3.4.2 Database Elements

YYYYMMMDD.DAY

Name: yrmondy.DAY (where: yr = 2 digit year, mon = 3 char month, dy = 2 digit day)

LogicalName: NA
Location: Sutron_dayfiles:
Organization: Indexed Sequential
RecordType: Variable, binary data
Key: Character, bytes (1:16)
MaxRecord: 1322 bytes

Fieldname	Byte/Type/Size/Dim				Description
Hydromet_ID_Code	1	C	2	. 2	User Identification Code (fixed value normally set to 100 octal).
Format	3	C	1	. 3	Data format (D=data, Q=diagnostic).
Site	4	C	8	. 11	Site or remote source of record; Normally a site defined in the system's configuration data.
Time	12	C	4	. 15	Time of data in 4 digit "hrmm" form
Rmode	16	C	1	. 16	Reporting mode of the data (S=self timed, R=random reported); primarily used for GOES satellite data in which data can be reported twice for the same time period. M = MDE
Ttype	17	C	1	.	Telemetry type (S=satellite, M=manually entered, L=line of site, etc.,); This field is not normally used by Sutron software.
Tzone	18	B	1	.	Time zone code of site's data when collected in number of hours behind GMT (positive numbers are standard hours, negative numbers are daylight savings tme hours). This field is only used during SHEF output
Ctype	19	C	1	.	Coding Type (S=SHEF, C=CBTT, I=ICAO, F=FOREIGN, O=OTHER); This field is not normally used by Sutron software.
Spare	20	C	2	.	Two spare bytes not currently used.
Npairs	22	B	1	.	Pair count of pcode and value pairs in the record (positive number between 1 and 100).
Pcodes	23	C	9	?	Parameter codes/quality flags array where ? is equal to the value of Npairs above; First 7 bytes of each pcode element are the parameter name, 8th byte is a spare, 9th byte is the logical quality flag byte.
Values	?	R	4	?	Data values array where ? is equal to the value of Npairs above.

Note that the quality flag is within byte 9 of each pcode array element. There is no separate data structure for it. The beginning position of all data elements except Values described above is known. The first byte of the Values array within the record can easily be computed as:

1st byte position = 23 + Npairs*9

3.4.3 IO Access Routines

The DAYFILEs program uses a buffered system. Each record is retrieved and the parameters within it are displayed as required. The access routine within the DAYFILEs program is called GETDATA. It is located in the file sutron_maindir:[dayfile]getdata.for. A call to GETDATA retrieves data from the daily files and place it into the DAYFILE buffer defined in the sutron_maindir:[dayfile]bufdef_inc.for include file. There is no further subroutine call available to unwind the contents of the DAYFILE buffer.

3.5 ARCHIVE FILES

3.5.1 Description

The archive files represent a secondary database designed by Sutron to allow the software system to easily collect and maintain long term records. The size and amount of information collected by a hydromet system for instance can easily exceed 3,600 Mbytes per year. Obviously most systems cannot afford to maintain that much data on disk each year. More importantly, the user cannot disseminate that much information and perform useful tasks. Consequently, the archives database was developed to allow the data manager to generate more meaningful values by summarizing the daily files data and generating a single value representing some function applied to a days worth of data for a particular site and parameter.

The files are maintained on an annual basis; one file per year. The files are named YTyyyy.acf, where YT is the year type and yyyy is the four digit year. The year type is either WY for water year or CY for calendar year. An example file name would be WY1988.acf for the 1988 water year. A water year is a hydrologic term representing the calendar beginning on October 1st and ending the following calendar year on September 30th. These dates represent the classic beginning and ending of the annual runoff in western U.S. states. The 1988 water year for instance began on October 1, 1987 and ended on September 30, 1988. Because the term may have no meaning for other types systems, a calendar year archive file can be used. It is controlled by the system logical name ACMFILETYPE on the system. If ACMFILETYPE translates into "WATERYEAR" the archive files use the water year date structure. If the logical name translates to "CALENDARYEAR" or anything else, the archive files use the calendar year date structure.

The archive files are indexed sequential files referred to as ISAM files. The data within these files is stored in binary form so it is not possible to edit these files with a text editor. File sizes of Archive file vary depending upon usage. A file with 10 records per site and 500 sites would generate an archive file over 16,000 blocks in size. The file for a particular year is generated at the beginning of that year. The data for each day within that year (for the current year) is stored after each day in that year is complete. Thus, unlike daily files which incrementally grow as data appears, the archive files essentially allocate all of their space at the beginning of the year and then fill the file with data as the year progresses.

The records within the files contain a years worth of data for a specific site and parameter. These records are indexed by site, parameter, and time of day. The parameter may be the same parameter name as the source of data in the daily files or it may be modified to represent its statistical nature (e.g., GH in the daily files would become GH_AVE in the archive files). The time aspect of the key is rather confusing. In some systems, the value at a particular time of day such as 07:30 am is of particular interest. This is often because operational decisions were made based on the value at that time. The time portion of the key in this instance would be set to "0730" just as in the daily files. The standard archive parameters have no time associated with them. The average gage height for a day has only a date associated with it. In this case, the time portion of the key would be left blank. Note that this allows two or more records to be generated for a particular site and parameter using a time stamp. There may also be "1530" and "2230" records generated to represent conditions at the end of each shift's workday.

There can be more than one record per site; in fact there is virtually no limit to the number of records one site can have. One site may have 40 archive records available for it while another site may only have 2 records. The source of archive file data is daily file data. The process that transforms daily file records into archive file data is called ACM. The ACM program is actually an RTCM procedure and sub-procedures designed by either Sutron or the data manager to extract and compute statistics for storage in the archive files.

Access to the archive files is normally by means of the ARCHIVE program. This program contains the low level calls to read keyed or sequentially the correct records within an archive file. The data within these records are then formatted and displayed on the user's terminal.

3.5.2 Database Elements

Name:	YTyear.DAY (where: year = 4 digit year, YT = year type)
LogicalName:	NA
Location:	Sutron_archives:
Organization:	Indexed Sequential
RecordType:	Fixed, binary data
Key:	Character, bytes (1:27)
MaxRecord:	1496 bytes

Fieldname	Byte	Type	Size	Dim	Description
Hydromet_ID_Code	1	C	2	.	User Identification Code (fixed value normally set to 100 octal).
Site	3	C	12	.	Site or remote source of record; Normally a site defined in the system's configuration data.
Pcode	15	C	9	.	The parameter code name
Time	24	C	4	.	Time of data in 4 digit "hrmm" form
Spare	28	C	5	.	Spare bytes
Dailyvalues	33	R	4	366	Daily values for a single year with array element 1 beginning on the first day of the year and 366 the last day.

3.8 RATING TABLE (RTFFILE) FILE

3.8.1 Description

The RTFFILE contains rating table records. A rating table is a hydrographic tool that describes the relationship between a stream's water level and its discharge. Normally, a series of water level measurements and their corresponding discharges are taken and then plotted (water level on the y axis, discharge on the x) with discharge being the dependent variable. By using the rating table, a hydrographer can determine the discharge in the stream or canal by measuring the water level and reading the corresponding discharge from the table. This process can be extended to other types of tabular conversions such as pump pressure versus rpm.

The rating table file (RTFFILE) lookup is a standard function of RTCM. The RTFFILE must be accessible to both RTCM and users. Thus, the RTFFILE is a shared access keyed file. The key to the file is made up of four parts. The first two are site and the dependent parameter name. A typical example would be "SITE06 FLOW." Normally, one would think that the site and parameter name would be all that was needed to define a table. The last two parts of the key are required for special reasons, as described in the following paragraphs.

In stream hydrology, rating tables sometimes change. The change can generally be handled by a shift in the table. Occasionally, the stream bed patterns change so much as to require a completely new table. When this happens, the table is said to have expired. The current table is considered no longer valid. A new table is developed and entered for this site and parameter. For this reason, the third part of the RTFFILE key is the expiration date.

It is important that the coding of the expiration date within the key be in sequential ascending time order. In this way, the time stamp of a value can automatically be used to determine which table to use during the conversion process. Since the current rating table has no expiration date as such, an expiration date of August 31, 2132 is assumed for all current tables. This date has the unusual feature of returning the integer number 99999 when a call to lib$day is made. Thus, the integer day since the beginning of VMS time (17-Nov-1858) of the expiration date is simply appended to the site and parameter portion of the key. The 5 character integer date was chosen rather than the lexical date simply to reduce key space.

One of the painful portions of any rating table record is its length. Practically every system requiring rating tables has the majority of tables that require 50 points or less and maybe 3 or 4 additional tables that require 500 points. Each point is considered an x and y row of the table. If room is allocated for 500 points for every table, it results in an enormous waste of space. The other choice is to force the user to break the single large table into several smaller tables. This is undesirable also. The solution chosen for the flexible length of rating tables was to adopt an extension record capability. The RTFFILE has a maximum of 120 points per record. If the table for that record exceeds 120 points, the table is extended (from record number 0) to record number 1 with points 121 through 240. If more than 240 points are required in the table, record number 2 is generated and so on. Currently, the RTF software maximum of 12 extension records are allowed. Thus a table with 500 points would use 5 RTFFILE records numbered 0 through 4. The extension number of the record makes up the fourth and last portion of the rating table file key.

3.8.2 Database Elements

Name:	Sutron.rtf
LogicalName:	SUTRON_RTFFILE
Location:	Sutron_maindir:[rtcm.table]
Organization:	Indexed Sequential
Recordtype:	Variable, binary data
Key:	Character, bytes (1:21)
MaxRecord:	2048 bytes

Fieldname	Byte	Type	Size	Dim	Description
Site	1	C	8	.	The site this table belongs to
Ylabel	9	C	7	.	The parameter that this table returns.
Expdays	16	C	5	.	The expiration date as the number of days since the beginning of VMS time.
Recnum	21	B	1	.	The record's extension number
Descr	22	C	~~32~~ 37	.	Description of the table
Interpcode	54	B	1	.	Interpolation code number
Xlabel	55	C	7	.	X parameter name
Yunits	62	C	5	.	Y parameter units
Xunits	67	C	5	.	X parameter units
Sigdigs	72	B	1	.	significant digit count
Cre8date	73	I	4	2	Creation date of the table
Editdate	81	I	4	2	Date of the last change to the table
Expdate	89	I	4	2	Expiration date in VMS format
Xferdate	97	I	4	2	Date of last transfer
Xferflag	105	B	1	.	Transfer flag
Username	106	C	12	.	The user name of the last editor
Linecnt	118	I	2	.	The number of rows in this record alone
Rowcnt	120	I	4	.	The number of rows in the total table
X	124	R	4	120	The x data values in the record
y	604	R	4	120	The y data values in the record
a	1084	R	4	120	The a coefficient values in the record
b	1564	R	4	120	The b coefficient values in the record

3.8.3 IO Access Routines

Input and output to the rating table file is best handled by using the upload and download utilities of the RTF software. In this way, the user or programmer need not worry about the details described above regarding the key structure of the file. The actual location of the io routines for the RTFFILE used in these upload and download operation is within a source file called Sutron_maindir:[rtcm.rtf]rtfio.for. The true low level primitives to the file called by these routines are kept in the same directory in the file rtfprimio.for.