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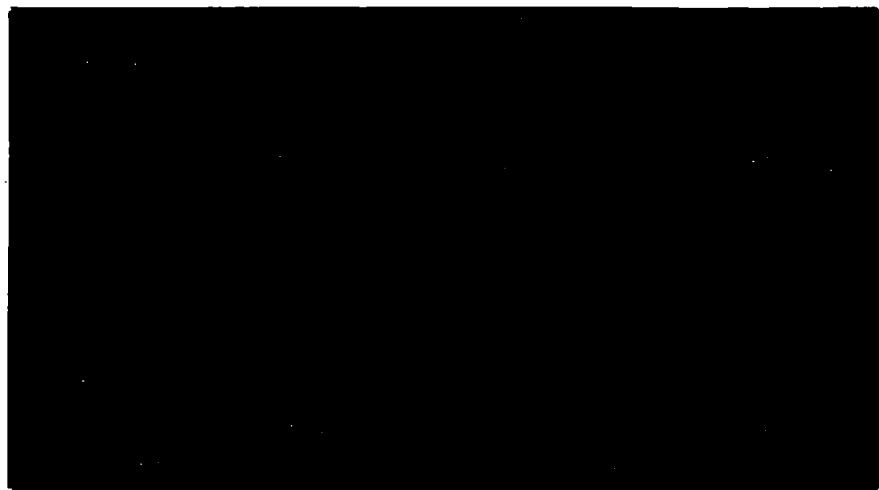
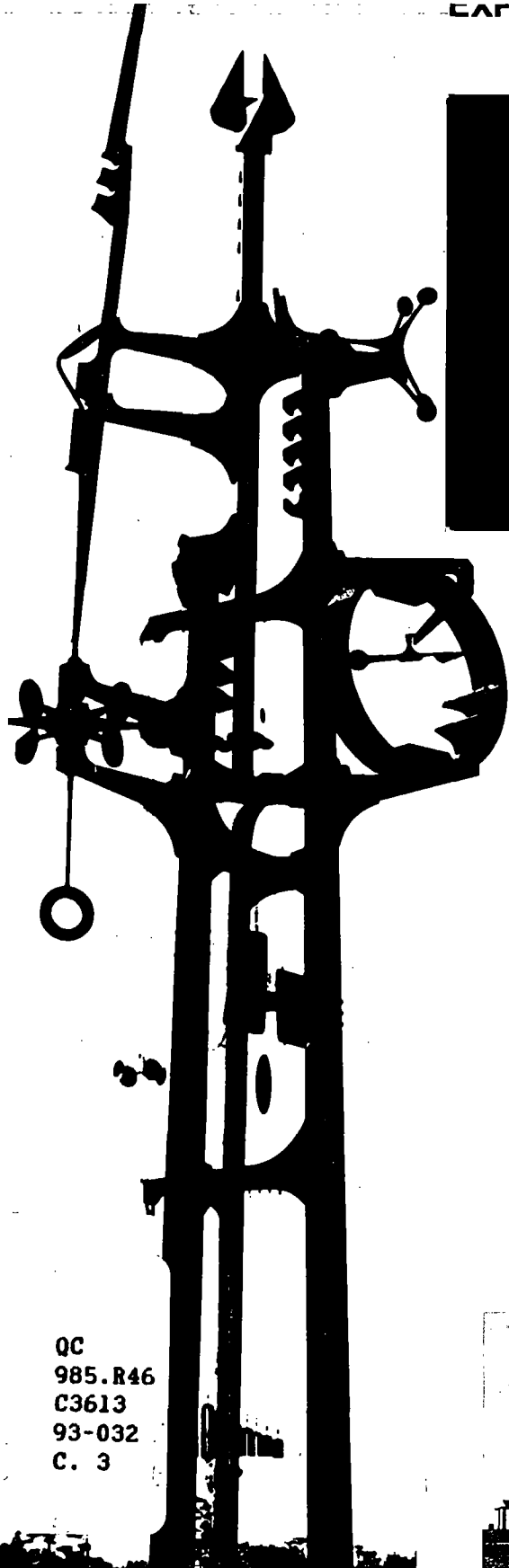
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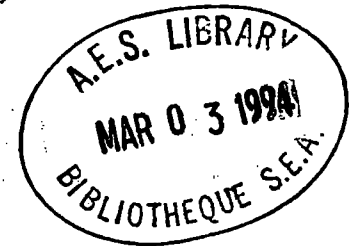
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DISPLAY SUPPORT FOR AN
ELECTRONIC CLIMATE SYSTEM
BULLETIN BOARD SYSTEM



FEBRUARY 1994

Report No. CCAD-93-032(CARE)

**DISPLAY SUPPORT FOR AN
ELECTRONIC CLIMATE SYSTEM
BULLETIN BOARD SYSTEM**

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1.1 Background of ECS BBS

The purpose of the Bulletin Board System (BBS) component of the Electronic Climate System (ECS) is to manage a local node of datalogger stations, acting as an intermediary between stations and remote users. Data is collected from a network of stations, processed on the BBS computer, and delivered via telecommunications to a variety of remote users.

The ECS BBS operates on an IBM compatible personal computer within a DOS operating system environment. All dataloggers (weather stations) are accessed from one asynchronous communication port. The Hayes compatible modem that receives user calls is accessed from a second communication port that can be operated simultaneously. Existing commercial software is utilized for support of BBS communication requirements: modem communication is supported by Hilgraeve's HyperACCESS/5 and autostation communication is supported by Campbell Scientific's PC208. A significant amount of development has occurred within HyperACCESS/5 script language and Microsoft QuickBasic in order to implement and support BBS features.

1.2 Background of QDISPLAY

The purpose of the QDISPLAY software component of the Electronic Climate System is to provide display support for ECS graphs and tables.

The display support software accomplishes several objectives. Display elements are organized into an interactive menu which is highly user accessible. Display elements are alternately organized into an automatic script sequence which operates hands-free. The BBS transmits an interpretable representation of graph images rather than literal graphic image files. An ASCII graph definition file is dramatically smaller than the image it defines. This allows efficient telecommunication of information and affords platform independence (with some development work, versions of QDISPLAY can be implemented for alternate operating systems and alternate graphic adapters).

1.3 System Requirements

The system requirements for the current implementation of the ECS display support software are outlined in the following table. Note that a typical display system must also satisfy the communication requirements outlined section 2.2. Refer to **USER MANUAL FOR AN ELECTRONIC CLIMATE SYSTEM BULLETIN BOARD** for more information.

DETAIL	MINIMUM REQUIREMENT
PROCESSOR	8086 (IBM PC or Compatible)
RAM MEMORY	512 KBYTES
HARD-DISK STORAGE	1 MBYTE
OPERATING SYSTEM	DOS V3.0
DISPLAY ADAPTER	EGA OR CGA
MONITOR	COLOUR DISPLAY

2.1 Purpose

Within the context of display, the two objectives for accessing the bulletin board system are:

- (1) To download the display support software
- (2) To download the current graphs and tables

2.2 Communication Requirements

DETAIL	REQUIREMENT
Modem Type	V.22, V.32 Compliant
Bit Per Second	2400 - 14400
Data Format	8 data bits (ASCII) 1 stop bit
Emulation Mode	TTY
Transfer Protocols	HyperPROTOCOL, Kermit, YModem Batch, ZModem

Details such as BBS phone number and user password are dependent on specific implementations. The maximum supported transfer rate (bits per second) is also dependent on BBS hardware.

The above requirements translate into a standard phone-line modem with a telecommunication software package for support. The communications software must be able to:

- initiate a data call to another computer
- negotiate sending and receiving of ASCII character data
- download a file using one of the above transfer protocols
- disconnect a data call (hangup)

One should understand how to perform these operations before attempting the procedures outlined in sections 2.3 and 2.4:

2.3 Download Software Procedure

The objective of the download software procedure is to receive the self-extractive ZIP file called **SOFTWARE.EXE**. This compressed file set contains a copy of the display support software.

Initiate a call to the BBS computer. Once the BBS answers, displays an introductory message, and prompts for a password, login by entering either the generic **USER** password or one's registered password. If one has successfully accessed the BBS, the system menu is now displayed:

MAIN MENU OPTIONS

- (1) Electronic Messages
- (2) Bulletins and News
- (3) Weather Observations
- (4) Bioclimate Indices
- (5) Summary Reports
- (6) Download Graphs and Tables
- (7) Slave Access
- (8) Datalogger Terminal Access
- (9) Model Maintenance
- (0) Log Off

Options (7) through (9) may in whole or in part be missing. Select **(6) Download Graphs and Tables** from the system menu. The following menu should appear:

DOWNLOAD GRAPHS AND TABLES

- (1) Help
- (2) Download Software (QDISPLAY V2.0)
- (3) Download Data
- (0) Return to Main Menu

Select **(2) Download Software** from this menu. It may occur that the system displays:

Sorry, the system is unable to locate this file.

and the download command is cancelled. Consult the BBS operator (ie. **SYSOP**) to determine the cause of the failure (the probable cause is that BBS maintenance work is in progress).

More typically, one is now asked to select a transfer protocol:

Options:

(H)yperprotocol
(K)ermit
(Y)modem Batch
(Z)modem
(A)hort

Protocol for downloading:

Should one selects **A**, the download is aborted and control returns to the menu. For any valid option selected, the download is initiated. (At this point, one normally must instruct the communication software to receive a file using the selected transfer protocol). All of the protocol options in this menu incorporate error checking during data transmission. There are two possible outcomes for a download:

Transfer successfully completed.

OR

Unsuccessful transfer.

2.4 Download Data Procedure

The objective of the download data procedure is to receive the self-extractive ZIP file called **DATA.EXE**. This compressed file set contains a copy of all BBS graphs and tables. Note that each time the download data procedure is repeated, one should either delete or overwrite the existing copy of **DATA.EXE**.

The download data procedure is similar to the download software procedure outlined in section 2.3. However, select **(3) Download Data** rather than **(2) Download Software** from **DOWNLOAD GRAPHS AND TABLES** menu.

2.5 Display User

An alternative to the download data procedure outlined in section 2.4 is to access the BBS as the **DISPLAY** user. At the password prompt, login by entering the **DISPLAY** password. The BBS will initiate a download of **DATA.EXE** using the **ZModem** transfer protocol. The call is disconnected when this transfer completes.

3.1 Software Installation

The objective of software installation is to unpack ECS display support software files into a directory residing on the host personal computer. Software installation need only be carried out once whereas data installation as described in section 3.2 is ongoing. Software installation should precede data installation.

Access the BBS to receive the self-extracting executable file set called **SOFTWARE.EXE**. Refer to section 2.3 which describes the download software procedure.

Explode the ZIP file sets by entering the designated filename as a command at the DOS prompt. For example, to install the display software in a new directory called **C:\QDISPLAY** when the software file was downloaded as **C:\COMM\QDISPLAY.EXE** enter the DOS command sequence:

```
MD \QDISPLAY  
CD \QDISPLAY  
C:\COMM\QDISPLAY.EXE
```

and thereafter refresh BBS graphs and tables from the downloaded data file **C:\COMM\DATA.EXE**:

```
CD \QDISPLAY  
C:\COMM\QDISPLAY.EXE -F
```

3.2 Data Installation

The objective of data installation is to unpack BBS graph and table files into a directory residing on the host personal computer. Data installation should precede execution of the display support software in order that one has access to current information.

Access the BBS to receive the self-extracting executable file set called **DATA.EXE**. Refer to section 2.4 (or 2.5) which describes the download data procedure.

Explode the ZIP file sets by entering the designated filename as a command at the DOS prompt. For example, to install/update the data files in a directory called **C:\QDISPLAY** when the data file was downloaded as **C:\COMM\DATA.EXE** enter the DOS command sequence:

```
CD \QDISPLAY  
C:\COMM\DATA.EXE -N
```

Note that the **-N** command option specifies **overwrite for newer files**. Refer to PKWARE (ZIP) documentation for more information on available command options.

4.1 Program Usage

When QDISPLAY is invoked, the default directory must contain the executable file, QDISPLAY.EXE, and all related files that are accessed by this program. For instance, this directory must contain the set of graph and table data files in an uncompressed format. QDISPLAY activates one of three operating modes as determined from the command-line syntax:

QDISPLAY	Interactive menu-driven display mode
QDISPLAY datafile	Interactive single-item display mode
QDISPLAY auto [hour [min]]	Automatic script-driven display mode

4.2 Interactive Menu Display Mode

Interactive menu-driven display mode is activated when command-line arguments are omitted. A customized menu (specified by QDISPLAY.MNU) organizes available display items into an annotated listing. Items are displayed upon selection from this interactive menu.

4.3 Interactive Item Display Mode

Interactive single-item display mode is activated when an argument, **datafile**, is specified on the command-line. This display mode allows direct access to one specific display item. The argument must specify the complete filename (with path and extension) of a valid display item (either an observation table, ?.OBS, model table, ?.MDL, report table, ?.RPT, or graph file, ?.GDF).

4.4 Automatic Script Display Mode

Automatic script-driven display mode is activated when the keyword **auto** is detected as the first argument of the command-line. The program will automatically display a customized sequence of graph and table objects. Two optional arguments, **hour** and **min**, control a timed exit function (section 4.6).

4.5 Manual Exit

Press the **ESCAPE** key to either finish the current operation, return to the previous screen, or exit the program. Issuing a manual exit from QDISPLAY while automatic display mode is active will generate an error file (section 4.6).

4.6 Timed Exit

Automatic display mode utilizes a timed exit function. Timeout parameters, hour and min, in conjunction with the system clock determine the exit time. The parameters may be explicitly specified as command-line arguments or assume default values.

PARAMETER	RANGE	USAGE	DEFAULT
hour	1 - 24	Display duration in hours	1
min	1 - 59	Minutes past hour at stop time	5

The following table illustrates how hour and min control a timed exit:

Start Time	hour	min	Exit Time
8:04	1 hour	5 minutes	8:05
8:06	1 hour	5 minutes	9:05
8:11	1 hour	5 minutes	9:05
15:10	1 hour	10 minutes	16:10
10:05	6 hours	4 minutes	16:04
8:04	24 hours	7 minutes	7:07
8:08	24 hours	7 minutes	8:07
16:11	24 hours	7 minutes	16:07

The timed exit function provides support when QDISPLAY is incorporated within an automatic display routine (section 7). Automatically exiting after a specified time period, the calling program or batch file may proceed with an update of current BBS information. Note that hour determines the data update rate while min allows time scheduling to prevent contention between automated callers.

4.7 Display Error File

An error file, QDISPLAY.ERR, is created in the current default directory when **automatic display mode** is interrupted. This is caused by several possible conditions:

- detection of ESCAPE key
- character font file is missing/invalid
- display script is missing/invalid
- no display items found

The error file contains a brief message indicating the probable cause of display termination. Note that a **timed exit** does not generate QDISPLAY.ERR.

Creation of an error file provides support when QDISPLAY is incorporated within an automatic display routine (section 7). Checking for the existence of such an error file, the calling program or batch file may branch to an appropriate response action.

4.8 Hardcopy Output

The current implementation of QDISPLAY does not support printing capability. However, hardcopy is indirectly available by employing a "screen capture" program. PIZAZZ PLUS has been used successfully in conjunction with QDISPLAY to produce excellent colour (and gray-scaled) copy. The figures appearing in this document were captured and printed using PIZAZZ.

5.1 Interactive Display Operations

Interactive display operations require direct user input from the keyboard. Note that all required command keystrokes except ESCAPE key may be accessed from the numeric keypad (with NUM LOCK off).

5.2 Selecting a Display Item

The interactive menu of QDISPLAY lists all available display items. Use UP, DOWN, PAGEUP, PAGEDOWN, HOME, END keys to reposition the highlight bar. Press ENTER key to select a display item. (Press ESCAPE key while an item is displayed to return to interactive menu.)

QDISPLAY V2.0 - CANADIAN CLIMATE CENTRE		02-01-1994 15:55
FREQUENCY & TYPE	DESCRIPTION	
HOURLY OBSERVATIONS	A. E. S.	
	FIRE WEATHER	
	SCIENTIFIC	
	SCIENTIFIC (PRECIP STATION)	
HOURLY PROFILES	SOLAR RADIATION & PRECIPITATION	
	AIR TEMPERATURE	
	SOIL TEMPERATURE	
	RELATIVE HUMIDITY	
	WIND SPEED	
HOURLY INDICES	HUMIDEX/WINDCHILL	
	FIRE WEATHER (SEVERITY RATING)	
HOURLY GRAPHS	SOLAR RADIATION FOR UPPER SITE	
	SOLAR RADIATION FOR LOWER SITE	
	BATTERY VOLTAGE	
	PRECIPITATION	
	AIR TEMPERATURE	
RELATIVE HUMIDITY		
Press: ? to move highlight ENTER to select item ESCAPE to cancel/quit		

Figure 1: SELECTING A DISPLAY ITEM

5.3 Scroll Table Section

This operation is available for tables with sections that are larger than the assigned screen area. While the table is displayed, press the ENTER key (several times) until the desired section is highlighted with a dark blue background (shaded region on a monochrome display). Press UP (DOWN) key to decrement (increment) row offset of highlighted section by one row. Press PAGEDOWN (PAGEUP) key to decrement (increment) row offset by one page. Press HOME (END) key to set row offset to start (end) of highlighted section.

Repeatedly pressing the ENTER key will cycle through each section of the table. Note that part of this cycle includes having no section highlighted; desirable prior to generating hardcopy.

QDISPLAY U2.0 - CANADIAN CLIMATE CENTRE 02-01-1994 15:58

HOURLY SCIENTIFIC OBSERVATIONS FOR 02-01-1994 AT 1500 EST

Parameter	Height	Unit	Base Station	ARQD Tower	Forest Clearing	Forest Edge	Closed Forest
Avg TC Temp	30m	degC	----	----	-10.0	----	----
Avg TC Temp	22.9m	degC	----	----	----	----	-9.0
Avg TC Temp	20m	degC	----	----	-9.1	----	----
Avg TC Temp	17.5m	degC	----	----	----	----	-8.9
Avg TC Temp	16m	degC	----	----	-11.0	-11.2	-8.9
Avg TC Temp	3m	degC	----	----	-10.4	-11.1	-9.0
Avg TC Temp	1.5m	degC	----	----	-11.5	-11.1	-9.0
Avg TC Temp	0m	degC	----	----	-2.7	-7.0	-13.4
Max TC Temp	30m	degC	----	----	-7.6	----	----
Time of Max	30m	HrMin	----	----	1427.0	----	----
Max TC Temp	22.9m	degC	----	----	----	----	-8.1
Time of Max	22.9m	HrMin	----	----	----	----	1441.0
Max TC Temp	20m	degC	----	----	-8.6	----	----
Time of Max	20m	HrMin	----	----	1458.0	----	----
Max TC Temp	17.5m	degC	----	----	----	----	-8.2

Scientific observations are reported every hour on the hour.
Average values cover full 60-minute period.
Sensors are scanned every 5 seconds.

Figure 2: SCROLLING A TABLE SECTION

5.4 Resize Graph Window

This operation is available for all graph images. While the graph is displayed, press the ENTER key once. A resize window will appear allowing specification of a new start time and stop time.

Use UP, DOWN keys to move between time fields. Press LEFT (RIGHT) key to decrement (increment) field value by one time step. Press PAGEDOWN (PAGEUP) key to decrement (increment) field value by 20 time steps. Press HOME (END) key to set field value to start (end) of time period. Note that start time and stop time are constrained to a time period not outside of the original graph window.

Adjust the time fields as desired. When completed, press the ENTER key to display the resized graph window. Note that a graph window can be resized indefinitely by following this procedure.

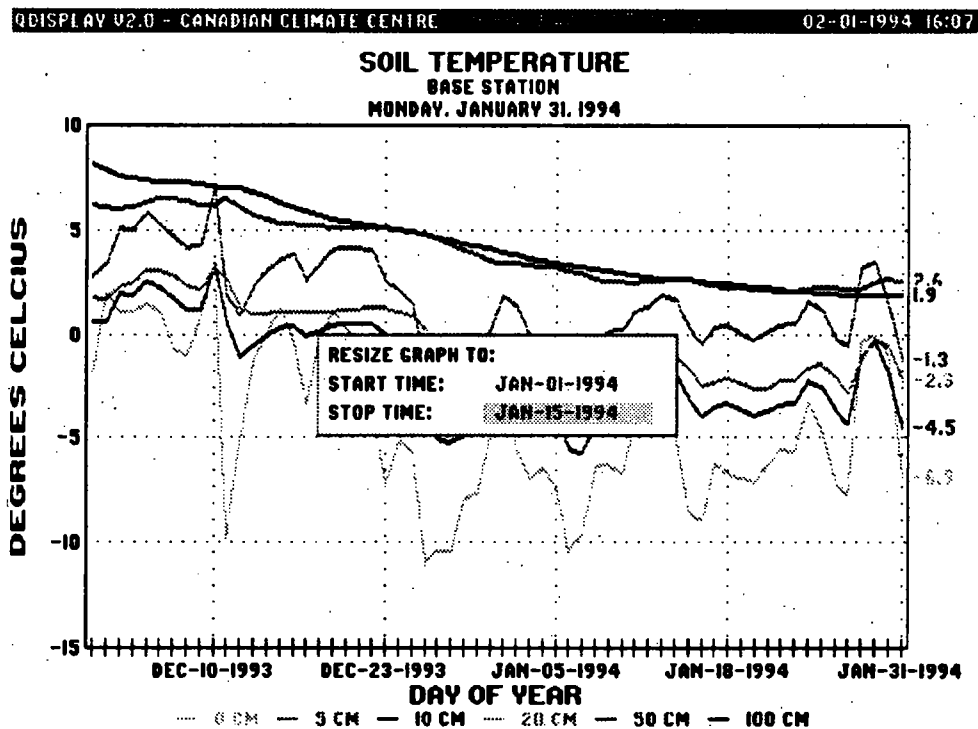


Figure 3: RESIZING A GRAPH WINDOW

6.1 Automatic Display Operations

The automatic display operations described in this section involve user input from the keyboard. All required command keystrokes except ESCAPE key may be accessed from the numeric keypad (with NUM LOCK off).

6.2 Influence Script Action

The script display sequence is affected by keyboard input. Press PAGEDOWN (PAGEUP) to move immediately to the next (previous) script display item. Press HOME (END) to move immediately to the first (last) script item and set positive (reverse) script direction. An unrecognized key defaults to PAGEDOWN action.

6.3 Access Interactive Menu

While automatic display mode is active, press the ENTER key to access the interactive display menu. All of the features associated with interactive display mode as described in section 5 are available. Note that the **timed exit function is suspended** while interactive display mode is in effect. Return to automatic display mode by pressing the ESCAPE key while the interactive menu is on-screen. Note that the display script resumes with at the current script position.

7.1 Purpose

The automatic display routine controls a computer which is dedicated to continuous display of ECS graphs and tables. Ideally the display routine should be self-regulating and not require user intervention. Note that multiple automatic display computer systems may be established to support one BBS.

7.2 Requirements

In general, an automatic display routine must accomplish three tasks:

- (1) Collect display data (DATA.EXE) from the BBS on a regular basis using an automatic communication script program.
eg. execute AUTODSP script
- (2) Explode the downloaded ZIP file set containing graph and table files
eg. execute DATA.EXE with overwrite newer files command option
- (3) Initiate the display of a defined set of graphs and tables
eg. execute QDISPLAY in automatic display mode

7.3 CONFIG.SYS

No special requirements exist for the display computer CONFIG.SYS file specification. However, if sufficient RAM is available, a worthwhile optimization is to define a virtual RAM disk from which QDISPLAY operates. This substantially reduces the amount of hard-disk access during normal display operation.

7.4 AUTOEXEC.BAT

AUTOEXEC.BAT must initialize environment variables used by AUTODSP and initiate the automatic display routine AUTODSP.BAT. An example AUTOEXEC.BAT file that supports automatic display is:

```
@ECHO OFF
ECHO AUTOEXEC.BAT (DISPLAY)

PROMPT $D $T$ $P$G
PATH D:\;C:\;C:\DOS;C:\BAT

SET TEMP=D:\
SET TMP=D:\

SET BBS_PHONE_NUMBER=14581528
SET SMART_SWITCH=NO
SET DISPLAY_FILE=D:\QDISPLAY\DATA.ZIP

MD D:\QDISPLAY
XCOPY C:\QDISPLAY\*.* D:\QDISPLAY

AUTODSP
```

7.5 AUTODSP.BAT

AUTODSP.BAT has been defined to coordinate the tasks of data collection, file extraction, and display within a continuous loop. The terminating condition for this routine is the existence of the text file, QDISPLAY.ERR, which is created only when QDISPLAY is interrupted. An example AUTODSP.BAT file that implements an automatic display routine is:

```
@ECHO OFF  
ECHO AUTODSP.BAT  
  
:1  
C:  
CD \HA5  
HA5DOS AUTODSP  
  
D:  
CD \QDISPLAY  
DATA -n  
IF EXIST QDISPLAY.ERR DEL QDISPLAY.ERR  
QDISPLAY AUTO 1 5  
IF NOT EXIST QDISPLAY.ERR GOTO 1
```


7.6 AUTODSP.RDY

AUTODSP.RDY is a HyperACCESS/5 script file that has been developed to automate **DISPLAY** calls to the BBS. The data collection procedure that is managed by this script can be summarized in the following steps:

- (1) Establish communication settings
- (2) Request the modem through a network if **SMART_SWITCH = YES**
- (3) Initialize the modem for asynchronous communication
- (4) Call the BBS computer at **BBS_PHONE_NUMBER**
- (5) Log on to the BBS computer under **DISPLAY** password
- (6) Download file, **DATA.EXE**, to the destination file specified by **DISPLAY_FILE** using **ZModem** file transfer protocol
- (7) Disconnect from BBS and exit to operating system

If a communication error occurs during any of the above steps, the display call is aborted and AUTODSP exits to DOS immediately.

7.7 QDISPLAY.SCR

The display script file QDISPLAY.SCR can be modified with a text editor to enable specification of a customized display sequence. In performing changes, one should ensure that the script file format is maintained. An example QDISPLAY.SCR file that specifies an automatic display script sequence is:

FILENAME	DELAY
AES.OBS	30
HSR.OBS	30
AESEAT.MDL	30
FWIFWS.MDL	30
HSRU.GDF	30
HSRL.GDF	30
HPP.GDF	30
HAT.GDF	30
HRH.GDF	30
HWS.GDF	30
R30PP.RPT	30
R30MT.RPT	30
G30PP.GDF	30
G30MT.GDF	30
R12PP.RPT	30
R12MT.RPT	30
G12PP.GDF	30
G12MT.GDF	30

APPENDIX 1: ZIP FILE SETS

SOFTWARE.EXE and **DATA.EXE** are created and maintained using **PKZIP** and **ZIP2EXE** (v1.10). **DATA.EXE** is updated each time the **BBS** collects weather observations.

SOFTWARE.EXE contains the following set of files:

QDISPLAY.DOC	- documentation file
QDISPLAY.EXE	- executable program file
QDISPLAY.FON	- character font file
QDISPLAY.MNU	- interactive menu file
QDISPLAY.SCR	- automatic script file

DATA.EXE contains the following set of files:

QDISPLAY.MNU	- interactive menu file
*.OBS	- observation table files
*.MDL	- model table files
*.RPT	- report table files
*.GDF	- graph definition files

APPENDIX 2: QDISPLAY FILE USAGE

The current working directory must contain all files accessed (read) by QDISPLAY. These files are identified in the following table.

FILENAME	FILE USAGE
QDISPLAY.EXE	Executable program file
QDISPLAY.FON	Character font data file
QDISPLAY.MNU	Interactive menu specification file
QDISPLAY.SCR	Automatic script specification file
*.OBS	Observation table file
*.MDL	Model table file
*.RPT	Report table file
*.GDF	Graph definition file

Note that an error file, QDISPLAY.ERR, is created in the default directory when the automatic display script is interrupted (terminates).

APPENDIX 3: QDISPLAY FILE FORMATS

A. QDISPLAY.MNU Menu File Format

FILENAME **(Header)**
(File 1) **(Menu 1)**
(File 2) **(Menu 2)**
: **:**
(File N) **(Menu N)**

FIELD	DESCRIPTION	RANGE
(Header)	Title of menu	string
(File K)	Filename of display item K	filename
(Menu K)	Description of display item K	string

(Header) and (Menu K) must not exceed 80 characters in width. The list may contain empty lines which allow the menu to be divided into sections.

(File K) specifies a filename including extension. Valid display items consist of observation tables, *.OBS, model tables, *.MDL, report tables, *.RPT, and graph definition files, *.GDF. The left field when non-empty is 14 characters wide.

B. QDISPLAY.SCR Script File Format

FILENAME **DELAY**
(File 1) **(D 1)**
(File 2) **(D 2)**
: **:**
(File N) **(D N)**

FIELD	DESCRIPTION	RANGE
(File K)	Filename of display item K	filename
(D K)	Delay in seconds display item K	1 - 32767

The list may contain empty lines, dividing it into sections.

(File K) specifies a filename including extension. Valid display items consist of observation tables, *.OBS, model tables, *.MDL, report tables, *.RPT, and graph definition files, *.GDF. The left field when non-empty is 14 characters wide.

C. Table File Format

QDISPLAY is compatible with the table data files generated by QTABLE, QMODEL, and QSET. Refer to **TECHNICAL MANUAL FOR AN ELECTRONIC CLIMATE SYSTEM BULLETIN BOARD** for detailed table file formats.

The general expected format of a table file is:

(Head 1)
(Head 2)
:
(Head H)
(Stat 1)
(Stat 2)
:
(Stat S)
(Body 1)
(Body 2)
:
(Body B)
(Foot 1)
(Foot 2)
:
(Foot F)

FIELD	DESCRIPTION	RANGE
(Head K)	Row K of table header	string
(Stat K)	Row K of table statistics	string
(Body K)	Row K of table body	string
(Foot K)	Row K of table footer	string

The total length of a table data file must not exceed 250 rows. Ideally, each row should have a constant width not exceeding 80 characters (for screen display).

The last row for each table section is distinct from all other rows of the section in that it is either blank or specifies a string of one specific character (eg. a dashed line).

A table file with extension **.OBS** or **.MDL** contains a header, body and optional footer. A table file with extension **.RPT** contains a header, stats, body, and optional footer. No other table file extensions are recognized.

D. Graph File Format

TITLE = (Label)
SUBTITLE = (Label)
CREATED = (Label)
Y-AXIS = (Label)
X-AXIS = (Label)
 (Blank)
TYPE = (Type)
 (Blank)
 (Legend)
 (Blank)
DATA PERIOD = (Period)
 (Blank)
 (Fields)
 (Blank)
 (Records)

FIELD	DESCRIPTION	RANGE
(Label)	Descriptive text label	string
(Type)	Graph type	custom
(Legend)	Legend specification	custom
(Period)	Graph period	custom
(Fields)	Source fields specification	custom
(Records)	Source records specification	custom

Each **(Label)** is displayed in upper case when the graph is drawn. **CREATED = (label)** specifies a creation date with the format: **(Day of Week), (Month) (Day), (Year)**.

(Type)	MEANING
LINE	Display values as a line graph
BAR	Display values as a bar graph
OVERBAR	Display values overlaying bar graphs for each successive parameter

D. Graph File Format (Cont.)

(Legend) has the format:

```

LEGEND SIZE = (L)
[(Blank)]
[LEG DESCRIPTION]
[ 1 (Leg 1)]
[ 2 (Leg 2)]
[ : : ]
[(L) (Leg L)]
    
```

FIELD	DESCRIPTION	RANGE
(L)	Number of legend items	0 - 6
(Leg K)	Description of legend item K	string

Normally the legend size (L) is either zero or the number of data parameters. If (L) is 0, the legend list is omitted.

(Period) has one of nine possible values:

(Period)	MEANING
DAY	One full day, hour 0100 - 2400
MONTH	One full month, day 1 - (length)
SEASON	One full season, julian 131 - 288
SEASON-M	One full season, month May - Oct
YEAR	One full year, julian 1 - (length)
YEAR-M	One full year, month Jan - Dec
#-HOUR	Last # hours
#-DAY	Last # days
#-MONTH	Last # months

(# represents an integer value)

A graph definition file is updated (overwritten) when the source dataset is full. The update frequency is closely related to **(period)**. Refer to sections 11.3.2 and 11.3.4.

D. Graph File Format (Cont.)

(Fields) has the format:

TOTAL FIELDS = (F)

(Blank)

FLD	FORMAT	DESCRIPTION
1	(TFmt)	(TDesc)
2	(DFmt 2)	(DDesc 2)
3	(DFmt 3)	(DDesc 3)
:	:	:
(F)	(DFmt F)	(DDesc F)

FIELD	DESCRIPTION	RANGE
(F)	Number of value fields	2 - 7
(TFmt)	Time field format	custom
(TDesc)	Time field description	custom
(DFmt K)	Format of data parameter K	custom
(DDesc K)	Description of data parameter K	string

(TFmt)	MEANING
HH:MM:SS	Hourly observations
HHMM	Hourly observations
HH	Hourly observations
JJJ	Daily observations
DD	Daily observations
MM	Monthly observations
MM-DD-YYYY	Daily or Monthly observations

(TDesc)	MEANING
TIME	Hourly observations
DATE	Daily or monthly observations

(DFmt K) specifies a string 1 to 10 characters wide using the # symbol. An optional decimal position is designated with a period.

D. Graph File Format (Cont.)

TOTAL RECORDS = (R)

(Blank)

(Rec 1)

(Rec 2)

:

(Rec R)

FIELD	DESCRIPTION	RANGE
(R)	Number of dataset records	custom
(Rec K)	Dataset record K	custom


The number of dataset records (R) is based on the setting for (period). The range is from 1 to maximum records for (period).

(Rec K) has the format:

(Time) (Data 2) (Data 3) ... (Data F)

FIELD	DESCRIPTION	RANGE
(Time)	Time field value	custom
(Data K)	Data value for field K	custom

(Time) and (Data K) are based on the field format specifiers (TFmt) and (DFmt K), respectively. Each field has a constant width equal to the character width of the source format specifier. Field values of a dataset record are separated by one character space.

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