University of Michigan Space Physics Research Laboratory		
TIDI Data Processing Software **EngineeringTrend File Format**	CAGE No. Drawing No. Project Contract No. Page	0TK63 055-3494C TIDI NASW-5-5049 1 of 5

Revision Record

Rev	Description	Date	Approval
A	Initial Release	10 Jun 1997	
B	Post Requirements Review Revision	12 Feb 1998	
C	• Correct length of variable name field in header record • Add source packet type field to header record • Add type column to Table 2, Data Record Format • Minor editorial corrections	8 Jul 1999	

Approval Record

Function	Name	Signature	Date
Originator	D. Gell		
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System Engineer			
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R&QA	John Eder		

1.   References

1   Musko, S. "TIDI Flight Software Requirements Specification", SPRL File 055-3320B, 17 March 1997.

2   Gell D., "File Header Contents", UM File T-018716-713, 22 May 1989

2.   Introduction

Trend files are a diagnostic tool, intended to permit easy access to long time series of engineering data. The trend package consists of a program to extract engineering values from the TIDI telemetry at appropriate intervals and store the values in a file. The second part of the trend package is a display and data access tool. The connection between the extraction and display is the trend file, documented in this memo.

Trend files will generally contain two extracted values per orbit resulting in 32 data records per day. For a planned two year mission, each trend file will contain 23,360 records. Extending the mission will result in an additional 11,680 records per year.

Data will be extracted from the trend files for a particular variable over specified time ranges. The file format must support convenient access to any range of times. Since updated level 0 files may be produced from time to time, it also has to be simple to replace data for a given day or range of days with new data.

3.   File Organization

3.1.   General

Trend files will be direct access files. The file will consist of a header and a set of data records. The header contains the information required to determine the location of any data item contained in the file. The data records consist a series of values for one engineering quantity converted to engineering units from TM values.

3.2.   Header

The header is a fixed length structure, containing the items described in Table 1, below.

Table 1, Trend File Header

Item	Description		Offset bytes	Length bytes
1	File Format Version ID		0	2
2	File Creation Time		2	6
3	Time of Last Modification		8	6
4	Time of Earliest Entry	T_0	14	6
5	Time of Most Recent Entry	T_r	20	6
6	Granularity (seconds)	T_g	26	4
7	Nominal duration of sample period (seconds)	D	30	4
8	Offset of Earliest Entry (bytes)	P_0	34	4
9	Record Length (bytes)	L_r	38	4
10	Variable Name		42	40
11	Variable Units		82	30
12	Creator Program		112	80
13	Creator Node		192	80
14	Source Packet Type		272	2

The file version identifier is intended to match the file with the reading program or routine. The format version identifier is to be changed whenever a new release of the reading program is required to read the file.

Items 2, 3, 4 and 5 are all times to the nearest second recorded using the TIMED binary format. The first four bytes of each time value are the seconds since the TIMED epoch. The remaining two bytes contain the fractional second in milliseconds and are set to zero in this application. The time that the file was created is recorded in item 2. The time at which any data record is added or deleted is recorded in item 3. The span of data record times are recorded in items 4 and 5. Item 4 is the time of the earliest data item in the file, specified when the file is created. Item 5 is the largest time value contained in the file. This item is updated whenever a new record is placed in the file with a more recent time. Item 6, granularity, is the spacing between data points in time. The time duration over which the data item is to be averaged is stored as item 7 in seconds. Item 8 is the position of the earliest record in the file, in bytes. Item 9 is the fixed length of the records stored in the file.

Items 10, 11, 12, and 13are strings. Items 10 and 11 describe the variable stored in the file and its units. The creator program item contains the complete path name of the program that created the file. The last item contains the name of the processor on which the program ran.

Item 14 is an integer containing the ID number of the packet containing the variable being trended.

The position of any record in the file is obtained from the time of the data and items 4, 6 and 7 of the header as follows:

$$P = \frac{(T_r - T_0)}{T_g} L_r + P_0$$

where P is the starting offset of a data record in bytes, T_r is the time of the data record to be located and the remaining symbols are defined in Table 1.

3.3. Data Record

Each data record is a fixed length structure containing 6 fields, as shown in Table 2, below.

Table 2, Data Record Format

Item	Description	type	Offset bytes	Length bytes
1	Time (seconds since epoch)	integer	0	4
2	Actual sample period (seconds)	integer	4	4
3	Average Data Value	float	8	4
4	Variance	float	12	4
5	Minimum Value	float	16	4
6	Maximum Value	float	20	4

The first item is the time in seconds since the TIDI epoch. This is a simplification of the TIMED binary time format, in that the fractional seconds portion of the time is omitted. Item 2 is the duration over which the telemetry was averaged to obtain the data value and its variance. Items 3 and 4 are floating point numbers containing the value of the data item at the time and the variance of the data item. Data items in this file are represented in engineering units. The minimum and maximum values recorded in items 4 and 5

4.   File Naming Convention

Each trend file will be named to indicate the variable, starting time, and granularity of the data it contains. The naming convention is shown in Table 3

Table 3, Trend File Naming Convention

vname_start_gran.TND	
field	description
vname	The name of the data item trend stored in the file.
start	The time of the first data item stored in the file
gran	The time between adjacent data records in seconds.
TND	The literal TND indicating that this is a trend file

The field "vname" contains the name of the data item contained in the file as documented in Reference 1. The next field "start", contains the date of the earliest record contained in the file in the TIMED standard ASCII format, with the time omitted, as shown below:

yyyydoy

where "yyyy" is the year and "doy" is the day of the year. As an example, the file containing the trend of the main current, beginning on 15 January 1999, with a time resolution of 45 minutes is named:

MAINCURR_1999015_2700.TND