IBM SYSTEM/370 MVS/TSO KERMIT USER'S GUIDE

Version 4.3

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1. IBM 370 KERMIT

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Kermit-370 is a family of programs implementing the KERMIT file transfer protocol for IBM 370-series mainframes (System/370, 303x, 43xx, 308x, 3090, *etc.*) under a variety of operating systems. Kermit-370 operates over asynchronous ASCII communication lines attached to a 3705-style or protocol enveloping 3708 front end (‘‘TTY’’ or line-mode devices), to a Series/1 or 4994 running the Yale ASCII Terminal Communication System or the IBM 7171 ASCII Device Control Unit or a 9370 with ASCII subsystem (‘‘SERIES1’’ devices), to the IBM 3174 protocol converter at level B2.0 or higher (‘‘AEA’’ devices), or to front-ends with graphics pass-through mode, such as the Datastream/Leedata 8010 and PCI 1076 (‘‘GRAPHICS’’ devices). As of this writing, the pending implementation of full(er) 7171 compatibility in the program product SIM3278 has not been completed. The non-line-mode devices are often called full-screen devices. For more details on front ends, see the section SET CONTROLLER.

The source is coded in IBM 370 assembly language and is compatible with the F, VS, and H assemblers. The code is divided into sections, some generic and some specific to an individual operating system. While the details of file-system and supervisor interaction vary widely among the systems available for IBM 370’s, the basic features are essentially the same. This chapter describes the features common to all variants of Kermit-370, and a separate chapter will deal with the system-specific details for each variant.

IBM 370 systems have some peculiarities that users should be aware of. First, these systems are essentially half-duplex; the communication line must "turn around" before any data can be sent. The ‘‘TTY’’ devices are strictly half-duplex, and even the ‘‘SERIES1’’, ‘‘GRAPHICS’’, and ‘‘AEA’’ devices, although they maintain full-duplex communication with the terminal, must transmit a block at a time to the mainframe. The fact that a packet has been received from the IBM system through a ‘‘TTY’’ device is no guarantee that it is ready for a reply; generally, the true indicator of readiness is the line turnaround character (XON), which the operating system sends immediately before issuing a read request. On some systems, however, it is possible for Kermit to do away with the system-supplied turnaround and schedule read requests immediately after the corresponding writes. It is up to the user to tell the other Kermit how it must conform to the requirements of the IBM mainframe.

A second distinction is that disk files are encoded using the EBCDIC character set. Consequently, there are three layers of character translation on packets exchanged on a ‘‘TTY’’ device. For an incoming packet, the outer layer is provided by the operating system, which translates all characters from ASCII to EBCDIC. Kermit-370 must then translate the packets back to ASCII (the middle layer) in order to calculate and verify the checksum. Data arriving through a ‘‘SERIES1’’, ‘‘GRAPHICS’’, or ‘‘AEA’’ device are still in ASCII and therefore bypass the two outer layers. In any case, Kermit-370 translates text files finally into EBCDIC (the inner layer) before storing on disk. When Kermit-370 sends a file, the opposite translations occur. The middle-layer tables used by Kermit must be the inverses of the corresponding outer-layer ones used by the host operating system if file transfers are to work at all. If necessary, the system programmer should add the appropriate SET TATOE/TETOA/TTABLE subcommands (*q.v.*) to the global INIT file. Indeed, it is usually a good idea to set TTABLE ON in the global INIT file to force using different built-in sets of tables for the inner and middle layers whenever the system has ‘‘TTY’’ devices. The standard 7-bit ASCII-to-EBCDIC translations can be found in the Appendix or the IBM System/370 Reference Card. See the section "Translation Tables" for more details.

Another distinction of IBM 370’s is that they store and retrieve files as records rather than byte streams. Records

may be either fixed-length with some sort of padding (as needed) or varying-length with some sort of (generally hidden) delimiters. Thus, Kermit-370 must assemble incoming data packets into records by stripping off carriage return-linefeed pairs (CRLF's) and padding with blanks or truncating as needed and must strip trailing blanks and append CRLF's to outgoing records. (See the SET FILE TYPE subcommand.) Further, disk files typically have the records combined into blocks for efficiency. One consequence of this form of storage is that files have attributes describing the component records: maximum record length (LRECL), record format (RECFM), and sometimes block size (BLKSIZE).

As mentioned before, Kermit-370 is a family of programs. At present, only the CMS, TSO, MUSIC, ROSCOE, and CICS variants are operational. Variants for DOS-4 and MTS have at least reached the "drawing board," but no others have even been started as of this writing. Volunteers are always welcome to port Kermit-370 to other operating systems or add new features to the existing family. Anyone interested should first get in touch with the Center for Computing Activities at Columbia University to find out what projects of a similar nature are already pending (and thereby prevent unnecessary duplication of effort). There are supplemental files in the Kermit distribution with explanations of how to go about porting Kermit-370 and how to add support for new terminal controller types. For details, refer to the installation guide for the variant of your choice.

1.1. Translation Tables

Traditionally, IBM mainframe Kermits have translated 7-bit ASCII characters to 8-bit EBCDIC characters and ignored the "parity" bit in the process. Similarly, the 8-bit EBCDIC characters have been mapped onto 7-bit ASCII, thereby producing many ambiguities in translating the ASCII files back to EBCDIC. These ambiguities fall into two categories: EBCDIC characters not representable in ASCII have been rendered as ASCII nulls, and alternate EBCDIC representations of characters such as the ASCII backslash have been mapped together, but at least no two 7-bit ASCII characters are translated into the same EBCDIC character. The ambiguities were tolerable in environments where the traditionally non-printable characters never occurred in text files, but text processing has increasingly tended to include such characters for mathematical formulas or for languages other than English. Ultimately, the translation tables must become completely invertible, lest information be lost in the transfer. There has long been an option to replace parts of the translation tables via commands from the user (or imbedded in the INIT files), but such replacements were always supported locally and were, therefore, basically non-standard.

The concept of standard translations is currently in a state of flux because of the proliferation of 8-bit code pages and the countervailing efforts at standardization among groups such as the ISO and Kermit developers. In particular, Kermit-370 now supports a set of EBCDIC and "extended ASCII" code pages with built-in translation tables and automatic identification of the "ASCII" transfer character set via Attribute packets. This facility supports files stored using numerous IBM Country Extended Code Pages and permits transfers using character sets ASCII, ARABIC, CYRILLIC, GREEK, HEBREW, JAPAN-EUC, KATAKANA, LATIN1, LATIN2, LATIN3, and THAI. See Table 1-1 for a display of the allowed combinations of character sets. See also file ISOK7.TXT in the Kermit distribution for a somewhat outdated description of the protocol extensions. Kermit-370 currently supports text files in the following languages: Afrikaans, Albanian, Arabic, Bulgarian, Byelorussian, Catalan, Czech, Croatian, Danish, Dutch, English, Esperanto, Faeroese, Finnish, French, Gaelic, Galician, German, Greek, Hebrew, Hungarian, Icelandic, Italian, Japanese (Katakana and Kanji), Lao, Latin, Macedonian, Maltese, Norwegian, Polish, Portuguese, Quechua, Romanian, Russian, Serbian, Slovak, Slovene, Spanish, Swahili, Swedish, Thai, Turkish, Ukrainian, and Volapük. Visual representations of the characters sets may be found in the ISO register (for transfer) and in various IBM documents, such as S544-3156 "About Type" (for files).

Kermit itself normally operates in English, but there are versions with the interactive messages translated into other languages. The currently available languages are Czech, Dutch, Finnish, French, German, Italian, Polish, Portuguese, Russian, and Spanish. Special thanks to Petr Adelsberger, Mauricio Alvarenga, Lorenzo Beltrame, Janusz Bien, Jose Eduardo de Lucca, Richard Gatersleben, Kauko Haumalainen, Jaroslaw Kurowski, Roberto Magana, Alberto Rio, Christian Robert, Gisbert Selke, Karel Smuk, Rob van der Wal, Konstantin Vinogradov, and Joachim Wlodarz for preparing these translations. See the installation guide for details on the alternate-language versions. There are no translations yet of the help files, nor of this document.

	Transfer character set										
Local	ASCII	ARAB.	CYR.	GREEK	HEB.	JAPAN	KATAK.	L1	L2	L3	THAI
CP037	*							**			
CP273								**			
CP275								**			
CP277								**			
CP278								**			
CP280								**			
CP281						*		**			
CP282								**			
CP284								**			
CP285								**			
CP290						*	**				
CP297								**			
CP420		**									
CP424					**						
CP500	*					*		**			
CP838											**
CP870									**		
CP871								**			
CP875				**							
CP880	*		**								
CP905										**	
CZECH									*		
DKOI	*		***								
EBCDIC	*	*						***			
H-EBCD						*	*				
KANJI						*					

Table 1-1: Allowed character set combinations in Kermit-370

All allowed combinations are marked with asterisks, and the preferred combination in each row or column is the one with the most asterisks. Whenever a character set is specified, either directly or through an Attribute packet, the other category of character set is checked to see if it makes up an allowed combination. If not, it is forced to the preferred character set.

As nearly as possible, the tables in Kermit-370 are invertible, but all of the character sets reserve many (typically 65) code points for control characters and leave them officially undefined and unprintable. This applies both to IBM code pages and ISO standard 8-bit character sets. Although 33 of the controls have widely accepted mappings, the others do not, and Kermit-370 currently uses those given in an appendix of IBM's VS/Fortran Reference Manual. Needless to say, such translations are arbitrary and may be invalidated by future decisions at IBM or ISO. Still, most of the translations are likely to be stable in the long run. Table 1-2 shows the current translation from LATIN1 to EBCDIC, which is likely to be the most often used. Other translations, including the reverse ones, may be displayed using the TDUMP subcommand of Kermit-370.

Besides converting files for transmission, Kermit-370 must also compensate for the EBCDIC/ASCII translation performed by some front ends and must, therefore, be able to apply the exact reverse translations on both input and output. This is the "middle layer" of translation described earlier for ‘‘TTY’’ devices. Consider the fate of a Left Square Bracket character in an inbound packet on a ‘‘TTY’’ line. It begins as ASCII code x'5B' (91 decimal), but the front end translates it to EBCDIC before presenting it to Kermit-370. In this example, suppose it becomes EBCDIC code x'4A' (74 decimal) instead of the standard x'AD' (173 decimal). Then, Kermit must be primed with

	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F
0-	00	01	02	03	37	2D	2E	2F	16	05	25	0B	0C	0D	0E	0F
1-	10	11	12	13	3C	3D	32	26	18	19	3F	27	1C	1D	1E	1F
2-	40	5A	7F	7B	5B	6C	50	7D	4D	5D	5C	4E	6B	60	4B	61
3-	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	7A	5E	4C	7E	6E	6F
4-	7C	C1	C2	C3	C4	C5	C6	C7	C8	C9	D1	D2	D3	D4	D5	D6
5-	D7	D8	D9	E2	E3	E4	E5	E6	E7	E8	E9	AD	E0	BD	5F	6D
6-	79	81	82	83	84	85	86	87	88	89	91	92	93	94	95	96
7-	97	98	99	A2	A3	A4	A5	A6	A7	A8	A9	C0	4F	D0	A1	07
8-	20	21	22	23	24	15	06	17	28	29	2A	2B	2C	09	0A	1B
9-	30	31	1A	33	34	35	36	08	38	39	3A	3B	04	14	3E	FF
A-	41	AA	4A	B1	9F	B2	6A	B5	BB	B4	9A	8A	B0	CA	AF	BC
B-	90	8F	EA	FA	BE	A0	B6	B3	9D	DA	9B	8B	B7	B8	B9	AB
C-	64	65	62	66	63	67	9E	68	74	71	72	73	78	75	76	77
D-	AC	69	ED	EE	EB	EF	EC	BF	80	FD	FE	FB	FC	BA	AE	59
E-	44	45	42	46	43	47	9C	48	54	51	52	53	58	55	56	57
F-	8C	49	CD	CE	CB	CF	CC	E1	70	DD	DE	DB	DC	8D	8E	DF

Table 1-2: EBCDIC (hexadecimal) code points for LATIN1

This table shows the values of the EBCDIC equivalents for the code points in the LATIN1 character set. The values are arranged in LATIN1 collating sequence, and the rows and columns are labeled with the first and second digits, respectively, of the LATIN1 code points. For example, LATIN1 code 41 (hex) is upper-case "A", and the intersection of row "4-" and column "-1" has the value C1 (hex), which is the EBCDIC code for "A". Rows "0-", "1-", "8-", and "9-" are officially undefined in ISO 8859-1 and so, in principle, could be changed at some future time, especially "8-" and "9-". Note that this table uses a format close to that of the TDUMP subcommand and of the Kermit code itself, but character-set tables are often displayed with the rows and columns interchanged.

---

a `SET TETOA 74 91` so that, when reconstructing the original ASCII packet, the character becomes x'5B' again. Otherwise, the packet checksum will appear invalid. Kermit comes with a pair of default tables, but it may be necessary to customize them, as this example shows. The following procedure will reveal any changes needed. The procedure has two stages: the first is for any line-mode front end, and the second only for front ends capable of full 8-bit data transfer. Note that, although the discussion refers to hexadecimal values, the Kermit-370 SET subcommands require decimal numeric arguments. Also, note that this procedure assumes you will run Kermit with TTABLE set on; hence, the references to Kermit-370 tables are to TATOE and TETOA. If you choose to define Kermit's file translation to match that of the front end, you should leave TTABLE set off and remove the T's from the SET subcommands described below. This will also turn off the automatic switching of translation tables according to the Attribute packets received from the other Kermit. Under CMS, you must issue a `CMS SET INPUT` and a `CMS SET OUTPUT` before starting this procedure.

1. Create a file containing all the non-control EBCDIC characters (hex codes 40-FF) and display the file on any available ASCII terminal hooked up to the line-mode front end in question.
2. If any printable ASCII character is missing from the display, Kermit cannot work through this front end (unless you modify the tables in the front end itself).
3. If any ASCII character appears twice, there is no cause for alarm.
4. If any ASCII character does not appear where it should, according to Table 1-3, a SET TATOE must be added to the system INIT file. For example, if EBCDIC code 5F (Not Sign, according to the Appendix) appears as an ASCII Tilde (7E), but EBCDIC A1 (Tilde) does not, a SET TATOE 126 95 is required. Warning: characters considered unprintable by the front end are likely to be filtered out entirely when you display the file; do not expect the display to line up just like Table 1-3.
5. Create a file on the mainframe using an ASCII terminal for input, and enter all 95 printable ASCII

characters in collating sequence. You can presumably save time by skipping the 52 upper- and lower-case letters and the 10 digits.

6. Display the file from the previous step in hexadecimal or other binary form.
7. If any duplicates appear among the 95 characters (or 33, if you have taken the short cut), Kermit cannot work through this front end (unless you modify the tables in the front end).
8. Compare the hexadecimal codes with rows 2-7 of Table 1-2. If a discrepancy appears, a SET TETOA must be added to the system INIT file. For example, if ASCII Left Bracket (5B) appears as EBCDIC 4A, a SET TETOA 74 91 is needed. At this point, the first stage is complete.
9. If 8-bit line-mode file transfer is desired, you must now verify the extended character set. Display the file of EBCDIC codes again, this time using a terminal with extended character set display, or capture the session with a micro Kermit and display the resulting file in hexadecimal. If any code in the range A0-FE does not appear, the front end will not allow 8-bit Kermit data transfers. Generate SET TATOE entries for the entire range, as needed, just as in the example given for 7-bit codes. If the front end's translation tables are documented, it may be easier to work from the manual, but you must be sure that you have tables for all of the translations that occur on the data path.
10. Create a file of the 95 extended ASCII codes A0-FE, if possible, by using a terminal capable of transmitting those codes or transmitting a pre-made file "raw". If necessary, use the appropriate table(s) in the manual(s) instead.
11. Again, if any duplicates appear, this front end is incapable of 8-bit file transfers. Otherwise, generate SET TETOA entries as before.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4-												.	<	(	+	|
5-	&										!	$	*	)	;	^
6-	-	/										,	%	_	>	?
7-										‘	:	#	@	’	=	"
8-		a	b	c	d	e	f	g	h	i						
9-		j	k	l	m	n	o	p	q	r						
A-		~	s	t	u	v	w	x	y	z				[		
B-														]		
C-	{	A	B	C	D	E	F	G	H	I						
D-	}	J	K	L	M	N	O	P	Q	R						
E-	\		S	T	U	V	W	X	Y	Z						
F-	0	1	2	3	4	5	6	7	8	9						

Table 1-3: Character graphics for EBCDIC codes

This table shows the representations of the EBCDIC codes arranged in EBCDIC collating sequence, row by row. Codes that do not correspond to ISO 646 characters (7-bit ASCII), have been left blank. One special case is the EBCDIC code 5F, which represents a Not Sign in IBM's CP037, but which is traditionally mapped to the ASCII Circumflex, as shown here. WARNING: this manual may have been printed on a device that maps characters differently. Consult the Appendix to verify.

1.2. File Attributes

Kermit-370 attempts to send and receive file attributes along with the files themselves. Before Kermit receives a file, it compares the Length attribute (if available) with the amount of disk space available (if known) so that the file can be rejected if it will not fit. In addition, the Type, Access, Encoding, Disposition, and Format attributes, if any, are interpreted in order to match the received file to the original as nearly as possible. All other attributes (including Date) are simply ignored. For Type, Kermit recognizes text and binary specifications; for Access, it recognizes append, normal, and supersede; for Encoding, it recognizes ASCII, extended, and EBCDIC (which it treats as binary); for Disposition, it recognizes mail, print, and job; and for Format, it recognizes text, D-binary, V-binary, binary, and LRECL. Any other values are rejected.

On sending a file, if the other Kermit is willing to accept Attribute packets, Kermit-370 sends the Type, Encoding, Format, Date, and Length attributes (unless some or all of them have been disabled -- see the SET ATTRIBUTE subcommand).

Unfortunately, the set of file attributes defined in the Kermit protocol is not well matched to the needs of IBM 370 file systems, so that much of the machinery for creating and interpreting of Attribute packets is useless. For example, the "Format" attribute, which should logically specify the record format of the received file, gives only the format of the file in transmission and cannot distinguish between fixed-length and varying-length records for text files. This limitation is partly due to the fact that other Kermits do not generally support the same attributes. In short, even if the protocol made it possible, some of the important attributes would never be specified anyway. Nonetheless, efforts are being made to extend the protocol to be more comprehensive.

1.3. Program Operation

Kermit-370 can be invoked directly or from a command procedure. In either case, it reads and executes subcommands sequentially until directed to quit, and then returns. A subcommand consists of one or more fields (words) separated by spaces or commas.

Upon startup, the program looks for two (optional) initialization files, one system-wide and a second specific to the user. Both *filespecs* are, of course, system-dependent. The purpose of these files is to allow Kermit to be customized for a particular system and for a user's specific settings without changing the source code. The system-wide file, which is maintained by a systems programmer, should contain Kermit subcommands that all users would need to issue in order for Kermit to run on the system, such as subcommands to modify the ASCII/EBCDIC tables used by Kermit-370. The user-specific file, if any, should contain subcommands that the user generally issues every time Kermit is run. Kermit-370 executes any subcommands found in these files as though they were typed at the terminal. Here is a sample INIT file:

```
* Asterisk in column one is a comment.
set transfer character-set latin1
set file collision rename
set block 3
```

During interactive execution, you may use the built-in help feature while typing Kermit-370 subcommands. A question mark ("?") typed at almost any point in a subcommand, followed by a carriage return, produces a brief description of what is expected or possible at that point. Moreover, mistyping a subcommand will generally produce a helpful error message or a list of possible options at the point of error. Keywords in such lists are displayed with the minimum-length abbreviation in upper case and the remainder, if any, in lower case. In entering Kermit subcommands, any keyword may be shortened to any substring that contains the minimum abbreviation.

Besides knowing the mechanics of entering Kermit subcommands and interpreting responses, the user must understand which subcommands are necessary. The default values for Kermit-370 options have, in some cases, been constrained by a desire for continuity, so that some of the default behavior is distinctly "suboptimal." An example of this is the traditional 80-byte default RECEIVE packet size, which generally gives much slower

transmission than a size of 1000 or more. Such options are flagged in this chapter with a notation that they perhaps ought to be set in the INIT files. Note, however, that the interplay of Kermit protocol sometimes provides a performance upgrade with no special action required from the Kermit-370 user. An example of this is the SEND packet-size, which is always under the control of the other Kermit. Kermit-370 always sends packets as long as the other Kermit allows, unless the frequency of transmission errors indicates that shorter packets would be more efficient (see the subcommand SET SPEED).

Kermit-370 also attempts to produce optimal results by adapting to the file attributes sent by the other Kermit along with the files, such as TYPE and LRECL. Such attributes, when sent by the other Kermit, temporarily override the current settings in Kermit-370 during the reception of the associated file. Potentially even more importantly, Kermit-370 automatically recognizes the character set used for the file transfer and chooses, if necessary, a compatible character set for file storage. Table 1-1 shows the currently supported list of character sets. As with any automatic operation, Kermit's honoring of the transmitted attributes may need to be suppressed in part or altogether, and the SET ATTRIBUTE subcommand provides this capability.

Another attribute that Kermit-370 supports is file disposition, which allows files to be received and immediately retransmitted as electronic mail, sent to a printer, or submitted as a batch job. These three options are highly site-specific and are implemented as a set of three host commands with similar calling sequences. In each case, the command is invoked in two different ways in the process of processing the file. It is called without any *filespec* or other options as soon as the corresponding attribute is recognized by Kermit-370. If the command is not implemented or for some reason returns a non-zero completion code (such a code should be negative, if at all possible), Kermit-370 rejects the file using the normal attribute exchange mechanism. Otherwise, the file is received as usual, and the command is invoked again at the end-of-file. The second time, the command is given the name of the received file and the options received from the sending Kermit (such as the list of recipients for electronic mail). The command is then responsible for disposing of the file (and deleting it, if desired). If, for any reason, the file cannot be sent as required, the command should return a negative completion code (or non-zero, at any rate), and Kermit-370 will send back an error message to the sending Kermit. The command itself should refrain from issuing any messages of its own or permitting commands that it invokes to issue messages. See the beginning of the chapter on the system-specific variant of Kermit-370 for the exact command syntax. Some sample implementations of such commands may be available in the Kermit distribution -- refer to the system-specific installation guide for a list of samples.

1.4. Kermit-370 Subcommands

The following is a summary of Kermit subcommands. The starred subcommands can be issued as remote Kermit commands to Kermit-370 when it is in server mode. System-specific subcommands are omitted from this list.

BYE	logs out other Kermit server.
CWD*	establishes a new working directory.
DIRECTORY	displays all or part of the disk directory.
ECHO	a line back to the user.
EXIT	from Kermit-370.
FINISH	other Kermit server.
GET	file(s) from a Kermit server.
GIVE*	creates a TAKE file snapshot of a table.
HELP	about Kermit-370.
HOST*	executes a system command.
KERMIT*	executes a Kermit subcommand.
QUIT	from Kermit-370.
RECEIVE	file(s) from other Kermit.
SEND	file(s) to other Kermit.
SERVER	mode of remote operation.
SET*	various parameters.
SHOW*	various parameters.
SPACE*	displays disk storage allocation.

STATUS*	inquiry.
STOP	easy escape from protocol mode.
TAKE*	subcommands from file.
TDUMP*	dumps the contents of a table.
TYPE*	a file.
VERSION*	of Kermit-370.
XECHO	echoes a line (transparently).
XTYPE	displays a file (transparently).

Although Kermit-370 is generally a remote Kermit, it has the capability of communicating with another Kermit in server mode. In that situation, the subcommand prefixes REMOTE and LOCAL refer to the Kermit server and Kermit-370, respectively, even when Kermit-370 is, strictly speaking, the remote Kermit. To help avoid confusion, this chapter will often use the term "foreign" to apply to the Kermit at the other end from Kermit-370. All the above subcommands may be preceded by the LOCAL prefix, but only certain ones are valid with REMOTE, including some not shown here. See the description of the SERVER subcommand for details. Any text replies Kermit-370 gets from the foreign Kermit server are added to a disk file (whose *filespec* is, of course, system-dependent). Such a transaction can be carried out, for example, under control of a TAKE file if Kermit-370 is not operating locally. If the local Kermit has a "magic" character sequence that switches it from terminal emulation to server mode, then an entire session could be controlled from the mainframe, possibly in response to a single command issued by a naive user. For example,

```
.grab
     Kermit-370 is invoked and executes the following TAKE file

ECHO Serve Me!        the local Kermit switches to server mode
GET file.a            the server uploads file.a
FINISH                the server switches back to terminal mode
```

The remainder of this section describes subcommands with special meaning or use in Kermit-370, except the highly system-dependent ones. For the latter, refer to the appropriate chapter. Subcommands are listed in alphabetical order.

The ECHO and XECHO Subcommands

Syntax: `[X]ECHO` *line*

These subcommands type the *line* back at the user. The *line* may contain control characters or any desired text, including upper or lower case. These subcommands may be used, for example, to test the ASCII/EBCDIC translate tables or to issue coded commands to the user's terminal. XECHO differs from ECHO primarily in that it sends the text as a raw transmission according to the current CONTROLLER setting. Thus, XECHO will, if necessary, break the text into pieces no larger than the current SEND PACKET-SIZE and will use transparent mode if CONTROLLER is SERIES1, GRAPHICS or AEA. It also offers its own brand of control-character quoting, using the ''^'' character to indicate that only the five low-order bits of the ASCII codes are to be used. Thus, ''`^a`'', ''`^A`'', and ''`^!`'' are all translated to SOH (CTRL-A), while ''`^[`'' becomes ESC. However, there must be one exception for ''^'' itself: ''`^>`'' and ''`^~`'' are both translated to RS (CTRL-^), but ''`^^`'' becomes just ''^''. XECHO also decodes 8th-bit quoting, just as in Kermit protocol, and this feature can be disabled by setting 8th-bit quoting off. For example, if the 8th-bit quote character is ''&'', entering the subcommand ''`XECHO &A`'' will transmit a code x'C1', but the same subcommand with quoting off will transmit two bytes: x'2641'.

The GET Subcommand

Syntax: `GET` [*foreign-filespec* [*filespec*]]

The GET subcommand tells Kermit to request a file or file group from the other system, which must have a Kermit running in server mode. Provided the other Kermit complies, the effect is the same as if SEND *foreign-filespec* had been issued directly to the other Kermit and RECEIVE [*filespec*] to Kermit-370. If this subcommand is issued without any arguments, Kermit-370 will prompt the user for both foreign and native *filespecs* (and will insist on getting the former, but will do without the latter). See the respective SEND and RECEIVE subcommands for a description of the each *filespec*.

The GIVE Subcommand

Syntax: `GIVE` *table-name filespec*

This compares the named translation or selection table with its current default values and saves the differences in the form of a TAKE file consisting of SET subcommands that would convert the default into the current arrangement. ATOE, ETOA, TATOE, and TETOA are the available translation tables, and CONTROL-CHAR is the selection table. The details of the *filespec* are system-dependent, but those details will, in general, be the same as for the TAKE subcommand (*q.v.*). In the case of tables ATOE and ETOA, the current defaults are the values from the most recent character-set definition, if any, but the defaults for TATOE and TETOA always remain at the initial values. See the SET FILE CHARACTER-SET and SET TRANSFER CHARACTER-SET subcommands for more details.

The HINTS Subcommand

Syntax: `HINTS`

This subcommand produces a screenful of suggestions for Kermit operation, including warnings about any current settings that may be undesirable.

The HOST Subcommand

Syntax: `HOST` *text of command*

This issues a command to the host operating system from Kermit-370. When a command returns a non-zero completion code, the code will be displayed. Generally, the name of the system (*e.g.*, CMS) is treated as a synonym for the HOST subcommand.

When Kermit-370 is in (non-local) server mode, you must avoid sending it any HOST commands that trigger full-screen terminal I/O, since the server-client interface does not provide any full-screen terminal emulation, nor is Kermit-370 usually able to intercept such I/O in any case.

The KERMIT Subcommand

Syntax: `KERMIT` *text of subcommand*

This is provided for redundancy as the counterpart of the HOST subcommand. Kermit-370 executes the specified text as a Kermit subcommand just as if the LOCAL prefix had been entered. Note, however, that the specified text must not begin with a second KERMIT prefix.

The RECEIVE Subcommand

Syntax: `RECEIVE [`*filespec*`]`

The RECEIVE subcommand tells Kermit-370 to accept a file or file group. The user must issue the corresponding SEND subcommand to the other Kermit. When files are received, their names are recorded in a transaction log in memory and may be viewed later via the TDUMP NAMES subcommand. The log contains the names along with the file sizes and any relevant error messages. Another form of log may be provided through an accounting exit routine, which is called at the end of every RECEIVE session. Such an accounting log may contain elapsed time and numbers of bytes sent, received, and transferred to/from disk. If an error occurs during the file transfer, as much of the file as was received is saved on disk. If, however, the sending of a file is cancelled by the user of the foreign system, Kermit-370 will discard whatever had arrived, unless FILE COLLISION is APPEND or INCOMPLETE is KEEP.

Kermit-370 has a context-dependent maximum record length, and received records longer than that will be folded or truncated to the proper length; when this happens, Kermit may or may not stop, depending on the FILE subparameter LONGLINE. If truncation does occur, Kermit will later note the fact as an error (unless something more serious happens in the meantime). In addition, when a fixed record length is specified, received records are padded to the correct length. The padding character is a blank for text files and a null for binary files. Received binary (but not V-binary or D-binary) files are treated as byte streams and broken up into records all of the logical record length, *i.e.*, folded. For more details on the RECEIVE subcommand syntax and operation, see the chapter on the desired system-specific variant of Kermit-370 under both RECEIVE and SET FILE. See also (in this chapter) the SET FILE LONGLINE subcommand for details on record truncation and folding.

The SEND Subcommand

Syntax: `SEND [`*filespec*`[<`*options*`>] [`*foreign-filespec*`]][, ...]`

The SEND subcommand tells Kermit-370 to send a file or file group to the other (foreign) Kermit. If no such file exists, Kermit-370 simply displays an error message and issues another prompt. Like RECEIVE, SEND keeps a transaction log of all files transferred in a group and calls the accounting exit routine at the end of the session. If this subcommand is issued without any arguments, Kermit-370 will prompt the user for both native and foreign *filespec*s (and will insist on getting the former, but will do without the latter). Either with or without prompting, SEND allows specifying a list of up to 13 files (or file groups) separated by commas. (By ending the command line or subsequent response with a comma, the user ensures further prompting.) In this syntax, the *options* enclosed in angle brackets may be regarded as part of the native *filespec*. There must be no intervening blanks. At present, the only supported option is a range of line numbers within the file to be sent. The range takes the form [*n*][-[*m*]], where *n* is the number of the first line to send (counting from 1), and *m* is the last. Omitting either number implies the corresponding limit is the physical beginning or end of the file. This same option syntax may be used in some commands issued to the foreign Kermit, namely, those involving *filespec*s in 370 form. In particular, GET and REMOTE TYPE can use this syntax. Note that a trailing ''>'' is used by some other Kermits, such as MS-Kermit, to indicate redirection of the output from REMOTE commands to disk. In order to transmit the ''>'' and also prevent the redirection to disk, it would be necessary to add an explicit redirection to the terminal, as in

```
REM TYPE filespec<n-m> > CON
```

Although file transfers cannot be cancelled from the 370 side, Kermit-370 is capable of responding to "cancel file" or "cancel batch" signals from the local Kermit; these are typically entered by typing CTRL-X or CTRL-Z, respectively.

When Kermit-370 sends files using long packets (longer than 94), the throughput is especially sensitive to the level of noise on the line because retries are so time-consuming. Therefore, Kermit-370 imposes an extra, heuristic size limit on packets when retries have been found necessary. When that is the case, after every 15 packets, Kermit computes the packet size for maximum throughput assuming that the transmission errors were due to sparse, Poisson-distributed noise bursts. The result of this calculation is then used as another limit on the size of outgoing packets besides the one specified by the other Kermit. If no retries are required, then Kermit-370 assumes the line to be noiseless and sends packets of the maximum length the other Kermit allows. The algorithm is explained in *Kermit News* V. 3 #1. For more details on the SEND subcommand syntax and operation, see the chapter on the desired system-specific variant of Kermit-370.

The SERVER Subcommand

Kermit-370 is capable of acting as a server. In server mode, Kermit-370 can send and receive files, execute host commands, execute a restricted set of Kermit subcommands, and perform a variety of generic Kermit functions. The following list shows the typical local Kermit commands along with the server functions they elicit. When Kermit-370 is talking to another Kermit running in server mode, these same subcommands may be used in the other direction.

BYE	log out the Kermit server.
FINISH	server mode.
GET	a file or files from the server.
REMOTE	
COPY	a file or files.
CWD	set new working directory.
DELETE	a file or files.
DIRECTORY	display file attributes.
HELP	display a command summary, such as this.
HOST	execute a system command.
KERMIT	execute a Kermit-370 subcommand.
PRINT	send a file to be printed by the server.
RENAME	a file or files.
SPACE	display disk space.
TYPE	a file.
SEND	a file or files to the server.

If your local Kermit does not support the REMOTE KERMIT command, you may need to issue SET subcommands to select various options before typing the SERVER subcommand. Once in server mode, Kermit-370 will await all further instructions from the client Kermit on the other end of the connection until a FINISH or BYE command is given.

Command execution in server mode is different in some respects from normal operation. First of all, some Kermit subcommands are not allowed (see the list at the beginning of this section). Moreover, command errors always terminate any active TAKE file. Also, all commands will be run in the special environment that Kermit sets up during protocol transfers. Among other things, Kermit intercepts all terminal I/O (if possible) in this environment in order to transmit the data to the local Kermit as text packets.

Note that some operations can be requested by several different commands. If for example, the IBM 370 system has a command ‘‘PRT’’ for displaying a file, a user interacting with a Kermit-370 server can choose to display a file by issuing any of the commands: REMOTE TYPE, REMOTE HOST PRT, REMOTE KERMIT TYPE, REMOTE KERMIT HOST PRT, or (if SYSCMD has been set ON) REMOTE KERMIT PRT. The first form simply transfers the requested file as text, but the others invoke the ‘‘PRT’’ command with any specified options, intercept the

terminal output, and return the results to the local Kermit. The first form is also distinguished by the fact that the line range may be specified in the same manner as in the SEND subcommand. The syntax of the others is system-dependent.

The SET Subcommand

Syntax: SET *parameter* [*value*]

The SET subcommand establishes or modifies various parameters controlling file transfers. The values can, in turn, be examined with the SHOW subcommand. Some parameters have two levels. In particular, there are two matching lists of SEND and RECEIVE sub-parameters corresponding to the values exchanged by Kermits in the Send-Init/ACK sequence. For each of these SEND/RECEIVE pairs one element is encoded in outgoing parameter packets, and the other is decoded from incoming ones. Setting the latter by hand may be needed to establish contact and also has the effect of redefining the default value for decoding from subsequent parameter packets. Generally, the distinction between SEND and RECEIVE parameters is unambiguous, the only exception being TIMEOUT (*q.v.*). The following SET subcommands are available in Kermit-370:

ATOE	Modify the Kermit-370 ASCII-to-EBCDIC table.
ATTRIBUTE	Determine A-packet generation.
BLOCK-CHECK	Level of error checking for file transfer.
CONTROLLER	Indicate type of terminal connection.
CONTROL-CHAR	Set prefixing state.
DEBUG	Log packet traffic during file transfer.
DELAY	Length of pause before a SEND subcommand.
EOF	Text file truncation at CTRL-Z.
ETOA	Modify the Kermit-370 EBCDIC-to-ASCII table.
FILE	Attributes for incoming or outgoing files...
CHARACTER-SET	... for 370 storage.
COLLISION	... treatment for duplicate names.
LONGLINE	... treatment of too-long records.
OVERWRITE	... treatment of attributes.
TYPE	... text or binary.
other	... system-specific attributes.
FOREIGN	Strings added to outgoing filespec...
PREFIX	
SUFFIX	
INCOMPLETE	Determine the action on an aborted file transfer.
LINE	Specify alternate communication line.
MARGIN	for sending files...
LEFT	
RIGHT	
PROMPT	For Kermit-370 subcommands.
RETRY	Maximum retry count...
INIT	... for initial packet exchange.
PACKET	... per packet for ongoing transfer.
SERVER-TIMEOUT	Spacing between server NAK's.
SPEED	Line speed for packet-size calculations.
SYSCMD	Try apparently invalid Kermit subcommands on host system.
TABS-EXPAND	Determine tab-to-space conversion on reception.
TAKE	
ECHO	Echo subcommands read from TAKE files.
ERROR-ACTION	Exit from TAKE file on command error.
TEST	Facilitate testing of Kermit.
TATOE	Modify the Kermit-370 ASCII-to-EBCDIC table.
TETOA	Modify the Kermit-370 EBCDIC-to-ASCII table.
TRANSFER	Options for transmission...
CHARACTER-SET	... of text files.

LOCKING-SHIFT	... protocol extension.
TTABLE	Determine which tables undo the terminal translation.
8-BIT-QUOTE	Determine state of 8th-bit prefixing.
SEND or RECEIVE	
END-OF-LINE	Packet terminator.
PACKET-SIZE	Maximum packet size.
PAD-CHAR	Character to insert before each packet.
PADDING	Number of pad characters to insert.
PARITY	Indicate if 7-bit or 8-bit data.
QUOTE	Use to quote control characters in packets.
START-OF-PACKET	Packet beginning marker.
TIMEOUT	Time limit for response.

SET ATOE etc.

Syntax: `SET` *table* [*num1 num2*]

This modifies one of the ASCII/EBCDIC translation tables used by Kermit-370 (for example, to conform to your system). The valid table names are ATOE, ETOA, TATOE, and TETOA. The arguments are, respectively, the offset within the named table and the new value for that offset. If the arguments are omitted, the table is restored to its initial arrangement. Both *num1* and *num2* should be in the range 0-255 (decimal). For example, in ATOE or TATOE, the offset is the ASCII character code, and the new value is the new EBCDIC result code. Initially, ATOE and TATOE each contain two identical copies of the 7-bit ASCII character table. Helpful hint: if you have files that make use of extended (8-bit) ASCII codes and wish to upload them via Kermit-370, be sure to define unique EBCDIC equivalents of all the needed 8-bit ASCII codes or else treat such files as binary data. Any time you use the SET ATOE or SET ETOA subcommands, that has a side effect equivalent to SET ATTRIBUTE ENCODING OFF (*q.v.*). If the extended ASCII character set is one of those supported for file transfer in Kermit-370, you need only issue a SET TRANSFER CHARACTER-SET (*q.v.*).

Note: the meaning of the tables depends on the TTABLE setting -- if TTABLE is OFF, the TATOE and TETOA tables are not used.

SET ATTRIBUTE

Syntax: `SET ATTRIBUTE` [*attribute*] `ON` *or* `OFF`

The individual *attribute*s are LENGTH, TYPE, DATE, CREATOR, ACCOUNT, AREA, PASSWORD, BLOCKSIZE, ACCESS, ENCODING, DISPOSITION, PROTECT, ORIGIN, FORMAT, SYS-INFO, and BYTE-LENGTH. Kermit-370 distinguishes between the two forms of this subcommand by counting "words". In order to see the list of supported attributes, you must enter ‘‘`SET ATTR ? ?`’’; if you enter just ‘‘`SET ATTR ?`’’, Kermit will list just the alternatives ON and OFF.

ON The specified attribute is to be processed, or attribute packets are generated for all outgoing files, provided the other Kermit indicates the ability to accept them. (Default).

OFF The specified attribute is to be ignored and not generated, or attribute packets are never generated.

SET BLOCK-CHECK

Syntax: `SET BLOCK-CHECK` *type*

This determines the type of block check used during file transfer, provided the other Kermit agrees. Valid options for *type* are: 1-byte (for a one-character checksum), 2-byte (for a two-character checksum), 3-byte (for a three-character CRC), and Blank-free-2 (for a shifted two-character checksum that avoids using blanks. This is one of only two Send-Init parameters that cannot be SET separately for SEND and RECEIVE.

SET CONTROLLER

Syntax: `SET CONTROLLER` *type*

The *type* may be TTY, SERIES1, GRAPHICS, AEA, FULLSCREEN, VTAMTTY, or NONE. Kermit-370 automatically determines whether you are connected via a Series/1 (or similar) emulation controller or a TTY line. In some circumstances, such as when the connection is through a non-graphics-capable 3174 port, Kermit will set CONTROLLER to NONE, which has the effect of disabling file transfers. This subcommand is provided, though, to allow the automatic choice to be superseded, and because Kermit may not be able to distinguish between Series/1-type and other 3270-emulation controllers. In particular, there is no way to distinguish between FULLSCREEN and GRAPHICS from within Kermit. When CONTROLLER is set to SERIES1, GRAPHICS, or AEA, Kermit disables the 3270 protocol conversion function by putting the terminal controller into "transparent mode", which allows Kermit packets to pass through intact. Note: an incorrect CONTROLLER setting may lock up or wipe out your session when you try to transfer files.

Kermit operation is possible through an IBM 3708 front end, but only in a rather specific configuration. See the installation guide for your variant of Kermit-370 for the details of that and other hardware-related restrictions and configurations.

SET CONTROL-CHAR

Syntax: `SET CONTROL-CHAR` *mode* [*number*]

The *mode* may be PREFIXED (normal Kermit protocol for control characters) or UNPREFIXED. In the latter case, the specified control character (given as a decimal number in the range 0-31 or 128-159) is transmitted "as is". If the *number* is omitted, then all control characters are set accordingly. Kermit-370 automatically overrides the user's settings for certain characters used for Kermit protocol: the start-of-packet, the end-of-packet, the handshake (if set), and XOFF (not really used, but too dangerous to send). Sending control characters without prefixes can speed up transfers of binary files.

The status of prefixing is initially "PREFIXED" for all control characters. It can be displayed by the TDUMP CONTROL subcommand, or saved in the form of a TAKE file by the GIVE CONTROL subcommand (*q.v.*).

SET DEBUG

Syntax: `SET DEBUG OFF` *or* `ON [RAW] [I/O] [SAVE] [LONG] [TIME]`

Note: any combination, in any order, of RAW, I/O, SAVE, and TIME may follow or replace ON. Each of the three implies ON.

ON — Keep a journal of all packets sent and received in a log file on disk. If the file already exists, it is erased and overwritten. The *filespec* of the log is, of course, system-dependent. All packets are logged in EBCDIC for legibility, even when CONTROLLER is set to SERIES1, GRAPHICS, or AEA.

RAW — The same as ON, but packets are logged in the form that is passed to or from the operating system, *i.e.*, EBCDIC for TTY or VTAMTTY terminals, and ASCII for SERIES1, GRAPHICS, and AEA terminals. This option is generally not recommended; I/O is preferable.

I/O — The same as ON, but the log includes additional transmission status information, such as the AID returned by a full-screen device. See below for a summary of the log formats.

SAVE — The same as ON, but the log file is closed after each entry is added, so that, if the session is abnormally terminated, the log file will be complete and readable.

LONG — The same as I/O, but the additional information is not truncated to 36 bytes.

TIME — Used only with I/O or LONG. The lines of hexadecimal dump are tagged with the time of day from the CPU clock, truncated to the nearest second.

OFF — Stop logging packets and close the the log file. (Default.)

Often, problems with Kermit file transfers or server-mode operations can be diagnosed by setting DEBUG on in one or both Kermits, regardless of where the problems actually lie. For Kermit-370, the maximum amount of information can generally be obtained by setting DEBUG to I/O or LONG, but the format of the log depends somewhat on which variant of Kermit-370 is involved. Before examining the log, you should set DEBUG OFF either explicitly or by exiting from Kermit-370.

There is an optional feature for logging dumps of storage blocks at selected points in the execution. By default, this feature is disabled (at assembly time) by having the variable symbol &KTRACE set to NO and also by virtue of the fact that no calls to the dump routine are present in the distribution code. Further, the dumps are suppressed unless both DEBUG and TEST (*q.v.*) are set on. To select when and what blocks to dump, it is necessary to insert calls to KHDMP at appropriate points in the source before assembling. Each such call generates a dump each time it is executed, provided that DEBUG and TEST are set, and the contents of all registers are preserved. The call specifies the starting address, the length, and a short title for the block. Only eight characters of the title will be used. Some examples:

```
KHDMP ATOE+128,128,'ATOEhigh'
```
Dump the 2nd half of the ATOE table.

```
KHDMP KHDSAV,20,'R14 - R2'
```
Dump registers 14-2.

```
KHDMP 32(,13),40,'**R3-R12'
```
Dump registers 3-12.

```
KHDMP (3),(0),'**QBLOCK'
```
Dump block addressed by R3 with length specified in R0.

There is another debugging facility that is enabled by the variable symbol &KTRACE along with the dump option, namely, an execution trace. There is a circular buffer of trace elements in Kermit's working storage, and a new element is written each time a Kermit subroutine is called or returns. The elements contain the subroutine name plus (on entry) a sequence number and the contents of registers 0 and 1 or (on exit) the character ''>'' and the contents of registers 15 and 1. There is also a mechanism for tracing extra events by inserting KTRACE calls into the source. For example,

```
KTRACE 0(5),REGS=5
```
Trace eight bytes pointed to by R5 and R5 itself.

```
KTRACE FOOBAR
```
Trace eight bytes at label FOOBAR.

```
KTRACE 'Found it',REGS=(1,7)
```
Trace "Found it", R1, and R7.

The trace table is simply updated in storage, eating its own tail. It can be found in a memory dump by locating the "eye-catcher" that says ''`KTRACE:`'', which precedes the start, current, and end pointers for the table. The table is also accessible interactively via the TDUMP subcommand (*q.v.*).

Each line in the debug log begins with a one-letter tag and a colon and contains information according to the tag. The following tags are defined.

S: The text of a packet sent. Normally, it will be encoded in EBCDIC for convenience, but if DEBUG is set to RAW, the packet will appear exactly as passed to or from the system, i.e., in EBCDIC for TTY or VTAMTTY lines and in ASCII for full-screen lines.

R: The text of a packet received. The same encoding applies.

A: The AID and buffer address returned by a full-screen device along with a read operation (three characters in all). The values should all be printable EBCDIC. This obsolete tag was used by TSO and MUSIC Kermits and appeared only when DEBUG was set to I/O.

*: Data dumped by the optional KHDMP routine.

The following tags appear only when DEBUG is set to I/O or LONG. All values are in hexadecimal. The meanings differ slightly according to the operating system. For CMS, the I/O parameter list is a channel command; for TSO or ROSCOE, the SVC 93 (TPUT/TGET) parameters; for CICS, an intermediate string similar to channel commands. Similarly, the status data consist of the stored CSW plus an attention interrupt indicator for CMS, but the return code from the I/O operation for TSO, ROSCOE, CICS, and MUSIC.

a: Channel and device status after an unexpected attention interrupt.

b: I/O parameter list for recovering from a CP break-in on screen.

c: I/O parameter list for resuming normal screen operation.

d: Data transferred on the previously indicated I/O operation.

e: Status data after an I/O command has completed with an error.

g: I/O parameter list for reading from the screen buffer.

i: Status data after an I/O command has completed normally.

m: I/O parameter list for displaying text on the screen.

o: I/O parameter list for initializing the screen for transfers.

r: I/O parameter list for reading from the terminal.

w: I/O parameter list for a transparent write.

?: I/O parameter list for some other operation, such as clearing the screen.

SET DELAY

Syntax: `SET DELAY` *number*

Normally, Kermit-370 waits 10 seconds after the SEND subcommand before starting the transfer, but this delay may be set to any non-negative value. Two DELAY values have special meaning. When DELAY is 1, the usual two-line greeting displayed during protocol mode is abbreviated to a short message (the default Kermit prompt with three dots...), and when DELAY is 0, the greeting is suppressed entirely, along with the extra one-second pause for subcommands like RECEIVE, SERVER, REMOTE, and the like.

SET EOF

Syntax: `SET EOF ON` *or* `OFF`

ON Scan each incoming TEXT file for the first occurrence of CTRL-Z and ignore the remainder of the file (but continue decoding up to the actual end of the file). BINARY files are not affected.

OFF Accept incoming files in their entirety. (Default.)

SET FILE CHARACTER-SET

Syntax: `SET FILE CHARACTER-SET` *name*

Specifies the name of the character set used in files stored on disk. This setting may be superseded by an Attribute packet of an incoming file. Currently, the available names are CP037, CP273, CP275, CP277, CP278, CP280, CP281, CP282, CP284, CP285, CP290, CP297, CP420, CP424, CP500, CP838, CP870, CP871, CP875, CP880, CP905, CP1047, CZECH, DKOI, EBCDIC, H-EBCDIK-DASH, and KANJI (or FUJITSU-KANJI, HITACHI-KANJI, or IBM-KANJI). The names beginning with CP refer to IBM code pages, while DKOI is the Cyrillic standard GOST 19768-87 used in the USSR, CZECH is a character set sometimes used in Czechoslovakia, and EBCDIC (the default) is the traditional *de facto* standard EBCDIC character set. A character set other than the default may be required by local conventions and, if so, should be specified in the system or user INIT files. See Table 1-1 for the allowed combinations of transfer and file character sets. Explicitly setting this option has a side effect equivalent to issuing SET ATTRIBUTE ENCODING ON (*q.v.*).

The name KANJI is actually just an alias for the local preferred proprietary Kanji code (Fujitsu, Hitachi, or IBM).

The various Kanji character sets have two-byte codes (DBCS), but are used with one-byte code pages (SBCS) as well. It is normally necessary to issue two SET FILE CHARACTER-SET SUBCOMMANDS in order to set up for a DBCS: first, selecting a compatible SBCS, and, second, selecting the DBCS itself. If the current SBCS is incompatible with the selected DBCS, a default will be chosen. This default, along with the choice of the particular proprietary character set associated with the alias KANJI, is chosen by the installer.

SET FILE COLLISION

Syntax: `SET FILE COLLISION` *action*

Specifies the action to take when an incoming file has the same name as an existing one. Two of the options involve choosing an alternative, unique name similar to the one in conflict, but the details of choosing are system-specific. Typically, the method involves adding digits to the existing name.

APPEND The new file is appended to the old one. This option has the the same effect as the old subcommand SET APPEND ON.

BACKUP The existing file is renamed, and the new file is given the desired name as if no conflict had occurred.

DISCARD The incoming file is rejected by returning a "cancel file" indication on any Data packets.

OVERWRITE The existing file is overwritten with the incoming file. This is the default for the CMS, TSO, ROSCOE, and MUSIC variants. Changing this default is a good candidate for INIT files. When COLLISION is set to OVERWRITE, the attributes of the new file are determined by the current setting of FILE OVERWRITE (*q.v.*).

RENAME The incoming file is renamed so as not to destroy (overwrite) the pre-existing one, and the new name is returned to the sending Kermit for information purposes. This has the same effect as the old subcommand SET WARNING ON. This is the default for the CICS variant.

SET FILE LONGLINE

Syntax: `SET FILE LONGLINE FOLD` *or* `TRUNCATE` *or* `HALT`

This specifies the action to take when a received line is longer than the current maximum record length. That length is determined by the context in a system-specific way. Refer to the description of the RECEIVE subcommand in the appropriate chapter for details.

FOLD Specifies that long lines are to be split into two or more records as needed, all but the last being of the maximum length. No null records are created when the received line is an exact multiple of the record length. BINARY files are always considered, by definition, as a single line and, therefore, are *always* folded, regardless of the setting of this parameter. V-BINARY and D-BINARY files, on the other hand, are reconstructed by folding at points determined by the context within the received file, and cannot be folded further to fit the current maximum length. Any such records that are too long will be truncated.

TRUNCATE Specifies that long lines are to be truncated at the maximum length. (Default.) Kermit-370 takes note of the number of such truncations performed on a file and reports it in the STATUS message and also treats the fact of truncation as an error when the file transfer is complete. The file will have been transferred, but obviously not quite intact. However, this option can be useful for some tasks, such as stripping sequence numbers from card images. The process is similar to that provided by the SET MARGIN RIGHT subcommand for sending files.

HALT Specifies that a file transfer is to halt immediately if a received line is too long. Kermit-370 then issues an error packet and stops the transfer.

SET FILE OVERWRITE

Syntax: `SET FILE OVERWRITE DEFAULT` *or* `PRESERVE`

DEFAULT Specifies that the current file attribute settings are to be used for the new file. The result is roughly the same as if the old file, if any, were completely erased before the new file is received. (Default.)

PRESERVE Specifies that the attributes of the file being overwritten are to be retained and used for the new file. The result is roughly the same as if the old files contents were deleted, and the new file were appended to the empty stub.

SET FILE TYPE

Syntax: `SET FILE TYPE` *type*

Specifies the type of data comprising files to be sent or received. This setting may be temporarily superseded by the Attribute packets for a file being received.

TEXT Specifies ordinary text. ASCII-to-EBCDIC or EBCDIC-to-ASCII translation is performed on the data. Trailing blanks are removed, and CRLF's are appended to outgoing records. CRLF's are used, in turn, to determine the end of incoming records, which are padded with blanks if necessary to fill buffers. (Default.) Note: trailing blanks are removed from outgoing, varying-length records only if they consist of a single blank each, or if there is a right margin specified (*q.v.*). Further note: a given file is intrinsically categorized as fixed-length or varying-length (or undefined-length) by the file system and cannot be changed simply by setting the FILE RECFM parameter in Kermit. Conversion between formats is a system-specific function; see the system documentation or consult your local support staff for details on conversion techniques.

BINARY Specifies bit-stream data. No translation is performed, no CRLF's are added to outgoing records, and blanks are neither added nor removed. Incoming bytes are added successively to the current record buffer, which is written out when the current LRECL is reached. Padding, if necessary, is done with nulls.

V-BINARY Specifies varying-length-record binary data. This type is like BINARY, except that a two-byte binary prefix is added to each outgoing record giving the number of data bytes, and incoming records are set off by (and stripped of) their prefixes on receipt.

D-BINARY Is like V-BINARY except that the length prefixes are five-byte ASCII-encoded decimal (right-justified with leading zeroes).

SET FOREIGN

Syntax: `SET FOREIGN PREFIX` *string*

This defines a prefix string to be added to the outgoing *filespec* generated by the SEND subcommand. For example, the string might be set to ''`B:`'' to specify output to the B disk drive on the other Kermit's system. The default is a null string. There is also a FOREIGN SUFFIX handled in the same manner.

SET HANDSHAKE

Syntax: `SET HANDSHAKE` *number*

This defines the character, if any, that Kermit-370 should send (or cause to be sent) immediately before reading each packet. The character is given as the decimal of an ASCII control character, or as zero if no handshake is to be sent. The default is 17 (XON), and any value in the range 0-31 is valid, but 13 (CR) should not be used because it is generally the end-of-packet character. When Kermit-370 is running through a full-duplex connection (such as a ''`SERIES1`''), the traditional IBM handshaking is not necessary, and HANDSHAKE should be set to 0 (as long as the other Kermit can be instructed not to expect a handshake). Note the distinction between `SET HANDSHAKE` in Kermit-370 (where it defines a character to be sent) and in many micro Kermits (where it defines a character to be expected).

SET INCOMPLETE

Syntax: `SET INCOMPLETE DISCARD` *or* `KEEP`

DISCARD Specifies that incomplete files (that is, files partially received in a transfer cancelled by the other Kermit) are to be erased. This is the default. Note that when FILE COLLISION is APPEND, incomplete files are never erased, lest pre-existing data be lost.

KEEP Specifies that incomplete files are to be kept.

SET LINE

Syntax: `SET LINE [`*name*`]`

This specifies an alternate communication line for file transfers. If the *name* is omitted, the default line (the user's terminal) is used. The format of *name* is, of course, system-dependent, and some variants of Kermit-370 do not support any alternate lines. No variant currently allows Kermit-370 to CONNECT over an alternate line.

SET MARGIN

Syntax: `SET MARGIN` *side column*

When Kermit-370 sends a text file, each line may be truncated on the left or right (or both) at fixed column numbers. Only the text from the left margin to the right margin (inclusive) will be sent, and any trailing blanks in the truncated lines will be stripped. A value of zero for either margin disables truncation on that side.

SET PROMPT

Syntax: `SET PROMPT [`*string*`]`

This defines the character string that Kermit-370 displays when asking for a subcommand. The prompt may be any string of up to 20 characters. The default is the name of the system-specific variant of Kermit-370 followed by a ">" sign, *e.g.*, `Kermit-CMS>`. If the *string* is omitted, normal system prompting will occur.

SET RETRY

Syntax: `SET RETRY INITIAL` *or* `PACKETS` *number*

Kermit-370 resends its last packet after receiving a NAK or bad packet, but it eventually gives up after repeated failures on the same packet. The limit on retries can be set separately for the initial packet exchange (Send-Init or server-mode command) and for ordinary packets. The default for INITIAL is 16 and for PACKETS, 5. Either limit can be set to any positive value.

SET SERVER-TIMEOUT

Syntax: `SET SERVER-TIMEOUT` *time*

This defines the *time* in seconds that Kermit-370 in server mode should wait for a command before sending a NAK packet. The default is 120. A value of 0 means that Kermit should wait indefinitely, not only in the server loop, but in all transfers, regardless of the timeout value specified by the other Kermit. Some variants are unable to time out in any case. Also, timeouts are not implemented for any of the full-screen terminal controllers.

SET SPEED

Syntax: `SET SPEED` *number*

This determines the communication line speed assumed by Kermit-370 in calculating the optimum packet size. If the value is zero, such calculations are suppressed. This option is purely informative and has no effect on actual line speed. (Default 1200.)

SET SYSCMD

Syntax: `SET SYSCMD ON` *or* `OFF`

ON If the user enters a command string which is not a valid Kermit subcommand, Kermit-370 will pass the string along to the host operating system for execution. If the string is rejected by the system as well, Kermit will report it as an invalid *Kermit* subcommand. Otherwise, Kermit will assume the string was intended as a host command and will simply report the completion code if non-zero.

OFF Invalid Kermit subcommands are simply rejected as such. System commands may be executed, of course, but only by specifying the generic prefix ''`HOST`'' or the appropriate system-specific prefix, such as CMS or TSO. (Default.)

SET TABS-EXPAND

Syntax: `SET TABS-EXPAND ON [`*list*`]` *or* `OFF`

ON Tab characters in incoming TEXT files are replaced by one or more blanks to bring the record size up to the next higher multiple of eight for each tab. If tab settings other than columns 1, 9, 17, *etc.* are desired, they may be specified explicitly in a list following the keyword ''`ON`''. Items in the list may be separated by spaces or commas and must be in strictly increasing order.

OFF Incoming tabs are retained. (Default.)

SET TAKE ECHO

Syntax: `SET TAKE ECHO ON` *or* `OFF`

ON Subcommands are echoed to the terminal as they are executed from a TAKE file.

OFF Subcommands from a TAKE file are executed "silently." (Default.)

SET TAKE ERROR-ACTION

Syntax: `SET TAKE ERROR-ACTION CONTINUE` *or* `HALT`

CONTINUE Execution continues in a TAKE file regardless of illegal commands, except in server mode. (This is the default.)

HALT A command error in a TAKE file causes immediate exit to Kermit subcommand level.

SET TEST

Syntax: `SET TEST ON` *or* `OFF`

ON Allow setting the START-OF-PACKET and other special characters to any value, and suppress type 1 checksum testing on received packets.

OFF Normal operation. (Default.)

SET TRANSFER CHARACTER-SET

Syntax: `SET TRANSFER CHARACTER-SET` *name*

Specifies the name of the character set used in sending or receiving files. This setting may be superseded by an Attribute packet of an incoming file. Currently, the available names are ASCII (the default), ARABIC, CYRILLIC, GREEK, HEBREW, JAPAN-EUC, KATAKANA, LATIN1, LATIN2, LATIN3, THAI, and TRANSPARENT. There are also special aliases L1, L2, and L3 for the LATINx names. All but JAPAN-EUC, TRANSPARENT, and ASCII represent 8-bit codes composed of a pair of 94- or 96-character sets from the ISO registry combined with normal definitions for the so-called C0 and C1 characters. JAPAN-EUC is a DBCS for encoding Kanji characters, plus Roman, Greek, and Cyrillic. ASCII is the traditional character set supported by Kermit, but one of the newer, 8-bit sets would be preferable for most users. This option is, therefore, a good candidate for inclusion in the system INIT file. See Table 1-1 for the allowed combinations of transfer and file character sets. Explicitly setting this option has a side effect equivalent to issuing SET ATTRIBUTE ENCODING ON (*q.v.*). There is one exception,

namely, TRANSPARENT, which sets ENCODING OFF and replaces both translation tables with null operations, regardless of the current nominal file character set.

The biggest drawback of the built-in tables for the various character sets is that neither the ISO registry nor IBM defines any mapping between the C1 characters (hex 80-9F in ISO arrangements) and the characters of EBCDIC code pages. Thus, the mappings in Kermit-370 tables are somewhat arbitrary, and future pronouncements may suddenly invalidate some or all of those 32 mappings.

SET TRANSFER LOCKING-SHIFT

Syntax: `SET TRANSFER LOCKING-SHIFT ON` *or* `OFF` *or* `FORCED`

ON The Kermit locking-shift protocol is to be used in transfers to or from cooperating partners, provided that 8th-bit quoting is enabled.

OFF The Kermit locking-shift protocol is not to be used.

FORCED The Kermit locking-shift protocol is to be used, regardless of the cooperation of the other Kermit. The encoding uses only the locking shifts, to the exclusion of 8th-bit quoting.

SET TTABLE

Syntax: `SET TTABLE ON` *or* `OFF` *or* `KP`

ON The translation that undoes the terminal controller's ASCII/EBCDIC conversion comes from the TATOE and TETOA tables, rather than the ATOE and ETOA tables (which are used only for translating disk files). This option has no effect when there is no translation built into the controller, *i.e.*, with SERIES1, GRAPHICS, and AEA connections.

OFF The ATOE and ETOA tables are used for all translations by Kermit-370. (Default.)

KP Same as ON, but also establishes values in the TATOE and TETOA tables based on IBM's corporate standard ASCII/EBCDIC translation (distinct from the internationally accepted *de facto* standard).

SET 8-BIT-QUOTE

Syntax: `SET 8-BIT-QUOTE` *char* *or* `ON` *or* `OFF`

This controls whether eighth-bit prefixing is done and can be used to specify the character to be used. This is one of only two Send-Init parameters that cannot be SET separately for SEND and RECEIVE.

char Eighth-bit prefixing will be done using *char*, provided the other Kermit agrees. The default value is an ampersand.

ON Eighth-bit prefixing will be done, provided the other Kermit explicitly requests it (and specifies the character).

OFF Eighth-bit prefixing will not be done.

SET SEND/RECEIVE

The following parameters can be set either as SEND or RECEIVE options. As a rule, in each pair, one is the operational value, and the other is used to change the default for Send-Init packets received from the other Kermit and to set up parameter values as if the other Kermit had specified them on the previous exchange. When both values are described, the operational one will be first. For all parameters besides QUOTE, the operational value is the RECEIVE. After a transfer, the operational values will be unchanged, but the others (as displayed by SHOW) will reflect the parameters specified by the other Kermit. The underlying defaults established by previous SET subcommands will still be in effect. In the syntax descriptions, *mode* is SEND or RECEIVE.

END-OF-LINE

Syntax: `SET` *mode* `END-OF-LINE` *number*

RECEIVE should not be changed.

SEND may be needed to establish contact. If the other system needs packets to be terminated by anything other than carriage return, specify the decimal value of the desired ASCII character. *number* must be in the range 0-31 (decimal). The default is 13 (CR).

PACKET-SIZE

Syntax: `SET` *mode* `PACKET-SIZE` *number*

RECEIVE defines *number* as the maximum length for incoming packets. The valid range is 26-9024, but 94 is the limit for normal short-packet protocol. The default is 80. Specifying a value greater than 94 is necessary and sufficient to enable the long-packet protocol for transfers to Kermit-370 (provided the other Kermit is willing). Kermit-370 will actually accept long packets in any case, but the protocol requires that the other Kermit not send them unless Kermit-370 asks. Raising this value from the default is a good candidate for inclusion in INIT files. In practice, the packet size may be limited by hardware and programming considerations. See the system-specific chapters for details.

SEND might be needed for sending files to a minimal Kermit that neither specifies a buffer size in the Send-Init sequence nor can accept the default (80). It may also be used to specify the packet size for a "raw" download via the XTYPE subcommand. This parameter has no other function and is completely irrelevant to long packets. If the other Kermit asks for long packets, Kermit-370 will always comply.

PAD-CHAR

Syntax: `SET` *mode* `PAD-CHAR` *number*

RECEIVE defines *number* as the character to be used by the other Kermit for padding packets. The character must be an ASCII control character (in the range 0-31). The default is 0 (NULL). This option is seldom useful.

SEND may be needed to establish contact if the other Kermit (or the transmission line) needs padded packets.

PADDING

Syntax: `SET` *mode* `PADDING` *number*

RECEIVE defines the *number* of pad characters to be used for padding packets from the other Kermit. This number may be anywhere from 0 to 94. The default is 0. This option is seldom useful.

SEND may be needed to establish contact if the other Kermit (or the transmission line) needs padded packets.

PARITY

Syntax: `SET` *mode* `PARITY MARK` *or* `NONE`

RECEIVE specifies the parity expected in the transparent-mode ASCII data received by the mainframe from a full-screen device. Such data will typically have either all Mark parity (seven data bits with the eighth bit set) or no parity (eight data bits). This is typically not the same as the parity used in communications between the protocol convertor and the terminal. Kermit-370 must know which kind of parity to expect in order to calculate checksums properly. Since Kermit-370 does not actually verify parity, the other possible variants (ODD, EVEN, and SPACE) are lumped together with MARK parity for the purpose of this subcommand, which merely chooses between 7-bit and 8-bit data transfer. The default is MARK.

SEND is also an operational value, specifying the parity to be used in constructing outgoing data packets on full-screen devices. NONE is the default and is generally preferable, in that it permits binary transfers without the need for eighth-bit prefixing, but MARK may be required in some configurations.

QUOTE

Syntax: `SET` *mode* `QUOTE` *char*

SEND indicates a printable character for prefixing (quoting) control characters and other prefix characters. The only good reason to change this would be for sending a file that contains many ‘‘#’’ characters (the normal control prefix) as data. It must be a single character with ASCII value 33-62 or 96-126 (decimal).

RECEIVE would be needed only for talking to a crippled Kermit that uses a non-standard quoting character, but does not admit it.

START-OF-PACKET

Syntax: `SET` *mode* `START-OF-PACKET` *number*

RECEIVE defines *number* as the character to be expected to mark the start of packets from the other Kermit. The character must be an ASCII control character (in the range 0-31). The default is 1 (SOH). This may need to be changed to establish contact.

SEND may also need to be changed to establish contact. It defines *number* as the character to be used to mark outgoing packets.

TIMEOUT

Syntax: `SET` *mode* `TIMEOUT` *time*

RECEIVE defines the *time* in seconds the other Kermit is to wait for a response from Kermit-370 before resending a packet. The default is 5. A value of 0 means the other Kermit should wait indefinitely.

SEND may be needed to define the *time* in seconds Kermit-370 is to wait for a response from the other Kermit in the initial packet exchange, although the default value 0 (indefinite wait) is probably satisfactory, especially since Kermit-370 in many cases cannot time out anyway. Specifying a non-zero value will prevent the other Kermit from ever requesting infinite "patience" from Kermit-370.

The SHOW Subcommand

Syntax: `SHOW` [*option*]

The SHOW subcommand displays the values of all parameters that can be changed with the SET subcommand, except CONTROL-CHAR, ATOE, ETOA, TATOE, and TETOA (for those, see the TDUMP subcommand). If specified, *option* can be a particular parameter or the keyword ‘‘`ALL`’’ (the default). Groups of parameters, such as SEND, can be displayed by requesting the group name, or individual sub-parameters can be displayed by specifying the complete name. For example,

```
SHOW RECEIVE EOL
```

will display the decimal value of the packet terminator that Kermit-370 currently expects, *i.e.*, 13. Similarly,

```
SHOW FOREIGN
```

will display the character strings currently in use for prefix and suffix on each outgoing *filespec*. When ‘‘`ALL`’’ is specified or implied, all parameters other than the attribute switches are displayed.

The STATUS Subcommand

Syntax: `STATUS`

This subcommand displays information about the previously executed subcommand. The response will include either the appropriate error message or the message ''`No errors`''. The initial status is ''`No file transfers yet`''. If the status reflects an error condition, the name of the last file used (excluding TAKE files) will be displayed as well. If the error was detected by the other Kermit, the message will be ''`Micro aborted`'' followed by the text from the Error packet. Conversely, if Kermit-370 detected the error, the text of the status message will have constituted the error packet sent out. In any case, if the last file transfer was cancelled (by virtue of an attribute mismatch or manual intervention), the reason for cancellation is displayed. Also, if the error occurred in disk I/O, any available explanatory information is displayed. Normally, the error status is altered only when a transfer-initiating subcommand (SEND or RECEIVE) is executed, but there are several exceptions. If an invalid subcommand is entered, the status becomes ''`Kermit command error`'', and the next subcommand entered will reset the status. Also, in server mode *every* subcommand is received through a transfer from the other Kermit and may affect the status (except the STATUS subcommand itself, of course).

Other information is also included. When Kermit-370 has been forced to truncate one or more records in the last RECEIVE operation (because of the current maximum record length), the number of records truncated is reported. The status display also includes throughput statistics for the last transfer: number of files sent, duration, number of packets, number of retries, and averages of bytes/packet and bytes/second. These last two quantities are calculated separately for bytes sent and received on the communication line (including padding, if any), and the last quantity is also calculated on the basis of the number of bytes read from or written to disk. Further, if retries were necessary, Kermit-370 computes the optimum packet size assuming the retries to have been due to sparse, Poisson-distributed bursts of noise. This is the same heuristic optimum that Kermit-370 computes and uses as an alternative packet-size limit when sending long packets. If TEST is set on, Kermit also reports the maximum size attained by its storage stack since execution began.

The STOP Subcommand

Syntax: `STOP`

This is not a subcommand in the usual sense. Instead, it is a command string that can be entered on the communication line while Kermit-370 is in protocol mode and will cause protocol mode to cease immediately. This may be useful if the other Kermit has crashed. The word "stop" may be entered in either upper or lower case, but it must be the only character string in the "packet" in question. If you are using a full-screen terminal, and if other information appears on the screen, you must clear that other text from the screen (using CLEAR EOF) before pressing ENTER.

The TAKE Subcommand

Syntax: `TAKE` *filespec*

Execute Kermit subcommands from the specified file, usually called a TAKE file. The TAKE file may in turn include TAKE subcommands, and the nesting may continue to a depth of ten. If a TAKE file includes the subcommand SERVER, however, the nesting count is saved and starts over again in server mode in case the client Kermit should transmit a REMOTE KERMIT TAKE command. The user has the option of seeing the subcommands echoed from the TAKE file as they are executed and also the option of automatically exiting from a TAKE file on error. See the subcommand SET TAKE for details.

The TDUMP Subcommand

Syntax: `TDUMP` *table-name or* `NAMES` *or* `TRACE`

This displays the contents of *table-name*. The same table can be modified using the SET subcommand. The ATOE, ETOA, TATOE, and TETOA translation tables and the CONTROL-CHAR prefixing selection table can presently be displayed and changed. The NAMES table is the transaction log for the last transfer, consisting of the *filespec* of each file sent or received, along with the size (in Kbytes) and any error messages. If the Kermit TRACE facility is enabled, the TRACE table may be displayed (and destroyed in the process). This table contains entries for subroutine calls and returns during program execution, but Kermit normally does not have the facility enabled. See SET DEBUG for more details on execution tracing.

The TYPE and XTYPE Subcommands

Syntax: `[X]TYPE` *filespec*

These subcommands display the named file. TYPE is effectively a synonym for (and allows the same options as) the host system command for displaying files at the terminal, but XTYPE performs a raw file transfer on the current communication line (which need not be the terminal) according to the current CONTROLLER setting. Thus, XTYPE uses transparent mode if CONTROLLER is SERIES1, GRAPHICS, or AEA. Also, it sends the data in bursts no larger than the current SEND PACKET-SIZE. Since XTYPE is basically a modified SEND, the options allowed on the *filespec* for SEND are also allowed for XTYPE.

The VERSION Subcommand

Syntax: `VERSION`

This subcommand displays the program version number and date.

1.5. Before Connecting to the Mainframe

Several options must be set in the micro Kermit before connecting to an IBM 370 system as a line-mode device. You should set LOCAL-ECHO to ON (to indicate half-duplex). This is the norm but not true in absolutely every case; if each character appears twice on your terminal screen, set LOCAL-ECHO to OFF. FLOW-CONTROL should be set to NONE, and on some systems HANDSHAKE should be set to XON. The parity should be set according to the system's specifications. On some micro Kermits, all of the above is done in one step using the DO IBM macro (or SET IBM ON). Set the baud rate to correspond to the line speed.

Connecting through a full-screen device also requires that certain options be set in the micro Kermit. You should set LOCAL-ECHO to OFF (to indicate full-duplex). FLOW-CONTROL should be set to XON/XOFF, and HANDSHAKE should be set to OFF. For many systems, the PARITY should be set to EVEN. Set the baud rate to correspond to the line speed.

One exception to these rules is the case where the micro Kermit is attempting automated file transfer, *e.g.*, downloading several separate files from Kermit-370 running in server mode. In fact, under those circumstances, handshaking is necessary even with ''`SERIES1`'' connections, and the two Kermits must be instructed to adopt a common handshake character (*e.g.*, by SET HANDSHAKE 10 to Kermit-370 and SET HANDSHAKE LF to the micro).

In any case, you should make sure that either the micro Kermit or Kermit-370 will provide timeouts during file transfers (if not both). Some variants of Kermit-370 (notably CMS) cannot provide timeouts, and you may need to set the TIMER to ON in the micro.

When you are connecting through a protocol convertor, it is useful to know the key sequence that causes the screen image to be repainted from the controller's memory. In many cases, it is CTRL-V, although CTRL-G and CTRL-C are also sometimes used. In general, this sequence should be typed whenever reconnecting to Kermit-370 after being in Kermit protocol mode (and sometimes after merely escaping to the local Kermit), since the local Kermit may have modified the screen.

1.6. Trouble-shooting Protocol Converters

Many, but not all, protocol converters have transparent modes that permit Kermit file transfers. The welter of competing and often incompatible communications devices would cause a major headache, except for three circumstances. First, Kermit-370 has routines for automatically detecting which kind of front end is controlling the current session; second, the Kermit installer is encouraged to tailor Kermit to force the correct choice of `CONTROLLER` whenever those routines don't work properly; and, third, Kermit offers a last-resort mode of operation that will work with almost any protocol converter. Because of the limitations in the catch-all mode (known as `FULLSCREEN` mode), it is still best to take advantage of the transparency, if any, in the protocol converter, and the automatic detection routines still play an important role. It will be instructive to outline what those routines actually do and how they can go wrong.

Recognizing a Series/1

Although protocol converters are advertised as simulating the behavior of IBM 3270-type terminals, there generally are differences which could be used to distinguish each type of device from the others and from real 3270-type terminals. However, all that really matters to Kermit-370 is whether there is a transparent mode available such that file transfers can be carried out. To date, only three fundamentally different transparent modes have been reported to Columbia, and it seems likely that no others have been (or, perhaps, ever will be) implemented. All are supported by Kermit.

Kermit-370 recognizes these front ends automatically by making two simple tests. The first takes advantage of one of the advanced features first implemented in the Yale ASCII system and subsequently copied in many of the devices that adopted the same transparent mode. This feature is a special 3270 data-stream order which requests a status report from the protocol converter. Kermit sends this order and then reads the "3270 screen". If Kermit sees a valid status report, it sets `CONTROLLER` to `SERIES1` and stops testing.

Two catches

Obviously, the Yale status order is not implemented in most other kinds of hardware. Thus, the order would be rejected by a non-Yale-type controller, and that could have undesirable side effects on the hardware. However, hardware is generally designed to be robust -- the real drawback lies in the side effects on certain communications software (notably VTAM/TSO), which may respond badly while trying to protect the robust hardware from illegal orders. If it proves impossible to make the external software behave properly, the only recourse is to modify Kermit-370 to skip the first test altogether and possibly to force the `CONTROLLER` setting; this modification is described in the relevant "Beware" file in a note dated 89/2/27.

Catch Two is that the status order is not implemented in all of the devices that support Yale-ASCII-style transparent mode. This means that some devices "fall through the cracks" in this procedure. A site where such devices are used may find it expedient to modify Kermit (following the same "Beware" pattern) to force the procedure to set `CONTROLLER` to `SERIES1` (assuming there are no other protocol converters also in use that support one of the other transparent modes). A list of such devices can be found in a footnote in the Kermit distribution file `ik0aaa.hlp`.

Recognizing a 3174

The second diagnostic test uses a hardware command (Read Partition Query) that is defined by IBM, but is not implemented on all 3270-type equipment. There is, thus, the same danger as in the first test, but the danger appears to be slight. Indeed, both CMS and TSO allow a user program to know in advance whether a Query is permitted. The Query response consists of one or more structured fields, and the 3174 AEA ASCII Graphics system (the only device with the `AEA` style of transparency) is easily identified by the appearance and content of a particular type of field. In fact, it is possible to tell from the Query data whether the particular 3174 line is allowed to use the ASCII Graphics transparency. Therefore, this test has three possible outcomes: Kermit may detect a transparency-enabled 3174 line (and set `CONTROLLER` to `AEA`); it may detect an incapable 3174 line (and set `CONTROLLER` to `NONE`); or it may detect "none of the above" (and set `CONTROLLER` to `GRAPHICS`). Thus, aside from the exceptions already noted, `GRAPHICS` simply means that the front end either supports SAS-style transparency or none at all.

Fallback positions

What should you do when the automatic detection fails? Obviously, the first thing is Be Prepared. Often, the misbehavior of VTAM can be halted by pressing ENTER or PA1, so you should be sure to know how to generate a PA1 when trying out Kermit on an unfamiliar type of protocol converter. Also, you should know what kind of transparency to expect for the front end and verify that Kermit-370 has, in fact, set `CONTROLLER` appropriately. This means checking the list of devices in the Kermit distribution file `ik0aaa.hlp`. If your configuration is listed as *un*supported, you may be wasting your time, but the list is not necessarily up-to-date. If your configuration is not listed at all, you have the opportunity to be a pioneer and report your findings back to Columbia for inclusion in future editions of the list. There are a few rules of thumb for quickly deducing the controller type by reading the manuals for the device; the manuals may not be specific enough, but this is clearly the easiest way of determining whether Kermit can support a given device and which controller type is applicable. The rules are as follows (in order of simplicity and likelihood):

1. GRAPHICS or SERIES1 may be implied when the device has a transparent or graphics mode described as compatible with that of a supported device listed in `ik0aaa.hlp`.
2. SERIES1 is implied when the device runs the "Yale ASCII Communication System" or something with a similar name.
3. GRAPHICS is implied if the manual mentions the SAS Institute in the context of ASCII graphics.
4. GRAPHICS is implied when output transparent data may be preceded by a WCC (Write Control Character) and 70 (hex).
5. SERIES1 is implied when transparent data must be preceded by a WCC and either 115D7F110005 (write-read) or 115D7F110000 (write-only).
6. GRAPHICS or SERIES1 may be implied when some of the manufacturer's other products are listed in `ik0aaa.hlp`, and all are shown as being of one type.
7. If none of the above rules apply, but the manuals describe a transparent mode in detail, the device may be a totally new type. The distribution file `ik0con.hlp` has hints on implementing Kermit support for the new type.
8. If nothing else works, you can probably use FULLSCREEN mode, as long as the micro Kermit supports it.

If Kermit tries to transfer a file with the wrong `CONTROLLER` value, there is a distressing possibility for the session to lock or, at least, appear to lock. When and if this happens, be sure to connect back to the mainframe, type ''`STOP`'', and press ENTER several times (perhaps as many as 15 times) before taking any drastic steps like breaking the connection. ''`STOP`'' is a special escape mechanism for getting out of Kermit protocol mode quickly. Kermit-370 recognizes such a request in most situations where terminal I/O is not entirely frozen. Sometimes, apparent lock-ups are due to something as simple as incorrect parity settings in the micro Kermit, so always check the basic communication settings and, if necessary, experiment before trying a different `CONTROLLER` type. Also, to avoid unnecessary confusion, check for the existence of a Kermit initialization file (possibly created by the installer) which could be re-setting `CONTROLLER` after the automatic procedure has finished. Such a re-setting is a poor idea in an initialization file, even a personal one, unless there is absolutely only one kind of communications

equipment on your system.

If file transfers do not work at first, it is best to do the following before trying again:

1. Reduce the packet size to no more than 80 at both ends.
2. Enable 8th-bit quoting at both ends.
3. Set `SEND PARITY MARK` in Kermit-370.

If those changes do not make transfers work, the next remedial action depends on the symptoms of failure.

- No packets exchanged and session locked up after reconnecting: change packet characters in both directions.
- No packets exchanged, but no lockup: change packet characters or parity.
- Always multiple retries of third or fourth packet: reduce receiving packet size.
- Multiple retries after random number of packets: check hardware and cables.
- Multiple retries after file-dependent number of packets: check for equipment that intercepts one or more printable characters or reduce the packet size.

When all else fails, you should be ready to reset `CONTROLLER` by hand and try again. The change most likely to be necessary is from `GRAPHICS` to `SERIES1`. However, it is conceivable that the installer has modified Kermit-370 at your location to force the `CONTROLLER` setting from the start, in which case, you might need to go the other way. Normally, Kermit's diagnostic procedure at start-up takes one or two seconds (because of programmed delays), so you should be suspicious if the Kermit prompt appears immediately after you start the program. The only initial `CONTROLLER` setting that you should *not* change by hand is `NONE`, which means that Kermit-370 has recognized a 3174 AEA line that is not configured for file transfer (or else the Kermit installer has a warped sense of humor).

If no amount of experimenting gets a transparent mode to work, it is time to recheck the list of supported devices and the age of your equipment. If yours is very old, it may require new microcode or some other software or hardware upgrade. In any case, if your results (whether positive or negative) are not already shown in `ik0aaa.hlp`, you should report them to Columbia so that others may profit by your experience.

1.7. After Returning from Kermit-370

When Kermit-370 receives a QUIT or EXIT subcommand or finishes the subcommand or subcommands specified in the original command string that invoked Kermit, control is returned to the caller. Before returning, Kermit-370 closes any active TAKE files (the EXIT or QUIT subcommand may be issued from a TAKE file). On return, the completion code is set from the current error status according to the codes in Table 1-4.

The error codes in Table 1-4 bear no relationship to the severity of the associated error conditions, aside from the assignment of code 0. The underlying rationale is that the only current generic system for the treatment of completion codes is to take a non-zero code as an indication of error. Indeed, Kermit returns a completion code of 0 when "error" condition 1 holds.

Code	Symbol	Error Message
0	NOE	No errors
1	NFT	No file transfers yet
2	TRC	Transfer cancelled
3	USC	Invalid server command
4	TIE	Terminal I/O error
5	BPC	Bad packet count or chksum
6	IPS	Invalid packet syntax
7	IPT	Invalid packet type
8	MIS	Lost a packet
9	NAK	Micro sent a NAK
10	ABO	Micro aborted
11	FNE	Invalid file name
12	FNF	File not found
13	FUL	Disk or file is full
14	DIE	Disk I/O error
15	MOP	Missing operand
16	SYS	Illegal system command
17	KCE	Kermit command error
18	TIM	No packet received
19	RTR	Records truncated
20	COM	Bad communication line
21	PTY	8th-bit quote not set
22	FTS	File too short
23	SOH	Missing start-of-packet
24	OPT	Option error on filespec
25	DSP	Unable to dispose of file

Table 1-4: Error messages and codes for Kermit-370

1.8. What's New

Below is a list of the changes in Version 4.3 of Kermit-370.

1. Compatibility with the (aging) F-level assembler.
2. Support for LATIN2, LATIN3, TRANSPARENT, CP870, CP905, and CP880, as well as the aliases L1, L2, and L3. New alias CP1047 for EBCDIC.
3. Support for IBM 3174 ASCII Graphics mode.
4. Improved controller detection, including local customization options.
5. Support for new unprefixed transmission of selected control characters.
6. Support for REMOTE PRINT, REMOTE MAIL, and REMOTE SUBMIT.
7. Improved error message for bad packet-size, new alias PACKET-LENGTH for PACKET-SIZE.
8. Correct observance of FILE COLLISION for all files in a group.
9. Ignoring spurious flow-control "packets" from (for example) MS-Kermit.
10. Support for new locking-shift Kermit protocol.
11. Support for Japanese Kanji file transfer and support for the Thai and Arabic character sets.
12. New versions of Kermit with the interactive messages in languages other than English.

13. New FULLSCREEN controller type.
14. New HINTS subcommand.
15. More graceful recovery from terminal I/O errors and exceptions.
16. Support for SNA LU1 3770-type devices and 8-bit, no-parity devices.
17. Optional conversion of EBCDIC printer carriage control into ASCII control characters.
18. Support for STOP command on "dumb" 3270 terminals and PCI protocol converters.
19. New efficiency display in STATUS report, based on SPEED setting.
20. New, uniform messages upon entering protocol mode, in the form "KERMIT READY TO SEND..." (or RECEIVE or SERVE).
21. 8-bit XECHO output.
22. Control prefixing for C1 controls.
23. New VERSION subcommand.
24. Improved debugging facilities.

1.9. What's Missing

Work on Kermit-370 will continue. Features that need to be improved or added include:

- Implement file archiving.
- Implement file transfer checkpointing.
- Add SET REPEAT subcommand.
- Improve Kermit-370 operation as a local Kermit.
- Implement public server mode.
- Allow REMOTE KERMIT HELP, REMOTE KERMIT DIR, and REMOTE SET from a micro.
- Add new SET FILE LONGLINE DISCARD option to allow multi-file transfer to proceed past a truncation problem.
- System-specific upgrades; see the respective chapters for details.

Anyone interested in working on these or other improvements should first get in touch with the Center for Computing Activities at Columbia University to find out if someone else has already begun a similar project (and, if so, who).

1.10. Further Reading

Below is a list of references for some of the material in this chapter.

1. *About Type: IBM's Technical Reference for 240-Pel Digitized Type*, S544-3156-02 (1989). This manual contains visual tables of many EBCDIC code pages and a comprehensive list of character names and acronyms.
2. *IBM System/370 Reference Summary*, GX20-1850-3 (1976). This reference card contains EBCDIC and ASCII character codes.
3. *IBM VS Fortran Application Programming: Language Reference*, GC26-3986-1 (1982). Appendix E contains a table of EBCDIC and ASCII characters with an implied full 256-byte translation table.
4. *IBM 3174 Character Set Reference*, GA27-3831-02 (1990). Chapter 5 contains visual tables of many

EBCDIC code pages.

5. *Info-Kermit Digest* Vol. 11 #1 (1989). This issue contains draft specifications of some Kermit protocol extensions.
6. *ISO International Register of Coded Character Sets to be used with Escape Sequences* (1989). This (very large) document has complete and unambiguous descriptions of standard coded character sets. It can be obtained from the ECMA.
7. *Kermit, A File Transfer Protocol* by Frank da Cruz; Digital Press (1987). This book contains a thorough description of the Kermit protocol and services with copious examples.
8. Kermit distribution file ISOK7.TXT (1992). This preliminary draft describes the new transfer protocol, including the international character-set support.
9. *Kermit News* Vol. 3 #1, p.5, "Dynamic Packet Size Control" (1988). This article describes an algorithm for optimizing Kermit throughput in the face of line noise.
10. *Kermit News* #4, p.16, "International Character Sets" (1990). This article discusses the new transfer protocol.
11. *ASCII and EBCDIC Character Set and Code Issues in Systems Applications Architecture*, SHARE white paper by Edwin Hart (1989). This document, available as file SHARE REQUIRE from LISTSERV@JHUVM, lays out general considerations for character codes and translatability.
12. Kermit distribution file LSHIFT.TXT (1991). This file describes the new protocol extension for better compression of 8th-bit text on 7-bit channels.

2. IBM MVS/TSO KERMIT

Program: John Chandler (Harvard/Smithsonian Center for Astrophysics); contributions from Vaçe Kundakçi and Daphne Tzoar (Columbia U), Bob Shields (U. Maryland), Greg Small (UC Berkeley), Bob Bolch and Steve Blankinship (Triangle), Ron Rusnak (U. Chicago), Charles Painter (U. Toronto), Roger Fajman and Dale Wright (NIH), André Pirard (U. Liège)
Language: IBM/370 Assembler
Documentation: John Chandler (CfA)
Version: 4.3.0 (93/9/30)
Date: 1993 September

Kermit-TSO Capabilities At A Glance:

Local operation:	No
Remote operation:	Yes
Transfers text files:	Yes
Transfers binary files:	Yes
Wildcard send:	Yes
`^X/^Z` interruption:	Yes (through micro)
Filename collision avoidance:	Yes
Can time out:	Yes (line mode only)
8th-bit prefixing:	Yes
Repeat count prefixing:	Yes
Alternate block checks:	Yes
Terminal emulation:	No
Communication settings:	No
Transmit BREAK:	No
Packet logging:	Yes
Transaction logging:	Yes
Session logging:	No
Raw transmit:	Yes (no prompts)
Sliding window:	No
Long packets:	Yes
Act as server:	Yes
Talk to server:	Yes
Advanced server functions:	Yes
Advanced commands for servers:	Yes
Local file management:	Yes
Handle Attribute Packets:	Yes
Command/init files:	Yes
Command macros:	No

TSO Specifics of Kermit-370:

Global INIT file:	`'SYS1.KERMINI'`
User INIT file:	`KERMINI`
Debug packet log:	`KER.LOG`
Server reply log:	`KER.REPLY`
Mail command:	`KERMAIL` *filespec* `LIST(`*users*`)`
Print command:	`KERMPRT` *filespec* `OPTIONS(`*options*`)`
Submit command:	`KERMSUB` *filespec* `OPTIONS(`*options*`)`
Maximum packet size:	1913 (SERIES1), 1024 (TTY)
Maximum disk LRECL:	32760

Kermit-TSO is a member of the generic Kermit-370 family and shares most of the features and capabilities of the group. As its name implies, Kermit-TSO is the variant of Kermit-370 that runs under the MVS/TSO operating system. The primary documentation for Kermit-TSO is actually the chapter on Kermit-370 (entitled IBM 370 Kermit), which describes general properties; the present chapter assumes the reader is familiar with that material.

Only the details specific to TSO operation will be discussed here, *e.g.*, command syntax relating to the TSO file system or commands not offered in general by Kermit-370.

2.1. The MVS/TSO File System

The features of the TSO file system of greatest interest to Kermit users are the format of file specifications (*filespecs*) and the concept of records. The latter is described in the Kermit-370 chapter.

The MVS/TSO *filespec* (called the data set name or DSN) takes the form of tokens (known as qualifiers) of up to 8 alphanumeric characters each, separated by periods. Each qualifier must begin with an alphabetic or national character. The total length must be no more than 44 characters, including periods. To be precise, a DSN may contain uppercase letters, digits, and the special characters ''$'' (dollar sign), ''#'' (number sign), ''@'' (at sign), and ''-'' (hyphen) in addition to the separating periods. Other characters must not be included.

There is another, structural restriction on data set names from the fact that TSO data sets are all cataloged. In a standard MVS catalog, each qualifier of each DSN is associated with an index of the same name. The index is a hierarchical catalog component which points downward either to a list of next-level indices or to a data set, but never to both. Consequently, a cataloged DSN is a chain of indices corresponding one-for-one with DSN qualifers, and the last index is a pointer to the data set itself. While there may be many indices with the same name, no two such duplicates may both be chained to the same next-higher-level index, so that, if DSN's are considered as strings of qualifiers (not of characters), no DSN can be a major substring of any other. For example, if the name `'A.BB.C'` exists in the catalog, then `'A.BB'` and `'A.BB.C.X'` are illegal, but `'A.B'`, `'A.BB.Y'`, `'A.BBB'`, and `'A.BB.BB'` are all legal. Although there is a newer form of catalog, known as IFC, which removes this substring restriction, it is still good practice to avoid violating it because there are still sites that use the older form.

A DSN given in its entirety (as in the foregoing examples) is called "fully qualified" and must be enclosed in single quotes when entered in TSO. However, by convention (and by definition) the first qualifier of each data set belonging to a given user must be the user's logon ID, and, by default, that ID is the assumed prefix in TSO when a DSN is *not* enclosed in quotes. In practice, then, names are abbreviated by omitting the quotes and the prefix. The most common type of name, in fact, consists of the prefix plus two more qualifiers giving the data set's name and type, respectively, so that many files have DSN's that correspond exactly to the canonical Kermit representation of a *filespec*. For instance, `TEST.FORT` is the source of a Fortran program named TEST, and its fully qualified DSN would be `'`*userid*`.TEST.FORT'`, where *userid* is the owner's logon ID.

While this description is complete as far as it goes, it omits two important features widely used in organizing files under MVS and TSO, namely, the partitioned data set (PDS) and the generation data group (GDG). A PDS is a data set like any other, except that it has members, each of which can usually be treated as a file in its own right. In fact, with QSAM (the file access method employed by Kermit and many other applications), only members, and not the whole PDS, may be read or written. Thus, the term "file", as used in this chapter and the Kermit-370 chapter, may refer to either a PDS member or an ordinary data set, but not to a PDS. The notation for a PDS member consists of the member name enclosed in parentheses and appended to the DSN (and the whole enclosed in quotes if the DSN is fully qualified). For example, if the Fortran program `TEST` were copied into a PDS called `DEBUG.FORT`, it would then be known as

```
DEBUG.FORT(TEST)
```

Although the member name is written together with the DSN, it and the surrounding parentheses are not really part of the DSN and are not counted toward the 44-character limit. Still, a member name must conform to the rules for a DSN qualifier and, in addition, must not contain any hyphens.

A generation data group is a collection of related data sets with similar names (distinguished by a serial number in the last qualifier). This organization is designed for data sets that are updated from time to time and which must be available in several versions at once. There is a notation, similar to that for PDS members, for describing GDG members relative to the current version, rather than by supplying the explicit DSN with imbedded serial number. The last qualifier is omitted, and a relative generation number in parentheses is appended. That number must be a

zero or a signed integer ("0" refers to the current version, "-1" the next most recent, and so on). For creating a new version, the number "+1" is used. Kermit-TSO supports both relative and absolute numbering for GDG members.

All these properties of DSN's come into play when a file is being received by Kermit-TSO because a valid DSN must be generated for the new data set. For example, any invalid character in the supplied *filespec* is replaced by a number sign (or converted to uppercase if it is a lowercase letter). Also, each qualifier (and the member name, if any) is prefixed with a number sign (if it does not already begin with an alphabetic or national character) and then shortened, if necessary, to eight characters. If no *filespec* is supplied, Kermit-TSO creates a default DSN of ‘‘`$.$`’’. The DSN is expanded to its fully qualified form and then truncated at 44 characters, if need be.

The DSN prefix, which defaults to the user's logon ID, is similar to a device specification on microcomputer systems: it selects an area of disk storage, and it usually need not be specified. In some ways, the prefix is also like a disk directory designator, since the file system structure is hierarchical. For this reason, the Kermit concept of the "working directory" is equated with a particular DSN prefix under Kermit-TSO. The current "working directory" is the collection of all data sets whose names begin with the current prefix, and file transfers take place to and from that area unless a fully qualified DSN is given.

To provide compatibility with other operating systems, when Kermit-TSO sends a file, it ordinarily makes a file header with only the last two qualifiers of the full DSN (or only the member name plus the last qualifier in the case of a PDS member). On the other hand, extra information may be added by way of the SET FOREIGN subcommand.

Although TSO data sets are cataloged, MVS allows uncataloged data sets as well, and Kermit-TSO can download such files, as long as the user specifies the proper disk volume via the SET FILE VOLUME subcommand. In principle, uncataloged data sets may have names with illegal characters or qualifiers longer than 8 characters, but such names are not recognized by Kermit-TSO.

Kermit-TSO allows a group of files to be specified in a single *filespec* by including the special "wildcard" character ‘‘`*`’’, which matches any string of characters (even a null string) anywhere either in the DSN proper or in the member name, if any. Only one `*` may be used in a *filespec*. Here are some examples:

`*.COBOL`	All files of type `COBOL` (all COBOL source files) in the current working directory.
`BATCH*H.FORT`	All files in the current directory which begin with `BATCH` and which end with `H.FORT`. This would not include `BATCH.FORT`, however.

TSO files, like those in other IBM 370 systems, are record-oriented (see the introduction to the Kermit-370 chapter). In particular, TSO files are characterized by record format (RECFM), which may be fixed-length, varying-length, or undefined-length; by maximum record length (LRECL); and by maximum block size (BLKSIZE). Fixed-length and varying-length records can be (and, under Kermit, always are) combined into blocks, but undefined-length records cannot. Indeed, by convention, they have no logical record length, only a maximum block size. Records (and blocks) in TSO files may be up to 32760 bytes long, but varying-length record blocks use four bytes to specify the block length and, therefore, place an effective limit of 32756 on the records. Indeed, the data portion of such records is limited to 32752 bytes.

When sending files, Kermit-TSO includes a date/time attribute if available. However, any date attribute of a file received into TSO is merely checked for validity and then discarded. Unlike many operating systems, MVS does not provide a time along with the date of creation of modification. Further, although partitioned data sets can store any amount of information regarding the individual members, there is no universal convention for saving a date for each member. ISPF is one system that supports both date and time tags for PDS members, and Kermit-TSO uses those whenever possible.

Another file system feature of occasional interest is the means of reporting errors. When Kermit-TSO encounters a disk error, it attempts to prepare an explanatory message for inclusion in the `STATUS` report. The primary method is the standard `SYNADAF` macro.

MVS/TSO allows, but does not encourage, the use of passwords to protect individual data sets. When a password is needed for file access, it is entered immediately after the *filespec*, separated only by a slash (''/''). In the case of a fully-qualified DSN, the password must be after the closing quotation mark.

2.2. Program Operation

At startup time, Kermit-TSO looks for two initialization files, `'SYS1.KERMINI'` and `'`*userid*`.KERMINI'` (where, as before, *userid* is the user's logon ID). The latter file would also be known as just `KERMINI`. The file `'SYS1.KERMINI'` would be maintained by a systems programmer, but `KERMINI` would be maintained by the user.

Three parameters in the user's profile (the character delete and line delete and intercom) are disabled during protocol mode (and restored afterwards) to prevent any conflict in case either of these characters has been defined to be printable. The settings in effect when Kermit starts up are saved as a sort of "normal" status snapshot (as opposed to the "protocol" status just described). The protocol status is selected whenever Kermit enters protocol mode, and the normal status is selected when Kermit leaves protocol mode. Note: if Kermit is interrupted in the midst of a transfer or while in server mode, these parameters will be left with peculiar settings (namely, the protocol status), and they may need to be restored by hand.

Although TSO does not allow an application program to take control of terminal synchronization on ''`TTY`'' lines, the various full-screen emulation front ends are quite a different matter. The standard IBM handshake (XON) is unnecessary, for example, with a 7171 or 4994 because the front end itself turns the line around with essentially no delay in transparent mode. Thus, handshaking should be suppressed for ''`SERIES1`'' devices (the micro Kermit should have HANDSHAKE set OFF, and Kermit-TSO should have HANDSHAKE set to 0). Since the generic Kermit-370 default handshake (XON) is retained in Kermit-TSO, the subcommand ''`SET HANDSHAKE 0`'' is a good candidate for inclusion the KERMINI file of any user who habitually uses ''`SERIES1`'' lines.

Interactive Operation:

To run Kermit-TSO interactively, invoke the program from TSO by typing `KERMIT`. When you see the prompt,

```
Kermit-TSO>
```

you may type a Kermit subcommand. When the subcommand completes, Kermit issues another prompt. The cycle repeats until you exit from the program. For example:

```
.KERMIT
Kermit-TSO Version 4.3.0 (93/9/30)
Enter ? for a list of valid commands
Kermit-TSO>send foo.*
  Files beginning with FOO are sent
Kermit-TSO>receive test.spss
  File is received and called TEST.SPSS
Kermit-TSO>exit
```

Command Line Invocation:

Kermit-TSO may also be invoked with command line arguments from TSO. The arguments are interpreted as a subcommand to be executed by Kermit after completion of the initialization. For instance:

```
.KERMIT send test.fort
```

Kermit will exit and return to TSO after completing the specified subcommand.

CLIST Operation:

Like other TSO programs, Kermit-TSO may be invoked from a CLIST. Subcommands can be passed to Kermit using the program input stack and/or command line arguments. For example, to start up Kermit-TSO and have it act as a server, include the line:

```
KERMIT server
```

To pass more than one subcommand, they must be stacked in the order in which they are to be executed. To start up a Kermit-TSO server with a three character CRC, create and stack a file with the following:

```
set block 3
server
```

and then invoke Kermit. Like many utility programs, Kermit-TSO uses the GETLINE/PUTLINE service routines for terminal I/O, and the nominally interactive subcommands can thus be supplied under program control. Another way of setting up multiple subcommands would be to collect the subcommands into a TAKE file and then issue the TAKE subcommand via the command line. CLIST's may be executed from Kermit, either directly or from a TAKE file, and CLIST's in turn may freely issue Kermit subcommands. The subcommand KERMIT is especially useful in this context for distinguishing Kermit subcommands from TSO commands. After each subcommand completes, the &LASTCC variable is set according to the current status code (see Table 1-4) so that CLIST processing can take appropriate action if a transfer fails.

Server mode:

Command execution in server mode is different in several respects from normal operation. First of all, some Kermit subcommands are not allowed (see the list of subcommands in the Kermit-370 chapter). Moreover, command errors always terminate any active TAKE file. Also, commands run in a special environment with the User Profile temporarily modified. Another difference is that Kermit intercepts terminal I/O as much as possible and transmits the data to the local Kermit as text packets. The problem with this redirection is that some MVS/TSO commands issue terminal I/O directly, so that many messages never appear to the local Kermit (except, perhaps, as bad packets).

2.3. Kermit-TSO Subcommands

Kermit-TSO supports all the subcommands described in the Kermit-370 chapter. In addition, there is the system-specific subcommand ‘‘TSO’’, which is just a synonym for the generic subcommand ‘‘HOST’’. ‘‘TSO’’ can be issued as a remote Kermit command when Kermit-TSO is in server mode. Also, the ‘‘END’’ subcommand is available as a synonym for ‘‘EXIT’’ and ‘‘QUIT’’.

This section concentrates on the subcommands that have special form or meaning for Kermit-TSO. These are ordered alphabetically. See the chapter on Kermit-370 for further details.

The CWD Subcommand

Syntax: CWD [*string or PDSname*()]

The CWD (Change Working Directory) subcommand establishes a new default DSN prefix or turns prefixing off. This facility is similar to, but not quite the same as, the prefix defined in the User Profile. The *string*, if specified, must consist of one or more DSN qualifiers, and the first must already be an index in the disk catalog. Subsequent file transfers take place to and from the corresponding disk area whenever a fully qualified DSN (one enclosed in quotes) is not given. The initial prefix is the user's logon ID, *i.e.*, the same as the default prefix in the User Profile. If no prefix is given in this subcommand, then prefixing is no longer performed. The user must be careful to remember the distinction between the prefix defined for Kermit and that for TSO. Pure Kermit subcommands (like SEND and TAKE) always use the former, but TSO commands (and the TSO-related subcommand TYPE) use the latter.

An alternative form of the CWD subcommand allows specifying the full (but unquoted) name of a PDS followed by paired parentheses. When such a "working directory" is in use, a *filespec* other than a fully qualified DSN is taken to be a member name within the PDS. For that reason, this form should be used cautiously, since the Kermit-TSO log *filespecs* (such as `KER.LOG` and `KER.REPLY`) would be treated the same way. In particular, it is advisable to turn on debug mode only when the Kermit prefix is a partially qualified DSN (once started, the log continues to the same data set regardless of what happens to the prefix).

The DIRECTORY Subcommand

Syntax: `DIRECTORY [`*filespec*`]`

The DIRECTORY subcommand uses the TSO LISTCAT command to display part of the data set catalog, *i.e.*, all data sets whose names begin with the qualifiers in the Kermit prefix (if any) concatenated with the given *filespec* (if any). Note: wildcards may not be used, and no options are allowed. If you require the LISTCAT options, you must issue a TSO LISTCAT command directly.

The HELP Subcommand

Syntax: `HELP [`*subcommand*`]`

The HELP subcommand uses TSO HELP facilities to display part or all of the Kermit help file. It follows the same syntax.

The RECEIVE Subcommand

Syntax: `RECEIVE [`*filespec*`]`

The RECEIVE subcommand tells Kermit to receive a file or file group from the other system. You must issue the corresponding SEND subcommand to the other Kermit.

A *filespec* in the subcommand indicates what name the incoming file should be given. Wildcards may not be used. If the *filespec* is invalid, Kermit-TSO will suppress the transfer. If the optional *filespec* is omitted (and, in any case, for all files after the first in a group) Kermit-TSO will use the name(s) provided by the other Kermit. If a name is not a legal DSN, Kermit-TSO will delete excess characters, change illegal characters to number signs, and so on, to create a legal name.

For the purposes of folding and truncation, the maximum record length, *i.e.*, the limit on the length of data in each record, is "LRECL" if RECFM is F, "LRECL"-4 if RECFM is V, and "BLKSIZE" if RECFM is U.

If the incoming file has the same name as an existing file (either a data set or a PDS member), the action taken depends on the FILE COLLISION setting. The possible settings and their meanings are given in the Kermit-370 chapter. Two of the settings (BACKUP and RENAME) require that Kermit-TSO change the incoming name so as not to obliterate the pre-existing file. It attempts to find a unique name by successively modifying the original and checking for the existence of such a file at each step. The procedure operates on the second qualifier of the full DSN (or the member name in the case of a PDS member) and begins by truncating it to seven characters, if necessary, and then appends ‘‘`0`’’. If a file by that name exists, Kermit then replaces the ‘‘`0`’’ with a ‘‘`1`’’. It continues in this manner up to ‘‘`9`’’, and if an unused name cannot be found, the transfer fails. If FILE COLLISION has not been set, but the obsolete option WARNING has been set ON, however, Kermit-TSO will protect an existing file in a different way when the *filespec* is entered with the RECEIVE subcommand. In that case, Kermit will prompt the user for permission to overwrite the file.

The SEND Subcommand

Syntax: `SEND [`*filespec*`[<`*options*`>] [`*foreign-filespec*`]][, ...]`

The SEND subcommand causes a file or file group to be sent from TSO to the Kermit on the other system. DSN prefixing is done on the *filespec* in the usual way (see also the CWD subcommand). For details on the *options*, see the chapter on Kermit-370. Note that a *filespec* may have both a password and options -- in that case, the options must be at the very end. Blanks may not appear anywhere in the string.

The *filespec* may contain a wildcard ‘‘*’’. If it does, then all matching files will be sent, up to 711 files in all (possibly more in the case of PDS members).

The *foreign-filespec*, if any, is used for the file header of the outgoing file, replacing the usual name.type derived from the MVS/TSO *filespec*. Normally, this form of the SEND subcommand is used only for single files because the *foreign-filespec* is used only for the first file of a group (subsequent files having default headers). If both *filespecs* are omitted for this subcommand, Kermit will prompt separately for each, and the respective syntaxes are exactly as described above. This prompting mode is especially useful when more than one file (or file group) is to be sent, since the command line is limited to 130 characters.

Trailing blanks in a text file with RECFM=F are deemed superfluous and are stripped off when Kermit-TSO downloads the file. In order to treat such blanks as significant, you must convert the record format to V, for example, by using TSO COPY with the "RECFM V" option.

The SET Subcommand

Syntax: `SET` *parameter* `[`*value*`]`

The SET subcommand establishes or modifies various parameters controlling file transfers. The following SET parameters are available in Kermit-TSO, but not in Kermit-370 in general:

DELIM	Line delimiter for entering multiple commands.
FILE	
BLKSIZE	Block size for incoming file.
LRECL	Logical Record length for incoming file.
RECFM	Record format for incoming files.
SPACE	Allocation unit (in tracks) for incoming files.
UNIT	Device type for incoming files.
VOLUME	Disk pack for incoming files.
PREFIX	Default disk area.

SET DELIM

Syntax: `SET DELIM [`*letter*`]`

This sets (or clears) a command line delimiter for interactive Kermit subcommands. Each occurrence of the delimiter character in the command buffer read from the terminal is treated as the start of a new subcommand. The initial value is a blank, *i.e.*, no delimiter, but it can be set in one of the initialization files and thereby be used in parsing the initial command-line arguments.

SET FILE BLKSIZE

Syntax: `SET FILE BLKSIZE` *number*

This sets the block size for incoming files to a *number* from 1 to 32760. In the case of fixed-format files, this number is just an upper bound; the actual block size is taken to be the largest multiple of the LRECL which does not exceed this limit. The default is 6233.

SET FILE LRECL

Syntax: `SET FILE LRECL` *number*

This sets the effective logical record length for incoming files to a *number* from 1 to 32760. This parameter is not used for files of undefined record format. The default is 80.

SET FILE RECFM

Syntax: `SET FILE RECFM` *option*

This sets the record format to use for incoming files. Valid *options* are "Fixed", "Varying" (the default), and "Undefined". This parameter is thus limited to a subset of the range of possibilities for the MVS/TSO RECFM. In Kermit-TSO, all incoming files of fixed or varying format are automatically blocked according to the current block size.

Note: the most common files with RECFM=U, load modules, cannot be transported directly using Kermit, since they contain disk-location pointers. Such files can be "unloaded" using IEHMOVE and then transmitted freely.

SET FILE SPACE

Syntax: `SET FILE SPACE` *number*

This sets the track allocation unit for incoming files to a number from 1 to 32760. The default is 5. Since data sets are allowed as many as 15 extents, this default provides for files up to 75 tracks.

SET FILE UNIT

Syntax: `SET FILE UNIT` *type*

This sets the device type or group for incoming files. Valid *types* are installation-dependent. The default is blank, which signifies the default UNIT group found in the User Attribute Data Set. This parameter should generally be left blank unless the user wishes to create files on a specific disk volume not included in the default group (for example, a private volume).

SET FILE VOLUME

Syntax: `SET FILE VOLUME` *name*

This sets the disk volume for incoming files. Valid *names* are installation-dependent, but are, in any case, no more than six alphanumeric characters. The default is blank (none); in that case, the system chooses one of the available volumes of the current UNIT type.

SET PREFIX

Syntax: `SET PREFIX` [*string*]

This subcommand is equivalent to the CWD subcommand (*q.v.*).

The TAKE Subcommand

Syntax: `TAKE` *filespec*

Execute Kermit subcommands from the specified file. The default DSN extension is ‘‘`TAKE`’’, so that datasets with names of the form *prefix.name*.`TAKE` can be executed by typing merely TAKE *name*. Names that end with `.TAKE` or `.KERMINI` are accepted as entered (aside from prefixing), and names in quotes are, of course, accepted exactly as entered, but all others are assumed to have a DSN extension of `.TAKE` for the purposes of the TAKE (and GIVE) subcommands.

The TSO Subcommand

Syntax: `TSO` *text of command*

Although Kermit-TSO does not have a full set of its own subcommands for managing TSO files, it provides those services through the operating system. You can issue any TSO command, *e.g.*, to list, type, rename or delete files, send messages, and so on. The `TSO` subcommand under Kermit is synonymous with the `HOST` subcommand.

2.4. How to build an executable Kermit-TSO

Before attempting to build Kermit-TSO, look in the Kermit distribution under IKTKER for an installation document, as well as "beware", help, and update files, and read them first. They will probably contain information that is more current than what you see here.

Kermit-TSO consists at present of a large assembly (KERMIT.ASM, containing the Kermit program) and a small one (DYNALC.ASM, containing a subroutine for allocating data sets). Although DYNALC is a single file in the Kermit distribution, the source for Kermit itself is in many pieces, some generic for Kermit-370 and some specific to TSO. All the necessary pieces are sequenced in columns 73-80 so that the numbers form a strictly increasing sequence when the pieces are correctly "pasted" together. It is important to preserve the original sequence numbers so that updates, if any, can be applied to the source.

To create a runnable version (the hard way):

1. Combine the following ‘‘`ASM`’’ files from the Kermit distribution into a single file with `RECFM=F(B)` and `LRECL=80`: IK0DOC, IK0MAC, IKTMAC, IK0DEF, IK0MAI, IK0COM, IK0CMD, IKTUTL, and IK0PRO. The resulting file is the composite source for Kermit-TSO, called KERMIT.ASM. This source must retain the original sequence numbers in columns 73-80 (in other words, be sure not to resequence the source accidentally by using the editor!)
2. Copy or rename IKTDYN.ASM from the Kermit distribution to a file called DYNALC.ASM with `RECFM=F(B)` and `LRECL=80`.
3. Assemble the source file(s).
4. Create the executable load module `KERMIT` using the linkage editor. Be sure to specify the REUS option. Kermit is designed to run as a command processor, and so it must be placed in SYS1.CMDLIB or in a PDS concatenated to SYS1.CMDLIB (for example, via the STEPLIB command).

To create a runnable version the easy way, extract the batch job from the installation document, supply a proper JOB card, and submit it.

If your site's ASCII/EBCDIC translation table for TTY lines does not conform to the one listed in the appendix (which in turn conforms to the one given in the IBM System/370 Reference Summary), then enter the appropriate SET ATOE/ETOA/TATOE/TETOA subcommands into `'SYS1.KERMINI'`. *NOTE:* If the ASCII/EBCDIC translation is not invertible, Kermit will not and cannot work.

In order to verify the operation of a new version of Kermit-TSO, you may run it under TEST using the CP parameter.

2.5. What's New

Below is a list of the TSO-specific features in Version 4.3.0 of Kermit-TSO added since the previous major release, Version 4.2 in March of 1990. For the list of generic additions, see the chapter on Kermit-370.

1. ISPF modification dates are used on downloads, where available. Suppression of invalid dates.
2. Proper selection of default disk unit group for received files.
3. Support for relative GDG numbers.
4. Multiple Kermit subcommands specifiable on TSO command line if the INIT file defines a delimiter.
5. Kermit status code available to CLIST after each subcommand completes.
6. Small bug fixes.

2.6. What's Missing

Work on Kermit-TSO will continue. Features that need to be improved or added include:

- Intercept ABEND's in TSO commands executed under Kermit.
- Implement file archiving.
- Add a SET REPEAT subcommand.
- Finish SET LINE, so that Kermit-TSO can be used as a local Kermit, connecting to a remote host over an alternate communication port. Add a CONNECT subcommand.
- Compute file size for outgoing A-packets and implement the SPACE subcommand.
- Reject files known (via A-packets) to be too big for available storage.
- Intercept *all* terminal output during protocol mode.

Anyone interested in working on these or other improvements should first get in touch with the Center for Computing Activities at Columbia University to find out if someone else has already begun a similar project (and, if so, who).

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