is a batch error. The operator is notified when the batch is terminated. Batch balance errors are corrected during verification. Up to five batch balance accumulators are available for each batch.

If additional batch totaling or balancing is required, a batch edit program can be used. Batch edit programs can also be used to calculate and/or validate subtotals, document totals and crossfooting.

Ascendency Check

An ascendency check is used to insure that the number entered in the current field is equal to, or greater than, the number entered in the corresponding field of the previous record. Although ascendency checks are normally applied to numeric fields, it may be applied to alphabetic or alphanumeric fields.

VERIFICATION

The input format also describes the type of verification, if any, to be performed by the operator. Verification options range from complete key verification to sight checking and include conditional verification and mandatory reverification.

Conditional verification is used with batch balancing. When a balance is incorrect, the fields forming that total are rekeyed until the correction is made. When one out-of-balance total is brought into balance, the cursor will no longer stop on that field for key verification.

When mandatory reverification is specified for an input format field, that field must be reverified if a correction is made by the operator. The cursor is automatically repositioned at the beginning of the field, and the operator must verify it again before continuing with subsequent fields.

Different types of verification can be specified for different fields of a record. In many cases, there is no need to verify a field, e.g., when the contents have been validated already by an automatic check digit comparison during entry.

CREATING AN INPUT FORMAT

Input formats are generated on ENTREX supplied layout forms. The completed format is then entered in a manner similar to data entry (a question and answer approach). The system displays questions on the screen; the supervisor supplies the answers in a field definition form. In this manner, a complete definition of each record field is entered. As each answer is entered, the system builds an input format field definitions display.

When an input format is entered, the format name is requested. Then, a series of questions is displayed requesting the supervisor to specify each data field format. The same series of questions is repeated for each field in the record. After each answer is keyed, the system displays

the next question. The following is an example of part of one field definition.

```

HELP                                PCM-1 RCD 00001   FLD 0001

FIELD NO. ---
TAG LOCATION: LINE ---   COLUMN 01
TAG:
-----
FLD LENGTH --           FLD USE (A,L,M,N,U) --
VERIFY (C,K,R,S) --    REVERIFY (Y) --
MUST ENTER (Y) --      MUST COMPLETE (Y) --
FLD BOUNDARY (Y) --    RIGHT JUST (Y) --
FILL (S,Z) DATA --    NO DATA --
BATCH BAL (A,S) --     IN ACCUMULATOR 1 --
  
```

```

HELP                                PCM-1 RCD-00001   FLD-0001

VALUE TABLE NO.        INVALID ENTRIES (Y) --
RANGE (I,O) --          VALUE ORDER (A,D,R) --
                        LOW -----
                        HIGH -----

AUTO FLD (D,E,I,S) --   CHK DGT METHOD (G,V) --
CHK DIGIT NO.           MULTIFLD CHK DGT (Y) --

UPDATE (E,K,R,S) --     TAB FLD (Y) --
ASCY CHK (Y) --         COND LINK (Y) --
ADDED FLD (Y) --
  
```

Once the input format is entered, it is stored in the input format library and tested by entering sample data. Sample data can be checked for accuracy on the screen by using the Examine Mode option on the Operator HELP List. When the supervisor is satisfied that the format is correct, the format can be called at any time by one or more operators for entering data.

MAINTAINING THE INPUT FORMAT LIBRARY

The system provides a permanent input formats storage library on disk. The Input Format Library option on the Supervisor HELP List includes the following features for maintaining the input format library:

- Display the names of all formats in the library or related formats,
- Create a new input format,
- Change a format that is already in the library,

- Delete formats that are no longer needed,
- Copy an existing format to allow for modification,
- Resume a format,
- Output a copy of any or all formats for reference,
- Write the input format library onto tape,
- Read the input format library onto disk from magnetic tape.

SECTION 7 SYSTEM 480 VALIDATOR LANGUAGE

The System 480 Validator language comprises all of the statements used to create record edit programs, batch edit programs, output programs, and sort programs. All statements are in English and can be combined to form simple programs consisting of a few statements in addition to powerful programs with branching statements and subroutines.

Record and batch edit programs validate data that has been entered. Output programs can perform any of the functions available with record and batch edits, in addition to reformatting data and creating new data. Sort programs control the sorting of one or more batches according to ascending and/or descending values.

LANGUAGE ELEMENTS

The language elements contained in the System 480 editor language provide all the ease-of-use and flexibility of a COBOL-like language. The following statements are available:

- Add, Subtract, Multiply, and Divide using data fields or constant information stored in the program,
- Move data fields and store them for subsequent use,
- Place an error flag in the desired position within a field,
- Pause to display a message to the operator,
- Test a field or partial field for equal, unequal, greater than, or less than conditions,
- Test for a particular input program number,
- Test for arithmetic overflow,
- Branch to a different portion of the program,
- Perform a subroutine,
- Release the current input record and return to the beginning of the program,
- Use arithmetic expressions as arguments,
- Stop the program and perform the required end of file operations,
- Write data to any available peripheral device or create a separate file called *LOG* on the disk,
- Sort batches to create a new file.

The data output statement also includes the necessary control functions for the formatting of printed reports, testing for end of file and end of tape, and writing the date or block count.

Statements are combined to form sentences. Depending on the statement used, sentences can contain references to data fields, variable information, numeric and alphanumeric literals, and arithmetic expressions. All references to data fields are indicated by the field number enclosed in parentheses. Examples of the use of various statements are included in the following paragraphs.

RECORD EDIT PROGRAMS

Record edit programs supplement the immediate error detection capabilities, contained within input formats, by testing the interrelationship among fields within the record. All System 480 editor language statements with exception of the data output statement can be used in record edits. The result is a wide variety of validation that can be custom-tailored to the requirements of each application.

Because record edits are executed as the operator releases each record, they provide an excellent means for immediate error detection. Record edits provide the capability to display a message explaining the nature of the detected error. By referring to the source document, the operator can easily correct the error.

If it is not desirable to display an operator message, the error may be flagged for later correction. Later, an operator can use the Error Flag Search to locate and correct all errors in the batch.

Record edits are programmed to test the relationship of fields. The following examples are the type of checks that can be accomplished:

- The supervisor can insure that both fields 1 and 7 of a particular record type are never left blank in the same record by including the following statement (where blanks have been declared) in a record edit.

```
IF (1) = BLANKS, IF (7) = BLANKS, PAUSE      'DATA REQUIRED  
IN EITHER FLD1 OR FLD7'.
```

The message is displayed to the operator if both fields are skipped.

- The following type of statement can be included to check the arithmetic relationship among fields, e.g., crossfooting can be validated:

```
IF (1) + (3) - (4) ≠ (7), FLAG (2).
```

This example causes an error flag to be placed in field 2 if the contents of fields 1 and 3 minus the content of field 4 are not equal to field 7.

BATCH EDIT PROGRAMS

Batch edit programs provide the capability to test the interrelationship among records in a batch regardless of the input programs used to enter them. Like record edits, batch edits validate data entered by the

operator; they do not insert new information into data records. Creation of new information is a function of output programs. A batch edit can be executed automatically upon termination of the batch with which it is associated, or it can be executed at will by the supervisor.

In addition to flagging errors or displaying messages when an error is detected, batch edit programs can build an error file on disk. Whenever a data output statement is encountered in a batch edit, the information specified in the output statement is placed in the batch log. The supervisor may also print the log or write it to tape. The batch log remains on the disk until its associated batch is deleted.

Batch edits executed automatically at the termination of a batch allow testing of any data within the batch. However, the supervisor can request a batch edit of several batches associated with a job. In so doing, the content of an entire job can be compared and tested. The following are examples of the type of checks that can be accomplished with batch edits:

- The program can insure that, when new account information is entered in field 7 of Input Format 1, Input Format 2 is selected to key additional shipping information. The following program statements are required.

```
ADD 1 TO RECORDNO.  
WHEN PGM 1, IF (7) ≠ 20' ' (20 blanks) MOVE 1 TO SWITCH.  
WHEN PGM 2, SUB 1 FROM SWITCH.  
WHEN PGM 3, IF SWITCH ≠ 0, OUTPUT 'ADDRESS  
INCOMPLETE', RECORDNO.
```

- An error file containing the message *ADDRESS INCOMPLETE IN* followed by the number of the incomplete record is created on the disk.
- The program can calculate a document total from a series of detail records and then compare it with a document total keyed by the operator.

```
WHEN PGM 1, MOVE (1) (invoice number) TO SAVE.  
WHEN PGM 3, ADD (5) TO DOCTOT.  
WHEN PGM 4, GO TO !COMPARE.  
  
RELEASE.  
  
!COMPARE, IF DOCTOT ≠ (1) (the document total),  
OUTPUT SAVE (to error log).
```

SORT PROGRAMS

The System 480 sort capability allows records within one or more batches to be sorted to form a file of keys on the disk. Any field or sequence of fields in a record can be specified as keys. Any number of keys can be specified; the only restriction is that the total number of characters specified as keys in a record cannot exceed 200. Batches can be sorted in ascending and descending order. Ascending and descending key fields can be specified within a record.

Because the sort feature is part of the System 480 editor language, it has access to all of the language statements. Data can be validated as it is being sorted; errors can be flagged, or the sort can be terminated immediately, if the data does not meet the specified requirements.

In addition to batches, other information contained in the system can be sorted, e.g., operator statistics. The following are examples of sort statements.

- To group batches by item number, the sort program specifies the Item-Number Field as the sort key. The item-number is contained in field 9 of the batch. The following sort statement is used.

```
SORT (9).
```

- A sort program can arrange a batch so that documents are ordered by invoice number, and detail records are ordered by item number within each invoice's set of records. The invoice number is entered in field 1 of Input Format 1, and the item number is entered as Field 2 of Input Format 2. The following statements are used.

```
WHEN PGM 1, GOTO  !ONE.  
WHEN PGM 2, GOTO  !TWO.  
  
RELEASE  
  
!ONE,  MOVE (1) TO INVNO (to save the invoice number).  
       SORT (1), '1'.  ('1' is a program-specified second key  
                       that insures that the header record  
                       always precedes the detail items for  
                       the invoice).  
  
       RELEASE.  
  
!TWO,  SORT INVNO, '2' (2).  
       RELEASE.
```

SECTION 8 DATA OUTPUT

After a batch has been entered and verified, it is ready for output. The primary output medium is magnetic tape, however, the system can also print data on a serial or line printer and communicate it over telephone channels.

Output programs are written in the System 480 editor language and control the reformatting and writing of data records. Creating an output program is a supervisory function. System 480 data output results in a file on magnetic tape in the format and binary code required by the user's computer application.

Reformatting, an integral part of data output, is the rearranging of data by field or by character within and among disk job records to produce an output record or records with data in the required order. It may be desirable to reformat records at output for any of the following reasons:

- Input formats are designed to follow the source document rather than the output format, which may be quite different.
- Reformatting eliminates the need for field duplicating and skipping when the batch is being entered on the disk, thereby increasing the efficiency of the entry and verification processes and saving disk space.
- One source file on disk can be used to create output files for several applications.

Using the Operator HELP List, the supervisor indicates the name of the output program that will reformat each job when the output operation is begun. Because reformatting is accomplished during output, the process is simple and does not require a separate operation.

OUTPUT PROGRAMS

Like record editing and batch editing programs, output editing programs are written in System 480 validator language. Depending on application needs, output programs range from simple reformatting routines to powerful data generation and reformatting programs. The following is a list of major functions that can be performed by output programs. Because of the flexibility of the editing language, many other functions are possible.

- Reorganizing the order of fields within a record,
- Saving fields for use in subsequent output records (duplicating during output),
- Manipulating data on a character, subfield or field basis,
- Inserting zeros, spaces or special characters,

- Inserting record and block counts as well as data,
- Formatting printed reports including headings and page numbers,
- Using arithmetic statements to generate new data (total),
- Inserting new information based on the content of another field,
- Writing standard header and trailer labels.

Using these functions, the supervisor can write an output program to rearrange the order of fields within a record, as illustrated by Figure 8-1, or a program that causes new information to be generated and inserted, as illustrated by Figure 8-2.

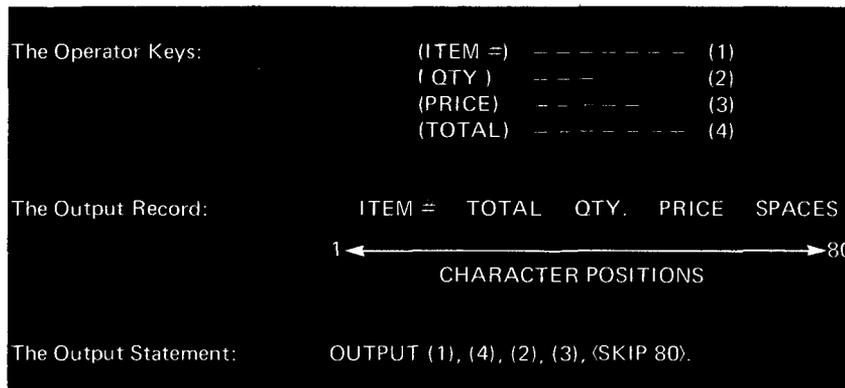


Figure 8-1. Rearranging the Order of Fields

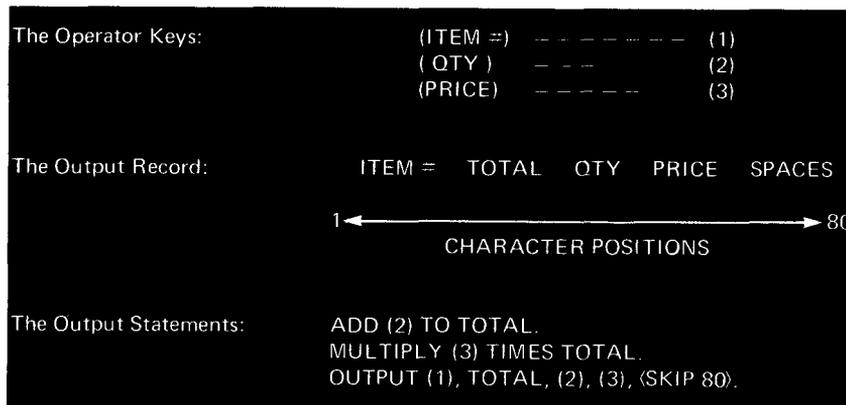


Figure 8-2. Reformatting and Insertion of New Data

NOTE:

In the previous examples, data fields keyed by the operator are referred to with the field number enclosed in parentheses, i.e., (2) indicates data field 2.

Because of the inherent flexibility of the System 480 Validator language, the action taken by an output program can be contingent upon any of the following factors:

- The number of the input format used to enter the record currently being reformatted,
- The content of a field within the record, or a field saved from a previous record,
- The presence of an error flag in the data,
- The occurrence of arithmetic overflow.

Many other tests can be included in the output program to insure that each record is reformatted in the appropriate manner. For example, the following statements can be used to save record information entered using Input Program 2 and combine it with record information using Input Program 3 for output.

```
WHEN PGM 2, MOVE (1) TO ACCTNO.  
RELEASE (the record).  
  
WHEN PGM 3, OUTPUT ACCTNO, (1), (4), (2), (6), (SKIP 80).
```

The result is that the account number (ACCTNO) is duplicated on each output record.

TESTING AN OUTPUT PROGRAM

Once an output program has been written and entered into the system, it is advisable to test it to insure that it produces the desired results. To test an output program, a batch output operation that uses the program is started by the supervisor. To insure that the output is correct, the supervisor can do either of the following:

- If a line or serial printer is attached to the System 480, print the file to insure that the reformatted records are the proper length and contain the required information.
- Write the data to tape and display the tape records to insure that they are correct.

MAINTAINING THE OUTPUT PROGRAM LIBRARY

The system provides a library for the permanent storage of output programs. The Output Program on the Supervisor Library options list provides the following capabilities:

- Display the names of programs in the library or of any desired set,
- Create a new output program,
- Change an existing output program,
- Change a program that is already in the library,
- Delete a program that is no longer needed,
- Print a copy of the program for reference,
- Copy a program for modification,
- Rename a program,
- Write the output program library onto tape,
- Read the output program library onto disk from tape.

BATCH OUTPUT

Batch output is a supervisory function. When a batch is ready for output, the supervisor selects the Batch Operations option from the Supervisor HELP List and selects batch output. The system requests the information needed to write the batch (e.g., the output device, the name of the output program and the names of the batches to be written).

Batches can be written individually, or they can be combined (pooled) to form a larger file. One output request can write many batches to tape, print them or transmit batches over communications lines. When writing to tape, output records can be blocked by any factor desired. When communicating, the maximum blocking factor varies according to the communications conventions being used. All data output operations are accomplished while other batches are being entered and verified.

Using the System 480 Batch Protection feature, the supervisor can specify the requirements that must be met by each batch before it is written. Any combination of the following requirements can be specified:

- Must have been written to tape or communicated,
- Must have been printed,
- Must be terminated,
- Must be verified,
- Must have a batch log (error log) associated with it,
- Must have been reopened for corrections after it was last written,
- Must contain error flags,
- Must be out-of-balance.

Likewise, it is possible to specify that any of the above conditions must not be met. For example, the requirements for the batch protection set in Figure 8-3 insure that only those batches that are terminated, verified and contain no errors are written to tape.

Once the supervisor has supplied the batch output information, the System 480 displays the names of all batches to be written. If the batch names are correct, the supervisor initiates the output operation. As the output operation progresses, the names of batches that did not meet the output requirements are displayed on the screen. By displaying batch status information, the supervisor can determine why the batch was not written.

		PROTECTION FOR OUTPUT	
BATCH MUST	MUST NOT:		
			HAVE BEEN WRITTEN
			HAVE BEEN PRINTED
X			BE TERMINATED
X			BE VERIFIED
	X		CONTAIN BATCH LOG
			HAVE BEEN REOPENED
	X		CONTAIN ERROR FLAGS
	X		BE OUT OF BALANCE
(KEY X BEFORE DESIRED REQUIREMENTS)			

Figure 8-3. Sample Batch Protection for Output

At the end of the output operation, the supervisor can either unload the tape or write more batches on the same tape. It is also possible to load a tape that was previously written on, position the tape to the end of data, and add new batches to the tape. Batches can be added onto the end of the last file on the tape or a new file can be started.

After a batch has been written, it can be deleted from the disk. Deleting batches is a supervisory responsibility and is included as part of the Supervisor HELP list. Batch protection for deleting operation is also provided, and is similar to batch protection for output operations.

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