

To: BBN TEN-SYS Group  
From: D. Murphy  
Subj: Terminal Usage and Conventions  
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This memo discusses the use of terminal service within TEN-SYS as documented in Strollo's memo of 21 March, TEN-SYS-3. The usual file name for the teletype or whatever other terminal is available will be `TERMINAL`. In the discussion below, references to `TELETYPE` should be interpreted as meaning the a general terminal. The terminal when used as a paper tape reader or paper tape punch will have a different name to specify this particular usage.

A teletype is a multi-purpose device. From the point of view of a program, it is sometimes an input file, sometimes several input files, and sometimes a source of commands and control (interrupts). From the point of view of the typist, a teletype is both an input device, an output device, and a control device. These multiple purposes often lead to difficulties and confusion in on-line systems. On the 940, if a program is expecting input characters from the teletype, it may treat some input characters as special, e.g. control A and Control Q, the usual editing characters. Also carriage return as typed usually requires an echo of line feed which the program must generate. However, if this program is suddenly given input from an ordinary disk file rather than the teletype, these conventions which were a help when used with the teletype become a hinderance. Also, if a program is set up to do input from a file, perhaps after asking the user for a file name, and the user supplies the name `TELETYPE`, the editing conventions and carriage return conventions will not apply and the user will find the teletype difficult to use. To circumvent these difficulties we propose to make the teletype be referenced in the same manner as any other file in the system. The scheme proposed in no way restricts the flexibility of teletype usage, and it has the advantage of treating the teletype in a consistent manner.

To be used by a program, the teletype must be opened as a file in exactly the same manner as all other files, i.e., the file opening mechanism is invoked, and the name `TELETYPE` is supplied. Each time a program opens a file, it will specify which of several modes of reading or writing are to apply to that file. These modes will have a general significance, but in the case of the teletype, they will

specify the wake-up conventions which the program requires. Some of the possible modes might be "line" mode which a program would use for reading a general file in its entirety, "character" mode which a program would use when it expects to interact with the incoming characters on a character by character basis (e.g., DDT), and third a "terminator" mode in which some specified class of characters act as wake-up indicators. A mode like this would be used by the routines which read file names for recognition, and the wake-up terminators would be alt-mode, end-of-line, and space.

By requiring that the mode be given for every file opened, we have effectively handled the case where the teletype is specified as a file name when it would not normally be expected. By providing several different wake-up modes, we achieve several goals. The first is system efficiency. The program need be woken up only as often as it is likely to need to interact with the input. This reduces swapping time and core residency requirements. The second is that the line and character edit facilities of the teletype service routine may be used in a maximum number of cases. When line input is specified, the user operating his teletype will be able to delete characters back to the beginning of the last line that he typed. If the input mode is terminator, then the user will be able to delete characters back to the last terminator that he typed, or to the beginning of the most recent string for which this mode applies. In the case of a file name for example, he would be able to delete the characters back to the beginning of the file name in case of error. In the character mode of course, no deleting facilities can be provided by the teletype service routine - the program which is receiving the characters must perform any abort operation required.

This scheme implies that it will be possible to open the teletype as a file several times. Typically this would happen when a program which was accepting commands from the teletype was also instructed to read a file from the teletype. The monitor will in general supply different file numbers for each opening of the teletype. This enables it to keep track of different wake up character settings for the several uses of the teletype which are being run concurrently. JSYS instructions will be provided to perform such operations as changing the mode (i.e. the wake up characteristics) of a file, and perhaps clearing the buffer or other such housekeeping operations. Every one of these instructions will take as an argument the file number of the file to which it is to apply. In this way one use of the teletype file can be changed without affecting other uses of it.



Control Codes

As stated in the memo on terminal service routines TEN-SYS-3, we expect to be able to use a variety of different terminals on the time sharing system. To do this, it is necessary to design language and control conventions keeping in mind the limitations of some of these terminals. As a minimum, it should be possible to use teletype models 33, 35, and 37, on either full- or half-duplex service. The main problem is in the use of the control characters. These are usually the prime candidates for such functions as panic, interrupt request, and line and character editing. However, many of these characters (some which have been used in the past for software functions) have a mechanical or formatting effect when received by the teletype printer. In order to avoid undesired or spurious action on half-duplex or full-duplex local-copy machines, we must avoid the use of such characters.

They include:

1. Control D - End of transmission. Causes some teletypes on dataset service to hang up.
2. Control E - Who are you. This causes the activation of the "here-is" wheel on teletypes so equipped.
3. Control G - Bell. Should be used only where a bell echo is appropriate.
4. Control H - Backspace. Available only as a separate key on some machines. Should be used only for an actual backspace function.
5. Control I - Horizontal Tab
6. Control J - Line feed. Note: the receipt of a single line feed (octal code 012) by a model 37 printer will both return the carriage and advance the line. There is no code to advance the line without returning the carriage.
7. Control K - Vertical tab.
8. Control L - Form feed.
9. Control M - Carriage return.
10. Control Q - XON. Turns the paper tape reader on.
11. Control S - XOFF. Turns the paper tape reader off.

In addition, there is Control N and Control O which change the ribbon color on terminals so equipped. It is probably not necessary to avoid use of these characters since the existence of a half-duplex terminal with ribbon shift is rather unlikely. A second question is whether control characters should be used at all for other than their specified functions since some terminals (for example the IBM Selectric) do not have the ability to generate control characters.