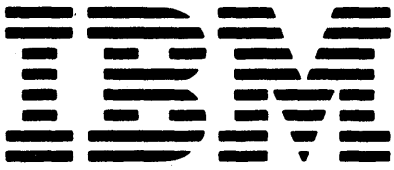
SC21-7656-4

File No. S34-32

IBM System/34
Data File Utility
Reference Manual

Program Number 5726-UT1



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Program Number 5726-UT1

Fifth Edition (January 1982)

This is a major revision of, and obsoletes SC21-7656-3 and Technical Newsletters SN21-8206, SN21-8027, and SN21-8104 (Japan and Taiwan only). Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change or addition.

This edition applies to release 8, modification 0 of the IBM System/34 Utilities Program Product (Program 5726-UT1), and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters. Changes are periodically made to the information herein; changes will be reported in technical newsletters or in new editions of this publication.

This publication contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of companies and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental. Use this publication only for the purpose stated in the *Preface*.

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Preface

The Data File Utility (DFU) is part of the System/34 Utilities Program Product (Program 5726-UT1). The purpose of this manual is to describe DFU for programmers who define DFU jobs. The manual also serves as a guide for programmers who run DFU jobs themselves to create and maintain System/34 files. This manual describes:

- DFU purpose and function
- DFU job setup and execution
- How to change supplied DFU format descriptions and create new ones
- How to operate DFU in each mode

Although this reference manual contains a guide to using DFU in each mode, it is not a substitute for the DFU portion of the System/34 Implementation Class or equivalent DFU training.

For a general tutorial on the operation of DFU, refer to the *IBM System/34 Data File Utility Operations*, SR30-0235 and the *IBM System/34 Data File Utility Operations Diskette*, SV30-0111.

A brief description of the contents of the various System/34 manuals is contained in the *Publications Summary* section of the *IBM System/34 Introduction*.

This program provides ideographic support when used with the ideographic version of the SSP and the ideographic hardware devices that version supports.

System Requirements

For a list of system requirements, see the *IBM System/34 Planning Guide*.

Prerequisite Publications

IBM System/34 Introduction, GC21-5153

IBM System/34 Planning Guide, GC21-5154

IBM System/34 System Support Reference Manual, SC21-5155

Related Publications

IBM System/34 Operator's Guide, SC21-5158

IBM System/34 Source Entry Utility Reference Manual, SC21-7657

IBM System/34 Sort Reference Manual, SC21-7658

IBM System/34 Ideographic Sort Reference Manual, SC21-7850

IBM System/34 RPG II Reference Manual, SC21-7667

IBM System/34 Displayed Messages Guide, SC21-5159

IBM System/34 Master Index, SC21-7739

IBM System/34 Keyboard Template, GX21-7660

IBM System/34 Bibliography, GH30-0231

RPG Control and File Description Specifications, GX21-9092

RPG Input Specifications, GX21-9094

System Configuration

The data file utility portion of the IBM System/34 Utilities Program Product runs on all models of System/34.

Contents

Chapter 1. Introduction

The IBM System/34 Data File Utility (DFU) Program Product allows you to create, maintain, display, and print data files. DFU provides these four functions:

- The enter function allows you to create indexed or direct data files.
- The update function allows you to maintain and/or add to existing indexed or direct data files. You can change records in an existing sequential data file.
- The inquiry function allows you to locate and display a particular record in an indexed, sequential, or direct file.
- The list function allows you to print formatted reports from indexed, sequential, and direct data files. The data can be printed in sorted or unsorted order.

Any of these functions can be performed by a person with no programming language experience. An understanding of DFU concepts and functional capabilities is required to efficiently use DFU. DFU prompts the operator at the display station for a description of the job to be performed. Once the operator has defined the job, the data files can be processed as required.

DFU CONCEPTS/TERMS

There are two basic steps in any DFU job, job setup and job execution. Once the job has been set up and the processing information saved, the job setup can be bypassed in future executions of the same job. In this case the job will immediately go to execution, where the actual data file processing takes place.

When a job is defined to DFU, the processing information is saved as a subroutine member in the library. This saved information is called a DFU format description, or DFU format. The format description describes the file and how it is to be processed by DFU.

The operator initiates a DFU job at a display station by entering one of the following DFU commands:

ENTER, to create a new indexed or direct data file

UPDATE, to alter an existing indexed, sequential, or direct data file

INQUIRY, to display an existing indexed, sequential, or direct data file at a display station

LIST, to print records from an existing indexed, sequential, or direct data file

DFU, an alternate way to call ENTER, UPDATE, INQUIRY, or LIST

Requesting DFU

There are two ways to request DFU:

- You can enter the command: DFU. When you do this, DFU displays a list of the four main DFU functions. (See *Command Parameters* in Chapter 5 for this display.)

- You can enter the command for the function desired. When you do this, a series of parameters that are needed to initiate the job are associated with each DFU command. If the first parameter (filename) or the second parameter (DFU format name) is not specified on the DFU command, DFU prompts for all parameters for the job on a single display. If a parameter is required for job initiation, but is not entered on the initial command, or in response to the DFU parameters prompt display, DFU prompts again for the missing parameter.

If parameters are entered on the initial command, one or more blanks must separate the command and the first parameter. The individual parameters must be separated by commas, and no blanks are allowed within the parameters. The DFU command parameters are positional parameters; that is, they must always appear in the same relative order on the command. If a parameter is missing, and if parameters are keyed after it on the initial command, a comma must be inserted for it.

Chapter 5 describes each command parameter.

When a DFU job is initiated, DFU determines if the format description (the second parameter–DFU format name) named by the operator already exists in the library. If the format does not currently exist, DFU calls the job setup to allow the operator to describe the processing required.

When the job setup is called, DFU requires a description of the file to be processed. The operator must then supply the name of an existing source member containing RPG II file description and input specifications (described in Chapter 2) that describe the file.

DFU will extract the file information from the RPG II source member and display it on the display station screen for the operator. This information is called DFU attributes (described in Chapter 9).

DFU then prompts the operator for a description of the job to be performed. Based on the operator responses, DFU creates processing information called DFU specifications (described in Chapter 10). These can also be displayed at the display station by the operator.

When the operator has finished describing the job, DFU merges the information from the DFU attributes and DFU specifications to create the format description (as a subroutine member in the library). DFU then calls the job execution to allow the operator to process the file.

See Figure 1-1 for a description of the DFU/operator interaction. This illustration shows a job in which DFU calls the job setup.

HOW DFU WORKS

Figure 1-1 illustrates the DFU/user interaction.

User Action	DFU Response
Provide an RPG II source member (via SEU or $MAINT) describing the data file. Enter the necessary setup command (DFU, ENTER, UPDATE, INQUIRY, or LIST), and DFU will prompt for additional command information.	Converts the RPG II source member into DFU attributes. DFU attributes are a simplified version of the RPG II source member.
Respond to prompts to create DFU specifications. (Your instructions of what you want DFU to do.)	Creates DFU specifications.

Figure 1-1 (Part 1 of 3). DFU User Interaction

User Action	DFU Response
Indicate the end of setup by pressing the EOJ command function key.	Builds a format description which is the end result of the setup. The format description is a subroutine member that reflects what you've told DFU to do (whether it's to enter a file, update a file, inquire into a file, or list a file). The format description is what you'll use to perform the DFU function. DFU creates the format description by combining the information from the attributes and specifications. The format description is stored as a subroutine member in the library with the name specified in the command or a default name. For the enter, update, and inquiry functions, a corresponding load member describing screen displays for the job is created. This load member has the same name as the DFU format description subroutine member. You can now create, maintain, display, or print the data file. If you are printing the data file, the report is printed automatically after the format description is built; no further action is required.

Figure 1-1 (Part 2 of 3). DFU User Interaction

User Action	DFU Response
Run the job that has been set up by doing one of the following:	Performs the requested function. Note that the library members created in the setup for this job can be stored and used in all subsequent runs of this job and similar jobs.
• Enter records into the data file	
• Change, add, or delete records	These members have the name specified for the DFU format, and include: • DFU format description (subroutine member) • Display screen formats for enter, update, and inquiry (load member)
• Display records from the file on the display screen	
• Print records on the printer	

Figure 1-1 (Part 3 of 3). DFU User Interaction

Figure 1-2 shows the overview of a typical DFU job setup step.

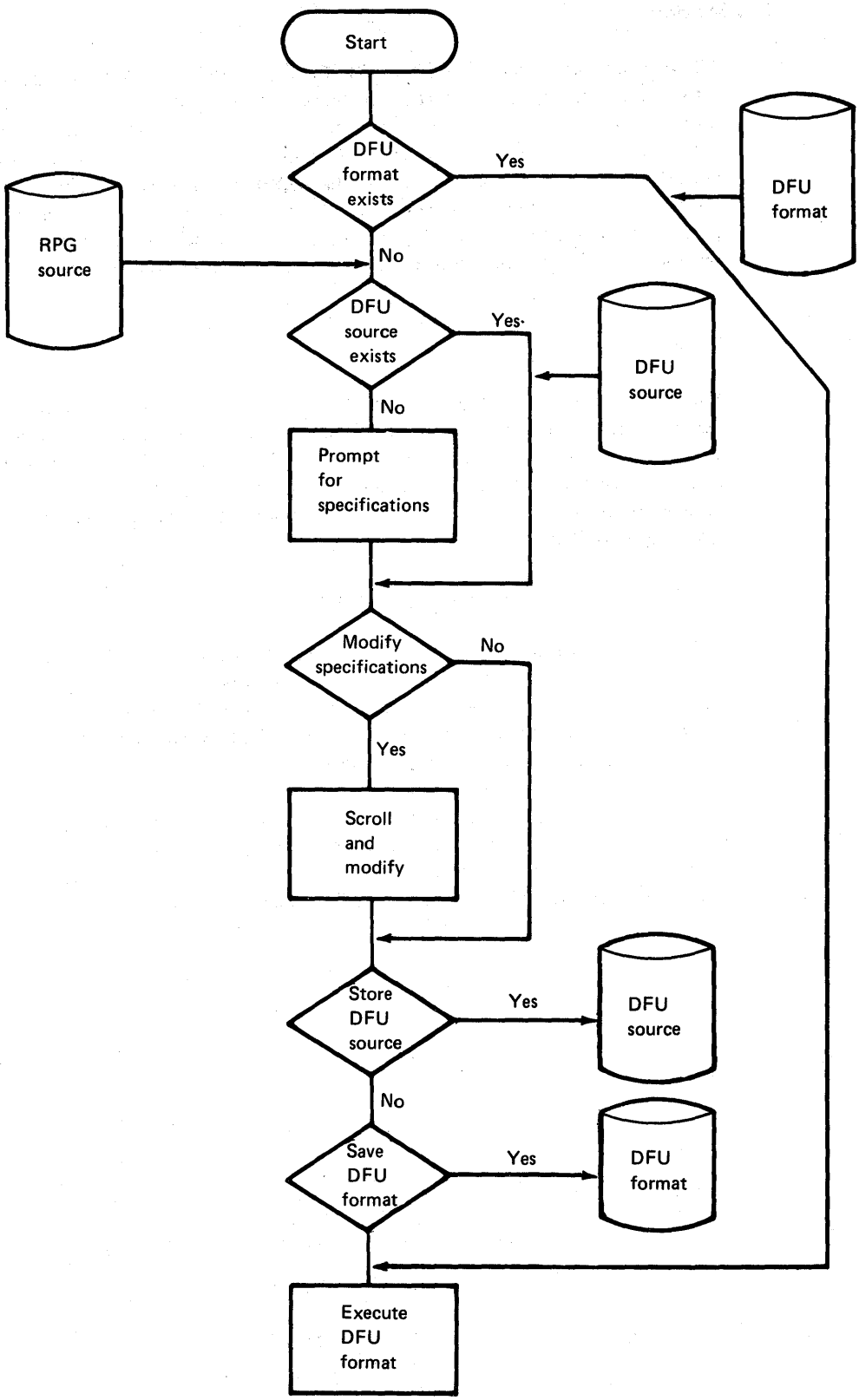


Figure 1-2. DFU Job Setup Step Overview

PROGRAMMER CONSIDERATIONS

File Sharing

All DFU functions share files (DISP-SHR). Therefore, when processing indexed files, there is no automatic sorting of the record key index area at the start or end of a DFU function. Functions that process a file in indexed order, such as Inquiry or List (without sorting), can only access the records currently in the sorted index area of a file. Therefore, the KEYSORT procedure (refer to the *System Support Reference Manual*) must be executed prior to displaying or printing a file which has keys that have not been sorted. For a further discussion of file sharing, see the *System Support Reference manual*.

Job Queue

Enter, update, and inquiry jobs cannot be submitted to the input job queue because they require operator interaction. List jobs not requiring operator interaction, other than responding to prompts for list procedure parameters, can be submitted to the input job queue (refer to the *System Support Reference Manual*). List jobs submitted to the job queue must meet one of the following conditions:

- The DFU format must exist in the library.
- If the DFU format does not exist in the library, cataloged DFU specifications must exist in the library; the name of the cataloged specifications (parameter 7) and the GO parameter (parameter 6) must be specified so that no operator responses are required at job setup. See Chapter 5 for an explanation of the DFU command parameters.

If a list job is submitted to the job queue, the parameters are not prompted for on a single display. The file name, SORT/NOSORT, and RPG II name parameters are prompted for individually if required. The DFU format is assumed to be the default name if it is left blank.

Evoked Jobs

Enter, update, and inquiry jobs cannot be evoked because they require operator interaction. List jobs not requiring operator interaction, other than responding to prompts for list procedure parameters, can be evoked (refer to the *System Support Reference Manual*). List jobs that are evoked must meet one of the following conditions:

- The DFU format must exist in the library.
- If the DFU format does not exist in the library, cataloged DFU specifications must exist in the library; the name of the cataloged specifications (parameter 7) and the GO parameter (parameter 6) must be specified so that no operator responses are required at job setup. See Chapter 5 for an explanation of the DFU command parameters.

If a list job is evoked, the parameters are not prompted for on a single display. The file name, format name, SORT/NOSORT, and RPG II name parameters are prompted for individually if required.

When you are processing a list job with sort, DFU creates a source member of sort sequence specifications to describe the sort. DFU then generates a name for this source member as follows:

Character	Value
1-3	#DF
4-5	Display station ID from which the job was initiated
6	1 – if display is not currently in system inquiry mode 2 – if display is currently in system inquiry mode 3 – if job is executing from the job queue 4 – if job has been evoked
7-8	Not used (blank)

If a list job with sort is evoked from a display station before completion of another evoked list job with sort from the same display station, duplicate sort sequence source member names are generated. In this instance, the second job, which attempted to create the sort source member, is halted with message SYS-2510, indicating an attempt was made to create a member that already exists. When this occurs, wait for the first evoked list job to finish; then respond to the halt message with a 0 option to allow the second job to proceed.

If message SYS-2510 is issued by an evoked list job that is the only *evoked* list job being processed, then a source member already exists with the same name that the list job creates. In this instance, select one of the following:

- Option 0–to replace the existing member and create new specifications.
- Option 2–to sort the file using the existing source member as sort specifications.
- Option 3–to cancel the list job.

Displaying Data

DFU does not perform data validity checking at execution time. When auto-duplicating data in entry or insert mode, or displaying data in update or inquiry mode, potential work station errors can occur when DFU displays data with a hexadecimal value of less than hex '40'. This could occur if packed data were processed as an alphameric field, (this may be avoided by defining different types of data as separate fields). If a work station error occurs while running in update mode, DFU scans for data that has a hex value less than X'40'. Any such data (except X'00', X'0E', and X'0F') is replaced with an X'FF' value and is displayed with DFU error message 0017. The results in these situations must be corrected by the user. When prompting for new data at the display station, DFU displays periods in the field prompting area to indicate the field length. When the data is returned to DFU for processing, the periods are removed as follows:

- Alphameric fields–trailing periods are replaced with blanks.
- Numeric fields–all periods are replaced with zeros (if processing a direct or sequential file, DFU treats the record number field as numeric when displayed, even if it is defined as an alphameric field in the record).

Printing Records

All job setup printing is done via the system listing device, and is directed to the current system listing device assignment for the job.

All job execution printing is done via printer data management. DFU output is directed to the printer currently assigned to the initiating work station. If a list job is submitted to the job queue, printing is directed to the system printer. The filename for the printer used by DFU is #DFPRINT. When entering, updating, inquiring, or listing data that is defined as numeric, DFU prints the data in an edited format. Thus any alphameric data in the field is converted to numeric before printing, even though it appears as alphameric on the display and in the data file. If the printer is set at less than 6 lines per page the title line is not printed.

DFU allows you to specify a printer line width of 60 to 198 positions. If you specify a printer width greater than 132 positions, you should change the printer density for the work station to 15 characters per inch (CPI), each time a DFU job is run, by using the LINES procedure or a FORMS or PRINTER OCL statement. Additionally, you should ensure that the output is directed to a printer capable of printing 198 characters per line.

Limitations When Processing

The amount of data that can be processed for each record is limited to the amount DFU can print in an edited format. If your printer line width is 132 or less positions, DFU will process as much data as will fit on three print lines; for printer line widths greater than 132 positions, DFU will process as much data as will fit on two lines.

Field editing characteristics will also subtract from the maximum amount of data. For example:

- If a column heading is longer than its data field, the excess is subtracted from the available positions for data.
- Column spaces between fields are subtracted from the available positions for data.
- Spaces lost at the end of print lines must be subtracted because DFU will not separate a data item or heading and continue that item or heading on the next line.
- DFU leaves space for a possible negative sign in numeric fields.
- A position is used by a decimal point if there are any decimal positions.

DFU Format Description Restrictions

A DFU format description created for an Enter, Update, or Inquiry job can be used by any DFU function. A format description created for a list job can only be used by list because no associated display format source and load members are created. If a format description is created for an inquiry function, and is subsequently used by enter or update, the default delete code and position (blank in position 1) is assumed. If the record key occupies position 1, the delete code position is assumed to be the last record position. If an inquiry format description is created using the edit function, the description cannot be used to execute an enter/update job. Format descriptions created to process one file can be used to process other files with similar attributes (record length, and if indexed, record key length and location). Additionally, a format description created to process a sequential or direct file can be used to inquire into or list an indexed file, if the record lengths are identical.

File Processing

This section describes the various disk file types processed by DFU, and how each is processed. This description pertains to files that are not delete-capable; DFU processing of delete-capable files is described later in this section. For a complete description of disk file processing see the *System Support Reference Manual.*

DFU will not process job files that were created in a previous job step. Job files are those with a RETAIN-J parameter on the //FILE statement. See the *System Support Reference Manual* for more information on this statement.

When entering, updating, or inquiring into an indexed file, the operator requests records by a unique record key associated with each record. To add a record to the file, the record key cannot exist; to change a record in the file, the record key must already exist in the file.

When entering, updating, or inquiring into a direct file, the operator requests records by their relative record number. The record number is the position of the record relative to the start of the file. These record numbers can be generated by DFU or you may supply the number. (See *Automatic Record Number Generation* in Chapter 6 for more information.) However, only one operator can use automatic record number generation if others are currently entering data into the same file. If another operator enters a record number that matches a number being generated at the same time by DFU, the second operator may be locked out. For example, the relative record numbers of the first, fifth, and seventh records in a file are 1, 5, and 7. The largest record number that can be retrieved by DFU is 9999999. When a direct file is created, all the records in the file are initialized to blanks. To add a record to the file, the record corresponding to the record number to be added must be blank; to change a record in the file, the record corresponding to the record number to be changed must not be blank.

For example, if operator A and operator B both request to update the same file, and both operators use automatic record number generation, the first operator to finish keying a new record will retain the function. When the second operator completes keying his first new record, DFU will determine that the requested record already exists. The second operator will then be forced to request subsequent record additions by keying the record number where a record is to be added.

You cannot use DFU to create sequential files, but you can use DFU to update, display, or print sequential files. As with direct files, the operator requests records by their relative record number. Because all records in a sequential file already exist, and because you cannot use DFU to add records beyond the current last record in the file, you cannot add records to a sequential file using DFU. Therefore, future references in this manual regarding the entry/insertion of new records only describe the function for indexed or direct files. Actually, you can process sequential files exactly like direct files.

To enter or insert a new record, the record corresponding to the record number to be inserted must currently be blank; to change a record in the file, the record corresponding to the record number to be changed must not be blank. When scrolling a direct file or sequential file, the next/previous records are read consecutively until a nonblank record is displayed. Therefore, the time required to display the next/previous record is related to the number of intervening blank records that must be read by DFU. When listing a direct or sequential file, DFU reads the records consecutively until a record is found matching one of the record types defined in the DFU format. Blank records are processed as if they were to be listed.

Member Names

Library members created by DFU must follow these naming conventions:

- Cannot be one of the reserved words (ALL, DIR, SYSTEM, NEW).
- Maximum of eight characters.
- First character must be alphabetic (A-Z, #, $, @).
- Remaining characters can be anything except embedded blanks, periods, single quotes, or commas. Other special characters, such as hyphens, question marks, and slashes, are allowed by DFU, but should be avoided. These characters can cause unpredicatable results when processed within the DFU procedures.

Names beginning with #DF should also be avoided; DFU generates names with these starting characters, and overlays existing members with the same name as the generated name. These naming restrictions apply to the following DFU library members:

- DFU format description.
- DFU source specifications.
- Display format source specifications.

DFU and 960-Character Displays

The following two display station screen sizes are available with System/34:

- A large (24 line, 1920 character) display
- A smaller (12 line, 960 character) display

All examples/displays in this manual show DFU executing from a large display (24 lines, 1920 characters). The equivalent DFU functions can also be executed from a small display (12 lines, 960 characters) with the following differences:

- When responding to DFU setup prompts, only four lines of DFU attributes/specifications are displayed at a time, compared to 10 lines of attributes/specifications on the larger display. Similarly, only four data fields can be specified on a small (12 line) display, rather than 10 on the larger (24 line) display (except where field limitations are less, such as sort and level fields).
- When correcting/updating DFU specifications during DFU setup, only seven specifications are displayed at a time on the smaller display, as compared to 19 on the larger display. Additionally, only six specifications can be added on a single small display, as compared to 18 on the larger display.
- When executing an enter, update, or inquiry job, data is displayed in the same manner as on the larger display, but 12 fewer lines are available for the data. Because of this, more displays may be required for a record.
- A DFU format created from the smaller display can be executed on either display. If it is executed on the larger display, only lines 1 through 12 are used. A DFU format created on the larger display can be executed on the larger display or on the smaller display if the total number of key or record number fields plus the data fields does not exceed nine. In this case a blank line will not separate the key or record number from the data.

Delete-Capable Files

You cannot create delete-capable files with DFU, and DFU cannot be used to delete records in the manner described for the system delete function in the *SSP Reference Manual*. You can however, update, list, and inquire into delete-capable files in a manner similar to that used for nondelete-capable files. For indexed files, a record that has previously been deleted cannot be retrieved. For sequential and direct files, records are processed as follows:

- New records can be put in the file only if the existing record is blank or if the record is a system deleted record.
- Records can be retrieved for update or display only if the record is not blank and is not a system deleted record.
- During inquiry, if DFU tries to redisplay the previous record processed and if that record has been deleted since it was last read, DFU displays blanks and/or the data the record contained before it was deleted.
- System deleted records cannot be retrieved for listing; blank records are processed as if they were to be listed.

The remainder of this manual describes how DFU processes files that are not delete-capable. If you are processing a delete-capable file with DFU, system deleted records are processed as blank records for enter, update, and inquiry functions.

DFU Storage Requirements

DFU requires 14K (14336) bytes of main storage. The enter/update functions of DFU require 16K (16384) bytes of main storage when processing with a printer line width greater than 132 positions. DFU will take advantage of any additional main storage to improve performance.

Ideographic Support

In the following fields, DFU allows you to specify the following types of data:

Field	Data Types Allowed
Titles	Alphanumeric, ideographic, or both, even within an individual field.
Key field headings	Alphanumeric, ideographic, or both, even within an individual field.
Data field headings	Alphanumeric, ideographic, or both, even within an individual field.
Key fields	Alphanumeric; ideographic; either, initialized to alphanumeric; either, initialized to ideographic. The initialization is based on the selection at job setup. An individual field cannot contain both alphanumeric and ideographic data.
Data fields	Alphanumeric; ideographic; either, initialized to alphanumeric; either, initialized to ideographic. The initialization is based on the selection at job setup. An individual field cannot contain both alphanumeric and ideographic data.
Select constants	Either alphanumeric or ideographic, initialized to alphanumeric. Alphanumeric apostrophes (') must surround ideographic select constants, but the constant itself cannot contain both alphanumeric and ideographic data.

DFU issues ideographic prompts and error messages and allows you to enter ideographic characters only when you are signed on in ideographic session. However, you can add ideographic functions (sort and field types) on the display screen that prompts you for updates to DFU specifications, even if you are not signed on in ideographic session.

During enter, update, or inquiry job execution, DFU uses column separators when it displays any field capable of ideographic input. However, the input field format for enter and update is different from the input field format for inquiry. Therefore, when you have ideographic field types, do not use the enter or update format for inquiry, and do not use the inquiry format for enter or update.

If an enter, update, or inquiry format contains ideographic data in any of the field headings or in the title, it can be executed only at a display station with an ideographic display screen and either an alphanumeric or ideographic keyboard. If an enter, update, or inquiry format requires ideographic data to be entered, it can be executed only at a display station with an ideographic display screen and an ideographic keyboard.

During job execution, DFU uses ideographic display screens for end-of-job and accumulator displays when your DFU format specifies that ideographic fields are going to be processed or when your DFU format contains ideographic output constants.

Page headings and informational messages for DFU list output are ideographic when your DFU format contains any of the following:

- Ideographic characters in a field heading
- Ideographic characters in the title
- Fields that allow ideographic data or that allow either alphanumeric or ideographic data
- Ideographic sort types

DFU always executes with extended character processing on for both work stations and printers, unless you modify DFU procedures to execute with extended character processing off. DFU always uses the current system list device (specified in the SYSLIST statement) or the currently assigned work station printer. If you are going to print ideographic data, be sure to specify that the output goes to a printer capable of printing ideographic data.

DFU always uses the ideographic sort if it exists in the active user library or in #LIBRARY; otherwise, DFU uses the alphanumeric sort. If your program requires an ideographic sort, be sure that the ideographic sort is in the proper library.

The first and last characters of an ideographic sort field are not included in the sort sequence specifications. DFU assumes that these positions contain the shift-out (S/O) control character (hex 0E) and the shift-in (S/I) control character (hex 0F) and, therefore, that they should not be included in the sort sequence specifications. In seion fields, however, the first and last characters are included in the sort sequence specifications, because seion fields do not contain ideographic data.

When you define a list with sort job, DFU requires that all sort field names be unique. Thus, if you need to sort a field on more than one ideographic sequence, redefine the field as often as required in your RPG II file description and input specifications.

On RPG II input specifications, when you define a field that can contain ideographic characters, you must include the S/O control character and the S/I control character that bracket the field. Thus, the S/O control character must correspond to the FROM position, and the S/I control character must correspond to the TO position. Because each ideographic character requires 2 bytes of data, whether it resides in storage or on disk, any field that can contain ideographic data must be defined to have an even number of positions and to have at least 4 positions.

Chapter 2. File Definition

When the DFU job setup is executed, you must provide an RPG II source member (file description and input specifications) that describes the file or files to be processed. This source member can contain only file description and input specifications, or it can contain an entire RPG II program. DFU uses the source member, along with your responses to prompts, to create a format description for the file to be processed.

FILE DEFINITION CONSIDERATIONS

DFU requires that:

- For indexed files, record keys be no more than 29 characters for an unpacked key or 8 characters for a packed key.
- Records in a file be no more than 512 characters. (See *Printing Records* in Chapter 1 concerning limitations on line width and record processing.)
- Alphameric fields to be processed be no more than 60 characters.
- No more than 60 record identification codes be used for each record type.
- Numeric fields be no more than 15 positions if unpacked and no more than 8 positions if packed. (Array fields that have been defined as packed, and greater than 15 positions are not allowed.)
- Binary fields can be specified in the RPG II specifications, but are ignored by DFU.
- If processing a sequential or direct file, and the record number is to be placed in a field in the record, the maximum length be 7 positions.

ENTRIES ON RPG II FILE DESCRIPTION SPECIFICATIONS

The file description specification (Figure 2-1) describes the file DFU will process. If the RPG II source member contains only one file description specification, DFU uses that specification for its file definition. If the RPG II source member contains more than one file description specification, DFU uses the one having the file name (columns 7-14) that matches the file being processed; DFU issues an error message if the filename being processed does not match any of the files described in the RPG II source member. Figure 2-1 lists only the file description specification entries required by DFU. DFU ignores other entries, which allows you to use a file description specification from an RPG II program that processes the file.

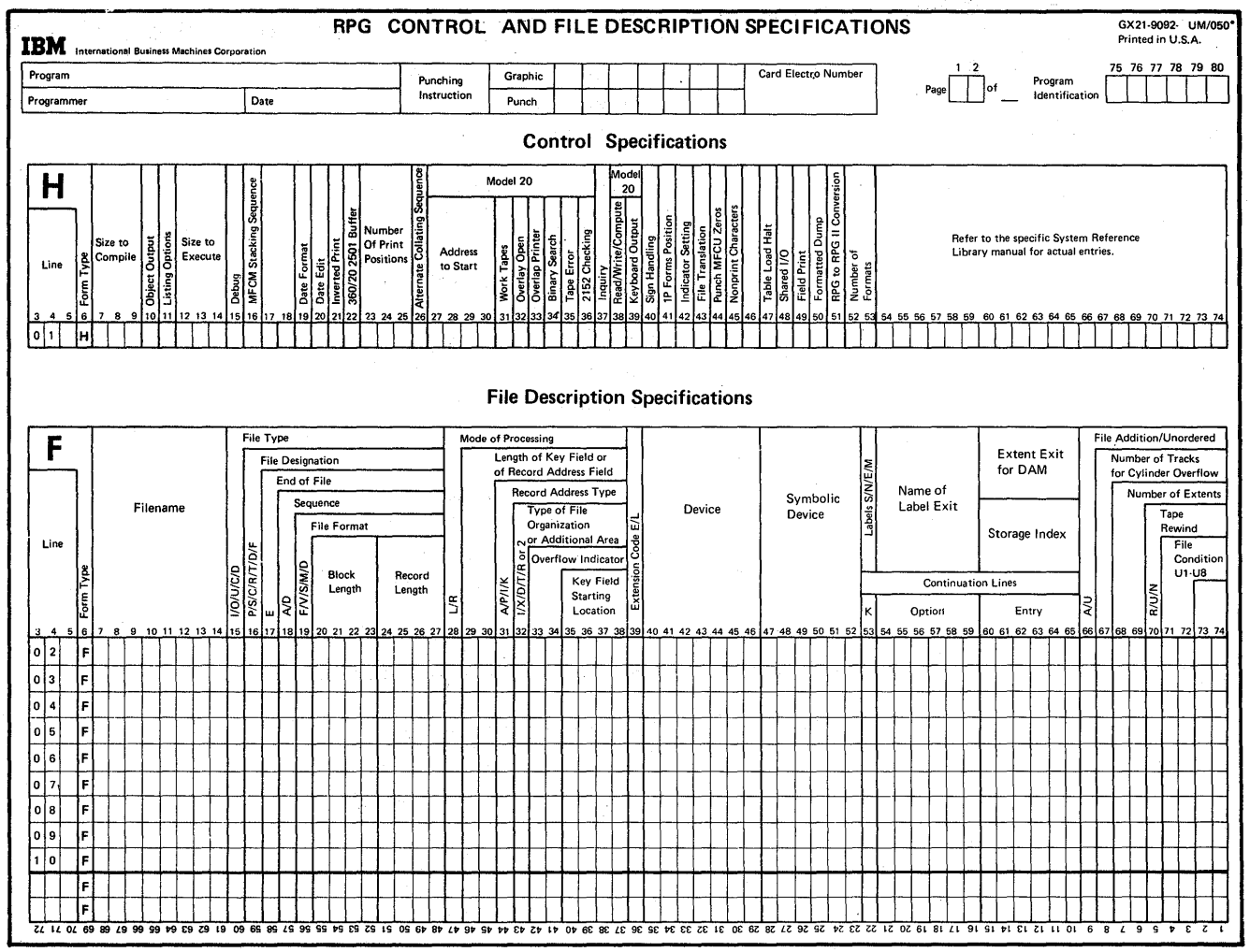


Figure 2-1 (Part 1 of 2). RPG II File Description Specification

Column	Heading	Explanation
6	Form Type	Contains a preprinted F, indicating a file description specification.
7-14	Filename	If only one set of file description and input specifications is in the member, DFU ignores this entry; otherwise, one of the entries must match the file you named in the job setup command.
24-27	Record Length	Record length of the file being processed. Maximum record length is 512. This entry must end in column 27.
29-30	Length of Key field or of Record address field	For an indexed file, the maximum length is 29 (unpacked keys) or 8 (packed keys). For a sequential/direct file, these columns must be blank. This entry must end in column 30.
31	Record Address type	This entry is required only for an indexed file. In this case a P indicates a packed key; any other entry indicates an alphameric key.
32	Type of File Organization or Additional Area	Code an I for an indexed file; any other entry indicates a sequential or direct file.
35-38	Key Field Starting Location	For an indexed file, code the starting location in the record of the record key. For a sequential or direct file, leave these columns blank. This entry must end in column 38.

Figure 2-1 (Part 2 of 2). RPG II File Description Specification

ENTRIES ON RPG II INPUT SPECIFICATIONS

The input specifications further define the file that DFU processes. They define the format of the records by specifying the record identification indicators and record identifying codes, and field names and locations.

DFU uses three types of input specifications: record type definitions, field definitions, and data structure definitions.

Each record type in a file (Figure 2-2) must be described by one or more record defining specifications; these specifications associate a record identifying indicator (01-99) with the record type, and describe the record codes (data in the record) that identify that record type.

When determining the record type, DFU scans the record codes in the order specified in the RPG II specifications; the record type selected is the first one whose codes match the data in the record.

The field defining specifications (Figure 2-3) for a record type directly follow the record type defining specifications. These specifications identify the locations, lengths, and data types for each field in the record type. See *Displaying Data* in Chapter 1 for considerations before defining field length and type.

Note: If you use a subdivided key field, the subfields must be defined in the RPG input specifications.

The third type of input specifications, data structure definitions (Figure 2-4), are optional; if present, they must follow all record and field defining input specifications for the file. These specifications allow a previously specified data field to be subdivided into named subfields.

Note: DFU will not scan for data structure subfields of data fields previously defined as packed or binary. For a further explanation of data structures, see the *RPG II Reference Manual.*

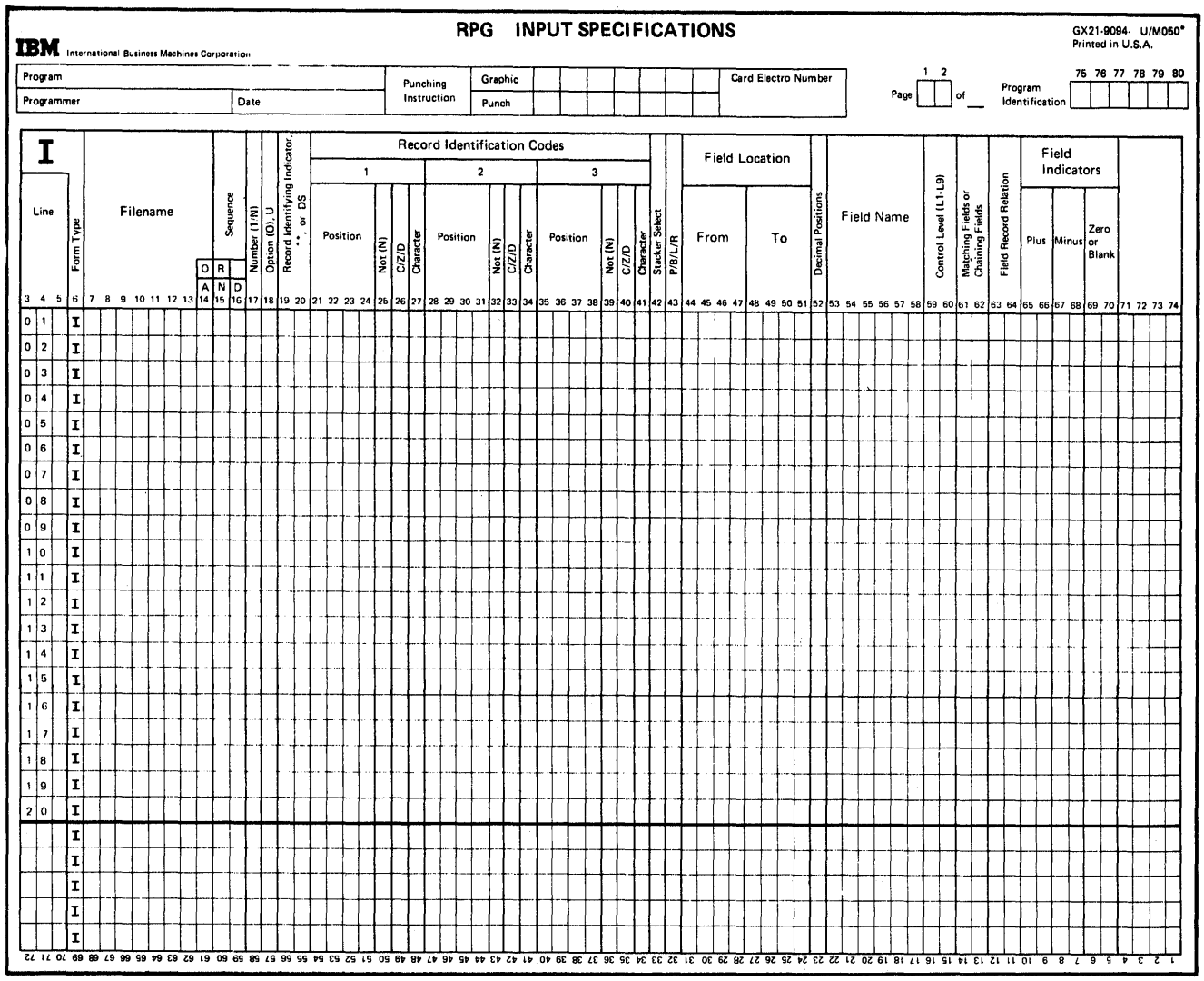


Figure 2-2 (Part 1 of 3). RPG II Input Specifications (Record Defining)

Column	Heading	Explanation
6	Form Type	Contains a preprinted I, indicating an input specification.
7-14	Filename	This field is valid only on the first input specification for a file. If there is only one set of file description and input specifications, DFU ignores this entry; otherwise, the name must match the filename you specified in the command.
14-16	OR/AND	This field is valid only when two or more record defining specifications are required to identify a record type, or when another record type is to be specified: AND The record identification codes on this specification must be used with those on the preceding specification to identify the record type. OR The record identification codes on this specification offer an alternative description of the codes for previously specified record types. Otherwise, another record type can be defined by coding its ID in columns 19-20.

Figure 2-2 (Part 2 of 3). RPG II Input Specifications (Record Defining)

Column	Heading	Explanation
15-16	Sequence	A numeric entry (01-99) indicates this record type is numerically sequenced. If so, DFU checks column 17 for 1 or N records of this type in sequence. *Note:* Record sequencing is used only for the enter/update function.
17	Number (1-N)	Checked if there is a numeric entry in columns 15-16. A 1 indicates only one of this record type in a sequence; an N indicates multiple records of this type in a sequence. If there is not a 1 or N, DFU expects the record types to be unsequenced. *Note:* Once DFU has encountered a valid sequenced record type, all succeeding record types are assumed sequenced. If columns 15-17 have invalid sequence entries, DFU assumes multiple records in the sequenced record type.
19-20	Record Identifying Indicator	A numeric entry (01-99) identifying the record type.
21-41	Record Identification Codes	Up to three codes in an AND relationship can be specified on each record identifying line to describe a record type. A maximum of 60 codes can be specified to identify a record type when it is necessary to use AND/OR lines to describe the record type. Two or more record types can be described with OR lines.

Figure 2-2 (Part 3 of 3). RPG II Input Specifications (Record Defining)

Column	Heading	Explanation
6	Form Type	Contains a preprinted I, indicating an input specification.
7-42		Must be blank.
43	P/B/L/R	Code a P for a packed field; otherwise leave blank.
44-47	Field Location (From)	Position in the record at which the field starts. This entry must end in column 47.
48-51	Field Location (To)	Position in the record at which the field ends. This entry must end in column 51.
52	Decimal Position	Code 0-9 for a numeric field. Leave blank for an alphameric field.
53-58	Field Name	The first character must be A-Z, #, @, or $; the remaining characters can be any combination of alphameric characters.
63-64	Field Record Relation	If a record identifying indicator (01-99) is in this field, the field is a part of only that record type. A blank indicates the field goes with all record types defined in the immediately preceding record defining input specifications.

Figure 2-3. RPG II Input Specifications (Field Defining)

FIRST SPECIFICATION

Column	Heading	Explanation
6	Form Type	Contains a preprinted I, indicating an input specification.
7-12	Filename	Name of the data structure. It must correspond to the field name of a previous field specification.
19-20	Record Identifying Indicator	Must contain the characters DS for data structure.

SUCCEEDING SPECIFICATIONS

Column	Heading	Explanation
6	Form Type	Contains a preprinted I, indicating an input specification.
44-47	From	Relative start position of subfield in data field. This entry must end in column 47.
48-51	To	Relative end position of subfield in data field. This entry must end in column 51.
52	Decimal Position	Code 0-9 for a numeric field.
53-58	Field Name	Name of the subfield (see Figure 2-3).

Note: A data structure definition requires two or more specifications. The first specification names the data structure; succeeding specifications identify the subfields in the data structure.

If the field being described is to contain ideographic characters, the From and To positions must include space for the ideographic shift-in and shift-out characters.

Figure 2-4. RPG II Input Specifications (Data Structure Defining)

ENTERING AN RPG II SOURCE MEMBER

Create the source member, which contains the file description and input specifications data, by using the source entry utility (SEU) or the $MAINT System Support Program Product utility.

Enter SEU, then respond to the prompts on the parameter prompt display. Refer to the *SEU Reference Manual* for a discussion of the entry prompting sequence.

For the $MAINT System Support Program Product utility, refer to the *System Support Reference Manual.*

ERROR DETECTION AND CORRECTION

DFU checks the RPG II file description and input specifications for errors before converting them to DFU attributes. If an error is found, DFU prints the incorrect specification and an error message on the system listing device and ends the job. See Appendix B in this manual for a description of the RPG II errors diagnosed by DFU.

Chapter 3. Function Control Keys

Function control keys are special keys located on the keyboard of the display station that are used to specify system functions. The following list names and describes each function control key which is relative to DFU:

Function Control Key	Description
Cmd	Pressing this key and one of the command function keys causes a corresponding function to be performed. See *Command Function Keys*, in Chapter 4.
Dup	This key causes information to be duplicated into a field; it then functions as the Field Exit key. A $\overline{*}$ is placed in the cursor position, and in every position to the right in the current field. These characters are replaced in the data file with the data from the same positions as the previously processed record. This key is valid only during enter/update and inquiry execution. *Note:* For update mode, DFU assumes the previous record processed to be the same as the record being updated.
Enter/Rec Adv	This key returns control to DFU to process the data keyed on the current display.

Function Control key	Description
Home	The Home key has meaning to DFU only during enter/update or inquiry execution. The function of the Home key depends on the time the key is pressed: 1. If the cursor is not at the initial cursor position for the current display, it is returned to that field. 2. If the cursor is at the initial cursor position, the following occurs: a. If the first display of data is being shown for update mode, the record is reset to its values before any updates. b. If the first display is being shown for entry or insert mode, or a new entry is being prompted for in update mode, the prompting is reset to the start of the current mode; any data keyed to this prompt or record is lost. c. If a record requires more than one display, and the first display is not being shown for a record, the display is reset to the preceding one for that record; any data keyed on this display is lost.

Function Control Key	Description
Field Exit	This key moves the cursor to the first position of the next unprotected field on the display. For alphameric fields, characters to the right of, and including, the current cursor position in the exited field are blanked. For numeric fields, the exited field is right adjusted and leading zeros are inserted. If DFU is in enter/update or inquiry execution, and if the cursor is in the record type field, this key functions the same as the Enter/Rec Adv function control key. This key also functions as Enter/Rec Adv when the last data field on the screen is entered.
Field -	This key causes a negative sign to be placed at the rightmost character in the current numeric field (the key is only valid for signed numeric fields); it then functions as the Field Exit key.
Field +	This key indicates a positive numeric field by placing a blank in the rightmost position of the current numeric field; it then functions as the Field Exit key.
Roll↑	This key's function depends on when it is used: Job setup: Displays the next set of DFU attributes or specifications. Job execution: • Update mode for a sequential or direct file–retrieves the next nonblank record in the file for update. • Inquiry mode for a sequential or direct file–retrieves the *next* or last nonblank record in the file for display. • Inquiry mode for an indexed file–retrieves the *next* record or the record with the highest key for display.

Note: For a discussion of record key or record number retrieval sequencing, see *Scrolling Records* in Chapter 7.

Function control Key	Description
Roll↓	This key's function depends on when it is used: Job setup: Displays the preceding set of DFU attributes or specifications. Job execution: • Update or inquiry mode for a sequential or direct file–retrieves *preceding* nonblank record from the record currently being displayed. • Inquiry mode for an indexed file–retrieves the *preceding* record from the record currently being displayed.

Except for the command parameter displays, Field Exit, Field-, or Field+ key must be pressed to complete a field; there is no automatic skipping from field to field (for either job setup or job execution).

Chapter 4. Command Function Keys

Command function keys (Figure 4-1) are identified by the System/34 Keyboard Template. These keys are used with the Cmd function control key and allow functions not provided by the function control keys. The following list describes the command function keys supported by DFU and their uses relative to DFU:

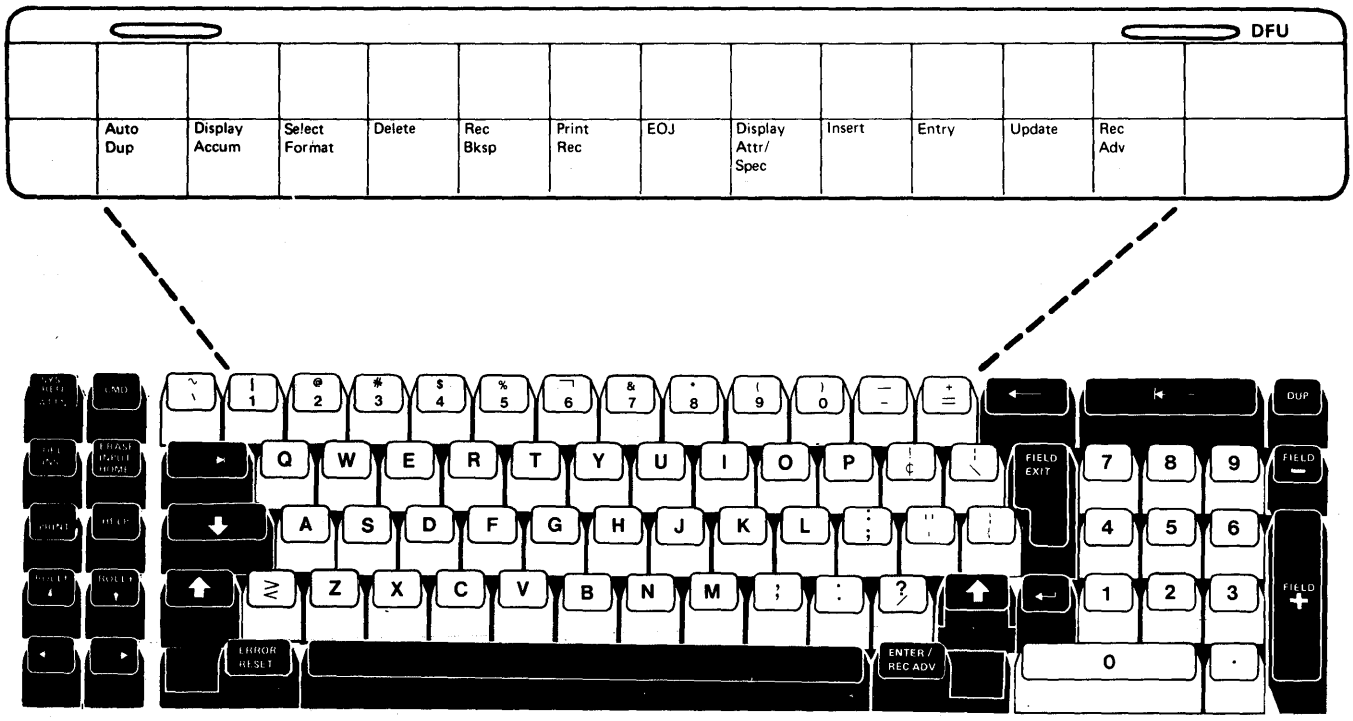


Figure 4-1. DFU Command Function Key Template

Command Function Key	Description	When Used
Auto Dup	Reverses the status of the auto-duplication indicator.	Enter/update
Display Accum	Displays the current values of the batch accumulators, and resets them to zero after adding them to the total accumulators. If a printer has been used with the job, these values will be printed.	Enter/update
Select Format	Positions the cursor at the record type (record identifying indicator) field so the operator can request a new record type. The operator can position the cursor at this field and change it without pressing the Select Format key. If operating in entry mode and the format has sequenced record types, pressing this key automatically causes a display of the next record type in the sequence.	Enter/update; inquiry

Command Function Key	Description	When Used
Delete	Marks the current record for deletion.	Enter/update
Rec Bksp	When the current record requires multiple displays and the first display is not currently being shown, this key causes the first display for the record to be shown. If the first display for a record is being shown, when this key is pressed the data entered to that point is ignored and one of the following occurs: • If displaying a record in update mode, the record is ignored and a new record key is prompted for. • If operating in entry or insert mode, or if a new record key is prompted for during update mode, the previously processed record is displayed. The mode is switched to update and the operator can change the record. When the record is completed, the mode returns to its previous setting. • If operating in inquiry mode, resets processing to the start of the current record. • If the first display of the previous record is already being shown, the Rec Bksp key is ignored.	Enter/update; inquiry

Command Function Key	Description	When Used
Print Rec	In inquiry, this key prints the currently displayed record. In update, this key prints the DFU attributes and specifications.	Any DFU job setup; inquiry
EOJ	Indicates that the current job step is complete.	Enter/update; inquiry
Display Attr/Spec	Reverses the display of DFU attributes to DFU specifications or DFU specifications to DFU attributes depending on which is displayed.	Any DFU job setup
Insert	Indicates that a new record is to be inserted into the file. If DFU is generating record keys for entry mode for an indexed file, you must supply record keys that are less than the next generated record key, if processing a direct file, the record must currently be blank.	Enter/update

Command Function Key	Description	When Used
Entry	Indicates that records are to be added to the file. For indexed files, the record key entered must not exist in the file; for direct files, the record to be added must currently be blank. If DFU is generating record keys or record numbers, pressing this key causes generation of the next sequential record key or record number in the file.	Enter/update
Update	Indicates that existing records in the file are to be changed. For indexed files, the record key entered must exist in the file; for sequential or direct files, the record to be altered must not currently be blank.	Enter/update
Rec Adv	Indicates that the current record or prompt is complete.	Enter/update setup and inquiry setup

Chapter 5. Command Parameters

The following parameters make up the DFU commands. Figure 5-1 shows each DFU command and its associated parameters. Figure 5-2 shows the DFU command display. For any DFU command, DFU prompts for all associated parameters if parameter 1 (filename) or parameter 2 (DFU format name) is omitted on the initial command.

FILENAME

This is the name of the file (1-8 characters) to be processed. DFU prompts for all parameters if you omit it on the initial command.

DFU FORMAT NAME

This is the name of the format description (job processing information) to be used to process the file(s). If the name does not exist as a subroutine member in the library, DFU starts the setup and you must create the subroutine member; if the name exists as a subroutine member in the library, DFU goes directly to job execution.

Note: If a user library is specified on the command, DFU searches only that library for the format description; otherwise, DFU searches only the system library.

If running an enter, update, or inquiry job and the format description subroutine member does not exist, you must ensure that a load member with the same name as the DFU format does not exist in the library. If a load member exists with that name, DFU issues an error message and halts the job instead of creating a load member of display formats with that name.

DFU prompts for all parameters if you omit this parameter on the initial command. You can use a default format by giving a null response to the format name prompt. In this case, DFU generates a format name by combining: #DF + terminal ID + 1 (if terminal is not in system inquiry mode), 2 (if terminal is in system inquiry mode) or 3 (if job is submitted to the job queue). DFU removes the default format description from the library at the end of the job. Default format names are not allowed for evoked list jobs. Associated with each DFU format description for enter, update, or inquiry are display screen formats to set up displays correctly. DFU creates a source member describing the displays. If a name is specified in parameter 10 (display format source name), DFU creates and saves the source specifications under that name. If the display format source name is not specified in the command, DFU generates a name for the source member, and then removes the member after the corresponding load member has been created. DFU generates a name for this member by combining: #DF + terminal ID + 1 (if session is not in system inquiry mode) or 2 (if session is in system inquiry mode). DFU then calls a compile step to create a load member of the required display screen formats with the same name as the DFU format description. All members are stored in the system library, unless a name is specified in parameter 9 (user library name).

RPG II SOURCE NAME

This is the name of the source member containing RPG II specifications that describe the file to be processed. This member can contain one or more sets of file description and input specifications, or an entire RPG II program. The file description and input specifications that correspond to the file are taken as the data description. This parameter is prompted for if required but it was not specified on the initial command or on the DFU parameter prompt. This parameter is required if the specified format description does not exist and job setup must be called. If you specify a user library on the command, this member must be in that library. If a user library is not specified in the command, this member must be in the system library.

NUMBER OF RECORDS

This specifies the maximum number of records you wish to enter in the file. If missing on the ENTER command or on the DFU parameter prompt, this parameter will be prompted for. When you are creating a file, DFU allows a maximum of 8 million records within that file. When used with the UPDATE command, this parameter specifies the number of records by which to extend a file when it is full. Values of zero or blank indicate that no file extension is required. If your system is not configured with extended disk data management, or you are processing a sequential file, this parameter is ignored on the UPDATE command.

SORT/NOSORT

This parameter indicates whether the file is to be sorted prior to listing. The default is NOSORT. There is no default for jobs placed on the JOBQ or evoked.

FILETYPE

This indicates the type of file that DFU processes. The only valid entries are D or blank, because only data files are processed.

DFU SOURCE PROCESSING

This two-character parameter is applicable if the format description does not exist and the job setup must be executed. It indicates whether the DFU specifications for this job are already stored in the library, and whether they are to be stored in the library when the job setup is complete. This source member of DFU specifications is stored or looked for in the system library, unless a user library name (parameter 9) is specified.

First Character (Input Indication)

N DFU specifications do not exist for this job. The operator is prompted to create DFU specifications.

Y DFU specifications exist in the library for this job. The operator is not prompted, but can update the stored specifications to describe another job, provided the format named in parameter 2 does not exist.

Second Character (Output Specification)

N The DFU specifications for this job are not stored as a library source member when job setup is complete.

Y The DFU specifications for this job are saved as a library source member when job setup is complete.

GO can also be entered. The following describes the combinations of the Y and N subparameters as well as the GO parameter:

NN Stored DFU specifications are not input to this job setup. The operator is prompted to create the specifications but they are not saved in the library. NN is the default value for the DFU source processing parameter.

YN Stored DFU specifications are input to this job setup. The operator is not prompted, but can update the retrieved specifications before the format description is created. If the operator changes the specifications at the display station, only this job is affected; the changes are not stored in the library.

YY Stored DFU specifications are input to this job setup. The operator is not prompted, but can update the retrieved specifications before the format description is created. The specifications in the library are replaced by the updated specifications.

NY Stored DFU specifications are not input to this job setup. The operator is prompted to create the specifications; once created, they are stored in the library.

GO Stored DFU specifications are input to this job setup. The operator is not prompted and cannot update the specifications before the format description is created unless errors are found. If errors are found in the specifications, the operator must correct the specification before the format description is created. However, the stored DFU specifications are not changed.

DFU SOURCE NAME

This is the name of the source member that contains, or will contain, saved DFU specifications. This parameter is required if the DFU source processing parameter is not NN. If the saved DFU specifications are input to job setup, DFU looks for the source member in the user library; if a user library is not specified, the system library is searched. If the saved DFU specifications are output from the job setup, DFU stores the source member in the user library, or in the system library if a user library is not specified.

MASTER FILENAME

This is the name of the indexed file containing the master file information for the file to be listed. If omitted on the command, or in response to the LIST parameters prompt display, this parameter is not prompted for; DFU assumes there is no master file to process.

USER LIBRARY

This is the name of an optional user library. All library members associated with the DFU job are looked for, or stored, in this library. If this parameter is not specified, DFU uses the system library.

DISPLAY FORMAT SOURCE NAME

This is the name of the member in which DFU is to store the display format source specifications when setting up an enter, update, or inquiry job. If omitted on the initial command and on the DFU parameters prompt display, DFU generates a default name for the member, and removes the source member from the library after the specifications have been converted to the display format load member.

If this parameter is specified, you can alter the generated display format source specifications at another time, compile them to replace the existing display format load member, and then run the same DFU job with the data displayed in the altered format. Refer to the *Display Screen Formats* section in Chapter 10 of this manual for a description of the alterations possible.

Command	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5	Parameter 6	Parameter 7	Parameter 8	Parameter 9	Parameter 10
ENTER	Filename	DFU format name	RPG II source name	Number of records	Filetype	DFU source processing	DFU source name		User library	Display format source name
UPDATE	Filename	DFU format name	RPG II source name	Number of records	Filetype	DFU source processing	DFU source name		User library	Display format source name
INQUIRY	Filename	DFU format name	RPG II source name		Filetype	DFU source processing	DFU source name		User library	Display format source name
LIST	Filename	DFU format name	RPG II source name	SORT/ NOSORT	Filetype	DFU source processing	DFU source name	Master file name	User library	
DFU										

Figure 5-1. Command Statement Parameters

DFU Command

If you wish to have DFU prompt you for the particular function you wish to perform, enter DFU. When you do this, DFU displays the following screen for you to select from:

```
                    DATA FILE UTILITY PROCEDURES

0 - Exit From DFU Processing

1 - ENTER Procedure, Creates a Data File

2 - INQUIRY Procedure, Displays a Data File

3 - LIST Procedure, Sorts/Prints a Data File

4 - UPDATE Procedure, Changes a Data File




ENTER NUMBER OF OPTION REQUIRED -->
```

Figure 5-2. DFU Procedures Display

CREATING YOUR OWN DFU PROCEDURE

The following example shows various ways you can create your own procedures to override the DFU default parameters. Use the SEU include function to include the DFU procedure in your procedure, then make the appropriate changes to the parameters. In this example, the procedure called PAYROLL was created to process a payroll file. The library parameters indicate how you can implement various user library defaults. See the *System Support Reference Manual* for a further discussion on the use of substitutions.

```
*    PAYROLL PROCEDURE-NAME
//   MEMBER USER1-#DF#MG
//   IF JOBQ-YES #ERR 0418,C,DFU
//   IF EVOKED-YES #ERR 0450,C,DFU
//   IF ?1?/ENTER ENTER PAYROLL,PAYROLL,,500,,,,,PAYLIB
//   ELSE IF ?1?/UPDATE UPDATE PAYROLL,PAYROLL,,,,,,,?LIB?
//   ELSE IF ?1?/INQUIRY INQUIRY PAYROLL,PAYROLL,,,,,,,?CLIB?
//   ELSE IF ?1?/LIST LIST PAYROLL,LISTPAY,,SORT,,,,PAYMAST,?USER?
//   ELSE GOTO ERROR
//   IF 1/1 RETURN
//   TAG ERROR
//   * 'PARAMETER MISSING OR INVALID - PROCEDURE CANCELED'
//   PAUSE
```

Chapter 6. Enter/Update

The DFU enter/update function allows you to create indexed or direct data files or to update indexed, sequential, or direct files. The operator enters data into these files in a predefined sequence. The enter/update function is made up of two separate steps; job setup (defining the format in which the data is entered) and job execution (data entry). See the *Programmer Considerations* section in Chapter 1 for general information relating to the enter/update function.

ENTER COMMAND

The ENTER command is interpreted by DFU as setup or execution depending on whether the DFU format name (parameter 2) you supplied already exists or not. When you key in the DFU format name, DFU checks to see if it already exists. If so, DFU skips the setup portion and goes directly to the execution portion of the enter function.

ENTER setup builds a format description and the display screen formats to create a data file. ENTER execution allows an operator to create a data file using an existing format description (DFU format name parameter) created during enter setup. The format for the ENTER command is:

> ENTER filename,DFU format name,RPG II source name,number of records, filetype,DFU source processing,DFU source name,, user library,display format source name.

Notes:

1. The master filename parameter is not used for the ENTER command, but a comma must be inserted for it if you enter the initial command with parameters.
2. User library must be entered if the format description, RPG II member, and DFU specifications are in that library or to be placed in that library. The system library is used if this parameter is omitted.
3. If you key the ENTER command, and omit filename (parameter 1), or the DFU format name (parameter 2), DFU prompts as in Figure 6-1 for all the ENTER parameters.
4. The filetype parameter will accept only a D if you enter the initial command with the parameters.

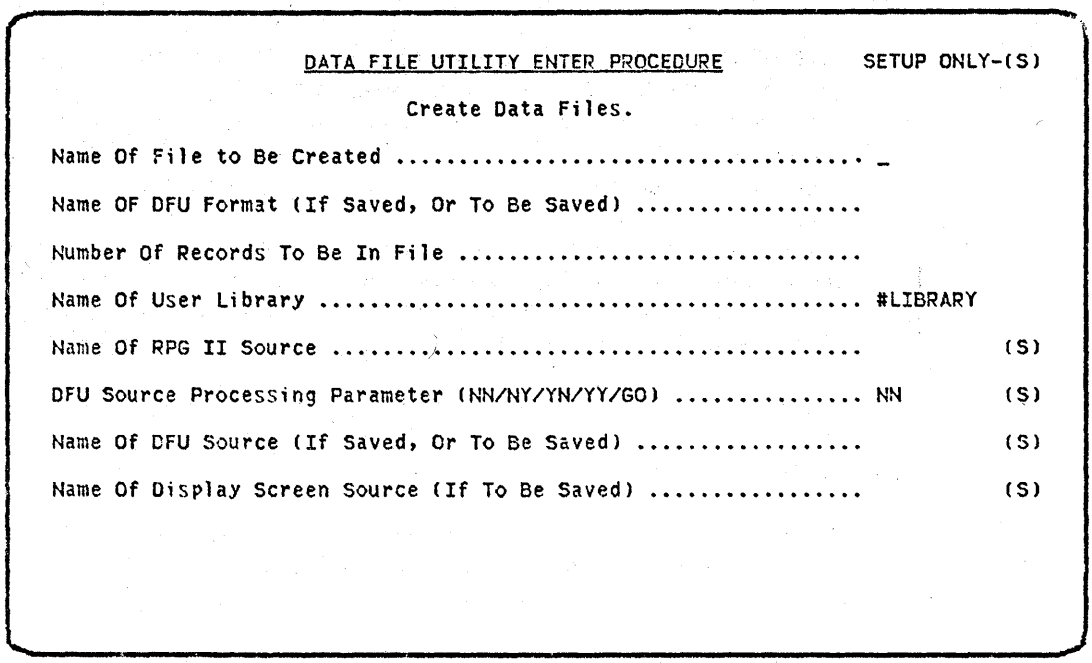


Figure 6-1. Enter Command Prompt

This prompt appears when the ENTER command is requested, and the filename (parameter 1) or the DFU format name (parameter 2) is not specified on the initial command. Any parameters entered on the initial command appear to the right of the corresponding prompts on this screen. The default parameters (#LIBRARY for the user library and NN for the DFU source processing parameter) will appear if nothing is entered for these parameters on the initial command.

Fill in the appropriate parameters and press the Enter/Rec Adv key to continue processing. Note that the last four prompts need be filled in only if the DFU format does not currently exist, and DFU job setup must be called.

UPDATE COMMAND

The UPDATE command is interpreted by DFU as setup or execution depending on whether the DFU format name (parameter 2) you supplied already exists or not. When you key in the DFU format name, DFU checks to see if it already exists. If so, DFU skips the setup portion and goes directly to the execution portion of the update function.

Update setup builds a format description and the display screen formats to change an existing data file. If a new format is to be created with the same name as an existing format, the existing format name must first be removed from the library. See *Saved DFU Specifications* in Chapter 10 for more detail.

Update execution allows an operator to alter a data file using an existing format description created during the update setup portion. The format for the UPDATE command is:

UPDATE filename,DFU format name,RPG II source name,number of records,filetype,DFU source processing,DFU source name,,user library,display format source name.

Notes:

1. The master filename parameter is not used for the UPDATE command, but a comma must be inserted in its place if you entered the initial command with parameters.
2. The number-of-records parameter specifies the number of records by which to extend the file when it is full. If your system is not configured with Extended Disk Data Management (EDM), this parameter is ignored.
3. User library must be entered if the format description, RPG II member, or DFU specifications are in that library or are to be placed in that library. The system library is used if this parameter is omitted.
4. If you enter the UPDATE command and omit the filename (parameter 1) or the DFU format name (parameter 2), DFU prompts as in Figure 6-2 for all the UPDATE parameters.

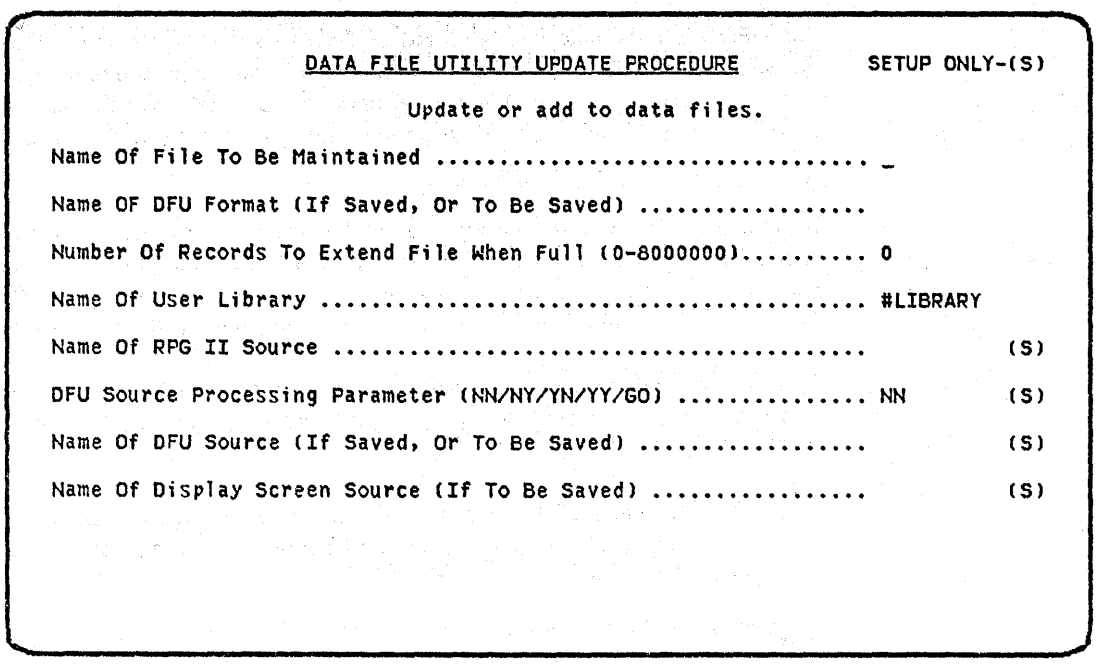


Figure 6-2. Update Command Prompt

This prompt appears when the UPDATE command is requested, and the filename (parameter 1) or the DFU format name (parameter 2) is not specified on the initial command. Any parameters entered on the initial command will appear to the right of the corresponding prompts on this screen. The default parameters (0 for the number of records, #LIBRARY for the user library, and NN for the DFU source processing parameter) will appear if nothing is entered for these parameters on the initial command.

Fill in the appropriate parameters and press the Enter/Rec Adv key to continue processing. Note that the last four prompts need be filled in only if the DFU format does not currently exist, and DFU job setup must be called.

ENTER/UPDATE FEATURES

Before setting up an enter/update job, you should know what DFU features are available to you during enter/update.

- Automatic record code insertion
- Automatic record key generation
- Automatic record number generation
- Automatic field duplication
- Field duplication with the Dup key
- Modulus 10 and 11 self-check
- Printing records
- Printer line width from 60 to 198 positions
- Batch and total accumulators
- Record sequencing
- Automatic zeroing packed fields not specified for processing
- Record number field selection
- Data display formats
- Ideographic field types

Automatic Record Code Insertion

At job setup, you can specify the record types to be processed. Each record type is referred to by a record identifying indicator from 01 to 99, as specified in the RPG II input specifications for the job. Each of these record identifying indicators is identified by one or more record codes. These codes are actual data in the record that identify it for future processing.

During job setup of an enter/update job, you do not need to define this record code as a field for the operator to key. Upon completion of a record during execution, DFU will examine the record and determine if any data has been keyed in the record code positions. If not, DFU will force the record codes in the record as follows before writing the record in the data file:

For record codes identified by the presence of a certain character, or the zone or digit portion of that character, DFU will move the character or the specified portion into the record. For record codes identified by the absence of a certain character, or the zone or digit portion of that character, DFU will first use the character blank (hex 40) or the zone or digit portion of blank to force the code; if this does not satisfy the 'NOT' condition, DFU will use the character 1 (hex F1), or the zone or digit portion of the character 1 to force the code. DFU will not force a record code into a character positioned in the record key of an indexed record. Although, processing continues as if the code were forced.

Automatic Record Key Generation

If the record key is composed of three positions of packed data or five positions of unpacked data, you can specify at job setup that DFU generate record keys during enter/update execution. The initial program-generated key value is 00010; the record key value is then incremented by 00010 for each successive record. During enter/update execution, you can still specify your own keys after pressing the Insert or Update command function keys to suspend automatic record key generation. In insert mode you can create a record with any key value less than the next key value that would be generated by DFU. In update mode you can only enter keys that currently exist. DFU resumes generating record keys when you press the Entry command function key.

Only one display station operator will be able to use the automatic record key generation feature if other DFU operators are currently keying data into the same file. The operator using the automatic record key generation feature will lose that feature if another operator (working with the same file) creates a record key first with a value matching a key that DFU would have generated. For example, assume DFU is generating record keys of 0010, 0020, 0030, and so on for operator A, and operator B creates a record key value of 0040. When DFU attempts to generate a record key of 0040 for operator A, it recognizes 0040 as a duplicate value and stops automatic record key generation for operator A.

Automatic Record Number Generation

If you are processing a direct file, you can specify at job setup that DFU generate record numbers during enter/update execution. The initial program generated record number is that of the first blank record in the file to be processed; the record number then increments by 1 for each successive record. Record number generation is applicable in entry mode; you can specify record numbers after pressing the Insert or Update command function key to suspend automatic record number generation. Only one display station operator can use the automatic record number generation if other DFU operators are currently entering data into the same file. If another operator enters a record number at the same time as DFU is generating the same number, the second operator will be locked out.

Automatic Field Duplication

At job setup you can specify auto-duplication fields. At execution time, data from the corresponding positions of the previously processed record will be inserted into the current record field. No operator entering is required.

Duplication occurs whenever the auto-duplication indicator is on and at least one record has been processed. The operator cannot enter data into an auto-duplication field unless the auto-duplication indicator is off. The status of this indicator (on or off) is reversed each time the Auto Dup command function key is pressed. At least one of the fields of the record key for an indexed file must not be an auto-duplication field. (Record keys are covered further under *Key Field Specification* later in this chapter.) In enter mode, data for an auto-duplication field is extracted from the corresponding field positions in the previous record. It is your responsibility to ensure that the data in the previous record is compatible with the data type of the auto-duplication field (packed/unpacked/alphabetic/numeric). Incorrect use of the auto-duplication function can cause erroneous data to be displayed or work station errors.

For efficient data entry, do not designate the last field on a display as an auto-duplication field. DFU specifies the last field on the display as an auto record advance field, allowing a Field Exit function control key to perform the Enter/Rec Adv function. If the auto record advance field is defined as an auto-duplication field (and auto-duplication is in effect) the cursor will not advance into this field. In this case the auto record advance function cannot be performed by the Field Exit keys and the Enter/Rec Adv function control key must be pressed to complete the display. This situation can normally be avoided by specifying auto-duplication fields before normal keyed fields at job setup time.

Field Duplication with Dup Key

In enter mode, the operator can duplicate information from the corresponding positions of the previously processed record into the current record by pressing the Dup function control key. Characters ⁼ appear on the screen wherever information is duplicated; when the display is complete, each field is scanned completely and each ⁼ is replaced with the data from the corresponding position of the previous record. This key is valid if at least one record has been processed previously and at least one of the following situations is present:

- The field being duplicated is a record key or record number field.
- The previous record type was the same as the current record type.
- The previous record type was different from the current record type, but the field of the current record type was defined as an auto-duplication field and the auto-duplication indicator is off.

Note: In update mode, DFU does not duplicate data from the preceding statement. Instead the Dup Key ignores your update to the field and restores the field to its original state. This provides an easy way to restore a field to its original form after a keystroke error.

Modulus 10 and 11 Self-Check

At job setup you can specify fields of 32 characters or less (including record-key fields) to be modulus 10 or 11 self-check fields (both cannot be specified for the same field). When data is keyed in these fields, the last digit in the field is the self-check digit; the digit portion of all characters prior to the last one make up the base number. If the digit generated by either the modulus 10 or 11 algorithm does not agree with this character, the error is detected and the field must be rekeyed. The algorithms used to compute these self-check digits are explained in the following paragraphs.

To compute the modulus 10 self-check digit:

1. Multiply the units position and every alternate position of the base number by 2.

2. Add the digits in the products to the digits in the base number that were not multiplied.

3. Subtract the sum from the next higher number ending in zero.

The difference is the self-check digit.

For example:

Base number	6 1 2 4 8
Units position (8) and every other or second position	6 2 8
Multiply by 2	12 4 16
Digits not multiplied	1 4
Add	1 + 2 + 1 + 4 + 4 + 1 + 6 = 19
Next higher number ending in 0	20
Subtract	-19
Self-check digit	1

To compute the modulus 11 self-check digit:

1. Assign a weighting factor to each digit position of the base number. These factors are: 2, 3, 4, 5, 6, 7, 2, 3, 4, 5, 6, 7, 2, 3, and so on, starting with the units position of the number and progressing toward the high-order digit. For example, the base number 991246351 would be assigned the weighting factors as follows:

Base number	9	9	1	2	4	6	3	5	1
Weighting factors	4	3	2	7	6	5	4	3	2

2. Multiply each digit by its weighting factor.

3. Add the products.

4. Divide this sum by 11.

5. Subtract the remainder from 11.

The difference is the self-check digit.

For example:

Base number	1 3 7 3 9
Weighting factors	6 5 4 3 2
Multiply	6 15 28 9 18
Add	6 + 15 + 28 + 9 + 18 = 76
Divide	76/11 = 6 plus a remainder of 10
Subtract	11 - 10 = 1
Self-check digit	1

Notes:
1. If the remainder from step 4 is 0, the self-check digit is 0.
2. If the remainder is 1, the base number has no self-check digit; and you must ensure that these base numbers are not used in the fields you define as self-check fields.

Printing Records

At job setup the operator can select one of the following print options for execution time:

- Print no records
- Print only new records
- Print only updated/deleted records
- Print both new and updated/deleted records

Note: Blanks are inserted when the data to be printed contains unprintable characters. A DFU option at job setup allows you to indicate if the printer is to halt when unprintable characters are encountered.

By specifying that no records be printed, you can use DFU without requiring a printer at any time.

All printing goes to the current, assigned printer. Output is printed with zero suppression for numeric data that is entered during the enter/update run.

If updated records are printed, the first line or lines show the record before any changes were made. Succeeding lines contain only the altered fields. If an altered field has been changed to all blanks, asterisks (*) are printed in the updated data area to indicate that the field was changed.

If records marked for deletion (by pressing the Delete command function key) are printed, the record to be deleted is followed by a line with the words RECORD DELETED. Records marked for deletion are not physically removed until the ORGANIZE procedure is run against the file.

Printer Line Width

DFU allows you to specify a printer line width of 60 to 198 positions. If you specify a printer width greater than 132 positions, you should change the printer density for the work station to 15 characters per inch (CPI), each time a DFU job is run. To do this, use the LINES procedure or a FORMS or PRINTER OCL statement. Additionally, you should ensure that the output is directed to a printer capable of printing 198 characters per line.

Note: DFU restricts the amount of data that can be processed per record. When a printer line width is 132 positions or less, up to three print lines of data can be processed. For printer line widths greater than 132 positions, two print lines of data can be processed. These restrictions apply even if no printing is requested for an enter or update job. This allows enter and update formats to be used with inquiry and list jobs. See *Printing Records* in Chapter 1 of this manual for more information about printing records.

Batch and Total Accumulators

At job setup you can specify 10 fields (alphabetic or numeric) to be accumulated. If the same field name occurs in two or more different record types, the totals appear in the same accumulator. During enter/update execution, the operator can press the Display Accum command function key to display the current batch totals. These accumulator values are printed only if printing has already occurred during this job.

Whenever the batch totals are displayed, they are added to the corresponding final totals and reset to zero. Any fields with less than 16 positions of unpacked data, or less than 9 positions of packed data can be accumulated. Accumulator values not referenced at enter/update execution are printed and displayed as blanks. Accumulator hold areas are always 15 positions; and accumulated values larger than this cause the accumulators to overflow. In this case the overflow value is displayed, and the accumulator is reset to the value of the field causing the overflow.

Note: If nonnumeric data is in a field to be accumulated, the results are unpredictable.

Record Sequencing

Record sequencing (entry mode only) can be specified in the RPG II specifications. Record sequencing occurs when a sequence number (columns 15 and 16 of the RPG II input specifications) is assigned to some or all of the record types specified. Sequenced records are assigned a frequency (column 17) of:

- 1, which indicates that the record occurs once in each sequence of records, or
- N, which indicates that the record occurs more than once in each sequence.

When record sequencing is used, the first record type in the sequence automatically appears for the initial display for the sequence. If you press the Select Format command function key, the next format in the record sequence appears. If the Select Format command function key is pressed when the format for the last record type in the sequence is displayed, the first record format reappears. If any sequenced record type is assigned a frequency of 1, the format for the next record type in the sequence is automatically selected (without pressing Select Format) after the record has been completed. If a record type has been assigned a frequency of N, that record type reappears after each record is completed until the Select Format command function key is pressed.

To select a nonsequenced record format (when some are sequenced) or to select a sequenced record format out of order, the operator must move the cursor to the record type field and key in the desired record type.

Automatic Zeroing of Packed Fields Not Specified for Processing

When you create a new record in a file, DFU automatically zeroes the first 100 packed fields not specified for processing at job setup. A packed field is zeroed after the operator has completed the record. The packed field is zeroed if it is not positioned in the record key of an indexed record and if the last character in the field is blank. The last character of the field can not be blank if a field specified for processing overlaps the packed field not specified for processing. The packed fields are zeroed in the order they are specified in the RPG II source specifications used for job setup. If a record type contains more than 100 packed fields that were not specified as fields to be processed, the excess packed fields remain as blanks in the record.

Initialization of Data Fields Not Keyed

When keying a new record for which the data will not all fit on a single display screen, you can complete a record without viewing all the screens for that record. You can do this by pressing the Rec Adv command function key before reaching the last display screen for the record. Data on the current display screen and all succeeding display screens will then be initialized as follows:

- Alphameric or unpacked numeric fields will be initialized to blanks.
- Packed numeric fields will be initialized to a packed value of zero (hexadecimal 0F in the last byte, and hexadecimal 00 in all remaining bytes).

Record Number Field Selection

At job setup, you can specify the name of a field to contain the relative record number when processing a direct file. When creating a new record in a direct file, the record number is saved in that field in the record. Also, the size of the field determines the length of the record number prompt at execution time; the maximum field length is 4 for packed data, and 7 for unpacked data.

Data Display Formats

There are three (single column, multiple column, and maximum data) data display formats available for displaying data. One of the three can be selected from the initial setup prompt display in the enter/update and inquiry functions. Examples of these formats are shown in Figures 6-3 through 6-5.

The criteria for selecting a particular data display format depend on the amount of data to be displayed, and the desired readability of that data on the screen. DFU will put as much data as possible on the screen for the particular format specified, and use as many display screens as necessary to display a record.

If the single column format is selected, DFU puts one data field on each line on the screen. All data keyed is left-aligned to the right of the longest data field heading. This format gives the least amount of data per screen, but offers the best readability.

If the multiple column format is selected, DFU attempts to put data alternately into 1, 2, 3, or 4 equal-length columns on the display screen. The column formats used are those that give the most data in the fewest number of displays. Within each column, data is left-aligned to the right of the longest heading in that column. This format puts more data on each screen than the single column format and still offers readability by formatting the data in a columnar presentation.

If the maximum data format is selected, data is placed directly to the right of its heading. Each succeeding data heading and associated field follow directly; a new line on the screen is started when the entire heading and data field will not fit on the current line. This format puts the most data on a screen, but offers the least readability.

Note: Even if the maximum data format is chosen, DFU first attempts to get all data in a columnar format and still fit it on a single display.

```
Title-------------------->                FILENAME:   NAME          MODE: ENTRY
RECORD TYPE: 01                                                   AUTO-DUP: OFF
   KEY HEADING 1 ......
   KEY HEADING 2 .........
   KEY HDNG 3    ..

DATA HEADING 1 .......
DATA HEADING 2 ........
DATA HDNG 3    .........
DATA HEADING 4 ....
DATA HEADING 5 .......
```

Figure 6-3. Single Column Data Display Format

```
Title-------------------->              FILENAME:   NAME          MODE: ENTRY
RECORD TYPE: 01                                                AUTO-DUP: OFF
   KEY HEADING 1 ......
   KEY HEADING 2 .........
   KEY HDNG 3    ...
DATA HEADING 1   ..                    DATA HEADING 2 ...........
DATA HEADING 3   ......                DATA HDNG 4    ......
DATA HEADING 5   .......
DATA HDNG 6      ..........................................................
DATA HEADING 7   ...                   DATA HEADING 8 ...........
DATA HEADING 9   ......
DATA HEADING 10  .........
DATA HEADING 11  ....
DATA HEADING 12  ...........
DATA HDNG 13     .....
DATA HEADING 14  ..........................................
DATA HDNG 15     ........
DATA HEADING 16  ...
DATA HDNG 17     ...........
DATA HDNG 18     ..
DATA HDNG 19     ...
DATA HDNG 20     ....
DATA HEADING 21  ......
```

Figure 6-4. Multiple Column Data Display Format

```
Title-------------------->              FILENAME:    NAME         MODE: ENTRY
RECORD TYPE: 01                                                AUTO-DUP: OFF
    KEY HEADING 1 ......
    KEY HEADING 2 .........
    KEY HDNG 3    ...
DATA HEADING 1   ........ DATA HDNG 2 ....................
DATA HEADING 3   ..................................... DATA HDNG 4 ......
DATA HDNG 5  ........  DATA HEADING 6 ..................................

    (Up to 15 more lines of data and associated headings)
```

Figure 6-5. Maximum Information Data Display Format

Ideographic Field Types

At job setup (if your system has ideographic support), you can specify fields to be any of these special types:

- Ideographic data only.
- Either ideographic or alphanumeric data. The field is initialized to ideographic data.
- Either ideographic or alphanumeric data. The field is initialized to alphanumeric data.

If you specify any of these special field types, the field must be defined as alphanumeric in the RPG input specifications, must have an even number of positions, and must have more than three positions. Prompts for these field types appear only if you are signed on in ideographic session.

ENTER/UPDATE SETUP PROMPTS

The enter/update setup allows you to create a format description that prompts the operator during the enter/update execution for the information required to create and update the records in the data file. DFU attributes and specifications created during setup can be saved for use in similar DFU jobs requiring a similar format description by selecting that option in the DFU source processing parameter in Enter or Update setup command or on the parameter prompt display.

When the job setup step is required, and saved DFU specifications are not used as input, DFU begins a prompting sequence in which you specify the process desired. The following pages describe the prompts and the order in which they appear.

General Information

The first display for setting up an enter/update job is one of the following:

- The contents of Figure 6-6 appear when processing an indexed file.
- The contents of Figure 6-7 appear when processing a sequential or direct file.

Note: The difference between these two displays is that you have the option of DFU generating record keys (indexed files only, Figure 6-6) or record numbers (direct or sequential files only, Figure 6-7).

```
ENTER/UPDATE GENERAL INFORMATION

      DATA DISPLAY FORMAT.......................... B
           A=SINGLE COLUMN    B=MULTIPLE COLUMNS    C=MAXIMUM DATA


      JOB TITLE.....................................
      DELETE CODE,POSITION.........................  ,1
      PRINT NEW RECORDS? (Y,N)..................... N
      PRINT UPDATED/DELETED RECORDS? (Y,N) ........ Y
      PRINTER COLUMN SPACING (0-9)................. 1
      PRINTER LINE WIDTH (60-198).................. 132
      HALT ON UNPRINTABLE CHARACTERS? (Y,N)........ N
      DFU TO GENERATE KEYS? (Y,N).................. Y
```

Figure 6-6. Enter/Update General Information Display–Indexed Files

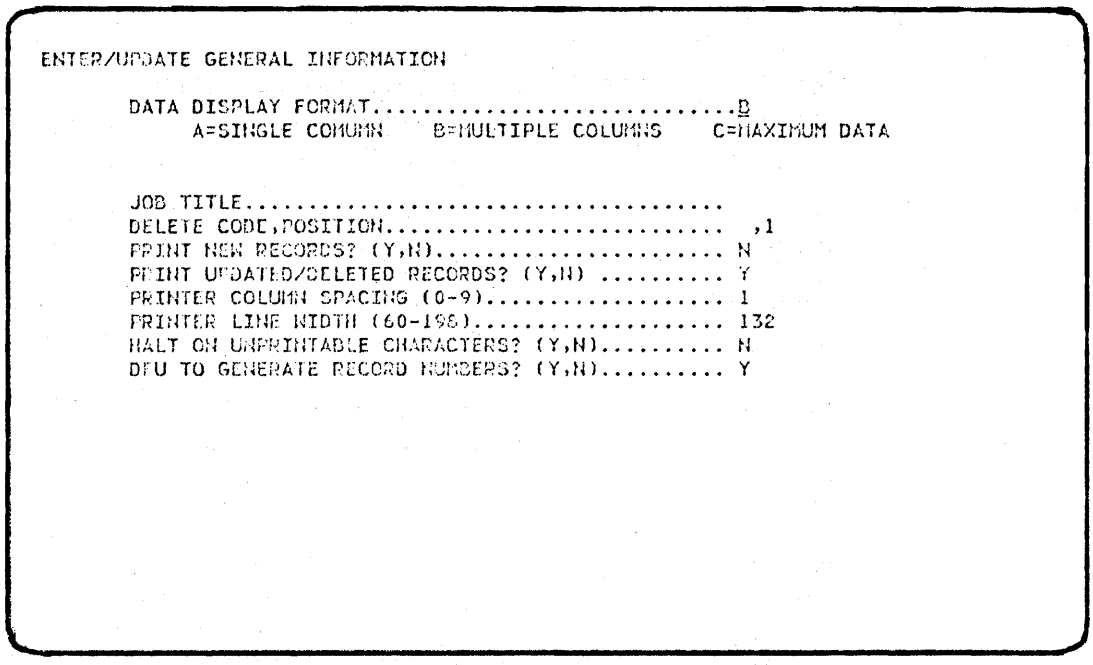


Figure 6-7. Enter/Update General Information Display–Sequential or Direct Files

Note: Do not use the option of DFU generating record numbers if processing sequential files.

Prompt	Response	Explanation
DATA DISPLAY FORMAT	A B C	During execution, data is displayed to the right of its heading. Data and headings are displayed in 1 to 4 columns. A–Single column (Figure 6-3) B–Multiple columns (Figure 6-4) C–Maximum data (Figure 6-5)
JOB TITLE	Null or literal	Specifies the title (up to 24 characters) that appears on the printer output and the display screen for this job.
DELETE CODE, POSITION	Null or Delete code, position (no intervening blanks)	Indicates the delete code character and its position. The default for a null response is a blank in position one of the records; if the key field of an indexed file occupies that position, you must enter a delete code and a position not part of the key field. Records are not physically deleted, but marked with the delete code for later deletion by the user.

Prompt	Response	Explanation
PRINT NEW RECORDS? (Y, N)	Y YES N NO	YES indicates that all records created during execution will be printed. NO indicates that the new records are not to be printed.
PRINT UPDATED/ DELETED RECORDS? (Y,N)	Y YES N NO	YES indicates that all records updated or deleted during execution will be printed. NO indicates that updated or deleted records are not to be printed.
PRINTER COLUMN SPACING (0-9)	0-9	Specifies the number of spaces between fields on the printed output; the default value is 1.
PRINTER LINE WIDTH (60-198)	60-198	Specifies the width of the printer line; the default is 132. Widths greater than 132 positions require special consideration. See the discussion of printer line width in this chapter.
HALT ON UNPRINTABLE CHARACTERS? (Y,N)	Y YES N NO	YES indicates that the printer halts and an SSP message is issued to indicate that unprintable characters are in the data to be printed. NO indicates that no halt occurs when unprintable characters are in the data to be printed. Blanks are substituted for the unprintable characters. N is the default.
INDEXED FILE:		
DFU TO GENERATE KEYS? (Y, N) *Note*: This prompt appears if the record key is five positions long (unpacked) or three positions (packed)	Y YES N NO	YES indicates DFU is to generate keys for the file. For a new file, the first key generated will be 00010; for an existing file, the first key generated will be the current high key value rounded up to the next multiple of 10. Y is the default. NO indicates record keys are provided by the operator during job execution.

Prompt	Response	Explanation
SEQUENTIAL or DIRECT FILE:		
DFU TO GENERATE RECORD NUMBERS? (Y,N)	Y YES	YES indicates that DFU is to generate record numbers for the file. The first record number generated is that of the first blank record in the file; each succeeding record number is incremented by 1. Y is the default. If you specify YES for direct or sequential files, the time it takes to sign on for an update job will be proportional to the number of records in your file.
	N NO	NO indicates that record numbers are provided by the operator during job execution NO should be specified for a sequential file.

For the remainder of the setup prompts, the top half of the display contains DFU attributes or DFU specifications. This allows you to see the records and fields you have to choose from (DFU attributes), and also allows you to see the fields/options you have already selected for processing (DFU specifications). Use the following keys to display the attributes/specifications:

DISPLAY ATTR/SPEC command function key–reverses the display of DFU attributes to DFU specifications, or DFU specifications to DFU attributes, depending on which is displayed.

Roll ↑ (up) function control key–displays the next set of attributes or specifications, whichever is currently on display. If the last attribute or specification is already on display, it displays the start of the attributes or specifications.

Roll ↓ (down) function control key–displays the preceding set of attributes or specifications, whichever is currently on display. If the first attribute or specification is already on display, it displays the end of the attributes or specifications.

If DFU specifications are on display when you respond to a prompt, the specifications, created as a result of the response, will be automatically displayed.

After you press a Roll function control key or the Display Attr/Spec command function key, DFU positions the cursor on the next line in which data is most likely to be entered.

Key Field Specification

This prompt (Figure 6-8) appears when DFU is processing an indexed file and is not automatically generating record keys. This display requests the name(s) of the field(s) (contained in the RPG I specification) that make up the record key for the file. This allows the record key to be subdivided by field and allows special functions such as accumulation, auto-duplication, and modulus checking on any or all of the fields of the record key.

Note: Auto-duplication cannot be specified for all of the fields which make up the record key.

If you press the Enter/Rec Adv function control key without entering data, the record key definition is taken from the RPG II file description specification and the record key then consists of one field. The display in Figure 6-9 will appear next.

The fields which make up the record key must be next to each other in the record. If you enter fields and press the Enter/Rec Adv key, DFU saves those fields and reprompts so more can be added (unless the maximum of five fields have been specified). But if you key fields and press the Rec Adv command function key, the record key prompting is complete. The display in Figure 6-11 will then appear.

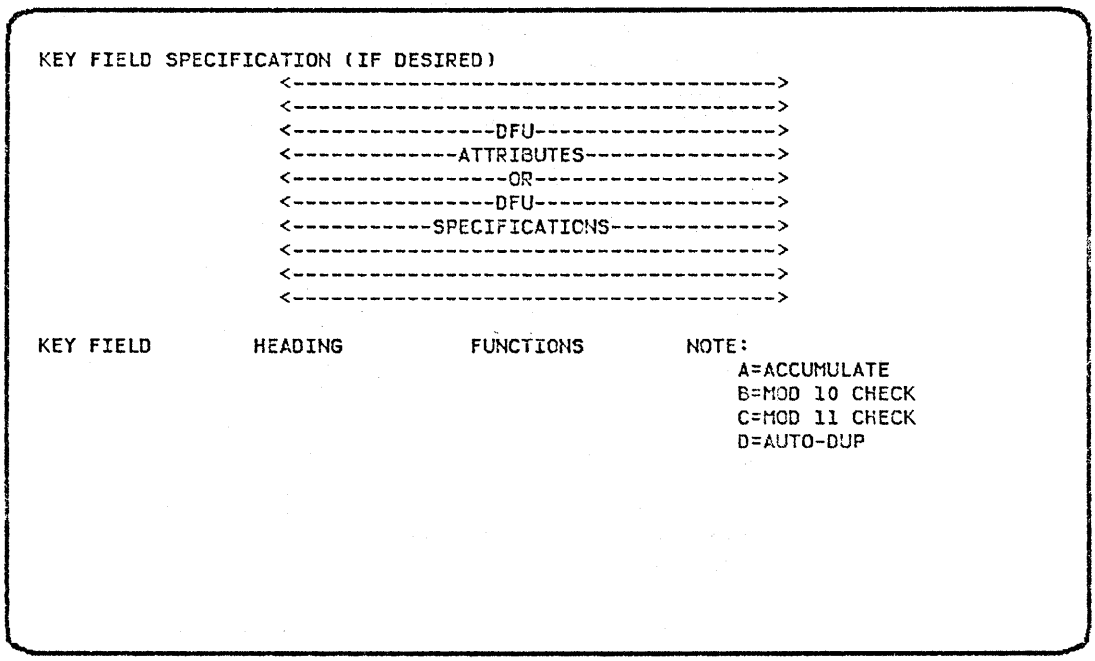


Figure 6-8. Key Field Specification Display for Enter/Update of Indexed Files

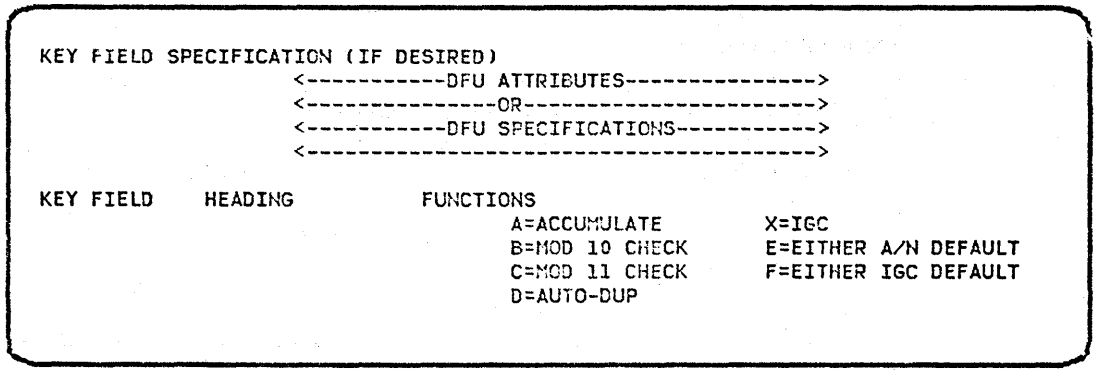


Figure 6-8.1. Key Field Specification Display for Enter/Update of Indexed Files (Ideographic Session)

Prompt	Response	Explanation
KEY FIELD	Name of next field that makes up the record key	The field(s) named must encompass the entire record key area.
HEADING	Literal; identifies the field when the field is printed or displayed	The maximum length is 16 characters; a null response defaults to the field name.
FUNCTIONS	Letters corresponding to the desired functions	The letters may be contiguous or separated with commas or blanks. A–Accumulated field B–Modulus 10 field C–Modulus 11 field D–Auto-duplication field X–Ideographic data only E–Either ideographic or alphanumeric data. The field is initialized to alphanumeric data. F–Either ideographic or alphanumeric data. The field is initialized to ideographic data. Function D cannot be selected for all the fields of the record key. Functions B and C are mutually exclusive responses. Functions X, E, and F are mutually exclusive and exclusive of functions A, B, and C. Functions X, E, and F are allowed only if you are signed on in ideographic session.

Record Key Description

This display (Figure 6-9) occurs when processing an indexed file and:

- DFU is generating record keys, or
- You did not specify any field names for the record key on the prompt shown in Figure 6-8.

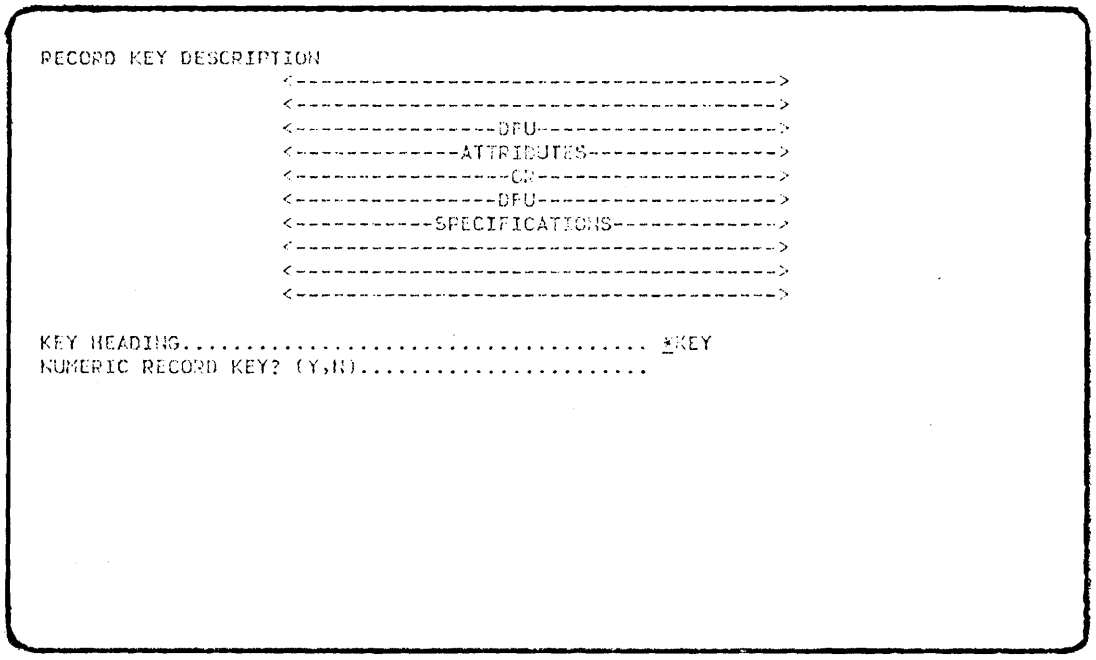


Figure 6-9. Record Key Description Display for Enter/Update–Indexed Files

Prompt	Response	Explanation
KEY HEADING	*KEY Literal	Specifies the heading for the record key. The maximum length is 16 characters; the default is *KEY.
NUMERIC RECORD KEY? (Y, N)	Y YES N NO	YES indicates that all keys are numeric fields, with a sign position. NO indicates that all record keys are alphameric fields. There is no default for this prompt.

Note: This prompt appears if all these conditions are met:

- DFU is not generating record keys.
- The key field is not packed.
- The key field is less than 16 positions long.

Record Number Description

This prompt (Figure 6-10) appears when processing a sequential or direct file. This display requests the heading to be displayed at execution time for the record number field. If desired you can name a field to contain the record number. The record number displayed at execution time is the actual record number in the file, not the value that is in the named record number field.

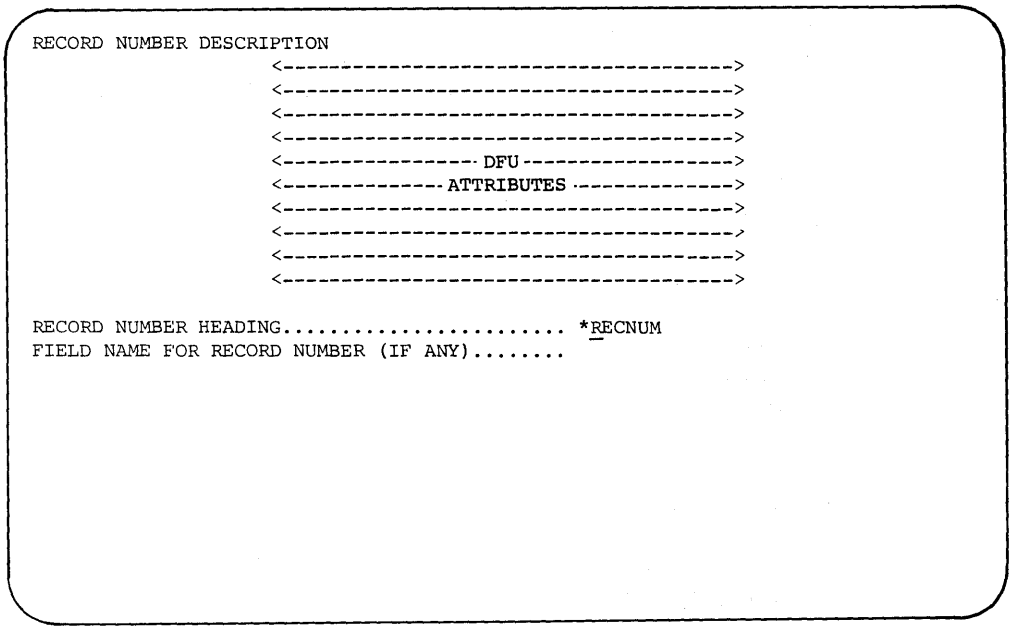


Figure 6-10. Record Number Description Display for Enter/Update—Sequential or Direct Files

Prompt	Response	Explanation
RECORD NUMBER HEADING	*RECNUM Literal	Specifies the heading for the record number field. The maximum length is 16 characters; the default is *RECNUM.
FIELD NAME FOR RECORD NUMBER (IF ANY)	Null or Field name	This names the field to hold the record number when creating a new record. This field must exist in every record type to be processed. The length of the field determines the length of the record number prompt; the maximum field length is 7 positions (unpacked) or 4 positions (packed). A null response indicates the record number will not be put in the record; the record number prompt length will then be 7 characters.

Record Type Selection

This prompt (Figure 6-11) occurs for each record type in the file. The 01 is replaced with the record identifying indicator of the record type currently prompted for. The DFU attributes include the record identifying indicator of the record type and as many fields as possible from the record type.

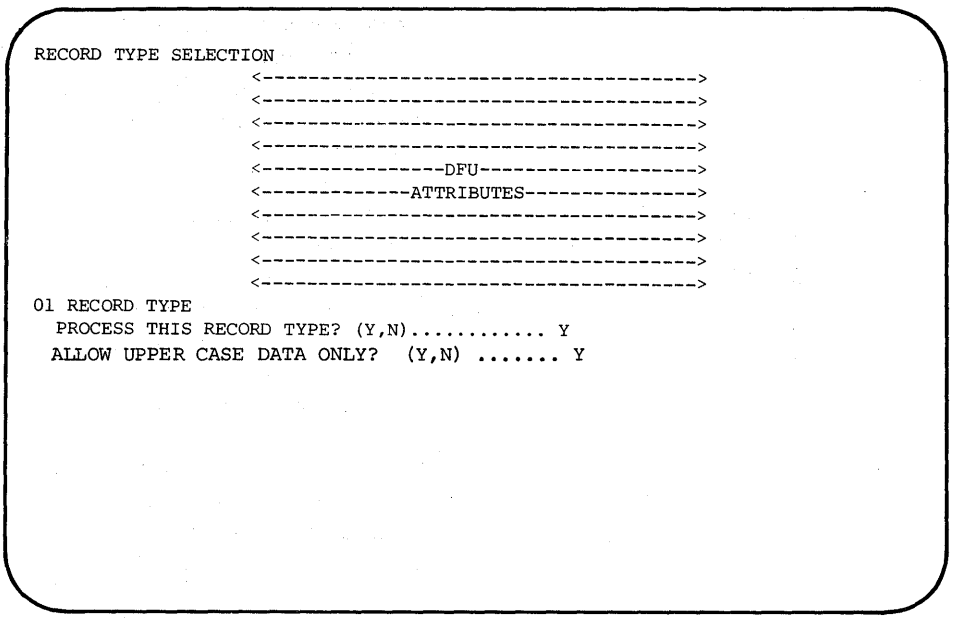


Figure 6-11. Record Type Selection Display for Enter/Update

The maximum number of record types DFU can process for enter/update depends on the number of display screens required for each record type. A maximum of 31 display screens can be created. Therefore, if some record types require multiple screens, the maximum number of record types that can be processed will be 31, less the number of additional display screens required.

Note: If you respond YES to this prompt, you should enter at least one data field on the next prompt (Figure 6-11) to avoid the problem of having no data to key at execution time. At execution time, DFU bypasses displays that have no input to be keyed and proceeds to the next logical display. This occurs if a record type has no data fields to display or if all of the data fields on a display are defined as auto-duplication fields and the auto-duplication indicator is ON. In these cases, no data is displayed at execution time when:

- DFU is generating record keys or record numbers for that record type. DFU creates and writes records in the file until the file is full or until the record type is changed (via sequenced record types).

- You request a record of that type for update. DFU retrieves the record, determines no data can be entered, and prompts for another record.

Prompt	Response	Explanation
PROCESS THIS RECORD TYPE? (Y, N)	Y YES N NO	YES indicates the record type is to be processed. The next prompt will be for the data fields from this record type (Figure 6-8). NO indicates the record type not to be processed. If there are more record types in the file, this prompt will repeat for the next defined record type; otherwise, the prompt is complete and you can update the created specifications.
ALLOW UPPER CASE DATA ONLY? (Y,N)	Y YES N NO	YES indicates the operator can only key uppercase data for this record type at execution time. NO indicates the operator can key uppercase and lowercase data for this record type at execution time. The operator must shift to uppercase or lowercase as needed. *Note:* The record key must be considered along with the data when determining whether lowercase characters are required for a record type.

Data Field Specification

You can enter one field per line, up to and including the next to the last line of the display (Figure 6-12) and press the Enter/Rec Adv function control key; DFU saves those fields then prompts for more (unless 40 fields including the record key or record number field have been specified). But if you enter fields and press the Rec Adv command function key, the data field specifications are considered complete for the current record type.

Pressing the Enter/Rec Adv function control key or the Rec Adv command function key without keying data terminates the data field prompting for this record type.

Refer to Figure 6-11 if more record types are defined; otherwise, the prompting is complete for this portion of the job. The next display allows you to update DFU specifications.

Note: When creating a record, any packed fields not specified to be processed for this record type, and not part of a record key are initialized to packed zero values by DFU. A maximum of 100 of these fields are initialized per record type.

```
DATA FIELD SPECIFICATION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR--------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
                                                    RECORD TYPE: 01
DATA FIELD        HEADING           FUNCTION          NOTE:
                                                        A=ACCUMULATE
                                                        B=MOD 10 CHECK
                                                        C=MOD 11 CHECK
                                                        D=AUTO-DUP
```

Figure 6-12. Data Field Specification Display for Enter/Update

```
DATA FIELD SPECIFICATION
                    <-----------DFU ATTRIBUTES--------------->
                    <---------------OR----------------------->
                    <-----------DFU SPECIFICATIONS----------->
                    <---------------------------------------->
                                                          RECORD TYPE: 01
DATA FIELD   HEADING          FUNCTIONS
                                    A=ACCUMULATE        X=IGC
                                    B=MOD 10 CHECK      E=EITHER A/N DEFAULT
                                    C=MOD 11 CHECK      F=EITHER IGC DEFAULT
                                    D=AUTO-DUP
```

Figure 6-12.1. Data Field Specification Display for Enter/Update (Ideographic Session)

Prompt	Response	Explanation
DATA FIELD	Name of next field to be processed	These fields cannot overlap the record key when processing an indexed file.
HEADING	Literal; identifies the field when the field is printed or displayed	The maximum length is 16 characters. A null response defaults to the data field name.
FUNCTIONS	Letters corresponding to the desired functions	The letters may be contiguous or separated by commas or blanks. A–Accumulated field. B–Modulus 10 field. C–Modulus 11 field. D–Auto-duplication field. X–Ideographic data only. E–Either ideographic or alphanumeric data. The field is initialized to alphanumeric data. F–Either ideographic or alphanumeric data. The field is initialized to ideographic data. Functions B and C are mutually exclusive. Functions X, E, and F are mutually exclusive and exclusive of functions A, B, and C. Functions X, E, and F are allowed only if you are signed on in ideographic session.

Note: For any record type only as many fields as will fit on three print lines can be processed at one time, up to a maximum of 40 fields (including any record key or record number fields).

Updating the DFU Specifications

When the setup step is completed, the following display (Figure 6-13) appears so that you can update the DFU specifications before going to the execution portion of enter/update. Chapter 10 describes the procedure for updating/correcting DFU specifications.

Press the EOJ command function key when DFU specifications are complete. This causes the DFU format and the display screen format to be created, and enter/update execution to begin.

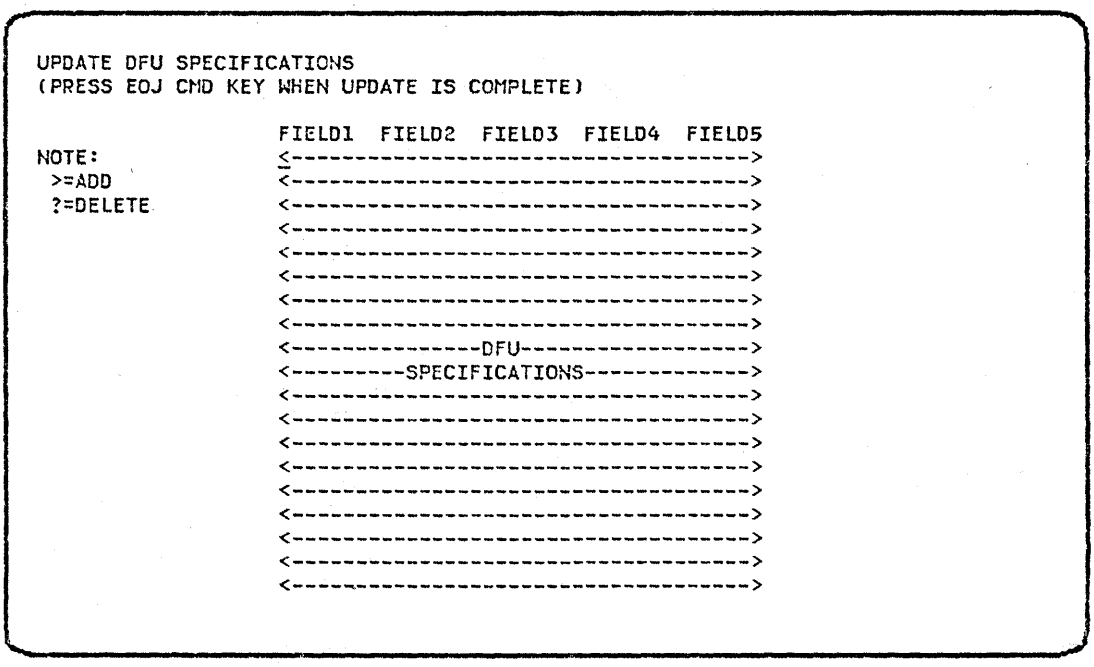


Figure 6-13. Updating DFU Specifications Display

ENTER/UPDATE EXECUTION

Enter/update execution starts after a format description and screen formats are built. During execution, the operator is prompted to enter the record key number and record data fields described in the format.

Only those fields defined at job setup are prompted for. As many fields as can fit on the display station screen for a record are prompted for at one time.

ENTER/UPDATE DISPLAY

When you enter or update data, the display contains the following information:

- Status information
- Record key or record number fields and headings
- Data fields and headings
- Errors

Status Information

Lines 1 and 2 of the display contain the status information for the current DFU enter/update job. The operator cannot key over this information except to change the current record type.

Title: This is the job title you specify at job definition time; this title also appears on any printer output for this job.

File: This is the name of the file being created or updated.

Mode:

ENTRY — A new record is being created.

UPDATE — An existing record is being modified.

INSERT — A new record is being created. This mode functions like entry mode except that automatic record type sequencing and DFU record key or record number generation are suspended. Additionally, if processing an indexed file and the DFU format description specifies DFU generated record keys, the the operator must enter record keys less than the next key DFU will generate.

Record Type: This field shows what record type is being processed. The operator can change this value by keying a new value after positioning the cursor at this field. (Pressing the Select Format command function key positions the cursor here when automatic record sequencing is not in effect.)

Last Record Type: This is the record identifying indicator of the last record processed. It is blank for the first entry processed. It is also blank if a record is retrieved while in update mode, and DFU is unable to determine the record type.

Auto-Duplication: This field is either ON or OFF to indicate whether or not auto-duplication is in effect. The status of this field is reversed by pressing the Auto Dup command function key.

Record Key or Record Number Fields and Headings

When processing an indexed file the record key is composed of from one to five fields. Beginning on line three, the screen displays the headings and data or data area for each field that makes up the record key (one key field per line).

When processing a sequential or direct file, the record number prompt appears on line 3.

The record key indicates the current record being processed. The operator keys the record key or record number field(s) to select a record. Once the record key or record number has been specified, and the first display for the record type has been entered, the record key or record number cannot be modified without completing the current record or restarting record processing. Pressing the Rec Bksp command function key or one of the mode selection command function keys will restart record processing.

Data Fields and Headings

If a record requires more data than fits on the first display, additional displays appear to allow completion of the record. If space allows, a blank line separates the data fields from the record key or record number on the display.

The format of the field headings and data depends on the data display format option selected by the operator at job setup.

When a new display appears, the cursor is positioned at the first field where data can be entered. Alphameric fields are left-justified; numeric fields are right-justified.

Numeric fields have one more position than the actual field size. This is the rightmost position in the field which contains the sign (- indicates a negative sign; blank indicates a positive sign). If the operator wants a negative field, the Field- key places a minus sign in this position. For a positive field, the Field+ function control key should be used (though the + sign is not displayed).

Errors

The last line of the display displays error and informational messages. This line is blank until an error is detected in data entry, at which time the field, field heading, and error message is displayed and highlighted. The MIC (message identification code) is also displayed so the operator can easily look up the error in the *Displayed Messages Guide*. Informational messages are displayed without the MIC, and processing can continue normally.

ENTER/UPDATE PROCESSING

DFU can be used to create, update, or add to indexed or direct files. It can be used to change records in sequential files. Each record in an indexed file can be retrieved by specifying the unique record key associated with that record. (The key is located in the same position in each record.) The record key can consist of one to five fields. Each record in a sequential or direct file can be retrieved by specifying the relative record number of the record in the file.

Note: Even though the record number field can be defined as alphameric data, DFU creates/retrieves records as if the data was numeric.

Enter/update processing functions in one of three modes: entry, update, or insert. The operator selects the processing mode by pressing the appropriate command function key.

Entry Mode

Any record key specified during entry mode while processing an indexed file must not exist in the data file or an error message is displayed and the duplicate record key is rejected.

Any record number specified during entry mode while processing a direct file must exist within the file and correspond to a record that is currently blank; if not, an error message is displayed and the record number is rejected.

The initial display format is for the first record type specified in the DFU format description unless record sequencing is specified. In this case, the first sequenced record type in the DFU format description is displayed. An operator can always select a different record type by positioning the cursor at the RECORD TYPE field and keying in a new record type. If record sequencing is not automatic, the cursor can be positioned at the RECORD TYPE field by pressing the Select Format command function key. Whenever returning to entry mode from another mode, the record type is reset to the last record type processed in entry mode. When returning to entry mode and the next entry record type is different than the last record type processed, the operator should turn off the auto-duplication indicator.

Operator-Specified Record Keys or Record Numbers

When the operator specifies record keys or record numbers, the initial display prompts for (1) the record key or record number of the record to be processed, and (2) all of the fields for that record type that fit on the first display for that record. The record key or record number appears on any succeeding displays along with remaining field prompts; however, the record key or record number cannot be modified after the first display is entered.

Figure 6-14 shows a sample initial display where the operator is supplying record keys. In this example, the key of the record consists of an invoice number and line number. Figure 6-15 is a similar example, but with one field auto-duplicated from the previous record. Data cannot be entered into an auto-duplicated field while the auto-duplication indicator is on.

```
DAILY SALES OPDEPS                    FILENAME: SALESORD          MODE: ENTRY
RECORD TYPE: 01                 LAST RECORD TYPE                AUTO-DUP: OFF
   INVOICE NUMBER  ......
   LINE NUMBER     ..

DATE            ........
CUST ORD. NO.   .....
CUSTOMER NUMBER .....
SHIP TO         ..
SHIP VIA        ..........
```

Figure 6-14. Entry Mode, Sample Display with Operator-Supplied Record Keys

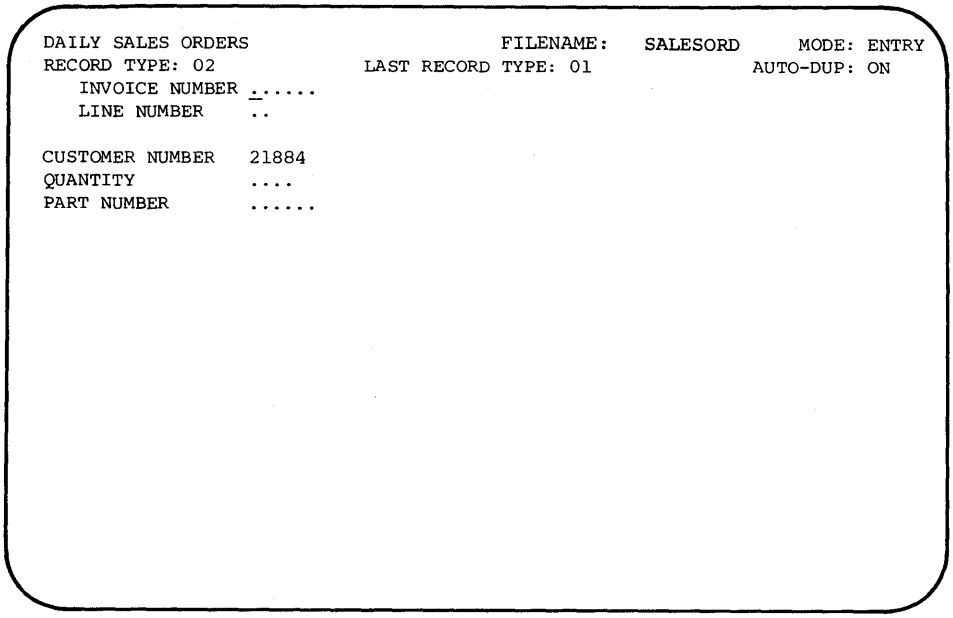


Figure 6-15. Entry Mode, Sample Display with Automatic Field Duplication

Automatic Record Type Sequencing

If automatic sequencing of record types is defined for this job (see *Record Sequencing* earlier in this chapter for a description of how to define this), DFU selects record types for the operator as follows:

- The initial record displayed is of the first, or only, type in the sequence.
- When the operator presses the Select Format command function key, or finishes keying a record defined as occurring once in each sequence, DFU automatically displays the next record type in the sequence. If there are no more record types in the sequence, the first record type is again displayed. If two or more record types in the sequence are in an OR relation, the system displays the next record type that is not included in that OR relation.
- To select a nonsequenced record type, or to select a sequenced record type out of sequence, the operator must position the cursor at the record type field and key the desired record type code. If the operator requests a nonsequenced record type, he is allowed to key that record. Upon completion of the record entry, the record type is reset to the last sequenced record type displayed.

DFU Generated Record Keys (Indexed Files)

When DFU generates the record keys, the initial display contains the first record key and prompts for the first set of fields for the record type indicated. DFU starts with a key value of 00010 when a file is created. When an existing file is being updated, DFU locates the highest key and starts generating record keys at the next multiple of 10.

The operator can specify a new record key that is less than the next key to be generated by pressing the Insert command function key to switch processing to insert mode. The operator can update existing records by pressing the Update command function key. To return to DFU generated record keys when in insert or update mode, the operator must press the Entry command function key.

Except that the record key is generated by DFU rather than the operator, processing with DFU generated keys is the same as processing with operator specified keys. Figure 6-16 shows an example of a DFU generated record key.

Note: DFU suspends the automatic generation of keys if one of the following occurs:

- The record key to be generated is greater than 99990.
- A duplicate record key error is encountered when DFU attempts to write a record for which it had generated the key. In this case it is assumed that another operator is already using the DFU generated key option for this file.

In these cases, the operator can still process in entry, insert, or update mode; however, DFU will no longer supply record keys in entry mode.

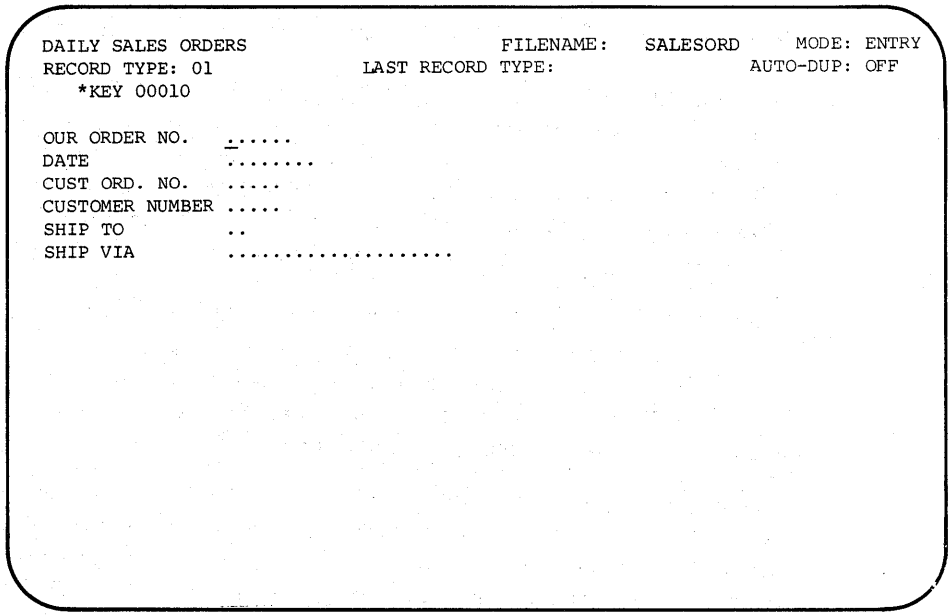


Figure 6-16. Entry Mode Sample Display with DFU Generated Record Keys

DFU Generated Record Numbers (Direct Files)

When DFU generates the record numbers, the initial display contains the first record number and prompts for the first set of fields for the record type indicated. When a file is being created, DFU starts with a record number of 1. When an existing file is being updated, DFU locates the first blank record in the file and starts with the corresponding record number. Because DFU reads the file consecutively until a blank record is found, the time required to sign on is proportional to the number of intervening nonblank records that must be read. Each succeeding record number is 1 greater than the record just created. The operator can specify record numbers by pressing the Insert command function key to switch processing to insert mode. The operator can update existing records by pressing the Update command function key. To return to DFU generated record numbers when in insert or update mode, the operator must press the Entry command function key.

Note: DFU suspends the automatic generation of record numbers if the next record number to be generated:

- Is higher than the last record in the file
- Is too large for the record number promoting field
- Corresponds to a record that is currently not blank

In these cases, the operator can still process in entry, insert, or update mode; however, DFU will no longer supply record numbers in entry mode.

Accumulators

After a record is complete, DFU updates the batch accumulator for any accumulator fields the record may contain. This update is as follows:

Entry mode or insert mode: Accumulators are added to the appropriate batch totals.

Update mode: If a record is deleted, accumulators are subtracted from the batch totals.

If a deleted record is changed to nondeleted status (by changing the delete code), the accumulators are added to the batch totals.

If a record is changed, changes to the accumulator fields are reflected in the batch totals.

When the batch accumulators are updated, it is possible for the values to overflow their respective hold areas. In this case, a display such as the following example (Figure 6-13) appears to show which accumulator values overflowed. The overflow value displayed is the last value of the accumulator before overflowing; the accumulator is reset to the value in the field of the record causing the overflow.

This information is also printed if a printer has been used in this job.

```
OVERFLOW IN BATCH ACCUMULATOR(S)

 ACCUMULATOR 1              XXXXXXXXXXXXXX.X
 ACCUMULATOR 4              XXXXXXXXXXX.XXXX









(PRESS ENTER KEY TO CONTINUE)
```

Figure 6-17. Accumulator Overflow Display Example

Update Mode

When processing indexed files, the operator presses the Update command function key and is prompted for a record key currently in the data file (Figure 6-18). When such a key is specified the record is retrieved, the data fields and associated headings are displayed, and all but the record key can be modified (Figure 6-19).

When processing sequential or direct files, the operator presses the Update command function key and is prompted for the record number of a record that exists in the file. The record must not be blank. When such a record number is specified, the record is retrieved, the data fields and associated headings are displayed and all but the record number can be modified. If a record is displayed with the wrong record type format, or if DFU is unable to associate a record with one of the defined record types (by record codes), the operator can position the cursor at the record type field and select the format in which the record is to be displayed.

When updating direct or sequential files, the operator may request records for update using a scrolling technique. Pressing the Roll ↑ (up) function control key retrieves the next nonblank record in the file. Pressing the Roll ↓ (down) function control key retrieves the preceding nonblank record in the file. The record used as the base for the scroll is the last record processed (entered or retrieved for update).

Note: If the auto-duplication indicator is on, fields defined to be auto-duplicated cannot be modified.

Insert Mode

Insert mode is used to enter new records without automatic record type sequencing or automatic record key or record number generation. Insert mode is selected by pressing the Insert command function key. When beginning insert mode, the record type is set to that of the last record type processed. When processing indexed files the operator is prompted for a record key; and the associated data. Thereafter, insert mode functions like entry mode with operator specified record keys. If DFU generated record keys are specified in the DFU format, however, the operator must specify a new record key less than the next record key to be generated by DFU.

When processing direct files, the operator is prompted for a record number and the associated data. It functions like entry mode with operator specified record numbers. The record corresponding to the specified record number must exist in the file and must currently be blank.

The insert mode can also be used when DFU generated record keys or record numbers are not specified. In this case it functions exactly like entry mode except that there is no automatic selection of record types. Figure 6-20 shows a sample insert mode display.

```
DAILY SALES ORDERS                    FILENAME:  SALESORD      MODE: UPDATE
                                LAST RECORD TYPE: 01           AUTO-DUP: OFF
   INVOICE NUMBER _.....
   LINE NUMBER    ..
```

Figure 6-18. Update Mode, Example of Record Key Prompt Display

```
DAILY SALES ORDERS                    FILENAME:  SALESORD      MODE: UPDATE
RECORD TYPE: 02            LAST RECORD TYPE: 02              AUTO DUP: OFF
   INVOICE NUMBER XC4312
   LINE NUMBER    02

CUSTOMER NUMBER 01313
QUANTITY        0015
PART NUMBER     412009
```

Figure 6-19. Update Mode, Sample Display

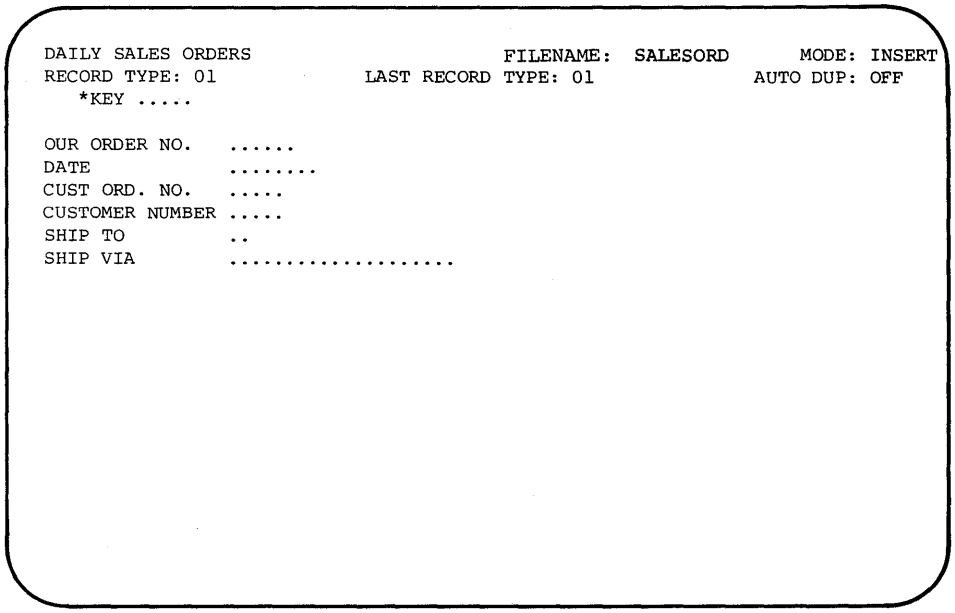


Figure 6-20. Insert Mode, Sample Display

ENTER/UPDATE EOJ

When the operator selects end-of-job (EOJ) by pressing the EOJ command function key, the display on Figure 6-21 appears. If a NO response is selected, DFU returns to the start of the last processing mode exited. If the default (YES) is selected, DFU ends the job. When you are using DFU to create or update a file, the number of records entered, updated, and deleted is displayed on the display station when EOJ is selected. In addition, the record count is printed as the last line of the listing if printing has previously occurred.

If the operator selects YES and no accumulators have been used, processing is terminated. If accumulators have been used during processing, the display in Figure 6-22 appears. When the operator is finished viewing the batch accumulator display, pressing Enter/Rec Adv displays the total accumulators (Figure 6-23). Pressing the Enter/Rec Adv function control key terminates processing.

Note: If any accumulators overflowed during the job, DFU issues an ACCUMULATORS OVERFLOWED warning message.

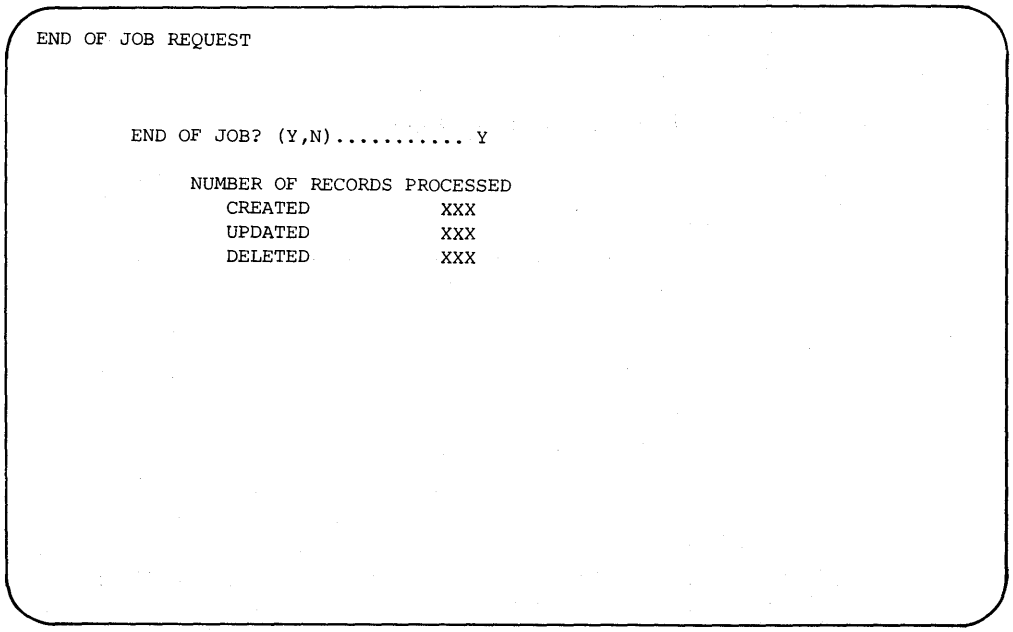


Figure 6-21. End-of-Job Display

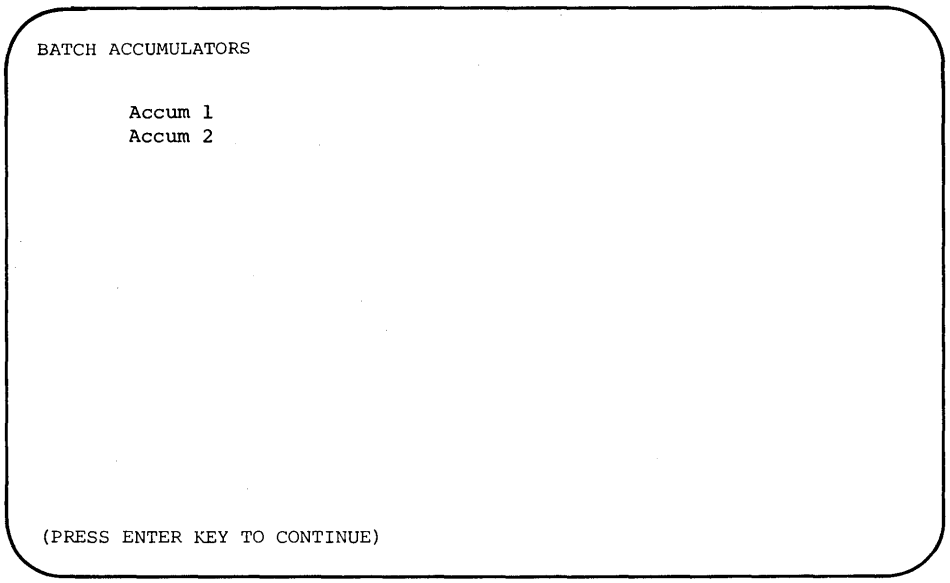


Figure 6-22. Batch Accumulators Display

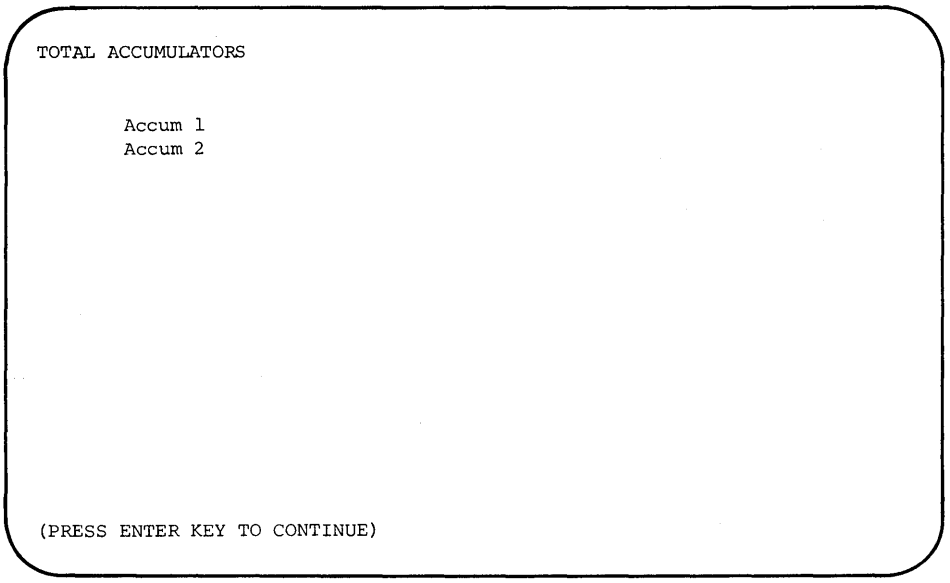


Figure 6-23. Total Accumulators Display

Chapter 7. Inquiry

The inquiry function allows access to indexed, sequential, or direct data files. This function is used to selectively view (and print if desired) any portion of, or all of such data files.

Refer to the *Programmer Considerations* section in Chapter 1 for information relating to the use of the inquiry function.

INQUIRY COMMAND

The INQUIRY command is interpreted by DFU as setup or execution depending on whether the DFU format name (parameter 2) you supplied already exists or not. When you enter the DFU format name, DFU checks to see if it already exists. If so, DFU skips the setup portion and goes directly to the execution portion of the inquiry function.

Inquiry setup builds a format description and screen formats to display a data file. If a new format is to be created with the same name as an existing format, the existing format name must first be removed from the library. See *Saved DFU Specifications* in Chapter 10 for more detail.

Inquiry execution displays a data file using an existing format description created during the inquiry setup portion. The format for the INQUIRY command is:

```
INQUIRY filename,DFU format name,RPG II source name,,filetype,DFU
source processing,DFU source name,,user library,display format source
name
```

Notes:

1. The number of records parameter and the master filename parameter are not used for the INQUIRY command, but commas must be put in their places.
2. User library must be entered if the format description, RPG II member, and DFU specifications are in that library or to be placed in that library. The system library is used if this parameter is omitted.
3. If the filename or the DFU format name is omitted on the initial inquiry command, all the command parameters are prompted for on a single display (Figure 7-1).

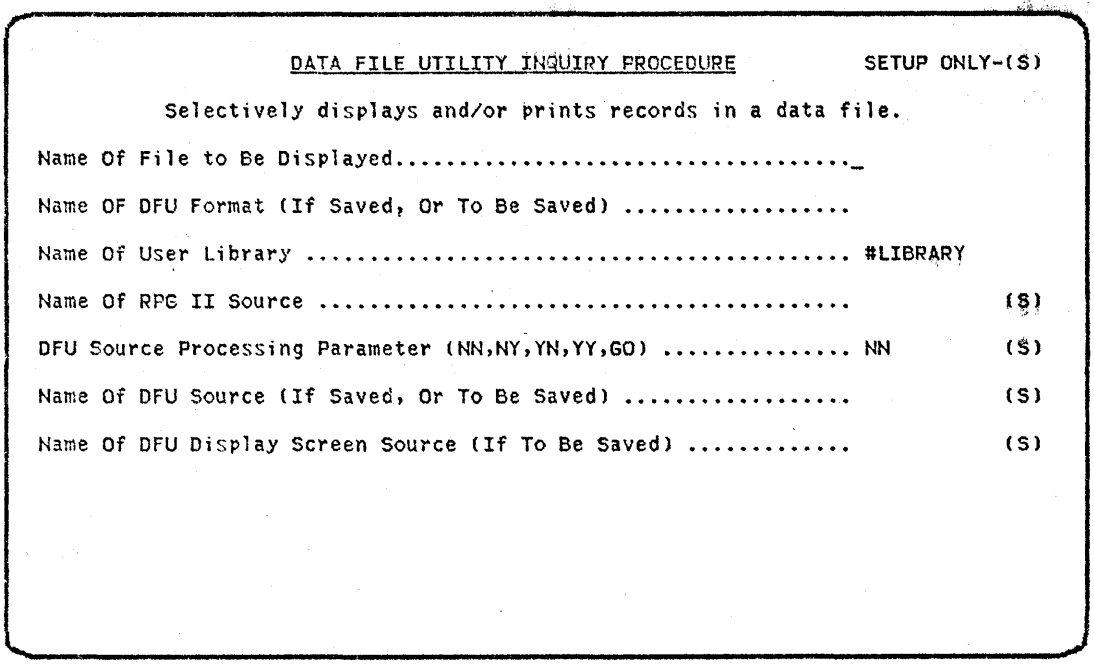


Figure 7-1. Inquiry Command Parameter Prompt

This prompt (Figure 7-1) appears when the command is requested, and the file (parameter 1) or the DFU format name (parameter 2) is not specified on the initial command. Any other parameters keyed on the initial command appear to the right of the corresponding prompts on this screen. The default parameters (#LIBRARY for the user library and NN for the DFU source processing parameter) will appear if nothing is entered for these parameters on the initial command.

Fill in the appropriate parameters and press the Enter/Rec Adv key to continue processing. Note that the last four prompts need be filled in only if the DFU format does not currently exist, and DFU job setup must be called.

INQUIRY FEATURES

Before setting up an inquiry job, you should know what DFU features are available to you during inquiry execution:

- Retrieving records by record key or record number
- Scrolling records
- Printing selected records
- Printer line width from 60 to 198 positions
- Specifying ideographic field types

Retrieving Records by Record Key or Record Number

When processing an indexed file, any record in the sorted index area of the file can be requested by entering its record key. If the record does not exist in the sorted index area of the file, an error message is issued and the operator can request a different record key. When processing a sequential or direct file, any record in the file can be requested by entering its record number. If the record number does not exist in the file limits, or the record number corresponds to a blank record, an error message is issued and the operator can request a different record number.

Scrolling Records

Instead of requesting a record by its record key or record number, the operator can display record(s) by scrolling. Pressing the Roll ↓ (down) function control key displays the preceding record from the record currently being displayed in key sequence when processing an indexed file, or the first preceding nonblank record from the record currently being displayed when processing a sequential or direct file. Pressing the Roll ↑ (up) function control key displays the next record from the record currently being displayed in key sequence when processing an indexed file, or the next nonblank record from the record currently being displayed when processing a sequential or direct file.

For indexed files, if a record key has been entered in the record key response area, DFU displays the next record with a key value equal to or greater than the record key value entered. If this key is higher than the last key in the file, the last record is displayed.

For direct or sequential files, DFU displays the next nonblank record with a record number equal to or greater than the record number entered. If this record number is beyond the last nonblank record in the file or beyond the end of the file, the last nonblank record is displayed.

When scrolling from a specified record number in direct or sequential files, you should specify a record number as close to a nonblank record as possible for performance reasons. If no record key or record number is entered in the response area, DFU displays the next record relative to the currently displayed record (next key for an indexed file, or nonblank for a direct or sequential file).

Printing Selected Records

By pressing the Print Rec command function key, the operator can print, in a report-type format, the record on display at the display station. The output is directed to the printer currently assigned to the requesting display station.

Note: Blanks are inserted when the data to be printed contains unprintable characters. A DFU option at job setup allows you to indicate if the printer is to halt when unprintable characters are encountered.

Each new page begins with a title line. The date is left-aligned, the title is centered on the longest detail line, and the page is right-aligned on the longest detail line.

Each time the record type changes, a new column heading line(s) identifies the record being printed. The detail information prints under its associated column heading.

If the detail information does not fit on one print line, the first line is left-aligned and all succeeding lines are right-aligned. If the column heading for a field is longer than the field, the field is centered under the heading. If the column heading is less than or equal to the field length, the heading is left-aligned over an alphameric field or right-aligned over a numeric field. A numeric field with decimal positions prints with a decimal point and, if negative, a trailing minus sign. Leading zeros through the tens' position are blanked.

Note: If the Print Rec command function key is not used, DFU does not require a printer for Inquiry.

Printer Line Width

DFU allows you to specify a printer line width of 60 to 198 positions. If you specify a printer line width greater than 132 positions, you should change the printer density for the work station to 15 characters per inch (CPI), each time a DFU job is run, by using the LINES procedure or a FORMS or PRINTER OCL statement. Additionally, you should ensure that the output is directed to a printer capable of printing 198 characters per line. For print lines greater than 132 positions, only two lines can be printed for each record, each data item, or header information.

Specifying Ideographic Field Types

If you have ideographic support at job setup, you can specify fields to be any of these special types:

- Ideographic data only.
- Either ideographic or alphanumeric data. The field is initialized to ideographic data.
- Either ideographic or alphanumeric data. The field is initialized to alphanumeric data.

If you specify any of these special field types, the field must be defined as alphanumeric in the RPG input specifications, must have an even number of positions, and must have more than three positions. Prompts for these field types appear only if you are signed on in ideographic session.

INQUIRY SETUP PROMPTS

The purpose of the inquiry setup is to create a format description that prompts the operator during inquiry execution for the information that allows a meaningful inquiry into the data file. DFU attributes and specifications are created during the setup. The DFU specifications can be saved for use in DFU jobs requiring a similar format description by selecting that option in the DFU source processing parameter in the INQUIRY setup command.

After you key the job setup command, DFU begins a prompting sequence in which you specify what information is to be displayed during inquiry execution. The following pages describe the prompts and the order in which they appear.

General Information

This is the first display (Figure 7-2) shown in the job setup portion of inquiry.

```
INQUIRY GENERAL INFORMATION

       DATA DISPLAY FORMAT.............................. B
            A=SINGLE COLUMN    B=MULTIPLE COLUMNS    C=MAXIMUM DATA


       JOB TITLE.....................................
       PRINTER COLUMN SPACING (0-9)..................... 1
       PRINTER LINE WIDTH (60-198)...................... 132
       HALT ON UNPRINTABLE CHARACTERS? (Y,N)............ N
       EDIT NUMERIC FIELDS? (Y,N)....................... N
```

Figure 7-2. Inquiry General Information Display

Prompt	Response	Explanation
DATA DISPLAY FORMAT	A B C	During execution, data will be displayed to the right of its heading. Data and headings are displayed in 1 to 4 columns. A – Single column (Figure 6-3) B – Multiple columns (Figure 6-4) C – Maximum data (Figure 6-5)
JOB TITLE	Null or literal	Specifies the title that appears on printer output and the display screen for this job. The maximum length is 24 characters.
PRINTER COLUMN SPACING (0-9)	0-9	Specifies the number of spaces between fields on the printed output; the default value is 1.
PRINTER LINE WIDTH (60-198)	60-198	Specifies the width of the printer line; the default is 132. Widths greater than 132 positions require special consideration. See the discussion of printer line width in this chapter.
HALT ON UNPRINT-ABLE CHARAC-TERS? (Y,N)	Y YES N NO	YES indicates the printer halts and an SSP message is issued to indicate that unprintable characters are in the data to be printed. No indicates that no halt occurs when unprintable characters are in the data to be printed. Blanks are substituted for the unprintable characters. NO is the default.
EDIT NUMERIC FIELDS? (Y, N)	Y YES N NO	If YES, DFU blanks any leading zeroes, left-justifies the numeric characters, inserts decimal points, and displays the sign if negative (-).

Note: For the remainder of the setup prompts, the top half of the display contains DFU attributes or DFU specifications. This allows you to see the records and fields you have to choose from (DFU attributes), and also allows you to see the fields/options you have already selected for processing (DFU specifications). Use the following keys to display the attributes/specifications:

DISPLAY ATTR/SPEC command function key–reverses the display of DFU attributes to DFU specifications, or DFU specifications to DFU attributes, depending on which is displayed.

Roll ↑ (up) function control key–displays the next set of attributes or specifications, whichever is currently on display. If the last attribute or specification is already on display, displays the start of the attributes or specifications.

Roll ↓ (down) function control key–displays the preceding set of attributes or specifications, whichever is currently on display. If the first attribute or specification is already on display, displays the end of the attributes or specifications.

Note: If DFU specifications are on display when you respond to a prompt, the specifications created as a result of the response will be automatically displayed.

After you press a Roll function control key or the Display Attr/Spec command function key, DFU positions the cursor on the next line on which data is likely to be entered.

Key Field Specification Indexed File

This display (Figure 7-3) requests the name(s) of the field(s) that make up the record key for the file; it appears when processing an indexed file.

If you press the Enter/Rec Adv function control key without keying data, DFU takes the record key definition from the RPG II file description specification. The record key will then consist of one field. The display shown in Figure 7-4 will appear next.

If you key fields and press the Enter/Rec Adv function control key, DFU will save those fields and reprompt for more (unless the maximum of five fields have been specified). If you key fields and press the Rec Adv command function key, record key prompting is considered complete. The display in Figure 7-6 will appear next.

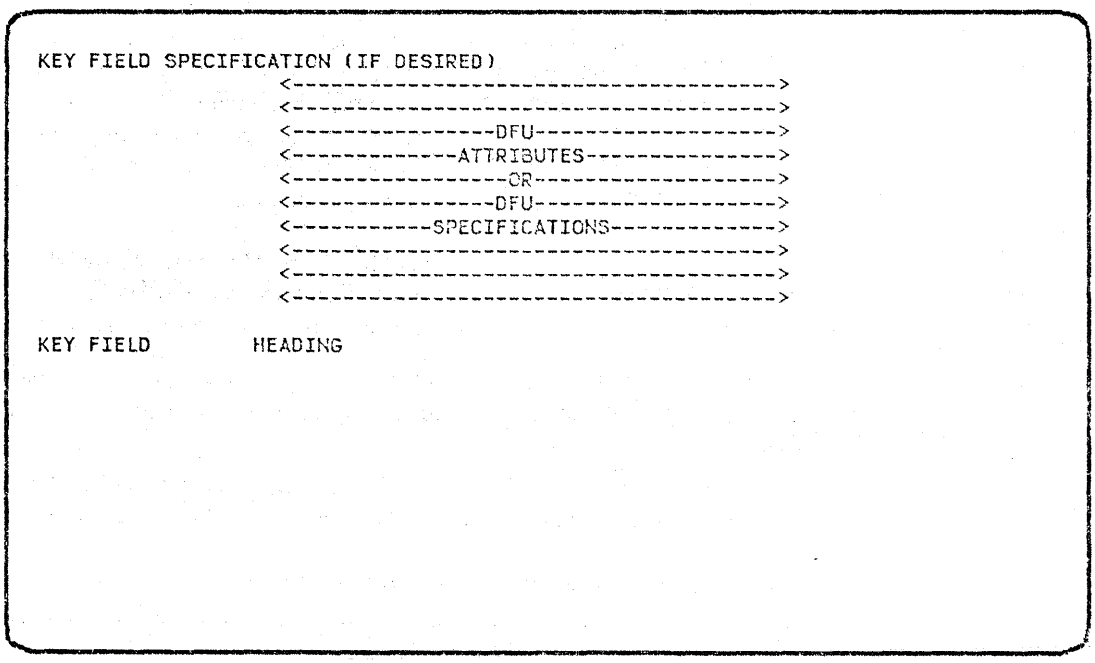


Figure 7-3. Key Field Specification Display for Inquiry–Indexed File

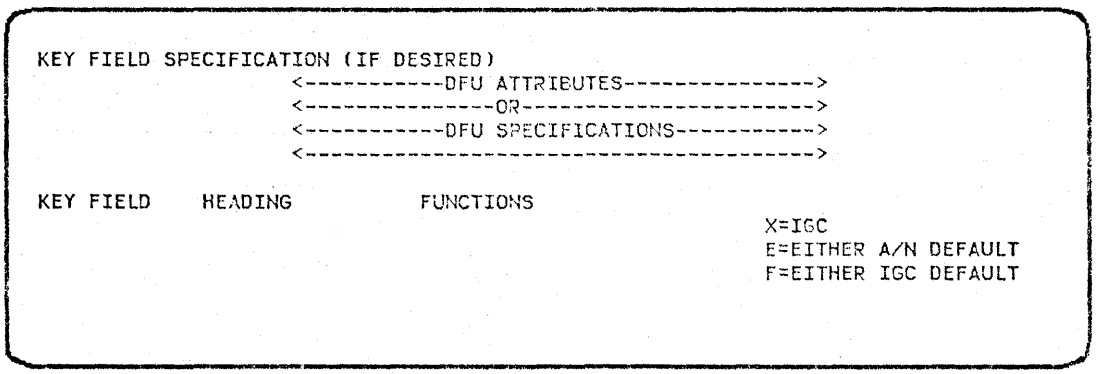


Figure 7-3.1. Key Field Specification Display for Inquiry–Indexed File (Ideographic Session)

Prompt	Response	Explanation
KEY FIELD	Name of next field that makes up the record key.	The field(s) named must encompass the entire record key area.
HEADING	Literal; identifies the field when the field is printed or displayed.	The maximum length is 16 characters; a null response defaults to the field name.
FUNCTIONS	Letters corresponding to the desired functions.	X–Ideographic data only. E–Either ideographic or alphanumeric data. The field is initialized to alphanumeric data. F–Either ideographic or alphanumeric data. The field is initialized to ideographic data. Functions X, E, and F are mutually exclusive and are allowed only if you are signed on in ideographic session.

Record Key Description

This prompt (Figure 7-4) occurs when you are processing an indexed file and if you did not specify any key fields on the previous display (Figure 7-3).

The next prompt that appears is shown in Figure 7-5.

```
RECORD KEY DESCRIPTION
                  <------------------------------------>
                  <------------------------------------>
                  <---------------DFU------------------->
                  <-------------ATTRIBUTES--------------->
                  <-----------------OR-------------------->
                  <---------------DFU------------------->
                  <-----------SPECIFICATIONS------------->
                  <------------------------------------>
                  <------------------------------------>
                  <------------------------------------>

KEY HEADING..................................... *KEY
NUMERIC RECORD KEY? (Y,N).....................
```

Figure 7-4. Record Key Description Display for Inquiry

Prompt	Response	Explanation
KEY HEADING	*KEY Literal	Specifies the heading for the record key. The maximum length is 16 characters, the default is *KEY.
NUMERIC RECORD KEY? (Y, N)	Y YES N NO	YES indicates the record key is numeric with a sign position. No indicates that the record key is alphameric. There is no default for this prompt.

Note:
This prompt appears if the key field is not packed and is less than 16 positions.

```
RECORD NUMBER DESCRIPTION
                    <--------------------------------------->
                    <--------------------------------------->
                    <----------------DFU-------------------->
                    <-------------ATTRIBUTES----------------->
                    <----------------OR--------------------->
                    <----------------DFU-------------------->
                    <-----------SPECIFICATIONS--------------->
                    <--------------------------------------->
                    <--------------------------------------->
                    <--------------------------------------->

RECORD NUMBER HEADING..................... *RECNUM
FIELD NAME FOR RECORD NUMBER (IF ANY).....
```

Figure 7-5. Record Number Description Display for Inquiry

This prompt (Figure 7-5) occurs when you are processing a sequential or direct file. This allows you to specify the heading to be used at execution time to prompt for the record number to be processed. This prompt allows you to name a field that in the record holds the record number. At execution the record number displayed is the actual record number in the file, not the value that is in the named record number field.

Prompt	Response	Explanation
RECORD NUMBER HEADING	*RECNUM Literal	Specifies the heading for the record number. The maximum length is 16 characters; the default is *RECNUM.
FIELD NAME FOR RECORD NUMBER (IF ANY)	Null or field name	This names the field that holds the record number when displaying a record. This field must exist in every record type to be processed. The field length determines the length of the record number prompt; the maximum field length is 7 positions (unpacked) or 4 positions (packed). A null response results in a record number prompt length of 7 positions.

Record Type Selection

This prompt (Figure 7-6) occurs for each record type in the file. The 01 is replaced with the number of the record type. The DFU attributes show the record type and as many fields as possible from the record type.

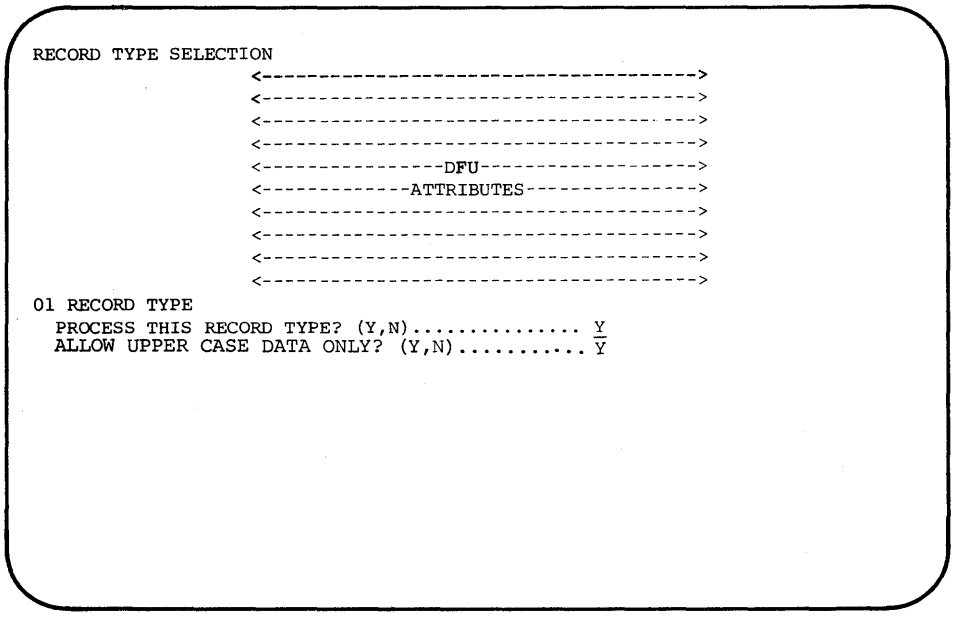


Figure 7-6. Inquiry Record Type Selection Display

The maximum number of record types DFU can process for inquiry depends on the number of display screens required for each record type. A maximum of 31 display screens can be created. Therefore, if some record types require multiple screens, the maximum number of record types that can be processed is 31, less the number of additional display screens required.

Prompt	Response	Explanation
PROCESS THIS RECORD TYPE? (Y, N)	Y YES N NO	YES indicates the record type is to be processed. The next prompt will be for the data fields for this record type (Figure 7-5). NO indicates the record type is not processed. If there are more record types in the file, this prompt will repeat; otherwise, prompting is complete and you can update the created specifications.
ALLOW UPPERCASE DATA ONLY? (Y,N)	Y YES N NO	YES indicates the operator can key only upper case record keys or record numbers for this record type at execution time. NO indicates the operator can key upper and lower case record keys or record numbers for this record type at execution time. The operator must shift to upper case as needed.

Data Field Specification

You can enter one field per line, up to and including the next to the last line of the display (Figure 7-7). If you enter fields then press the Enter/Rec Adv function control key, DFU saves those fields and reprompts for more (unless 40 fields including record number or record key fields have been specified). But if you enter fields then press the Rec Adv command function key, the data field specifications for this record type are considered complete.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, the data field prompting terminates for this record type.

The record type selection display is redisplayed if more record types exist in the file; otherwise, the prompting is complete for this portion of the job. The next display allows you to update the DFU specifications.

```
DATA FIELD SPECIFICATION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR--------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
                                                    RECORD TYPE: 01
DATA FIELD        HEADING
```

Figure 7-7. Data Field Specification Display for Inquiry

```
DATA FIELD SPECIFICATION
                     <-----------DFU ATTRIBUTES--------------->
                     <---------------OR----------------------->
                     <-----------DFU SPECIFICATIONS----------->
                     <---------------------------------------->
                                                    RECORD TYPE: 01
DATA FIELD    HEADING          FUNCTIONS
                                                  X=IGC
                                                  E=EITHER A/N DEFAULT
                                                  F=EITHER IGC DEFAULT
```

Figure 7-7.1. Data Field Specification Display for Inquiry (Ideographic Session)

Prompt	Response	Explanation
DATA FIELD	Name of next field to be processed.	These fields cannot overlap the record key when processing an indexed file.
HEADING	Literal; identifies the field when the field is printed or displayed.	The maximum length is 16 characters. If blank, the heading defaults to the data field name.
FUNCTIONS	Letters corresponding to the desired functions.	X–Ideographic data only. E–Either ideographic or alphanumeric data. The field is initialized to alphanumeric data. F–Either ideographic or alphanumeric data. The field is initialized to ideographic data. Functions X, E, and F are mutually exclusive and are allowed only if you are signed on in ideographic session.

Note: For any record type, only as many fields as will fit on three printed lines can be processed at a time, up to 40 fields including the record number or record key fields.

Update DFU Specifications

The setup step is now completed and the following display (Figure 7-8) appears so that you can update the DFU specifications before going on to the execution portion of inquiry. Chapter 10 describes the procedure for updating DFU specifications. Press the EOJ command function key when the DFU specifications are complete; this causes the DFU format and display screen format to be created and inquiry execution to begin.

```
UPDATE DFU SPECIFICATIONS
(PRESS EOJ CMD KEY WHEN UPDATE IS COMPLETE)

                    FIELD1  FIELD2  FIELD3  FIELD4  FIELD5
NOTE:               <----------------------------------->
 >=ADD              <----------------------------------->
 ?=DELETE           <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------DFU----------------->
                    <----------SPECIFICATIONS------------>
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
                    <----------------------------------->
```

Figure 7-8. Updating DFU Specifications Display

INQUIRY EXECUTION

The purpose of the inquiry execution is to respond to the predefined prompts (format description) that were created during the inquiry setup to allow for a meaningful inquiry into the data files.

The display contains the following information for all inquiry jobs:

- Status information
- Record key or record number and headings
- Data fields and headings
- Errors

Figure 7-9 illustrates the format of this information on the display station screen. Initially, the first record in the file is displayed and the cursor is positioned at the next record key or record number area to allow the operator to request a different record.

Note: For a direct or sequential file, the first nonblank record is considered to be the first record in the file.

Status Information

Lines 1 and 2 of the display contain the status information for the current DFU inquiry job. The operator cannot key over the information except to change the current record type.

Title

This is the job title specified by you at job setup. This title also appears on any printer output for this job.

Filename

This is the name of the file currently being inquired into.

Inquiry

This is the indication to the operator that the records of the file can only be searched/viewed (inquired).

Record Type

This field shows what record type is being processed. The operator can change this value after positioning the cursor at this field to display a record in a different format.

Record Key or Record Number and Headings

When processing indexed files beginning at line 3 is the key area of up to five fields for the record key being displayed, and a space where you can enter the key of the next record desired. Each field of the key area is on a separate line so the key area can consist of lines 3 to 7. The cursor is positioned at the first field of the record key in the space where the operator requests the next record key.

If the operator wants a numeric field to be negative, the Field- function control key places a minus sign after the last digit.

When processing sequential or direct file, line 3 contains the record number of the current record on display, and a space where you can enter the record number of the next record desired. The cursor is positioned at this record number request area.

Data Fields and Headings

If a record requires more data than fits on the first display, additional displays appear to allow completion of the record. If space allows, a blank line separates the data fields from the record key or record number on the display.

The format of the field headings and data depends on the data display format option selected by the operator at job setup.

Numeric fields have one more position than the actual field size. This is the rightmost position in the field, which contains the ± sign (blank for positive and - for negative).

Errors

The last line of the display displays error messages. This line is blank until an error is detected during processing, at which time the field, field heading, and error message is displayed and highlighted. The MIC (message identification code) is also displayed so the operator can look up the error in the *Displayed Messages Guide*.

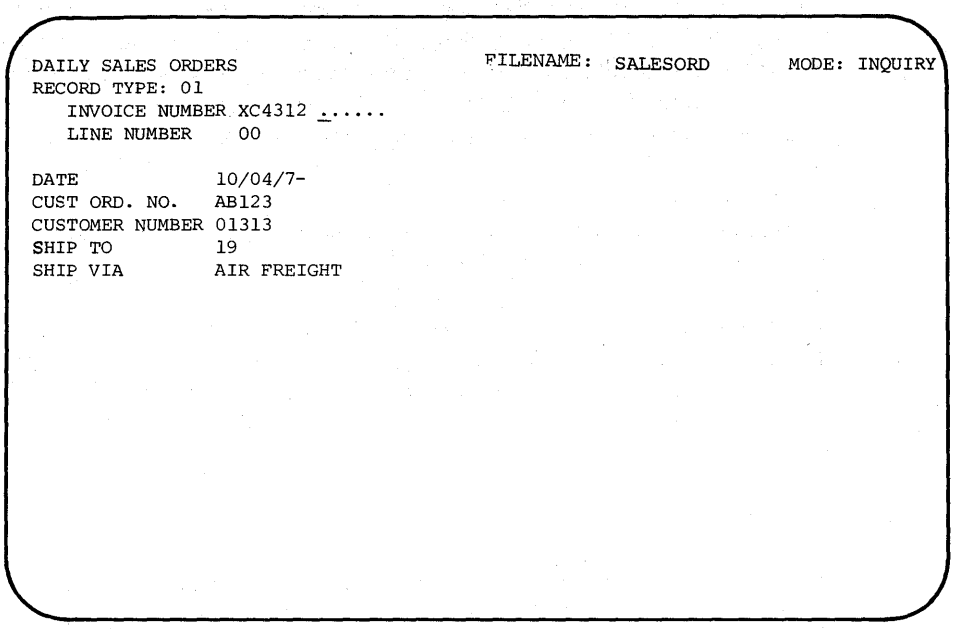


Figure 7-9. Example of Inquiry Data Display Layout

The format of each line in the record key area (from left to right) is a field heading, a field for the record key of the current record on display, and a field for the record key of the next record to be displayed. The operator requests records by keying into the next record key area.

If a record is retrieved which does not match any of the record types defined in the DFU format, or the operator wishes to change the format of a displayed record, the operator can press the Select Format command function key to position the cursor at the RECORD TYPE field. The operator should then specify the record type in which the current record is to be displayed.

INQUIRY EOJ

When the operator selects end-of-job (EOJ) by pressing the EOJ command function key, Figure 7-10 appears. A Y response terminates processing. An N response returns the program to the last record displayed.

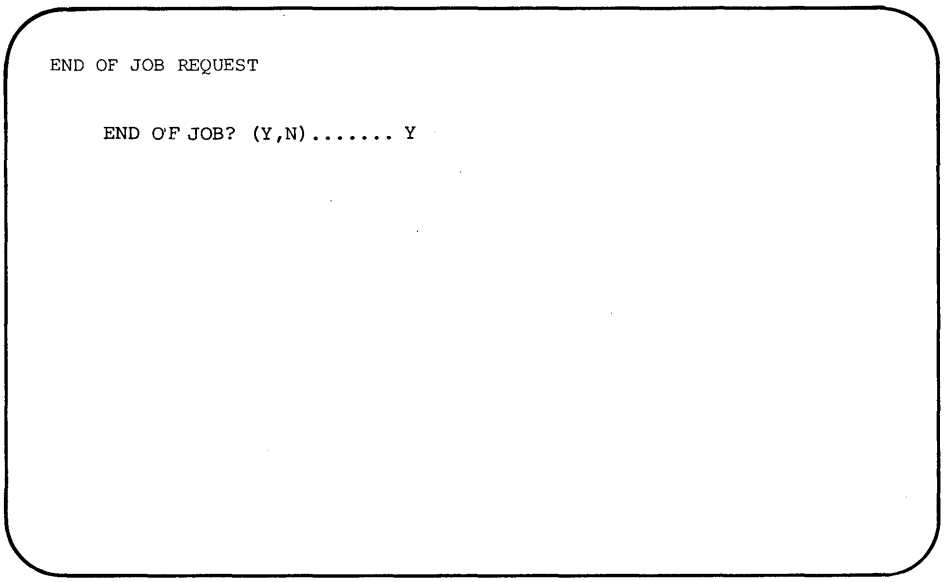


Figure 7-10. End-of-Job Display

Chapter 8. List

The purpose of the list function is to allow data files to be sorted and printed in various report-type formats.

Refer to the *Programmer Considerations* section in Chapter 1 for general information relating to the list function.

LIST COMMAND

The LIST command is interpreted by DFU as setup or execution depending on whether the DFU format name (parameter 2) you supplied already exists or not. When you key in the DFU format name, DFU checks to see if it already exists. If so, DFU skips the setup portion and goes directly to the execution portion of the list function.

List setup builds a format description that allows the operator to print a report.

If a new format is to be created with the same name as an existing format, the existing format name must first be removed from the library. See *Saved DFU Specifications* in Chapter 10 for more detail.

List execution prints the data file in the report-type format specified at list setup. The format for the list command is:

LIST filename,DFU format name,RPG II source name,SORT/NOSORT, filetype,DFU source processing,DFU source name,master filename,user library.

If the filename (parameter 1) or the DFU format name (parameter 2) is omitted on the initial command, all the command parameters are prompted for on the list parameter prompt display (Figure 8-1).

Note: User library must be entered if the format description, RPG II member, and DFU specifications are in that library or to be placed in that library. The system library is used if this parameter is omitted.

```
                    DATA FILE UTILITY LIST PROCEDURE          SETUP ONLY-(S)

          Sorts and prints data files in various report-type formats.

Name Of File To Be Listed .....

Name Of DFU Format (If Saved Or To Be Saved) .....

SORT/NOSORT Indication ..... NOSORT

Name Of Master File (If Any) .....

Name Of User Library ..... #LIBRARY

Name Of RPG II Source .....                                          (S)

DFU SOURCE Processing Parameter (NN/NY/YN/YY/GO) ..... NN            (S)

Name Of DFU Source (If Saved, Or To Be Saved) .....                  (S)
```

Figure 8-1. List Command Parameter Prompt Display

This prompt (Figure 8-1) appears when the list command is requested, and the filename (parameter 1) or the DFU format name (parameter 2) is not specified on the initial command. Any parameters keyed on the initial command appear to the right of the corresponding prompts on this screen. The default parameters (NOSORT for the SORT/NOSORT indication, #LIBRARY for the user library and NN for the DFU source processing parameter) will appear if nothing is entered for these parameters on the initial command.

Fill in the appropriate parameters and press the Enter/Rec Adv key to continue processing. Note that the last three prompts need be filled in only if the DFU format does not currently exist, and DFU job setup must be called.

LIST FEATURES

The list function prints data from a requested sequential, direct, or indexed sequential data file and directs the output to the current printer device. Blanks are inserted when unprintable characters appear in the data to be printed. A DFU option at job setup allows you to indicate if the printer is to halt when unprintable characters are encountered. The following features are available with the list function:

- Sort prior to list
- Related master file data
- Record selection based on field value
- Accumulator fields
- Control break fields
- Calculated result fields
- Printing of record key or record number
- Number of records processed
- Single, double, or triple spacing
- Multiple field heading lines
- Printer line width from 60 to 198 positions

Sort Prior to List

The sort prior to list does not rearrange the data file; instead, a temporary data file of sorted relative record numbers is created, and deleted after the printout is complete. The file can be sorted on five different fields, in ascending or descending order with respect to each field; the sort fields must be present in each record type listed. The Sort program product must be in the system library or the currently designated program user library when you are using this function.

If your system has ideographic support, you can also choose from the six basic ideographic sort types. To use any of the ideographic sort types, you must have the ideographic sort program in the system library or in the currently designated program library when you are using this function.

DFU executes the Sort program with list function in two separate job steps: (1) the file is sorted, and (2) the file data is listed in that order. Because DFU executes with all shared files (DISP-SHR), you could change the data in any of the sort fields between the preceding steps 1 and 2. DFU prints the records in order according to the original data in the record, not according to the current data in the record (even though the latest data is printed). It is the user's responsibility to guard against this situation.

When doing a sort with DFU list, it is possible to get the SORT-7725 message. This message is issued when DFU builds too many sort sequence specifications for the current region size. If this message occurs, increase the region size to the maximum size that is allowed on your system. Refer to the *Region Statement* section in the *System Support Reference Manual*. Then rerun the list job. If the problem reoccurs, call your system support representative.

Another error that can occur during a sort with DFU list is SORT-7732 (OUTPUT FILE TOO SMALL). This error occurs when the sorted output contains more records than will fit in the temporary sort file allocated by DFU.

DFU allocates a sort output file large enough to contain all of the records that were in the file when your list job was started. However, records might have been added to the file, by another job, before the sort was completed and the temporary sort output file could be too small to contain these additional records. To avoid this, rerun the list job and ensure that no other work station operator is adding records to the file while you are trying to list it.

Related Master File Data

In addition to listing data from the requested file, data can be printed from a related indexed master file. When a list file record is read, a field from the record is used as a key to retrieve a corresponding master file record. Data from the master file can then be printed, used as factors in result fields, or as control break fields.

To print data from a related master file, the operator must specify the master filename on the initial LIST command (parameter 8) or on the list parameter prompt display. Also if job setup is required, a source member containing RPG II file description and input specifications describing the master file must be supplied. DFU prompts for the name of this member at job setup time. The member can be the same as that used to describe the list file, or it can be a different member.

The member must be in the system library if a user library was not specified on the list command; otherwise, it must be in the specified user library.

Record Selection Based on Field Value

Records can be selected for printing based on record selection criteria specified at job setup. In this way a field in the record can be compared to another field in the record, to a constant value, or to the current date, year, month, or day, and if it satisfies a user-specified criterion (EQ = equal, NE = not equal, GT = greater than, LT = less than, GE = greater than or equal, LE = less than or equal), the record will be printed. Ten record selection criteria (in an AND/OR relationship) can be specified for a list. A field compared to a constant value cannot be greater than 20 characters. Ideographic fields can be compared against ideographic constants or other ideographic fields, but, because the comparisons being made are in EBCDIC values, the only meaningful comparisons are EQ and NE.

Accumulator Fields

Ten fields can be specified, at job setup, to be accumulated. If the same field name occurs in different record types, the field is totaled in one accumulator. Any numeric field can be accumulated; alphameric fields must be less than 16 characters to be accumulated. Unpredictable results can occur when a field to be accumulated contains nonnumeric data.

Control Break Fields

Five fields can be specified at job setup to be control break fields. These control break fields, along with accumulator fields, give group totals for a series of detail records. They can be in the list file or a related indexed master file. The first control field specified is the major control field, and each succeeding control field is at a lower level. Whenever a control field changes value, a control break occurs at that level and each lower level, causing the accumulator values to be printed for each level of the control break. The first line is the lowest level, and each succeeding line contains the next higher level, up to the level of the control break.

When an accumulator value is printed, it is added to the next level of the accumulator and zeroed out. There can be up to five levels of subtotals plus a final total for all the records. For each control break line, a number of asterisks equal to the control level number print to the right of the last field on the line.

When you specify a control break field at job setup, you can also indicate if DFU should skip to a new page after that control break field changes value during list execution.

Calculated Result Fields

The list function generates and prints result fields. Result fields are created by combining information from fields in a record, and/or operator-specified constant data. The fields can be in the list file or a related indexed master file.

For any detail record, you can specify a maximum of 24 result fields to be listed; the total number of factors used in the computations also cannot exceed 24. Mathematical operations can be specified to combine information into a result field. One level of parentheses can be used to group factors in a mathematical expression. The generated result field can be named and used as a factor in succeeding result fields for the current record.

Any result field can be specified to be one of the 10 accumulator fields. Subtotals and final totals print as on a normal list. A result field operand cannot exceed 15 positions. If a divide by zero occurs at list execution, slashes are printed for the result. If the factors of a result field calculation contain nonnumeric data, the results of the calculation are unpredictable.

Printing of Record Key or Record Number

The operator can print the record key or record number as the first field in each record. For sequential or direct files, you can specify that DFU print the actual record number of the record in the file, or generate a 5-byte record number starting at 00010 and incrementing by 10 for each successive record. For indexed data files, the actual record key is printed. Specifications of fields within the record key, as in enter/update or inquiry, are not allowed in list; however, any field defined on the RPG II input specifications, including fields which are part of the record key, can be named as one of the fields to be listed.

Note: The generated record number has no relation to the records position in the file.

Number of Records Processed

The last line of any list output is the total number of the records included in the printout. If no records are processed, only a title line is printed with the record count.

Single, Double, or Triple Spacing

Single, double, or triple spacing between detail records can be specified at job setup. Lines of a multiple print line record are single spaced (default).

Multiple Field Heading Lines

A maximum of three field heading lines is allowed for a list job. All or part of the heading lines can be blank. If the printer line width is greater than 132 positions, only two field heading lines can be used.

Printer Line Width

DFU allows you to specify a printer line width of 60 to 198 positions. If you specify a printer line width greater than 132 positions, you should change the printer density for the work station to 15 characters per inch (CPI), each time a DFU job is run, by using the LINES procedure or a FORMS or PRINTER OCL statement. Additionally, you should ensure that the output is directed to a printer capable of printing 198 characters per line. For print lines greater than 132 positions, only two lines can be printed for each record, each data item, or header information.

LIST OUTPUT

Each list report has a title line printed at the top (line 6) of each page containing the date edited and left-aligned, a title of up to 24 characters centered on the longest detail line, and the page number right-aligned on the longest detail line.

For any detail record, three lines from 60 to 132 positions, or two lines from 133 to 198 positions, can be printed. The first detail line for a record will print left-aligned beginning in position 1. Succeeding lines are right-aligned on the printer page. If more than one heading line is specified for a field in the detail record, only one line can be printed. If a field's column heading is longer than the field, the field is centered under the heading. If a field's column heading is shorter than the field, the heading is left-aligned over an alphameric field, and right-aligned over a numeric field. Numeric fields print with a decimal point and a minus sign, if applicable, and all insignificant zeros up to the one's digit are suppressed. If specified during job setup, fields of zero value print as blanks.

There are three list report formats that can be specified at job setup:

- Record type list
- Summary with detail printing
- Summary without detail printing

Record Type List

There is a separate column heading line(s) for each type of record listed; these record types are determined by record identification codes specified on the RPG II input specifications for the file to be listed. As each record is read from the file, its record type is determined. If the record type has changed from the previous record, or the record is the first on a new page, the column heading line(s) for the record type is printed, followed by print line(s) of the selected fields from the record type. The column heading line(s) will print again only if:

- The record type changes
- A new page is needed
- A control break has caused accumulators to print

Detail lines are single, double, or triple spaced depending on the values specified during list setup. There are two blank lines before and one blank line (single or double spacing) or two blank lines (triple spacing) after a column heading is printed. If accumulators are printed, the first five accumulators print on one line; accumulators 6 through 10 print on the next line. The accumulator headings are right-aligned over their respective fields. Accumulator fields cannot have multiple line headings in a record list. The accumulator field hold areas are always 15 positions. An accumulated value larger than this causes the accumulators to overflow. In this case the overflow value is printed, and the accumulator is reset to the value of the field causing the overflow.

Summary List with Detail Printing

All the records in the file are printed with the same heading line(s) repeated on each page. Each time a record is read, the selected fields are extracted, edited, and printed; if the record does not contain all fields to be listed, blanks are printed in the missing fields.

Accumulator field hold areas are two characters longer than the field being accumulated (15 characters maximum); an accumulator value larger than the hold area causes the accumulator to overflow. In this case the value is printed and the accumulator is reset to the value of the field causing the overflow. When accumulators are printed on a control break, there is not a separate column heading line for the accumulators; they print under their respective detail headings.

Summary List Without Detail Printing

The output from this list is similar to the normal summary list. Accumulator values on control breaks are printed, but detail records are not. If the control break fields are specified as list fields, the control field value prior to the control break is also printed.

LIST SETUP PROMPTS

The purpose of the list setup is to create a format description that allows the useful formatting and sorting of the data files in a report-type format during list execution. DFU attributes and specifications are created during the job setup.

The DFU specifications can be saved for use in similar DFU list jobs requiring a similar format description, by selecting that option in the DFU source processing parameter in the LIST setup command.

DFU requires one source member when you set up a job to create, maintain, or display a data file. One or two source members are required to list a data file:

- One source member (to describe the list file) if a related master file is not used, or

- Two source members (one describing the list file and one describing the master file) if a related master file is used. (Both descriptions could exist in the same source member.)

The RPG II source member name to describe the list file is a parameter on the initial command; if the parameter is missing, you will be prompted for the name. If you specify a related master file in the LIST setup command, DFU prompts for the RPG II source member name of the master file during job setup. Once you create, name, and save an RPG II source member in a library on disk, you need only the assigned name to set up and run a DFU job.

After you key the LIST command, DFU begins a prompting sequence to allow you to specify how the data file is to be listed. The following pages describe the prompts and the order in which they appear.

Master File Specification

If a related indexed master file is specified on the initial LIST command, or list parameters prompt, DFU prompts for the name of the RPG II source member describing the master file, plus the name of the data field from the list file that is to be used as a key to retrieve master records. See Figure 8-2.

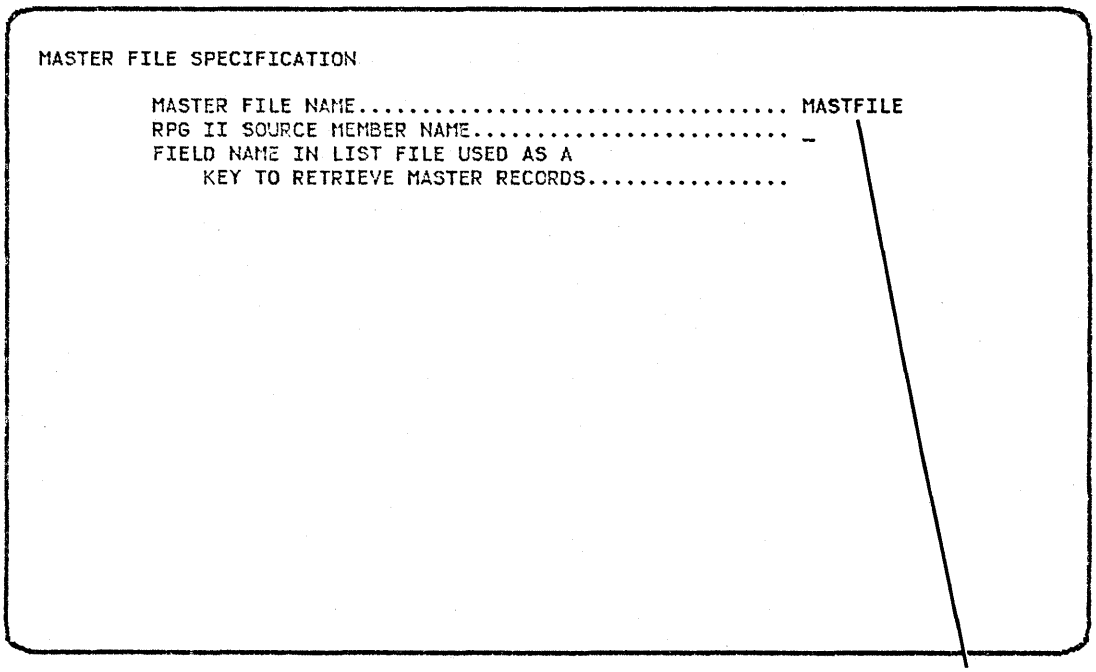


Figure 8-2. Master File Specification Display

Prompt	Response	Explanation
RPG II SOURCE MEMBER NAME	The name of your RPG II source member	Enter the name of the RPG II source member that describes the master file.
FIELD NAME IN LIST FILE USED AS A KEY TO RETRIEVE MASTER RECORDS	Field name	Enter the data field name from the list file that will be used as a key to retrieve master records.

General Information

One of the following displays prompts for the list general information in the list setup prompting routine:

- Indexed files, Figure 8-3
- Sequential or direct files, Figure 8-4

```
LIST GENERAL INFORMATION

       LISTING FORMAT................................ _
            A=RECORD LIST
            B=SUMMARY LIST, DETAIL PRINTING
            C=SUMMARY LIST, NO DETAIL PRINTING

       JOB TITLE.....................................
       PRINT RECORD KEY FIRST? (Y,N)................. N
       PRINTER COLUMN SPACING (0-9).................. 1
       PRINTER LINE WIDTH (60-198)................... 132
       PRINTER LINE SPACING (1,2,3).................. 1
       HALT ON UNPRINTABLE CHARACTERS? (Y,N)......... N
```

Figure 8-3. List General Information Display–Indexed Files

Prompt	Response	Explanation
LISTING FORMAT	A B C	A – A record type list is printed. B – All selected records are listed in a summary list plus detail lines. C – Only totals and control fields are listed, and only when a control field changes value.
JOB TITLE	Null or literal	Specifies the title that appears on printer output for this job. The maximum length is 24 characters.
PRINT RECORD KEY FIRST? (Y, N)	Y YES	YES indicates the record key will be printed as the first field of each data line.
	N NO	NO (the default) specifies the record key will not print as the first field of each data line (although it can be specified as one or more of the list fields later).
PRINTER COLUMN SPACING (0-9)	0-9	Specifies the number of spaces between fields on the printed output; the default value is 1.
PRINTER LINE WIDTH (60-198)	60-198	Specifies the width of the printer line; the default is 132. Widths greater than 132 positions require special consideration. See the discussion of printer line width in this chapter.
PRINTER LINE SPACING (1, 2, 3)	1 2 3	Specifies the line spacing between list output records (single, double, or triple spacing). Single spacing is the default.
HALT ON UNPRINT-ABLE CHARAC-TERS?	Y YES	YES indicates the printer will halt and an SSP message is issued when unprintable characters are in the data to be printed.
(Y,N)	N NO	NO indicates that no halt occurs when unprintable characters are in the data to be printed. NO is the default.

```
LIST GENERAL INFORMATION

       LISTING FORMAT................................ _
            A=RECORD LIST
            B=SUMMARY LIST, DETAIL PRINTING
            C=SUMMARY LIST, NO DETAIL PRINTING

       JOB TITLE.....................................
       PRINT RECORD NUMBER FIRST? (Y,N)............... N
       PRINTER COLUMN SPACING (0-9)................... 1
       PRINTER LINE WIDTH (60-198).................... 132
       PRINTER LINE SPACING (1,2,3)................... 1
       HALT ON UNPRINTABLE CHARACTERS? (Y,N).......... N
```

Figure 8-4. List General Information Display–Sequential or Direct Files

Prompt	Response	Explanation
LISTING FORMAT	A B C	A – A record type list is printed. B – All selected records are listed in a summary list plus detail lines. C – Only totals and control fields are listed, and only when a control field changes value.
JOB TITLE	Null or literal	Specifies the title that appears on printer output for this job. The maximum length is 24 characters.
PRINT RECORD NUMBER FIRST?	Y YES	YES indicates a record number will print as the first field of each data line.
	N NO	NO indicates a record number will not print as the first field of each data line. NO is the default.
PRINTER COLUMN SPACING (0-9)	0-9	Specifies the number of spaces between fields on the printed output; the default value is 1.
PRINTER LINE WIDTH (60-198)	60-198	Specifies the width of the printer line; the default is 132. Widths greater than 132 positions require special consideration. See the discussion of printer line width in this chapter.
PRINTER LINE SPACING (1, 2, 3)	1 2 3	Specifies the line spacing between list output records (single, double, or triple spacing). Single spacing is the default.
HALT ON UNPRINT-ABLE CHARAC-TERS? (Y,N)	Y YES	YES indicates the printer will halt and an SSP message is issued to indicate that unprintable characters are in the data to be printed.
	N NO	NO indicates no halt when unprintable characters are in the data to be printed. This is the default.

Note: For the remainder of the setup prompts, the top half of the display contains DFU attributes or DFU specifications. This allows you to see the records and fields you have to choose from (DFU attributes), and also allows you to see the fields/options you have already selected for processing (DFU specifications). Use the following keys to display the attributes/specifications:

DISPLAY ATTR/SPEC command function key–reverses the display of DFU attributes to DFU specifications, or DFU specifications to DFU attributes, depending on which is displayed.

Roll ↑ (up) function control key–displays the next set of attributes or specifications, whichever is currently on display. If the last attribute or specification is already on display, displays the start of the attributes or specifications.

Roll ↓ (down) function control key–displays the preceding set of attributes or specifications, whichever is currently on display. If the first attribute or specification is already on display, displays the end of the attributes or specifications.

Note: If DFU specifications are on display when you respond to a prompt, the specifications created as a result of the response will be automatically displayed.

After you press a Roll function control key or the Display Attr/Spec command function key, DFU positions the cursor on the next line on which data is likely to be entered.

Record Key Description

This display (Figure 8-5) appears if you have requested that record keys be printed. The next prompt is Figure 8-7.

```
RECORD KEY DESCRIPTION
                  <-------------------------------------->
                  <-------------------------------------->
                  <---------------DFU--------------------->
                  <-------------ATTRIBUTES---------------->
                  <----------------OR--------------------->
                  <---------------DFU--------------------->
                  <-----------SPECIFICATIONS-------------->
                  <-------------------------------------->
                  <-------------------------------------->
                  <-------------------------------------->

KEY HEADING................................... *KEY
NUMERIC RECORD KEY? (Y,N).....................
```

Figure 8-5. List Record Key Description Display

Prompt	Response	Explanation
KEY HEADING	*KEY or Literal	Specifies the heading for the record key. The maximum length is 16 characters, with the default of *KEY.
NUMERIC RECORD KEY? (Y,N)	Y YES	YES indicates that the record key is numeric, with a sign position and no decimal positions.
Note: This prompt appears if the key field is not packed and is less than 16 positions.	N NO	NO indicates that the record key is alphameric. There is no default for this prompt.

Record Number Description

This display (Figure 8-6) appears when you are processing a sequential or direct file and requested that record numbers be printed (Figure 8-4). The next prompt is Figure 8-7.

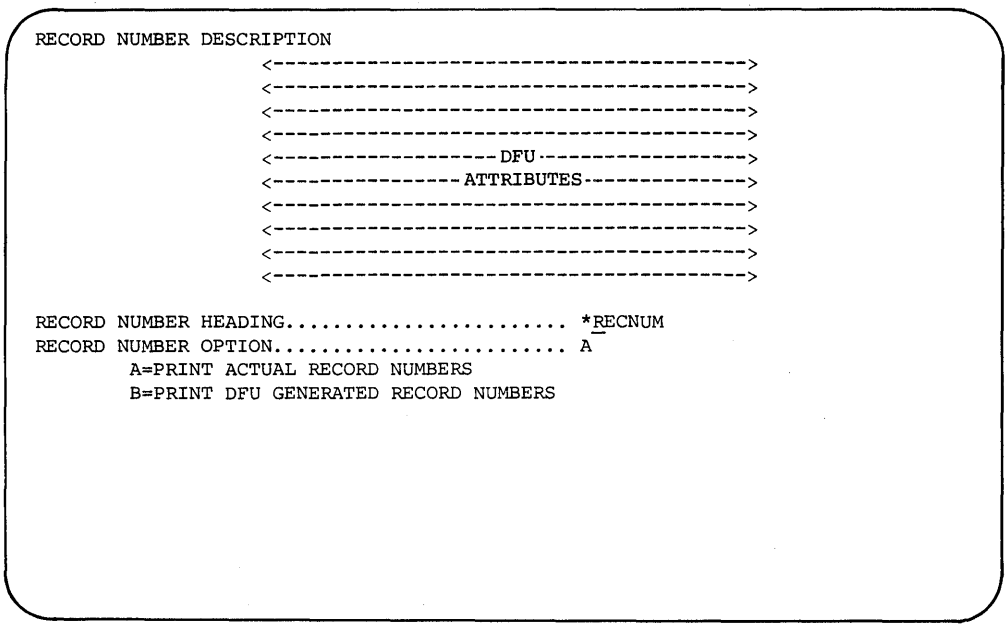


Figure 8-6. List Record Number Description Display

Prompt	Response	Explanation
RECORD NUMBER HEADING	*RECNUM* or literal	Specifies the heading for the record number. The maximum length is 16 characters, with the default of *RECNUM
RECORD NUMBER OPTION	A	A (default) indicates the actual record number of the detail record being printed is printed as the first field. This is a 7-character field.
	B	B indicates that DFU generates a five-digit record number and prints it as the first field for each detail (the number starts at 00010 and increments by 10 for each successive record).

Record Type Selection

The format of this display (Figure 8-7) varies, depending on whether you requested a record list or a summary list in the initial prompt (Figure 8-2).

Record List

This prompt occurs for each record type in the file. The 01 next to RECORD TYPE is replaced with the number of the record type. For every record type to be listed, a record list data field specification display is shown. The DFU attributes include the record type and as many fields as possible from the record type.

```
RECORD TYPE SELECTION
                    <-------------------------------------->
                    <-------------------------------------->
                    <-------------------------------------->
                    <-------------------------------------->
                    <---------------DFU--------------------->
                    <------------ATTRIBUTES---------------->
                    <-------------------------------------->
                    <-------------------------------------->
                    <-------------------------------------->
                    <-------------------------------------->
01 RECORD TYPE
  PROCESS THIS RECORD TYPE? (Y,N)..... Y
```

Figure 8-7. List Record Type Selection Display

Prompt	Response	Explanation
PROCESS THIS RECORD TYPE? (Y,N)	Y YES	YES (the default) indicates the record is to be listed. The next prompt will be for the data fields for this record type (Figure 8-8).
	N NO	NO indicates the record type is not to be listed. If there are more record types in the file, this prompt will repeat for the next defined record type; otherwise, the next prompt will be for sort fields (Figure 8-11).

Summary List

The 01 in Figure 8-7 is replaced with the number of the record type. The DFU attributes show the record type and as many fields as possible from the record type. This prompt is repeated until you have responded for all record types unless you key ALL the first time this prompt appears; then DFU includes all record types in the list which contain one or more of the fields to be printed.

Prompt	Response	Explanation
PROCESS THIS RECORD TYPE? (Y, N)	Y YES	YES (the default) indicates the record type is to be listed. If there are more record types in the file, this prompt will repeat for the next defined record type; otherwise, you will be prompted for the data fields to be listed (Figure 8-9).
	N NO	NO indicates the record type is not to be listed. If there are more record types in the file, this prompt will repeat for the next defined record type; otherwise, you will be prompted for the data fields to be listed (Figure 8-9).
	ALL	An ALL response indicates all record types are to be listed; this response is only valid the first time the prompt appears.

Record List Data Field Specification

This display (Figure 8-8) appears if you requested a record list. You can key one field per line, up to and including the next to last line on the display. If you then press the Enter/Rec Adv function control key, DFU saves those fields and reprompts for more (unless 40 fields including the record key or record number have been specified). If you press the Rec Adv command function key, the data field specifications are considered complete for this record type.

If your response is a + under FIELD to indicate a result field, DFU processes any fields prior to the + and then prompts as in Figure 8-10 for the result field description. You can request only one result field at a time and it must be the last field requested on that display.

If you desire multiple heading lines for a field or result field, key * under the corresponding field to indicate a continuation, and then key the heading under HEADING. The heading field can be left blank. Continuation headings cannot be specified if the field is also to be accumulated. As many as two continuation headings can be specified for any other field. You must align the headings as they are to appear when printed. Functions cannot be specified on a heading continuation line.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, the data field prompting terminates for this record type.

If more record types are defined, Figure 8-7 is redisplayed; otherwise, the data field prompting is complete.

```
DATA FIELD SPECIFICATION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR---------------------->
                    <---------------DFU--------------------->
                    <-----------SPECIFICATIONS-------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
(KEY + FOR A RESULT FIELD NAME)                          RECORD TYPE: 01
DATA FIELD       HEADING          FUNCTIONS        NOTE:
                                                       A=ACCUMULATE
                                                       Z=BLANK IF ZERO
```

Figure 8-8. Record List Data Field Specification Display

Prompt	Response	Explanation
DATA FIELD	Field name, + or *	Field name indicates that the field is to be listed; + indicates a result field is desired. An * indicates a heading continuation line. An * is not allowed on accumulated fields in a record list or on the first input line. The field can be from a list file or a master file. Only heading continuation lines can follow a result field request.
HEADING	Literal; specifies the heading for the field	The maximum length is 16 characters. If blank, the heading defaults to the data field name, or to *RESULT if a result field is requested. No default is assumed when using heading continuations.
FUNCTIONS	Key in the letters for the functions desired.	The letters can be contiguous or separated by commas or blanks. A–Field is to be accumulated. Z–Field will print as blanks whenever it has a zero value. This is valid only for a numeric field *Note*: If the field is also accumulated, any accumulated values of zero are not blanked. No functions can be specified on a heading continuation line.

Note: For any record type, only as many fields as will fit on three print lines (one print line if multiple headings are used, two print lines if greater than 132 positions are used) can be processed at a time; up to 40 fields can be processed at a time.

Summary List Data Field Specification

This display (Figure 8-9) appears if you specified a summary list. You can key one field per line up to and including the next to last line on the display. If you then press the Enter/Rec Adv function control key, DFU saves those fields and reprompts for more (unless 40 fields including record key or record number fields have been specified). If you press the Rec Adv command key, the data field specifications are considered complete.

If you key a + under FIELD to indicate a result field, DFU will process any fields prior to the + and then prompt as in Figure 8-10 for the result field description. You can only request one result field at a time in this prompt and it must be the last field requested in the display.

If you desire multiple heading lines for a field or result field, key * under the corresponding field to indicate a continuation, and then key the heading under HEADING. The heading field can be left blank. Up to two heading continuations can be specified for each summary list field. You must align the headings as they are to appear when printed. An * is not allowed on accumulated fields in a record list or on the first input line.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, the data field prompting terminates.

Note: If specifying the fields for a nondetail summary list, only the fields that are accumulated or that will be defined as control fields appear on the listing.

```
DATA FIELD SPECIFICATION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------CR--------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
(KEY + FOR A RESULT FIELD NAME)
DATA FIELD       HEADING          FUNCTIONS        NOTE:
                                                       A=ACCUMULATE
                                                       Z=BLANK IF ZERO
```

Figure 8-9. Summary List Field Specification Display

Prompt	Response	Explanation
DATA FIELD	Field name, + or *	Field name indicates that the field is to be listed. The + indicates a result field is desired. An * indicates a heading continuation line. An * is not allowed on the first input line. The field can be from a list file or a master file. Only heading continuation lines can follow a result field.
HEADING	Literal; specifies the heading.	The maximum length is 16 characters. If blank, the heading defaults to the data field name, or to *RESULT if a result field is requested. No default is assumed when using heading continuations.
FUNCTIONS	Enter the letters for the functions desired.	The letters can be contiguous or separated by commas or blanks. A–Field is to be accumulated. Z–Field will print as blanks whenever it has a zero value. This is valid only for a numeric field. *Note:* If the field is also accumulated, any accumulate values of zero are not blanked. No functions can be specified on a heading continuation line. *Note*: For any record type, only as many fields as will fit on three print lines (one print line if multiple headings are used, two print lines if greater than 132 positions are used) can be processed at a time; up to 40 fields can be processed at a time.

Result Field Specification

This prompt (Figure 8-10) appears if you requested a result field on the Data Field Specification prompt.

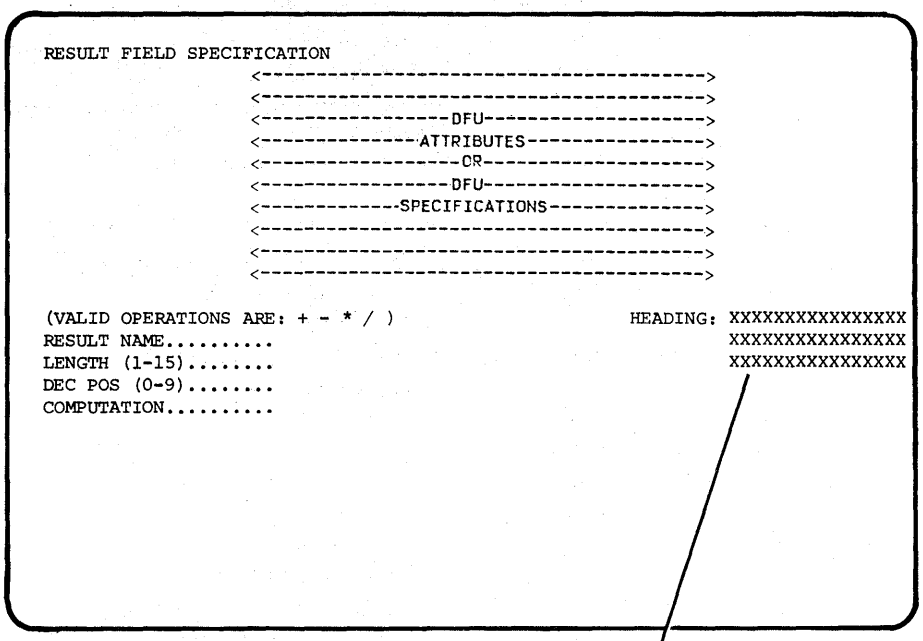


Figure 8-10. Result Field Specification Display

Prompt	Response	Explanation
RESULT NAME	Null response or a valid field name (six or less characters, starting with A-Z, #, @, or $, and remaining characters alphameric)	Null response indicates the result will not be used in later result fields. Field name indicates the result of this operation can be used as a factor in later result fields for this record. The result field operand cannot exceed 15 positions. This name cannot be the name of a field in a record type being listed.
LENGTH (1-15)	Number from 1 to 15	Indicates the length of the field generated.
DEC POS (0-9)	Number from 0 to 9	Indicates the precision (decimal positions) of the result field.
COMPU-TATION	Key an arithmetic expression describing the fields/ constants to be combined for the result	Examples: PRICE * QTY PRICE * .10 PRICE * .10- (PRICE * QTY) * .10

The rules for specifying this computation are:

1. DFU will process the factors in the exact order they are specified. There is no hierarchy of operations other than grouping (see rule 4).

   Thus if A = 1, B = 2, C = 3

   A + B * C = 9

   while A + (B * C) = 7

   Note: A result field operand cannot exceed 15 positions.

2. An arithmetic operation code must have at least one blank before and after it.

3. A negative numeric constant is indicated by placing a minus sign directly after the last digit (or possible decimal point) in the constant; there can be no intervening blanks.

4. Factors can be grouped with up to one level of parentheses (thus a left parenthesis must have a right parenthesis before another left parenthesis can be specified).

5. Factors can be: a field from the input file, a field from a master file, a previously named result field from the current record, or a numeric constant.

6. The computation specification can be up to 137 characters long.

7. Twenty-four result field factors can be specified for each detail record printed in a list job setup. These factors can be distributed in any manner; for example, one could have 24 result fields of one factor each, or 12 result fields of two factors each.

Result Field Rounding

DFU calculates all result fields using as many significant digits as possible. Once the result is determined, the field is truncated to the number of decimal positions you specified. If you want the result to be rounded upward, specify an add of some power of ten times .5 for one of your calculations. For example:

```
1.4451 <------ DFU calculation.
 .005  <------ You specified this add for your final calculation.
------
1.45   <------ This is the result of DFU truncating and rounding
               your number upward.
```

Note: This method will not work with negative results.

When adding or subtracting, DFU determines which of the two factors involved has the greater number of decimal positions, and then carries the results out to that number of decimal positions. For example:

```
  1.0      This factor has one decimal position.
- .999     This factor has three decimal positions.
-------
  0.001    Result is carried out to three decimal positions.

  1.253    This factor has three decimal positions.
+ 3.8      This factor has one decimal position.
-------
  5.053    Result is carried out to three decimal positions.
```

When multiplying, DFU carries the results out to the sum of the decimal positions in the two factors. For example:

```
  1.25     This factor has two decimal positions.
x 1.2      This factor has one decimal position.
-------
  1.500    Result is carried out to three decimal positions.
```

When dividing, DFU carries the results out to the largest number of decimal positions in a factor encountered up through the division operation, or the number of decimal positions indicated on the specification display (whichever is the larger). For example assume you specified that the final result of the following factors is to print with one decimal position:

```
                10.2 x 12 / 5 + .05

Multiply:       10.2 x 12 = 122.4
Divide:         122.4 / 5 = 24.4        Note that the division
                                        is carried out to only
                                        one decimal position,
                                        because no factor yet
                                        encountered has more
                                        than one decimal position.

Add:            24.4 + .05 = 24.45
```

Thus, the final result is 24.4.

Assume the same factors but specified as:

```
                .05 + (10.2 x 12 / 5)

Multiply:       10.2 x 12 = 122.4
Divide:         122.4 / 5 = 24.48       Note that the division
                                        is carried out to
                                        two decimal positions.

Add:            .05 + 24.48 = 24.53
```

Thus the final result is 24.5. Result is carried to one decimal position as specified.

Sort Field Specification

This display (Figure 8-11) appears for any list. You can specify one sort field in each line containing an A in the sequence entry. The total length of all sort fields cannot exceed 256 characters. If you key fields, and then press the Enter/Rec Adv function control key, DFU saves those fields and prompts for more (unless five sort fields have been specified). But if you press the Rec Adv command function key, the sort specifications will be considered complete.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, the sort field prompting terminates and records will not be sorted before listing. If you specified SORT on the initial command, at least one sort field must be specified.

Upon completion of this prompt, DFU prompts as in Figure 8-12.

```
SORT FIELD SPECIFICATION (IF DESIRED)
                   <---------------------------------------->
                   <---------------------------------------->
                   <----------------DFU--------------------->
                   <-------------ATTRIBUTES----------------->
                   <-----------------OR---------------------->
                   <----------------DFU--------------------->
                   <-----------SPECIFICATIONS--------------->
                   <---------------------------------------->
                   <---------------------------------------->
                   <---------------------------------------->
(MAJOR TO MINOR ORDER)
SORT FIELD         SEQUENCE          NOTE:
                   A                     A=ASCENDING
                   A                     D=DESCENDING
                   A
                   A
                   A
```

Figure 8-11. Sort Field Specification Display

```
SORT FIELD SPECIFICATION (IF DESIRED)
                   <-----------DFU ATTRIBUTES--------------->
                   <--------------OR----------------------->
                   <-----------DFU SPECIFICATIONS----------->
                   <---------------------------------------->
(MAJOR TO MINOR ORDER)
SORT FIELD         SEQUENCE             CONTROL FIELD TYPE
                   A   A=ASCENDING      0   O=ALPHAMERIC      R=R/S/T
                   A   D=DESCENDING     0   E=SEION           S=S/R/T
                   A                    0   I=PRON/R/S/T      T=IGC CHARACTER
                   A                    0   J=PRON/S/R/T
```

Figure 8-11.1. Sort Field Specification Display (Ideographic Session)

Prompt	Response	Explanation
SORT FIELD	Field name	The specified field becomes the next sort field. A maximum of five entries is allowed. These fields cannot be selected from the master file.
SEQUENCE	A D	A for ascending or D for descending sequence.
CONTROL FIELD TYPE	Blank	Alphanumeric
	O	Alphanumeric
	E	Seion
	I	Single pronunciation/radical/stroke/ tie breaker
	J	Single pronunciation/stroke/radical/ tie breaker
	R	Radical/stroke/tie breaker
	S	Stroke/radical/tie breaker
	T	IGC character type

Note: Control field type is valid only when you are signed on in ideographic session.

Control Field Specification

This display (Figure 8-12) appears for all list functions.

You can specify one control field per line, up to and including the last line containing an N in the skip after indication. If you then press the Enter/Rec Adv function control key, DFU saves those fields and prompts for more (unless five levels of fields have been specified). If you press the Rec Adv command function key, the control field specification will be considered complete.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, the prompt terminates and no control fields are generated. Any control fields can be specified to cause a skip to a new page after printing all data associated with a control break at that level.

Upon completion of this prompt, DFU prompts as in Figure 8-13.

```
CONTROL FIELD SPECIFICATION (IF DESIRED)
                  <--------------------------------------->
                  <--------------------------------------->
                  <----------------DFU-------------------->
                  <-------------ATTRIBUTES---------------->
                  <-----------------OR--------------------->
                  <----------------DFU-------------------->
                  <-----------SPECIFICATIONS-------------->
                  <--------------------------------------->
                  <--------------------------------------->
                  <--------------------------------------->
(MAJOR TO MINOR ORDER)
CONTROL FIELD     SKIP AFTER? (Y,N)
                  N
                  N
                  N
                  N
                  N
```

Figure 8-12. Control Field Specification Display

Prompt	Response	Explanation
CONTROL FIELD	Null or Field name	The specified field becomes a control field; a maximum of five control fields are allowed.
SKIP AFTER? (Y,N)	Y YES	YES indicates DFU skips to a new page after a control break occurs in this field.
	N NO	NO indicates DFU does not skip to a new page after a control break occurs in this field. NO is the default.

Select Field Specification

This display (Figure 8-13) appears for all list functions. You can define one record selection criterion per line, up to and including the next to last line on the display. If you then press the Enter/Rec Adv function control key, DFU saves those fields and prompts for more (unless 10 have been defined). If you press the Rec Adv command function key, the select field specifications are considered complete.

If you press the Enter/Rec Adv function control key or the Rec Adv command function key without keying data, DFU terminates this prompt and there is no record selection based on field value.

The cursor is initially positioned under FIELD; thereafter, it is positioned under OR/AND.

Upon completion of this prompt, the list setup is complete.

```
SELECT FIELD SPECIFICATION (IF DESIRED)
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------APPLICATION---------------->
                    <-----------------OR---------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
(VALID CRITERIA ARE: EQ NE GT LT GE LE )
OR/AND       SELECT FIELD     SELECT CRITERIA          FIELD/'CONSTANT'
```

Figure 8-13. Select Field Specification Display

Prompt	Response	Explanation
OR/AND	OR AND	Specifies whether next criterion is to be in an OR or AND relationship with the last criterion. OR indicates the start of a new set of record selection criteria for a record (only one set of criteria has to be met for printing to occur). AND indicates this criterion must be met in addition to the previously specified criterion for a record to be printed.
FIELD	Field name	Select records based on value of this field. The field cannot be a field from the master file DFU attributes or one of the named result fields. The field name specified should appear in each record type associated with this select criteria. If the field name specified does not appear in a particular record type, this record select criteria and any others connected to it with an AND condition are ignored when processing that record type.
SELECT CRITERIA	EQ	Equal to the compare value
	NE	Not equal to the compare value
	LT	Less than the compare value
	GT	Greater than the compare value
	LE	Less than or equal to the compare value
	GE	Greater than or equal to the compare value

Prompt	Response	Explanation
FIELD/ 'CONSTANT'	Field name or constant, or date keyword	DFU compares the select field to this value. A field cannot be from the master file and cannot be one of the named result fields. A constant must be entered in quotes. The maximum length of a constant is 20. A field name indicates that the select field will be compared to another field in the record. The field name specified should appear in each record type associated with this select criteria. If the field name specified does not appear in a particular record type, this record select criteria and any others connected to it with an AND condition are ignored when processing that record type. A constant indicates that the select field will be compared to the constant data. A date keyword indicates the select field is compared to the current program date, or a portion of that date (UDATE=date, UYEAR=year, UMONTH=month, UDAY=day). *Note:* For UDATE, the field in the record to be checked must be in the same format as the stored program date (MMDDYY, YYMMDD, or DDMMYY). DFU does not rearrange data in descending order of importance for UDATE comparisons. Thus, if the stored program date is not YY/MM/DD (year/month/day), any compare criteria other than EQ (equal) and NE (not equal) can give unpredictable results.

Update DFU Specifications

The setup step is now completed and the following display (Figure 8-14) appears so that you can update the DFU specifications before going on to the execution portion of list. Chapter 10 describes the procedure for updating DFU specifications.

Press the EOJ command function key when the DFU specifications are complete; this causes the DFU format to be created and list execution to begin.

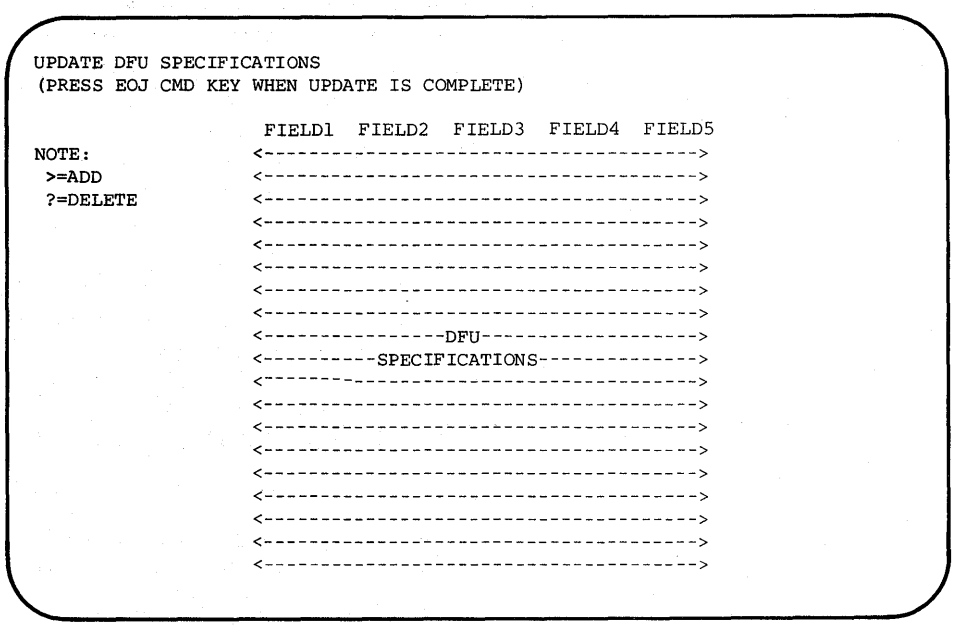


Figure 8-14. Updating DFU Specifications Display

LIST EXECUTION

The purpose of list execution is to generate a printed report of the specified file, formatted as specified in the DFU format description.

If no sort fields are defined in the DFU format description, the specified file can only be listed in unsorted order (parameter 4 on the command must be NOSORT). If sort fields are defined in the DFU format description, the specified file can be listed in sorted or unsorted order (parameter 4 on the command can be SORT or NOSORT).

LIST EXAMPLES

The following examples of DFU generated lists (Figures 8-15 through 8-17) show the same file printed (listed) in different formats. The file is a typical order entry application (see Appendix A) containing two record types for each order.

- The header record (record type 01) indicates customer, date, and shipping information.
- The detail record (record type 02) indicates customer, quantities, item purchased, and prices.

For each list type, the quantity and dollar amounts have been accumulated and printed.

```
77/08/10              RECORD TYPE LIST              PAGE    1

CUSTOMER NO.  DATE          SHIPPED TO    SHIP VIA

    21884     10/30/7-          19        AIR FREIGHT

CUSTOMER NO.  QUANTITY   PART NUMBER       PRICE   AMOUNT

    21884          25        412008         0.75    18.75
    21884          25        412009         0.39     9.75
    21884         600        456116         0.98   588.00

                          QUANTITY              AMOUNT

                             650               616.50 *

CUSTOMER NO.  DATE          SHIPPED TO    SHIP VIA

    14121     10/30/7-          74        BEST WAY

CUSTOMER NO.  QUANTITY   PART NUMBER       PRICE   AMOUNT

    14121          48        612695        50.00 2400.00
    14121          48        612623        55.00 2640.00
    14121          48        612783        60.00 2880.00

                          QUANTITY              AMOUNT

                             144              7920.00 *
                             794              8536.50 **

        8 RECORDS PROCESSED
```

Figure 8-15. Record Type List, Sample

77/08/10 DETAIL SUMMARY LIST PAGE 1

CUSTOMER NO.	DATE	SHIPPED TO	SHIP VIA	QUANTITY	PART NUMBER	PRICE	AMOUNT
21884	10/30/7-	19	AIR FREIGHT				
21884				25	412008	0.75	18.75
21884				25	412009	0.39	9.75
21884				600	456116	0.98	588.00
				650			616.50 *
14121	10/30/7-	74	BEST WAY				
14121				48	612695	50.00	2400.00
14121				48	612623	55.00	2640.00
14121				48	612783	60.00	2880.00
				144			7920.00 *
				794			8536.50 **

8 RECORDS PROCESSED

Figure 8-16. Summary List with Detail Printing, Sample

Note: In the examples shown, the slashes in the date field were keyed in by the operator as part of the data.

```
77/08/10 NON-DETAIL SUMMARY LIST  PAGE   1

CUSTOMER NO.  QUANTITY      AMOUNT

   21884           650      616.50 *
   14121           144     7920.00 *
                   794     8536.50 **

      8 RECORDS PROCESSED
```

Figure 8-17. Summary List without Detail Printing, Sample

This page is intentionally left blank.

Chapter 9. DFU Attributes

DFU attributes are temporary records for the current job which contain information about the file; DFU builds them from an RPG II source member (Figure 9-1). The attributes consist of 40-character records divided into five 8-character fields. The DFU attributes are displayed while the prompts are being responded to in the job setup step. Figure 9-2 describes each line of the DFU attributes built from the input on the RPG II source member specifications.

DFU ATTRIBUTES WHEN USING A RELATED MASTER FILE

If a related master file is specified in the LIST command, the RPG II source member describing the master file and the name of the field in the list file that DFU uses to retrieve master file records must also be specified during job setup. DFU builds attributes for the list file (using the RPG II source member that describes the list file) and then builds attributes for the master file (using the RPG II source member that describes the master file). The master file attributes follow the list file attributes and are the same as those described in Figure 9-2 with the following exceptions:

- In B, field 3 names the field in the list file that corresponds to the key field in the master file.
- C and D do not appear in the DFU attributes. DFU does not determine the record type when retrieving a master record.

Figure 9-2 shows an example of DFU attributes created for a list job.

DISPLAYING ATTRIBUTES

While the setup prompts are being responded to, the DFU attributes can be shown on the top half of the display. While the DFU specifications are being displayed for updating or correction, DFU attributes can be displayed on the entire display.

You can scan through the attributes by using the Roll↑ and the Roll↓ function control keys. The Display Attr/Spec command function key displays DFU attributes if specifications are on the display or specifications if attributes are on the display. A listing of the attributes and specifications can be obtained from the system list device by pressing the Print Rec command function key when the specifications are being displayed for updating.

File Description Specifications

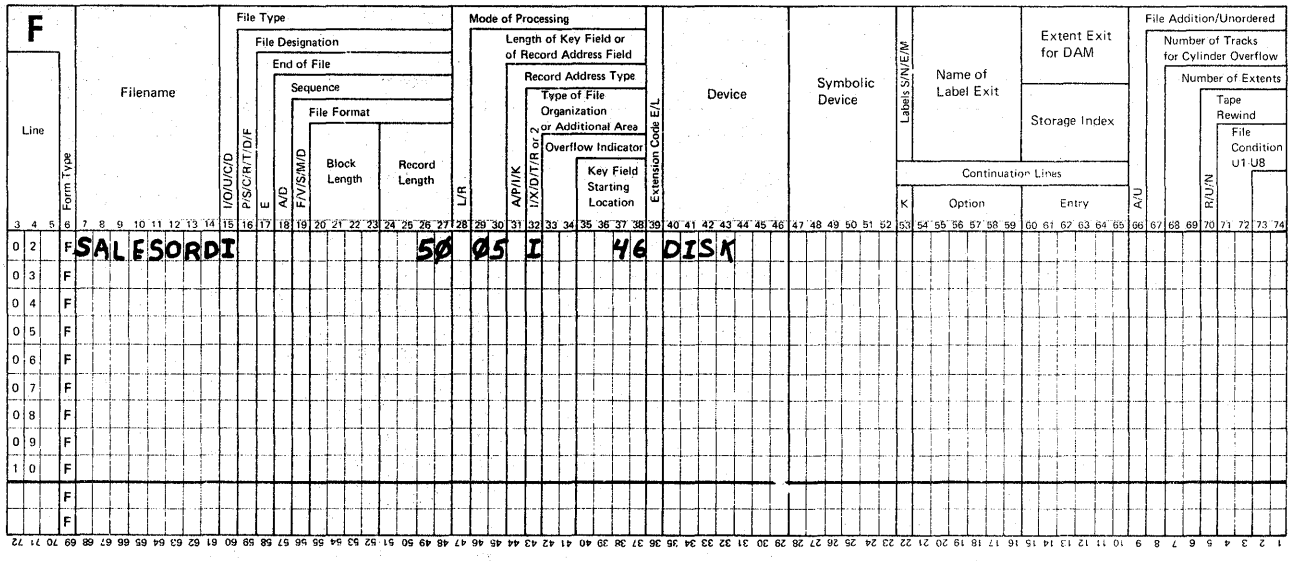


Figure 9-1 (Part 1 of 2). RPG II Source Member Example

RPG INPUT SPECIFICATIONS

IBM International Business Machines Corporation

GX21-9094 U/M050*
Printed in U.S.A.

Program		Punching Instruction	Graphic		Card Electro Number
Programmer	Date		Punch		

Page 02 of 2 — Program Identification

Line	Form Type	Filename	Sequence	Number (1) Nu	Option (O) U	Record Identifying Indicator or DS	Record Identification Codes 1: Position	1: Not (N)	1: C Z D	1: Character	2: Position	2: Not (N)	2: C Z D	2: Character	3: Position	3: Not (N)	3: C Z D	3: Character	Stacker Select	P B L R	Field Location: From	Field Location: To	Decimal Positions	Field Name	Control Level (L1-L9)	Matching Fields or Chaining Fields	Field Record Relation	Field Indicators: Plus	Field Indicators: Minus	Field Indicators: Zero or Blank
01	I		01			01	1		C	H																				
02	I																				1	1		CODE						
03	I																				2	6	Ø	CUSTNO						
04	I																				7	12		ORDNO						
05	I																				13	17		CUSORD						
06	I																				18	25		DATE						
07	I																				26	27		SHPTO						
08	I																				28	42		SHPVIA						
09	I		02	N		02	1		C	D																				
10	I																				1	1		CODE						
11	I																				2	6	Ø	CUSTNO						
12	I																				7	12		ORDNO						
13	I																				13	16	Ø	QTY						
14	I																				17	22		PARTNO						
15	I																													
16	I																													
17	I																													
18	I																													
19	I																													
20	I																													
	I																													
	I																													
	I																													
	I																													
	I																													

Figure 9-1 (Part 2 of 2). RPG II Source Member Example

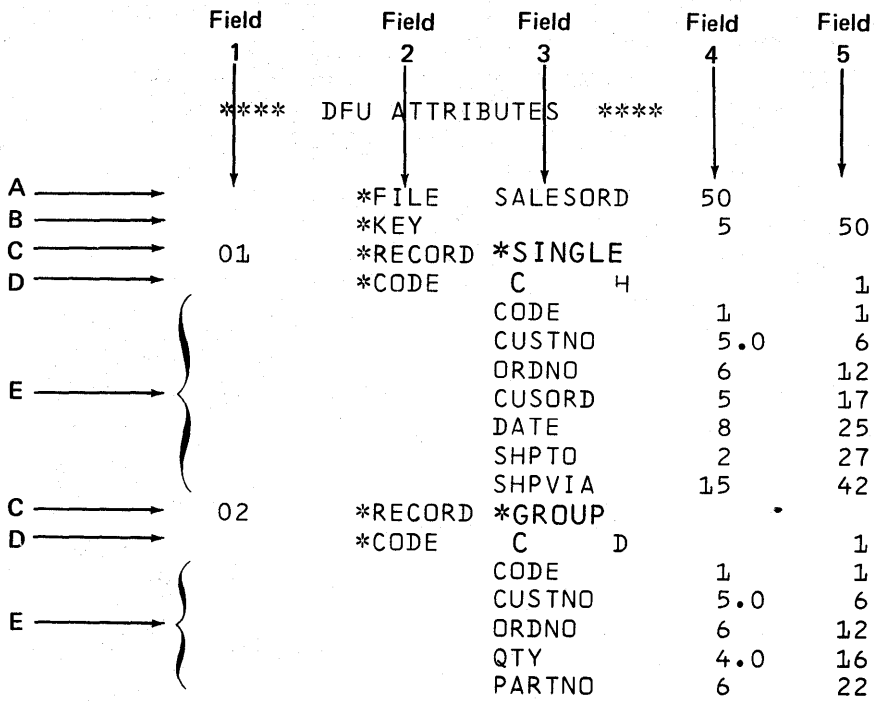


Figure 9-2 (Part 1 of 3). DFU Attributes Examples

A describes the file to be processed.

Field 1: Blank

Field 2: *FILE

Field 3: Name of the file specified to be processed

Field 4: Length of the records in the file

Field 5: Blank

B describes the record key in the file to be processed. This attribute line does not appear if you are processing a sequential or direct file.

Field 1: Blank

Field 2: *KEY

Field 3: Blank

Field 4: Length of the record key. If packed keys are used, the length is preceded by the letter P.

Field 5: End position of the record key in the record

Each C identifies the record type described by the DFU attributes lines that follow (the D and E lines).

Field 1: Record identification indicator of the record type

Field 2: *RECORD

Field 3:

*SINGLE	This record type is sequenced, with a single record in the sequence.
*GROUP	This record type is sequenced, with one or more records in the sequence.
Blank	If there have been no sequenced record types, yet, this record type is also unsequenced. If there have been sequenced record types previously, this record type has the same sequence attributes (*SINGLE or *GROUP) as the preceding record type. This situation occurs when two or more record types are in an 'OR' relation.

Field 4: Blank

Field 5: Blank

Figure 9-2 (Part 2 of 3). DFU Attributes Examples

Each D specifies the record identification codes for the record type.

Field 1: Blank for the first or only code line; AND or OR for succeeding code lines

Field 2: *CODE

Field 3: Record identification code

Field 4: Blank

Field 5: Position of the identification code in the record

Each E describes the fields in the record type.

Field 1: Blank

Field 2: Blank

Field 3: Name of the field

Field 4: Length of the field. For a numeric field, field 4 contains the length of the field followed by a period and a digit indicating the number of decimal positions in the field. For a packed decimal field, the number in field 4 is preceded by the letter P.

Field 5: End position of the field in the record.

Figure 9-2 (Part 3 of 3). DFU Attributes Examples

Chapter 10. DFU Specifications

DFU specifications are created by DFU from your responses to prompts in the setup steps. The specifications describe the file processing desired. DFU specifications can be saved as a source member in the library and used as input for other DFU jobs, allowing you to skip the setup prompting sequence.

This chapter explains the contents of the DFU specifications, how the specifications can be modified, and how they can be saved and used in other setups.

DFU SPECIFICATION LINES

DFU specifications consist of 40-character records. There are several types of lines within the specifications.

1. The header line is the first line in the specifications. It specifies the DFU job type and special processing required when the job is run.

2. The record key line or lines follow the header line and specify special record key or record number processing required when the job is run, as well as the headings for record key or record number fields.

3. The title line follows the record key field specification. It specifies the column spacing value and job title.

4. The record line(s) specifies the record identification indicator for the record types to be processed. There is one record line for each record type processed. The record lines must be in the same order as they are in the RPG II source member if sequenced record types are specified for an enter/update function.

5. The data field specification lines describe the processing required on the individual fields within the record types. A data field specification line must be present for each processed field in the record type.

6. Continuation lines describe additional heading lines to create multiple line list headings.

For record list or summary list DFU specifications, more than one field specification line may be needed to specify multiple heading lines, calculated result fields, and record selection criteria.

DFU SPECIFICATION TYPES

The DFU specifications differ depending on the type of job being set up. The types of DFU specifications are:

- Enter/update
- Inquiry
- Record list
- Summary list

Enter/Update Specifications

The enter/update specifications (Figure 10-1) must occur in this order:

	Field 1	Field 2	Field 3	Field 4	Field 5
Header specification	blank or *HALT	*ENT/UPD	*LIST *LISTNEW *NOLIST blank	Delete code	*COLUMN *COLUMNS *MAXIMUM blank
Record key specification	Field name or blank	*KEY	*GENKEY *NUMERIC *FIELDS blank	Heading → Heading → blank Heading →	 blank
Key field specifications(s) (If *FIELDS, specified in key specification)		opcode	Field name	Heading →	
Title specification	Field column spacing and printer line width	*TITLE	←	Title →	
Record specification	Record ID	*RECORD	blank *LOWCASE		
Data field specification		Opcode	Field name	Heading →	

Figure 10-1. Enter/Update Specifications

After the title specification, the record and associated data field specifications alternate until all record types have been defined.

Enter/Update Specification Explanation

Header specification: Always present.

Field 1:	*HALT	Halt when unprintable characters are in data to be printed.
	Blank	Do not halt when data to be printed contains unprintable characters.
Field 3:	*LIST	Print records as created, plus updated and deleted records.
	*LISTNEW	Print only new records.
	*NOLIST	Don't print any records.
	Blank	Print only updated or deleted records.
Field 4:	Delete code	Delete code, position (for example X, 1).
Field 5:	*COLUMN	The display is in single-column format.
	*COLUMNS	The display is in multiple column format.
	*MAXIMUM	The display is in maximum data format.
	Blank	Defaults to *COLUMNS.

Record key specification: Always present.

Field 1:	Field name	Name of the field to contain the record number when processing sequential or direct files.
	Blank	Applicable only for sequential or direct files; the record number is not placed in a created/changed record.

Field 3: *GENKEY — DFU generates a five-digit numeric key for indexed files, or sequential record numbers for sequential or direct files.

*NUMERIC — The operator supplies a numeric key when processing indexed files.

*FIELDS — The record key is composed of field(s) in the record (the following specifications describe the record key fields). This is applicable only when processing indexed files.

Blank — The operator supplies an alphameric key when processing indexed files, or DFU is not generating record numbers for sequential or direct files.

Key field specifications: Present only if *FIELDS specified in the key specification.

Field 2: Op code — A description of the valid enter/update operation codes is listed later in this chapter.

Title specification: Always present.

Field 1: F XXX

F = Number of spaces between fields on printer output (0-9).
XXX = Printer line width (60-198); value must be right-justified.

Record specification: At least one must be present.

Field 1: Record ID

Field 3: Blank — Allows operator to key only uppercase data for this record type.

*LOWCASE — Allows operator to key uppercase and lowercase data for this record type.

Data field specification: Optional.

Field 2: Op code — A description of the enter/update operation codes is listed later in this chapter.

Inquiry Specifications

The inquiry specifications (Figure 10-2) must occur in this order:

	Field 1	Field 2	Field 3	Field 4	Field 5
Header specification	blank or *HALT	*INQUIRY	blank or *EDIT		*COLUMN *COLUMNS *MAXIMUM blank
Record key specification	Field name or blank	*KEY	*NUMERIC *FIELDS blank	Heading → Heading →	
Key field specification (If *FIELDS, specified in record key specification)		Opcode	Field name	Heading →	
Title specification	Field column spacing and printer line width	*TITLE	Title →		
Record specification	Record ID	*RECORD	blank *LOWCASE		
Data field specification		Opcode	Field name	Heading →	

Figure 10-2. Inquiry Specifications

After the title specification, the record and associated data field specifications alternate until all record types have been defined.

Inquiry Specifications Explanation

Header specification: Always present.

Field 1:	*HALT	Halt when data to be printed contains unprintable characters.
	Blank	Do not halt when data to be printed contains unprintable characters.
Field 3:	*EDIT	Indicates that numeric data is edited. DFU blanks any leading zeros, left-justifies the numeric characters, inserts decimal points, and displays the sign if it is negative (-).
	Blank	Indicates no editing of numeric data.
Field 5:	*COLUMN	The display is in single-column format.
	*COLUMNS	The display is in multiple column format.
	*MAXIMUM	The display is in the maximum data format.
	Blank	Defaults to *COLUMNS.

Record key specification: Always present.

Field 1:	Field name	Name of the field in the record that contains the record number when processing sequential or direct files.
	Blank	Applicable when processing direct or sequential files; assumes a field length of 7 for the record number prompt.
Field 3:	*NUMERIC	The operator supplies a numeric key.
	*FIELDS	The record key is composed of field(s) in the record (the following specifications describe the record key fields).
	Blank	The operator supplies an alphameric key when processing indexed files, when processing sequential or direct files, this field must be blank.

Record key field specifications: Present only if *FIELDS is specified in the key specification.

Field 2:	Op code	A description of the valid inquiry operation codes is listed later in this chapter.

Title specification: Always present.

Field 1:	F XXX	F = Number of spaces between fields on printer output (0-9). XXX = Printer line width (60-198); value must be right-adjusted.

Record specification: At least one must be present.

Field 1:	Record ID.	
Field 3:	Blank	Allows the operator to key only uppercase data for this record type.
	*LOWCASE	Allows the operator to key uppercase and lowercase data for this record type.

Data field specification: Optional.

Field 2:	Op code	A description of the valid inquiry operation codes is listed later in this chapter.

Record List Specifications

The following table (Figure 10-3) describes the first set of specifications for a record type list. The first set of specifications must occur in this order:

	Field 1	Field 2	Field 3	Field 4	Field 5
Header specification	blank or *HALT	*LIST	*RECORD		
Key specification		*KEY	*RECNUM *PRINT *NUMERIC blank	Heading → Heading → Heading →	
Title specification	Field column spacing and printer line width values	*TITLE	Title →		
Record specification	Record ID	*RECORD			
Data field specifications	 Length• decimal positions Length• decimal positions	Opcode Opcode Opcode	Field name *RESULT +Field name	Heading → Heading → Heading →	
Continuation specification(s)	*	*HDNG	Blank	Heading or blank	
Result field specifications (if preceding data field specification indicates a result field)	ADD SUB MULT DIV		Factor → (Factor → Factor →) (Factor →)		

Figure 10-3 (Part 1 of 2). Record List Specifications

As in enter/update and inquiry, record and associated data field specifications alternate until all record types to be listed are defined. The following specifications, if present, follow all record and field specifications. These sort, control level, and select specifications can be in any order, and intermingled. (The exception is a select specification in which a field is compared to a constant; the constant must directly follow the associated select specification.)

	Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**
Sort field specification(s)	Control field type	*SORTA *SORTD	Field name Field name		
Control field specifications(s)	blank *SKIP	*TOTAL	Field name		
Select field specification(s) (compare field to another field)	blank (1st) AND/OR	*SELECT	Field name	Relation	Field name or keyword
Select field specification(s) (compare field to a constant)	blank (1st) AND/OR	*SELECT	Field name Constant →	Relation ↓ (Two specifications)	blank →

Figure 10-3 (Part 2 of 2). Record List Specifications

Record List Specifications Explanation

Header specification: Always present.

Field 1:	*HALT	Halt when the data to be printed contains unprintable characters.
	Blank	Do not halt when the data to be printed contains unprintable characters.

Record key specification: Always present.

Field 3:	PRINT	Print an alphameric record key as the first field when processing an indexed file. When processing a sequential or direct file, generate and print a record number for each consecutive record.
	*NUMERIC	Print a numeric record key as the first field. This is only applicable for indexed files.
	Blank	Don't print a record key or record number as the first field.
	*RECNUM	Print the relative record number as the first field. This is only applicable for sequential or direct files.

Title specification: Always present.

Field 1:	F,L XXX	F = Number of spaces between fields on printer output (0-9). L = Detail line spacing on printer output (1, 2, 3). XXX = Printer line width (60-198); value must be right-justified.

Record specification: At least one must be present.

Field 1: Record ID

Data field specifications: Optional.

Field 1:		Specifies the length and decimal positions for the result field (length, decimal position).
Field 2:	Op code	A description of the valid list function operation codes is listed later in this chapter.
Field 3:	Field name:	This field is printed as is.
	*RESULT	This field is printed after combining factors from one or more input fields and/or constants via arithmetic operations. These factors are described in the following result field specifications.
	+Field name	Same as *RESULT. The result of the calculation can be used as a factor in succeeding result fields on the print line.

Continuation specification: Optional.

Field 1:	*	Indicates this is a continuation specification.
Field 2:	*HDNG	Indicates this is a heading continuation.
Field 3:	Blank	Field 3 must be blank for heading continuations.

Result field specifications: Present if the preceding data field specification is *RESULT or +Field name.

Field 1:	ADD	Add this factor to the result.
	SUB	Subtract this factor from the result.
	MULT:	Multiply this factor times the result.
	DIV	Divide the result by this factor.
Field 3-5:		These fields hold the factor to be incorporated into the result:
	Factor	A single factor.
	(Factor	The first factor in a parenthetical expression.
	Factor)	The last factor in a parenthetical expression.
	(Factor)	The only factor in a parenthetical expression.

Notes:
1. The factor can be a numeric constant, a field from the list or master file, or the name of a previous result field.
2. If the factor is a previously named result field, do not key the + sign preceding the result name.

Sort field specifications: Optional; if specified, they must be in a major to minor order.

Field 1: Blank – Alphanumeric type
E – Seion sort type
I – Single pronunciation/radical/stroke/tie breaker
J – Single pronunciation/stroke/radical/tie breaker
R – Radical/stroke/tie breaker
S – Stroke/radical/tie breaker
T – Ideographic character type

Field 2: *SORTA Sort this field in ascending sequence.

*SORTD Sort this field in descending sequence.

Control field specifications: Optional; if specified, they must be in a major to minor order.

Field 1: Blank Do not skip to a new page after a control break on this field.

*SKIP Skip to a new page after a control break on this field.

Select field specifications: Optional

Comparing a field to a field:

Field 1: Blank First select field specification.

AND This condition must be satisfied in addition to the previous select criterion.

OR The start of a new set of select conditions.

Field 4: Relation EQ, NE, GT, LT, GE, or LE

Field 5: Field name – Compare select field to this field.

UMONTH – Compare select field to current month.

UDAY – Compare select field to current day.

UYEAR – Compare select field to current year.

UDATE – Compare select field to current date.

Comparing a field to a constant (requires two specifications):

1. First specification: Same as above, except field 5 is blank.

2. Second specification: Fields 3 through 5 hold the constant to be compared against.

Summary List Specifications

The following table (Figure 10-4) describes the first set of specifications for a summary list. The first set of specifications must occur in the specified order.

	Field 1	Field 2	Field 3	Field 4	Field 5
Header specification	blank or *HALT	*LIST	*SUMMARY	blank *DETAIL	
Record key specification		*KEY	*PRINT *NUMERIC blank *RECNUM	Heading → Heading → Heading →	
Title specification	Field column spacing and printer line width values	*TITLE	Title →		
Record specification	Record ID	*RECORD			
Data field specifications(s)	 Length• decimal position Length• decimal position	Opcode Opcode Opcode	Field name *RESULT +Field	Heading → Heading → Heading →	
Continuation specification(s)	*	*HDNG	Blank	Heading or blank →	
Result field specifications (if preceding data field specification indicated a result field)	ADD SUB MULT DIV		Factor → (Factor → Factor →) (Factor →)		

Figure 10-4 (Part 1 of 2). Summary List Specifications

Unlike enter/update, inquiry, and record list, all summary-list record specifications appear before any summary-list data field specifications; if there are no record specifications, all record types containing a field to be listed will be included in the list.

The sort, control level, and select specifications, if present, follow all data field specifications. They can be in any order, and intermingled. (The only exception is a select specification in which a field is compared to a constant; the constant must directly follow the associated select specification.)

	Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**
Sort field specification(s)	Control field type	*SORTA *SORTD	Field name Field name		
Control field specification(s)	blank or *SKIP	*TOTAL	Field name		
Select field specifications(s) (compare this field to field)	blank (1st) AND/OR	*SELECT	Field name	Relation	Field name or keyword
Select field specification(s) (compare field to constant)	blank (1st) AND/OR	*SELECT	Field name Constant →	Relation	blank

Figure 10-4 (Part 2 of 2). Summary List Specifications

Summary List Specifications Explanation

Header specification: Always present.

Field 1:	*HALT	Halt when data to be printed contains unprintable characters.
	Blank	Do not halt when data to be printed contains unprintable characters.
Field 4:	Blank	Print only control fields and accumulator fields on control breaks.
	*DETAIL	Print all detail records selected for processing.

Key field specification: Always present.

Field 3:	*PRINT	Print an alphameric record key as the first field when processing an indexed file. When processing a sequential or direct file, generate and print a record number for each consecutive record.
	*NUMERIC	Print a numeric record key as the first field. This is only applicable for indexed files.
	Blank	Don't print the record key or record number as the first field.
	*RECNUM	Print the relative record number as the first field. This is only applicable for sequential or direct files.

Title specification: Always present.

Field 1:	F,L XXX	F = Number of spaces between fields on printer output (0-9). L = Detail line spacing on printer output (1, 2, 3). XXX = Printer line width (60-198); value must be right-justified.

Record specification: Optional; if absent, all record types containing at least one list field will be printed.

Field 1: Record ID

Data field specification: Optional.

Field 1:		Required for result fields. This is the length and decimal positions used for the result field (length decimal positions).
Field 2:	Op code	A description of the valid list function operation codes is listed later in this chapter.
Field 3:	Field name	This field is printed as is.
	*RESULT	This field is printed after combining factors from one or more input fields and/or constants via arithmetic operations. These factors are described in the succeeding result field specifications.
	+Field name	This field is the same as *RESULT above. In addition, the calculation result can be used as a factor in succeeding result fields on the print line.

Continuation specification: Optional.

Field 1:	*	Indicates this a continuation specification.
Field 2:	*HDNG	Indicates this is a heading continuation.
Field 3:	Blank	Field 3 must be blank for heading continuations.

Result field specifications: Present if the preceding specification is *RESULT or +Field name.

Field 1:	ADD	Add this factor to the result.
	SUB	Subtract this factor from the result.
	MULT	Multiply this factor times the result.
	DIV	Divide the result by this factor.
Field 3-5:		These fields hold the factor(s) to be incorporated into the result.
	Factor	A single factor.
	(Factor	The first factor in a parenthetical expression.
	Factor)	The last factor in a parenthetical expression.
	(Factor)	The only factor in a parenthetical expression.

Notes:

1. The factor can be a numeric constant, a field from the list or master file, or the name of a previous result field.
2. If the factor is a previously named result field, do not key the + sign preceding the result name.

Sort field specifications: Optional; if specified, they must be in major to minor order.

Field 1:	Blank	– Alphanumeric type
	E	– Seion sort type
	I	– Single pronunciation/radical/stroke/tie breaker
	J	– Single pronunciation/stroke/radical/tie breaker
	R	– Radical/stroke/tie breaker
	S	– Stroke/radical/tie breaker
	T	– Ideographic character type
Field 2:	*SORTA	Ascending sequence sort.
	*SORTD	Descending sequence sort.

Control field specifications: Optional; if specified, they must be in major to minor order.

Field 1:	*SKIP	Skip to a new page after a control break on this field.
	Blank	Do not skip to a new page after a control break on this field.

Select field specifications: Optional.

Comparing a field to a field:

Field 1:	Blank	First select field specification.	
	AND	This condition must be satisfied in addition to the previous select criteria.	
	OR	The start of a new set of select criteria.	
Field 4:	Relation	EQ, NE, GT, LT, GE, or LE.	
Field 5:	Field name	Field name	– Compare select field to this field.
	or date	UMONTH	– Compare select field to current month.
	keyword	UDAY	– Compare select field to current day.
		UYEAR	– Compare select field to current year.
		UDATE	– Compare select field to current date.

Comparing a field to a constant (requires two specifications):

1. First specification: Same as above, except field 5 is blank.
2. Second specification: Fields 3 through 5 hold the constant to be compared against.

OPERATION CODES FOR DFU SPECIFICATIONS

This table (Figure 10-5) lists the operation codes (op codes) that can be specified for fields in each of the DFU functions:

Op Code	Functions						Used By		
	Mod 10	Mod 11	Auto-Dup	Blank Fill	Accumulate	Heading Continuation	ENTER/ UPDATE	INQUIRY	LIST
(no functions)							X	X	X
*C	X						X		
*K		X					X		
*Z				X					X
*D			X				X		
*ADD					X		X		X
*ADD Z				X	X				X
*CD	X		X				X		
*KD		X	X				X		
*ADDC	X				X		X		
*ADDK		X			X		X		
*ADDD			X		X		X		
*ADDCD	X		X		X		X		
*ADDKD		X	X		X		X		
*HDNG						X			X

Figure 10-5. Operation Codes for DFU Specifications

This table (Figure 10-6) lists additional operational codes (op codes) that can be specified for fields for ENTER/UPDATE or INQUIRY on systems with ideographic support.

Op Code	Functions				Used By	
	Auto-Dup	Ideographic Data Only	Ideographic or Alphanumeric Data. Field Initialized to Alphanumeric.	Ideographic or Alphanumeric Data. Field Initialized to Ideographic.	ENTER/ UPDATE	INQUIRY
*X		X			X	X
*XD	X	X			X	
*E			X		X	X
*ED	X		X		X	
*F				X	X	X
*FD	X			X	X	

Figure 10-6. Operation Codes for Ideographic Support

SAVED DFU SPECIFICATIONS

It is possible to save and name the DFU specifications built during setup as a source member in a library. They can be used as input for the setup of a similar DFU job, modified as necessary, then used in building the format description for that job.

The format description can be named and saved in the library, or the default name can be used, causing the format to be removed from the library at the end of the job. If a new format is to be created with the same name as the existing format, the existing format name must first be removed from the library using the REMOVE command. The format may be stored as a subroutine member as well as a corresponding display format load member for enter, update, and inquiry. Both must be removed.

It is also possible to create DFU specifications offline and store them as a source member in the library. These DFU specifications can be used as input to the job setup in place of operator-entered prompt responses or DFU specifications saved from a previous job setup, before control is passed to the execution portion of the job.

The ability to save and retrieve the DFU specifications allows the user to retrieve and alter them rapidly to describe a different job to be performed without going through the prompting sequences to create the specifications.

Any saved DFU specifications used must be requested on the initial command or on the DFU parameter prompt display. An RPG II source member for the file(s) to be processed must also be available. The DFU attributes are created from information in the RPG II source member, and then the DFU specifications are retrieved from the source member. Control is then passed to the specification update routine, bypassing the prompting cycle, allowing the operator to modify the DFU specifications.

HOW TO SAVE DFU SPECIFICATIONS

You indicate in the setup command whether or not you wish to save the DFU specifications. Refer to the discussion of the DFU Source Processing Parameter in Chapter 5.

Note: This parameter is not prompted for if not entered in the setup command or on the DFU parameter prompt display.

UPDATING DFU SPECIFICATIONS

During the update procedure, any part of the DFU attributes or specifications can be displayed by pressing the Display Attr/Spec command function key, or the Roll↑ and Roll↓ function keys. Beginning at line 5, DFU attributes or specifications are displayed one per line, up to and including the next to last line of the display; any DFU specifications displayed here (Figure 10-7) can be altered. Change a specification by positioning the cursor, keying the changes, and pressing the Enter/Rec Adv function control key. You can also delete or add specifications as explained in the following paragraphs. A listing of the DFU attributes and specifications can be obtained from the system list device by pressing the Print Rec command function key.

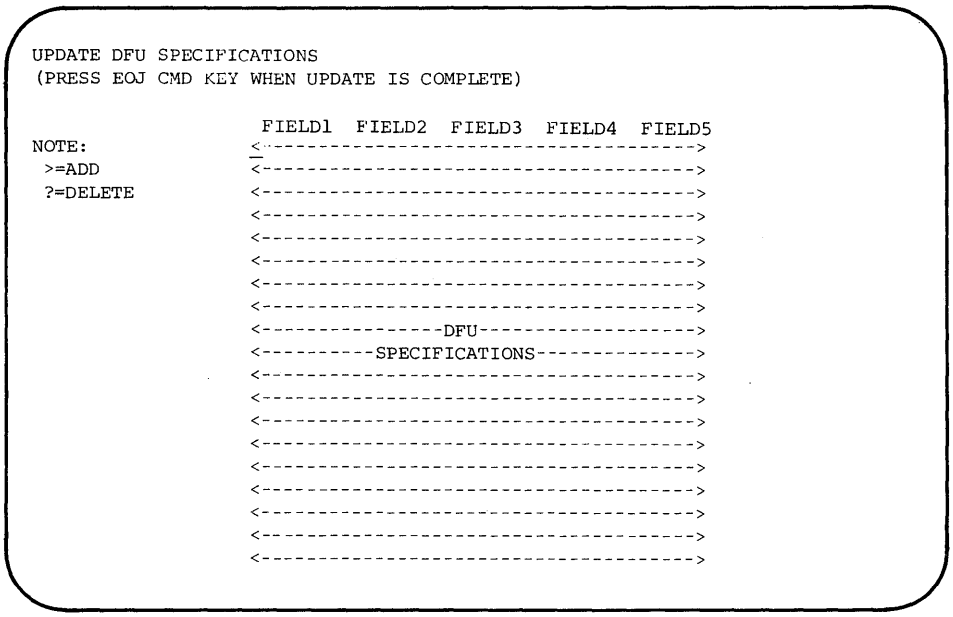


Figure 10-7. DFU Specifications Update Display

If the Enter/Rec Adv function control key is pressed and no specifications have been changed, a roll up (Roll↑) function occurs to display the next set of specifications. A roll up function performed at the end of the specifications will roll the specifications back to the beginning of those specifications.

Deleting

A DFU specification(s) can be deleted by inserting a question mark (?) in the first position of the line(s) to be deleted and pressing the Enter/Rec Adv function control key.

Inserting

DFU specifications can be added by placing the greater than sign (>) in the first position of the line to be inserted after, and pressing the Enter/Rec Adv function control key. An ADD screen is then displayed to allow the addition of DFU specifications beginning at line 5; they can be added one per line up to and including the next to last line on the display (Figure 10-8). Pressing the Enter/Rec Adv key without keying data on a line terminates the ADD screen; any data keyed on preceding lines is saved. Filling add lines causes the ADD screen to repeat.

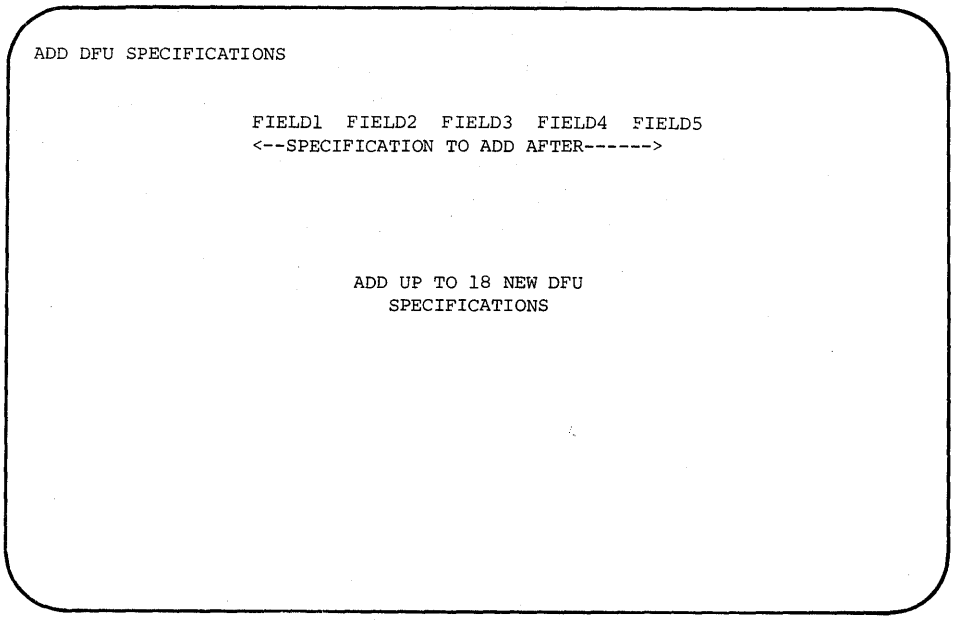


Figure 10-8. ADD Screen Display

CORRECTING DFU SPECIFICATIONS

When you have finished updating the DFU specifications, press the EOJ command function key. This indicates the end of the setup and causes the DFU specifications to be checked for errors. If no errors are found, the DFU specifications are converted to a format description and you cannot update the DFU specifications any further in this setup step. Changes are allowed by DFU only if an error is detected.

When errors are detected, a DFU specification is highlighted (Figure 10-9). The cursor is positioned at the highlighted specification and the MIC is displayed with the error message on the last line of the display. In the case of a syntax error the highlighted specification contains the error and must be corrected or deleted to continue with the job. When a required specification is missing the specification in its place is highlighted. For some errors several specifications can be involved in causing and/or correcting the error. One of the specifications is displayed. Use the MIC to find an explanation of the error in the *Displayed Messages Guide*. You can either correct the error by reentering the proper data or cancel the job. If you make a correction to the DFU specifications and press the EOJ command function key, the corrected specifications are diagnosed. If you press the EOJ command function key without changing any of the specifications, a message asks if the job is to be terminated. If you select the 0 option, the error screen is redisplayed; if you select the 3 option, the job is canceled. A listing of the DFU attributes and specifications can be obtained by pressing the Print Rec command function key, which causes the attributes and specifications to be listed on the system listing device.

CREATING THE DFU FORMAT DESCRIPTION

Once the DFU specifications are error free, they are converted into the format description which is saved as a subroutine member in the library by combining the information from the DFU attributes and specifications. For a list function, the list execution is then called.

Display screen formats are required for enter, update, and inquiry DFU jobs before execution is called.

```
CORRECT DFU SPECIFICATION(S) IN ERROR
(PRESS EOJ CMD KEY AFTER CORRECTIONS ARE MADE)
IF NO CORRECTIONS ARE MADE, THE JOB IS CANCELLED)
                   FIELD1  FIELD2  FIELD3  FIELD4  FIELD5
NOTE:              <------ERROR SPECIFICATION------------>
 >=ADD             <--------------------------------------->
 ?=DELETE          <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <---------------DFU-------------------->
                   <----------SPECIFICATIONS-------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
                   <--------------------------------------->
DFU XXXX - ERROR MESSAGE
```

Figure 10-9. DFU Specifications Error Display

DISPLAY SCREEN FORMATS

DFU jobs defined for enter, update, and inquiry require the creation of source specifications describing the display screen formats for the job. DFU creates these automatically, puts them in a source member, and calls a compile step to create a corresponding display station data management load member. The load member is cataloged under the same name as the DFU format description.

The source member is named by the operator in parameter 10 of the initial command; if parameter 10 is not specified, DFU generates a name and then removes the source member after the corresponding load member has been created. The name is generated by combining: #DF + (session ID) + (1 or 2–depending respectively on whether or not the session is in system inquiry.

If a name is specified in parameter 10, the display format source specifications are saved with that name. You can alter the specifications using SDA (see *Updating an Existing $SFGR/WSU Source Member* in the *SDA Reference Manual*). Once the specifications are altered, SDA will compile them to replace the existing load member. (See the FORMAT procedure in the *System Support Reference Manual*.) Then run the DFU job with the data displayed in the altered format. Exercise care when altering the specifications since DFU is unaware of the changes to the display format load member. When altering the specifications the following rules apply:

- You can alter the locations of fields.
- You can alter the length and data in output constants.
- Do not add or delete any display screens, or change the names of any display screens.
- Do not alter the order of the specifications.
- Do not change the length on any input fields, or add any input fields.
- Do not change any indicators specified.

Once these members have been created, you can initiate an enter, update, or inquiry function. However, changing these specifications is a complex procedure and should be done with a great deal of care.

Appendix A. Job Setup Examples

The following are two examples of DFU job setup steps. Example 1 describes how to prepare a job that allows an operator to create and maintain a customer order file.

Example 2 describes how to set up a job to list a data file. In Example 2, there is no operator action required once the list setup is complete. As soon as you complete the job setup step and create the format description, DFU lists the file.

Note: Parts of the displays in these examples have to be entered by you. The displays are shown as they look after those entries have been made.

EXAMPLE 1: JOB DESCRIPTION

This example describes how to set up a DFU job that allows an operator to create (from an order form, Figure A-1) and maintain a customer order file.

ABC Hardware Company
123 Main Street
Any City, Any State

Sold To
Smith Inc.
1295 Broad ST.
New York, N.Y.

Shipped To:
Jones Co (19)
5161 2nd St.
Boston, Mass.

Our Order No.	Date	Cust. Ord. No.	Customer No.	Ship Via	
XC4313	10/30/-	13019	21884	Air Freight	

Quanity	Part Number	Description	Unit Price	Amount
25	412008	Elec. Receptacle		
25	412009	Elec. Cover plate		
600	456116	Elec. Wiring - 12 gauge		

Figure A-1. Sample Order Form

Example 1: Setting Up the Job

The required RPG II source member, called SALESRPG, describes the customer order file and is now on disk for your use. The SEU command statement that allows you to enter this source member is:

```
SEU SALESRPG,R
```

Figure A-2 shows the file descripiton and input specifications of the RPG II source member. From the RPG II source member, you see:

1. The file name is SALESORD (columns 7 through 14 of the file description specifications). Each record in the file is 50 characters long (see columns 24 through 27 of file description specifications).

2. The key field is five positions long (columns 29 and 30 of the file description specifications).

3. The customer order file is an indexed file (column 32 of the file description specifications).

4. The key field begins at position 46 in each record of the file (columns 35 through 38 of the file description specifications).

5. The customer order file contains two record types.

   Record type 01 is a header record. It is a sequenced record type (columns 15 and 16 contain a numeric entry), and there is one record in the sequence (1 in column 17). It is identified by an H in position 1 of the record and includes the following fields:

Field Name	**Heading on the Order Form**
CODE	This is the record identification code. It does not appear on the order form.
CUSTNO	Customer No.
ORDNO	Our Order No.
CUSORD	Cust. Ord. No.
DATE	Date
SHPTO	Shipped to
SHPVIA	Ship Via

File Description Specifications

F

Line	Form Type	Filename	I/O/U/C/D	P/S/C/R/T/D/E	E	A/D	F/V/S/M/D	Block Length	Record Length	L/R	A/P/I/K	1/2/D/T/R or Additional Area	Overflow Indicator	Key Field Starting Location	Extension Code E/L	Device	Symbolic Device	Labels S/N/E/M	Name of Label Exit	Extent Exit for DAM	Storage Index	Continuation Lines: K	Continuation Lines: Option	Continuation Lines: Entry	A/U	Number of Tracks for Cylinder Overflow	Number of Extents	Tape Rewind	File Condition U1-U8
02	F	SALESORDI							50	Ø5		I		46		DISK													
03	F																												
04	F																												
05	F																												
06	F																												
07	F																												
08	F																												
09	F																												
10	F																												
	F																												
	F																												

RPG INPUT SPECIFICATIONS

IBM International Business Machines Corporation

GX21-9094 U/M050* Printed in U.S.A.

Program		Punching Instruction	Graphic		Card Electro Number
Programmer	Date		Punch		

Page Ø2 of 2 — Program Identification

I

Line	Form Type	Filename	Sequence (OR AND)	Number (1/N)	Option (O), U	Record Identifying Indicator, C, or DS	Record Identification Codes 1: Position	1: Not (N)	1: C/Z/D	1: Character	2: Position	2: Not (N)	2: C/Z/D	2: Character	3: Position	3: Not (N)	3: C/Z/D	3: Character	Stacker Select	P/B/L/R	Field Location: From	Field Location: To	Decimal Positions	Field Name	Control Level (L1-L9)	Matching Fields or Chaining Fields	Field Record Relation	Field Indicators: Plus	Field Indicators: Minus	Field Indicators: Zero or Blank
01	I		Ø11			Ø1	1		CH																					
02	I																				1	1		CODE						
03	I																				2	6Ø		CUSTNO						
04	I																				7	12		ORDNO						
05	I																				13	17		CUSORD						
06	I																				18	25		DATE						
07	I																				26	27		SHPTO						
08	I																				28	42		SHPVIA						
09	I		Ø2N			Ø2	1		CO																					
10	I																				1	1		CODE						
11	I																				2	6Ø		CUSTNO						
12	I																				7	12		ORDNO						
13	I																				13	16Ø		QTY						
14	I																				17	22		PARTNO						
15	I																													
16	I																													
17	I																													
18	I																													
19	I																													
20	I																													
	I																													
	I																													
	I																													
	I																													
	I																													

Figure A-2. The RPG II Source Member, SALESRPG

Record type 02 is also a sequenced record type (columns 15 and 16 are numeric), with one or more records in the sequence (N in column 17). Record type 02 is a detail record. It is identified by a D on position 1 of the record and contains information for each line on the order form. Record type 02 has the following fields:

Field Name	Heading on the Order Form
CODE	This is the record identification code. It does not appear on the order form.
CUSTNO	Customer No.
ORDNO	Our Order No.
QTY	Quantity
PARTNO	Part Number

Note: Chapter 2 describes the RPG II source member required by DFU.

You set up the job so that:

1. DFU prompts the operator for
   a. The header record fields
   b. The detail record fields in the order that you want these fields entered from the order form, and with the headings as they appear on the order form.

      This prompting increases the operator's order entry speed and decreases the chance of error.

2. DFU prints each record after the operator keys it from the order form.

3. The delete code is an X in position 1 of the record, the position reserved for the record identification code.

4. DFU generates keys for the records.

5. The title of the job is Daily Sales Orders.

6. DFU duplicates the ORDNO and CUSTNO fields from the header record into each detail record of an order form.

7. DFU accumulates a total for the QTY field on each order form and prints the total for each order form.

8. You make the file big enough to contain a maximum of 50 records.

9. The format description you build in this setup step is called ORDERFMT. DFU saves it for you on disk where the operator can use it over and over for creating and maintaining the customer order file.

Example 1: Prompting Sequence

Begin the job setup step by keying ENTER and pressing the Enter/Rec Adv function control key. The following prompt appears:

```
                    DATA FILE UTILITY ENTER PROCEDURE          SETUP ONLY-(S)

                              Create data files.

Name Of File To Be Created ..................................... SALESORD

Name Of DFU Format (If Saved, Or To Be Saved) .................. ORDERFMT

Number Of Records To Be In File ................................ 50

Name Of User Library ........................................... #LIBRARY

Name Of RPG II Source .......................................... SALESRPG  (S)

DFU Source Processing Parameter (NN/NY/YN/YY/GO) ............... NN         (S)

Name Of DFU Source (If Saved, Or To Be Saved) .................             (S)

Name Of Display Screen Source (If To Be Saved) .................            (S)
```

Respond to the prompts on this display as shown.

The prompt

DFU ATTRIBUTES BEING BUILT

appears momentarily on the display station screen. DFU is converting the RPG II source member into DFU attributes.

Figure A-3 shows the DFU attributes that have been built from the RPG II source member.

For information about DFU attributes, refer to Chapter 9.

```
****  DFU ATTRIBUTES  ****

        *FILE    SALESORD  50
        *KEY                5     50
01      *RECORD  *SINGLE
        *CODE     C     H           1
                 CODE         1      1
                 CUSTNO       5.0    6
                 ORDNO        6     12
                 CUSORD       5     17
                 DATE         8     25
                 SHPTO        2     27
                 SHPVIA      15     42
02      *RECORD  *GROUP
        *CODE     C     D           1
                 CODE         1      1
                 CUSTNO       5.0    6
                 ORDNO        6     12
                 QTY          4.0   16
                 PARTNO       6     22
```

Figure A-3. DFU Attributes Created for Example 1

When DFU completes the conversion, the following display appears:

This display is the first of a series of prompts in the job setup. Respond to the prompts on this display as illustrated. On the last line of this display, DFU is prompting to see if you want DFU to generate keys (in increments of 10) or if you want to specify record keys. Press the Enter/Rec Adv function control key to continue to the next display screen.

```
ENTER/UPDATE GENERAL INFORMATION

       DATA DISPLAY FORMAT.......................... B
            A=SINGLE COLUMN    B=MULTIPLE COLUMNS    C=MAXIMUM DATA


       JOB TITLE.................................... DAILY SALES ORDERS
       DELETE CODE, POSITION ....................... X,1
       PRINT NEW RECORDS? (Y,N)..................... Y
       PRINT UPDATED/DELETED RECORDS? (Y,N) ........ Y
       PRINTER COLUMN SPACING (0-9)................. 2
       PRINTER LINE WIDTH (60-198).................. 132
       HALT ON UNPRINTABLE CHARACTERS? (Y,N)........ N
       DFU TO GENERATE KEYS? (Y,N).................. Y
```

Since you have specified in the previous display that you wish DFU to supply record keys, this is the next display that appears. Retain the default of *KEY and press the Enter/Rec Adv function control key to continue.

```
RECORD KEY DESCRIPTION
                              *FILE   SALESORD   50
                              *KEY                5    50
                    01        *RECORD *SINGLE
                              *CODE    C     H          1
                                       CODE       1     1
                                       CUSTNO     5.0   6
                                       ORDNO      6     12
                                       CUSORD     5     17
                                       DATE       8     25
                                       SHPTO      2     27

KEY HEADING..................................... *KEY
```

Complete the following display as illustrated. In this example, we wish to process record type 01. Retain the default (Y) and press the Enter/Rec Adv function control key to continue to the next display screen.

```
RECORD TYPE SELECTION
                    01          *RECORD *SINGLE
                                *CODE    C     H          1
                                        CODE        1     1
                                        CUSTNO      5.0   6
                                        ORDNO       6     12
                                        CUSORD      5     17
                                        DATE        8     25
                                        SHPTO       2     27
                                        SHPVIA      15    42
                    02          *RECORD *GROUP
01 RECORD TYPE
  PROCESS THIS RECORD TYPE? (Y,N)..... Y
  ALLOW UPPER CASE DATA ONLY? (Y,N)..... Y
```

Complete the following display as illustrated. Press the Field Exit function control key to move the cursor to the next field to have an entry in it. When the fields are completed as shown, press the Rec Adv command function key to complete the prompting. Pressing the Enter/Rec Adv function control key would redisplay this screen to allow you to enter additional fields.

```
DATA FIELD SPECIFICATION
                    01          *RECORD *SINGLE
                                *CODE    C     H          1
                                        CODE        1     1
                                        CUSTNO      5.0   6
                                        ORDNO       6     12
                                        CUSORD      5     17
                                        DATE        8     25
                                        SHPTO       2     27
                                        SHPVIA      15    42
                    02          *RECORD *GROUP
                                                          RECORD TYPE: 01
DATA FIELD      HEADING             FUNCTIONS     NOTE:
ORDNO           OUR ORDER NO.                       A=ACCUMULATE
DATE            DATE                                B=MOD 10 CHECK
CUSORD          CUST. ORD. NO.                      C=MOD 11 CHECK
CUSTNO          CUSTOMER NO.                        D=AUTO-DUP
SHPTO           SHIPPED TO
SHPVIA          SHIP VIA
```

When you have completed entering all the record type 01 fields and headings/ and have indicated so by pressing the Rec Adv command function key, the following is the next display that will appear.

In this example, we wish to process record type 02. Retain the default (Y) and press the Enter/Rec Adv function control key to continue to the next display.

```
RECORD TYPE SELECTION
                    02      *RECORD *GROUP
                            *CODE    C    D          1
                                     CODE       1     1
                                     CUSTNO     5.0   6
                                     ORDNO      6     12
                                     QTY        4.0   16
                                     PARTNO     6     22

02 RECORD TYPE
  PROCESS THIS RECORD TYPE? (Y,N)..... Y
  ALLOW UPPER CASE DATA ONLY? (Y,N)..... Y
```

Complete the following display as illustrated. Press the Field Exit function control key to move the cursor to the next field to have an entry in it. When the fields are completed as shown, press the Rec Adv command function key to complete the prompting for this display. Pressing the Enter/Rec Adv function control key would redisplay this screen to allow you to enter additional fields.

```
DATA FIELD SPECIFICATION
                    02      *RECORD *GROUP
                            *CODE    C     D         1
                                     CODE E   1       1
                                     CUSTNO    5.0    6
                                     ORDNO     6      12
                                     QTY       4.0    16
                                     PARTNO    6      22


                                                          RECORD TYPE: 02
DATA FIELD      HEADING          FUNCTIONS       NOTE:
ORDNO           OUR ORDER NO.    D                   A=ACCUMULATE
CUSTNO          CUSTOMER NO.     D                   B=MOD 10 CHECK
QTY             QUANTITY         A                   C=MOD 11 CHECK
PARTNO          PART NUMBER                          D=AUTO-DUP
```

DFU determines that there are no more record types defined in the RPG II source member and displays the DFU specifications on the display screen. You can modify the specifications at this time (refer to Chapter 10, *DFU Specifications*, for an explanation of how to do this) or you can end the setup step. In this example you do not need to modify the specifications. Press the Print Rec command function key to list the DFU attributes and specifications. Then press the EOJ command function key to build the format description and the prompt DFU FORMAT IS BEING CREATED will appear. Figure A-4 shows the DFU attributes and specifications built in this setup step.

```
UPDATE DFU SPECIFICATIONS
(PRESS EOJ CMD KEY WHEN UPDATE IS COMPLETE)

                  FIELD1  FIELD2  FIELD3  FIELD4  FIELD5
NOTE:             _       *ENT/UPD*LIST   X,1     *COLUMNS
  >=ADD                   *KEY    *GENKEY *KEY
  ?=DELETE        2   132 *TITLE  DAILY SALES ORDERS
                  01      *RECORD
                          *       ORDNO   OUR ORDER NO.
                          *       DATE    DATE
                          *       CUSORD  CUST. ORD. NO.
                          *       CUSTNO  CUSTOMER NO.
                          *       SHPTO   SHIPPED TO
                          *       SHPVIA  SHIP VIA
                  02      *RECORD
                          *D      ORDNO   OUR ORDER NO.
                          *D      CUSTNO  CUSTOMER NO.
                          *ADD    QTY     QUANTITY
                          *       PARTNO  PART NUMBER
```

This ends the setup step for this example. You have created the format description, ORDERFMT, that allows the operator to create and maintain the customer order file. The execution portion of the job begins automatically. For this example, the operator is required to create the SALESORD file by entering order forms into it.

For a description of how data will be entered in the SALESORD file using the ORDERFMT format description, refer to the *System Operator's Guide*.

Create the file (using the *Operator's Guide* for instruction) and the data on the forms in Figure A-5.

```
****  DFU ATTRIBUTES ****


        *FILE   SALESORD  50
        *KEY                5     50
01      *RECORD *SINGLE
        *CODE    C     H            1
                CODE        1       1
                CUSTNO      5.0     6
                ORDNO       6      12
                CUSORD      5      17
                DATE        8      25
                SHPTO       2      27
                SHPVIA     15      42
02      *RECORD *GROUP
        *CODE    C     D            1
                CODE        1       1
                CUSTNO      5.0     6
                ORDNO       6      12
                QTY         4.0    16
                PARTNO      6      22


**** DFU SPECIFICATIONS  ****


       *ENT/UPD*LIST   X,1     *COLUMNS
       *KEY    *GENKEY *KEY
2  132 *TITLE  DAILY SALES ORDERS
01     *RECORD
       *       ORDNO   OUR ORDER NO.
       *       DATE    DATE
       *       CUSORD  CUST. ORD. NO.
       *       CUSTNO  CUSTOMER NO.
       *       SHPTO   SHIPPED TO
       *       SHPVIA  SHIP VIA
02     *RECORD
       *D      ORDNO   OUR ORDER NO.
       *D      CUSTNO  CUSTOMER NO.
       *ADD    QTY     QUANTITY
       *       PARTNO  PART NUMBER
```

Figure A-4. DFU Attributes and DFU Specifications Created for Example 1

EXAMPLE 2: JOB DESCRIPTION

This example explains how you prepare a job to print a report from the SALESORD customer order file. (Example 1 in this chapter shows how you prepare the format description for creating SALESORD.)

To print this report, DFU needs the following:

- Part number
- Part description
- Quantity ordered
- Price per item
- Dollar value of sales

ABC Hardware Company
123 Main Street
Any City, Any State

Sold To
Smith Inc.
1295 Broad ST.
New York, N.Y.

Shipped To:
Jones Co (19)
5161 2nd St.
Boston, Mass.

Our Order No.	Date	Cust. Ord. No.	Customer No.	Ship Via
XC 4313	10/30/7-	13019	21884	Air Freight

Quantity	Part Number	Description	Unit Price	Amount
25	412008	Elec. Receptacle		
25	412009	Elec. Cover plate		
600	456116	Elec. Wiring - 12 gauge		

ABC Hardware Company
123 Main Street
Any City, Any State

Sold To
Adams Plumbing
1248 South St.
New York, N.Y.

Shipped To:
Mills Apartments (74)
1522 Mills Road
New York, N.Y.

Our Order No.	Date	Cust. Ord. No.	Customer No.	Ship Via
XC 4314	10/30/7-	21215	14122	Best Way

Quantity	Part Number	Description	Unit Price	Amount
48	612695	Sink, Oval yellow		
48	612723	Sink, Oval Blue		
48	612783	Sink, Oval Green		

Figure A-5. Sample Order Forms

Shows the sample order forms that have been entered into the SALESORD data file.

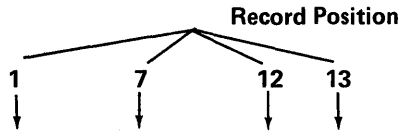
Example 2: Setting Up the Job

You require the following information to set up the job:

- Two RPG II source members must be on disk before you begin: SALESRPG and INVENRPG. Figure A-2 describes SALESRPG. Figure A-6 describes INVENRPG. The SEU command statements that allow you to enter these source members are:

  ```
  SEU SALESRPG,R

  SEU INVENRPG,R
  ```

- Two data files must be on disk before you begin: SALESORD and INVENTRY. Example 1 in this appendix describes how you set up the job to create SALESORD. The following shows the INVENTRY file:




```
412008  I   075  ELEC. RECEPTACLE
412009  I   039  ELEC. COVER PLATE
456116  I   098  ELEC. WIRING-12 GAUGE
612695  I  5000  SINK, OVAL YELLOW
612723  I  5500  SINK, OVAL BLUE
612783  I  6000  SINK, OVAL GREEN
```

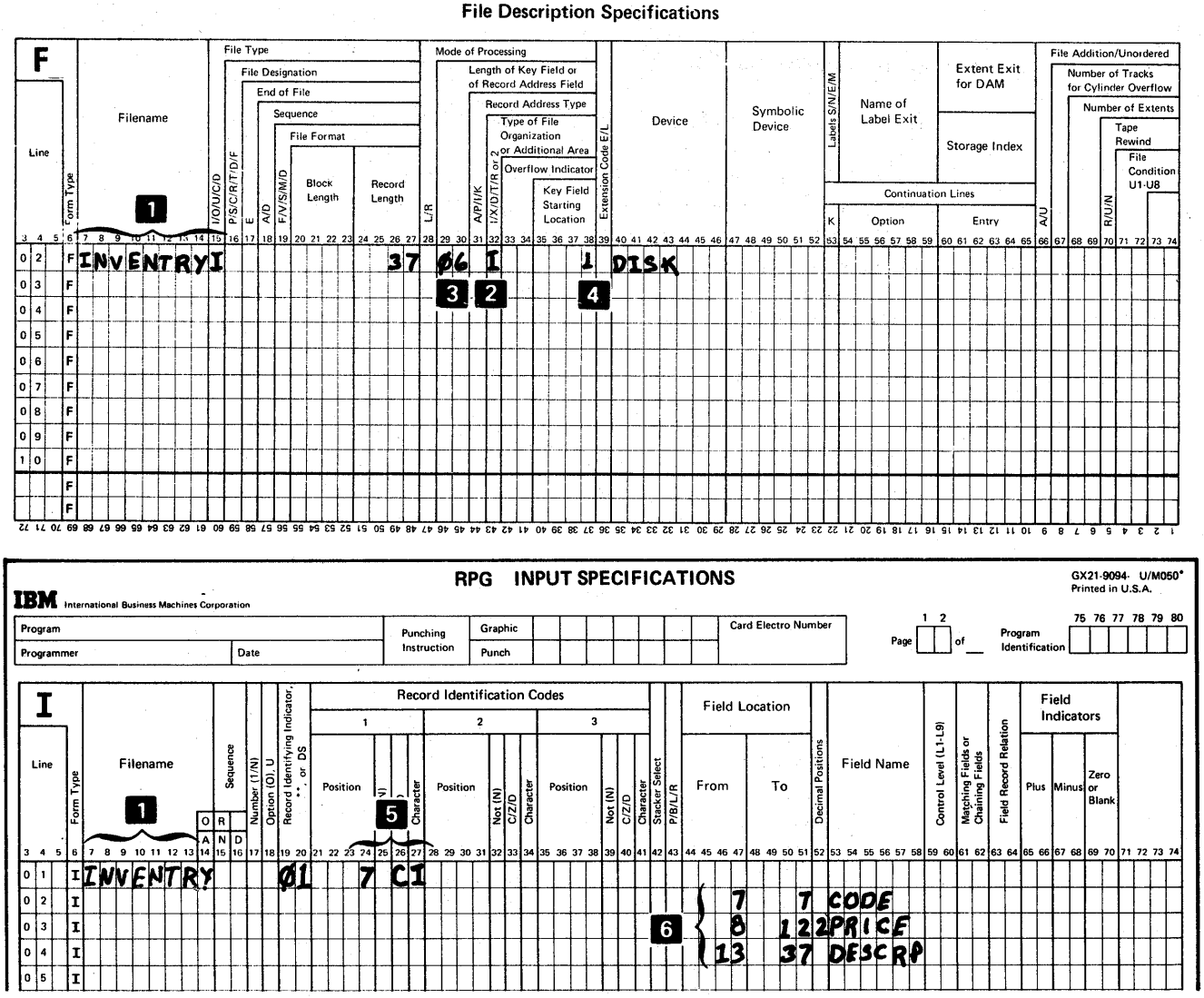


Figure A-6. RPG II Source Member Named INVENRPG That Describes the Inventory File

Note: The command statement you key to use the source entry utility to create this RPG II source member is SEU INVENRPG,R.

From the RPG II source member, you see:

- The file name is INVENTRY 1 .
- The inventory file is an indexed file 2 .
- The key field is six positions 3 and begins in position 1 of the record 4 . The part number is the record key. DFU uses it to retrieve records from this file.
- There is one record type identified by an I in position 7 5 .

- The fields in each record are 6 :

CODE	Record identification code
PRICE	Price per item
DESCRP	Description of the item

- In the prompting sequence of the setup step, you indicate the following:

1. The report is a summary list in which only one record type is listed.
2. The title of the report is Customer Sales Analysis.
3. The report headings are:

   Customer Number

   Part Number

   Description

   Quantity

   Price

   Sales Amount

4. DFU accumulates the item quantities.
5. For each transaction, DFU calculates a result field, Sales Amount, by multiplying the item quantity by the price per item.
6. DFU accumulates the sales amounts.
7. DFU sorts the report by customer number and part number and prints accumulated quantities and sales amounts each time the customer number changes.
8. For this report, you are only interested in printing transactions from certain customers: customer numbers 14121 and 21884.

Example 2: Prompting Sequence

Begin the job setup step by keying:

```
LIST
```

The following prompt appears:

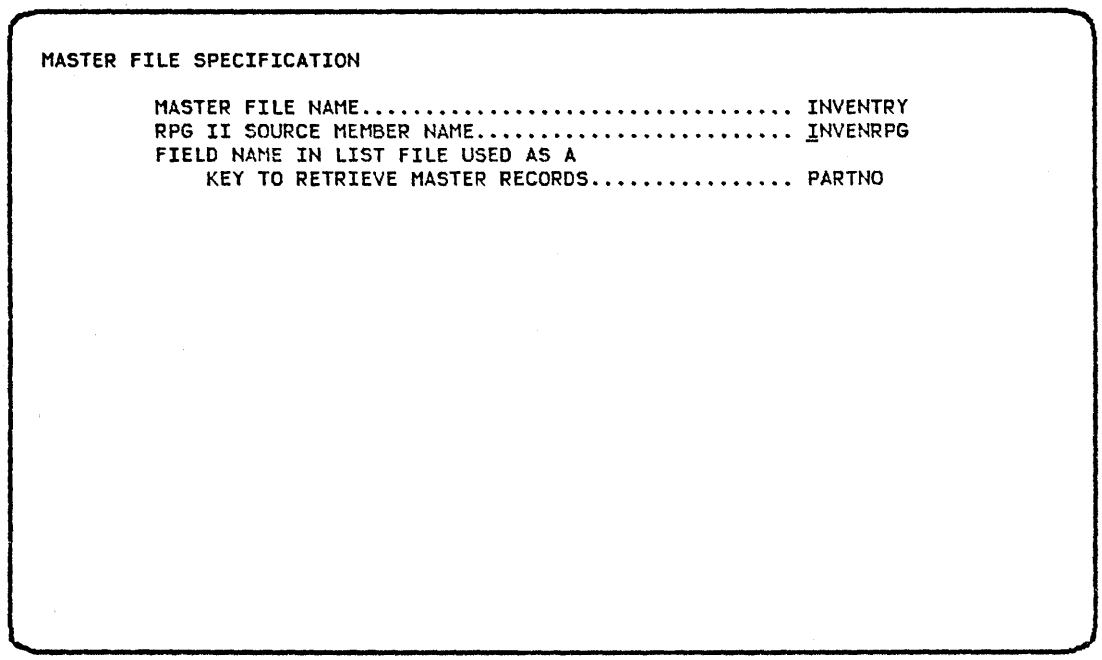
```
                    DATA FILE UTILITY LIST PROCEDURE          SETUP ONLY-(S)

          Sorts and prints data files in various report-type formats.

Name Of File To Be Listed ..................................... SALESORD

Name Of DFU Format (If Saved Or To Be Saved) ..................

SORT/NOSORT Indication ........................................ SORT

Name Of Master File (If Any) .................................. INVENTRY

Name Of User Library .......................................... #LIBRARY

Name Of RPG II Source ......................................... SALESRPG  (S)

DFU SOURCE Processing Parameter (NN/NY/YN/YY/GO) ..............  NN        (S)

Name Of DFU Source (If Saved, Or To Be Saved) ..................          (S)
```

Respond to the prompt as shown. Leave the DFU format name blank to obtain a default format. This format is removed from the library at the end of the job.

The prompt

DFU ATTRIBUTES ARE BEING BUILT

appears momentarily on the display screen. DFU is converting the RPG II source member SALESRPG into DFU attributes. When DFU completes the conversion, the following display appears:



INVENTRY is displayed as the name of the related master file. Key INVENRPG as the name of the RPG II source member that describes the related master file. Then key PARTNO as the field name of the master key in SALESORD that DFU will use to retrieve records from INVENTRY, then press the Enter/Rec Adv function control key.

Respond to the display screen prompts by entering the information shown. By selecting B of the Listing Format, you have specified that you want DFU to list detail records in a summary report format. Retaining the N for the PRINT RECORD KEY FIRST? prompt indicates that record keys are not useful to have in this printed report. Press the Enter/Rec Adv function control key.

```
LIST GENERAL INFORMATION

      LISTING FORMAT.............................. B
           A=RECORD LIST
           B=SUMMARY LIST, DETAIL PRINTING
           C=SUMMARY LIST, NO DETAIL PRINTING

      JOB TITLE................................... CUSTOMER SALES ANALYSIS
      PRINT RECORD KEY FIRST? (Y,N)............... N
      PRINTER COLUMN SPACING (0-9)................ 1
      PRINTER LINE WIDTH (60-198)................. 132
      PRINTER LINE SPACING (1,2,3)................ 1
      HALT ON UNPRINTABLE CHARACTERS? (Y,N)....... N
```

Change the default to N since DFU requires no information from the header record (type 01) to print the report. Press the Enter/Rec Adv function control key to continue.

```
RECORD TYPE SELECTION
                  01      *RECORD *SINGLE
                          *CODE    C      H          1
                                  CODE         1     1
                                  CUSTNO       5.0   6
                                  ORDNO        6     12
                                  DATE         5     17
                                  SHPTO        8     25
                                  SHPVIA       2     27
                  02      *RECORD *GROUP      15     42
01 RECORD TYPE
  PROCESS THIS RECORD TYPE? (Y,N)..... N
```

Retain the default (Y) since DFU lists the detail record (type 02) in the report. Press the Enter/Rec Adv function control key to continue.

```
RECORD TYPE SELECTION
                    02      *RECORD *GROUP
                            *CODE    C     D          1
                                     CODE      1       1
                                     CUSTNO    5.0     6
                                     ORDNO     6      12
                                     QTY       4.0    16
                                     PARTNO    6      22
                            *FILE    INVENTRY 37
                            *KEY     PARTNO    6       6
                                     CODE      1       7
02 RECORD TYPE
  PROCESS THIS RECORD TYPE? (Y,N).....   Y
```

Complete this display as shown. Select a + for the SALES AMOUNT field. This designates the field as a result field. When the fields are completed, press the Rec Adv command function key to complete prompting for this display.

```
DATA FIELD SPECIFICATION
                    01      *RECORD *SINGLE
                            *CODE    C     H          1
                                     CODE      1       1
                                     CUSTNO    5.0     6
                                     ORDNO     6      12
                                     CUSORD    5      17
                                     DATE      8      25
                                     SHPTO     2      27
                                     SHPVIA   13      42
                    02      *RECORD *GROUP
(KEY + FOR A RESULT FIELD NAME)
FIELD           HEADING              FUNCTIONS    NOTE:
CUSTNO          CUSTOMER NUMBER                       A=ACCUMULATE
PARTNO          PART NUMBER                           Z=BLANK IF ZERO
DESCRP          DESCRIPTION
QTY             QUANTITY             A
PRICE           PRICE
+               SALES AMOUNT         A
```

Complete this display as shown:

DFU performs the SALES AMOUNT calculation by multiplying PRICE by QTY. Press the Enter/Rec Adv function control key.

```
RESULT FIELD SPECIFICATION
                  01      *RECORD *SINGLE
                          *CODE    C     H            1
                                   CODE         1      1
                                   CUSTNO       5.0    6
                                   ORDNO        6      12
                                   CUSORD       5      17
                                   DATE         8      25
                                   SHPTO        2      27
                                   SHPVIA       15     42
                  02      *RECORD *GROUP
(VALID OPERATIONS ARE: + - * / )                    HEADING:  SALES AMOUNT

RESULT NAME.....
LENGTH (1-15)..... 7
DEC POS (0-9)..... 2
COMPUTATION..... PRICE * QTY
```

DFU shows this display to ensure that there are no further result fields that you wish to specify. Press the Enter/Rec Adv function control key to complete the data field specification.

```
DATA FIELD SPECIFICATION
                  01      *RECORD *SINGLE
                          *CODE    C     H          1
                                   CODE       1      1
                                   CUSTNO     5.0    6
                                   ORDNO      6      12
                                   CUSORD     5      17
                                   DATE       8      25
                                   SHPTO      2      27
                                   SHPVIA     15     42
                  02      *RECORD *GROUP
(KEY + FOR A RESULT FIELD NAME)
FIELD          HEADING          FUNCTIONS     NOTE:
                                                  A=ACCUMULATE
                                                  B=BLANK IF ZERO
```

Complete this display as shown. This display allows you to specify the fields that you wish to be sorted for the final report. By allowing the default A to remain under sequence you are telling DFU that you wish these two fields to be listed in ascending numerical order (smallest customer number and part number first). When the fields are complete as shown, press the Rec Adv command function key to complete prompting for this display. Pressing the Enter/Rec Adv function control key would redisplay this screen to allow you to enter additional fields.

```
SORT FIELD SPECIFICATION (IF DESIRED)
                          *FILE   SALESORD   50
                          *KEY                5      50
                    01    *RECORD *SINGLE
                          *CODE    C     H             1
                                   CODE       1         1
                                   CUSTNO     5.0       6
                                   ORDNO      6        12
                                   CUSORD     5        17
                                   DATE       8        25
                                   SHPTO      2        27
(MAJOR TO MINOR ORDER)
SORT FIELD        SEQUENCE          NOTE:
CUSTNO            A                     A=ASCENDING
PARTNO            A                     D=DESCENDING
                  A
                  A
                  A
```

Complete this display as shown. When you specify CUSTNO as a control field you are indicating the groupings of the data in the final printed report. DFU recognizes your specified control field and will list all transactions peculiar to each specific customer.

When the fields are completed as shown, press the Rec Adv command function key to complete prompting for this display. Pressing the Enter/Rec Adv function control key would redisplay this screen to allow you to enter additional fields.

```
CONTROL FIELD SPECIFICATION (IF DESIRED)
                          *FILE   SALESORD   50
                          *KEY                5     50
                   01     *RECORD *SINGLE
                          *CODE    C     H            1
                                   CODE       1        1
                                   CUSTNO     5.0      6
                                   ORDNO      6       12
                                   CUSORD     5       17
                                   DATE       8       25
                                   SHPTO      2       27

(MAJOR TO MINOR ORDER)
CONTROL FIELD     SKIP AFTER? (Y,N)
CUSTNO            N
                  N
                  N
                  N
                  N
```

Complete this prompt as shown. This display allows you to specify to DFU the fields (and the part of your data file) that you are selecting to be printed on your final report. When the fields are completed as shown, press the Rec Adv command function key to complete prompting for this display. Pressing the Enter/Rec Adv function control key would redisplay this screen to allow you to enter additional fields.

```
SELECT FIELD SPECIFICATION (IF DESIRED)
                           *FILE   SALESORD   50
                           *KEY                5     50
                    01     *RECORD *SINGLE
                           *CODE    C     H            1
                                    CODE       1       1
                                    CUSTNO     5.0     6
                                    ORDNO      6      12
                                    CUSORD     5      17
                                    DATE       8      25
                                    SHPTO      2      27
(VALID CRITERIA ARE: EQ NE GT LT GE LE)
OR/AND          SELECT FIELD SELECT CRITERIA          FIELD/'CONSTANT'
                CUSTNO       EQ                       '21884'
OR              CUSTNO       EQ                       '14121'
```

DFU has determined that there is no other information required to produce the report requested. DFU displays the DFU specifications to allow you to modify the specifications at this time (refer to Chapter 10, *DFU Specifications*, for an explanation of how to do this) or you can end this particular setup step. In this example you do not need to modify the specifications. Press the Print Rec command function key to list the DFU attributes and specifications. Then press the EOJ command function key to build the format description for the report to be listed. Figure A-7 shows the DFU attributes and specifications built from this setup step.

```
UPDATE DFU SPECIFICATIONS
(PRESS EOJ CMD KEY WHEN UPDATE IS COMPLETE)

                  FIELD1  FIELD2  FIELD3  FIELD4  FIELD5
NOTE:                     *LIST   *SUMMARY*DETAIL
    >=ADD                 *KEY
    ?=DELETE      1,1 132 *TITLE  CUSTOMER SALES ANALYSIS
                  02      *RECORD
                          *       CUSTNO  CUSTOMER NUMBER
                          *       PARTNO  PART NUMBER
                          *       DESCRP  DESCRIPTION
                          *ADD    QTY     QUANTITY
                          *       PRICE   PRICE
                  7.2     *ADD    *RESULT SALES AMOUNT
                  ADD             PRICE
                  MULT            QTY
                          *SORTA  CUSTNO
                          *SORTA  PARTNO
                          *TOTAL  CUSTNO
                          *SELECT CUSTNO  EQ
                                  21884
                  OR      *SELECT CUSTNO  EQ
                                  14121
```

```
****  DFU ATTRIBUTES  ****

        *FILE   SALESORD  50
        *KEY               5    50
01      *RECORD *SINGLE
        *CODE    C     H          1
                 CODE       1     1
                 CUSTNO     5.0   6
                 ORDNO      6    12
                 CUSORD     5    17
                 DATE       8    25
                 SHPTO      2    27
                 SHPVIA    15    42
02      *RECORD *GROUP
        *CODE    C     D          1
                 CODE       1     1
                 CUSTNO     5.0   6
                 ORDNO      6    12
                 QTY        4.0  16
                 PARTNO     6    22
        *FILE   INVENTRY  37
        *KEY    PARTNO     6     6
                CODE       1     7
                PRICE      5.2  12
                DESCRP    25    37


****  DFU SPECIFICATIONS  ****

        *LIST   *SUMMARY*DETAIL
        *KEY
1,1 132 *TITLE  CUSTOMER SALES ANALYSIS
02      *RECORD
        *       CUSTNO  CUSTOMER NUMBER
        *       PARTNO  PART NUMBER
        *       DESCRP  DESCRIPTION
        *ADD    QTY     QUANTITY
        *       PRICE   PRICE
7.2     *ADD    *RESULT SALES AMOUNT
ADD             PRICE
MULT            QTY
        *SORTA  CUSTNO
        *SORTA  PARTNO
        *TOTAL  CUSTNO
        *SELECT CUSTNO  EQ
                21884
OR      *SELECT CUSTNO  EQ
                14121
```

Figure A-7. Example 2, DFU Attributes and Specifications

```
77/03/24                    CUSTOMER SALES ANALYSIS                    PAGE    1

CUSTOMER NUMBER  PART NUMBER  DESCRIPTION              QUANTITY   PRICE  SALES AMOUNT

     14121          612695    SINK, OVAL YELLOW            48   50.00       2400.00
     14121          612723    SINK, OVAL BLUE              48   55.00       2640.00
     14121          612783    SINK, OVAL GREEN             48   60.00       2880.00

                                                          144               7920.00 *

     21884          412008    ELEC. RECEPTACLE             25    0.75         18.75
     21884          412009    ELEC. COVER PLATE            25    0.39          9.75
     21884          456116    ELEC. WIRING-12 GAUGE       600    0.98        588.00

                                                          650                616.50 *
                                                          794               8536.50 **

      6 RECORDS PROCESSED
```

Figure A-8. Example 2, Sample Report

Figure A-8 shows the report that is described in the format description that you have set up.

The annotation for batch accumulators (*) is shown after each customer listing and the total accumulator (**) is shown at the bottom of the Sales Amount column. DFU also annotates the report with the number of records processed (in this example, six were processed).

Appendix B. DFU Programmer Messages

This appendix describes DFU programmer messages that appear on the system output device for the display station. These messages and their message identification codes are printed when errors are detected in the RPG II specifications. For a description of DFU operator error messages, see the *IBM System/34 Displayed Messages Guide*.

DFU-0100 RECORD LENGTH NOT VALID NUMERIC--COLS 24-27

The record length specified in the RPG II file description specification (columns 24-27) must be numeric and greater than 0.

DFU-0101 KEY LENGTH NOT VALID NUMERIC--COLS 29-30

The record key length specified in the RPG II file description specification (columns 29 and 30) must be numeric and greater than zero when processing an indexed data file with the enter/update, inquiry, or list functions.

DFU-0102 KEY START NOT VALID NUMERIC--COLS 35-38

The record key start specified in the RPG II file description specification (columns 35-38) must be numeric and greater than zero when processing an indexed data file with the enter/update, inquiry, or list functions.

DFU-0103 INVALID FIELD NAME--COLS 53-58

This message indicates an input specification contains an invalid field name (columns 53-58). The first character in the field must be alphabetic, and the remaining characters must be alphameric with no embedded blanks.

DFU-0104 'OR' INVALID FOR FIRST RECORD TYPE

The first record type input specification for a series of fields has OR specified in columns 14 and 15. Column 15 must be blank, and columns 7-14 can contain a filename for the first record type.

DFU-0105 'TO' POSITION GT DATA STRUCTURE LENGTH

A data structure field specification is in error. The TO position (columns 48-51) is greater than the specified length of the data structure.

DFU-0106 COL 43 MUST BE BLANK FOR DATA STRUCTURE

The field specification in error is part of a data structure; the packed/binary indication (column 43) must be blank.

DFU-0140 DUPLICATE RECORD IDENTIFYING INDICATOR

DFU found a record defining input specification that has a record identifying indicator in columns 19-20 that matches a previous record defining input specification.

DFU-0147 NO RECORD TYPE DEFINED FOR INPUT SPECIFICATION

A field defining input specification has been found without a prior record defining input specification.

DFU-0148 RECORD LENGTH TOO LONG--COLS 24-27

The record length specified in the RPG II file description specification must be less than 512 for data files.

DFU-0149 MISSING FILE DESCRIPTION SPECIFICATION

Either the RPG II source member contains no file description specifications, or multiple file description specifications exist, but none have a filename in columns 7-14 that matches the file being processed.

DFU-0150 FILE ORGANIZATION MUST BE 'I' FOR KEYS--COL 32

Column 32 of the RPG II file description specification must contain an I for indexed data files. This is required for entry, update, and inquiry, and also for list if other entries on the file description specification indicate an indexed file.

DFU-0151 RECORD ID INDICATOR MISSING OR INVALID--COLS 19-20

A record identifying indicator in columns 19-20 of the RPG II input specifications must be present for each record type and must be a valid two-digit number from 01-99.

DFU-0153 INVALID RPG II SPECIFICATION DETECTED

Either the specification in error is not recognized as a valid RPG II specification type (E, I, O, L, C, T, F), or DFU is unable to determine whether it is a record or field defining input specification.

DFU-0154 RECORD ID POSITION IS GREATER THAN RECORD LENGTH

One of the record identification code positions (columns 21-24, columns 28-31, or columns 35-38 of the RPG II input specifications) contains a value that is greater than the record length.

DFU-0155 INVALID 'C/Z/D' ENTRY--COL 26, 33, OR 40

Columns 26, 33, and 40 of the RPG II input specifications must be blank or contain C, Z, or D.

DFU-0156 MORE THAN 60 RECORD IDENTIFICATION CODES

DFU allows only 60 record identification codes for a particular record type. These 60 codes can be ANDed or ORed together in any combination.

DFU-0157 FROM POS NOT VALID NUMERIC--COLS 44-47

The FROM entry (columns 44-47) in the RPG II input specifications must be numeric.

DFU-0158 INVALID PACKED FIELD ENTRY--COL 43

Column 43 of the RPG II input specifications must be blank for an alphameric field and blank or P for a numeric field.

DFU-0159 TO POS NOT ALL NUMERIC--COLS 48-51

The TC entry (columns 48-51) in the RPG II input specifications must be numeric.

DFU-0160 INVALID DECIMAL ENTRY--COL 52

Decimal positions specified in column 52 of the RPG II input specification must be numeric and equal to or less than the field length.

DFU-0165 KEY END POSITION GREATER THAN RECORD LENGTH

The start position of the record key (columns 35-38) of the file description specifications is such that the end position of the specified key field is beyond the specified record length.

DFU-0166 KEY FIELD TOO LONG--COLS 29-30

The key length (columns 29 and 30 in the RPG II file description specification) must be less than 30 positions for an unpacked key, and less than 9 positions for a packed key.

DFU-0171 INVALID NOT (N) CONDITION

In the RPG II input specifications, columns 25, 32, and 39 must contain an N or blank.

DFU-0173 RECORD ID POSITION NOT NUMERIC

In the RPG II record defining input specifications, columns 21-24, 28-31, and 35-38 must be numeric.

DFU-0175 TO POS EXCEEDS RECORD LENGTH--COLS 48-51

The field location in columns 48-51 of the RPG II input specification is greater than the defined record length.

DFU-0176 FROM LOCATION GREATER THAN TO LOCATION--COLS 44-47

The FROM field location in columns 44-47 must be less than or equal to the TO field in columns 48-51 of the RPG II field defining input specifications.

DFU-0177 NUMERIC FIELD LENGTH GREATER THAN 15

In the RPG II input specifications a numeric field is longer than 15 positions. The difference between the FROM and TO field locations must not be greater than 15 positions for all numeric fields.

DFU-0193 MISSING INPUT SPECIFICATIONS

There are no input specifications in the RPG II source member, or more than one file description specification exists, but no input specifications exist with a filename (columns 7-14) that matches the file being processed.

Appendix C. DFU Setup Sheets

The following setup sheets are intended to aid you in performing the DFU setup step. The setup step can apply to creating a data file, maintaining a data file, displaying records from a data file, and printing reports from a data file.

Note: This appendix is provided to allow you to remove pages and duplicate them for use as DFU setup sheets.

Because you may be using the setup sheets to do any of these functions and you may also be processing indexed, sequential, or direct files, all screen prompts are included on the setup sheets. Each setup sheet specifies its applicability to one, two, or all three of these file types. Additionally, many of the screens are dependent on information specified on a previous screen. There is a note on these screens mentioning what should have been specified on a previous screen in order to display the current screen. Each of the four DFU functions (Enter, Update, Inquiry, and List) is also noted on the setup sheet for each screen.

The screens are presented as they are displayed, with all defaults supplied. On some screens Xs are shown to indicate data that will be supplied by DFU during the setup step; this data does not have to be supplied by the person performing the setup step. If you choose not to use the supplied defaults, draw a line through the default and write in the value you want entered.

If you have questions about how to fill in the data required for each screen, refer to Chapters 6, 7, and 8 of this manual. Chapters 3 and 4 explain the function control keys and command function keys used with these screens.

After you have completed the DFU setup step, you can save some or all of the library members created for use in the future. Library members that can be created by DFU are:

Library Members Created	**Calling DFU Procedure**	**Prompt Where Specified**
Subroutine and Load	Enter Update Inquiry	Name of DFU Format
Subroutine	List	
Source	Enter Update Inquiry List	Name of DFU Source
Source	Enter Update Inquiry	Name of Display Screen Source

Use the following format to indicate what library members you want to save. The format can also be used to instruct an operator to save and KEYSORT a file.

DFU PROCESSING INFORMATION TO BE SAVED
(Circle appropriate sections or fill in parameters)

Diskette(s) Supplied
Initialize Diskette(s)

Use Scratch Diskette(s) Yes No

Diskette I. D.s _____
(If yes, use INIT commands below) _____

(vol-ID) (owner-ID) (location)

INIT _____, _____, RENAME ,_____
DELETE
FORMAT
INIT _____, _____, FORMAT2 ,_____

Execute the following procedures to save specified library members.

	(member name)	(member type)	(file name)	(retention days)	(volume ID)	(Library)	(Location)	(AUTO/ NOAUTO)
FROMLIBR	_____,	_____ ,	_____,	11, _____,	_____,	_____,	_____,	_____
FROMLIBR	_____,	_____,	_____,	11, _____,	_____,	_____,	_____,	_____
FROMLIBR	_____,	_____,	_____,	11, _____,	_____,	_____,	_____,	_____
FROMLIBR	_____,	_____,	_____,	11, _____,	_____,	_____,	_____,	_____
FROMLIBR	_____,	_____,	_____ ,	11, _____,	_____,	_____,	_____,	_____

Execute the following procedure to save the file.

	(filename)	(retention days)	(date)	(vol-ID)	(location)	(AUTO/ NOAUTO)
SAVE	_____,	_____,	_____,	_____,	_____,	_____

Execute the following procedure to sort an indexed file after UPDATE.

	(filename)	(date)
KEYSORT	_____,	_____

Key ENTER and press the Enter/Rec Adv key, and DFU will prompt you as follows:

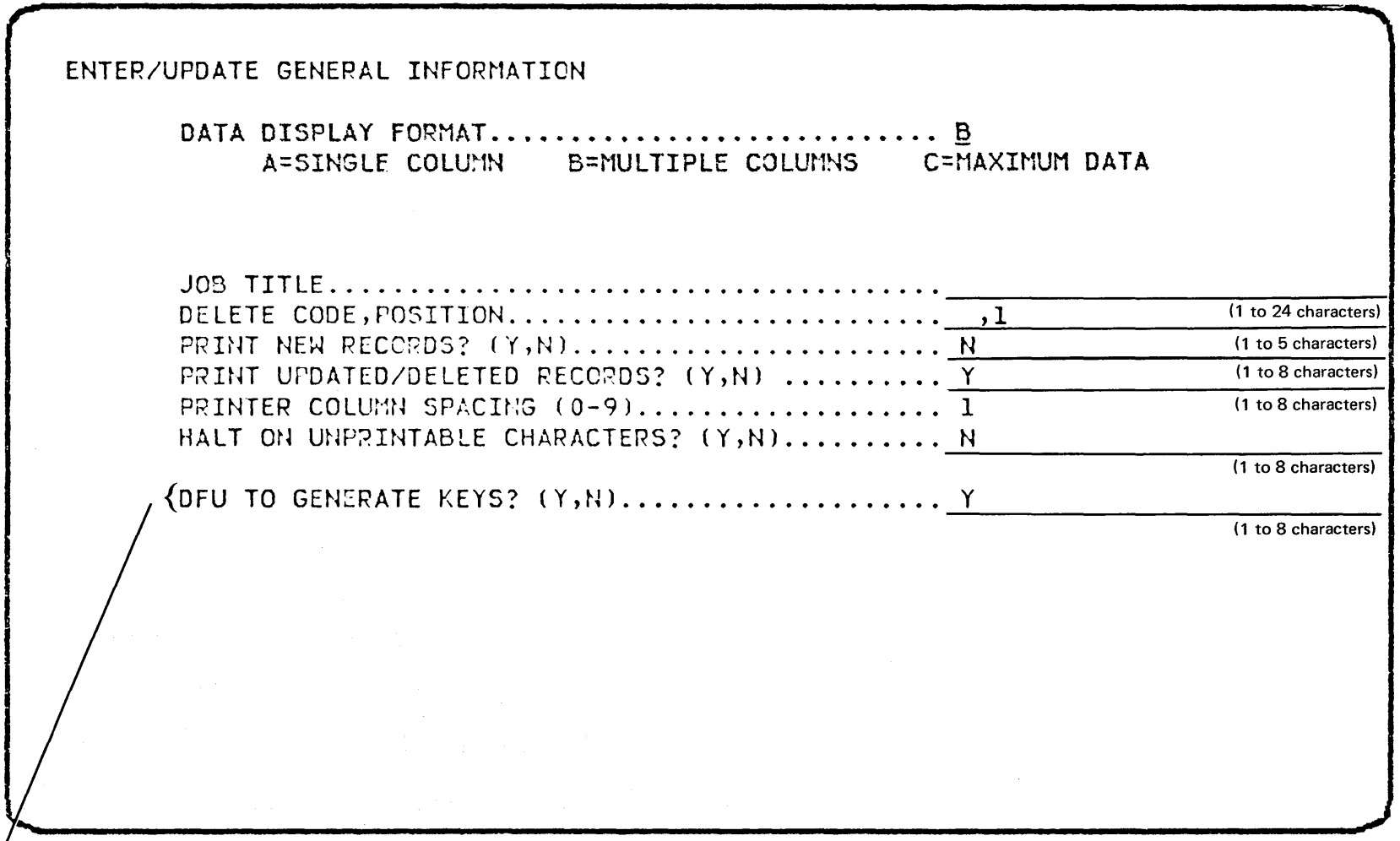
```
                    DATA FILE UTILITY ENTER PROCEDURE          SETUP ONLY-(S)

                              Create Data Files.

Name Of File to Be Created ..................................._____
                                                               (1 to 8 characters)
Name OF DFU Format (If Saved, Or To Be Saved) ................._____
                                                               (1 to 8 characters)
Number Of Records To Be In File .............................._____
                                                               (1 to 8 characters)
Name Of User Library ........................................ #LIBRARY
Name Of RPG II Source ....................................._____(S)
                                                               (1 to 8 characters)
DFU Source Processing Parameter (NN/NY/YN/YY/GO) ..............NN        (S)
Name Of DFU Source (If Saved, Or To Be Saved) ................._____(S)
                                                               (1 to 8 characters)
Name Of Display Screen Source (If To Be Saved) ..............._____(S)
                                                               (1 to 8 characters)
```

Enter the parameters required to begin defining an enter format description.

Key UPDATE and press the Enter/Rec Adv key, and DFU will prompt you as follows:

```
                    DATA FILE UTILITY UPDATE PROCEDURE          SETUP ONLY-(S)

                          Update or add to data files.

Name Of File To Be Maintained ..................................._____________
                                                                  (1 to 8 characters)
Name OF DFU Format (If Saved, Or To Be Saved) ..................._____________
                                                                  (1 to 8 characters)
Number Of Records To Extend File When Full (0-8000000)..... 0_____________
                                                                  (1 to 7 characters)
Name Of User Library ..................................... #LIBRARY
Name Of RPG II Source ..........................................._____________(S)
                                                                  (1 to 8 characters)
DFU Source Processing Parameter (NN/NY/YN/YY/GO) ..............  NN          (S)
Name Of DFU Source (If Saved, Or To Be Saved) ..................._____________(S)
                                                                  (1 to 8 characters)
Name Of Display Screen Source (If To Be Saved) ..................._____________(S)
                                                                  (1 to 8 characters)
```

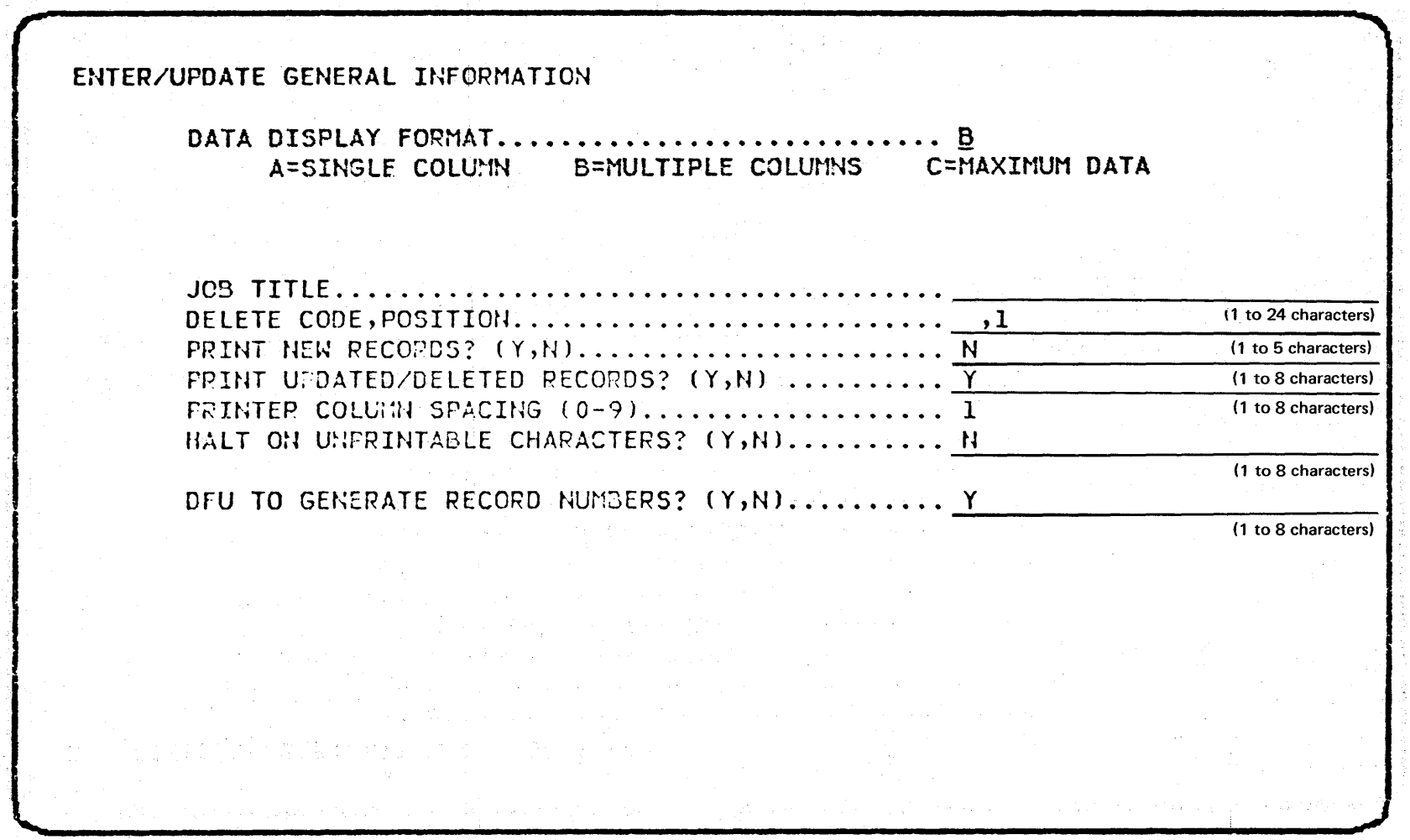
Enter the parameters required to begin defining an update format description.



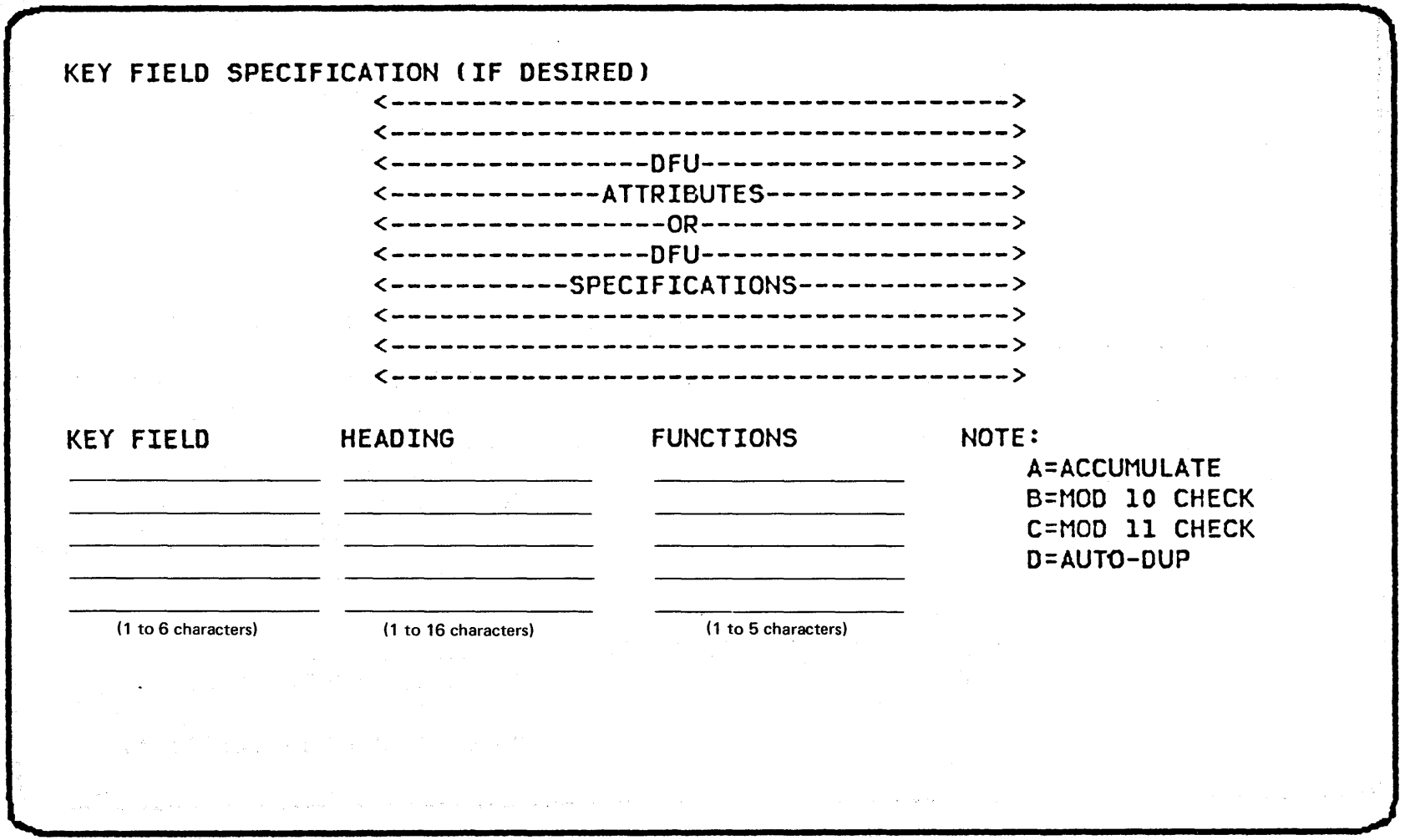
– Indexed files only.

{– This prompt appears if the key field is five numeric positions.

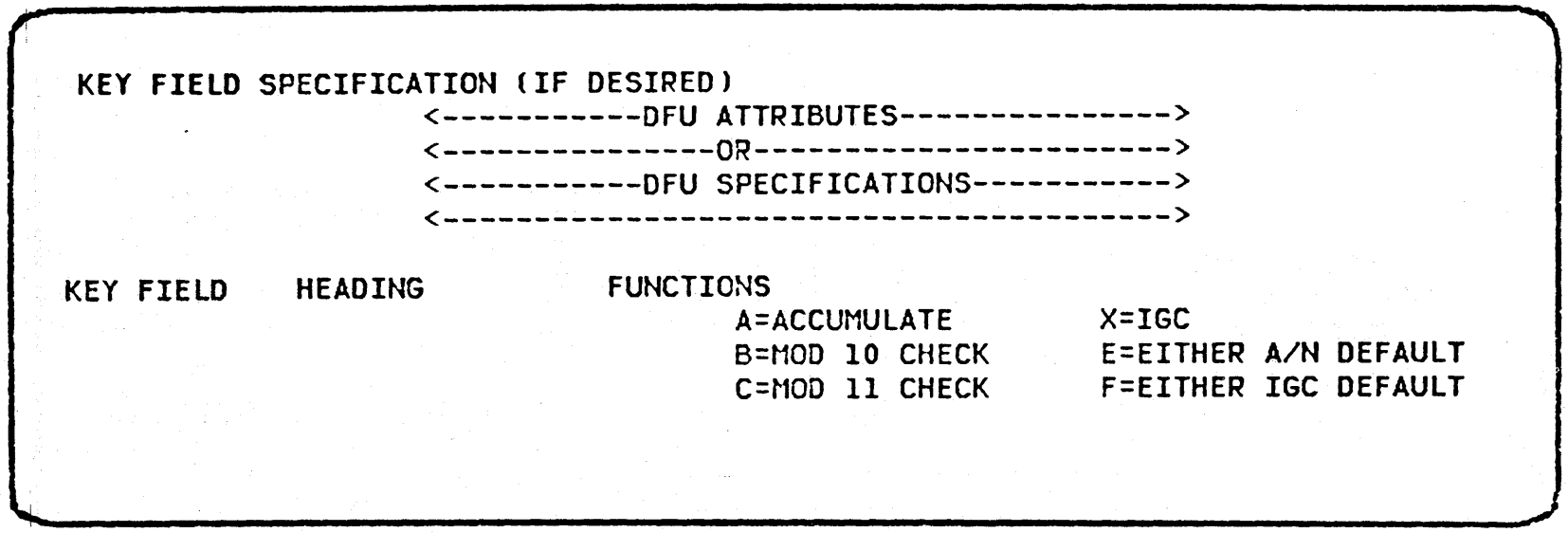
For direct and sequential files:



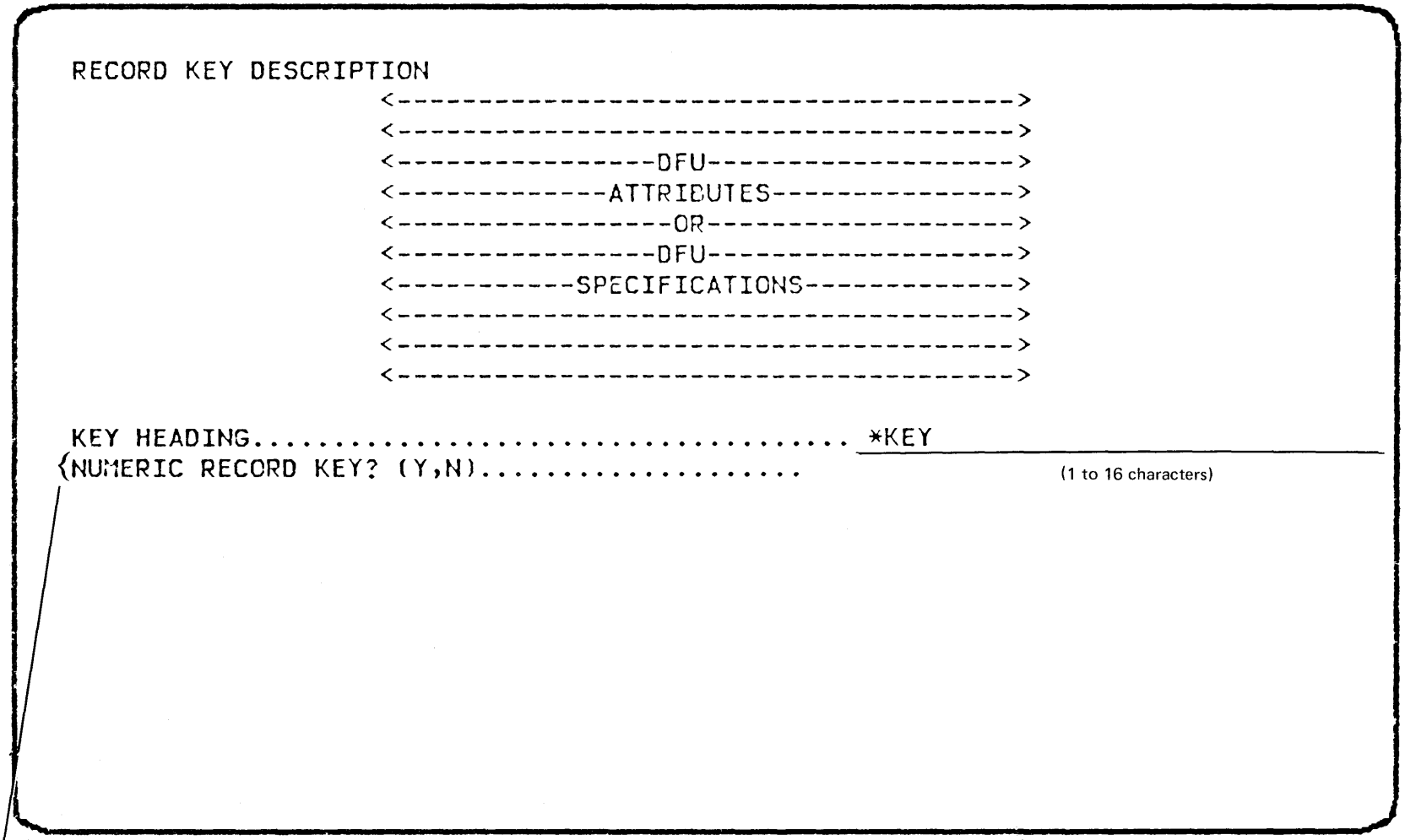
For indexed files if DFU is not generating record keys:



For indexed files if DFU is not generating record keys (ideographic session):



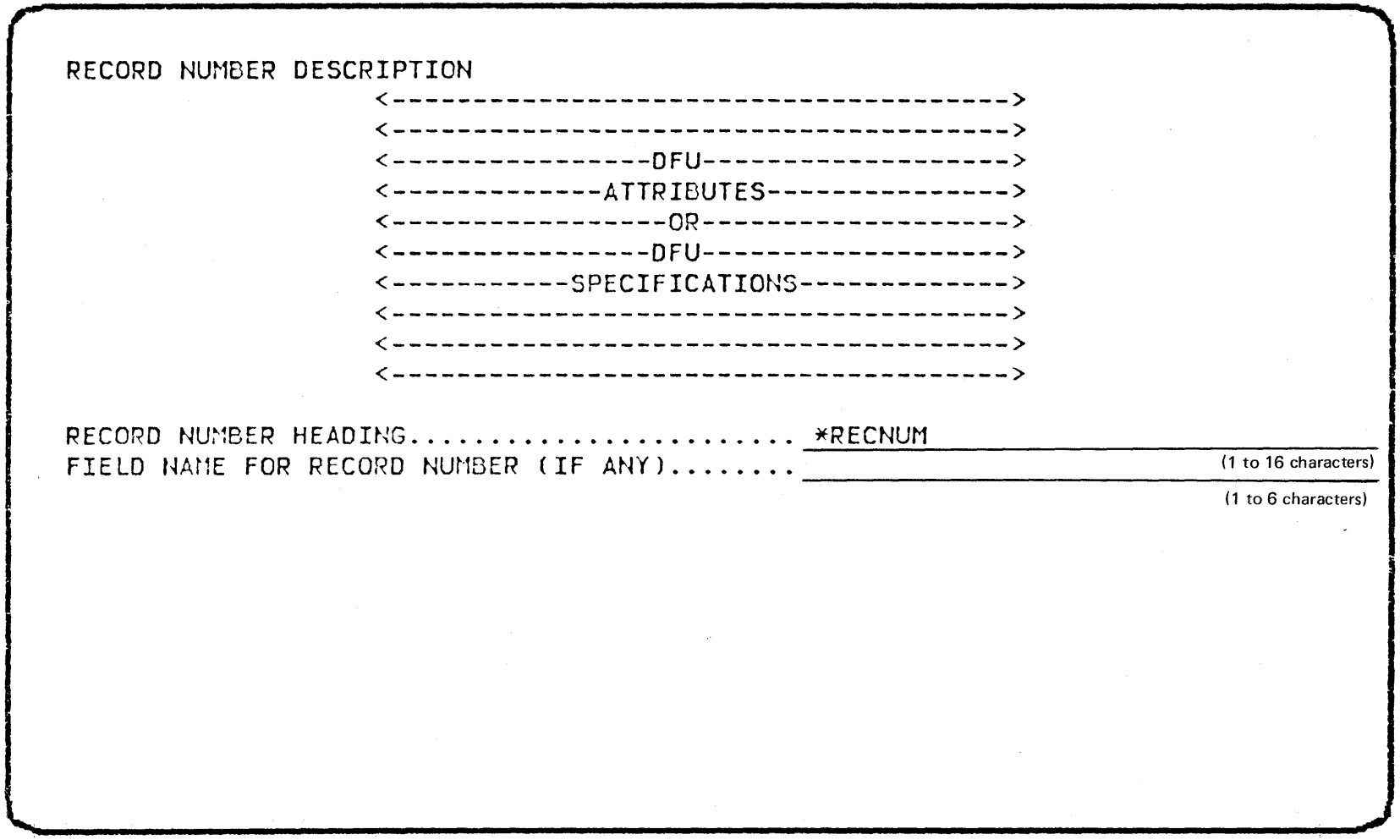
For indexed files when DFU is generating record keys or key fields were not specified on the Key Field Specification prompt:



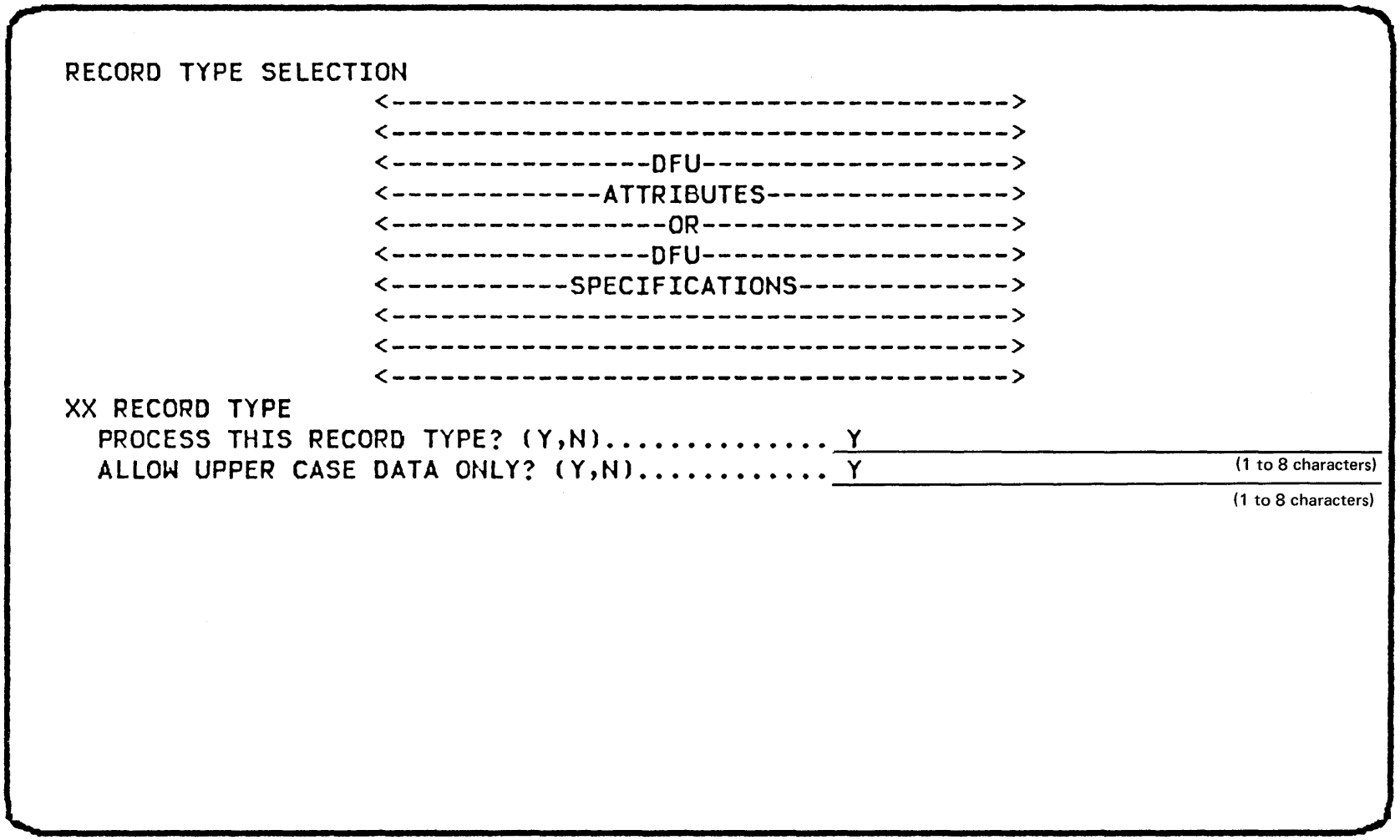
This prompt appears if:

- DFU is not generating record keys.
- Record keys are not packed and are less than or equal to 15 positions.

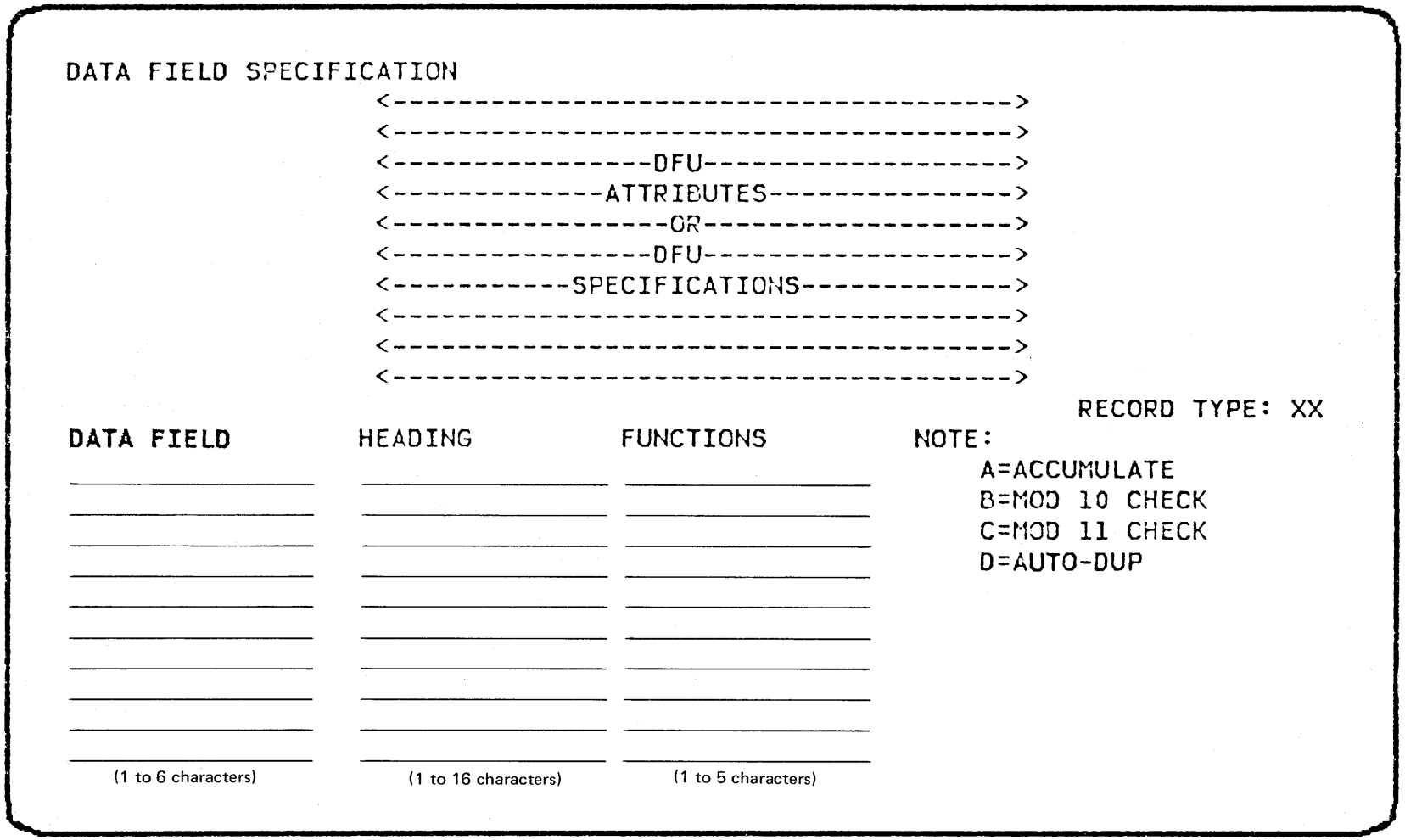
For direct and sequential files:



For indexed, direct, or sequential files:



For indexed, direct, or sequential files:



For indexed, direct, or sequential files (ideographic session):

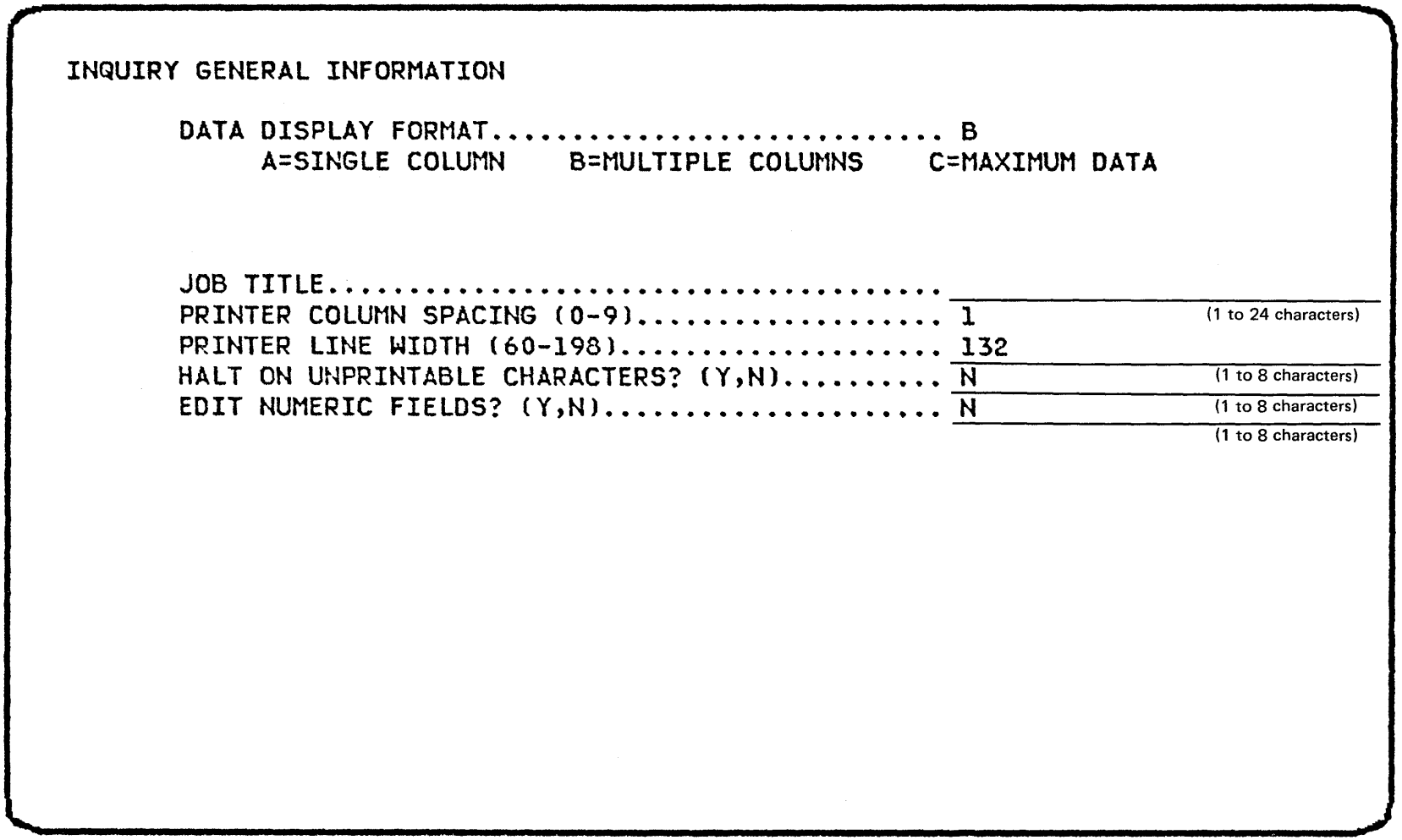
```
DATA FIELD SPECIFICATION
                    <-----------DFU ATTRIBUTES---------------->
                    <----------------OR------------------------>
                    <-----------DFU SPECIFICATIONS------------>
                    <------------------------------------------>
                                                        RECORD TYPE: 01
DATA FIELD   HEADING          FUNCTIONS
                                    A=ACCUMULATE        X=IGC
                                    B=MOD 10 CHECK      E=EITHER A/N DEFAULT
                                    C=MOD 11 CHECK      F=EITHER IGC DEFAULT
                                    D=AUTO-DUP
```

Key INQUIRY and press the Enter/Rec Adv key, and DFU will prompt you as follows:

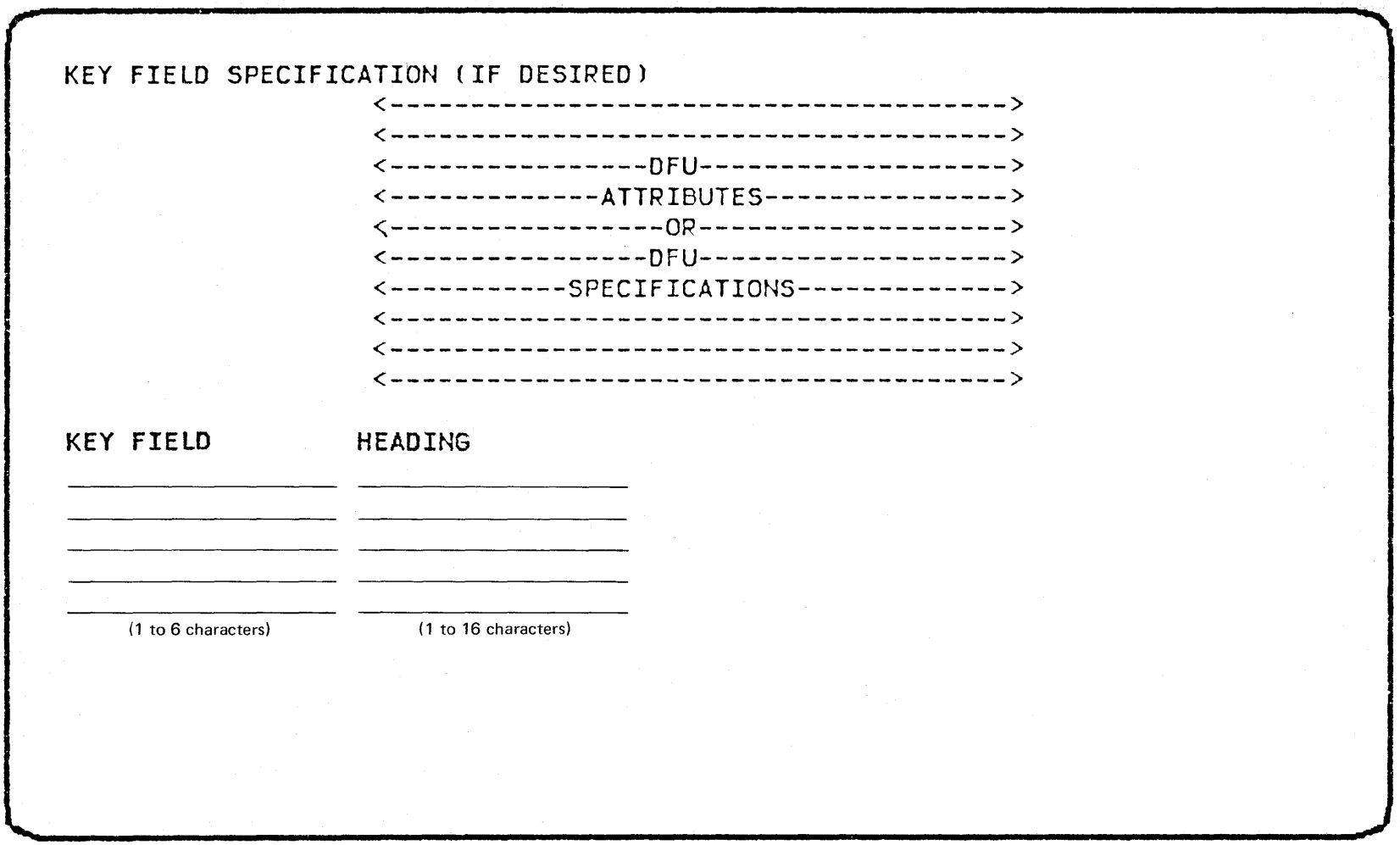
```
                    DATA FILE UTILITY INQUIRY PROCEDURE          SETUP ONLY-(S)

          Selectively displays and/or prints records in a data file.

Name Of File To Be Displayed ..................................._____
                                                                 (1 to 8 characters)
Name Of DFU Format (If Saved, Or To Be Saved) .................._____
                                                                 (1 to 8 characters)
Name Of User Library ..................................... #LIBRARY
Name Of RPG II Source ..................................._____(S)
                                                          (1 to 8 characters)
DFU Source Processing Parameter (NN,NY,YN,YY,GO) ..... NN        (S)
Name Of DFU Source (If Saved, Or To Be Saved) ..........._____(S)
                                                          (1 to 8 characters)
Name Of Display Screen Source (If Saved, Or To Be Saved) ....._____(S)
                                                          (1 to 8 characters)
```

Enter the parameters required to begin defining an inquiry format description.

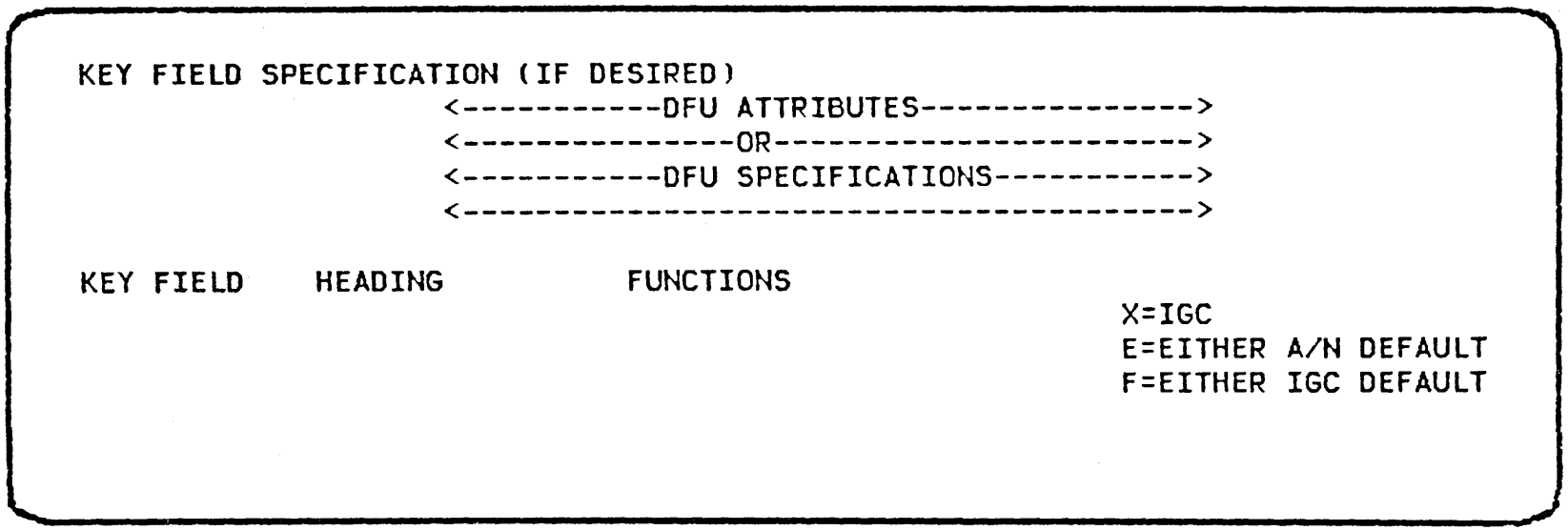
For indexed, direct, or sequential files:



For indexed files only:



For indexed files only (ideographic session):



For indexed files if key fields were not specified on the Key Field Specification prompt.

```
RECORD KEY DESCRIPTION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR---------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->

 KEY HEADING..................................  *KEY
{NUMERIC RECORD KEY? (Y,N)....................
```

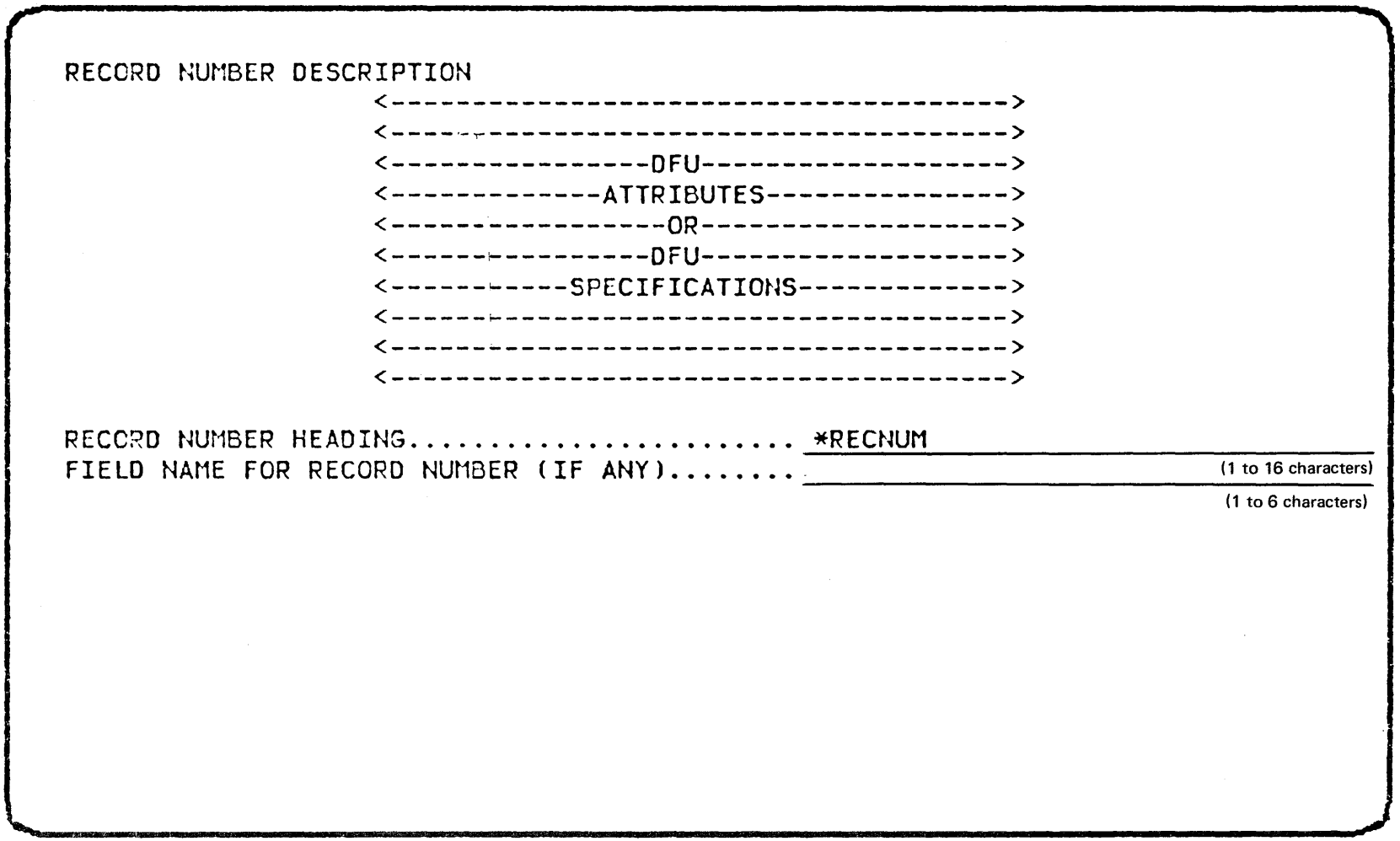
(1 to 16 characters)

(1 to 8 characters)

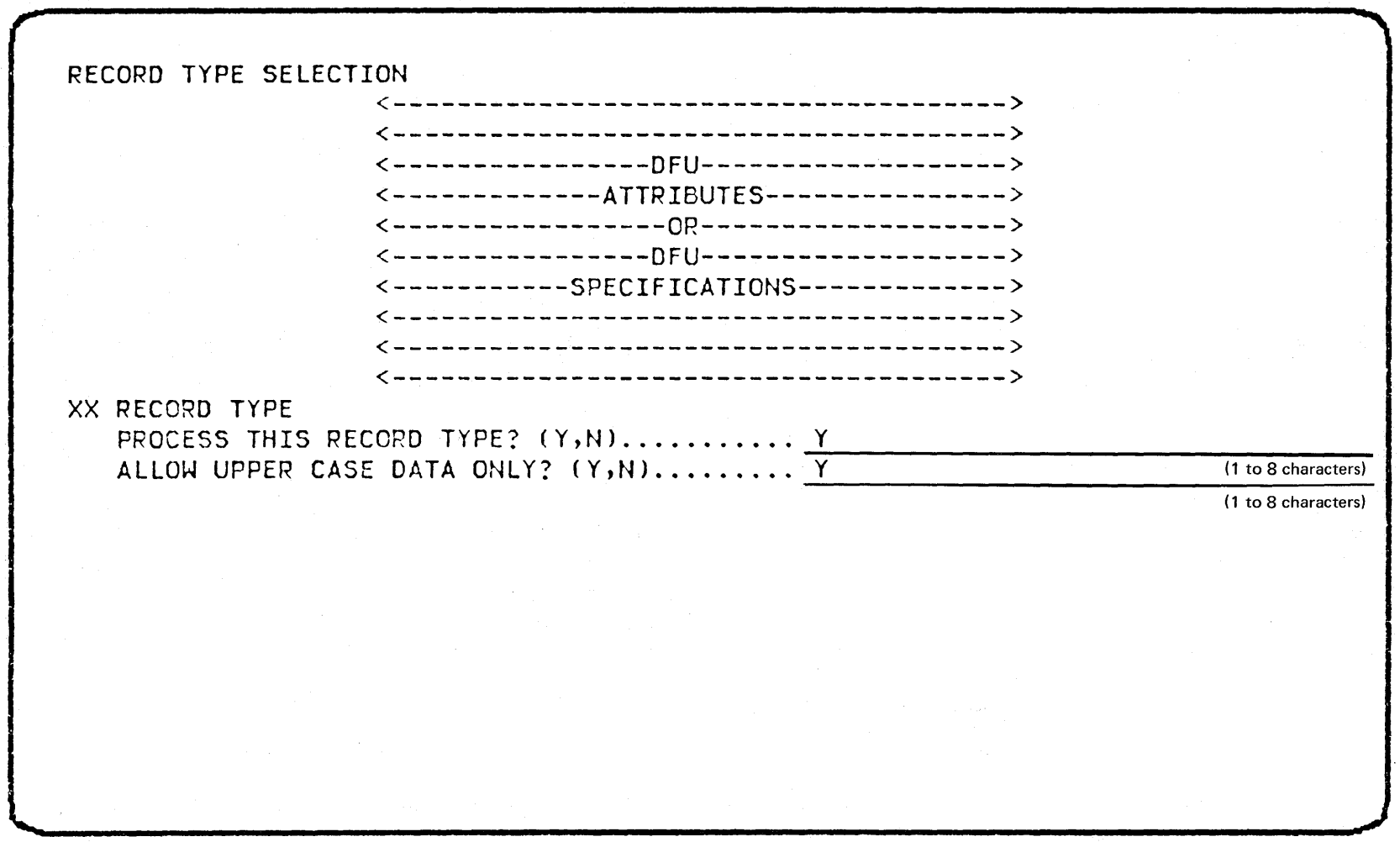
This prompt appears if:

- DFU is not generating records keys.
- Record keys are not packed and are less than or equal to 15 positions.

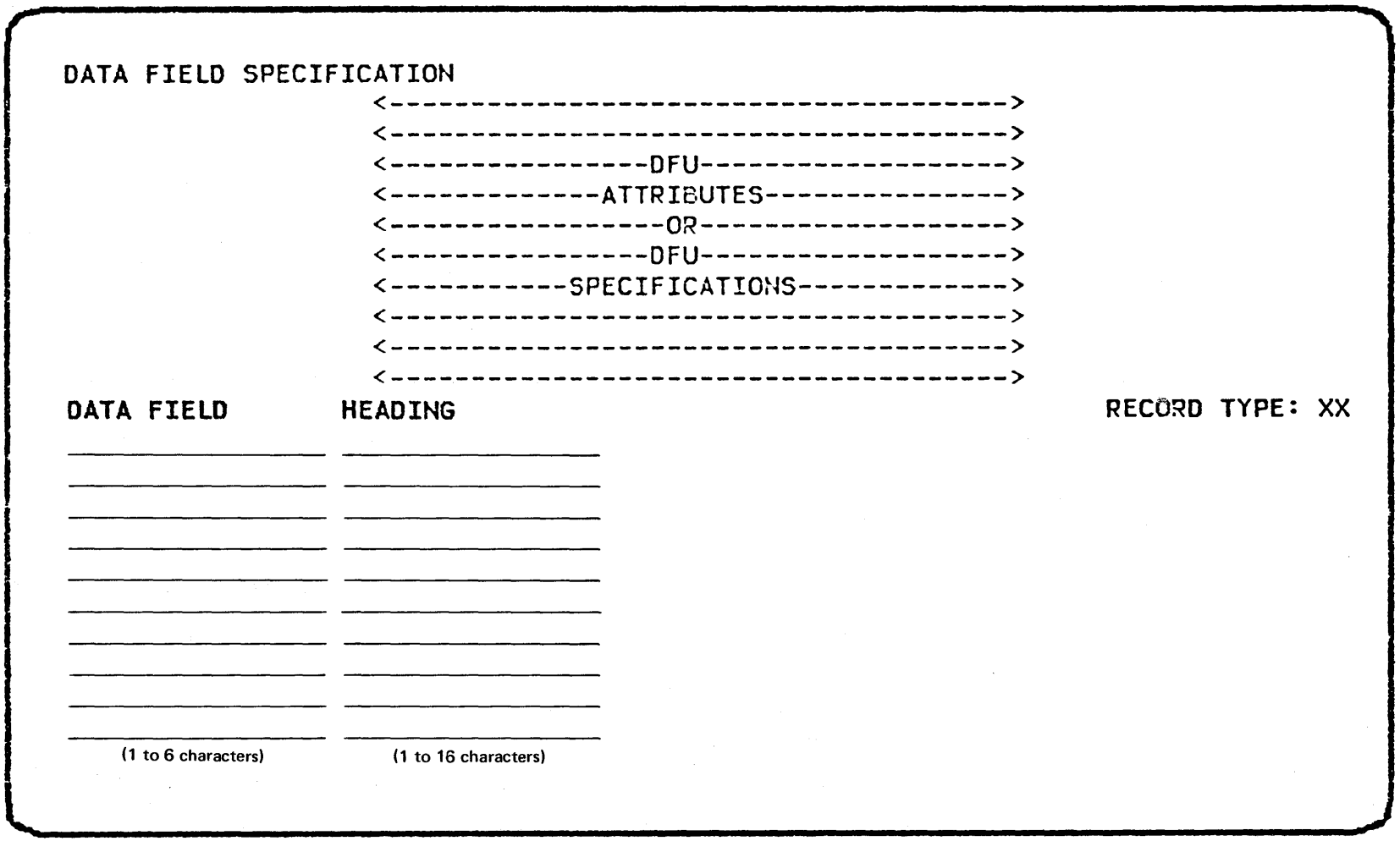
For direct or sequential files:



For indexed, direct, or sequential files:



For indexed, direct, or sequential files:



For indexed, direct, or sequential files (ideographic session):

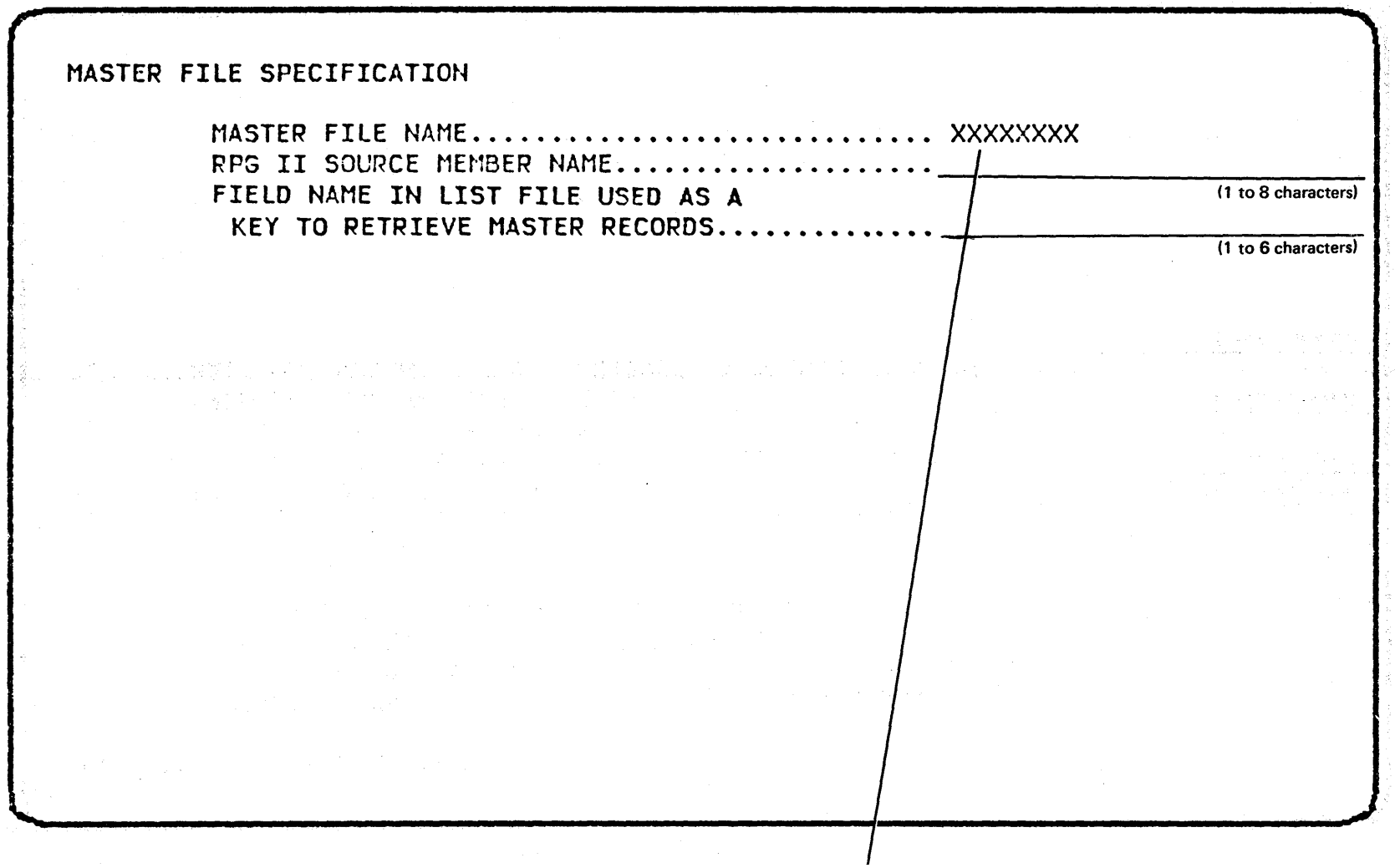
```
DATA FIELD SPECIFICATION
                    <-----------DFU ATTRIBUTES--------------->
                    <----------------OR----------------------->
                    <-----------DFU SPECIFICATIONS----------->
                    <---------------------------------------->
                                                        RECORD TYPE: 01
DATA FIELD   HEADING          FUNCTIONS
                                                    X=IGC
                                                    E=EITHER A/N DEFAULT
                                                    F=EITHER IGC DEFAULT
```

Key LIST and press the Enter/Rec Adv key, and DFU will prompt you as follows:

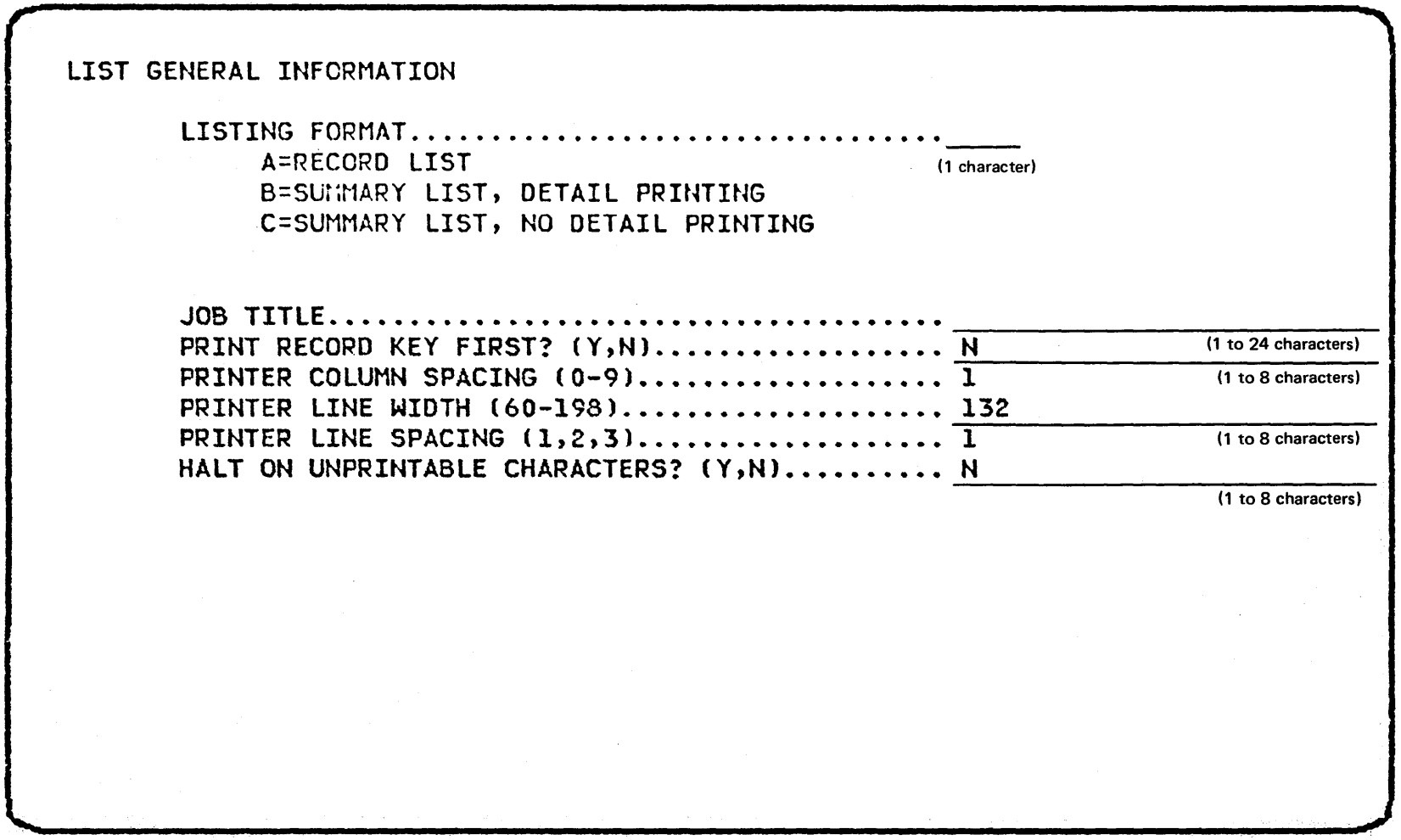
```
                DATA FILE UTILITY LIST PROCEDURE              SETUP ONLY-(S)

          Sorts and prints data files in various report-type formats.

Name Of File To Be Listed ..................................._____
                                                              (1 to 8 characters)
Name Of DFU Format (If Saved, Or To Be Saved) ..............._____
                                                              (1 to 8 characters)
SORT/NOSORT Indication ..................................... NOSORT
Name Of Master File (If Any) ................................._____
                                                              (1 to 8 characters)
Name Of User Library ....................................... #LIBRARY
Name Of RPG II Source ......................................._____(S)
                                                              (1 to 8 characters)
DFU Source Processing Parameter (NN/NY/YN/YY/GO) ..............NN          (S)
Name Of DFU Source (If Saved, Or To Be Saved) ..............._____(S)
                                                              (1 to 8 characters)
```

Enter the parameters required to begin defining a list format description.

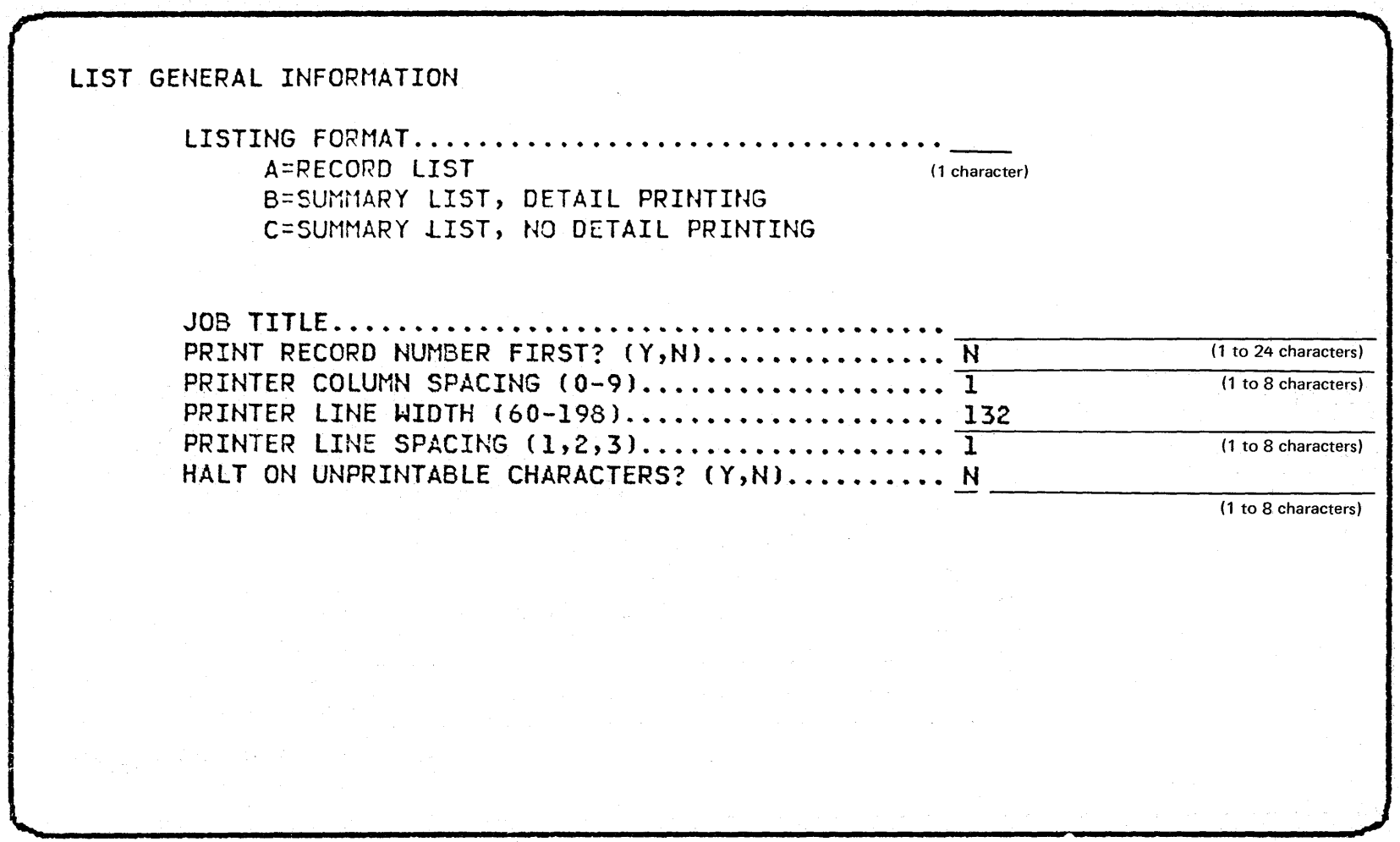
For indexed, direct, or sequential files when a master file has been specified.



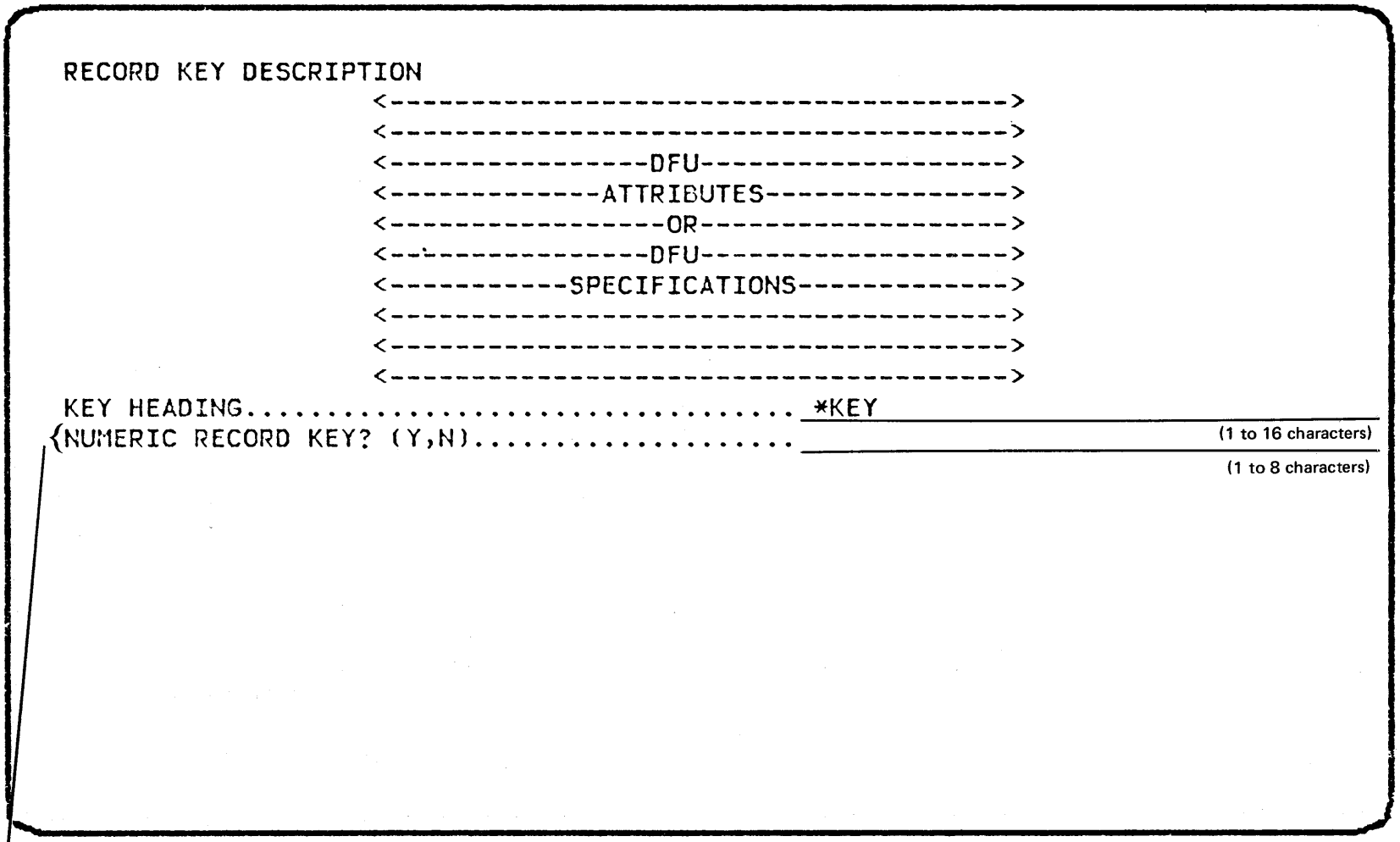
For indexed files only:



For direct or sequential files:



For indexed files when you have responded YES to the PRINT RECORD KEY FIRST prompt on the List General Information prompt:

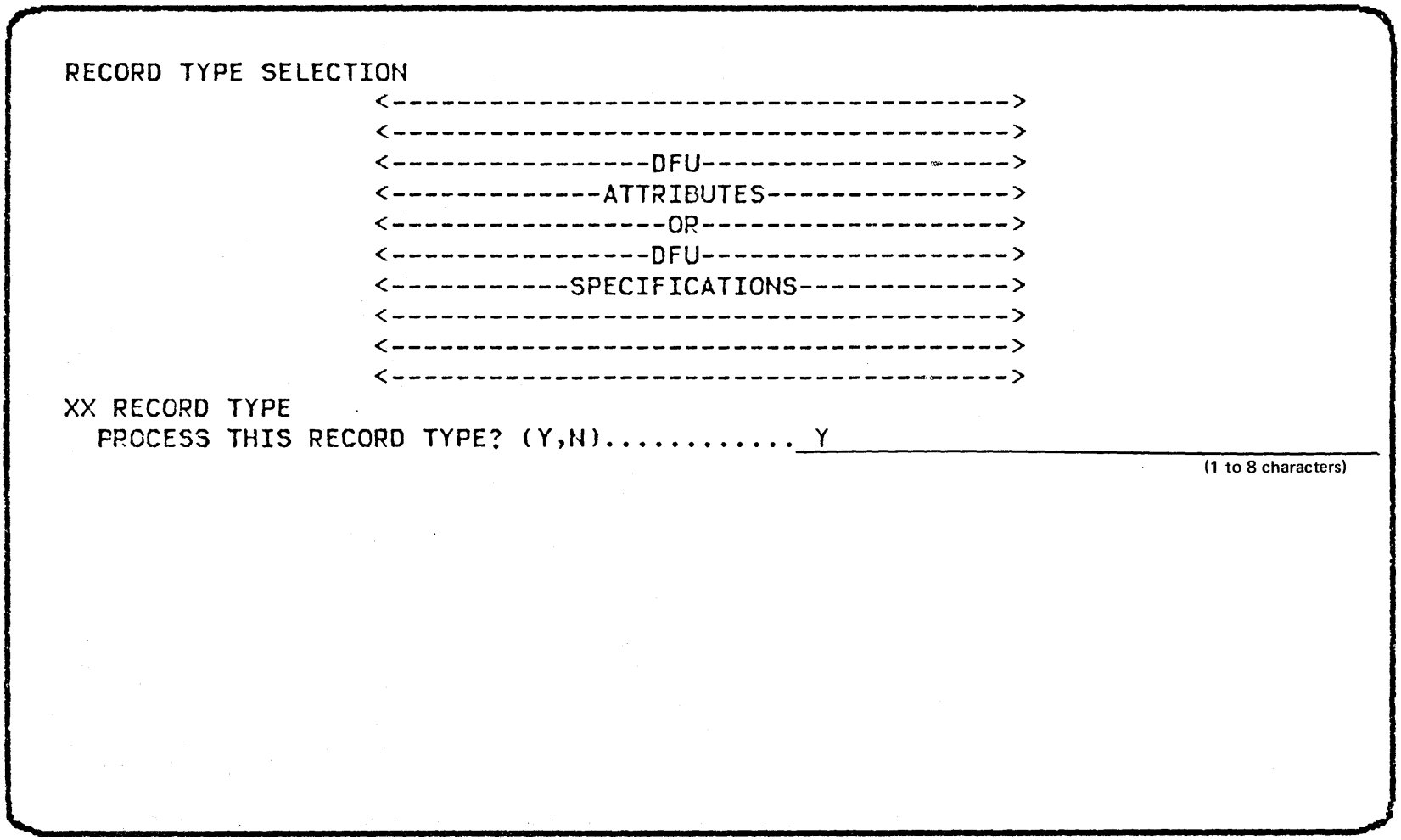


{This prompt does not appear if the key field is packed or if the key field is longer than 15 positions.

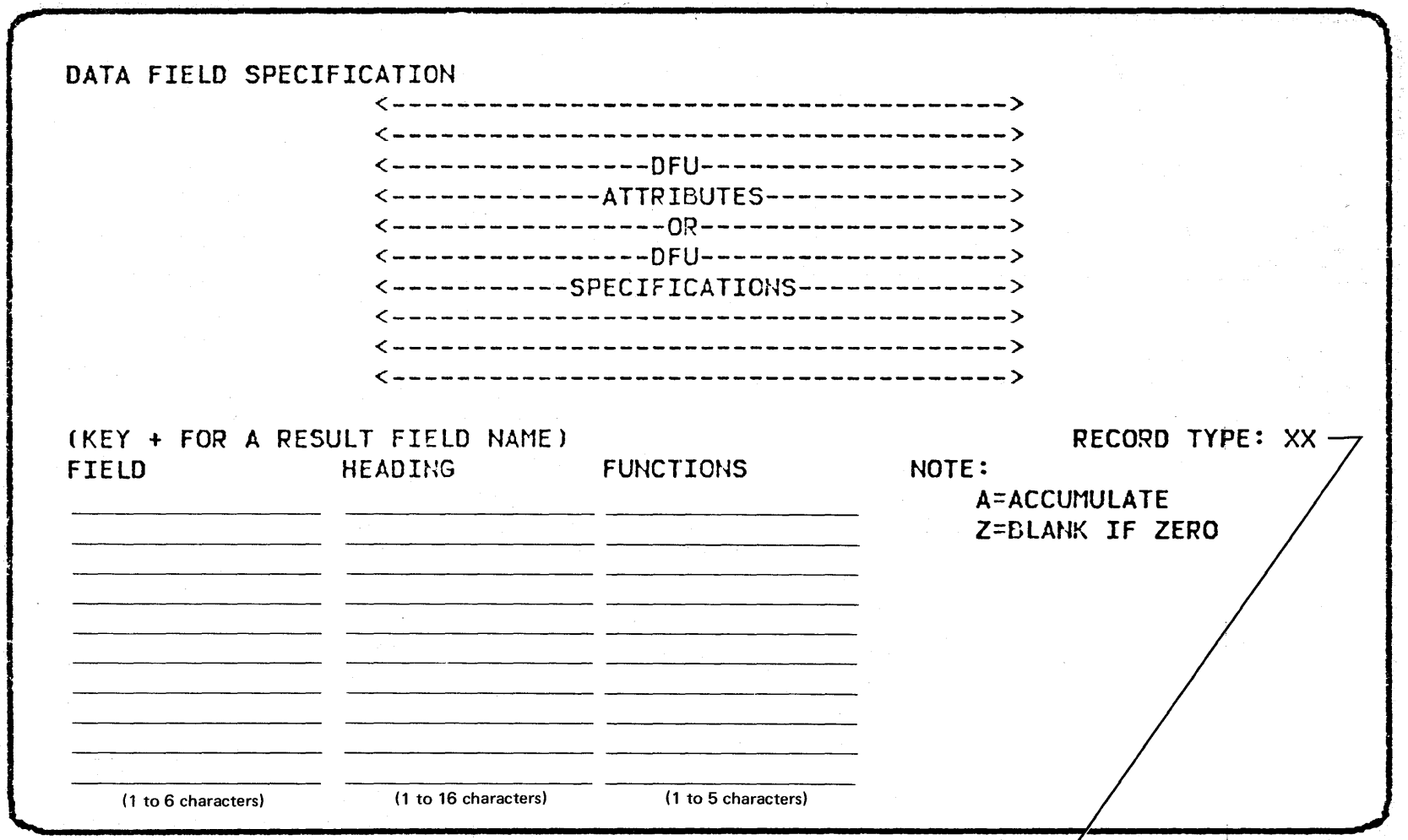
For direct or sequential files when you have responded YES to the PRINT RECORD NUMBER FIRST prompt on the List General Information prompt:

```
RECORD NUMBER DESCRIPTION
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR--------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
RECORD NUMBER HEADING.......................*RECNUM
RECORD NUMBER OPTION.......................... A                (1 to 16 characters)
    A=PRINT ACTUAL RECORD NUMBERS
    B=PRINT DFU GENERATED RECORD NUMBERS
```

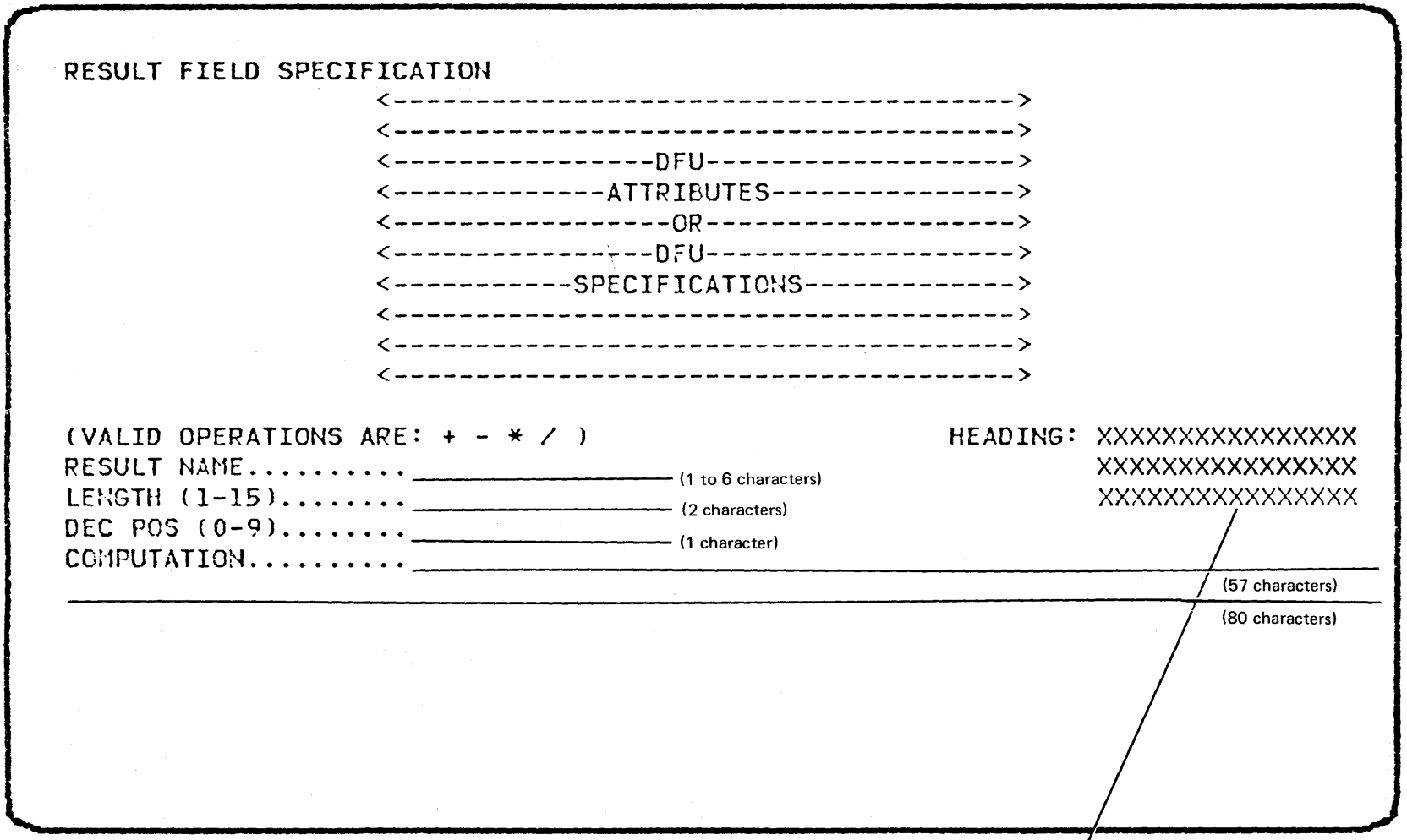
For indexed, direct, or sequential files:



For indexed, direct, or sequential files:

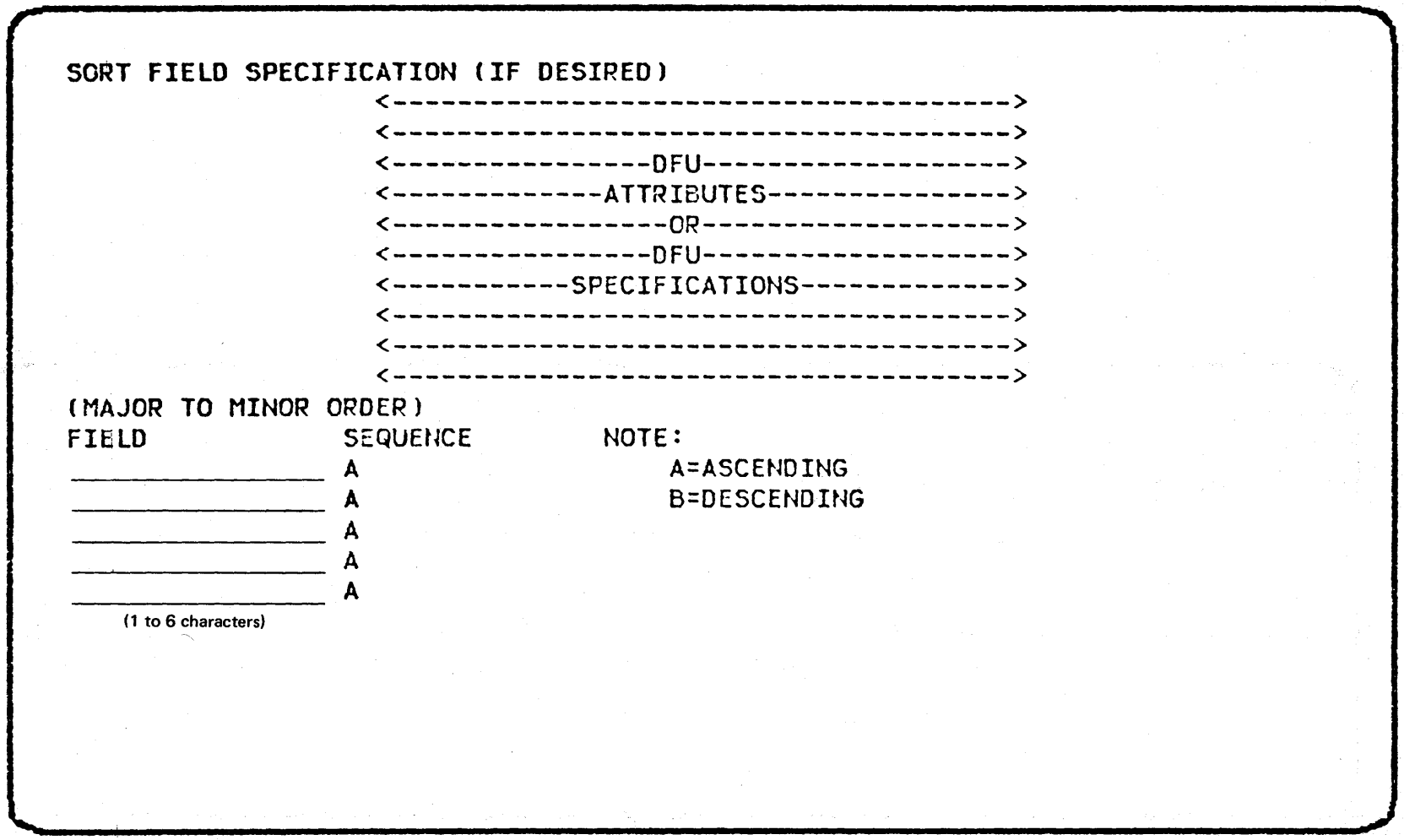


This information does not appear when you are preparing to list summary lists.



- Indexed, direct, or sequential files.
- You specified a + for a result field name on the Data Field Specification prompt.

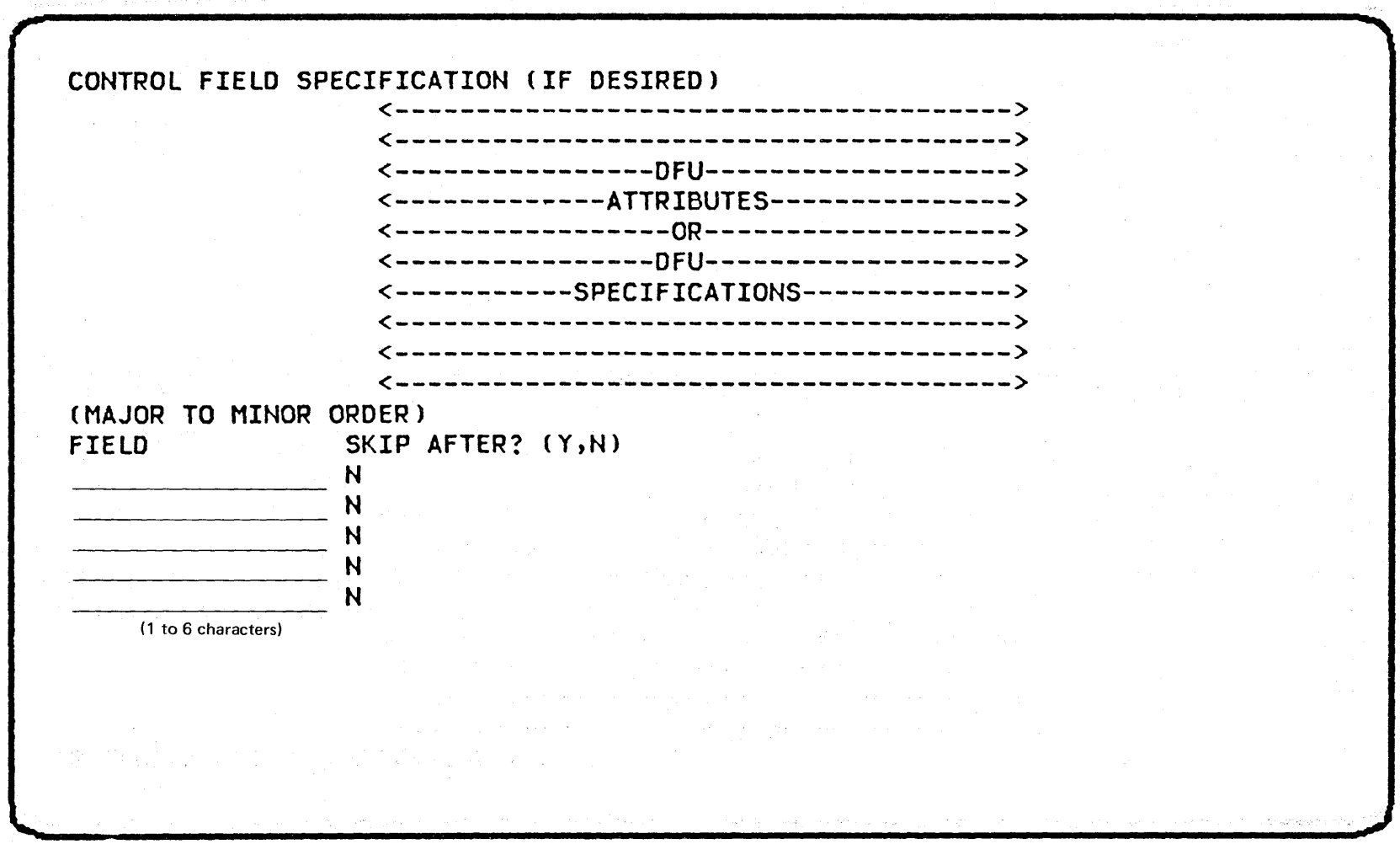
For indexed, direct, or sequential files:



For indexed, direct, or sequential files (ideographic session):

```
SORT FIELD SPECIFICATION (IF DESIRED)
                    <-----------DFU ATTRIBUTES--------------->
                    <---------------OR------------------------>
                    <-----------DFU SPECIFICATIONS----------->
                    <---------------------------------------->
(MAJOR TO MINOR ORDER)
SORT FIELD        SEQUENCE              CONTROL FIELD TYPE
                  A   A=ASCENDING       O   O=ALPHAMERIC      R=R/S/T
                  A   D=DESCENDING      O   E=SEION           S=S/R/T
                  A                     O   I=PRON/R/S/T      T=IGC CHARACTER
                                        O   J=PRON/S/R/T
```

For indexed, direct, or sequential files:



For indexed, direct, or sequential files:

```
SELECT FIELD SPECIFICATION (IF DESIRED)
                    <---------------------------------------->
                    <---------------------------------------->
                    <----------------DFU--------------------->
                    <-------------ATTRIBUTES----------------->
                    <-----------------OR---------------------->
                    <----------------DFU--------------------->
                    <-----------SPECIFICATIONS--------------->
                    <---------------------------------------->
                    <---------------------------------------->
                    <---------------------------------------->
(VALID CRITERIA ARE:  EQ NE GT LT GE LE )
OR/AND              FIELD          SELECT CRITERIA          FIELD/'CONSTANT'
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
_______             ____________   _______                  ______________________
(3 characters)      (1 to 6 characters)  (2 characters)      (22 characters)
```

Note: The first input field under OR/AND is protected on the first Select screen.

When you have finished the setup step, DFU displays the Update DFU Specifications display. After correcting the DFU specifications (if required), you should press the Print Rec command function key, and DFU prints a copy of the DFU specifications for this particular setup. You can then press the EOJ command function key to exit the setup step. If any errors exist in the DFU specifications, a message is displayed, and you can again correct any errors. If there are no errors, DFU then proceeds to the execution phase.

Appendix D. DFU Utility Control Statements

The format of a DFU utility control statement is:

```
// DFU keyword parameters
```

The valid DFU utility control statement parameters are:

Keyword	Description
FL	Filename.
FT	Format name.
RG	RPG source member name.
DS	If used in a List command this is the sort parameter. On other commands, this is the display format source name.
SP	Catalog specifications parameter.
SN	DFU source member name.
MF	Master file name.
LB	User library name.
UT	Utility function type (E,U,I,L).
DF	Default name for format.

The following chart lists the DFU modules and DFU functions that use the DFU utility control statement keywords.

	#DFMP		#DFEX		#DFSB
Keyword	Enter, Update, Inquiry	List	Enter, Update, Inquiry	List	List
FL	Yes	Yes	Yes	No	Yes
FT	Yes	Yes	Yes	Yes	Yes
RG	Yes	Yes	No	No	No
DS	Yes	Yes	No	Yes	No
SP	Yes	Yes	No	No	No
SN	Yes	Yes	No	No	No
MF	No	Yes	No	Yes	Yes
LB	Yes	Yes	Yes	Yes	Yes
UT	Yes	Yes	Yes	Yes	No
DF	Yes	Yes	Yes	Yes	Yes

The following chart lists the DFU procedure names and the DFU parameter numbers in those procedures where the values associated with the DFU keywords are used.

	DFU Procedure Name			
Keyword	**Enter, Update, Inquiry**	**List**	**#DFMP**	**#DFST**
FL	1	1	1	1
FT	2	2	2	2
RG	3	3	3	-
DS	10	4	4	-
SP	6	6	5	-
SN	7	7	6	-
MF	8	8	7	3
LB	9	9	8	4
UT	-	-	9	
DF	-	-	10	5

Appendix E. DFU Indicators

The following is a list of DFU indicators used for enter/update/inquiry to create the source specifications that describe the display for your job. Changing the display screen source is a complex procedure and should be done with a great deal of care.

Indicator	Usage
01-40	Positions the cursor at relative key fields or data fields 1-40.
41-63	Is not currently used.
64	Indicates a put override operation for the current display.
65	Causes the output of execution data fields.
72	Causes the output of error messages on line 24.
73-77	Causes the highlighting of the headings for relative key fields 1-5. This highlighting occurs when an error occurs in a key field.
78	Causes the highlighting of key fields in the second record key area. The second record key area corresponds to the key requested via the inquiry function. This area is highlighted when an error(s) is found in a requested key.
79	Causes the highlighting of the current RECORD TYPE information. This area is highlighted when an invalid record type is requested.
80	Is not currently used.
81-85	Causes the highlighting of key fields in the first record key area. The first record key area corresponds to the key requested via the enter or update functions. This area is highlighted when errors are found in a requested key.

Indicator	Usage
86	Causes highlighting of the first data field on a display that is not defined as an auto-duplication field. This is used to highlight an invalid field duplication request.
87	Causes highlighting of the first data field on a display that is defined as an auto-duplication field. This is used to highlight an invalid field duplication request on this field.
88	Causes the nondisplay and protection of the current RECORD TYPE field.
89	Causes the nondisplay of all data fields.
90	Causes the protection of all key fields not defined as auto-duplication fields.
91	Causes the protection of all key fields defined as auto-duplication fields. This is turned on when the auto-duplication switch is turned on.
92	Causes the protection of all data fields not defined as auto-duplication fields.
93	Causes the protection of all data fields defined as auto-duplication fields. This is turned on when the auto-duplication switch is turned on.
94	Positions the cursor at the current RECORD TYPE field.
95	Positions the cursor at the first key field of the second record key area (for the inquiry function).
98	Causes the nondisplay and protection of the second record key area. This indicator is always on for the enter and update functions and off for the inquiry function.
99	Causes the nondisplay of the LAST RECORD TYPE and AUTO-DUP fields of the status line. This indicator is always on for the inquiry function and off for the enter and update functions.

Glossary

alphabetic character: Any one of the letters A through Z, or one of the special characters #, $, and @.

alphanumeric character: A character that requires 1 byte of storage. Contrast with *ideographic character*.

alphanumeric session: A display station operating session that an operator requests by specifying N for the IGC prompt on the sign-on display. Contrast with *ideographic session*.

auto dup feature: A feature of the data file utility (DFU) program that allows certain types of information from predetermined fields in a previous record to be duplicated into the current record.

auto dup indicator: A field on the display screen that contains a message telling whether the auto dup function is on or off.

automatic field duplication: Same as auto dup feature.

automatic key generation: A DFU feature that allows 5-digit record keys to be assigned to the records of a file.

basic ideographic character set: An ideographic character set defind by IBM that contains 3707 characters consisting of 3226 Kanji characters and 481 additional characters which include Katakana, Hiragana, the alphabet (A through Z and a through z), numerics (0 through 9), roman numerals (I through X), Greek, Russian, and special symbols. The basic ideographic character set is defined in hardware for each ideographic-capable printer and display station.

batch accumulator: An area where subtotals for a field are stored. Contrast with *total accumulator*.

command: A request for the performance of an operation or the execution of a particular program. See also *command statement*.

command function keys: The 14 keys on the top row of the display station keyboard that are used with the Cmd function control key to request functions of program products and user programs. By using the uppercase shift, 24 different key functions are available.

command statement: A statement that requests the performance of a particular function. A command statement always contains the name of the command and may include parameters or data.

control field: 1. In RPG II programming, one or more specified fields that are compared to determine the record sequence that identifies a record's relationship to other records (such as a part number in an inventory record). Control fields are compared from record to record to determine when certain operations are to be performed. 2. When sorting or merging records, one or more specified fields that are compared to determine record sequence in the output file.

cursor: A movable character (underscore) on a display screen, used to indicate where the next character keyed by the operator will appear.

delete code: A character that identifies a record to be removed from a file.

DFU attributes: A group of 40-character records, each record containing five 8-position fields, that is created from the RPG II specifications when the DFU job is being set up.

DFU specifications: A group of 40-character records, each record containing five 8-position fields, that is created from the responses to prompts when the DFU job is being set up.

direct file: A disk file in which records are assigned specific record positions. Regardless of the order in which records are put in a direct file, they always occupy the assigned position in the file. Contrast with *indexed file, sequential file.*

display screen: The part of a display station on which data, messages, or other information is displayed.

display station: An input/output device containing a display screen on which data is displayed, and an attached keyboard from which data is entered. It can be used to request jobs and/or enter data. A display station can be designated as the system console or as a command or data display station at system configuration time.

edit: To modify the form or format of data; for example, to insert or delete characters such as page numbers or decimal points.

extended character file: An area on disk that contains IBM-supplied extended characters and that can contain user-defined characters (see *extended ideographic character set*).

extended ideographic character set: An ideographic character set that contains 3483 IBM-supplied ideographic characters and up to 4370 user-defined ideographic characters. The extended ideographic character set is stored in hardware and is on disk (see *extended character file*).

factor: A field name or constant used in a calculation.

filename: The name associated with a file. A filename can be from 1 to 8 characters long. The first character must be alphabetic, and the remaining characters can be any combination of alphabetic or numeric characters. Blanks cannot appear between characters in a name.

format description: In DFU, a load member created at the end of a job setup step. The format description describes a file and the processing to be done for the file.

function control keys: Special keys on the keyboard used to request specific system functions.

ideographic character (IGC): A pictogram or graphic that requires 2 bytes of storage. Contrast with *alphanumeric character*.

ideographic character set: A character set that contains pictograms or graphics that can be used to represent ideas.

ideographic session: A display station operating session that an operator requests by specifying Y for the IGC prompt on the sign-on display. Contrast with *alphanumeric session*.

ideographic support: The combination of hardware and software elements that allow the use of ideographic data on a System/34.

IGC: See *ideographic character*.

indexed file: A file in which the position of each record is recorded in a separate portion of the file called an index. The index contains an index key and disk address for each record in the file. Indexed files can be processed by the consecutive, sequential by key, sequential within limits, random by key, or addrout file processing methods. Contrast with *direct file, sequential file*.

list file: A data file from which information is extracted to print a report.

load member: A collection of instructions that the system can execute to perform a particular function, regardless of whether the function is requested by the operator or specified in an OCL statement. Load members can also contain screen formats and message members. Load members are stored in a library.

MIC: Message identification code.

modulus 10 checking/modulus 11 checking: Formulas used to calculate the self-check digit for a self-check field. *See self-check field.*

null response: The action of pressing the Enter/Rec Adv key without having previously keyed any data.

parameter: 1. A variable that is assigned a particular value for a specific purpose or process. 2. A value specified in a command statement or a control statement.

prompt: A message issued by a program that requests either information or an operator action to continue processing.

protected field: A field on a display in which operators cannot key data.

record identification code: A code placed in a record to identify that record type.

record key: A field within a record that identifies the record in a file.

record number: The relative position of a record in a file.

record type: The classification of records in a file. Records are classified according to a specific field or fields within each record. Records of the same type have the same fields in the same order and identical record identification codes.

record-identifying indicator: In DFU, a two-digit entry that can be tested in the program to verify that a specific record type has been read as input.

result field: 1. The field that will contain the result of an operation. 2. An area in storage where the result is stored after an instruction is executed.

RPG II: A commercially oriented programming language specifically designed for writing application programs that meet common business data processing requirements.

seion: A Japanese syllable containing phonetic characters.

select field: A field tested for a condition to determine whether a record contains information that should be printed in a report.

selection criteria: Conditions that must be met when determining if a record contains information that should be printed.

self-check digit: The rightmost digit of a self-check field. See *self-check field*.

self-check field: A field, such as an account number, consisting of a base number and a self-check digit. For data entry applications, the operator-entered self-check digit is compared to the self-check digit computed by the system. If the operator makes a mistake when entering (keying) a self-check field, an error message is displayed and the entire field can be rekeyed.

sequential file: A file in which records are entered one after the other; one in which there is no relationship between the contents of the records and their positions in the file. Contrast with *direct file, indexed file.*

shift-in (S/I) control character: A character that indicates the end of a string of ideographic characters. The shift-in control character is represented by hex 0F. Contrast with *shift-out (S/O) control character.*

shift-out (S/O) control character: A character that indicates the start of a string of ideographic characters. The shift-out control character is represented by hex 0E. Contrast with *shift-in (S/I) control character.*

source member: A collection of records (such as RPG II specifications or sort sequence specifications) that is used as input for a program. Source members are stored in a library.

total accumulator: A storage area where final totals for a field are kept. Contrast with *batch accumulator.*

unprintable character: A character to be printed that does not have a representation on the printer to which it is being sent.

unprotected field: A field on display into which operators can key data.

user library: A library created by the user. A user library is in addition to the system library, and may contain any type of library member.

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