DWINDO

Hydrologic Engineering Center
Interactive Data Entry and Editing

User's Manual

Version 2.1
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Chapter 1

Introduction

DWINDO is a generalized program which provides interactive entry and editing of HEC Data Storage System (DSS) time-series data in a form displayed on the computer console or remote access terminal. An example is shown in Figure 1. DWINDO requires a display environment that meets the ANSI standards.

Short - Period Reservoir Computations
Friant Reservoir, San Joaquin River, California

Date	Time	Precip inches	Elevation feet	Storage ac-ft	Release cfs	Inflow cfs
12JUN86	0347	0.00	5175.00	195000	0	--
12JUN86	0416	--	5176.21	197000	0	10000
12JUN86	0648	0.00	5176.21	197500	0	16000
12JUN86	0730	0.00	--	--	--	--
12JUN86	0912	0.00	5181.40	198000	400	13000
12JUN86	1000	--	5181.40	198000	400	--
13JUN86	0710	1.42	5179.04	196400	0	--
13JUN86	1200	1.60	5179.02	--	10	800
14JUN86	0640	1.53	5178.88	196320	0	500
14JUN86	2114	0.00	--	--	0	500

Figure 1. Sample Form

DWINDO presents time series data in columns on the form. All columns are of the same length, and each row in a column corresponds to a time for which there is at least one data value among all the columns. Since only a few data observations can be shown in the columns at one time, the columns may be scrolled (moved up or down one row at a time) or paged (moved up or down by a full number of form rows). When scrolling or paging occur, the data in all columns move together.

Data entry and editing in DWINDO is controlled mainly through the use of specially designated function keys. Each key invokes a particular function, such as moving the cursor among the rows and columns.

Cursor movement allows the user to move both horizontally and vertically from one cell to the next on the displayed form. New values are simply input from the keyboard (preferably, the numeric keypad). Existing values may be edited in the cell by a combination of overtyping, insertion and deletion, or may be erased and a substitute entered.

The forms used to present data are designed by the user in order to permit organizations of data which are appropriate to the user's needs. Descriptions of the forms are contained in a reference file. When a particular form is used, the form is filled with data in accordance with a user-defined time window.

One typical application of DWINDO would be entry of real-time operational data, either by office personnel entering data for several field projects on a local computer, or by field personnel entering data pertaining to their specific projects on remote terminals.

Chapter 2

Use

2.1 Program Initiation

DWINDO is initiated from job control by:

```
DWINDO [parameter] ...              [DOS]
dwindo [parameter] ...              [UNIX]
```

"parameter" has the form "keyword=xxx" and may be one or more of the following specifications:

Keyword	Default	Description
INPUT	CON(stdin)	Terminal input
OUTPUT	CON(stdout)	Terminal output
FORMS	forms	Forms description file
QFORMS	qforms	Forms quick reference file
TRMDEF	dwindo.trm	Terminal definitions file
REPORTS	dwindo.rep	File in which to print forms
FUNFILE	dwindo.fun	PREAD functions file
MACFILE	dwindo.mac	PREAD macros file
SCNFILE	dwindo.scn	PREAD screens file

2.2 Global Control

When the DWINDO program is first executed, the user is prompted for the type of display terminal in use and then the "D>" prompt is presented. At this point, commands are used to direct the functioning of the program. Normally, a time window is defined (TIME), a form is loaded (LOAD) and then entry and editing of data begins. Once entry and revision of data on the form is complete, the form is saved by the user and then program control returns back to the "D>" prompt. The program is also terminated from the "D>" prompt using the (FINISH) commnd. The type of terminal being used or emulated must be identified by the program and definitions of control keys for the terminal must be present in the terminal definition file (see section 3 below).

DWINDO has the capabilities of a system known as "PREAD" imbedded in the program executable. This system allows DWINDO to be operated using menu selection screens and predefined macros controlling the program. For more information, refer to PREAD User Interface User's Manual.

TIme start-date start-time end-date end-time

A time window is required to define the time span of the data to be retrieved or stored in the DSS file. For example:

```
TI 01SEP86 0730 31OCT86 0730
```

The argument "T" may be used to designate the current time and date. Further, "T" may be modified to indicate a reference relative to the current time and date. For example:

```
TI T-30D T
```

The example designates a time window which begins 30 days prior to the current date and time and ends with the current date and time. "H" is used to designate hours and "M" minutes in a relative time reference.

The time window determines the number of data values directly available (ie., those which can be scrolled or paged) in DWINDO for a particular form. A time series in DWINDO may contain up to 1000 values. When the possibility exists for inserting more data values, a lesser number must be retrieved in order to provide space for insertion. When regular-interval time series are retrieved, then the number of data consists of all observations of the series which fall within the time window, including ones with missing values. When irregular -interval data are retrieved, all observations within the time window are retrieved.

LOad form-name

The load command causes the form labeled "form-name" to be displayed, filled with data consistent with the current time window. If the time window has not been defined, an error message will result.

UPdate

UP (update) causes creation or update of the forms quick reference file. Forms reference information is read from the file "FORMS" in the current directory and stored in the file "QFORMS". FORMS must be prepared as specified in section 3 below.

STatus

ST (status) results in the display of key file names and the currently defined time window.

FInish

The FI (Finish) command terminates operation of the DWINDO program.

2.3 Data Entry

A successful LO command results in a clearing of the screen and the appearance of the specified form, filled with data found for the time window. The cursor is positioned in the first column on the row of data corresponding to the end of the time window. While data are shown in a form, the operation of DWINDO is controlled by keys on the keyboard or by commands.

2.3.1 Function Keys

The control functions are referred to by their mnemonics. The functions and their mnemonics are summarized in Table 1.

Table 1. Form Control Functions

Mnemonic	Description
EXIT	Prompt to save data, return to "D>"
CMD	Prompt for command
CURU	Move cursor up one row in column
TABF	Move cursor to next column
TABB	Move cursor to previous column
CURD	Move cursor down one row in column
BOL	Move cursor to beginning data in row
EOL	Move cursor to ending data in row
BNL	Move cursor to beginning data in next row
PGUP	Fill form with previous page of data
PGDN	Fill form with next page of data
INSL	Prompt for time, insert row at new time
DELL	Delete irregular-interval data observation
ENTR	Save new data value in memory, move to next column
CURR	Move cursor right one cell
CURL	Move cursor left one cell
INSC	Insert character(s) in cell
DELC	Delete character in cell
DUP	Duplicate previous value in column
ERAS	Erase (blank) cell
REST	Restore cell to value in memory
MISS	Enter missing value flag in cell

Data are entered by moving the cursor to the appropriate cell (column and row) and then entering data values with the numeric keypad. If data is already present in the cell, values can be changed using the insert and delete keys as well as overtyping the existing value.

Movement around the form is controlled mainly by the use of the function keys which control cursor movement: CURU, CURD, CURL, CURR, TABF, TABB, BOL, EOL, BNL, PGUP and PGDN. In addition, the ENTR function causes movement to the next cell in the row.

The order in which the cursor is placed in cells in response to the cursor movement keys is controlled, in turn, by the order in which the data are defined in the forms description file (see Chapter 3). Cells displaying intrinsic variables (dates and times) are skipped as are regular-interval time series cells for which there are no data for the particular time.

When the cursor is positioned at a data cell, the entry of numeric data and INSC, DELC, DUP, ERAS, REST, and MISS key entries imply one of three data change styles: entry, edit or replacement. The style is indicated on a status line at the bottom of the form.

Entry is the style implied when the cell is initially undefined with "M" (missing) displayed for regular-interval time series data or "--" for irregular-interval time series. In entry, the cursor remains at the rightmost position in the cell, and digits in the cell are shifted left as more are entered. A sign is placed at the beginning of the value if none exists; otherwise, it toggles the existing sign.

Entry	Cell
-	M
6	6
9	69
1	691
5	6915

Replacement is implied when the DUP function is used. In replacement, digits entered are interpreted as replacements for the least significant digits of the cell. As many digits of the cell are replaced as entered. For example:

Entry	Cell
<DUP>	98651
6	98656
7	98667

Editing is implied when the cell already contains a value or the INSC or DELC functions are used. Data in the cell are altered by a combination of inserting, deleting and overtyping.

In all three styles of change, the cell being changed is highlighted and the value in the cell no longer is consistent with the value in memory. Keyboard entries change the display until the enter key or a cursor movement key are depressed. At that point, the value displayed is submitted to a data checking process, the result is put in the memory and the memory value is confirmed by display of the memory contents for that cell. Data checking parameters are minimum, maximum, and maximum negative and positive changes and are specified in the forms definition file.

The enter key also causes movement to the next data cell in a regular sequence. If the sequence for a particular row is finished, the cursor is moved to the first in the sequence in the next row. If the next row is not showing on the form, scrolling or paging occurs as appropriate to reach the proper row.

Data entry and editing are made easier with special function keys: duplication of a preceding value (DUP); restoration of a the last previous value in memory (REST); erasure of a cell contents (ERAS); deletion and insertion of characters in a cell (DELC and INSC); and deletion of an irregular-interval time series observation (DELL).

The association of keys with functions is specified in a terminal definition file which is described in section 3 below. The program permits considerable flexibility in the designation of these associations, but the capabilities of the terminal being used may restrict the ease of implementation or use.

2.3.2 Commands

Commands are also used to direct the program when a form is displayed. The key designated for the CMD function is used, and a prompt (>) appears at the bottom of the form. Commands are entered in response to the prompt. Certain commands prompt for additional information as noted below.

GOTO

GOTO is used to move to data associated with a particular date and time in the form. The program prompts for the date and time, which are entered military style (see the TI command above). The desired date and time must be within the range of the time window in effect.

CHECK

CHECK allows a review of all data entered in a session entry to allow correction of the data before it is saved in a DSS file. Data exceeding specified limits are tagged in the entry process. When the CHECK command is given, a search is made of all data entered during the session. When a value is found with an error tag, the appropriate page of data is presented and the cursor is moved to the appropriate data cell to allow corrections. A message appears at the bottom of the screen to indicate the error condition and the value of the respective limit.

Corrections are made with the entry and change procedures described above. If an error condition is found again when the enter key is pressed, the cursor stays at the position and the reason for the error is again displayed at the bottom of the screen. If no error is found, the cursor is moved to the next erroneous value, if any are present. The error check may be overridden (ie., acceptance forced) by use of the TABF function rather than the ENTR key.

Pressing the EXIT key provides an escape from the checking process. Checking may be resumed later and will continue beginning at the same location where an escape was made. Otherwise, when the review process is complete, a message to that effect is displayed at the bottom of the screen, and the form is returned to its state prior to the CHECK command.

PRINT

An image of the screen is recorded in the file assigned to the reports parameter when the DWINDO program is initiated.

TW

The current time window is displayed on the message line at the bottom of the screen.

2.4 Saving Data

The EXIT key is used to terminate transactions in a form. Before the form is erased from the screen, the program inquires about saving the data. The default response is to save the data. If the response so indicates, the data in memory is copied to appropriate files. Data in the files for operative time window are overwritten.

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Chapter 3

Implementation

A forms description file and a terminal definition file must exist in order to use DWINDO. The forms description file is used to describe forms and data references. The terminal definition file contains information describing the characteristics of particular terminals and their function key layouts. These files may be created or changed with any text editor.

3.1 Forms Description File

The forms description file FORMS contains information describing forms and their contents. Specifically, a forms description file contains: an image of the form as it is to appear on the screen; definitions of windows (or "viewports") in which data appear; definitions of individual data records which appear in columns in the windows; and locations of the data records in DSS files. A sample form definition is shown in Figure 2.

A processed version of FORMS is actually used by DWINDO to provide more rapid access to individual forms. This processing is performed by DWINDO when the UP (update) command is used. FORMS is assumed to be in the current directory.

All information about a particular form is located contiguously in FORMS in the order described below. Unique labels are used to indicate the separations among forms and among their parts: each section describing an individual form component ends with #END beginning in column 1.

Comments may be placed anywhere within the form definition, except within the form image itself (ie., between #FORM and the #END which terminates the form image). Comment lines begin with a "*".

Form specifications are entered on lines in "free form" unless otherwise noted. "Free form" means an individual specification need not begin in any particular column on a line, but must be provided in the order indicated and separated from other specifications by blanks or commas. A "null" entry (ie., an optional specification) must be indicated by two successive commas.

Certain form descriptors specify a location on the form in terms of rows or columns. A "row" is the same as a horizontal line on the display device and are numbered from 1 at the top of the form increasing downward. "Column," in this context, means a character position in a row, numbered from 1 at the leftmost position.

```
#FORM DATAH ************************************************************************
```

```
   Location Name: ^N    River Mile: ^B    Description: Hydro-Power
```

Date (ddmmmyy)	Time (hhmm)	Stage-Upper (ft)	Stage-Upper Change	Stage-Lower (ft)	Stage-Lower Change	Hydro Release	Hydro Units
-------	----	-----	-----	-----	-----	-----	----
-------	----	-----	-----	-----	-----	-----	----
-------	----	-----	-----	-----	-----	-----	----

Temperature Air	Temperature Water	Precip (in)	Weather Type	Tows Waiting Above	Tows Waiting Below	Delay (hh)	Delay (mm)	Tows Locked Up	Tows Locked Down	Dam Condition
----	----	----	---	--	--	--	--	--	--	-----
----	----	----	---	--	--	--	--	--	--	-----
----	----	----	---	--	--	--	--	--	--	-----

```
     Weather Type:
 1 - Fair    4 - Fog
 2 - Cloudy  5 - Snow
 3 - Rain    6 - Windy

   F1  - Exit or Help                F5  - Override Data
   F2  - Insert new date/time
   F3  - Delete date/time line at cursor position
   F4  - Clear data field at cursor position
#END
* ---------------------------------------------------------------------------------
*          NUMBER     NUMBER OF   ROW NUM OF   BEG COL    END COL
*            OF       ROWS PER    TOP ROW IN     OF         OF
*         VIEWPORT    VIEWPORT     VIEWPORT    VIEWPORT   VIEWPORT
* ---------------------------------------------------------------------------------
#VPORTS      2          3
                                      7          1        80
                                     14          1        80
#END
* ---------------------------------------------------------------------------------
* LABEL    VIEWPORT  BEG.    COL.    DATA    MIN     MAX     NEG     POS
*           NUMBER   COL.   WIDTH   FORMAT  VALUE   VALUE   CHANGE  CHANGE
* ---------------------------------------------------------------------------------
#DEF
@DDMMMYY       1       3       7       A
@HHMM          1      14       4       A
SUP            1      23       5      N1       1.0    99.0
CUP            1      33       5      N1      -9.0     9.0
SLW            1      43       5      N1       1.0    99.0
CLW            1      53       5      N1      -9.0     9.0
HPREL          1      63       5      N1       0.0   100.0
UNITS          1      73       4      N0         0       8
TAIR           2       3       4      N0       -40     120
TWTR           2      10       4      N0        32      90
PREC           2      18       4      N2      0.00     9.0
WEAT           2      27       3      N0         1       6
WAB            2      35       2      N0         0     100
WBL            2      42       2      N0         0     100
DHRS           2      48       2      N0         0     240
DMIN           2      53       2      N0         0      59
LUP            2      59       2      N0         0     100
LDN            2      66       2      N0         0     100
DCON           2      73       5      N1         0   999.0
#END
```

Figure 2 Form Definition Example

```
* ------------------------------------------------------------------------------
* LABEL DATA    DATA   TIME TIME DSS FILENAME:DSS PATHNAME
*       TYPE    UNITS  OFFS SHFT
* ------------------------------------------------------------------------------
#DSS
SUP  ,INST-VAL ,FEET   , , ,DSSNAV.DSS://^B/STAGE-UP//IR-YEAR/OBS/
CUP  ,PER-CUM  ,FEET   , , ,DSSNAV.DSS://^B/STAGE-CHANGE_UP//IR-YEAR/OBS/
SLW  ,INST-VAL ,FEET   , , ,DSSNAV.DSS://^B/STAGE-LO//IR-YEAR/OBS/
CLW  ,PER-CUM  ,FEET   , , ,DSSNAV.DSS://^B/STAGE-CHANGE_LO//IR-YEAR/OBS/
HPREL,INST-VAL ,KCFS   , , ,DSSNAV.DSS://^B/FLOW-HYDRO_POWER//IR-YEAR/OBS/
UNITS,INST-VAL ,COUNT  , , ,DSSNAV.DSS://^B/COUNT-HP_UNITS//IR-YEAR/OBS/
TAIR ,INST-VAL ,DEG-F  , , ,DSSNAV.DSS://^B/TEMP-AIR//IR-YEAR/OBS/
TWTR ,INST-VAL ,DEG-F  , , ,DSSNAV.DSS://^B/TEMP-WATER//IR-YEAR/OBS/
PREC ,PER-CUM  ,INCHES , , ,DSSNAV.DSS://^B/PRECIP-INC//IR-YEAR/OBS/
WEAT ,INST-VAL ,CODE   , , ,DSSNAV.DSS://^B/CODE-WEATHER//IR-YEAR/OBS/
WAB  ,INST-VAL ,COUNT  , , ,DSSNAV.DSS://^B/COUNT-WAIT_ABOVE//IR-YEAR/OBS/
WBL  ,INST-VAL ,COUNT  , , ,DSSNAV.DSS://^B/COUNT-WAIT_BELOW//IR-YEAR/OBS/
DHRS ,INST-VAL ,HOURS  , , ,DSSNAV.DSS://^B/TIME-DELAY_HOURS//IR-YEAR/OBS/
DMIN ,INST-VAL ,MINS   , , ,DSSNAV.DSS://^B/TIME-DELAY_MINUTES//IR-YEAR/OBS/
LUP  ,PER-CUM  ,COUNT  , , ,DSSNAV.DSS://^B/COUNT-LOCK_UP//IR-YEAR/OBS/
LDN  ,PER-CUM  ,COUNT  , , ,DSSNAV.DSS://^B/COUNT-LOCK_DN//IR-YEAR/OBS/
DCON ,INST-VAL ,FEET   , , ,DSSNAV.DSS://^B/GATE-OPENING//IR-YEAR/OBS/
#END
```

Figure 2 Form Definition Example (cont'd)

3.1.1 Form Image

A form begins with the label #FORM name beginning in column one, where name is the name (one to eight characters) by which the form is retrieved. The lines following #FORM are a character-by-character image of the fixed component of the form as it appears on the screen. The numbers of lines and characters per line should be consistent with the maximum number available on the terminal to be used. The number of characters per line cannot exceed 132. Locations on the form where data are to appear will be overwritten after the form is displayed on the screen.

3.1.2 Viewports

The lines following the image define "viewports" and are bracketed by "#VPORTS" and "#END" keywords. Keywords like these must begin in column one (1). A viewport is a region of the form composed of horizontally adjacent columns. Viewports are used to effect rapid scrolling and paging. A viewport may contain as many columns as will fit (but without exceeding the limitations numbers of data records), and at least one and up to 10 viewports may be defined. All viewports scroll or page synchronously. Because they perform synchronously, all viewports have the same number of rows.

The line beginning with "#VPORTS" also specifies two viewport parameters: the number of viewports, and the number of rows per viewport. The subsequent lines define parameters for the viewports, one line per viewport. The parameters are: beginning row in the form and beginning and ending character positions on a row.

3.1.3 Data Definitions

The lines following the viewport definitions and bracketed by "#DEF" and "#END" provide definitions for the data to be displayed in columns in the form on the terminal screen. Each column is part of a time series of data: either expressions of time or data values. The expression of time is defined by the use of "intrinsic" values. Data values are retrieved from and saved in DSS files.

The data definition section of FORMS identifies the various data columns, provides information on where they're displayed on the screen, and, for data values, specifies numeric criteria for checking the values as they are entered. Each definition is specified in "free format" on a single line as described below.

The order in which the definitions appear on the form controls order in which they are accessed with horizontal cursor movements. A top to bottom order in FORMS corresponds to the conventional order of left to right for horizontal cursor movement.

Table 2. Data Definitions

Field	Description
1	Label for data item. Labels beginning with "@" designate intrinsic data --- see Table 3 below.
2	Viewport assignment: viewport 1 would be "1", etc.
3	Beginning character position on form.
4	Width of column for data in characters.
5	Format for data: A - alphanumeric Nn - numeric with n spaces to right of decimal if n is 0, no decimal is shown.
6	Minimum accepted value for screening data. A null entry implies no checking.
7	Maximum accepted value for screening data. A null entry implies no checking.
8	Maximum accepted negative change between the current and previous values. A null entry implies no checking.
9	Maximum accepted positive change between the current and previous values. A null entry implies no checking.

Table 3. Intrinsic Variables

Variable	Description	Example
@DDMMMYY	Military date	01JAN87
@DDMMMYYYY	Military date	01JAN1987
@DD	Day of month	01
@HHMM	Military time	1745

3.1.4 DSS References

The lines following the data definitions and bracketed by the keywords "#DSS" and "#END" specify references to data records in DSS files. The DSS references are specified in free format. The DSS reference is correlated with the data items by a label. Units, type, and offset are used only when the information is not found in a DSS file.

Table 4. DSS References

Field	Description
1	Label, same as corresponding data definition, up to 10 characters.
2	DSS data type default (INST-VAL, PER-AVER, INST-CUM, or PER-CUM). Used when originating a new DSS record or the type is not specified in the old record; otherwise, the type specified in the old record is used.
3	Data units default. Used when originating a new DSS record or the type is not specified in the old record; otherwise, the units specified in the old record are used.
4	DSS regular interval time offset default. Minutes from the beginning of the standard interval: for example, if a daily value is recorded at 0730, the time offset would be 450 (7 x 60 + 30). Used when originating a new DSS record; otherwise, the offset specified in the old record is used. A blank entry implies no time offset (data time is at end of interval).
5	Time shift. Minutes to shift the data forward (+) or backward (-) in time for display on the form. The data will be displayed on the form as follows: actual_time_of_data - time_shift Data entered will be stored in DSS at the actual time by applying the time shift as appropriate. Applies to regular-interval data only. A blank entry implies no shift.
6	DSS file and pathname reference in the form: filename:pathname For example: `MASTDB:/SCIOTO/CLSF4/FLOW/.....`

3.2 Terminal Definition File

ANSI terminals from different vendors tend to have extensive sets of functions which may be controlled by unique and exclusive command sequences from a host computer. As a result, a specific terminal usually must be configured for use with DWINDO through a terminal definition file named "DWTRM.DEF". This file contains control sequences used to specify initiation and termination sequences to initiate and restore the terminal and designate function key assignments. "DWTRM.DEF" is provided with the DWINDO program and may already contain a satisfactory description of the terminal to be used.

"DWTRM.DEF" is an ASCII (text) file divided into sections, one for each terminal type, headed by a line beginning with TERM and ending with a line beginning with ENDTRM. The line beginning with TERM also specifies the identity of the terminal by a 6 character identifier. Each section contains a sequence of: IM (initiate message); RM (reset message), NL (maximum number of lines); NC (maximum number of characters); DE (redefinition of a command key sequence); or D2 (alternative definition of a command key sequence). These may appear in any order. An example terminal definition is shown in Figure 3.

TERM name

This line begins a sequence of lines providing configuration of a particular terminal identified as name. <name> may be up to 6 characters long.

NL no_of_lines

no_of_lines specifies the maximum number of lines available on the device screen.

NC no_of_char

no_of_char specifies the maximum number of characters available on one row of the display device.

IM and RM

Initiation messages (IM) and reset messages (RM) each consist of a sequence of up to forty characters which are interpreted into control sequences and sent to the terminal by DWINDO. A control character is represented as a combination of "^" followed by a normal character whose ASCII code is offset from the ASCII code of the control character by 64. For example, "^[" represents an escape (the ASCII code of "[" is 91; an escape is ASCII code 27).

```
TERM HDS
NL 24
NC 132
*  REDEFINE CONTROL KEYS
*
*  TURN ON TRANSPARENT MODE
*IM '^[Q'
*
*  SET TERMINAL TO ANSI
IM '^[<'
*  Set Horizonal scroll ON
*IM '^[[=4h'
*  Set Black Background
IM '^[[?5l'
*  Set normal attributes
IM '^[[0m'
*  Set replacement mode (instead of insert)
IM '^[[4l'
*
*  PROGRAM HDS KEYBOARD
*  Delete Line (ESC [ M)                      F17
IM '^[[17;1;0u*^[[M*'
*  Insert Line (ESC [ L)                      F18
IM '^[[18;1;0u*^[[L*'
*  Beginning of Line (control-D)              F10
IM '^[[10;1;0u*^D*'
*  Beg. of Next Line (ESC-E)                  Shift ENTER
IM '^[[185;1;0u*^[E*'
*  End of Line (control-F)                    F12
IM '^[[12;1;0u*^F*'
*  HELP (CMD?)                                F20
IM '^[[20;1;0u*^[AA?*'
*  Restore (control-C)                        F21
IM '^[[21;1;0u*^C*'
*  Command  (ESC-A-A)                         F22
IM '^[[22;1;0u*^[AA*'
*  Insert Character Mode (ESC O p)            F1, Shift F1
IM '^[[1;1;0u*^[Op*^[[31;1;0u*^[Op*'
*  Insert Character Mode (ESC O p)            F16
IM '^[[16;1;0u*^[Op*'
*  Delete Character (ESC [ P)                 F13
IM '^[[13;1;0u*^[[P*'
*  Missing Value (ESC [ m)                    F106 (numeric keypad)
IM '^[[106;1;0u*^[[m*'
*  Tab Backward (ESC [ H)                     F203 (shift left arrow)
IM '^[[203;1;0u*^[[H*'
*  Tab Forward (^I)                           F202 (shift right arrow)
IM '^[[202;1;0u*^I*'
```

Figure 3. Terminal Definition Example

```
*  Page Up (ESC [ V)                              F206 (shift PAGE)
IM '^[[206;1;0u*^[[V*'
*  Page Up (ESC [ V)                              F200 (shift up arrow)
IM '^[[200;1;0u*^[[V*'
*  Page Down (ESC [ U )                           F126 (PAGE)
IM '^[[126;1;0u*^[[U*'
*  Page Down (ESC [ U)                            F201 (shift down arrow)
IM '^[[201;1;0u*^[[U*'
*  SCROLL UP Function (ESC O m)                   Shift SCROLL
*IM '^[[205;1;0u*^[Om*'
*  SCROLL DOWN Function (ESC O l)                 SCROLL
*IM '^[[125;1;0u*^[Ol*'
*  Exit Form            (ESC [ O)                 F23
IM '^[[23;1;0u*^[[O*'
*
*  Disable certain keys                           F5, Shift F5
IM '^[[5;6;0u^[[35;6;0u'
*
*  TURN OFF TRANSPARENT MODE
*IM '^[R'
*
*  Reset Numeric Keypad; Clear temporary key definitions
RM '^[>^[[0;8;0u'
ENDTERM
```

Figure 3 Terminal Definition Example (cont'd)

Initiation messages are interpreted and sent to the terminal as soon as they are encountered in the input stream. Reset messages are stored in memory and sent each time the program returns from ANSI (full screen) operation or an abnormal termination occurs.

DE and D2

Each of the keys designated for control actually generates a unique sequence of one or more characters which are transmitted to the host computer when the key is pressed. Each sequence begins with a control character to distinguish the control sequence from literal input. A control character is represented as a combination of a "^" followed by a normal character whose ASCII code is offset from the ASCII code of the control character by 64. For example, "^[" represents an escape (the ASCII code of "[" is 91; an escape is ASCII code 27). A list of the functions is shown in Table 5.

Table 5. Control Function Sequences

Mnemonic	Control Function	Control Sequence	Default
BNL	Move to beginning of next line	^[E	
BOL	Move to beginning of current line	^D	
CMD	Prepare to accept command	^[AA	
CURD	Move down one line, same column	^[[B	
CURL	Move left one cell	^[[D	
CURR	Move right one cell	^[[C	
CURU	Move up one line, same column	^[[A	
DELC	Delete character	^[[P	
DELL	Delete line	^[[M	
DUP	Duplicate previous entry in column	^[OR	
ENTR	Enter (carriage return)	^M	
EOL	Move to end of line	^F	
ERAS	Erase entry	^[OQ	
EXIT	Exit form	^[[O	
INSC	Insert character	^[Op	
INSL	Insert line	^[[L	
MISS	Enter missing value flag	^[[m	
PGDN	Page down	^[[U	
PGUP	Page up	^[[V	
REST	Restore entry (from memory)	^C	
TABB	Move to previous column	^[[H	
TABF	Move to next column	^I	

The table may be altered by DE and D2 directives in the terminal definition file, with each directive altering the control sequence for a single function. DE substitutes a sequence for the default one. For example, the following sequence designates an alternative sequence for CURR:

```
DE CURR=^[[KJ
```

D2 creates an additional sequence which is recognized for a function to allow more than one key to be designated for the same function. The syntax for a D2 directive is the same as for DE. The following limitations apply in use of DE and D2:

1) Two different functions may not be assigned the same control sequence, including default sequences.

2) Escape sequences may not be more than four characters long, including the escape character.

3) Sequences that do not begin with an escape (^[) are restricted to the following (to avoid conflicts with those which have other significance in communications between the terminal and host computer): A B C D F P R T U V W Y \ ] _