UniFLEX™ Enhanced Spooler

technical systems consultants, inc.

UniFLEX™ Enhanced Spooler

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MANUAL REVISION HISTORY

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DISCLAIMER

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Preface

This manual describes the UniFLEX Enhanced Spooler. The Enhanced Spooler is intended to replace the spooler that is supplied with UniFLEX. It is not possible to have both spoolers running under the same system. The "insert" procedure supplied on the master disk will remove the old spooler before adding the enhanced version.

The Enhanced Spooler requires that UniFLEX be at least version 1.05 or later. The version is checked and the message "Wrong UniFLEX version" appears if one attempts to run the spooler on an earlier version.

The Enhanced Spooler is much more complicated than the spooler that is supplied with UniFLEX. It is strongly recommended that the System Manager read this manual thoroughly before installing the spooler. It may be necessary to read this manual several times before a good working knowledge of the spooler is obtained. To install the Enhanced Spooler the System Manager should follow the directions given on the "Installation Procedure" sheet that accompanies the disk. The System Manager should not attempt to install the Enhanced Spooler on the UniFLEX master disk, but only on system disks generated from the master.

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Introduction to Spooling

Spooling is a mechanism that allows the printing of output to take place at a time other than when the task that produced the output is run. Under simple operating systems, a task that produces output must communicate directly with the printer, essentially keeping the printer reserved for the entire time that the task is running. If the task does a lot of computing before printing, the printer is not actively being used and also is not available for other tasks to use. This is a waste of resources, especially in a multi-tasking and multi-user environment.

More sophisticated multi-tasking operating systems take advantage of the multi-tasking capability by having a separate task print the output from other tasks. The task producing the output does not communicate directly with the printer, but rather writes the output into a file. The file is, in turn, read by another task whose sole purpose is to print the contents of the file on the printer.

The task that is printing the output may be quite sophisticated, allowing the operator great freedom in selecting which output files are to be printed at what time and on which forms they are to be printed. A spooler may be sophisticated enough to allow the user to specify that several copies of the output are to be printed, that only a part of the output is to be printed, or that the output not be printed at all until the user specifically requests that it be printed.

This flexibility relieves the programmer from the burden of taking these features into consideration when writing a program. All that the program has to do is produce the output, the spooler will handle such things as number of copies and the scheduling of the printer.

Structure of the Enhanced Spooler

The UniFLEX Enhanced Spooler consists of several programs, each of which performs a specific function. These programs communicate with each other, and with the printer, through a specific directory and data structure.

The Printer Device

The printer devices are defined in the directory "/dev". There are predefined devices for parallel and serial printers, and there may be some entries for specialized printers having their own interface board. The program that actually prints the output file communicates with the printer through the appropriate entry in the "/dev" directory. Normally, the System Manager need be concerned only with knowing which printer is associated with each device. If desired, the System Manager may rename a printer device, giving it a name that is more meaningful than the one supplied. This is covered in the section of this manual that describes the specific steps to take when adding a new spooler to the system.

The Spooler Information Directory

The spooler programs keep information about the status of the printer and the files that are waiting to be printed in a directory. There is one such information directory associated with each printer on the system. The name of the information directory is the same as that of the printer device in the "/dev" directory, and this information directory is defined as a subdirectory of "/usr/spooler". Thus, information about the "spr" printer and those files waiting to be printed on that printer is contained in files in the directory "/usr/spooler/spr".

The information directory contains one file entry for each file that is waiting to be printed. Also in the directory are two files that are used by the various spooler programs for communicating with each other. There is a status and communications file called ".splr*cf" which is used to interrogate and communicate with the program that is actually connected to the printer, and there is a a queue file called ".splr*qf" which contains information about each file that is waiting to be printed. More information about these files will be given later.

The Queueing Program

One of the programs that comprise the Enhanced Spooler is the "queueing" program. This program makes entries in the information directory and in the queue file describing the data that is going to be printed. The queueing program has the name "spool" and normally resides in the "/etc" directory. However, the user does not refer to the queueing program by

that name. The queueing program must be given the same name as the device (and as the information directory). Normally this is accomplished by using the UniFLEX "link" command to create an entry in the "/bin" or "/usr/bin" directory with the desired name. The exact command will be described later in this manual in the section that describes the method to use when adding a spooler to the system. Suffice it to say that there are three items associated with each printer that have the same name: the device, the information directory for that printer, and the queueing program for that printer.

The queueing program is the program that is invoked by the user when sending output to the spooler. The output may be sent to the spooler in one of two ways: as data in a file, or via the UniFLEX "pipe" mechanism. In either case, the queueing program will generate a name for the output that consists of the first eight characters of the name of the owner of the file followed by a three digit sequence number. The name of the owner of the file is obtained from the password file, and the sequence number is kept in the queue file. It is this name that is reported back to the user and which should be used in all other commands that require the name of the file in the queue.

If the output that is to be printed is already in a file, the queueing program checks for that file being on the same device as the information directory. If it is on the same device, the UniFLEX "link" function is used to create a file entry in the information directory that points to the file containing the output. The name of this entry is the one that was generated by the queueing program. If the output file is not on the same device as the information directory, it is copied to a file in the information directory, giving that file the generated name.

If the pipe mechanism is being used, the queueing program copies the output from the pipe into a file in the information directory, giving the file the generated name.

Thus, if one were to invoke the "dir" command on the information directory, one would get a list of the names of those files that are queued for printing. However, for security reasons, access to the spooler information directory is restricted to the System Manager and selected programs. A special program called "splstat" is provided so that users may determine the status of output files awaiting printing as well as the status of the printer. This program will be described later on in this manual.

Once an output file is ready to be queued, an entry is made in the queue file giving the generated name of the file as well as other information about the output file. Some of this other information is obtained from parameters supplied to the queueing program when it is invoked. These parameters are described in detail in the documentation of the queueing program later on in this manual.

One value associated with a file in the queue is its priority. Priorities may range from 0 through 255. Only files with priorities greater than zero will be printed. Thus, a zero priority is the

mechanism that is used to hold a file in the queue until the user requests that it be printed. When a file is put into the queue, it is given a starting priority of 20. Files in the queue are "aged" in that whenever a new file is put in the queue, the priority of any file that has not yet been printed is incremented. Priorities below 10 and above 250 are not subject to ageing. The user has very limited control over the priority associated with a file in the queue. These restrictions are outlined in the documentation of the "setpr" command, later on in this manual.

The Queue File

The queue file contains information about each file that is waiting to be printed. If this file does not exist when the queueing program is invoked, it will be created automatically. The first two bytes of the queue file contain the sequence number that will be assigned to the next file that is queued. This number is incremented whenever a file is placed in the queue. The rest of the queue file is composed of "queue file entries" one of which is associated with each file waiting to be printed. Included in each queue file entry is the following:

1. The file name. This is the name that was generated by the queueing program.

2. Owner's ID. This is the user number of the person that owns the file in the queue. If the file in the queue was the result of data transmitted by the pipe mechanism, the owner's ID is the user number of the person that invoked the queueing program.

3. Queue priority. This is the priority that is associated with the file.

4. Repeat count. This is the number of additional copies of the output that are to be printed. This value is supplied as a parameter to the queueing program.

5. Form number. This is a number that ranges from 0 through 255 and may be used to associate a file in the queue with a particular form (e.g. single sheets, checks, multi-part, etc.).

6. Starting and ending page numbers. These specify the first and last physical pages that are to be printed. By supplying these values to the queueing program, only a portion of a file will be printed.

7. Lines per page. Normally, it is assumed that the output contains some default number of lines per page. This default is defined when the spooler is initiated with the "insp" command, described later. The user may specify to the queueing program that a specific output file has a different number of lines per page than

the default value.

8. Line length. This specifies the maximum number of characters that may appear on one line. If a line in the output file is longer than this value, it is broken into parts, each part being printed on a separate line. Optionally, long lines may be truncated, with the excess discarded. If the user does not specify a line length to the queueing program when a file is put into the queue, a default value, defined by the System Manager is used.

9. Flags. By specifying options to the queueing program, the user may indicate that the output file should not have a banner prepended to it, should not issue the form feed character to the printer, or that the printer should be stopped at the top of each page, allowing the insertion of a new sheet of paper. These options may also be set, by default, when the spooler is initialized with the "insp" program, described later.

10. Post-filter name. The user may request that a "post-filter" program be invoked when the file is being printed. The name of this program is stored in the queue file entry for that file. More information on "post-filters" is given later in this manual.

There is some other information in the queue file that is used internally by the program that is connected to the printer.

The Printer Program

The next major part of the Enhanced Spooler is the printer program. This is the program that actually opens the printer device and communicates with it. The printer program is located in the "/etc" directory and has the name "printer$". When running, the printer program reads the queue file and selects the next file that is to be printed according to criteria which will be described later.

When the printer program initially opens the printer device, no special handling or configuration of the device is performed. The exception occurs when the printer is connected as a "protocol" device (described in the section on adding printers to the system), or when a "raw mode" connect is requested. In this latter case, "raw mode" status is set using the "ttyset" mechanism.

At any one time, the printer program can be in one of four states: inactive, active and idled, active and printing, and active and not printing. The current state of the printer program may be determined by running the utility program "splstat", which is described later in the section on spooler commands.

When the printer program is "inactive", it is not running and no default configuration has been defined. If files are queued while the printer program is inactive, they will not be printed until the printer program is activated and configured by the System Manager. Only the System

Manager may activate the printer program. This is accomplished by using the "insp" command which will be discussed in more detail in the section on spooler commands. The printer program may be considered to be "not running" or "shut down" when it is inactive.

The printer program is "active" if the System Manager has used the "insp" command to define a starting configuration for it. Once activated, the printer program need not be deactivated unless a major change in the configuration is required. The printer program may be left active even across operating system shutdowns so long as it is not actually printing a file when the system is shut down. (Note that this is unlike the standard UniFLEX spooler which requires that it be deactivated before running the "shutup" command.)

If the printer program is active and idled (which can be the result of one of several commands), it will not search the queue for files to print. The "idle" mechanism, therefore, is a means of temporarily shutting down the printer program without having to deactivate it. A user may make the printer program idle if it is necessary to change forms, print wheels, etc. or to prevent the program from starting to print a file because system shutdown time is approaching. The printer program will automatically become "idle" if it receives an error when writing to the printer device. The file that it is currently printing is returned to the queue. In effect, the action is as though a "break" command (described later) had been issued.

When searching for files to print, the usual candidate is the file with the highest priority whose form number matches the one that the print program assumes is in the printer. It is possible for the System Manager to force a specific file to be printed next by using a variation of the "next" command. This is described in the spooler commands section of this manual. If the printer program cannot find a file to print, it terminates. Thus, there is no task consuming resources if there is nothing to print. The queueing program recognizes this condition and will automatically invoke the printer program, if necessary, when it puts a file into the queue. The queueing program will not invoke the printer program if the file being queued has a priority of zero, if the form number does not match that currently being processed, or if the printer program is idled.

If the printer program has been activated, the "splstat" utility will display the current configuration (default number of lines per page, form number, etc.). In addition, if the printer program is actually printing a file, the name of the file and an estimate of the page number being printed is displayed. Also, the task number of the printer program is given. If the printer program has terminated because it could not find a file to print, the "splstat" utility will indicate that the printer program is active but is not printing a file. It is when the printer program is in this condition (or is completely inactive)

that the system may be shut down without disturbing the spooler.

The Status and Communications File

The other commands that comprise the spooler communicate with the printer program through the status and communications file mentioned above. This file is divided into two parts: a status area and a communications area. The status area contains information that the "splstat" program uses when displaying the current status of the printer program. The communications area consists of several communications function blocks used by programs that wish to send information or commands to the printer program. When a program wishes to communicate with the printer program, it writes its information in one of the communications blocks and issues a USER1 interrupt to the printer program. This interrupt causes the printer program to read the communications block and take the appropriate action. The UniFLEX record locking mechanism is used to serialize access to the communications file.

Output File Handling

This section describes how the printer program handles the actual printing of the output file, especially the assumptions under which it operates.

Lines in the Output File

In general, it is assumed that the content of the file that is going to be printed consists of lines of ASCII characters, terminated by a carriage return. Normally, the parity bit should be off in each character. There are some ASCII characters for which the printer program scans, and which take on special meaning when found. These characters are: carriage return (hex 0D), form feed (hex 0C), horizontal tab (hex 09), and start of heading (hex 01).

The Carriage Return Character

The carriage return character signals the end of a line of text in the output file. The parity bit should not be set on this character when it is in the file. When the line is sent to the printer device, the carriage return is also sent. When activated by the System Manager, the printer program may be configured to always send a line feed character after the carriage return to accommodate those printers that do not have automatic line feed capability. In addition, if the printer device is operating in "protocol" mode (described later), an "end of text" character (ETX, hex 03) character may be appended by the printer program to the end of each line.

The Horizontal Tab Character

The horizontal tab character (hex 09) is automatically expanded by the printer program. The tab stops are fixed at every eight columns, (8, 16, 24, ...). When encountered, the horizontal tab character is replaced by the proper number of spaces to reach the next tab stop. If the tab character is already at a tab stop, no spaces are inserted. This feature may be disabled by an option when the queueing program is called. Horizontal tab expansion is also disabled if "raw mode" is specified to the queueing program. When activated by the System Manager, the printer program may be configured to always ignore horizontal tab characters.

The Form Feed Character

The form feed character (hex 0C) is used as a page indicator. Whenever encountered, it is assumed to be the start of a new page. It is not necessary that pages start with a form feed for the printer program to work properly. If there are no form feeds in the file, a line count is

used to determine the start of a page. (See the section on page numbering, below.)

The form feed character must be the first character on a line before it can be detected by the printer program. Form feeds embedded in a line of text are not detected, and are sent directly to the printer.

The form feed character may be ignored by an option specified to the queueing program. In this case, the form feed character is still used as a page indicator, but it is not sent to the printer device. This option may be selected on a file-by-file basis when each output file is put into the queue by the queueing program. It may also be specified as a configuration option by the System Manager when the printer program is activated.

If it is desired to replace the form feed character with one or more line feed characters, a filter program must be used prior to queueing the output file. Filter programs are described later on in the manual.

The printer program attempts to suppress completely blank pages caused by consecutive lines starting with form feeds by not sending a form feed character to the printer if it would cause a blank page to be printed. This option may be suppressed by an option specified to the queueing program when the file is placed in the print queue. The blank page suppression does not take place between output files.

If the printer program is stopping at the top of each page, the form feed is sent to the printer before the pause occurs.

The Start of Heading Character

The start of heading character (hex 01) is used to indicate that the line is a message to the operator, and not part of the text that is being printed. The start of heading character must be the first character in the line to be detected by the printer program. If the output file is being printed in "raw mode", the start of heading character is ignored.

When detected, the remainder of the line is not sent to the printer. Instead, it is placed in an area in the communications file and the printer program pauses. The "splstat" program can be used to read the communications file and display the line.

The Banner Page

Normally, each output file is prefixed with a banner page. The banner page contains the generated name of the file in large letters, followed by the date and time that the file is printed. The banner page begins and ends with a line containing only a form feed character. Printing of the banner page may be suppressed by an option specified to the queueing program. When the printer program is activated by the System Manager,

it may be configured so that a banner page is never printed. No attempt is made to insure that the banner page appears on a particular "even" or "odd" page.

Page Numbering

The printer program counts the pages that it prints. This is for accounting purposes as well as for printing only a part of an output file when requested by the user. The page number starts at one and is incremented whenever the first character of a line is a form feed character. The page number is also incremented if the specified number of lines on a page is reached before a form feed character is seen. The number of lines per page may be specified on a file-by-file basis when they are placed in the queue by the queueing program. If the number of lines per page is not specified when the file is queued, a default is assumed. This default is defined by the System Manager when the printer program is activated. If the System Manager does not specify a default, 66 lines per page is assumed.

While the printer program is printing a file, it periodically writes the current page number into the communications file where it may be displayed by the "splstat" program. To reduce system impact, this value is not written every time the page number changes, but only after several pages have been printed. Thus, the number displayed by "splstat" is only an approximation. If the printer program is stopping at the top of each page, the exact number of the page that is going to be printed is written into the communications file before the printer program pauses. Thus, if the "splstat" program indicates that the printer program is paused, the page number displayed is correct.

It is very important to note that the page number corresponds to the physical page number. It may have no relation to any page number that is printed at the top of each page of the output file.

Printing Part of a File

When an output file is put into the queue, the user may specify that only part of the file is to be printed. This is indicated by specifying a physical page range to the queueing program. The format of this option is described in the documentation of the queueing program. Again, it must be stressed that the page numbers specified are physical page numbers and may not be related to any page number that is printed on the listing.

If the starting page number is not one, the printer program must read the output file from the beginning so that it may count pages. This is the only way that it will know when it has reached the proper page at which to start printing. If the file is long, and the starting page number is large, a delay will be observed before printing starts. The delay is due to the printer program skipping the pages that are not

being printed.

Line Length

The largest line that may be in an output file is 511 characters. This includes both printing and non-printing characters. The maximum number of printing characters that is allowed is 255. The user may specify a maximum line length when a file is placed in the queue. If the printer program reads a line that is longer than the specified length, the offending line printed in parts on individual lines. If the user does not specify a line length, a default line length, specified by the System Manager when the printer program was activated, is used. If the System Manager did not specify a default length, 132 characters is assumed.

The user may request that lines longer than the maximum be truncated, with the remainder discarded, instead of printing the long line on several shorter lines. This is specified as an option when queueing the output file. The System Manager may force this condition on all files by specifying an option when the printer program is activated.

Restart Information

As indicated above, the printer program keeps track of the page number that it is currently printing. This information is used to restart the printing of a file in the event of an operating system crash. If the system should crash or be shut down while the printer program is actually printing a file, that file will not be reprinted from the beginning once the printer program is restarted. The restart information will be used to start printing the file at a position slightly before the page it was printing when the interruption occurred.

Passing Control Information to the Printer

In some cases, it is necessary to send control information to the printer device. An example of this would be when sending spacing information to a printer that is running in proportional spacing mode. In order to prevent the printer program from misinterpreting the control information, two actions should be taken by the user. First, the output file should be placed in the queue with the "raw mode" option specified. This is discussed later in the documentation of the queueing program. Second, any program that inserts control information should set the parity bit "on" in any control character that may be misinterpreted as a carriage return. Note that a carriage return is still necessary at the end of each line. A form feed may be used to indicate the start of a page, if desired.

Spooler Commands

This section describes the commands used to control operation of the UniFLEX Enhanced Printer Spooler. Most of the commands are available to any user of the system. Some are restricted to the System Manager. Also, some commands which any user may invoke take on extra power when used by the System Manager.

Command Program Structure

Most of the commands are actually performed by one program which resides in the "/etc" directory. This program is called "splcmd". However, it is never invoked with that name. The UniFLEX "link" mechanism is used to create meaningful names in the "/usr/bin" directory. It is these names that are used when invoking the commands. The "rgo", "splstat", and "requeue" commands are separate programs and reside in the "/usr/bin" directory.

The queueing program is called "spool" and also resides in the "/etc" directory. It also is never called with that name. The UniFLEX "link" mechanism is used to create a name in the "/bin" or "/usr/bin" directory that is the same as the name of the device that will be associated with that queueing program. This is described in more detail in the section on adding additional spoolers.

With the exception of the queueing program, the first argument to each command is the name of the spooler (which is the same as the name of the device). No path information should be specified since this will be supplied by the command itself when it uses the name.

ERROR MESSAGES

There are some error conditions which are detected by all commands. The following is documentation of these general error messages.

Cannot access spooler directory - The program could not gain access to the directory that contains information about the queue and printer program. This may be caused by the user having omitted the spooler name from the command, or having specified the wrong name.

Cannot access communications file - The command could not access the communications file used for interfacing with the printer program. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Cannot access queue file - The command could not access the file containing information about the files waiting to be printed. This normally indicates a severe problem and should be brought to the

attention of the System Manager.

Cannot create communications file - The communications file did not exist in the spooler directory and the command received an error when it tried to create a new communications file. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Cannot create queue file - The queue file did not exist in the spooler directory and the command received an error when it tried to create a new queue file. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Cannot start printer task - The command attempted to invoke the program but received an error when it tried to start the task. This normally indicates a severe problem and should be brought to the attention of the System Manager.

No spooler specified - No spooler name was specified to the command.

Communications file full - The command attempted to communicate with the printer program through the communications file, but could not find room in the file to post its request. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Error reading the queue file - The command received an I/O error when reading the queue file. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Cannot read communications file - An I/O error was detected when trying to read the communications file. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Error in communications file structure - The command detected an anomaly in the communications file. This normally indicates a severe problem and should be brought to the attention of the System Manager.

Other messages issued by commands are specific to each command and are described in the documentation of that command.

Spooler Commands

The following pages describe the individual spooler commands. Documentation for the queueing program is given first since the name that is used when the program is called will vary, depending on the device to which the output is being sent. For easy reference, the documentation for each command is given is alphabetical order and each

appears on a separate page. Documentation for the status program "splstat" appears after that for the commands.

The Queueing Program

Queue up output for a printer device.

SYNTAX

```
spooler_name file_name file_name ... options
spooler_name options
```

DESCRIPTION

The queueing program is invoked by specifying the name of the printer on which the output is to be printed. There are two ways of sending output to the queueing program: the output may already exist in a file, or the output may be sent to the queueing program via the UniFLEX "pipe" mechanism. If a file name is specified, that file is assumed to contain the information that is to be printed. If more than one file name is specified, each is assumed to be an independent output file and is queued under a different name. If no file name is specified, the queueing program reads its standard input channel, assuming that the data to be printed is being transmitted through a pipe. The data is queued when an end of file is detected. In either case, a unique name is generated for each file queued. It is this name that should be used in commands that refer to a file that has been queued. This name is reported back to the user in a message of the form:

"file" queued for spooler_name as "generated_name"

In this message, "file" is the name of the file that the user specified to the queueing program. (This is omitted if the data was transmitted through a pipe.) The "spooler_name" is the name of the spooler (printer) that will be printing the output, and "generated_name" is the name that the queueing program assigned to the file in the queue. The generated name is composed of the first eight characters of the user's name followed by a 3-digit sequence number.

There are several options available to the user when queueing information to be printed. Options are indicated by preceding a string of option letters with a plus sign; for example: "+bht". Most of the option letters are lower case letters, but some are in upper case. More than one such string may be specified, if necessary. Some options require that a value be specified. The value may immediately follow the option letter, or may be separated from the option letter by an equal sign. For example, the option "f10" is the same as "f=10". If combined with other option letters, options that take a value must be at the end of a string of option letters; for example: "+bf10". If options are specified along with more than one file name, the options apply to each file.

Detailed descriptions of the individual options follow.

F - Do not suppress blank pages. The printer program attempts to suppress the printing of completely blank pages caused by form feeds in consecutive lines. Specifying the "F" option will permit completely blank pages to be printed. This option may be forced on all files by the System Manager when the printer program is activated.

L - Specify maximum line length. This option is followed by a numeric value that specifies the maximum number of printable characters allowed on a line. This value may range from 1 through 255. Lines longer than this value will be broken into parts, each part being printed on a separate line. Another option may be used to cause truncation of long lines, with the excess being discarded. If this option is not used, a default line length, specified by the System Manager when the printer program was activated, is used.

P - Specify post-filter program. This option is used to specify the name of a post-filter program that will take output from the printer program, process it, and send it on to the device. Additional information about such post-filter programs is provided in a later chapter.

R - Indicate raw mode transfer. By specifying this option, the printer device will be put into "raw mode" before the file is printed. The effect of this will vary depending on the printer. Specifying the "R" option will also cause the "t" option, described below, to be set.

T - Truncate long lines. By specifying "T" as an option, lines which are longer than the specified maximum line length are truncated, with the excess data discarded. This option may be forced on all files by the System Manager when the printer program is activated.

b - Suppress the printing of the banner page. Specifying "b" will cause the printer program to not print a banner page at the beginning of the output file. This option may be forced on all files by the System Manager when the printer program is activated. Specifying the "s" option, described below, will also cause the "b" option to be set.

e - Ignore form feed characters. This option will cause the printer program to not send form feed characters to the printer. The form feed character will still be recognized as an indicator of the start of a new page. This applies only to form feed characters that appear as the first character of a line. Form feeds embedded in the middle of a line will not be detected and will be sent to the printer. This option may be forced on all files by the System

Manager when the printer program is activated.

f - Specify form number. This option requires that a value be specified. The value is a decimal number between 0 and 255 and is used to indicate that a specific form (paper) be used when printing the file. The printer program will print only those files whose form number matches that which it is accepting. If this option is not used, form number 0 is assumed.

h - Hold file in print queue. This option will cause the file to be put into the print queue with a priority of zero. The printer program will not print the file until the priority is made non-zero by the user or the System Manager.

l - Specify page length. This option is followed by a value between 0 and 255 inclusive which specifies the number of lines on a page. The printer program will increment the page number whenever the specified number of lines is printed, unless a form feed character is encountered. If this option is not used, a default value, specified by the System Manager when the printer program was activated, is assumed. If the file being printed does not contain form feeds, the user should be sure that the page length corresponds to the actual size of the paper being used. This will insure proper alignment and pauses if "stop at top of each page" is selected.

m - Do not issue "queued" message. This option will suppress the issuing of the message that indicates that the file has been successfully queued. Note that if this option is used, the user will not be informed of the generated name that is associated with the file in the print queue.

p - Specify page range. This option is used to specify a range of physical pages to print. By using this option, the user may indicate that only a portion of the output file is to be printed. The page range is specified in one of three ways:

p=fff-lll - Here, "fff" is the first physical page number and "lll" is the last physical page number. Only pages "fff" through "lll" inclusive will be printed.

p=fff - Here, "fff" indicates the first physical page to print. Pages "fff" through the end of the file will be printed.

p=-lll - Here, "lll" indicates the last physical page to print. Printing will occur from the beginning of the file through page "lll".

Note that physical page numbers are those counted by the printer program, and may have no relation to page numbers printed on the

paper.

r - Specify repeat count. This option is used to cause the printer program to print additional copies of the output file. A value between 1 and 255 inclusive may be specified and indicates that number of additional copies to be printed. For example, specifying "r3" implies three additional copies, for a total of 4 copies of the output.

s - Stop at top of page. Specifying the "s" option will cause the printer program to pause at the top of each page. The "go" command is used to resume printing. If the file being printed contains form feed characters to indicate the start of a page, the form feed is sent to the printer (unless suppressed by the "e" option) before the printer program pauses. This option may be forced on all files by the System Manager when the printer program is activated. Specifying this option also selects the "b" option.

t - Do not expand horizontal tab characters. Normally, the printer program replaces horizontal tab characters with enough spaces to reach the next tab stop. (Tab stops are defined every eight columns, viz. 8, 16, 24, ...). Specifying this option will cause the tab characters to be sent directly to the printer. This assumes that the printer will do the necessary spacing. This option may be forced on all files by the System Manager when the printer program is activated.

Use of Filter Programs

In some cases, it is desired to perform some editing of the contents of an output file before putting it in the queue. An example of this would be if it were desired to replace all occurrences of a form feed character with three blank lines. One method for doing this is through the use of a "filter" program.

A filter is a program that reads data from its standard input channel, edits it, and then writes it to its standard output channel. Information is sent to a filter through the UniFLEX "pipe" mechanism. Similarly, the output from the filter is usually directed into another program through another pipe. When used with the printer spooler, the filter would send its output into a pipe connected to the queueing program. For example, if the program that replaced form feeds with blank lines were called "ff", its use as a filter into the queueing program for "spr" would look like:

```
list file ^ ff ^ spr
```

Use of this type of filter program should not be confused with

"post-filters" which are discussed in a separate chapter.

EXAMPLES

ppr program data
Print the contents of the files "program" and "data" on the printer "ppr".

page program ^ spr2 +s
Print the listing of the file "program" as output by the "page" utility on the printer "spr2", pausing at the top of each page.

ppr manual +sp10-20 +l88
Print pages 10 through 20 inclusive of the file "manual" on printer "ppr", stopping at the top of each page. Specify that a page consists of 88 lines of print.

ERROR MESSAGES

Cannot locate "file" - The queueing program could not locate the file that the user specified as an argument.

"file" is not a file - The name that was specified to the queueing program was that of a device or a directory, not a file.

Permissions deny access to "file" - The person queueing the file does not have permission to read the file being queued.

Cannot link "generated name" to "file" - The queueing program could not create the file entry in the spooler directory, even though the file resides on the same device as the spooler directory. This may indicate a corrupted disk and should be brought to the attention of the System Manager.

Cannot create "generated name" - The queueing program attempted to copy the data to be printed into a file in the spooler directory, but an error was detected during the copy process.

Unknown option specifed - An invalid option letter was specified to the queueing program.

Error in line length - A non-numeric character was detected in the value that was specified by the "L" option.

Line length too large - The line length specified by the "L" option was larger than 255.

Error in form number - A non-numeric character was detected in the

value that was specified by the "f" option.

Form number too large - The form length specified by the "f" option was larger than 255.

Error in page length - A non-numeric character was detected in the value that was specified by the "l" option.

Page length too large - The page length specified by the "l" option was larger than 255.

Error in repeat count - A non-numeric character was detected in the value that was specified by the "r" option.

Repeat count too large - The repeat count specified by the "r" option was larger than 255.

Error in page specification - One of the page numbers specified by the "p" option contained a non-numeric character.

Illegal filter name - The specified name of a post-filter either was longer than 14 characters or contained the path separator character (the slash).

abort

Stop printing immediately and deactivate the printer program.

SYNTAX

```
abort spooler_name
```

DESCRIPTION

This command may only be issued by the System Manager. When issued, the printer program is immediately deactivated. If a file is currently being printed, the printing of that file stops immediately and the file is discarded. If no file is currently being printed, the effect of this command is the same as that of the "pstop" command. Once this command is issued, the "insp" command will have to be used to reactivate the printer program.

EXAMPLE

```
abort ppr
```
Terminate printing on the printer "ppr" and deactivate the printer program.

ERROR MESSAGE

Only System Manager may use this command - A user who was not the System Manager attempted to invoke this command.

break

Stop printing the current file and return it to the queue in such a way that when printing of that file resumes, it will start just before the current page.

SYNTAX

```
break spooler_name optional_priority
```

DESCRIPTION

When the "break" command is issued, the printer program stops printing the current file and returns it to the print queue. The file is returned in such a way that when the printing of that file resumes, it will start at some point just before the page that was printing when the "break" command was issued. This means that the printing of a file may be interrupted and resumed at a later time without having to print the entire file. After processing the "break" command, the printer program becomes "idle". The "next" command must be used to cause the printer program to begin searching for more files to print.

An optional priority may be specified when the "break" command is invoked. This priority will be assigned to the file when it is put back into the queue. If none is specified, the maximum priority, 255, is assigned to the file. This means that this file should be the first file to be printed once printing is resumed. Normally, one would specify a priority only if one lower than 255 is desired. Such would be the case if the user wanted to hold the file in the queue until a later time.

If no file is being printed when this command is issued, or if the printer program is not active, this command has no effect. The System Manager may always invoke the "break" command; however, a user may invoke the "break" command only if that person is the owner of the file that is currently being printed.

EXAMPLES

```
break ppr
```
Stop printing the current file, return it to the queue with a priority of 255, and idle the printer program.

```
break spr2 0
```
Stop printing the current file, return it to the queue with a priority of 0, and idle the printer program.

ERROR MESSAGES

Error in priority - The specified priority contained a non-numeric character.

Priority too large - The specified priority was larger than 255.

User does not own the file being printed - The user did not own the file that was being printed and was not the System Manager.

end

Terminate the printing of the current file and look for another file to print.

SYNTAX

```
end spooler_name
```

DESCRIPTION

The "end" command will cause the printer program to stop printing the current file, discard it, and search the queue for another file to print. If no file is being printed, this command has no effect. The System Manager may always invoke the "end" command; however, a user must own the file being printed in order to invoke the "end" command.

EXAMPLE

```
end spr
```
Stop printing the current file on "spr" and search the queue for another file to print.

ERROR MESSAGE

User does not own the file being printed - The user does not own the file that is being printed and is not the System Manager.

forms

Tell the printer program which form is currently in the printer.

SYNTAX

```
forms spooler_name form_number
```

DESCRIPTION

The "forms" command is used to tell the printer program that a new form has been put into the printer. The printer program will only print those files whose specified form number matches the one that is in the program. By associating the proper form number with an output file, the user may have output files that require different paper in the queue at the same time. When the proper paper has been put into the printer, the "forms" command is used to inform the printer program of the change, and it will then search for and print the appropriate files.

The "form_number" may take on a value from 0 through 255. Any user may invoke the "forms" command. The printer program must be "active" for the "forms" command to take effect. If the printer program is not active when the "forms" command is invoked, an error message is returned. If the printer program is waiting for a "go", the "forms" command will be pended and not processed until the printer program is started.

Form numbers have no particular meaning in themselves. The association of a number with a particular form is usually decided by the System Manager.

EXAMPLE

```
forms spr 25
```
Indicate that form number 25 is now in the printer for "spr".

ERROR MESSAGES

Printer is not active - The command was invoked when the printer program was not "active".

Error in form specification - The form number contained a non-numeric character.

Form number too large - The specified form number was larger than 255.

go

Resume printing after the printer program has paused.

SYNTAX

```
go spooler_name
```

DESCRIPTION

The "go" command is used to resume the printing of a file that has been stopped because the printer program has paused. The pause may have occurred automatically at the top of a page, or as the result of a "pause" command or the detection of an operator message in the file being printed.

The System Manager may issue a "go" at any time; however, a user may issue a "go" only if that person owns the file that is currently being printed. If no file is currently being printed, the "go" command is ignored. If the printer program is not active when the "go" command is issued, an error message is returned. If it is anticipated that the user will have to invoke the "go" command several times in succession, the "rgo" command will be less tedious to use.

NOTE: The "go" command should not be issued unless the printer program is actually paused. If the "go" command is issued when the printer program is actively printing a file, and is not paused, information will be lost on the page that is currently being printed. The "splstat" program or "rgo" command will indicate when the printer program is actually paused.

EXAMPLE

```
go ppr
```
Resume printing of the file on the printer "ppr".

ERROR MESSAGES

User does not own the file being printed - The user does not own the file that is being printed and is not the System Manager.

Printer is not active - The command was invoked when the printer program was not "active".

idle

Stop searching for files when the current file being printed is finished or when the queue is empty.

SYNTAX

```
idle spooler_name option
```

DESCRIPTION

This command causes the printer program to become "idle". It will no longer search for files to print. The "next" command is used to start the printer program searching for files again. If the "idle" command is issued with no option specified while the printer program is printing a file, that file will print to completion, including any additional copies, if specified. The only allowable option is "+e". If specified, the printer program will go idle only when it has processed all the files in the queue. Any user may issue the "idle" command. If the printer program is waiting for a "go", the "idle" command is pended and will be processed when the printer program is started.

EXAMPLES

```
idle spr2
```
Have the printer program for "spr2" stop searching for files to print.

```
idle ppr +e
```
Have the printer program for "ppr" stop searching for files to print when it has finished processing all the files in the queue.

ERROR MESSAGE

Printer is not active - The command was invoked when the printer program was not "active".

insp

Activate a printer program.

SYNTAX

```
insp spooler_name options
```

DESCRIPTION

The "insp" command is used by the System Manager to activate the printer program for a particular spooler. This command normally resides in the "/etc" directory. The "spooler_name" is the name of that spooler (printer) that will be printing the output.

There are several options available to the System Manager when activating a printer program. Options are indicated by preceding a string of option letters with a plus sign; for example: "+bit". Most of the option letters are lower case letters, but some are in upper case. More than one such string may be specified, if necessary. Some options require that a value be specified. The value may immediately follow the option letter, or may be separated from the option letter by an equal sign. For example, the option "f10" is the same as "f=10". If combined with other option letters, options that take a value must be at the end of a string of option letters; for example: "+bf10".

Many of the options selected by the "insp" command are reported when the status of the printer program is requested with the "splstat" command, described later. Detailed descriptions of the individual options follows.

E - Print terminal eject. This option will cause the printer program to issue a form feed after all the files in the queue have been processed. This should be sufficient to force the last page out of the printer so that it may be torn off.

F - Do not suppress blank pages. The printer program attempts to suppress the printing of completely blank pages. Specifying the "F" option will permit completely blank pages to be printed. This option will be forced on all files printed by the printer program and cannot be overridden by the user.

L - Specify maximum line length. This option is followed by a numeric value that specifies the maximum number of printable characters allowed on a line. This value may range from 1 through 255. Lines longer than this value will be broken into parts, each part being printed on a separate line. Another option may be used to cause truncation of long lines, with the excess being discarded. This value may be altered on an individual file by the user when

that file is put into the print queue. If this option is not used, a default line length of 132 characters is assumed.

P - Specify post-filter program name. This option is used to specify the name of a post-filter program that will take output from the pronter program, process it, and send it on to the printer device. This post-filter will be used for all files in the queue except for those for which the user has specified a different post-filter. Additional information on post-filters is contained in a separate chapter.

R - Indicate raw mode transfer. By specifying this option, the printer device will be put into "raw mode" for all files being printed. The individual user may not override this option. The effect of this will vary depending on the printer. Specifying the "R" option will also cause the "t" option, described below, to be set.

T - Truncate long lines. By specifying "T" as an option, lines which are longer than the specified maximum line length are truncated, with the excess data discarded. This option will be forced on all files printed by the printer program and cannot be overridden by the user.

a - Specify ACK/ETX protocol for the device. This option will cause the printer program to append an ETX character (hex 03) to the end of each line, and will not send another line to the printer until an ACK character (hex 06) is received from the printer. This requires that the printer be connected as a bidirectional device. Additional information on protocol operation is given in the section on adding new printers to the system. Specifying this option also forces the "x" option.

b - Suppress the printing of the banner page. Specifying "b" will cause the printer program to not print a banner page at the beginning of each output file. The user cannot override this option and cause a banner page to be printed. Specifying the "s" option, described below, will also cause the "b" option to be set.

d - Double-buffered protocol in effect. This option indicates that the ACK/ETX protocol is in effect and that the protocol is double-buffered. This means that the printer program will attempt to overlap the processing of the next line with the printing of the current line. In effect, an ETX is sent to the printer and no wait for an ACK is performed until the after the next line is sent. Additional information about protocol operation is in the section on adding new printers to the system. This option forces the "a" and "x" options.

e - Ignore form feed characters. This option will cause the printer program to not send form feed characters to the printer. The form feed character will still be recognized as an indicator of the start of a new page. This applies only to form feed characters

that appear as the first character of a line. Form feeds embedded *in the middle of a line will not be detected and will be sent to* the printer. This option may not be overridden by the user.

f - Specify initial form number. This option requires that a value be specified. The value is a decimal number between 0 and 255 and is used to indicate that a specific form (paper) be used when printing a file. The printer program will print only those files whose form number matches that which it is accepting. If this option is not used, form number 0 is assumed. Users may change the form number with the "forms" command.

i - Bring up in "idle" condition. Specifying this option will cause the printer program to be activated in an "idle" condition. The "next" command will have to be issued before the printer program will start to search the queue for files to print.

l - Append a line feed to the end of each line. Specifying this option will cause a line feed character (hex 0A) to be inserted after the carriage return in each line. This option is used to accommodate those printers that do not automatically perform a line feed on receiving a carriage return character.

m - Do not issue accounting message. This option will cause the printer program to not issue accounting messages. More information about this is in the section on accounting messages.

p - Specify page length. This option is followed by a value between 0 and 255 inclusive which specifies the number of lines on a page. The printer program will increment the page number whenever the specified number of lines is printed, unless a form feed character is encountered. If this option is not specified, a default value of 66 is assumed. The individual user may override the default value by specifying a page length when the file is put into the print queue.

s - Stop at top of page. Specifying the "s" option will cause the printer program to pause at the top of each page. The "go" command is used to resume printing. If the file being printed contains form feed characters to indicate the start of a page, the form feed is sent to the printer (unless suppressed by the "e" option) before the printer program pauses. This option is forced on all files printed by the printer program and cannot be overidden by the user. Specifying this option forces the "b" option.

t - Do not expand horizontal tab characters. Normally, the printer program replaces horizontal tab characters with enough spaces to reach the next tab stop. (Tab stops are defined every eight columns, viz. 8, 16, 24, ...). Specifying this option will cause the tab characters to be sent directly to the printer. This assumes that the printer will do the necessary spacing. This option is forced on all files printed by the printer program and

cannot be overridden by the user.

u - Map output to upper case. Specifying this option will cause all lower case characters in the file to be mapped into their upper case equivalents before being sent to the printer. The following special characters are also mapped as indicated:

```
{ is mapped onto (
| is mapped onto !
} is mapped onto )
~ is mapped onto ^
DEL is mapped onto a space
```

x - Append ETX to each line. This option causes an ETX character (hex 03) to be appended to the end of each line before it is sent to the printer. The ETX may be required by the printer for proper operation, or may be part of an ETX/ACK protocol sequence.

EXAMPLES

/etc/insp ppr +sf10
Activate the printer program for "ppr". The printer program will always stop at the top of each page and will initially print only those files that require form number 10.

/etc/insp spr +sieap88 +L80
Activate the printer program for "spr". This printer program will be brought up in the "idle" state and will always stop at the top of each page. Form feed characters will not be sent to the printer, and the ETX/ACK protocol will be observed. The default page length is 88 lines and the default line length is 80 characters.

ERROR MESSAGES

Unknown option specifed - An invalid option letter was specified to the "insp" command.

Error in line length - A non-numeric character was detected in the value that was specified by the "L" option.

Line length too large - The line length specified by the "L" option was larger than 255.

Error in form number - A non-numeric character was detected in the value that was specified by the "f" option.

Form number too large - The form length specified by the "f" option was

larger than 255.

Error in page length - A non-numeric character was detected in the value that was specified by the "p" option.

Page length too large - The page length specified by the "p" option was larger than 255.

Page length is zero - A zero value was specified as the parameter to the "p" option.

Only System Manager may use this command - A user who was not the System Manager attempted to invoke this command.

Printer already active - The printer program for the specified spooler was already active when the "insp" command was issued.

Illegal filter name - The specified name of a post-filter either was longer than 14 characters or contained the path separator character (the slash).

Cannot run filter with protocol - The System Manager specified a post-filter name and either the "a" or "d" option.

next

Start the printer program searching the queue for files to print.

SYNTAX

```
next spooler_name
next spooler_name file_name
```

DESCRIPTION

The "next" command will remove the printer program from the "idle" state, causing it to resume the searching of the queue for files to print. Any user may issue the "next" command for this purpose. If the printer program is not active when this command is issued, an error message is returned.

The "next" command may also be used by the System Manager to force a particular file in the print queue to be the next file printed, regardless of its priority or form number. In this case, the desired file name is specified after the spooler name when the command is invoked. The file name must be the name as it appears in the queue (the "generated" name). If the printer program is not printing a file when the System Manager requests that a specific file be printed, printing of that file will begin immediately. This will occur even if the printer program is "idle". If the printer program is currently printing a file when the System Manager requests that a specific file be printed next, the printer program will remember the name of that file and will print it as soon as the current file is finished (including additional copies, if any). Only one name may be remembered by the printer program.

If the "next" command is issued while the printer program is waiting for a "go", the "next" command will be pended and processed when the printer program is started.

EXAMPLES

```
next spr
```
Cause the printer program for "spr" to resume its searching of the queue for files to print.

```
next ppr system035
```
Request that the file "system035" be the next file printed regardless of its priority, form number, or whether or not the printer program is idle.

ERROR MESSGAGES

Printer is not active - The command was invoked when the printer program was not "active".

File name is too long - The name of the file that was specified as the next file to be printed is too long to be a valid name.

Another file is pending - The System Manager attempted to specify a file to be printed next when the printer program was already remembering the name of a file to print after the current file is printed.

Only System Manager may use this command - A user who was not the System Manager attempted to specify that a particular file is to be printed next.

pause

Stop printing temporarily.

SYNTAX

```
pause spooler_name option
```

DESCRIPTION

The "pause" command will cause the printer program to stop the printing of the current file and wait for a "go" command to be issued. The only option allowed is "+t". If this option is specified, the pause will take place at the top of the next page. The System Manager may issue the "pause" command while any file is being printed. A user who is not the System Manager may issue the "pause" command only if that person owns the file being printed.

EXAMPLES

pause ppr
: Cause the printer for "ppr" to stop printing and wait for a "go" command.

pause spr +t
: Cause the printer for "spr" to stop printing and wait for a "go" when the top of the next page is reached.

ERROR MESSAGES

User does not own the file being printed - The user does not own the file that is being printed and is not the System Manager.

Printer is not active - The command was invoked when the printer program was not "active".

Printer is not running - The printer program was not printing a file when the command was issued.

pskip

Skip pages forwards or backwards.

SYNTAX

```
pskip spooler_name skip_count
```

DESCRIPTION

This command allows the user to have the printer program skip forward or backward in the file currently being printed. The skip_count is the number of pages to be skipped. If this is a positive number, the skip will be forward; if negative, the skip will be backward. If no skip_count is specified, a skip forward of one page is performed. The skip count may not be larger than 255.

The printer program must be stopped, waiting for a "go", when this command is issued. It is not possible to skip beyond the page range of the file. A skip backward before the first page will cause printing to resume at the first page of the page range. A skip forward past the last page will cause printing of the file to terminate. A skip backward is performed by rewinding the file and skipping pages until the desired page is reached. On large files, this may take some time.

The System Manager may issue a "pskip" on any file being printed; however, a user may invoke "pskip" only if that person owns the file that is being printed.

EXAMPLES

```
pskip ppr
```
Skip forward one page on "ppr".

```
pskip spr +5
```
Skip forward five pages on printer "spr". The "+" in front of the skip count is optional.

```
pskip spr2 -3
```
Skip backward 3 pages on printer "spr2".

ERROR MESSAGES

User does not own the file being printed - The user does not own the file that is being printed and is not the System Manager.

Printer is not active - The command was invoked when the printer program was not "active".

Printer is not running - The printer program was not printing a file when the command was issued.

Error in skip count - The skip count was not a number.

Skip count too large - The skip count was larger than 255.

Printer is not stopped - The printer program was not waiting for a "go" when the command was issued.

pstop

Stop printing at end of current file and deactivate the printer program.

SYNTAX

```
pstop spooler_name
```

DESCRIPTION

This command may only be issued by the System Manager. When issued, this command causes the printer program to finish printing the current file (including additional copies, if any) and then deactivate. Once issued, this command may not be rescinded by any other command. The "insp" command must be used to reactivate the printer program after it has become inactive.

If no file is currently being printed, the printer program is immediately deactivated.

EXAMPLE

```
pstop ppr
```
Finish printing the current file and deactivate the printer program.

ERROR MESSAGE

Only System Manager may use this command - A user who was not the System Manager attempted to invoke this command.

purge

Remove files from the print queue.

SYNTAX

```
purge spooler_name file_names
```

DESCRIPTION

The "purge" command is used to remove one or more files from the print queue before they are printed. The System Manager may remove any file from the print queue. Other users may only remove files that they own. A file may not be removed if it is the file that is currently being printed. The names that are specified to this command are those assigned by the queueing program (the "generated" name).

EXAMPLES

```
purge ppr source231
```
Remove the file "source231" from the print queue for "ppr".

```
purge spr source001 test023
```
Remove files "source001" and "test023" from the print queue for "spr".

ERROR MESSAGES

File "file name" is not in the queue - The indicated file name could not be found in the print queue.

"File name" is busy - The indicated file is currently being printed and cannot be removed. The "end" command should be used to terminate printing of the file.

User is not the owner of "file name" - The user does not own the indicated file.

requeue

Change parameters on a file in a queue, optionally moving it to another queue.

SYNTAX

```
requeue spooler_name file_names options
```

DESCRIPTION

This command permits the user to change parameters on a file in a print queue. Optionally, the file may be moved to another queue.

A user may only requeue files owned by that user. The System Manager, however, may requeue any file. The list of file names is optional. If a list is specified, only those files are affected by the requeue command. If no list is specified, all files owned by the user are affected. Additional form number and priority constraints on those files affected may be applied through the use of some of the options described below.

There are three classes of options, each of which is indicated by a special first character. These are "+" options, "-" options, and "@" options. The "+" options are identical to those used with the queueing program. Specifying any one of these options will cause that option to take effect in the same way as though the file were originally queued with that option. See documentation on "The Queueing Program" for information on these options.

The "-" options are used to reverse the effect of options already in force on a file in the queue. In essence, these options take on a meaning exactly opposite to that of the corresponding "+" options. When applying the options to a file in the queue, the "-" options are applied first, followed by the "+" options. If the System Manager has forced the corresponding "+" option on all files when the printer program was activated, the "-" option will have no effect. Detailed descriptions of these "-" options follows.

F - Suppress blank pages. Specifying this option will cause the printer program to attempt to suppress completely blank pages.

P - Remove post-filter. Specifying this option will remove any post-filter name associated with this file. This option will not affect a post-filter that was specified on the "insp" command by the System Manager when the printer program was activated.

R - Clear raw mode transfer. When printed, the file will not be printed with the printer device in "raw mode". Specifying this

option will also clear the "t" option.

T - Fold (do not truncate) long lines. Lines longer than the specified maximum line length will be printed on more than one line instead of being truncated.

b - Print a banner page. A banner page will be printed in front of the file.

e - Process form feed ejects. This option will cause the printer program to send form feed characters to the printer instead of ignoring them.

h - Release "hold" of file in queue. This option will assign the default priority to the file, thus allowing it to be printed by the printer program.

s - Do not stop at the top of each page. This option will cause the printer program to not stop when the top of a page is reached.

t - Expand tabs. This option will cause the printer program to replace horizontal tab characters with sufficient spaces to reach the next tab stop. Tab stops are defined every eight columns.

As a convenience to the user, the following "-" options are exactly equivalent to the corresponding "+" options: L, f, l, p, and r.

The "@" options are used to apply additional constraints on which files will be affected by the "requeue" command. They are also used to supply information relating to the movement of files to another queue. Detailed descriptions of these options follows.

f - Specify form number. This option specifies which form number is to be affected by the "requeue" command. Files which have a different form number are not affected. An equals sign between the letter "f" and the form number is optional. If the form number is being changed with the "+f" option, the original form number, not the new one, should be specified for the "@f" option.

k - Retain file in original queue. This option may be used only when moving files to another queue. If specified, the file moved will not be deleted from its original queue. Thus, it will appear in two queues: the original queue, and the queue to which it was moved. This option requires that the "@q" option, described below, also be specified.

p - Specify priority constraints. This option allows the user to specify a range of priorities that control which files are to be affected by the "requeue" command. Files whose priorities fall within the specified range will be processed. The priority range is indicated by one of the following three forms:

p=lll-hhh - Files whose priority is between "lll" and "hhh", inclusive, are processed.

p=lll - Files whose priority is "lll" or larger are processed.

p=-hhh - Files whose priority is "hhh" or smaller are processed.

The equals sign is optional.

q - Specify new queue name. Specifying this option will cause the files to be moved to the indicated queue. Unless the "@k" option is also specified, each file moved will be purged from the original queue. An equals sign between the "q" and the queue name is optional.

When files are moved to a new queue, the original name will be kept whenever possible. If the original name should be the same as the name of a file in the new queue, a new name will be assigned to the file being moved. This name will be reported to the user.

EXAMPLES

requeue spr source129 +sf10
Change the parameters on file "source129" in the "spr" queue to add "stop at top of form" and set the form number to 10.

requeue spr source004 @q=ppr
Move the file "source004" from the "spr" queue to the "ppr" queue.

requeue spr -h @q=spr2 @p-0
Move those files which have priority zero from the "spr" queue to the "spr2" queue. Also release the "hold" on those files.

requeue ppr +f20 @f0
Change the form number to 20 on all files in the "ppr" queue that currently have form number 10.

ERROR MESSAGES

File "file name" is not in the queue - The indicated file name could not be found in the print queue.

"File name" is busy - The indicated file is currently being printed and cannot be requeued.

User is not the owner of "file name" - The user does not own the indicated file.

Unknown option specifed - An invalid option letter was specified to the

requeueing program.

Error in line length - A non-numeric character was detected in the value that was specified by the "L" option.

Line length too large - The line length specified by the "L" option was larger than 255.

Error in form number - A non-numeric character was detected in the value that was specified by the "f" option.

Form number too large - The form length specified by the "f" option was larger than 255.

Error in page length - A non-numeric character was detected in the value that was specified by the "l" option.

Page length too large - The page length specified by the "l" option was larger than 255.

Error in repeat count - A non-numeric character was detected in the value that was specified by the "r" option.

Repeat count too large - The repeat count specified by the "r" option was larger than 255.

Error in page specification - One of the page numbers specified by the "p" option contained a non-numeric character.

Error in priority specification - One of the priority numbers specified by the "@p" option contained a non-numeric character.

Priority too large - One of the priority numbers specified by the "@p" option was larger than 255.

Cannot create "file name" - The requeueing program could no create the indicated file in the new queue when attempting to move a file.

Cannot access "file name" - The requeueing program could not access the indicated file in the old queue when attempting to move a file.

Error while reading "file name" - An I/O error was detected while reading the indicated file.

Error while writing "file name" - An I/O error was detected while writing the indicated file.

Illegal spooler name - The name specified by the "@q" option was longer than 14 characters or contained a path separator character ("/").

Error reading new queue file - An I/O error was detecting while reading

the new queue file.

"@k" requires move to new queue - The "@k" option requires that the "@q" option be specified.

Cannot requeue file - An error other than "file exists" or "crossed devices" was received when the requeueing program attempted to create an entry in the new queue.

Illegal filter name - The specified name of a post-filter either was longer than 14 characters or contained the path separator character (the slash).

rerun

Stop printing the current file and return it to the queue.

SYNTAX

rerun spooler_name optional_priority

DESCRIPTION

When the "rerun" command is issued, the printer program stops printing the current file and returns it to the print queue. The file is returned to the queue in such a way that when printing is resumed, that file will be printed from the beginning. After processing the "rerun" command, the printer program becomes "idle". The "next" command must be used to cause the printer program to begin searching for more files to print.

An optional priority may be specified when the "rerun" command is invoked. This priority will be assigned to the file when it is put back into the queue. If none is specified, the maximum priority, 255, is assigned to the file. This means that this file should be the first file to be printed once printing is resumed. Normally, one would specify a priority only if one lower than 255 is desired. Such would be the case if the user wanted to hold the file in the queue until a later time.

If no file is being printed when this command is issued, or if the printer program is not active, this command has no effect. The System Manager may always invoke the "rerun" command; however, a user may invoke the "rerun" command only if that person is the owner of the file that is currently being printed.

EXAMPLES

```
rerun ppr
```
Stop printing the current file, return it to the queue with a priority of 255, and idle the printer program.

```
rerun spr2 0
```
Stop printing the current file, return it to the queue with a priority of 0, and idle the printer program.

ERROR MESSAGES

Error in priority - The specified priority contained a non-numeric character.

Priority too large - The specified priority was larger than 255.

User does not own the file being printed - The user did not own the file that was being printed and was not the System Manager.

rgo

Allow the user to give a "go" by typing only one character.

SYNTAX

```
rgo spooler_name
rgo spooler_name wait_time
```

DESCRIPTION

This command is used when it is necessary to issue several "go" commands to a printer program. Such would be the case, for example, when printing a document on single sheet forms and the printer program is stopping at the top of each page.

When invoked, this program watches the printer program for the specified printer device and will report when the program has paused. The current page number will also be reported. If the pause was caused by the detection of an operator message in the output file, the message is displayed after the page number. This command will then wait for a single character to be typed. When a character is received, it will issue a "go" to the printer program. This command is terminated by typing control-c. The command may also be terminated by typing control-d when it is waiting for the user to type a character.

This program may be invoked by any user. However, the program will not watch a printer unless it is printing a file that is owned by the user. The System Manager is not subject to this restriction and may use this command on any file that is being printed.

If this command is invoked with a "wait time" specified, it will pause for that number of seconds after detecting that the printer program has stopped, and then issue the "go" automatically, without the user having to type a character. The wait time must be a number between 1 and 255 inclusive. A wait time of zero is treated as though no wait time were specified, and "rgo" will wait for the user to type a character before giving a "go" to the printer program. When running "rgo" with a wait time specified, the user should make sure that enough time has been allowed to permit the performance of whatever duties are required while the printer program is paused.

To minimize system impact, the "rgo" command delays for 5 seconds between checks for the printer program having paused. If the printer program is not running, or is printing a file that is not owned by the user, "rgo" will delay 30 seconds and then check again for a file being

printed.

EXAMPLES

rgo ppr
Monitor the printer program for "ppr" and issue a "go" whenever the user types a character.

rgo spr 15
Monitor the printer program for "spr" and automatically issue a "go" 15 seconds after a pause is detected.

ERROR MESSAGE

Error in wait time - The specified wait time contained a non-numeric character or was greater than 255.

setpr

Change priority of a file in the print queue.

SYNTAX

```
setpr spooler_name file_name new_priority
```

DESCRIPTION

The "setpr" command is used to change the priority of a file in the print queue before it is printed. The file name that is specified is the name that was generated by the queueing program when the file was put into the print queue. The new priority is a number between 0 and 255 inclusive, subject to certain restrictions described below. A new priority may not be set on a file if it is currently being printed.

The System Manager may set any priority on any file that is in the print queue. If a user wishes to change the priority of a file in the print queue, several restrictions apply.

1. The user must be the owner of the file whose priority is being changed.

2. If the current priority of the file is above 20, the priority may not be increased, only decreased.

3. If the current priority of the file is less than 20, the priority may be set to any value between 0 and 20 inclusive.

EXAMPLES

setpr ppr source231 30
: Set the priority of the file "source231" in the queue for "ppr" to 30. Unless the user is the System Manager, 30 must be less than the current priority of the file.

setpr spr source021 0
: Set the priority of the file "source021" in the queue for "spr" to zero. This will prevent the file from being printed until the priority is made non-zero.

ERROR MESSAGES

File "file name" is not in the queue - The indicated file name could not be found in the print queue.

"File name" is busy - The indicated file is currently being printed and cannot have its priority changed.

User is not the owner of "file name" - The user does not own the indicated file.

Not enough arguments - The spooler name, file name, or new priority is missing from the command.

User may not increase priority - The user may increase the priority only if the current priority of the file is below 20.

The Status Program

Obtain a report of the status of the printer and/or the print queue.

SYNTAX

splstat spooler_name options

DESCRIPTION

This program is used to report on the status of the printer program and/or the print queue. It may be invoked by anyone. If no options are specified, a report on the status of the printer program is returned. By specifying an option, information about the print queue may be obtained. The following are the valid options:

a - Report the status of the printer program and the contents of the print queue.

q - Report the contents of the print queue only.

Printer Program Activity Status

The "splstat" program first reports whether or not the printer program is active. The message reporting this information may take on one of three forms:

Printer for "spooler" is not active - The printer program for the indicated spooler has not been activated by the System Manager with the "insp" command.

Printer for "spooler" is active, but no file is being printed - The printer program has been activated by the System Manager with the "insp" command but is not actively printing a file. Following this message is a section giving some facts about the current configuration of the printer spooler.

Printer for "spooler" is running as task nnn - The printer program has been activated by the System Manager with the "insp" command and is currently running as a task. The "nnn", above, is replaced by the task number of the printer program. If the printer program is actually printing a file, the name of the file and an approximation of the physical page number of the file currently being printed are given. If the System Manager has requested that a specific file be printed after the current one is finished, the name of that file is given, preceded by "Pending file: ". Following this information is a section giving some facts about the current configuration of the printer program.

Printer Facts Section

If the printer program has been activated by the System Manager with the "insp" command, a section titled "Printer Facts" is displayed. If the printer is paused because it has detected a printer message in the file being printed, that message is displayed immediately below the title. The rest of the information in this section indicates the current configuration of the printer program. Some of the messages are the result of the parameters specified by the System Manager when the "insp" command was issued. The following is a summary of those messages that may appear:

Idled - The printer program is in an "idle" condition and will not search the queue for files to print. The "next" command must be used to start the printer program searching for files to print.

Waiting for a "go" - The printer program is paused and will not resume printing until a "go" command is issued. The "rgo" command may also be used to give a "go" to a paused printer program.

Tab characters are not being expanded - The "t" option was specified by the System Manager when the printer program was activated. No horizontal tab characters in any output file will be expanded. It is assumed that the printer itself has the capability to handle horizontal tab characters.

Accounting messages are disabled - No accounting messages are being produced by the printer program. More information about accounting messages is given in a separate section of this manual.

ETX being appended to each line - An ETX character is being appended to each line before it is sent to the printer device.

Default page length: nnn - Unless overidden by the user when a file is put into the print queue, the indicated number of lines "nnn" is assumed to constitute one page.

Form number: nnn - The printer program will only print those files whose form number matches the indicated number, "nnn". This number may be changed by using the "forms" command.

Filter: xxxx - The post-filter program "xxxx" will be used for printing all files except for those for which a different post-filter was specified.

Form feeds are being suppressed - The System Manager specified the "e" option when the printer program was activated. Form feed characters which appear at the beginning of a line will not be sent to the printer device.

Banner is suppressed - The "b" option was specified by the System Manager when the printer program was activated by the "insp"

command. The printer program will not print a banner page for any file in the print queue.

Pause always occurs at the top of each page - The System Manager specified the "s" option to the "insp" command when the printer program was activated. The printer program will pause and wait for a "go" when the top of each page is detected. This will occur for any file in the print queue.

Lower case letters are mapped to upper case - The "m" option was specified when the printer program was activated. All lower case characters in the output file are mapped into their upper case equivalents. Some special characters are also mapped into different characters. Details of this mapping are given in the documentation of the "insp" command.

Line feed is appended to each line - The System Manager specified the "l" option when the printer program was activated. All lines in each output file will have a line feed character inserted after the carriage return before the line is sent to the printer device.

ACK/ETX protocol being observed - The "a" option was specified when the printer program was activated. An ETX character will be appended to each line before it is sent to the printer device, and another line will not be processed until an ACK character is received from the printer.

ACK/ETX protocol is double buffered - The "d" option was specified when the printer program was activated. The printer program will append an ETX character to the end of each line before it is sent to the printer device, and will send a line before waiting for the ACK to the previous line.

Consecutive form feeds printed - The "F" option was specified by the System Manager when the printer program was activated. This means that the printer program will not try to suppress completely blank pages.

Default line length: nnn - Unless overridden by the user when a file is put into the print queue, the line length "nnn" will be assumed.

Long lines are truncated - The "T" option was specified when the printer program was activated. Any line longer than the specified line length will be truncated, and the excess discarded.

Terminal eject printed - The "E" option was specified when the printer program was activated. A form feed character will be printed when the printer program has finished processing all files in the queue.

Will go idle when queue empty - The "+e" option was specified on an "idle" command. The printer program will go "idle" when it has

finished processing the queue.

Printer always in raw mode - The "R" option was specified when the printer program was activated. The printer device will always be in "raw" mode.

Print Queue Information

On request, the status program will print information about those files that are in the print queue. If the print queue is empty, the simple message "Queue is empty" is printed. If the queue is not empty, information about the files in the queue is printed in tabular form. The following lists the titles for the columns, and their interpretation.

File Name - The name of the file in the queue. This is the name that was assigned to the file when it was put into the queue by the queueing program.

Pri - The current priority of the file.

Rpt - The number of additional copies of the file that will be printed. This number is decremented as the copies are finished.

Frm - The form number on which the file is to be printed.

Page Range - The physical page numbers of the file that will be printed. If the entire file is to be printed, "All pages" is displayed.

Lines - The number of lines per page. If none was specified by the user when the file was put into the queue, the word "Default" appears. A number appears here only if the user specified a page length to the queueing program.

Flags - Indicators of other options specified when the file was put into the print queue. These flags appear as a string of letters. The letters that appear in this field have the same meaning as those used to specify options to the queueing program. In addition, an asterisk is displayed in this field if the file is the one currently being printed by the printer program. The following is a summary of the characters that may appear in this field.

F - Completely blank pages are not suppressed.
R - Raw mode transfer was specified.
T - Long lines are truncated.
b - The banner page is suppressed for this file.
e - Form feed characters are not sent to the printer.
s - Stop at the top of each page.
t - Horizontal tab characters are not expanded.
* - This file is currently being printed.

Filter - The name of a post-filter that will be used when the file is printed. The post-filter will take output from the printer program, process it, and send it on to the printer device. More information on post-filters is contained in a subsequent chapter.

Spooler Accounting

The UniFLEX Enhanced Printer Spooler has the capability to accumulate data about the files that have been printed. This information is stored in a disk file and may be used for accounting purposes.

The Accounting Information File

The accounting information is stored in a file named "splrlog" in the directory "/act". All spoolers in the system use the same file for their accounting information. It is the printer program that records accounting information. This file must be created by the System Manager, the printer program will not automatically create the file if it does not exist. The command to create this file is:

```
create /act/splrlog
```

This same command is used to re-initialize the file after the System Manager has processed the accounting information. If the file does not exist when the printer program is activated, it will not issue any accounting messages. The status program will report that "accounting messages are disabled". Accounting messages may also be disabled by the System Manager when a particular printer program is activated. If messages are disabled, the only way to enable them for a particular spooler is to deactivate the printer program with the "pstop" command, make sure that the accounting information file exists, and then reactivate the printer program with the "insp" command.

Format of the Accounting File

The accounting file consists of a sequence of records, each one containing information about a file that has been printed. The information is recorded in binary, not ASCII, and so cannot be listed directly. Following is a description of the entries in the accounting file:

Spooler name - A 14 byte field that contains the name of the spooler. The name is in ASCII and is followed by nulls if the name is shorter than 14 characters.

File name - A 12 byte field that contains the name of the file that was printed. The name is followed by nulls if it is shorter than 12 characters.

Finishing time - A 4 byte field that contains the date and time that the printer program finished printing the file. The date and time are in UniFLEX internal format, which is a count of the number of

seconds that have elapsed since 0000 January 1, 1980 UTC.

User number - A 2 byte field that contains the user number of the owner of the file that was printed.

Character count - A 4 byte field that contains the number of characters that were sent to the printer device. This includes non-printing characters.

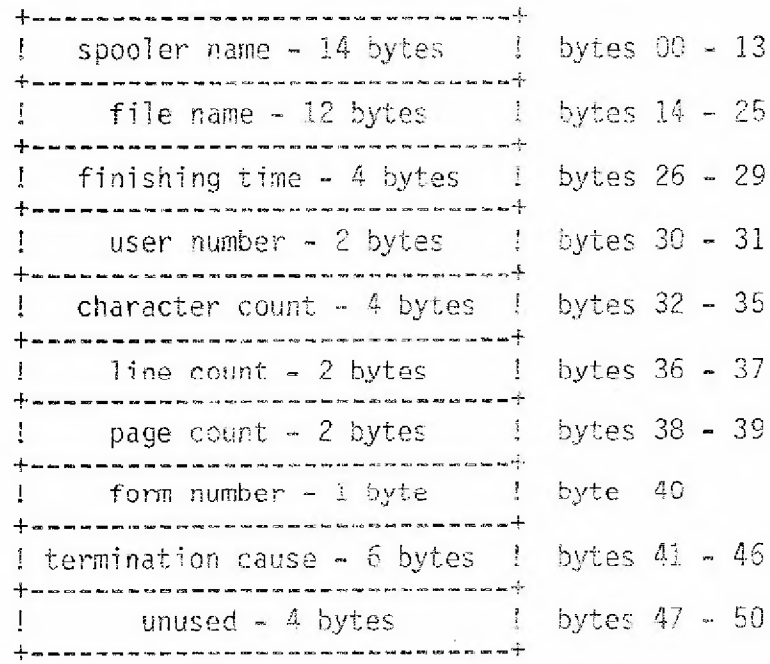
Line count - A 2 byte field that contains the number of lines that were printed.

Page count - A 2 byte field that contains the number of physical pages that were printed.

Form number - A 1 byte field that contains the form number on which the file was printed.

Termination cause - A 6 byte field which may contain a message indicating that the printing of the file was terminated abnormally. A message is present if the printing was stopped because of an "abort", "break", "end", or "rerun" command. If the message is shorter that 6 characters, it is padded with nulls. If no message is present (indicating normal termination), the entire field is filled with nulls.

There are 4 unused bytes at the end of the record. The following is picture of an accounting file record.



A Program to List the Accounting File

The following is a program which will list the contents of the spooler accounting file. It is presented here to illustrate some of the techniques that may be used to decode the information in the accounting file. This program is written in UniFLEX Basic Precompiler form for readability.

```
$ttl List Spooler Accounting Information
$type s
$integer i

 width 0
 on error goto open_error
 open old "/act/splrlog" as 1 size 51
 field #1, \
   14 as spooler_name, \
   12 as file_name, \
    4 as finishing_time, \
    2 as user_number, \
    4 as character_count, \
    2 as line_count, \
    2 as page_count, \
    1 as form_number, \
    6 as termination_message, \
    4 as spare_bytes

 print spc(12);"Spooler   Job Name    Form  User Characters "; \
   "Lines Pages"
 print
 on error goto read_error

read_next_record
 get #1
 finishing_time!=0.0
 for i=1 to 4
 finishing_time!=256.*finishing_time!+asc(mid$(finishing_time,i,1))
 next i
 form_number%=asc(form_number)
 character_count!=0
 for i=1 to 4
 character_count!=256.*character_count!+\
                 asc(mid$(character_count,i,1))
 next i

 print clock$(finishing_time!); \
    tab(13);left$(spooler_name,8); \
    tab(22);file_name;tab(34);
 print using "#### ##### ########## ##### ##### \2345\", \
  form_number%,cvt$%(user_number),character_count!, \
  cvt$%(line_count), cvt$%(page_count), termination_message
 goto read_next_record
```

```
open_error
 if err <> 4 then on error goto 0
 exit

read_error
 if err <> 24 then on error goto 0
 close 1
 exit
```

Adding Printers and Spoolers to the System

This section describes the exact steps that the System Manager should use to add new printers to the operating system. The actual connection of the hardware will not be described here since that is dependent on the particular machine on which UniFLEX is running. The "Hardware Setup" sheets that were included with UniFLEX describe the requirements for connecting printers.

Adding the Spooler for the Printer

The following are those steps necessary to create a spooler for a new printer. We will use the device "spr2" as an example. This device is already defined in the "/dev" directory.

1. Login as the System Manager.

2. Create an entry in the "/usr/spooler" directory with the proper name. In the case of our example, it will be "spr2". In order to protect the contents of the directory from unauthorized access, the permissions should be set to deny access to anyone other than the System Manager. In our example, the following commands will accomplish this:

```
crdir /usr/spooler/spr2
perms o-rwx /usr/spooler/spr2
```

3. Create the queueing program. The queueing program already exists as "/etc/spool". However, a copy of it must exist with the same name as that of the printer. The UniFLEX "link" mechanism is used to accomplish this. The queueing program name should be placed in either the "/bin" or "/usr/bin" directory. In our example, the following command would be used:

```
link /etc/spool /bin/spr2
```

or

```
link /etc/spool /usr/bin/spr2
```

4. Activate the printer program for the spooler. The System Manager should use the "insp" command, with appropriate parameters, to activate the printer program. In our example, assuming that no special parameters are required, the command to accomplish this is:

```
/etc/insp spr2
```

The new spooler is now ready for use. It is not necessary for the System Manager to create the communication or queue file since they will be created automatically when they are needed.

As another example, we will just list the commands necessary to create a spooler for "ppr".

```
crdir /usr/spooler/ppr
perms o-rwx /usr/spooler/ppr
link /etc/spool /bin/ppr
```

Protocol Printers

In some cases, it may be necessary to drive a printer that uses a protocol. In such a case, it is necessary for the printer program to be able to read a response from the printer device. The standard printer devices supplied with UniFLEX do not permit reading from the printer. In order to properly run a protocol device, it is necessary to use one of the terminal ports for the printer. Because the printer must be on a terminal port, it must be a serial printer, and be able to accept 8-bit characters with no parity and one stop bit.

After a suitable port has been selected and the printer connected to it, the System Manager should boot the operating system. In single-user mode, the System Manager should examine the file "ttylist" in "/etc" and make sure that the character in front of the terminal number associated with the printer port is a minus sign. If it is a plus sign, the editor should be used to change it to a minus sign.

If desired, the System Manager may select a name for the printer. If none is chosen, the name of the terminal will have to be used as the name of the spooler. This may be confusing or cumbersome. Once a name is chosen, the UniFLEX "link" mechanism should be used to create a device in the "/dev" directory with that name, linking it to the appropriate terminal device. For example, if the chosen name is "xpr" and it is connected to the port that should be "tty11", the command to create the device is:

```
link /dev/tty11 /dev/xpr
```

There is now a device called "xpr" in the "/dev" directory that points to the protocol printer. All that remains to be done is to create a spooler for this device. The procedure for this is identical to that outlined above for other printers. In our example, the commands are:

```
crdir /usr/spooler/xpr
perms o-rwx /usr/spooler/xpr
link /etc/spool /bin/xpr
```

The System Manager should now activate the spooler for the printer. It will be necessary to specify the "a" or "d" option for the "insp" command so that the printer program will use the protocol when

communicating with the device.

Renaming an Existing Printer

The System Manager may rename an existing printer device, giving it a more meaningful name. This is accomplished with either the UniFLEX "rename" command or the "link" command. Once a device has been renamed, the procedure outlined above for adding a spooler should be used to create a spooler for that device.

As an example, assume that the System Manager wishes to give the name "letter" to a letter-quality printer that is currently connected as "spr2". The following command will create a synonym for "spr2" called "letter":

```
link /dev/spr2 /dev/letter
```

Now, the System Manager may create a spooler for this device with the commands:

```
crdir /usr/spooler/letter
perms o-rwx /usr/spooler/letter
link /etc/spool /bin/letter
```

Recovering from Problems

The System Manager should use the "install" procedure included on the spooler master disk to install the Enhanced Printer Spooler. This procedure guarantees that all of the programs are in their proper directories, are owned by "system", and have the "s+" permission set. All of these are required for proper operation of the spooler.

If the System Manager has just installed the spooler into the operating system, and it does not run, several things should be checked.

1. The version of UniFLEX is 1.05 or later.

2. Three items should have the same name: the printer device, the spooler information directory, and the queueing program.

3. The printer is connected to the proper port, has its connector wired properly, is powered on and "on line".

4. The printer program has been activated with the "insp" command and is not "idle".

5. There is a file in the queue with a non-zero priority that has a form number matching the one that the printer program is processing.

An earlier section of this manual described several error messages that only appear when something has gone wrong with the printer spooler. Most of these are concerned with the communications and queue files. Following is a general discussion of handling problems with these files. After this discussion, some other specified problems are addressed.

Problems With the Communications File

Since all of the spooler programs run with the permissions of "system", there should never be any problem with creating or accessing the communications file. Errors that indicate that the file cannot be created or read are usually the result of a bad spot on the disk. They may also be caused by structural damage to the directories involved. The diagnostic routines "devcheck", "fdncheck", and "blockcheck" should be run to determine the nature of the damage.

The message "Cannot access communications file" means that a command could not interlock that file. The command will have tried several times to interlock the file before issuing the message. Normally, a task that interlocks the file does so for a very brief length of time. One situation in which the file may be locked for a lengthy time is when the printer program is opening the printer device. This action is done with the communications file locked. It is possible for the printer program to "hang" processing the open under some conditions described later on in this section. Once the printer program completes the

opening of the device, it will release the communications file.

Under some circumstances, it may be necessary for the System Manager to delete the communications file. This would be necessary if the message "Error in communications file structure" appears. It is also necessary to delete the communications file to recover from some other spooler problems which are discussed later on. When deleting the communications file, the path name must be placed in quotation marks since the name contains the special character "*". The general form for the command to delete the communications file is:

```
kill "/usr/spooler/spooler_name/.splr*cf"
```

The "spooler_name" should be replaced by the appropriate name. As an example, if we want to delete the communications file for the spooler for "spr2", we would issue the command:

```
kill "/usr/spooler/spr2/.splr*cf"
```

After the communications file has been deleted, the "insp" command must be used to reactivate the printer program.

Problems With the Queue File

Since all of the spooler programs run with the permissions of "system", there should never be any problem with creating or accessing the queue file. Errors that indicate that the file cannot be created, read, or accessed are usually the result of a bad spot on the disk. They may also be caused by structural damage to the directories involved. The diagnostic routines "devcheck", "fdncheck", and "blockcheck" should be run to determine the nature of the damage.

There should not be a need for the System Manager to delete the queue file. If, for some reason, this must be done, any files waiting to be printed should also be deleted from the spooler directory. This is necessary since once the queue file is deleted, there is no way for the printer program to find these files and they will never be printed.

The procedure for deleting the queue file is similar to that for deleting the communications file. When deleting the queue file, the path name must be placed in quotation marks since the name contains the special character "*". The general form for the command to delete the queue file is:

```
kill "/usr/spooler/spooler_name/.splr*qf"
```

The "spooler_name" should be replaced by the appropriate name. As an example, if we want to delete the queue file for the spooler for "spr2", we would issue the command:

```
kill "/usr/spooler/spr2/.splr*qf"
```

After deleting the queue file, any files that have not been printed may be deleted with the command:

```
kill /usr/spooler/spooler_name/*
```

Again, "spooler_name" would be replaced by the name of the spooler involved.

An Abnormally Terminated Printer Program

When the printer program cannot find any more files to print, it terminates, relying on the queueing program or a command to invoke a new copy if necessary. Before terminating, however, it stores information in the communications file indicating that these other programs must invoke the printer program, if necessary. If the printer program is terminated by some outside event, however, the proper information will not be stored in the communications file and the other programs will assume that the printer program is still running. This situation may be caused by running "shutup" when the printer program is actively printing a file, by a system crash necessitating a "reset" while the printer program task is running, or by the System Manager using the "int" command to specifically terminate the task.

The remedy for this situation is for the System Manager to delete the communications file for the spooler and reactive it with the "insp" command. If a file was actively being printed when the printer program was terminated abnormally, the printer program will choose that file as the first one to print. Printing will resume very close to the page that was being printed when the program was terminated.

A Hung Printer Program

A printer program is considered "hung" if the printer device is powered on and "on line" and the "splstat" program shows that the printer program is running as a task and not waiting for a "go", yet nothing is being printed. On protocol printers, this may be caused by the printer not having sent an ACK in response to the ETX sent by the printer program.

If the printer device is not a protocol printer, the quickest solution to the problem of a hung printer program is for the System Manager to terminate it with the "int" command. The task number to use in the "int" command is that reported by the "splstat" program. Once the printer program has been terminated, the System Manager should proceed as outlined above for handling an abnormally terminated printer program. If the "int" command reports that the interrupt cannot be sent, The System Manager may assume that the printer program task is gone and should treat the situation as an abnormally terminated printer program problem.

If the printer device is running under a protocol, the problem may be that the printer itself did not respond to an ETX. The printer program is waiting for the response. Before proceeding as outlined above for a hung printer program, the System Manager should first attempt to clear the condition by sending a USERI interrupt to the printer program. The USERI interrupt is interrupt number 12. The format of the command to do this is:

```
int +12 task_number
```

where "task_number" is that one reported by the "splstat" program. If this does not remedy the situation, the System Manager should assume that the printer program cannot be restarted, and should proceed as outlined above for a hung printer program.

Whenever the printer program is invoked, it attempts to open the printer device. If the printer is a serial device and is connected to the port such that hardware "handshaking" via clear-to-send, request-to-send, and data-terminal-ready signal lines is honored, the printer must be ready and "on line" when the printer program attempts to open it. If it is not, UniFLEX will wait for the proper signals before allowing the open to complete. Thus, the printer program will be "hung" until the printer device is ready. The only remedy for this condition is to ready the printer so that the open may be completed. UniFLEX will not allow the task to proceed or be interrupted while it is waiting for an open to complete. If the printer cannot be made ready (or the required signals be generated by some other means), it may be necessary to shut down the operating system completely to clear up the problem. If this has to be done, the System Manager will have to delete the communications file when the system is re-booted.

Printer Program Goes "idle" Unexpectedly

The printer program normally goes "idle" in response to the "idle", "break", and "rerun" commands. If the printer program stops printing a file in the middle and becomes "idle", this may be caused by its having received an error when trying to write to the printer device. When this occurs, the printer program acts as though a "break" command had been issued.

Printer Program Deactivates Itself

The printer program will deactivate itself if it cannot open the printer device. Any error returned by UniFLEX when the printer program attempts to open the device is sufficient reason for the program to deactivate itself. The printer device is only opened once by the printer program. It is left open until the program terminates. Thus, the deactivation will only take place when the printer program is invoked by a command or by the queueing program. Since the printer program runs with the permissions of "system", the only causes for an error to be returned is if the device does not exist in the directory, or the printer driver has

detected a problem with the printer. The type of printer problem that would cause an error to be returned depends on the specific hardware and printer driver and is beyond the scope of this discussion.

Post-filters

Post-filters are programs that take output from the printer program, perform some processing on that output, and then send it to the printer device. It is called a "post-filter" because it performs its processing after the printer program has performed its own processing of the data being printed.

One common application for a post-filter is character set translation. If a printer does not accept the ASCII character set, a post-filter can be written to take the ASCII characters sent to it by the printer program and convert them to the required character set before sending them on to the printer.

Another common application for a post-filter would be in those instances where some initialization of the printer device is necessary before printing can start. In this case, the post-filter would perform the necessary initialization when it is first invoked and then simply pass on the data that it receives from the printer program to the printer device.

Specifying a post-filter

The name of a post-filter may be specified when the file is put into the queue by the Queueing Program. The "+P" option is used to specify the name. For example:

```
ppr abc +P=convert
```

The "requeue" command may also be used to assign a post-filter to a file already in the queue. Again, "+P" is the parameter to use for "requeue". The same parameter to "requeue" is used to change the name of a post-filter if one has already been assigned to the file in the queue.

The System Manager may specify that a certain post-filter be used for all files in the queue. The name of this post-filter is specified by the "+P" parameter to the "insp" command. If the System Manager has specified such a post-filter, and the user specifies a different post-filter when the file is put into the queue, the user's post-filter will be the one that is used.

There are certain restrictions on the "+P" parameter in all of the above commands. The parameter may not contain a path separator character (the slash) nor may the name be longer than 14 characters. If the "+P" option is specified along with other options, it must either be by itself or be the last option in an option string. For example:

```
ppr abc +bsP=convert
```

The filter program itself must reside in one of the following

directories: "/usr/bin", "/bin", the spooler directory, or a subdirectory named "bin" in the spooler directory. In general, filters that may be used with more than one spooler should be placed in "/bin" or "/usr/bin". Those filters that will be used with only one specific spooler should reside in the spooler directory or in a "bin" subdirectory of the spooler directory.

How the spooler handles post-filters

If the System Manager has specified a post-filter on the "insp" command, that program is started before the first file is printed. The post-filter is left running until either the printer program terminates or it has to process a file that has specified its own post-filter. When this latter case occurs, the first filter program is terminated and the user-specified program is run. When the printing of the file has completed, the user-specified post-filter is terminated and the original one is started again.

Since the printer program is actually sending data to another program instead of the printer device, it cannot honor any protocol that may be required when communicating with the device. If the printer program is running with a protocol and sees a file in the queue with a post-filter, it will ignore that file.

If the filter program should terminate abnormally before the entire file is printed, the printer program detects this and takes appropriate action depending on how the filter terminated. If the filter was terminated by an interrupt (such as may be issued by the "int" command), a "break" command is simulated and the file is returned to the queue with a priority of 255. The printer program will then go idle. If the filter program terminated itself with a non-zero termination status, the printer program will simulate a "rerun" command, returning the file to the queue with a priority of zero. In this case, the printer program will continue to search the queue for files to print.

Writing a post-filter program

A post-filter program may be written in any language that satisfies the following requirements:

1. The language must permit the reading of the UniFLEX standard input channal and the writing to the UniFLEX standard output channel.
2. The language must produce a self-contained absolute binary object module. Languages that interpret an intermediate language or which require an additional run-time package to execute are not acceptable.

Assembly language is one obvious choice. There may be other languages which are also suitable. The filter program may not be written in a language that is interpreted by another program.

The program must be written so that it reads the data from the UniFLEX standard input channel, processes the data, and writes it to the UniFLEX standard output channel. The filter should not expect any arguments from the command line since none will be provided by the printer program.

The only other constraint on the filter program is that it must check for data lines which consist solely of the ASCII characters FS and CR (hexadecimal 1C followed by 0D). This sequence is sent by the printer program whenever it is going to pause and wait for a "go" from the user. On detecting this sequence, the filter program should flush any data that it may have in internal buffers out to the device. This special sequence should not, however, be sent to the device. The filter program should be able to handle consecutive occurrences of this sequence as well as its being the first line of a file.

When the filter detects an end of file condition on the UniFLEX standard input channel, it should flush out any data that is still in internal buffers and terminate with a zero termination status.

It should be noted that the printer program will still count lines and pages even though it is sending the data to the filter program. If the filter program does any processing which changes line counts or page counts, it cannot communicate this back to the printer program. In such cases, the information in the accounting file will be incorrect.