GH20-1974-1

TSO-3270 Display Support and Structured Programming Facility (SPF/TSO) Version 2.2 General Information Manual

Program Product

IBM

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Program Number 5740-XT8

Program Product

SPF is a program development tool designed to take advantage of the characteristics of IBM 3270 display terminals, and to increase productivity in the TSO environment for users of both structured and conventional programming techniques.

SPF operates under VS2 Release 1.7 (SVS) with TSO/TCAM, or Release 3.7 (MVS) with either TSO/TCAM or TSO/VTAM. SPF supports 24-line, 32-line, and 43-line IBM 3270 display stations, equipped with either 12 or 24 program function keys.

This manual provides an overview and functional description of SPF.

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RELATED PUBLICATIONS

- Program Reference Manual, GH20-1975 - Provides detailed information on how to use and install SPF.

- Program Logic Manual, LY20-2339 - Describes SPF internal logic, program structure, data flow, data areas, and custom tailoring procedures.

A plastic overlay, SX20-1976, is available to assist in the use of SPF program function keys. A quick reference card, GX20-2328, with a summary of SPF operations is also available.

Second Edition (October 1978)

This edition is a major revision obsoleting GH20-1974-0. It applies to Version 2, Release 2, Modification Level 0, of the program product TSO-3270 Display Support and Structured Programming Facility (5740-XT8) and to all subsequent versions and modifications until otherwise indicated in new editions or Technical Newsletters.

Changes are continually made to the information herein. Therefore, before using this publication, consult your System/370 Bibliography (GC20-0370) for the editions that are applicable and current.

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CONTENTS

LIST OF ILLUSTRATIONS

Following is a summary of changes and enhancements which have been incorporated into SPF Version 2.2. New SPF users who are not familiar with the previous release should skip this section of the manual.

GENERAL

- Support for New Display Terminals - In addition to the display stations previously supported, SPF Version 2.2 supports the new 24-line, 32-line, and 43-line display stations, namely:

  IBM 3276 Models 2, 3, 4, 12, 13, and 14
  IBM 3278 Models 2, 3, and 4

  Support is provided for either 12 or 24 Program Function (PF) keys, although the 24 key configuration is strongly recommended for flexibility and ease of use. Users may rearrange the assignment of SPF-defined key functions, and may equate additional keys to edit and browse primary commands or to edit line commands.

  PF key assignments can be specified and changed via menus under option 0 (specify SPF parms). Key definitions are retained across sessions in the SPFPARMS data set.

- Session Manager Interface - SPF provides better coordination with Release 2 of the Session Manager, program product 5740-XE2, as follows:

  - Simple line messages resulting from SPF-initiated operations (e.g., SUBMIT under edit or under option 5) will be displayed on the SPF screen rather than causing a transition to Session Manager mode.

  - Under option 4 (foreground processing) and option 6 (enter TSO command) the user has an option of remaining in SPF mode or entering Session Manager mode.

BROWSE AND EDIT

- Hex Data Display - Both edit and browse have been enhanced to allow the user to display the hexadecimal representation of data on the screen and, under edit, to change characters by overtyping the hex representation. Hex data may be displayed in "data" format (two character positions per byte) or vertically (one character position but two lines per byte).

  The FIND and CHANGE commands have been enhanced to allow specification of a hex string in the form X'hhhh' or 'hhhh'X, where 'h' represents a hex character.

- Text and Picture Strings for FIND/CHANGE Commands - A text or picture string can be used in a FIND command under browse or edit, and as the "from" string in a CHANGE command under edit.

  Text strings are entered in the form T'cccc' or 'cccc'T, where 'c' is any character. Text strings allow a FIND/CHANGE search to be satisfied without regard to upper/lower case alphabetics. Example:

```
FIND T'The'
```

  will find any of the following: The, the, THE, tHe, (etc.)

  Picture strings are entered in the form P'xxxx' or 'xxxx'P, where 'x' is an alphameric or special character. Picture strings allow a FIND/CHANGE search to be satisfied when a particular type of character is encountered. Examples:

```
FIND P'.'       - find next non-displayable (invalid) character
FIND P'¬' 72    - find next non-blank character in col 72
CHG P'=' 73 80 ' ' ALL    - change any characters in cols 73-80
                            to blanks
```

- New Format for Mode Commands - Primary commands which change browse or edit modes now use an ON/OFF operand to specify the action. Examples:

New Format	Old Format
CAPS ON/OFF	CAPS, ASIS
NUMBER ON/OFF	NUMBER, NONUM
TABS ON/OFF	TABS, NOTABS

  If the operand is omitted, ON is assumed as the default. For compatibility with previous releases of SPF, the old forms (ASIS, NONUM, etc.) are still accepted as aliases of the corresponding "off" commands.

  The three YES/NO parameters on the edit data set menu (automatic print, automatic renumber at save time, and generation of SPF statistics) have also been replaced with ON/OFF mode commands.

BROWSE ONLY

- Symbolic Labels - A label of the form ".xxxxx" may be entered in place of a command on the command input line. It is treated as an internal symbol and equated to the top line on the screen. It can then be used with the LOCATE command to cause scrolling directly to that line. Labels are not retained upon exit from browse.

- LRECL and RECFM Extensions - SPF now supports browsing of data sets with logical record length (LRECL) as large as 32K bytes. In addition, data sets with undefined record format (RECFM=U) may also be browsed.

EDIT ONLY

- Edit Recovery - Under user option, the SPF editor will automatically maintain an audit trail of change activity in a temporary data set. If there is a system failure, the user can recover the edit session up to the point of failure. A menu is displayed when edit is entered to indicate that automatic recovery is in effect.

- Edit Profiles - The SPF editor supports multiple edit profiles which are remembered across sessions as user parameters. The profiles provide improved user control over edit options and defaults such as NULLS mode, NUMBER mode, MASK line, and TABS line. A separate profile is maintained for each data set type. The user may create and invoke alternate profiles.

- Extended MOVE/COPY/CREATE/REPLACE Primary Commands - The MOVE, COPY, CREATE, and REPLACE primary commands have been enhanced to allow any existing sequential or partitioned data set to be the source of a MOVE or COPY, or the destination for a CREATE (PDS member only) or REPLACE. For COPY, a range of lines to be copied may optionally be specified.

  The edit ABEND menu has been eliminated from Version 2.2. If an ABEND occurs during a SAVE operation, the user is informed via a message. The REPLACE or CREATE commands may then be used to save the data in another data set, or split screen mode may be entered to compress or re-allocate the data set.

- Text Entry and Edit Commands - Three new line commands have been added to support entry and edit of textual data, such as program documentation:

  TE - Text Entry. This command facilitates bulk entry of text by inserting several blank lines, and providing automatic cursor skip from the end of one line to the beginning of the next. (The cursor skips over the line number area, which is protected in this mode of operation.)

  TS - Text Split. This command splits a line into two lines at the designated cursor position to facilitate insertion of new material in existing text.

  TF - Text Flow. This command reflows a paragraph of text from the line on which the "TF" is entered to the end of the paragraph.

  The text edit features are intended to provide basic services for creation and maintenance of simple draft documents.

- Overlay Line Commands - New line commands, "O" (overlay) and "OO" (block overlay), may be used in conjunction with the move/copy line commands in place of the "A" (after) or the "B" (before) line commands. These new commands cause data to be copied or moved "over" the existing data on one or more lines. Blank characters in the receiving line(s) are overlayed with corresponding characters in the source line(s). Non-blank characters are not overlaid.

- Move/Copy Line(s) Multiple Times - The M/MM and C/CC line commands have been enhanced so that a number (n) can be entered with the "A" (after) or "B" (before) line commands, which causes 'n' copies of the line(s) to be moved or copied. This feature applies only to the move and copy line commands (not the MOVE and COPY primary commands).

- UNNUM Primary Command - The UNNUM primary command may be used to set sequence numbers to blanks. It applies to either "standard" numbers, COBOL numbers, or both. The UNNUM command also causes number mode to be set OFF.

- Logical Tabs - A new capability for logical tabs may be invoked via the command:

  TABS ON $ where '$' is any special character

  Logical tabbing occurs when the user enters data in the form:

  $wxyzw$xy$z where '$' is the tab character

  In the above example, the first data field 'wxyzw' is placed by SPF after the first tab position (as defined by the TABS line), the second field 'xy' is placed after the second tab position, etc.

UTILITIES

- Outlist Utility - A new SPF utility, option 3.8, allows the user to browse, delete, re-queue, or print output data which has been held in a SYSOUT queue.

- Library Utility - The library utility, option 3.1, has been enhanced to allow browsing of members from either the data set menu or the member list. If option "B" is entered, the specified member will be displayed in browse mode.

- Data Set Utility - The data set utility, option 3.2, has been enhanced to display the creation date on the data set information display. Also, if the data set is deleted or renamed, the volume is displayed in the confirmation menu along with a message indicating whether or not the data set will be uncataloged.

- Move/Copy Utility - The move/copy utility, option 3.3, has been enhanced to indicate whether a member which has been copied (or moved) has replaced an existing member. One of the following messages will appear on the member list following the member name: "*COPIED", "*MOVED", "*NOREPL", or "*REPL". The "*REPL" message is new.

  The move/copy utility will now handle data sets with logical record length (LRECL) as large as 32K bytes.

  The "to" data set disposition field for a PDS has been eliminated from the second move/copy menu. The move/copy utility now provides integrity as well as better performance without the need to allocate DISP=OLD.

- Reset Utility - The reset utility, option 3.5, has been enhanced to provide better user control of SPF statistics and renumbering. The new options are:

  R - Create/update SPF statistics, conditionally reset numbers.
  N - Create/update SPF statistics, no reset of numbers.
  D - Delete SPF statistics.

MISCELLANEOUS

- Scroll Extensions - SPF Version 2.2 provides two new scrolling features:

  - If the characters 'CSR' or 'C' are entered in the scroll amount field (i.e., SCROLL ===> CSR), scrolling is performed based on the current position of the cursor. The line or column indicated by the cursor is moved to the top, bottom, left, or right of the screen, depending upon which scroll key is pressed.

  - Any scroll amount that can be entered in the scroll field may be entered instead in the command input area. When a scroll key is pressed, the value in the command area overrides the normal scroll amount without causing a change to the scroll field. This results in a one-time override; the value in the command area is blanked out after scrolling occurs.

- Return PF Key Enhancement - The user can go directly from one SPF option to another without displaying the primary option menu, as follows: In any menu input field or primary command line, enter an equal sign (=) followed by a primary option. Then press the Return PF key rather than the ENTER key.

- Support for TIME Command - The TSO TIME command may now be entered under option 6 (enter TSO command).

- Job Statement Passwords - Job statements are now scanned for PASSWORD parameters prior to being saved in the SPFPARMS (user parameters) data set. Passwords are replaced with question marks.

- List, Log, and Temporary Data Set Naming Conventions - If SPF is installed under MVS, and if a user prefix different from the user id is specified in the TSO profile, the data set name for SPF list, log, and temporary data sets will start with the prefix followed by the user id. Example:

  prefix.user-id.SPF3.LIST

  If the prefix and user id are the same, or if NOPREFIX is specified, the data set names will start with user id, as before.

- SPF Installation Procedures - SPF installation procedures have been changed to use the System Modification Program (SMP). Initial installation of SPF Version 2.2 and all subsequent PTF's will be via SMP.

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SPF is a program development tool designed to take advantage of the characteristics of IBM 3270 display terminals, and to increase productivity in the TSO environment for users of both structured and conventional programming techniques. SPF can be used either by an individual programmer, or by many programmers working together on a project. SPF features which increase programmer productivity and simplify operation include:

- Display presentations and menus which prompt the user, reduce keystrokes, and minimize the opportunity for error.
- Support for multi-level programming libraries, automatic collection of library activity statistics, and printing of library contents.
- Full screen, context editing which allows additions and changes to multiple lines in a single interaction.
- Simple one-character edit commands for inserting, deleting, duplicating, or rearranging lines of source data.
- Forward, backward, and sideways scrolling of source data or listings, plus the ability to locate information by character string or line number.
- Split screen, allowing two SPF functions to be performed independently on the same display terminal.
- Use of program function keys for frequently performed SPF operations and commands.
- Menu-driven utilities for specification and maintenance of libraries, data sets, catalogs, and DASD volumes.
- Menu interface to standard language processors (compilers, assembler, and linkage editor) for execution in the foreground or background.
- Text editing features for document preparation and maintenance.
- Hardcopy log summarizing significant user actions during the session.
- Online tutorial for instruction and reference -- especially valuable for the occasional or novice user of SPF.

SPF operates as a TSO command processor and is invoked simply by entering the command "SPF". It operates under VS2 Release 1.7 (SVS) with TSO/TCAM, or under VS2 Release 3.7 (MVS) with either TSO/TCAM or TSO/VTAM. SPF supports 24-line, 32-line, and 43-line IBM 3270 display stations, equipped with either 12 or 24 program function keys.

STRUCTURED PROGRAMMING FEATURES

Structured programming emphasizes the use of segmentation and indentation. A source program normally consists of a large number of relatively small segments. The segments are stored as separate members of a partitioned data set. Within a segment, source statements are block-indented under each "IF-THEN-ELSE" or "DO-WHILE" to show the control structure. Features of SPF which are specifically oriented toward structured programming include:

- Fast call-up and saving of members within the same partitioned data set. Multiple members may be accessed with a single allocation of the data set.

- Ease of segmentation changes. One member can easily be split into multiple members, or multiple members can be merged into one.

- Ease of indentation changes. Single statements or blocks of statements can easily be shifted left or right by a specified number of column positions.

- Insert in context. A "DO-END" pair, for example, may be coded on consecutive lines, and then space can be opened between the two lines to allow insertion of a block of code.

- Visual verification aids. A block of code may be temporarily excluded from display so that the space which it occupies on the screen is closed up. This facilitates visual verification of the control structure, particularly when the length of a segment exceeds the screen size.

DISPLAY FORMAT

SPF uses four basic types of display presentations.

1. Option Selection Menus - The user selects from a list of options by typing a number and pressing the ENTER key. Example: The SPF primary option menu (Figure 1). This is the first display that the user sees after invoking SPF.

2. Parameter Entry Menus - The user supplies parameters by filling in labeled fields. In many cases, SPF pre-enters parameters based on what the user last entered. Example: The browse data set menu (Figure 2). This menu is displayed if the user selects option 1 from the primary option menu.

```
------------------------  SPF PRIMARY OPTION MENU  -----------------------------
SELECT OPTION ===>

                                                          USERID    - JOSLIN
   0  SPF PARMS  - SPECIFY TERMINAL AND SPF PARAMETERS     TIME      - 10:47
   1  BROWSE     - DISPLAY SOURCE DATA OR OUTPUT LISTINGS  TERMINAL  - 3277
   2  EDIT       - CREATE OR CHANGE SOURCE DATA            PF KEYS   - 12
   3  UTILITY    - PERFORM SPF UTILITY FUNCTIONS
   4  FOREGROUND - COMPILE, ASSEMBLE, LINK EDIT, OR DEBUG
   5  BACKGROUND - COMPILE, ASSEMBLE, OR LINK EDIT
   6  TSO        - ENTER TSO COMMAND OR CLIST
   7  TUTORIAL   - DISPLAY INFORMATION ABOUT SPF
   X  EXIT       - TERMINATE SPF USING LIST/LOG DEFAULTS

PRESS END KEY TO TERMINATE SPF
```

Figure 1. Primary option menu

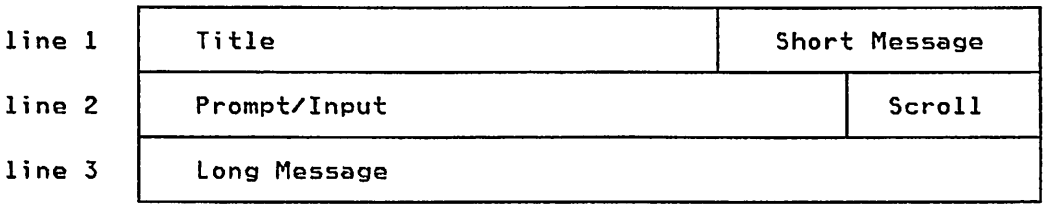
```
-------------------------  BROWSE - DATASET MENU  ----------------------------
ENTER/VERIFY PARAMETERS BELOW:

SPF LIBRARY DATASET:
   PROJECT ===> SPFDEMO
   LIBRARY ===> B
   TYPE    ===> PLI
   MEMBER  ===>          (BLANK FOR MEMBER SELECTION LIST)

OTHER PARTITIONED OR SEQUENTIAL DATASET:
   DATASET NAME  ===>
   VOLUME SERIAL ===>          (IF NOT CATALOGED)

DATASET PASSWORD ===>          (IF PASSWORD PROTECTED)
```

Figure 2. Browse - data set menu

3. Member Selection Lists - Displays a list of members in a partitioned data set. The user may select a member by entering a one-character code in front of the appropriate member name. Figure 3 shows an example of a member list on which the user has selected member COINS.

4. Data Display - for displaying source code or output listings. Figure 4 shows an example of the browse display of member COINS in data set SPFDEMO.B.PLI.

SPF formats the first three lines of the display as follows:



The title area (line 1) identifies the function being performed and, where appropriate, the data set name, member name, version number and modification level. The short message area (line 1) is used to indicate:

- Current line number (browse) and column positions (browse and edit),
- Successful completion of a processing function,
- Error conditions (accompanied by audible alarm, if installed).

The prompt/input area (line 2) is used to enter an option selection or command. In cases where no option selection or command is applicable, this area contains a prompt. The scroll area (line 2) contains the current scroll amount whenever scrolling is applicable. The scroll amount may be overtyped by the user (see "Scrolling").

The long message area (line 3) is used to display an explanation of error conditions upon request (see "Help Text"). Normally this line is blank on menus, contains column headings on member selection lists, and is treated as part of the data area on data displays.

Under TSO/TCAM, broadcast messages sent by the system operator or other TSO user will also appear in the long message area on line 3. When such a message occurs, three asterisks (***) will appear on the bottom line of the screen and the audible alarm will be sounded. No further output will be sent to the terminal until the user presses ENTER or one of the other interrupt keys.

Under MVS/TSO/VTAM, broadcast messages are displayed on a blank screen, immediately followed by three asterisks. Again, no further output will be sent to the terminal until ENTER or another interrupt key is pressed.

```
BROWSE - SPFDEMO.B.PLI ------------------------------------------------------
COMMAND INPUT ===>                                            SCROLL ===> PAGE
   NAME            VER.MOD  CREATED    LAST MODIFIED     SIZE  INIT  MOD   ID
  ACCOUNT           01.00  75/01/09  75/01/09 17:07      21    21     0  JOSLIN
  ACCT1             01.01  75/01/09  75/04/23 14:52      99   193     0  JOSLIN
  ACCT2             01.00  75/01/09  75/01/09 17:07      20    20     0  JOSLIN
S COINS             01.04  75/04/24  75/04/24 16:20      19    19     4  JOSLIN
  COMPX             01.00  75/01/09  75/01/09 17:08      44    44     0  JOSLIN
  COMPY             01.01  75/01/14  75/01/14 12:30      13    13     1  JOSLIN
  DCLS              01.00  75/04/23  75/04/23 15:14      20    20     0  JOSLIN
  LISTNEW           01.02  75/04/23  75/04/23 15:60      17    13     6  JOSLIN
  MAIN              01.00  75/01/09  75/01/09 17:03       4     4     0  JOSLIN
  TESTDIR           01.02  75/04/23  75/04/23 17:04      30    43    10  JOSLIN
  UPDATE            01.00  75/01/09  75/01/09 17:08      13    13     0  FD2PHJ
  **END**
```

Figure 3. Browse - member selection list

```
BROWSE - SPFDEMO.B.PLI(COINS) - 01.04 ---------------- LINE 00000 COLS 001 080
COMMAND INPUT ===>                                            SCROLL ===> PAGE
****************************** TOP OF DATA ************************-CAPS-**
COINS:                                                                00010001
  PROCEDURE OPTIONS (MAIN);                                           00020000
    DECLARE                                                           00030000
      COUNT    FIXED BINARY (31) AUTOMATIC INIT (1),                  00040000
      HALVES   FIXED BINARY (31),                                     00050000
      QUARTERS FIXED BINARY (31),                                     00060003
      DIMES    FIXED BINARY (31),                                     00070000
      NICKELS  FIXED BINARY (31),                                     00080004
      SYSPRINT FILE STREAM OUTPUT PRINT;                              00090000
    DO HALVES = 100 TO 0 BY -50;                                      00100000
      DO QUARTERS = (100 - HALVES) TO 0 BY -25;                       00110000
        DO DIMES = ((100 - HALVES - QUARTERS)/10)*10 TO 0 BY -10;     00120000
          NICKELS = 100 - HALVES - QUARTERS - DIMES;                  00130000
          PUT FILE(SYSPRINT) DATA(COUNT,HALVES,QUARTERS,DIMES,NICKELS);00140000
          COUNT = COUNT + 1;                                          00150000
        END;                                                          00160000
      END;                                                            00170000
    END;                                                              00180000
  END COINS;                                                          00190001
****************************** BOTTOM OF DATA ***********************-CAPS-**
```

Figure 4. Browse - data display

MENU PARAMETER SPECIFICATION

Several parameter entry menus require specification of the following types of information.

- Data set and member names
- Data set password (if applicable)
- Job statement parameters (for submitting background jobs)

These are described in the following paragraphs.

Data Set and Member Names

SPF encourages standardization in the structure and naming of programming libraries. A "standard SPF library" is a cataloged partitioned data set with a 3-level data set name in the form:

```
'project-name.library-name.type'
```

where--

- "project-name" identifies the programming project. This name is used in lieu of user ID as the high level qualifier for sharing libraries on projects involving more than one programmer.

- "library-name" identifies the particular library, which may be a master library, a test library, a development library, etc.

- "type" identifies the type of data contained in the data set, such as: ASM (Assembler source), COBOL (COBOL source), OBJ (object modules), or LOAD (load modules). This is analogous to the "type" qualifier in TSO data set naming conventions, except that it need not conform to the standard TSO type identifiers.

To facilitate entering data set names, SPF menus prompt the user for each component of the name, as follows:

```
SPF LIBRARY DATA SET:
    PROJECT ===>
    LIBRARY ===>
    TYPE    ===>
    MEMBER  ===>          (BLANK FOR MEMBER SELECTION LIST)
```

For convenience, any cataloged data set (sequential or partitioned) with a 3-level name may be entered in this manner, even if the three components of the data set name do not actually identify project, library, and type. For partitioned data sets, if the member name is not specified, a member selection list will be displayed.

Exception: In foreground and background processing, options 5 and 6, only a partitioned data set may be specified, and the member name must be specified on the menu.

Some menus allow a concatenated sequence of up to four SPF libraries to be specified. For example:

```
SPF LIBRARY DATA SET:
    PROJECT ===> SAMPLE
    LIBRARY ===> MYOWN    ===> TEST     ===> MASTER   ===>
    TYPE    ===> COBOL
    MEMBER  ===>           (BLANK FOR MEMBER SELECTION LIST)
```

In this example, three data sets would be concatenated in the following order:

```
SAMPLE.MYOWN.COBOL
SAMPLE.TEST.COBOL
SAMPLE.MASTER.COBOL
```

In SPF, concentenation applies only to partitioned data sets. It is a user responsibility to insure that the concatenated data sets have consistent record formats, logical record lengths, and block sizes.

Data sets which do not conform to the SPF library conventions may be specified as follows:

```
OTHER PARTITIONED OR SEQUENTIAL DATA SET:
    DATA SET NAME ===>
    VOLUME SERIAL ===>          (IF NOT CATALOGED)
```

Any fully qualified data set name may be entered, enclosed within apostrophes. If the apostrophes are omitted, the user ID (SVS) or user prefix (MVS) is automatically left-appended to the data set name. For partitioned data sets, a member name enclosed in parentheses may follow the data set name. For example:

```
'SYS1.PROCLIB(ASMHC)'
```

If the member name (and parentheses) are omitted, a member selection list will be displayed. If both an SPF library and "other" data set name are specified on the same menu, the "other" data set name is used.

The volume serial parameter may specify a real DASD volume or a virtual volume residing on an IBM 3850 Mass Storage System. To access 3850 virtual volumes, the user must also have MOUNT authority (see TSO ACCOUNT command).

Note: SPF does not support multi-volume data sets.

Data Set Password

SPF provides an interface with the standard VS2 mechanism for data set password protection. Any data set may be protected for read-only or read/write access. More than one password may be assigned to the same data set. A data set that is read/write protected, for example, might allow several authorized users to read it, but only one user to write.

SPF allows specification of a data set password in the following manner:

```
DATA SET PASSWORD ===>          (IF PASSWORD PROTECTED)
```

In this case, a non-display input field is used so that the password will not appear on the screen. For data set menus which allow specification of a concatenated sequence of libraries, the password applies to all data sets in the concatenation sequence.

Note: SPF is compatible with TSO/VS2 Programming Control Facility (PCF) and the Resource Access Control Facility (RACF). PCF and RACF provide alternate mechanisms for protecting data set security.

Job Statement Information

SPF supports submission of background jobs for printing and for language processing. Before submitting a background job, the user must supply a job statement. For this purpose, 4 lines are provided on each job submission menu. The first time a job submission menu is displayed, the job statement information appears as follows:

```
JOB STATEMENT INFORMATION:
    ===> //user-idA JOB (ACCOUNT),'NAME'
    ===> //*
    ===> //*
    ===> //*
```

SPF pre-enters a job name consisting of the user ID right-appended with the letter "A". SPF automatically increments the last character of the job name to "B", "C", etc., each time the job statement information is used. The user may change the last character of the job name to a numeric digit, rather than a letter, in which case SPF will cycle the last character from 0 to 9, rather than A to Z.

The user may overtype the entire job name, if desired, but automatic incrementing of the last character is suspended unless the job name starts with the user ID.

The remaining job statement information must be entered by the user the first time a background job is submitted. The lines containing "//*" may be used as continuation lines (by changing the "//*" to "//"), or they may be used to enter other JCL statements, such as a JOBLIB DD statement. If these lines are not needed, they may be blanked out. Blank lines are not submitted to the job stream.

Saving User Parameters

SPF retains default parameters and pre-enters appropriate information on menus according to what was last entered by the user. This includes the following types of information:

- Project name, library name(s), type, and data set password
- Job statement information
- SYSOUT class for printed output
- Defaults for list/log allocation and processing
- Terminal characteristics and PF key definitions
- Edit profiles, mask and tab lines
- Processing options for each of the language processors
- Data set allocation/information parameters

This information is automatically maintained in an SPF-controlled permanent data set (referred to as the SPFPARMS data set) so that user information and defaults can be carried from one session to another. Accordingly, a new SPF user will have to enter each type of information the first time it appears on a menu. But from that point on, he simply verifies the information and makes whatever changes are desired before proceeding.

PROGRAM ACCESS AND FUNCTION KEYS

The two program access (PA), and 12 or 24 program function (PF) keys are used to request commonly used SPF operations. Keys which are not needed for SPF-defined key operations may be equated to edit and browse primary commands, or edit line commands, using the SPF parms option (option 0).

The default key arrangement for the 3-by-4 key pad (right-hand side of the keyboard) is shown in Figure 5. These are PF keys 1-12 on an IBM 3277/3275 terminal, or keys 13-24 on an IBM 3278/3276 terminal. A plastic overlay for the key pad, IBM order number SX20-1976, is available to assist with program key usage.

For 24-key terminals, PF keys 1-12 have the same defaults as keys 13-24. It is strongly recommended that users of 24-key terminals continue to use the key pad (13-24) for SPF-defined operations, and redefine PF keys 1-12 to edit and browse commands.

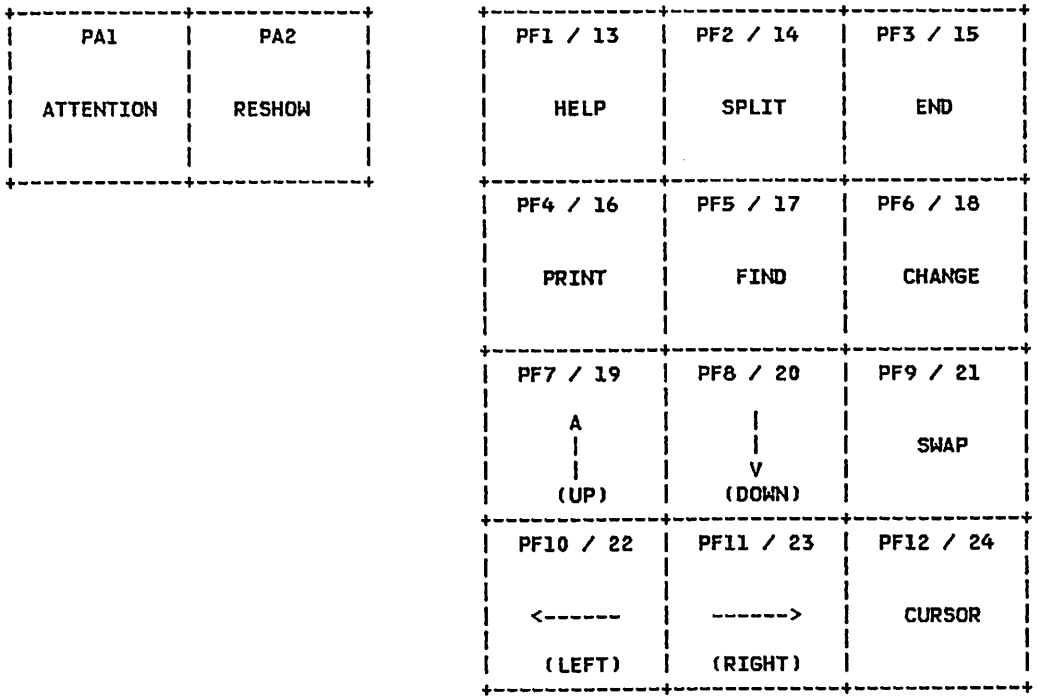


Figure 5. Program key arrangement

The two PA keys are defined as follows. These may not be redefined by the user.

ATTENTION (PA 1) This key is logically disabled by SPF whenever the keyboard is unlocked, except during execution of a TSO command under SPF (foreground processing option or TSO command option).

RESHOW (PA 2) Redisplays the contents of the screen in the event that the user has accidentally pressed the ERASE or CLEAR key, or has entered unwanted information. Note that SPF does not support use of the Field Mark character (up-shift PA2).

The SPF-defined PF key operations are described below. See Figure 5 for the default key assignments.

HELP Displays additional information about an error message or tutorial information about SPF commands and options.

SPLIT Causes entry into split screen mode or a change in location of the split.

END Terminates the current operation and causes a return to the previous menu. If the primary option menu is displayed, this key terminates SPF operations.

PRINT Causes a "snapshot" of the screen image to be recorded in a the SPF list data set.

FIND Repeats the action of the previous FIND command (applies to browse and edit only).

CHANGE Repeats the action of the previous CHANGE command (applies to edit only).

UP Causes scrolling up by the number of lines shown in the scroll amount field.

DOWN Causes scrolling down by the number of lines shown in the scroll amount field.

SWAP Moves the cursor to wherever it was previously positioned on the other logical screen (applies to split screen mode only). See section entitled "Split Screen" for further explanation.

LEFT Causes scrolling left by the number of columns shown in the scroll amount field.

RIGHT Causes scrolling right by the number of columns shown in the scroll amount field.

CURSOR Moves the cursor to the first input field on line 2 (normally, the option selection or command input field). Pressing this PF key again causes the cursor to be moved to the second input field on line 2 (normally the scroll amount field).

RETURN Causes an immediate return to the primary option menu, bypassing any intermediate menus. (Logically equivalent to repeated use of the END key.) May also be used to go directly from one SPF option to another, without displaying the primary option menu, as follows: In any menu input field or primary command line, enter an equal sign (=) followed by a primary option. Then press the Return PF key rather than the ENTER key.

PRINT-HI Same as PRINT except that high intensity characters on the screen are printed with overstrikes (using suppress-space carriage control) to simulate the dual intensity display.

NOP Causes the PF key to be functionless.

The RETURN, PRINT-HI, and NOP functions have no default key assignments. Users of 12-key terminals may wish to assign RETURN to an infrequently used PF key, such as PF4 (in lieu of PRINT) or PF12 (in lieu of CURSOR).

SCROLLING

During edit and browse, the information to be displayed will generally exceed the screen size. Scrolling allows the screen "window" to be moved up, down, left, or right across the information. A member list can also be scrolled up and down, if it exceeds a single screen length.

Four program function (PF) keys are used for scrolling -- one for each direction. Whenever scrolling is allowed, a scroll amount is displayed at the top of the screen (line 2). This amount determines the number of lines (or columns) scrolled with each use of a Scroll PF key. The user may change the scroll amount by moving the cursor to the scroll field and overtyping the displayed amount. Valid scroll amounts are:

- A number from 1 to 9999 - specifies the number of lines (up or down) or columns (left or right) to be scrolled.
- PAGE - specifies scrolling by one page.
- HALF - specifies scrolling by a half page.
- MAX - specifies scrolling to the top, bottom, left margin, or right margin, depending upon which Scroll PF key is used.
- CSR - specifies scrolling based on the current position of the cursor. The line or column indicated by the cursor is moved to the top, bottom, left margin, or right margin of the screen, depending upon which Scroll PF key is used. If the cursor is not in the body of the data, or if it is already positioned at the top, bottom, left margin, or right margin, a full page scroll will occur.

A scroll amount can also be entered in the command input field and used in conjunction with a Scroll PF key. For example:

```
ENTER COMMAND ===> 3                          SCROLL ===> HALF
```

If a Scroll PF key is pressed, three lines (columns) of scrolling will take place but the scroll amount field will not be changed. If this technique is used and some key other than a Scroll PF key is pressed, the number in the command input field will be interpreted as a command and will probably result in an error message.

For scrolling purposes, a "page" is defined as the amount of information currently being viewed. On a 24-line display terminal, this is normally 22 lines by 80 columns for browse, or 22 lines by 72 columns for edit. (In split screen mode, the number of lines will be less than 22.) Thus, in full screen browse, a scroll amount of HALF will move the window up or down by 11 lines, or right or left by 40 columns.

For member lists and browsing, the scroll amount is initialized to PAGE. For editing, the scroll amount is initialized to HALF. When the user overtypes the amount, the new value remains in effect until it is again changed by the user, or until a new member list or new data is displayed. The value MAX is an exception; following a MAX scroll, the scroll amount reverts to its previous value.

SPLIT SCREEN

During edit and browse, the entire display screen is normally used for displaying one partitioned data set member or sequential data set. Sometimes it is helpful to view and/or edit two different (though probably related) members or data sets, or to be able to perform a utility function without leaving another SPF option. Split screen mode permits this dual use of the IBM 3270 terminal by splitting the screen into two "logical" SPF screens. The top and bottom screens are used independently to perform any of the functions provided by SPF.

The two logical screens are treated by SPF as though they were independent terminals. Functions that can be performed simultaneously on two separate terminals, such as browsing through the same data set, can be done on the top and bottom screens. Functions that are in conflict on two separate terminals, namely editing the same member of a partitioned data set or the same sequential data set, will also be in conflict when simultaneously attempted on the top and bottom screens.

Split screen mode is entered by pressing the Split PF key, but first the user moves the cursor to the desired location for the split. The line containing the cursor will become the split line and will be identified by a row of periods. When the Split PF key is pressed, all lines below the cursor are treated as the bottom screen. The first display to appear on the bottom screen is the primary option menu. See Figure 6.

```
BROWSE - SPFDEMO.B.PLI(COINS) - 01.04 ---------------- LINE 00000 COLS 001 080
COMMAND INPUT ===>                                        SCROLL ===> PAGE
******************************** TOP OF DATA ***************************-CAPS-**
COINS:                                                                  00010001
  PROCEDURE OPTIONS (MAIN);                                             00020000
    DECLARE                                                             00030000
      COUNT    FIXED BINARY (31) AUTOMATIC INIT (1),                    00040000
      HALVES   FIXED BINARY (31),                                       00050000
      QUARTERS FIXED BINARY (31),                                       00060003
. . . . . .
---------------------- SPF PRIMARY OPTION MENU ----------------------------
SELECT OPTION ===>

                                                        USERID   - JOSLIN
   0  SPF PARMS  - SPECIFY TERMINAL AND SPF PARAMETERS   TIME     - 12:47
   1  BROWSE     - DISPLAY SOURCE DATA OR OUTPUT LISTINGS TERMINAL - 3277
   2  EDIT       - CREATE OR CHANGE SOURCE DATA          PF KEYS  - 12
   3  UTILITY    - PERFORM SPF UTILITY FUNCTIONS
   4  FOREGROUND - COMPILE, ASSEMBLE, LINK EDIT, OR DEBUG
   5  BACKGROUND - COMPILE, ASSEMBLE, OR LINK EDIT
   6  TSO        - ENTER TSO COMMAND OR CLIST
   7  TUTORIAL   - DISPLAY INFORMATION ABOUT SPF
   X  EXIT       - TERMINATE SPF USING LIST/LOG DEFAULTS

PRESS END KEY TO TERMINATE SPF
```

Figure 6. Split screen example

The split location may be repositioned at any time by moving the cursor to the desired line and pressing the Split PF key again. Repositioning may be required to bring an entire menu or tutorial page into view, since menus and tutorial pages are non-scrollable.

When SPF is being operated in split screen mode, one or the other of the logical screens is considered active at any point in time. Any interrupts, such as the operation of program function keys, are interpreted as having meaning for the active screen. The location of the cursor is used to identify which of the two screens is active. To switch from the top screen to the bottom screen, for example, move the cursor to the bottom screen. The Swap PF key may be used to move the cursor from one screen to another.

Note: Since only one logical screen is active at a time, the user cannot split the screen while executing a foreground compilation or TSO command.

In addition to moving the cursor to the other logical screen, the Swap PF key will automatically reposition the split if either logical screen is less than five lines long. For example, if the split occurs at the third line down from the top and the cursor is on the bottom screen, pressing the Swap PF key will move the cursor to the top screen and reposition the split to the third line up from the bottom.

Split screen mode is terminated by ending SPF processing on either logical screen (i.e., by pressing the End PF key when the primary option menu is displayed). The remaining logical screen is then expanded to its full size. Split screen may also be terminated by entering an "=X" (exit option) in the command input area and pressing the Return PF key.

HELP TEXT

The "help" function allows the user to obtain additional information about any error message that has been displayed in the upper right-hand corner of the screen, or general information about an SPF command or option. If an error message is displayed, pressing the Help PF key causes a one-line explanation to be displayed. If this explanation is not sufficient, pressing the PF key again will display the appropriate section of the SPF tutorial for further information. If an error message was not displayed, the Help PF key causes the tutorial mode to be entered and displays the appropriate section of the tutorial.

LIBRARY ACTIVITY STATISTICS

Under user option, the SPF editor will automatically generate and maintain the following activity statistics for each member of a partitioned data set.

Version Number:	Initialized to 1 when the member is created.
Modification Level:	Number of times this version has been modified.
Creation Date:	When this version was created.
Date/Time Modified:	When this version was last modified.
Current No. Lines:	Current size (number of records).
Initial No. Lines:	Initial size of this version.
No. Modified Lines:	Number of lines added or changed since this version was created. (Zero for unnumbered data.)
User ID:	Who created or last updated this version.

This information is maintained in the "user" portion of the directory entries for each member of a partitioned data set.

For display and printing purposes, the following formats are used.

- For version number and modification level: VV.MM (e.g., "LEVEL 02.15" means version 2, modification 15).
- For creation date and date last modified: YY/MM/DD (e.g., "75/07/28" means July 28, 1975).
- For time last modified: HH:MM (e.g., "17:20" means 5:20 PM).

During browse and edit, the current version and modification level is displayed in the title area (line 1) following the data set and member name. The version number and/or user ID may be changed via the "reset SPF statistics" utility.

LIST AND LOG DATA SETS

SPF helps the user maintain hardcopy listings of source modules and compiler output. Under user option, a listing of any source module that is created or modified by the SPF editor may be automatically recorded in a listing data set. Source listings and other types of printed output may also be obtained from the SPF utilities. A screen "snapshot" may be obtained by pressing the Print PF key.

SPF also maintains a log of significant user activities, including a record of data sets (and members) which were modified via edit or utility options, background jobs which were submitted, etc.

TASK STRUCTURE

The SPF task structure is shown in Figure 7. The SPF main controller is attached by TSO whenever a user enters the SPF command. The main controller performs initialization/termination functions and handles display I/O (via TSO/TCAM or TSO/VTAM) on behalf of the other SPF programs. It attaches the processor main driver, which displays the primary option menu and links to the appropriate processing program, depending on the option selected. If the user enters the split screen mode, the main controller again attaches the processor main driver to handle operations on the second logical screen.

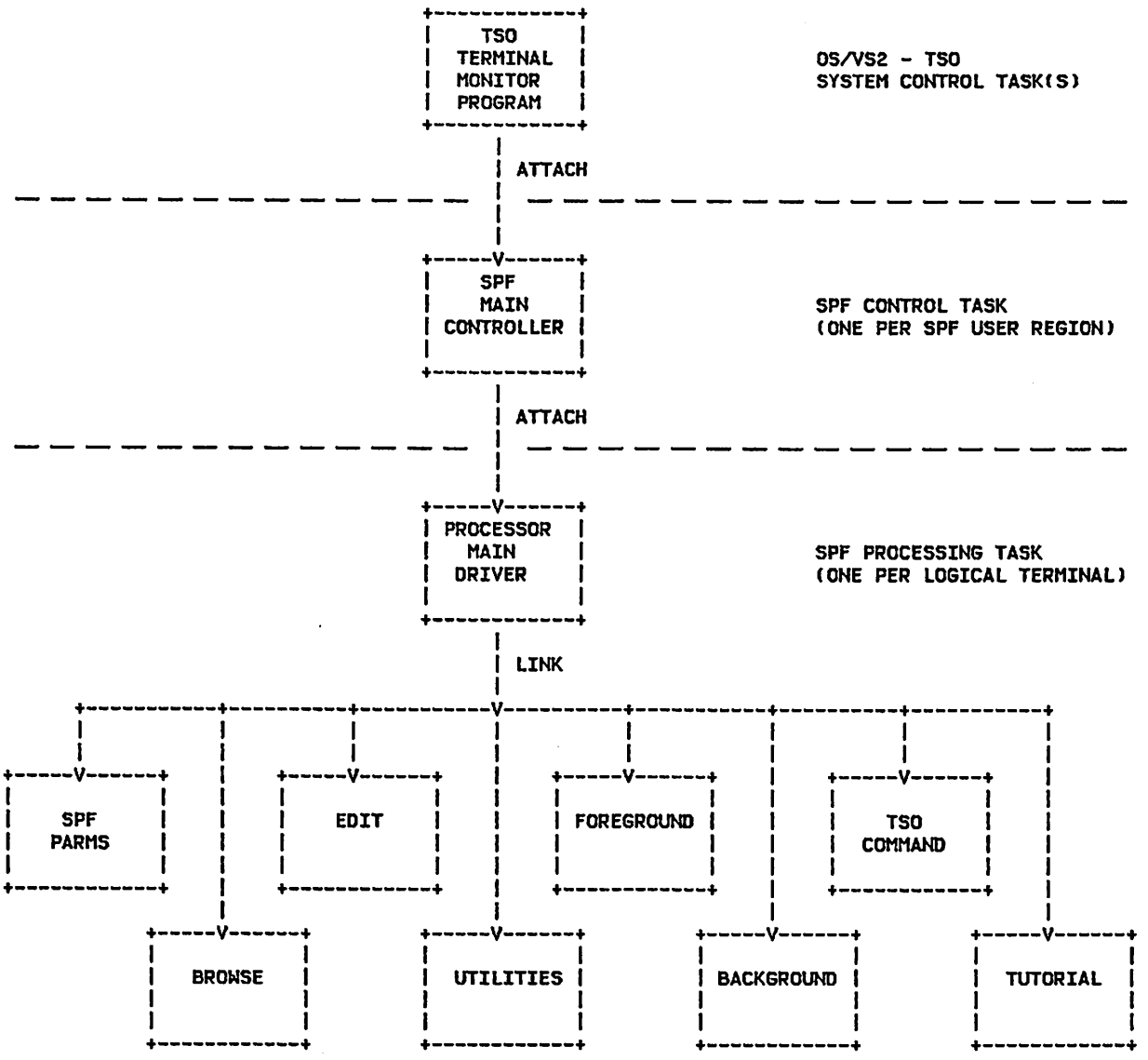


Figure 7. SPF task structure

The customer must have installed a properly configured IBM System/370, appropriate terminals and other required devices, and OS/VS2 with the Time Sharing Option (TSO). Also, the appropriate processing programs and TSO prompters must be installed to use the SPF foreground and background processing functions.

To install SPF under TSO, the customer will need operations personnel who are knowledgable in OS/VS JCL, TSO, and the System Modification Program (SMP). Installation procedures are described in the SPF Program Reference Manual.

If SPF is to be used with TSO/TCAM, the customer must reassemble the standard TSO/TCAM messgage handler to incorporate minor modifications. These modifications are designed to eliminate interference between the full screen I/O operations used by SPF and the line-oriented I/O operations used by TSO. No other changes are required to TSO or TCAM.

The SPF user must be familiar with OS/VS2 and TSO, and should review the SPF Program Reference Manual. Special SPF training or courses are not required for programming personel familiar with the IBM 3270, the programming and machine systems, and the language processors in use.

SYSTEM REQUIREMENTS

PROGRAMMING SYSTEMS

SPF operates as a TSO command processor under the Time Sharing Option of VS2, Release 1.7 (SVS) or Release 3.7 (MVS). SPF is written in PL/S and translated into OS/VS Assembler Language. The BPAM and BSAM access methods are employed by SPF for reading and writing data sets, and the facilities of TSO/TCAM or TSO/VTAM are used for reading and writing the display.

SPF provides menu interfaces to the following IBM processing programs for foreground and background execution:

System Assembler (supplied with OS/VS2)	
OS/VS COBOL Compiler	5740-CB1
FORTRAN IV G1 Compiler	5734-F02
PL/I Checkout Compiler	5734-PL2
PL/I Optimizing Compiler	5734-PL1
Linkage Editor (supplied with OS/VS2)	
COBOL Interactive Debug (foreground only)	5734-CB4
FORTRAN Interactive Debug (foreground only)	5734-F05
TSO Assembler Prompter (foreground only)	5734-CP2
TSO COBOL Prompter (foreground only)	5734-CP1
TSO FORTRAN Prompter (foreground only)	5734-CP3

The appropriate processing programs and corresponding TSO prompters must be installed to use the SPF foreground and background processing options.

Note: For foreground use of the Assembler and the COBOL or FORTRAN compiler, both the TSO prompter and associated compiler or assembler must be installed.

SPF provides internal interfaces to the following IBM programs:

OS/VS2 MVS 3270 Extended Display Support - Session Manager	5740-XE2
TSO Command Processor "DSPRINT" (TSO/TCAM only)	5798-AYF
TSO/VTAM Data Set Print (DSPRINT)	5798-CPF
TSO/VS2 Programming Control Facility (PCF)	5798-BBJ
TSO Programming Control Facility - II (PCF-II)	5798-CLW

These programs are not required to operate SPF. However, a DSPRINT command processor must be installed if SPF hardcopy output is to be directed to an IBM 3284, 3286, 3287, 3288, or 3289 printer.

All the program-numbered products listed above can be ordered separately under IBM licensing agreements.

MACHINE CONFIGURATION

The computer system requirements are the same as needed for OS/VS2 with the Time Sharing Option (TSO).

The storage requirements for the user regions will vary depending upon the size of the data sets being edited and the extent that "split screen" will be used. The SPF programs are reenterable and should be placed in the system link pack area. This will reduce the size requirement for the user regions and should also improve performance.

The following minimum region sizes are suggested for SVS. These sizes may have to be expanded if large code segments are to be edited.

256K - If SPF resides in the link-pack area
512K - If SPF does not reside in the link-pack area

TERMINALS

SPF supports the following IBM 3270 Display Stations:

3275 Models 2 and 12
3276 Models 2, 3, 4, 12, 13, and 14
3277 Model 2 (local or remote attachment)
3278 Models 2, 3, and 4 (local or remote attachment)

The following keyboards are supported:

For 3275 or 3277 Display Stations:

78 Key Operator Console (feature 4632)
78 Key EBCDIC Typewriter (feature 4633)
78 Key ASCII Typewriter (feature 4635)
78 Key EBCDIC Typewriter/APL (feature 4638), when operated with APL switch off.

For 3276 or 3278 Display Stations:

75 Key EBCDIC Typewriter (feature 4621)
75 Key ASCII Typewriter (feature 4624)
87 Key EBCDIC Typewriter (feature 4627)
87 Key ASCII Typewriter (feature 4628)

The standard character set (94 graphics plus blank and null) is supported on 3276 and 3278 Display Stations.

The following are supported, but not required:

Audible alarm (Feature #1090)
IBM 3284, 3286, 3287, 3288, and 3289 printers
Print dual-case character set (RPQ #8K0366)

Installation of the audible alarm feature is strongly recommended to enhance usability. The alarm is sounded by SPF whenever a warning or error message is displayed.

The IBM 3284, 3286, 3287, 3288, and 3289 printers, if used, are supported via the "DSPRINT" TSO command processor, which must be installed if SPF output is to be directed to one of these printers.

INVOCATION AND TERMINATION

SPF is invoked by entering the command "SPF". No parameters are required. When SPF receives control it clears the screen, performs initialization functions, and displays the primary option menu (Figure 8). The user selects an option by typing a one-character code in the option field and pressing the ENTER key, e.g.,

```
SELECT OPTION ===> 2
```

to select the edit option.

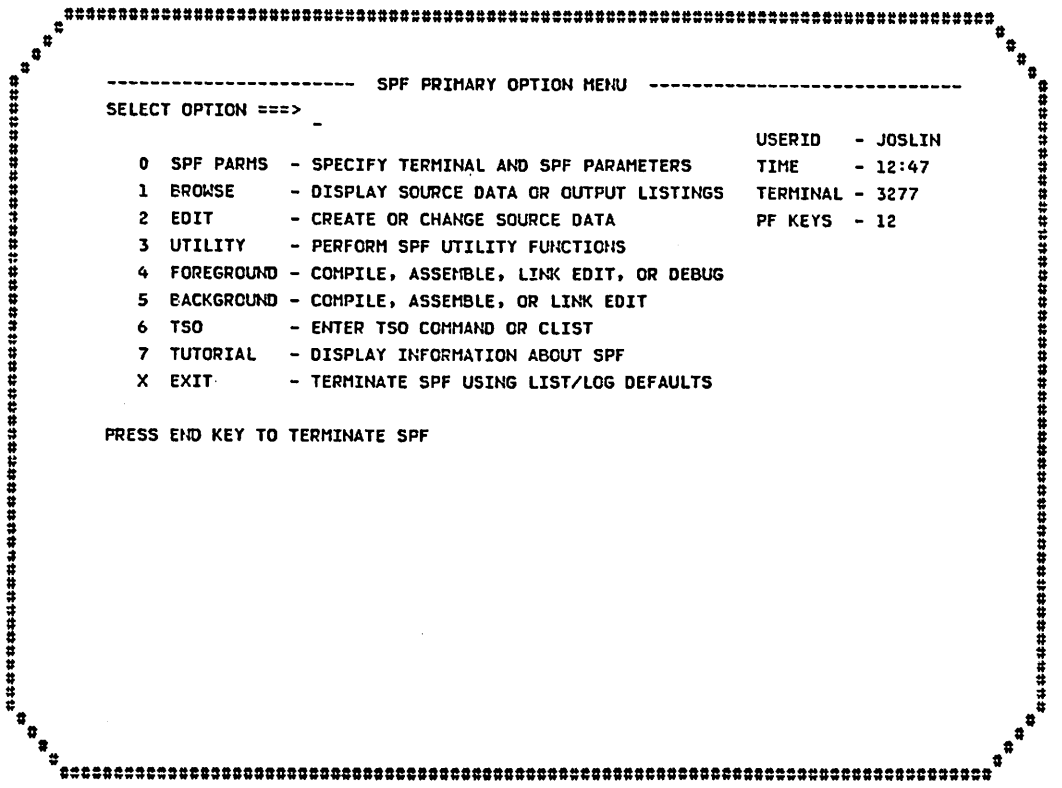


Figure 8. Primary option menu

The SPF primary options are:

- SPF PARMS - To specify SPF parameters and defaults, including: terminal type, mono/dual case, number of program function (PF) keys, allocation parameters and default dispositions for list and log data sets, and PF key definitions.

- BROWSE - To display source data or output listings contained in partitioned or sequential data sets. Browse is intended primarily for viewing large data sets such as compiler listings or dumps.

- EDIT - To create or change source data contained in partitioned or sequential data sets. Unlike browse, edit reads the selected member or entire sequential data set into virtual storage and retains it there during edit operations.

- UTILITIES - To print, rename, or delete library members or entire data sets; allocate or compress data sets; move or copy information between data sets; display or print catalog listings or volume table of contents (VTOC's); reset SPF library statistics; initiate hardcopy output; or browse, print, delete, or requeue held SYSOUT data.

- FOREGROUND - To execute IBM prompters and language processing programs in the foreground, including: Assembler, COBOL, FORTRAN, PL/I (checkout or optimizer), linkage editor, and COBOL or FORTRAN interactive debug.

- BACKGROUND - To generate and submit JCL for background execution of IBM language processing programs, including: Assembler, COBOL, FORTRAN, PL/I (checkout or optimizer), and linkage editor.

- TSO - To enter a TSO command or command procedure (CLIST) during execution of SPF.

- TUTORIAL - To obtain immediate online instruction in the use of SPF. The tutorial may be viewed sequentially from beginning to end, or randomly by selecting topics from the table of contents or alphabetized index. The tutorial may also be entered from other SPF options by means of the Help PF key.

Each of these options is explained in detail in the remainder of this manual.

To terminate SPF, the user must be out of split screen mode and must return to the primary option menu (via the End or Return PF key). Two termination options are available:

1. Option "X" may be entered on the primary option menu. This causes SPF to terminate with user defaults for processing list and log data sets, as specified via SPF parms (option 0).

   Note: Option "X" may be used in conjunction with the Return PF key to immediately terminate split screen mode, or (in single screen mode) to immediately terminate SPF, as follows: In any menu input field or primary command line, enter an equal sign (=) followed by an X. Then press the Return PF key.

2. The End PF key may be pressed to display the SPF termination menu (Figure 9) for specification of list and log processing. (If neither data set has been allocated, pressing the End PF key results in immediate termination.)

The termination menu allows the user to specify whether the list and log data sets are to be printed via a background job or routed to a local printer, or whether the data sets are to be deleted or kept without printing. For printing via a background job, a SYSOUT class and job statement must also be specified. For local printing, a printer id must also be specified and the appropriate DSPRINT program must be installed.

Once the list/log options have been entered, the ENTER key is pressed to complete SPF termination. Alternatively, the End PF key may be pressed to redisplay the primary option menu and continue SPF processing. (Use of the End PF key, in this instance, provides an escape mechanism in the event that the termination procedure was entered by mistake.)

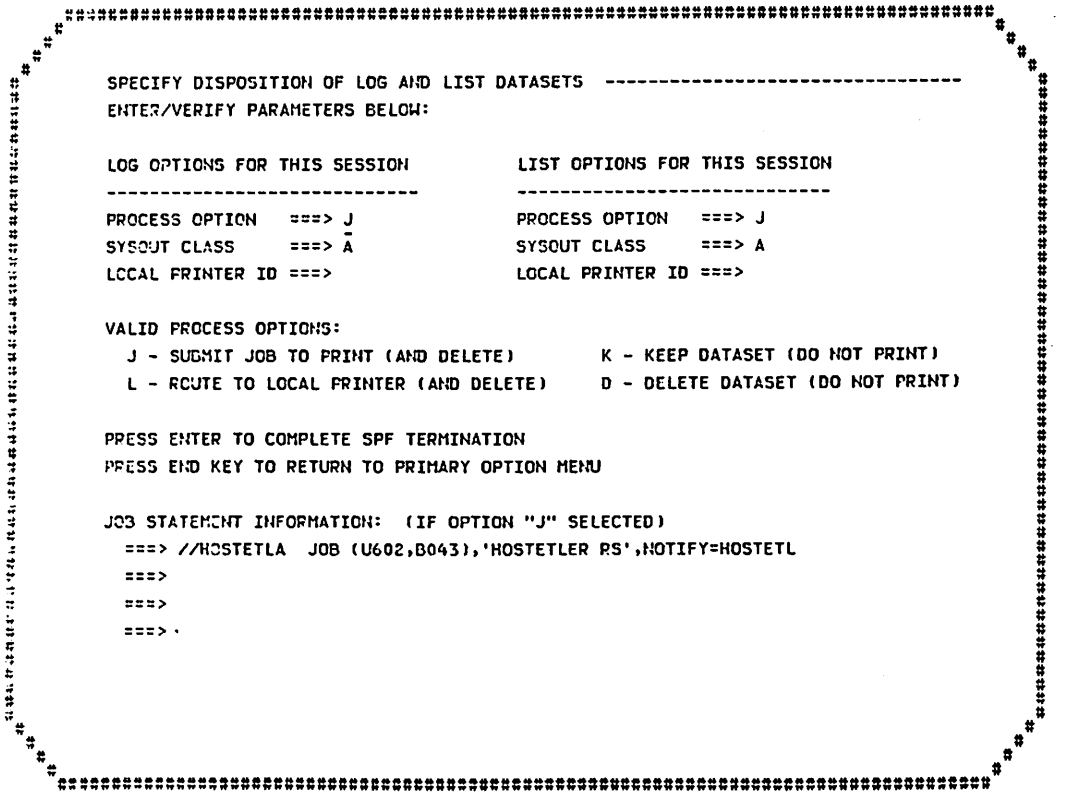


Figure 9. SPF termination menu

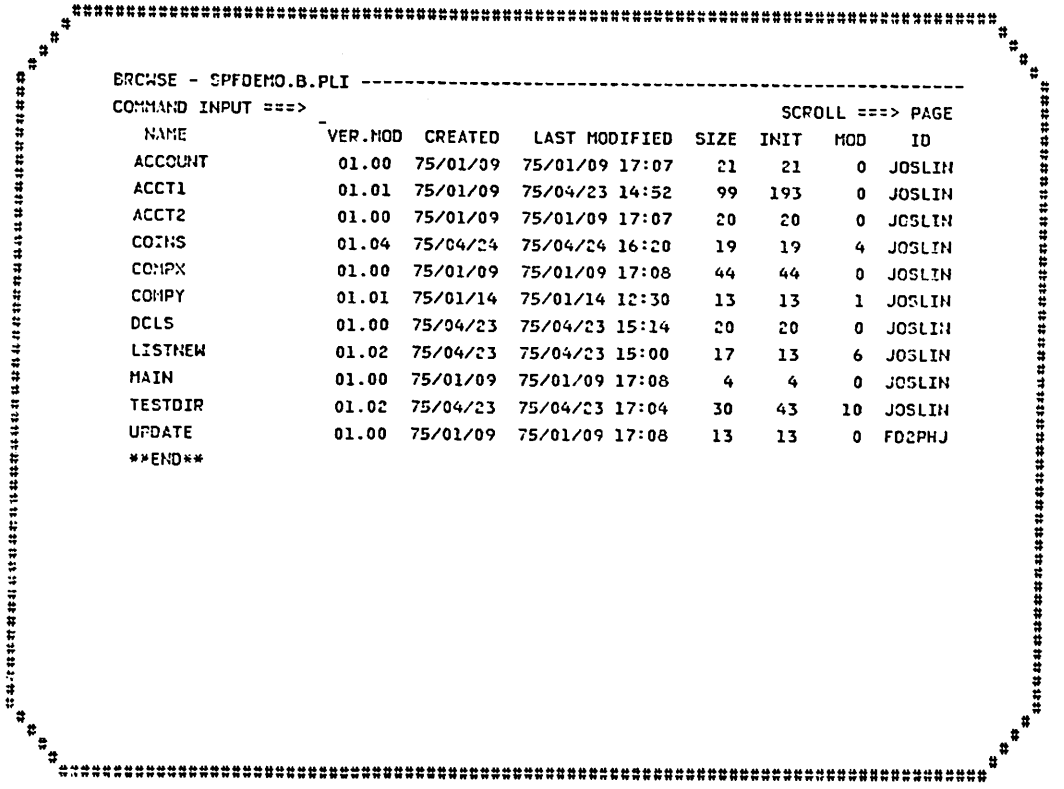
Upon termination of SPF, the screen is cleared, one or more messages is displayed indicating list/log disposition, followed by a READY message, and the user is returned to normal TSO processing.

MEMBER LIST COMMANDS

For any of the following SPF options, a member selection list will be displayed if a partitioned data set is specified but no member name is supplied:

- Browse
- Edit
- Library Utility
- Move/Copy Utility
- Reset SPF Statistics Utility

An example of a member list display is shown in Figure 10.



```
BROWSE - SPFDEMO.B.PLI ------------------------------------------------------
COMMAND INPUT ===> _                                        SCROLL ===> PAGE
   NAME          VER.MOD  CREATED    LAST MODIFIED      SIZE  INIT  MOD   ID
  ACCOUNT         01.00  75/01/09  75/01/09 17:07        21    21     0  JOSLIN
  ACCT1           01.01  75/01/09  75/04/23 14:52        99   193     0  JOSLIN
  ACCT2           01.00  75/01/09  75/01/09 17:07        20    20     0  JOSLIN
  COINS           01.04  75/04/24  75/04/24 16:20        19    19     4  JOSLIN
  COMPX           01.00  75/01/09  75/01/09 17:08        44    44     0  JOSLIN
  COMPY           01.01  75/01/14  75/01/14 12:30        13    13     1  JOSLIN
  DCLS            01.00  75/04/23  75/04/23 15:14        20    20     0  JOSLIN
  LISTNEW         01.02  75/04/23  75/04/23 15:00        17    13     6  JOSLIN
  MAIN            01.00  75/01/09  75/01/09 17:08         4     4     0  JOSLIN
  TESTDIR         01.02  75/04/23  75/04/23 17:04        30    43    10  JOSLIN
  UPDATE          01.00  75/01/09  75/01/09 17:08        13    13     0  FD2PHJ
  **END**
```

Figure 10. Member list display

The member list may be scrolled up and down by means of the Scroll PF keys. In addition, a LOCATE command may be entered in the command input field on line 2 of any member list display, to cause a direct scroll to the specified member name.

For browse and edit, one member at a time may be selected from the list, either by entering the single character "S" in front of the desired member name, or by entering a SELECT command in the command input field on line 2.

For the utility options, multiple members may be selected from the list, by entering a one-character code in front of one or more member name(s)

before pressing the ENTER key. For the move/copy and reset utilities, the selection code is "S". For the library utility, the allowable codes are "P" (for print), "R" (for rename), "D" (for delete), and "B" (for browse).

SPF PARMS (OPTION 0)

The SPF parms option allows the user to display and change a variety of of of SPF parameters at any time during the SPF session. Changes remain in effect until the user changes the parameter again. Furthermore, these parameters are automatically retained in the SPFPARMS data set, so that current values remain in effect across SPF sessions.

When the SPF parms option is selected (primary option 0) a secondary selection menu is displayed (Figure 11). This menu may be bypassed by entering two numbers, separated by a decimal point, on the primary option menu. For example, entering "0.2" on the primary menu has the same effect as entering "0" on the primary menu and "2" on the secondary menu.

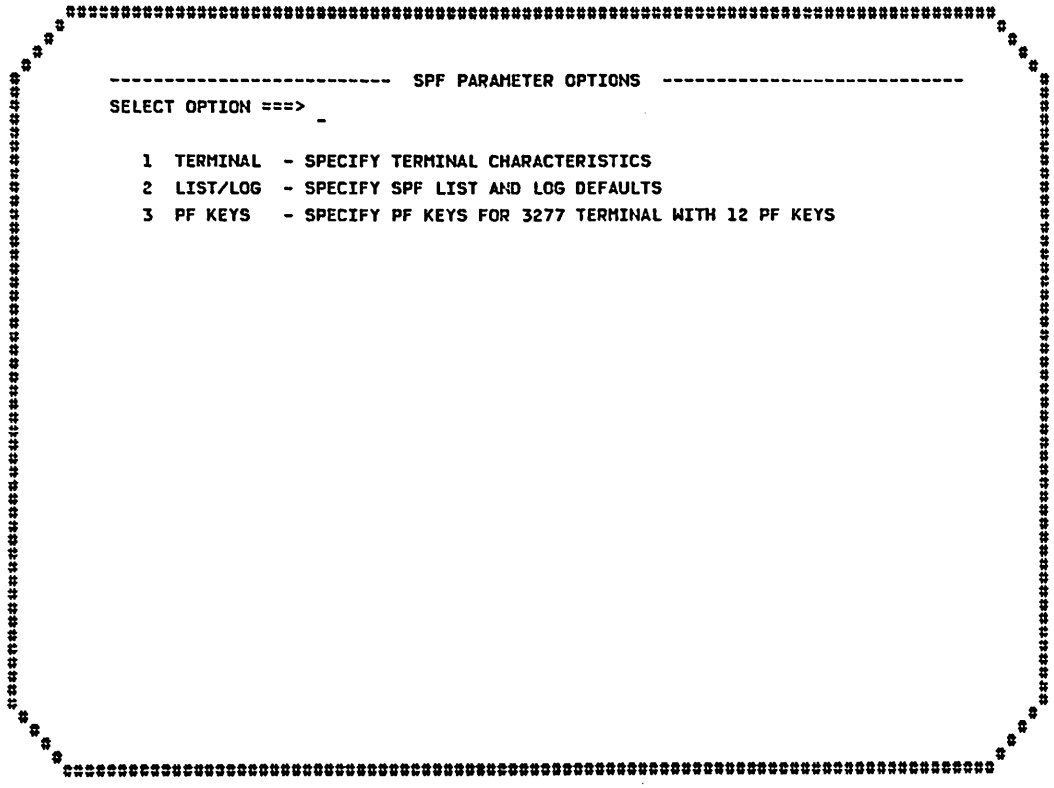


Figure 11. SPF parameter menu

The following describes each of the SPF parms functions, corresponding to the three options on the secondary menu.

Specify Terminal Characteristics (Option 0.1)

When this option is selected (SPF parms option 1), a menu is displayed which allows the user to specify:

- Type of terminal (3275/3277 or 3276/3278)
- Number of program function keys on the terminal (12 or 24)
- Mode (mono or dual case) of the terminal.

Specify SPF List and Log Defaults (Option 0.2)

When this option is selected (SPF parms option 2), a menu is displayed which allows the user to specify default processing for list and log data sets (to be used when SPF is terminated via primary option "X"), as well as lines per page, and allocation parameters.

Specify SPF Program Function Keys (Option 0.3)

When this option is selected (SPF parms option 3), a menu is displayed which allows the user to specify the mapping of the PF keys into specific functions. Before selecting this option, the user should ensure that the correct terminal type (3277 or 3278) and number of PF keys (12 or 24) has been specified via option 0.1.

The allowable SPF-defined key functions are listed in the section entitled "Program Access and Function Keys". More than one key can be defined to the same function.

The user may equate a PF key to an edit or browse primary command, or to an edit line command, in the following manner:

>string Causes the specified PF key, when used in edit or browse, to simulate the entering of a primary command. Example:

```
PF10 ===> >FIND ABC
```

Pressing PF10 when browsing or editing data will have the same effect as entering a FIND ABC primary command.

:string Causes the specified PF key, when used in edit, to simulate the entering of a line command. Example:

```
PF11 ===> :TF
```

Pressing PF11 when editing data will have the same effect as entering the "TF" (text flow) line command on whichever line the cursor is positioned when the key is pressed.

BROWSE (OPTION 1)

The browse option allows the user to display source programs and output listings stored in DASD-resident sequential or partitioned data sets with the following charactersitics:

Record Format (RECFM):

- Fixed, variable (non-spanned), or undefined
- Blocked or unblocked
- With or without printer control characters

Logical Record Length (LRECL): Up to 32,767

When browse is selected (primary option 1), a menu is displayed to allow the user to specify a data set name, volume serial (if the data set is not cataloged) and data set password (if the data set is protected). See Figure 12. For partitioned data sets, the user can supply the name of the member to browsed, or he can leave tha member name blank to request a member list from which a member may be selected.

When the user has properly specified a data set (and member), the first page of data is displayed. Two lines are reserved at the top of the screen for title information, short messages, command entry, and the scroll amount. The remainder of the screen contains the data (Figure 13).

During browse, four-way scrolling is available via the Scroll PF keys. The FIND and LOCATE commands may also be used to scroll to a particular character string, line number, or symbolic label.

Browse provides several commands which may be entered in the command input field on line 2 to: locate a specific line, display a column identification line, find a specified character string, or enter hex display mode.

See Appendix B for a summary of browse commands.

Browse may be terminated by pressing the End PF key, which causes a return to the previous menu (either the member selection list or the data set menu). When return is to the member selection list, the member just browsed will appear at the top of the list. Another member may be selected from the list or the End key may be pressed again to return to the data set menu.

When the data set menu is displayed, another data set or member may be selected, or the End key may be pressed to return to the primary option menu.

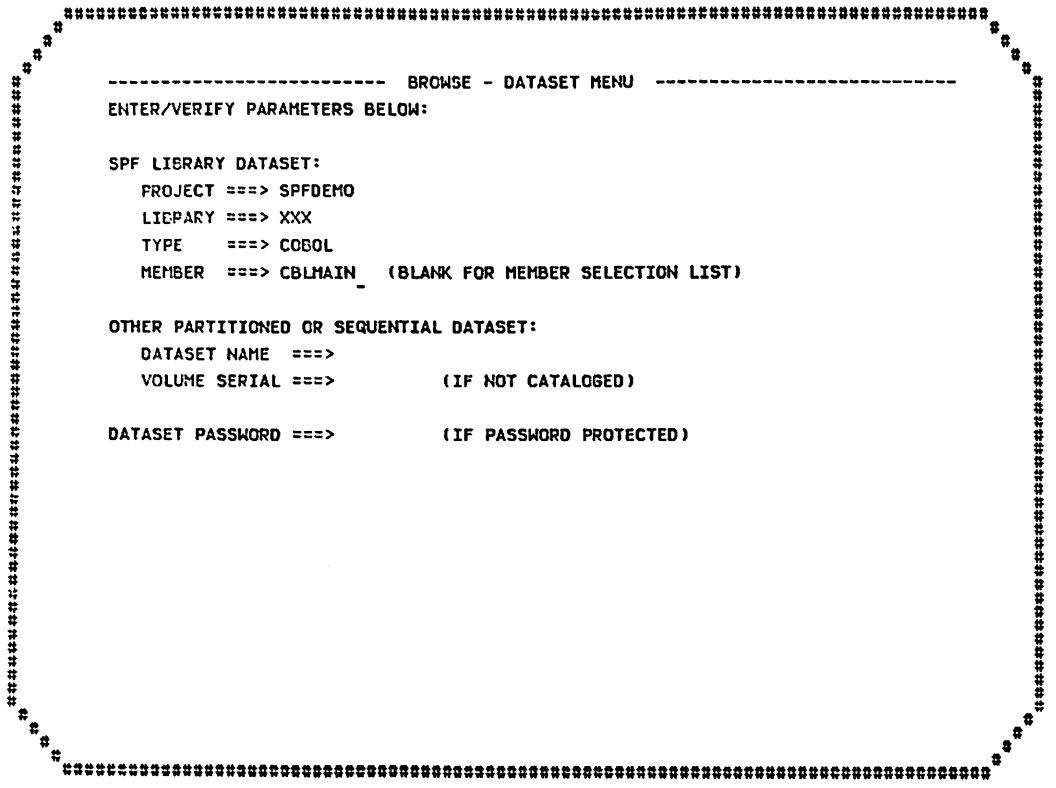


Figure 12. Browse - data set menu

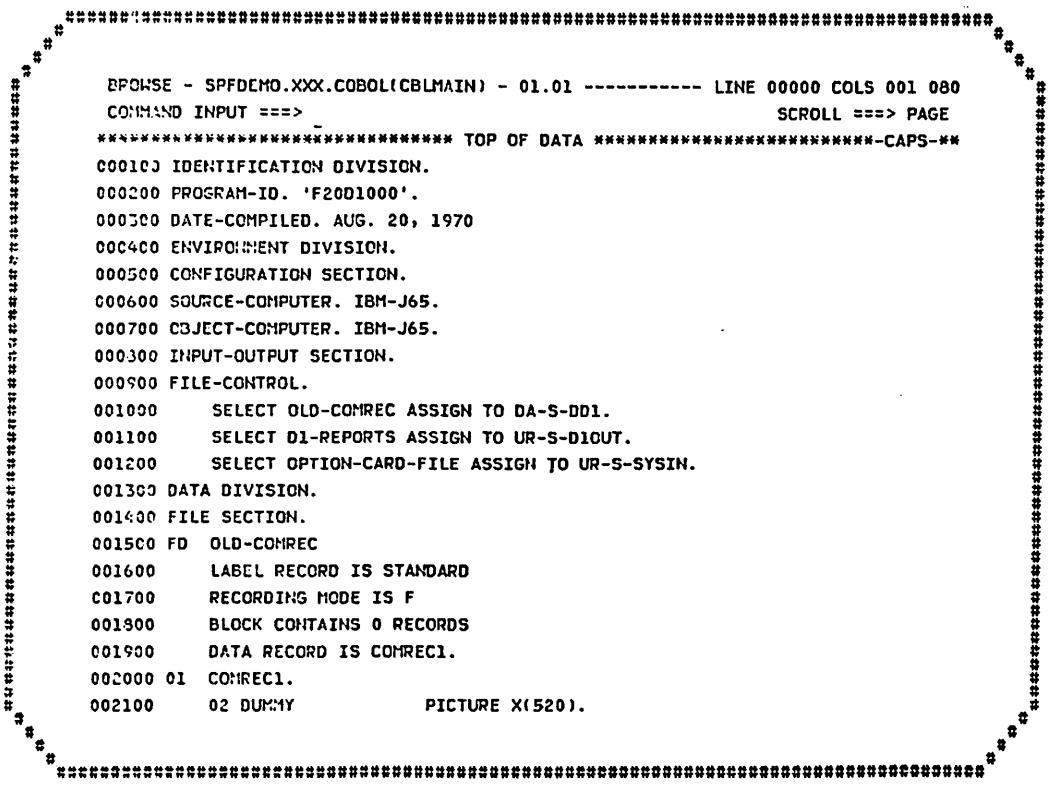


Figure 13. Browse - data display

EDIT (OPTION 2)

The edit option allows the user to create, display, and modify source data (program code, test data, text, etc.) stored in DASD-resident sequential or partitioned data sets with the following characteristics:

Record Format (RECFM):

- Fixed or variable (non-spanned)
- Blocked or unblocked
- With or without printer control characters

Logical Record Length (LRECL):

- From 10 to 255, inclusive, for fixed length records
- From 14 to 259, inclusive, for variable length records

When edit is selected (primary option 2), a menu is displayed to allow the user to specify a data set name, volume serial (if the data set is not cataloged) and data set password (if the data set is protected). See Figure 14.

The menu also allows specification of a profile name, which may be entered to override the default edit profile. See description under "Edit Modes and Profiles."

For edit, a concatenated sequence of partitioned data sets may be specified. The concatenated sequence applies to the fetching of members to be edited. The libraries are searched in the designated order to find the member and bring it into working storage. When the edited member is saved, it is placed in the first library in the concatenation sequence regardless of which library it came from.

Space for the selected data set must have been previously allocated, but it may be empty. Selection of an empty sequential data set or a nonexistent member of a partitioned data set allows creation of new source data.

The selected member or sequential data set is read into virtual storage, wherein it is updated during edit operations. Use of virtual storage for edit work space results in high performance, but requires sufficient region (memory) size for the data being edited. If insufficient storage is available, an ABEND 80A will occur, indicating that a larger region (memory) size is required.

The edit data display is similar to a browse display except that each line consists of a six-column line-number field followed by a 72-column data field (see Figure 15). The line-number field reflects the contents of the sequence numbers in the data, if the data is numbered. For unnumbered data, the line numbers start at 1 and are incremented by 1.

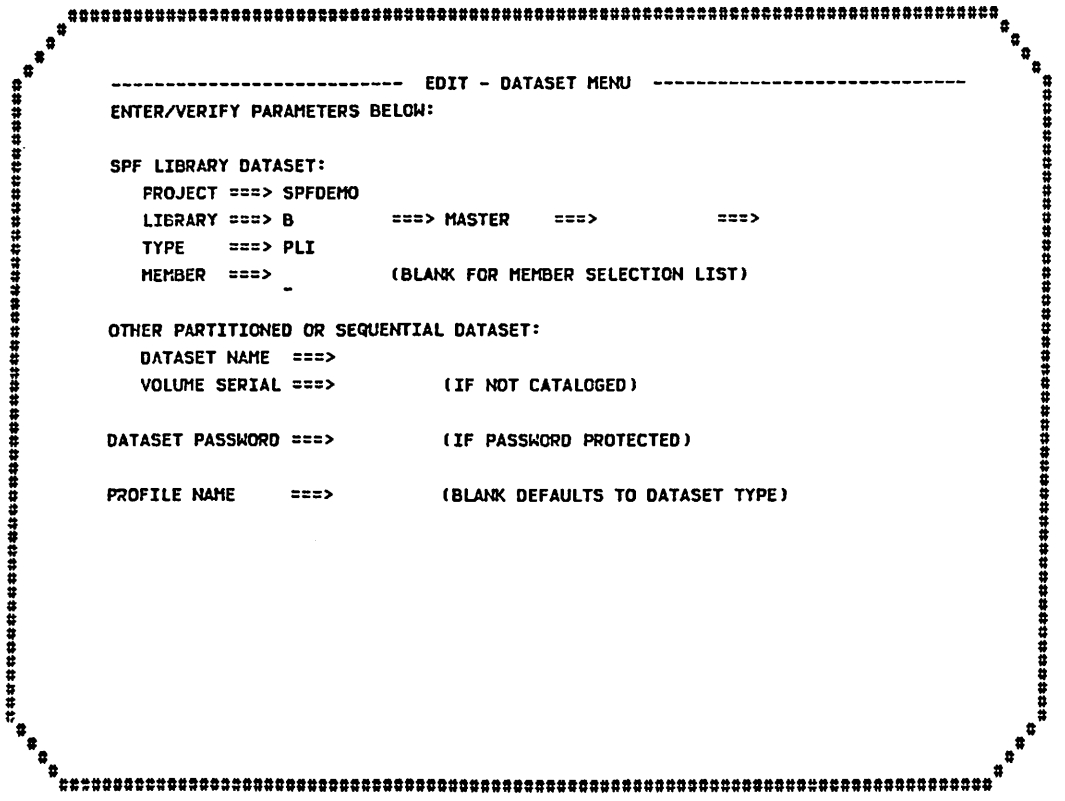


Figure 14. Edit - data set menu

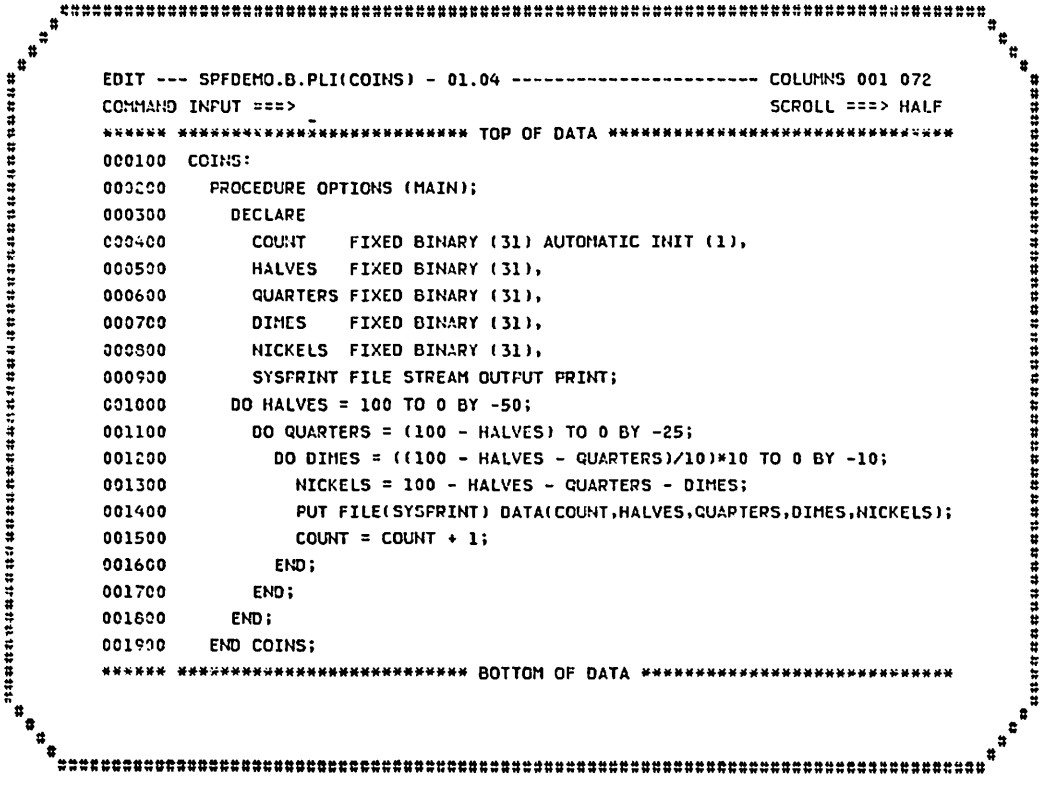


Figure 15. Edit - data display

Basic Edit Operations

Under edit, four-way scrolling is available via the Scroll PF keys. The FIND and LOCATE commands may also be used to scroll to a particular character string or line number.

To modify one or more lines of data, the user simply moves the cursor to the desired location and enters the new information by overtyping the existing lines. Several lines may be modified before pressing the ENTER key.

Lines may be deleted, inserted, shifted left or right (for indentation changes), duplicated, or rearranged by overtyping the line-number fields with "line commands" consisting of one or more characters. Single character line commands operate on individual lines (e.g., D to delete a line, I to insert a blank line, M to move a line). Double character line commands operate on blocks of lines (e.g., DD on two different lines to indicate the first and last lines to be deleted). In most cases, a number may follow the line command to indicate multiple occurrences (e.g., I3 to insert three blank lines). Several line commands as well as data modifications may be typed before pressing the ENTER key.

For general edit operations, "primary commands" may be entered at the top of the screen to: control edit modes, locate a specific line, submit data to the job stream, find and change designated character strings, control sequence numbering and character translation, effect segmentation changes (splitting a member into two members or merging two members into one), save the edited data, or cancel without saving.

See Appendix B for a summary of edit commands.

Edit Modes and Profiles

Edit is capable of operating in the following modes:

- NUMBER Mode - controls validation and generation of sequence numbers.
- AUTONUM Mode - controls automatic renumbering when the data is saved.
- STATS Mode - controls generation of SPF statistics for members of partitioned data sets.
- PRINT Mode - controls automatic recording of source listings in the SPF list data set.
- CAPS Mode - controls translation of alphabetic characters to upper case.
- NULLS Mode - controls replacement of trailing blanks with null characters on the display screen.
- TABS Mode - controls use of "hardware" or "logical" tabs feature.

- HEX Mode - controls display of data in hexadecimal representation.

- RECOVERY Mode - controls automatic recording of edit transactions to facilitate recovery following a system crash.

Each mode may be turned on or off independently of the other modes by means of the following primary commands: NUMBER, AUTONUM, STATS, PRINT, CAPS, NULLS, TABS, HEX, and RECOVERY.

The current settings of the modes, together with the current MASK, TABS, and BOUNDS lines, are maintained in an edit "profile" which may be displayed at any time via the PROFILE primary command. When edit is terminated, the current profile is automatically saved in the SPFPARMS data set.

SPF maintains up to 25 different edit profiles for each user. This allows different mode settings and different MASK, TABS, and BOUNDS lines to be remembered and used as the initial settings for different types of source data.

Each profile is normally associated with a data set "type" (the last qualifier in the data set name). When the user edits an ASM type data set, for example, the profile which was in effect the last time he finished editing an ASM data set is automatically re-instated. The user may create and invoke additional profiles by specifying a profile name on the edit data set menu, or as an operand on the PROFILE command.

Sequence Number Generation

When operating in NUMBER mode, edit automatically generates sequence numbers on new lines that are created by insert or copy operations, and automatically renumbers the data when it is saved (provided AUTONUM mode is also in effect).

Sequence numbers may be generated in the "standard" sequence field, the COBOL sequence field, or both. The standard sequence field is either the last eight characters (for fixed length records) or the first eight characters (for variable length records), regardless of the programming language. The COBOL sequence field is always the first six characters of the line, and is valid only for fixed length records.

For members of partitioned data sets, the format of "standard" sequence numbers is dependent on whether SPF statistics are being generated. If STATS mode is in effect, standard sequence numbers are six digits in length, followed by a two-digit "modification flag". The flag reflects the modification level of the member when the line was created or last changed. If, for example, a sequence number field contains 00040002, the line was added or last changed at modification level 02. The sequence number is 000400. When a new member is created with SPF statistics, the modification flags are all set to 00, since the modification level is initialized to zero.

Sequence numbers normally start at 100 and are incremented by 100. When inserting lines, edit will drop down to the tens or units position and, if

necessary, renumber one or more succeeding lines to keep the sequence numbers in order.

As data is fetched for editing, it is examined to determine whether or not it contains sequence numbers. If all lines contain numeric characters in either the standard or COBOL sequence field positions (or both), and if the numbers are in ascending order, edit assumes the data is numbered and turns on NUMBER mode. Otherwise, edit turns off NUMBER mode.

Special Features

Following is a brief discussion of some of the special features provided by the SPF editor.

- Column Identification Line - A special line may be displayed anywhere in the data area of the screen (via the COLS line command) to determine column positions. Format of the line is:

  ```
  ----+----1----+----2----+----3---etc.
  ```

  where "1" indicates column 10, "2" indicates column 20, etc.

- Insert Mask - Information may be pre-entered on inserted lines by defining a mask (via the MASK line command). The contents of the mask remain in effect until changed by the user. The mask is saved, along with other user parameters, in the SPFPARMS file. Initially, the mask contains all blanks.

- Excluded Lines - Designated lines of data may be temporarily excluded from display (via the X or XX line command) to facilitate visual verification of program control structure. Excluded lines may also be used to limit the scope of the FIND and CHANGE commands. Excluded lines may be redisplayed via the S (show), F (first), and L (last) line commands. The excluded lines are removed from display, but not deleted from the data.

- Tabs - Three types of tabs may be defined (via the TABS line command): "software" tabs which control cursor repositioning when the ENTER key is pressed, "hardware" tabs which cause attribute bytes to be inserted at user-defined positions on each line of the screen, or "logical" tabs which cause SPF to reposition data based on a user-defined special tab character. The tab definitions remain in effect until changed by the user.

- Bounds - The column boundaries, which delimit the extent of the shift line commands and the FIND and CHANGE primary commands, may be changed at any time (via the BOUNDS line command). Normally, these bounds encompass the "statement body" of each data record, excluding the sequence number field.

- Null Characters - Trailing blanks in each data field may be displayed as null characters (via the NULLS primary command) to facilitate use of the 3270 INSERT key. Normally, all blanks are displayed as blanks.

- Hexadecimal Display - Data may be displayed and updated using hexadecimal representation. The format may be "data" (two character positions per byte) or "vertical" (one character position, but two lines per byte). The user is allowed to change characters by overtyping the hex representation and/or issuing CHANGE commands with hex syntax.

- Document Preparation Support - Document preparation is aided by commands which facilitate: the bulk entry of text, the insertion of new material into existing text, and the "reflowing" of text.

- Edit Recovery - Under user option, the SPF editor will automatically maintain a history of change activity in an SPF-controlled temporary data set. If there is a system failure, the user can recover the edit session up to the point of failure. A menu is displayed when edit is reentered to indicate that automatic recovery is in effect.

Edit Termination

Normally, edit is terminated by pressing the End PF key, which causes the following actions:

1. If any changes have been made to the data:

   - The data is renumbered if both NUMBER mode and AUTONUM mode are on.

   - The data is automatically saved. Note: "Special" lines (MASK, TABS, COLS, BOUNDS, message lines, and profile display lines) are never saved as part of the data, and need not be deleted prior to SAVE or end.

   - The SPF statistics are updated (or generated if none previously existed) if the data set is partitioned and STATS mode is on. If the member was an alias, the alias indicator is turned off.

   - A source listing of the data is recorded in the SPF list data set for eventual printing if PRINT mode is on.

2. A return is then made to the previous menu (either the member selection list or the data set menu). When return is to the member selection list, the member just edited will appear at the top of the list.

Note: The Return PF key, which is logically equivalent to repeated use of the End PF key, will also cause action (1) to occur.

The user may save the data without terminating edit (and without printing) via the SAVE command. The user may also terminate editing without saving (or printing) via the CANCEL command.

UTILITIES (OPTION 3)

The utility option provides a variety of utility functions for: library, data set, and catalog maintenance; moving and copying data; resetting SPF library statistics; initiating hardcopy output; displaying or printing VTOC entries for a DASD volume; and browsing and printing held SYSOUT data.

When the utility option is selected (primary option 3), a secondary selection menu is displayed (Figure 16). It is possible to bypass the secondary menu by entering two numbers, separated with a decimal point, on the primary option menu. For example, entering "3.2" on the primary menu has the same effect as entering "3" on the primary menu and "2" on the secondary menu.

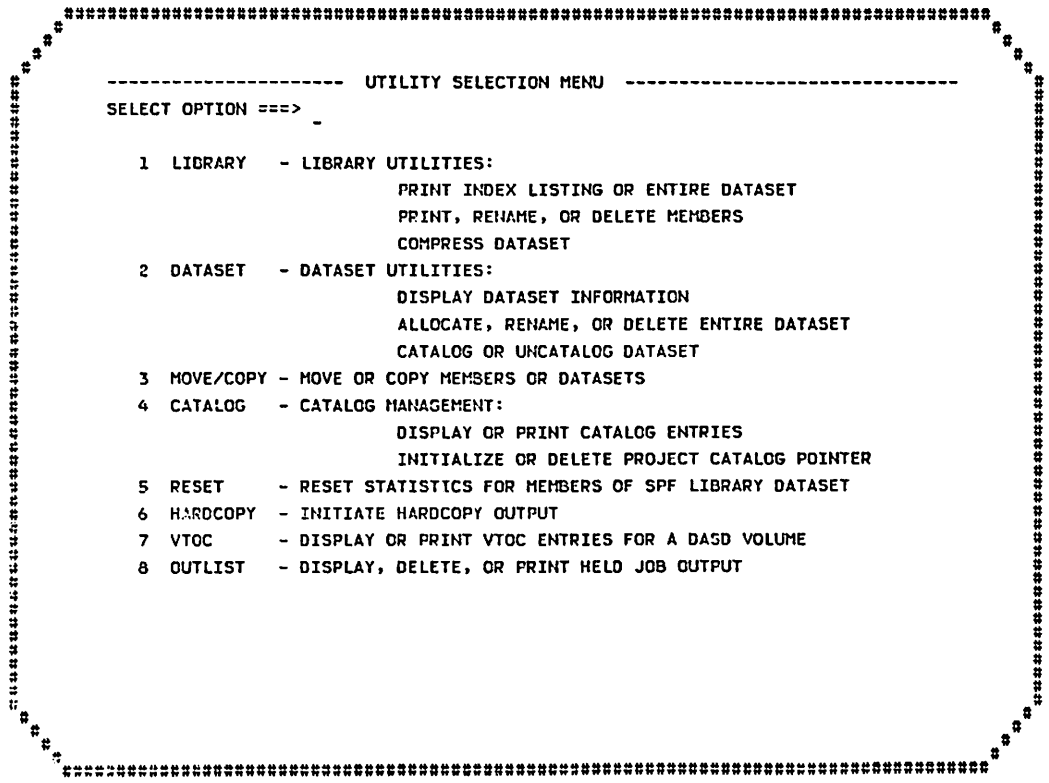


Figure 16. Utility selection menu

The following describes each of the utility functions, corresponding to each option on the secondary menu.

Library Utility (Option 3.1)

When this option is selected (utility option 1), a menu is displayed which allows the user to specify a data set and indicate an action to be performed. Possible actions are:

C - Compress data set	P - Print member
X - Print index listing	R - Rename member
L - Print entire data set	D - Delete member
blank - Display member listing	B - Browse member

The library utility is intended primarily for maintenance of partitioned data sets, but the "print index listing" function (option "X") and the "print entire data set" function (option "L") also apply to sequential data sets.

If option "C" (compress data set) is selected, any partitioned data set may be specified. The data set is compressed by invoking IEBCOPY.

Note: Foreground compress via IEBCOPY is supported only under SVS.

If option "X" (print index listing) is selected, any DASD-resident sequential or partitioned data set may be specified. The index listing is recorded in the SPF list data set. For a partitioned data set, the index listing includes general information about the data set followed by a member list. For a sequential data set, the index listing includes general information only.

If option "L" (print entire data set) is selected, any DASD-resident sequential or partitioned data set may be specified. An index listing and source listing of the entire data set (including all members of a partitioned data set) are recorded in the SPF list data set.

If option "P" (print member) is selected, a partitioned data set and member name must be specified. A source listing of the member is recorded in the SPF list data set.

If option "R" or option "D" (rename member or delete member) is selected, a partitioned data set and member name must be specified. A new member name must also be specified for the "rename member" function.

If option "B" (browse member) is selected, a partitioned data set and member name must be specified. The specified member will be displayed in the browse mode. All browse commands can be executed. When browse is terminated by pressing the End PF key, the menu from which the member was selected will be redisplayed.

If no option is specified (blank to display member listing), a partitioned data set must be specified. A member listing is then displayed from which the user may select members for printing, renaming, deleting, or browsing by entering "P", "R", "D", or "B" in front of one or more member names. For renaming, a new member name must also be entered in the field immediately following the current member name. The member list may be scrolled up and down via the scroll PF keys or via the LOCATE command.

Data Set Utility (Option 3.2)

When this option is selected (utility option 2), a menu is displayed which allows the user to specify a data set and indicate an action to be performed. Possible actions are:

A - Allocate new data set
R - Rename data set
D - Delete data set
C - Catalog data set
U - Uncatalog data set
blank - Display data set information

Any DASD-resident sequential or partitioned data set may be specified for "allocate new data set". Any DASD-resident, non-VSAM data set may be specified for the other options.

If option "A" (allocate new data set) is selected, a menu is displayed to allow specification of volume serial (may specify a real DASD volume or an IBM 3850 virtual volume), data set characteristics, and space allocation parameters. Default values are pre-entered based on what the user last entered on this menu, or based on the last "display data set information" request (whichever occurred most recently). The user may overtype the displayed defaults.

If option "R" (rename data set) is selected, a menu is displayed to allow the user to enter the new data set name. If a volume serial is specified for a data set to be renamed, the data set is not re-cataloged to the new data set name. If a volume serial is not specified, the data set is re-cataloged to the new data set name and the old data set name is uncataloged.

If option "D" (delete data set) is selected, a confirmation request is displayed to insure that the user did not select this option by mistake. As directed in the confirmation message, the user must then press either the ENTER key to confirm or the End PF key to cancel.

If a volume serial was specified for the data set to be deleted, the data set is scratched but not uncataloged (SPF assumes the data set is already uncataloged). If a volume serial was not specified, the data set is scratched and uncataloged.

If option "C" (catalog data set) is selected, the specified data set is cataloged. For this option the user must specify the volume serial on which the data set resides (regardless of whether the data set is specified via project, library, and type or "other" data set name). The data set must reside on the specified volume.

If option "U" (uncatalog data set) is selected, the specified data set name is uncataloged. There is no requirement for the specified data set to be allocated or mounted.

If no option is specified (blank to display data set information), the volume serial, data set characteristics, current space allocation, and current space utilization are displayed.

Move/Copy Utility (Option 3.3)

When this option is selected (utility option 3), a menu is displayed which allows the user to specify the "from" data set (and member if it is partitioned), and to indicate an action to be performed. Possible actions are:

CP - Copy dataset or member(s) and print
MP - Move dataset or member(s) and print
C - Copy without print
M - Move without print

When the ENTER key is pressed, a second menu is displayed which allows the user to specify the "to" data set. The following options must also be specified on this menu.

- If the "to" data set is partitioned:
  Replace like-named members (YES or NO)

- If the "to" data set is sequential:
  "To" data set disposition (OLD or MOD)

A DASD-resident sequential or partitioned data set may be specified for either the "from" or "to" data set. The allowable data set characteristics are the same as for browse.

Load modules (stored in partitioned data sets with "undefined" record format) may be moved or copied, but not printed.

Both data sets must already exist. The utility will not automatically allocate space for a new "to" data set.

If "move" is indicated and the "from" data set is partitioned, the selected member(s) will be deleted in the "from" data set after they have been successfully copied to the "to" data set. If "move" is indicated and the "from" data set is sequential, the entire "from" data set will be deleted after its contents have been successfully copied to the "to" data set. If "copy" is indicated, no deletions will occur.

If "print" is indicated for either move or copy, source listing(s) will be recorded in the SPF list data set. If the "to" data set is partitioned, a listing of each new or replaced member will be recorded. If the "to" data set is sequential, a listing of its entire contents will be recorded after the information has been successfully copied. The allowable dataset characteristics for printing are the same as for browse.

A member listing is displayed when the "from" data set is partitioned and the "from" member name is left blank. The user may select members to be moved or copied by entering an "S" in front of one or more member names. The options for move or copy, and print or no print must have been previously specified on the first move/copy data set menu. If the "to" data set is partitioned, the member(s) may also be renamed by entering a new member name in the field immediately following the current name.

The member list may be scrolled up and down via the Scroll PF keys or via the LOCATE command. The member list may be terminated by pressing the End PF key, which causes a return to the first move/copy menu.

Catalog Management Utility (Option 3.4)

When this option is selected (utility option 4), a menu is displayed that allows the user to specify the project name for an SPF library (or high-level qualifier for any sequential or partitioned data set), and an action to be performed. Possible actions are:

I - Initialize project catalog alias
D - Delete project catalog alias
P - Print catalog entries
blank - Display catalog entries

If option "I" (initialize project catalog alias) is selected, a volume serial (for SVS) or catalog name (for MVS) must also be specified. This action is valid only if there are no data sets currently allocated with this project name. It causes all subsequent catalog entries for this project name to be placed in the user catalog, pointed to by a single entry in the master catalog.

If option "D" (delete project catalog alias) is selected, the CVOL pointer or alias for the designated project name is deleted from the master catalog.

If option "P" (print catalog entries) is selected, a catalog listing for the designated project name is recorded in the SPF list data set. The listing is produced by the IEHLIST program (SVS) or the Access Method Services (AMS) program (MVS). In the latter case, AMS list catalog parameters may be specified on the menu to control the amount of output produced, and more than one level of qualifiers may be specified for project.

If no option is specfied (blank to display catalog entries), a catalog listing (produced by IEHLIST or AMS) is displayed at the terminal. The listing may be scrolled up and down via the Scroll PF keys or via the LOCATE command. All browse commands may also be entered from this display. The listing may be terminated by pressing the End PF key, causing a return to the previous menu.

Reset SPF Statistics Utility (Option 3.5)

When this option is specified (utility option 5), a menu is displayed that allows the user to create, update, or delete SPF statistics and to reset sequence numbers. The reset utility handles partitioned data sets with fixed or variable length records only. Refer to the section entitled "SPF Library Statistics" for a discussion of the type of information maintained for each member of an SPF library data set.

There are three valid options for this utility:

R - Create/update SPF statistics, conditionally reset sequence numbers
N - Create/update SPF statistics, no reset of sequence numbers
D - Delete SPF statistics

The "R" option is used to either create SPF statistics in a partitioned data set which does not currently have them, or to update SPF statistics in a partitioned data set which has them. The data is scanned to determine if valid, ascending sequence numbers are present in all records. If valid, ascending sequence numbers are present, the data is renumbered and the modification level flags (the last two digits of each sequence number) are set to zeros. If valid sequence numbers are not present, renumbering is not done.

The "N" option is also used to create or update SPF statistics as in option "R"; however the data is not renumbered. This option should be used if the data already contains SPF statistics and the user wants to update the user id and/or version information without renumbering the data.

The "D" option is used to delete SPF statistics.

If a version number is specified, the statistics are created or reset as follows:

Version number:	set to the specified value
Modification level:	set to zero
Creation date:	set to current date
Date/time last modified:	set to current date and time
Current number of lines:	set to the current number of data records
Initial number lines:	set to the current number of data records
Number of modified lines:	set to zero

If member listing is requested, the user may select members to be reset by entering an "S" in front of one or more member names. The member list may be scrolled up and down via the Scroll PF keys or via the LOCATE command. The member list may be terminated by pressing the End PF key, which causes a return to the previous menu.

Hardcopy Utility (Option 3.6)

When this option is selected (utility option 6), a menu is displayed which allows the user to specify a sequential data set or member of a partitioned data set to be printed or punched, and the destination of the output. It also allows the user to specify whether a sequential data set is to be kept or deleted after printing. (Partitioned data set members are always kept.)

Possible actions are:

- J - Generate JCL to print or punch dataset
- L - Route dataset to local printer

Any DASD-resident data set may be specified except for the SPF list and log data sets. Since these two data sets remain open throughout SPF processing, they may only be printed upon SPF termination.

If option "J" (generate JCL to print or punch dataset) is selected, a SYSOUT class and job statement parameters must also be specified. The SYSOUT class may specify a printer or punch. When the user enters the desired information and presses the ENTER key, SPF generates JCL which contains the job statement parameters and a job step that will print or punch the specified data set, using the IBM utility IEBGENER.

If option "L" (route dataset to local printer) is selected, a printer id must be specified. When the user enters the desired information and presses the ENTER key, SPF invokes the "DSPRINT" TSO command processor to print the data set on the specified local printer.

DSPRINT is an IBM Field Developed Program that must be installed to use the "L" option.

List VTOC Utility (Option 3.7)

When this option is selected (utility option 7), a menu is displayed which allows the user to specify a volume serial for a DASD volume and, optionally, a project name or other high-level data set name qualifier. Possible actions are:

- P - Print VTOC entries
- blank - Display VTOC entries

If option "P" (print VTOC entries) is selected, a VTOC listing for the designated volume is recorded in the SPF list data set.

If the option field is left blank, the VTOC listing is displayed at the terminal. The listing may be scrolled up and down via the Scroll PF keys or via the LOCATE command. All browse commands may be entered from this display.

For either the print or display options, the VTOC listing may be limited to data sets which begin with a designated high-level qualifier (specified via project name on the list VTOC menu).

Outlist Utility (Option 3.8)

This utility gives the user a capabilty to browse, print, delete, or requeue job output which is in a held SYSOUT queue. When this option (utility option 8) is selected, a menu is displayed which allows the user to select the option to be performed and the parameters associated with that option. This utility has the following options:

L - List job names via the TSO STATUS command
D - Delete job output
P - Print job output
R - Requeue job output to a new output class
blank - Display job output

If option "L" (list job names) is selected, a list of job names (and job id's for MVS) will be displayed for currently held jobs. If no job name is supplied, or if the job name supplied is the user's id plus one character, status will be displayed for all job names which begin with the user's id. If any other job name is supplied, status for that exact job will be displayed.

If option "D" (delete job output) is selected, the held output for a specific job will be deleted from the specified SYSOUT queue.

If option "P" (print job output) is selected, the held output for a specific job will be removed from the SYSOUT queue for printing. After the ENTER key is pressed, a secondary menu will be displayed. On this menu, the user enters information about how and where the job output is to be printed.

If option "R" (requeue job output) is selected, the held output for a specific job will be requeued to another SYSOUT class from the specified SYSOUT queue. The user must enter the new SYSOUT class on the menu.

If a blank is specified (display job output), the held output for the specified job will be displayed in browse mode. All browse commands can be executed. Under MVS, the data remains in the SYSOUT queue. When the user presses the End PF key to terminate browse, the outlist menu is redisplayed and the user may then choose to print, requeue, or delete the job output. Under SVS, the data is deleted from the SYSOUT queue when browse mode is entered. When browse is terminated, the outlist print menu is displayed to allow printing of the job output.

FOREGROUND PROCESSING (OPTION 4)

The foreground option provides an interface with standard language processors for foreground compilation, assembly, linkage edit, or debugging of programs stored in SPF library data sets. For foreground processing of other partitioned or sequential data sets, the appropriate TSO prompter commands may be entered directly via the TSO command option (primary option 6).

When foreground is selected (primary option 4), a secondary menu is displayed to allow the user to select a language processor (Figure 17). It is possible to bypass the secondary menu by entering two numbers, separated with a decimal point, on the primary menu. For example, entering "4.3" on the primary menu has the same effect as entering "4" on the primary menu and "3" on secondary menu.

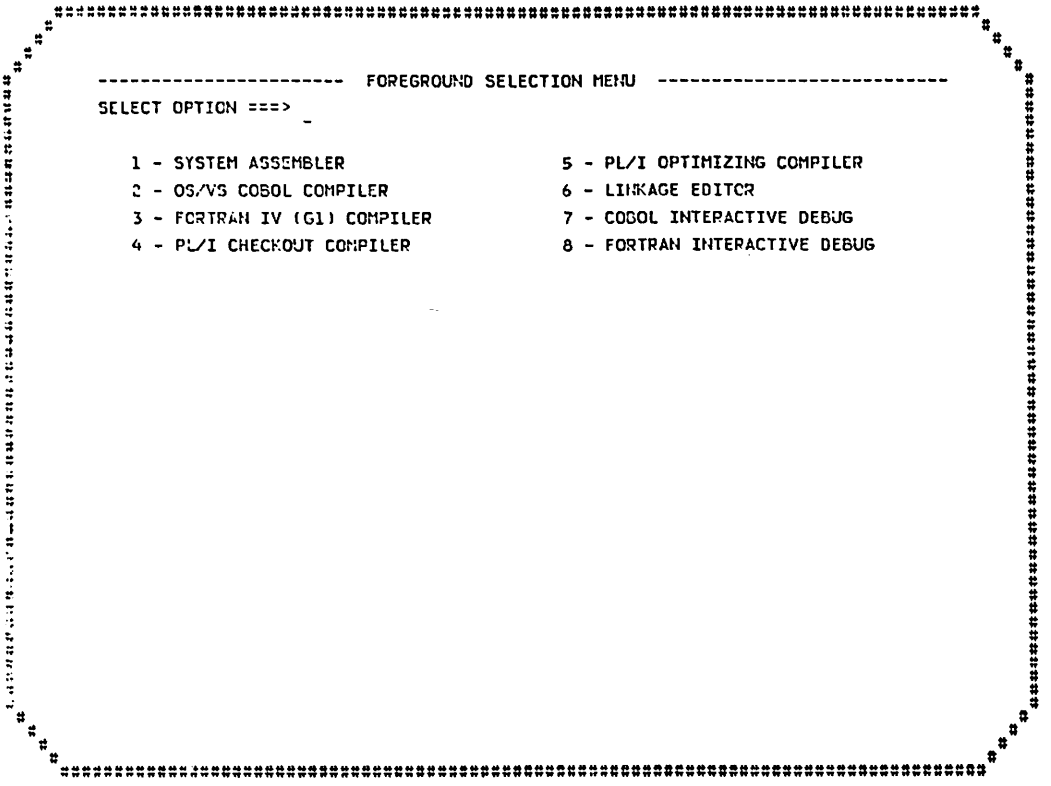


Figure 17. Foreground selection menu

When a language processor has been selected, a menu is displayed to allow the user to enter the appropriate data set and member names, library concatenation sequence, and processor options. Figure 18 shows an example for Assembler. The project name, first library name, type qualifier, member name, and list id must be specified. The other parameters are optional.

Once the appropriate processor menu has been filled in, the user may press either:

- the ENTER key, which causes the foreground processor to be invoked without entering Session Manager mode, or

- any one of the SPF Scroll keys, which causes foreground execution under control of the Session Manager (if the Session Manager program product, 5740-XE2, is installed).

If the Session Manager is not invoked, the PA and PF keys revert to their usual TSO-defined meaning (generally, the PF keys are treated the same as the ENTER key). Any communication with the foreground processor is in line-I/O mode. Upon completion of foreground processing, three asterisks (***) are displayed on the bottom line of the screen. The user may then press ENTER to return to the foreground processor menu.

Under the Session Manager, the terminal is operated according to Session Manager procedures. Upon completion of foreground processing the user is prompted to enter a null line to return to the SPF foreground processor menu.

When the foreground processor menu is redisplayed, a message indicating normal or abnormal completion is displayed in the upper right-hand corner of the screen. The user may then enter another foreground processing request or press the End PF key to return to the previous menu.

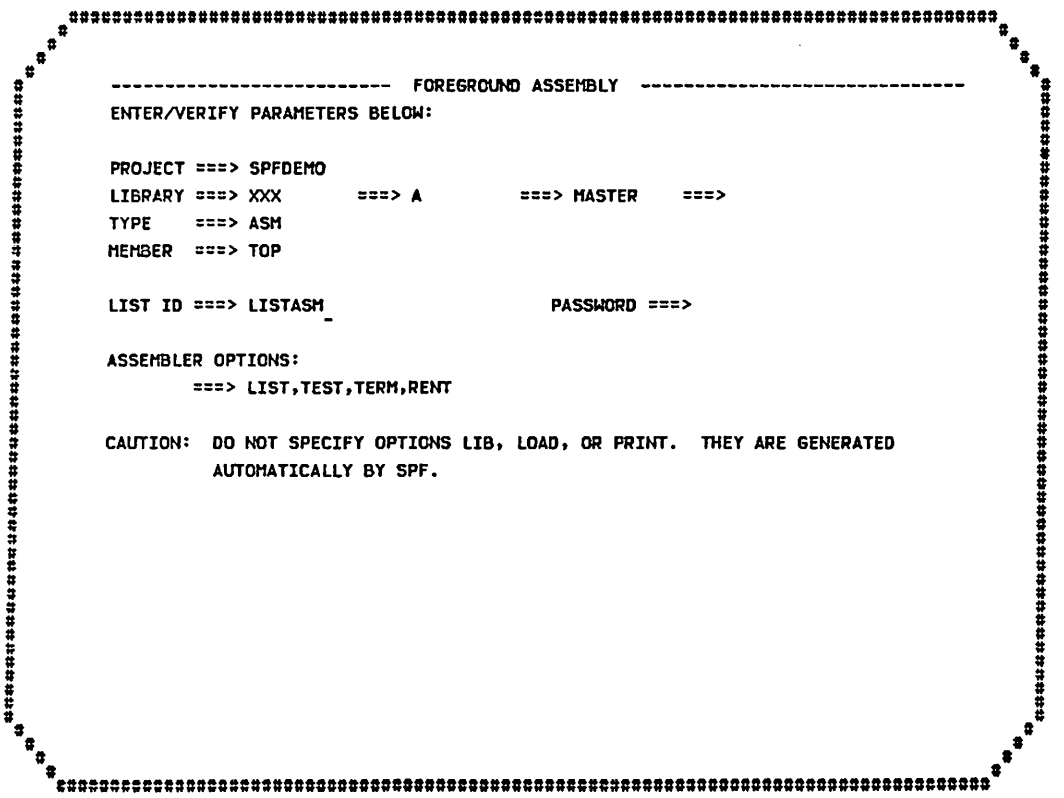


Figure 18. Foreground - Assembler example

Assembler/Compiler Processing

The Assembler menu shown in Figure 18 is typical of the language processor menus. In the figure, a library concatenation sequence of three data sets has been specified. The concatenation order is:

```
SPFDEMO.XXX.ASM
SPFDEMO.A.ASM
SPFDEMO.MASTER.ASM
```

Before invoking the foreground processor, SPF will scan the concatenated sequence of libraries to find the member to be assembled or compiled (member TOP in this example). If, in this example, member TOP first appears in data set SPFDEMO.A.ASM, the following prompter command would be generated.

```
ASM  'SPFDEMO.A.ASM(TOP)'
     LIB('SYS1.MACLIB',
         'SPFDEMO.XXX.ASM',
         'SPFDEMO.A.ASM',
         'SPFDEMO.MASTER.ASM')
     LOAD('SPFDEMO.XXX.OBJ(TOP)')
     PRINT(LISTASM)
     LIST,TEST,TERM,RENT
```

The data set menus for COBOL, FORTRAN, and the two PL/I compilers are similar to the one for Assembler. The type qualifiers for these languages are normally COBOL, FORT, or PLI. The prompter commands generated for these cases are also similar, except that:

- The command verb is COBOL, FORT, PLI, or PLIC.
- The macro library 'SYS1.MACLIB' is not included in the concatenation sequence passed via the LIB parameter.
- For COBOL, an optional TEST parameter may be generated by SPF, as follows: TEST ('project-name.lib1-name.SYM(member-name)'). The user may control the generation of this parameter via a field on the menu.
- For FORTRAN, there is no LIB parameter. The concatenation sequence is still used to locate the member to be compiled.
- For the two PL/I compilers, an OBJECT parameter (rather than LOAD) is generated by SPF to designate the destination of the object module.
- For the PL/I Checkout compiler, the OBJECT parameter is optional (controlled by a field on the menu). If the user specifies OBJECT, the following PLIC parameter is generated by SPF:

  ```
  OBJECT('project-name.lib1-name.OBJ(member-name)'
         'project-name.lib1-name.ITEXT')
  ```

  If the user specifies NOOBJECT, neither OBJ nor ITEXT data is generated.

In addition to constructing the input data set name, the SPF foreground processing option automatically generates the following optional parameters. Accordingly, the user should not specify these parameters on the "options" line of the menu.

```
For ASM:        LIB, LOAD, PRINT
For COBOL:      LIB, LOAD, PRINT, TEST
For FORT:       LOAD, PRINT
For PLIC:       LIB, OBJECT, PRINT
For PLI:        LIB, OBJECT, PRINT
For LINK:       LIB, LOAD, PRINT
For TESTCOB:    LOAD, PRINT, PARM
For TESTFORT:   LIB, PRINT, SOURCE
```

Linkage Editor Processing

For the Linkage Editor, the data set menu allows specification of up to two system subroutine libraries. The concatenation sequence used by SPF to locate the member for input to the linkage editor is:

```
project-name.lib1-name.type
project-name.lib2-name.type
(etc.)
```

where "type" is whatever the user specifies on the menu (may be OBJ or may be some other type containing linkage editor control statements). If the type is not OBJ, an "OBJECT" DDNAME is automatically allocated to facilitate use of the following linkage editor control statements.

```
INCLUDE OBJECT(member-name)
```

The concatenation sequence passed to the linkage editor via the LIB parameter has a type qualifier of LOAD and includes the user-specified system libraries, as follows:

```
LIB('project-name.lib1-name.LOAD',
    'project-name.lib2-name.LOAD',
    etc.,
    'syslib1-name',
    etc.)
```

This concatenation sequence is used by the linkage editor to resolve "automatic call" references.

BACKGROUND PROCESSING (OPTION 5)

The background option provides an interface with standard language processors for background compilation, assembly, or linkage edit of programs stored in SPF library data sets. For other background jobs, the SUBMIT command may be entered via the TSO command option (primary option 6) or via the SUBMIT command under edit.

When background is selected (primary option 5), a menu is displayed to allow the user to select a language processor, and to enter and/or verify job statement parameters (Figure 19). When the user enters the desired information and presses the ENTER key, SPF generates a JOB statement, and displays the appropriate data set menu.

It is possible to bypass the secondary menu by entering two numbers, separated by a decimal point, on the primary menu. For example, "5.2" to select a background COBOL compile. Note, however, that use of this procedure does not allow verification or changes to the job statement parameters, nor does it allow the generation of multiple compilations and/or link edits within the same job.

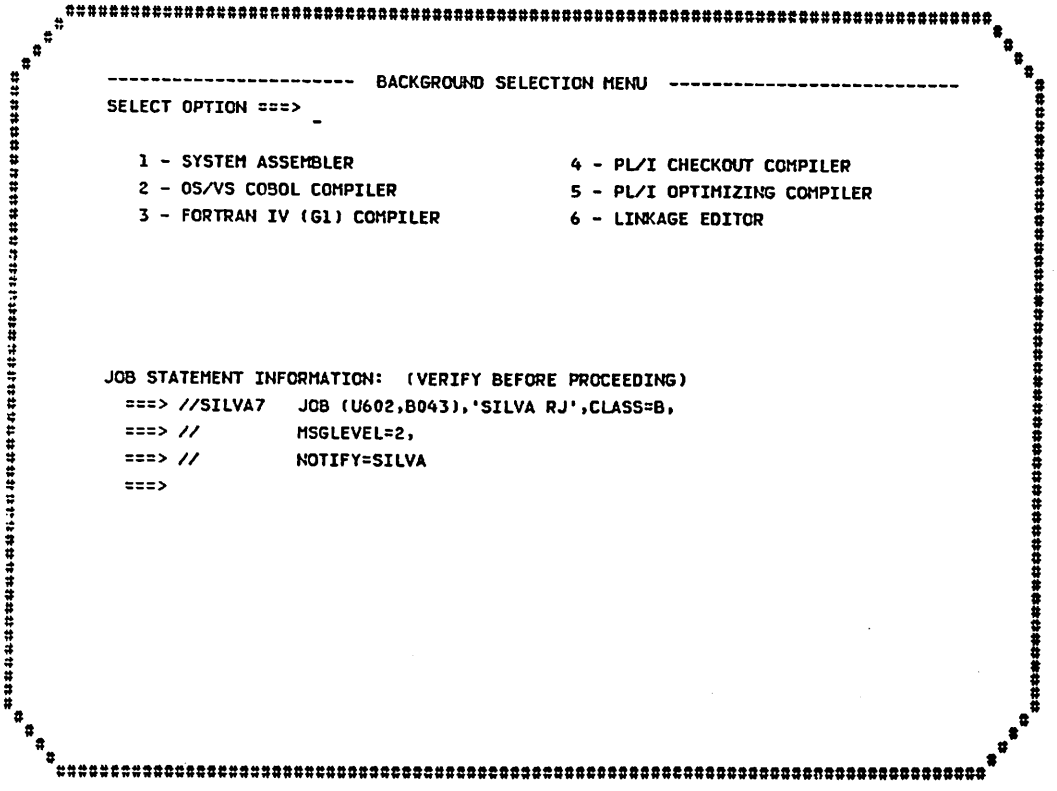


Figure 19. Background selection menu

The data set menus for background processing are similar to those for foregound processing, except that the user may enter either a list id (if the output listing is to be stored in a data set) or SYSOUT class (if the listing is to be printed as part of the background job). If both list id and SYSOUT class are specified, list id is used.

When the user has filled in the menu entries and pressed the ENTER key, SPF generates the appropriate JCL statements. SPF then returns to the background selection menu (unless that menu was bypassed by entering two numbers on the primary menu), with a message "JCL GENERATED" displayed in the short message area (line 1). If the background selection menu was bypassed, SPF submits the generated JCL and returns directly to the primary option menu.

When the background menu is redisplayed, the job statement parameters are shown for information only -- they are no longer intensified and may not be overtyped, since the JOB statement has already been generated. At this point, the user may select another processor to cause more JCL to be generated, he may cancel out by entering the option CANCEL, or he may press the End PF key (or Return PF key) to cause the generated JCL to be submitted for execution.

TSO COMMAND (OPTION 6)

The TSO command option allows direct entry of a TSO command or command procedure (CLIST) under SPF. When this option is selected (primary option 6), a blank menu is displayed with the following prompt:

```
ENTER TSO COMMAND OR CLIST BELOW:
===>
```

The TSO command is entered to the right of the arrow, using standard TSO command syntax. The command may be continued on the next two lines, if necessary.

The following commands may NOT be entered under SPF:

- TEST
- LOGON, LOGOFF
- SPF
- Authorized commands (e.g., RACF commands)
- CALL to an authorized program

After the desired TSO command has been typed, the user may press either:

- the ENTER key, which causes the TSO command to be executed without entering Session Manager mode, or

- any one of the SPF Scroll keys, which causes the TSO command to be executed under control of the Session Manager (if the Session Manager program product, 5740-XE2, is installed).

If the Session Manager is not invoked, the PA and PF keys revert to their usual TSO-defined meaning (generally the PF keys are treated the same as the ENTER key). Upon completion of the TSO command, three asterisks (***) are displayed below the command output. The user may then press ENTER to redisplay the TSO command menu.

Under the Session Manager, the terminal is operated according to Session Manager procedures. Upon completion of TSO command processing, the user is prompted to enter a null line to return to the SPF TSO command menu.

When the TSO command menu is redisplayed, the command which was just executed is pre-entered to the right of the arrow. The user may then enter another command, or press the End PF key to return to the primary option menu.

TUTORIAL (OPTION 7)

The tutorial option provides immediate online reference and instruction on how to use SPF. It may be invoked from the primary option menu or via the Help PF key. The tutorial may be viewed sequentially from beginning to end, or it may be viewed randomly by selecting specific topics from an alphabetic index or table of contents.

When the tutorial is invoked from the primary option menu (option 7), introductory pages are displayed to explain how the tutorial works. Following the introduction, a table of contents is displayed from which the user may select a topic by entering the desired section number.

When the tutorial is invoked via the Help PF key, the appropriate section of the tutorial is entered based on what the user was doing when he pressed Help.

During execution of the tutorial, the four scroll PF keys are interpreted as follows:

UP	- display higher level list of topics
DOWN	- not used
LEFT (back)	- display previous tutorial page
RIGHT (next)	- display next tutorial page

The Help PF key may be pressed at any time to display a one-page summary of how to use the tutorial.

The tutorial function is terminated by pressing the End PF key. This causes a return either to the primary option menu or to the display from which the user requested help.

APPENDIX A: SPF LIBRARIES

TYPES OF LIBRARIES

SPF encourages standardization in the structure and naming of programming libraries. A "standard SPF library" is a cataloged partitioned data set with a 3-level data set name in this form:

'project-name.library-name.type'

where: "project-name" identifies the programming project. This name is used as the high level qualifier, rather than user id, to facilitate sharing of libraries on projects with several programmers.

"library-name" identifies the particular library, such as master library, development library, etc.

"type" identifies the type of information in the data set, such as: ASM (Assembler source), COBOL (COBOL source), OBJ (object modules), or LOAD (load modules). This is similar to the "type" qualifier in TSO data set naming conventions, except that in SPF it need not conform to the standard set of TSO type identifiers.

For source libraries, each member of the partitioned data set contains a program segment. During compilation or assembly, segments may be combined to form a single object module by using INCLUDE or COPY statements in the source text.

For object libraries, each member of the partitioned data set contains an object module. During linkage editing, object modules may be combined to form a single load module by using link edit INCLUDE statements, or the "automatic call" feature.

For load libraries, each member of the partitioned data set contains a load module. During program execution, a load module may invoke additional load modules by using ATTACH, LINK, LOAD, or XCTL supervisor services.

LIBRARY HIERARCHY AND CONCATENATION

Most projects require a number of related libraries to maintain effective version control over the programming development process and to reduce contention in library useage. Figure 20 shows a simple library hierarchy consisting of a set of master libraries and three sets of development libraries (A, B and C). Typically, a higher degree of control is maintained over the master libraries than the development libraries. New code segments or segments undergoing changes will reside in the development libraries, while the "official" versions are maintained in a master library. This will lead to situations where a segment (member) of the same name may appear in a master library and one or more of the development libraries.

Library concatenation allows more than one partitioned data set to be searched for each referenced member during source editing, compilation, assembly, or link edit. Generally the lower level libraries are concatenated ahead of the master library. Where applicable, SPF menus allow concatenation of up to four libraries. For example:

```
PROJECT ===> XXX
LIBRARY ===> B      ===> MASTER ===>    ===>
TYPE    ===> PLI
MEMBER  ===> TOP
```

In this case, two data sets would be concatenated as follows:

```
XXX.B.PLI
XXX.MASTER.PLI
```

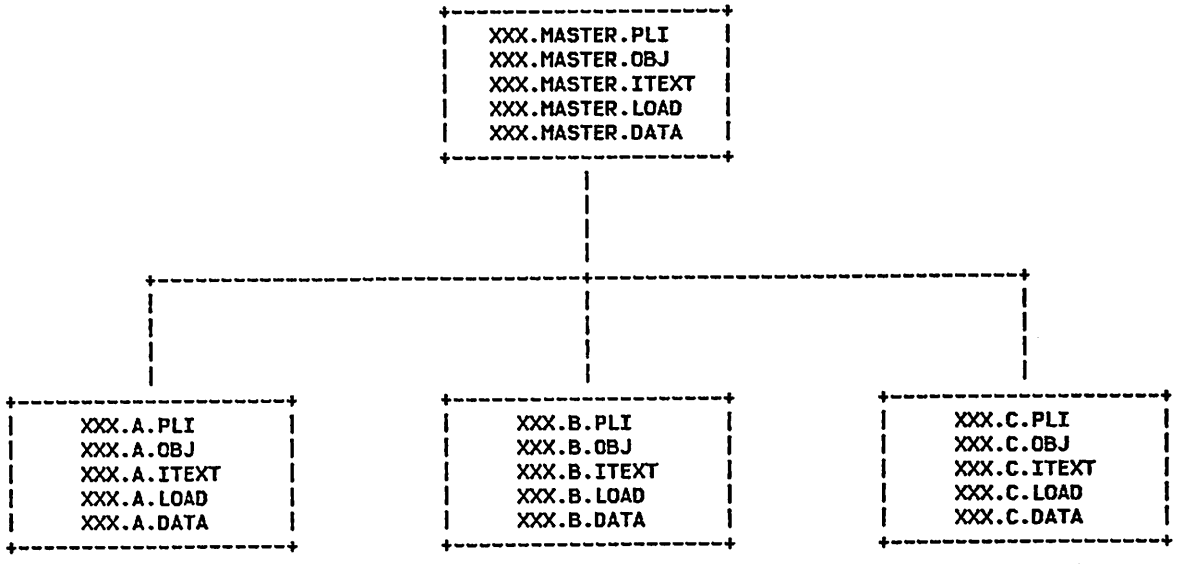


Figure 20. Sample library hierarchy

The purpose of concatenation during source editing is to provide automatic copying of a segment from the master source library to the lower level library. The edited segment is saved in the lower level library (the first library in the concatenation sequence), while the unchanged version remains in the master library. When the new version is fully checked out, it may be promoted back to the master library by means of the SPF move/copy utility.

The purpose of concatentation during compilation, assembly, or link edit is to allow debugging of new or modified programs without altering the contents of the master object, intermediate text, or load libraries. Here again, the output from the compilation, assembly, or link edit is stored in the first library in the concatenation sequence (e.g., XXX.B.OBJ or XXX.B.LOAD).

APPENDIX B: SUMMARY OF SPF COMMANDS

MEMBER LIST COMMANDS

The following commands may be entered in the command input field (line 2 of the logical screen) on member list displays.

LOCATE Causes direct scrolling to the specified member name (may be entered on any member list display).

SELECT Causes the specified member name to be selected for browse or edit (invalid on utility member list displays). Allows selection of a member which is not in the list.

On member list displays, the following one-character commands may be entered at the beginning of a line, ahead of the member name.

S (select) Causes the member to be selected for browse, edit, move/copy, or reset utility (invalid under the library utility).

P (print) Causes the member to be printed (valid only under the library utility).

R (rename) Causes the member to be renamed (valid only under the library utility). The new name must be entered to the right of the member name.

D (delete) Causes the member to be deleted (valid only under the library utility).

B (browse) Causes the member to be browsed (valid only under the library utility).

BROWSE COMMANDS

The following commands may be entered in the command input field (line 2 of the logical screen) under browse, and also under the "display" option of the catalog management, list VTOC, and outlist utilities.

LOCATE Causes direct scrolling to the specified relative line number or label.

COLS Causes display of a line that identifies column positions.

RESET Removes the column identification line from display.

FIND Causes the data to be scanned for one or all occurrences of a character string. The cursor is repositioned to the beginning of the first occurrence, if it is found.

CAPS Causes character strings, entered as part of the FIND command, to be converted to upper case. CAPS OFF causes character strings to be left as-is.

HEX Causes data to be displayed in hexadecimal representation. HEX OFF restores normal display format.

EDIT LINE COMMANDS

Under edit, line commands may be entered at the beginning of a line by overtyping the line number.

COLS Causes display of a line that identifies column positions.

I (insert) Causes a new line to be inserted after this line.

D (delete) Causes the line to be deleted.

R (repeat) Causes the line to be repeated and the duplicate copy to be inserted after this line.

M (move) Identifies a line to be moved.

C (copy) Identifies a line to be copied.

A (after) Identifies the line after which copied or moved lines are to be inserted.

B (before) Identifies the line before which copied or moved lines are to be inserted.

MASK Causes display of the insert mask, to allow pre-entry of data on inserted lines.

< (left) Causes the contents of the line to be "data" shifted left.

> (right) Causes the contents of the line to be "data" shifted right.

((left) Causes the contents of the line to be "column" shifted left.

) (right) Causes the contents of the line to be "column" shifted right.

BOUNDS Causes display of the column boundary line, to allow redefinition of boundary positions.

X (exclude) Causes the line to be excluded from display. May also be used to limit the scope of the FIND and CHANGE commands.

S (show) Causes an excluded line to be redisplayed.

F (first) Causes the first line in a block of excluded lines to be redisplayed.

L (last) Causes the last line in a block of excluded lines to be redisplayed.

TABS Causes display of the tab line, to allow definition of hardware, software, and logical tab positions.

TE Facilitates bulk text entry by allowing the user to type continuously without regard to the line number area.

TS Causes splitting of a line into two lines at the designated cursor position to facilitate the insertion of new material in existing text.

TF Causes reflowing of a paragraph of text from the cursor position to the end of the paragraph.

O (overlay) Causes data to be copied or moved "over" the existing data on one or more lines. Blank characters in the receiving line(s) are overlayed with corresponding characters in the source line(s).

The following line commands may be entered with double characters to indicate the beginning and end of a block of lines.

DD - Block delete
RR - Block repeat
MM - Block move
CC - Block copy
<< - Block "data" shift left
>> - Block "data" shift right
((- Block "column" shift left
)) - Block "column" shift right
XX - Block exclude
OO - Block overlay

The following line commands may incorporate a number (n) consisting of one or more digits.

In - Insert n lines following this line
Dn - Delete n lines starting at this line
Rn - Repeat this line n times
RRn - Repeat block of lines n times
Mn - Move n lines starting at this line
Cn - Copy n lines starting at this line
An - Causes n copies of the line(s) to be moved or copied after the line containing this line command
Bn - Causes n copies of the line(s) to be moved or copied before the line containing this line command
<n - Data-shift line left n positions
<<n - Data-shift block of lines left n positions
>n - Data-shift line right n positions
>>n - Data-shift block of lines right n positions
(n - Column-shift line left n positions
((n - Column-shift block of lines left n positions
)n - Column-shift line right n positions

))n - Column-shift block of lines right n positions
Xn - Exclude n lines starting at this line
Sn - Show n lines in a block of excluded lines
Fn - Show first n lines in a block of excluded lines
Ln - Show last n lines in a block of excluded lines
TEn - Causes n lines to be inserted following this line for text entry
TSn - Causes n lines to be inserted between the split lines
TFn - Same as TF except "n" specifies the desired width (in columns) of the reflowed text
On - Overlay n lines

If a number is not entered, the default is 1 except for:

- the shift commands (which have a default of 2 column positions)
- the TE command (which defaults to the number of lines remaining on the screen)
- the TF command (which defaults to the specified column boundaries)

EDIT PRIMARY COMMANDS

Under edit, the following commands may be entered in the command input field (line 2 of the logical screen).

LOCATE Causes direct scrolling to the specified line number.

NUMBER Causes sequence numbers to be generated for any new lines that are created via insert, repeat, or copy. NUMBER OFF causes lines to be generated without numbers.

RENUM Renumbers each line and turns on NUMBER mode.

UNNUM Causes sequence numbers to be set to blanks and turns off NUMBER mode.

AUTONUM If edit is in NUMBER mode, causes sequence numbers to be automatically renumbered whenever a save is done. AUTONUM OFF bypasses automatic renumbering at save time.

STATS Causes SPF statistics to automatically be created/updated whenever data is saved, created, or replaced. STATS OFF causes members to be stored without statistics.

PRINT Causes a source listing of the edited data to be automatically recorded in the SPF list data set whenever data is saved by pressing the End PF key. PRINT OFF bypasses automatic source listings.

RECOVERY Enables the SPF edit recovery function. If there is a subsequent system failure, the user can recover the SPF edit session up to the point of failure. RECOVERY OFF disables the edit recovery function.

RESET Causes a general resetting of intensified messages, incomplete line commands, and special lines.

SUBMIT Causes the data being edited to be submitted to the job stream for batch execution.

SAVE Causes the data to be stored back into the edit file and editing to continue.

CANCEL Causes editing to be terminated without saving the data.

FIND Causes the data to be scanned for one or all occurrences of a character string. The cursor is repositioned to the beginning of the first occurrence, if it is found.

CHANGE Causes one or all occurrences of a character string to be replaced with a second string. The cursor is repositioned to the end of the first occurrence, if it is found.

COPY Causes data to be copied from another source and inserted at a point indicated with the A (after) or B (before) line command. The other source can be a member in any partitioned data set or a sequential data set.

MOVE Same as COPY, except that the other source is deleted after the copy operation.

CREATE Causes a line or block of lines to be stored in any partitioned data set as a new member. The line(s) to be stored are designated with the C or CC (copy), or M or MM (move) line commands.

REPLACE Same as CREATE, except that it allows an existing member or an entire sequential data set to be replaced.

NULLS Replaces trailing blanks on the screen with null characters. NULL OFF causes trailing blanks to be sent to the screen as blanks.

TABS Enables the use of "hardware" or "logical" tabs at user defined positions (specified via the tabs line command). TABS OFF disables the use of "hardware" or "logical" tabs.

PROFILE Causes the display of the current setting of edit modes (NUMBER, AUTONUM, STATS, PRINT, CAPS, NULLS, TABS, HEX, and RECOVERY). Also displays the MASK, TABS, and BOUNDS lines whenever they have settings other than their defaults.

HEX Causes data to be displayed in hexadecimal representation. HEX OFF restores normal display format.

CAPS Causes alphabetic data, as entered from the terminal, to be translated to upper case, including FIND and CHANGE strings. CAPS OFF causes alphabetic data to be left as-is.

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