

Product Requirement Specification

MBScope, Trending Snapshot Data (TSD) File Format V4.2

994-0118-001
Rev E

| | | Date MMMM DD,YYYY |
|-------------|---|----------------------|
| Created By | Stephen Pickett Electrical Engineer | September 23, 2011 |
| Created By | Mauricio Munoz Electrical Engineer | September 23, 2011 |
| Approved By | Tim A Harris Electrical Engineering Manager | September 23, 2011 |

REVISION HISTORY

| <u>Rev</u> | <u>ECO</u> | <u>Description</u> | <u>Date</u> MM/DD/YYYY | <u>Edited By</u> | <u>Checked By</u> |
|------------|------------|--|---------------------------|------------------|-------------------|
| A | n/a | Release to baseline (V3 format) | 09/23/2012 | SPT | MMZ |
| B | E12-0033 | - Updated individual channel values for ERSP300 - Updated disk space requirements Changes are highlighted in blue. -V4.1 format | 01/19/2012 | MMZ | SPT |
| C | E12-0167 | - Updated individual channel values for ERSP300 - Updated scope on Changes are highlighted in blue. -V4.2 format | 05/10/2012 | MMZ | SPT |
| D | E12-0393 | Changes are highlighted in blue. - Updated available options for version header section - Type of sampling frequency Int | 08/20/1012 | MMZ | SPT |
| E | E14-0018 | Changes are highlighted in blue. - Updated available options in header section - Updated .tsd example | 01/24/1014 | MMZ | SPT |

1 TABLE OF CONTENTS

| | | |
|-------|--|---|
| 1 | Table of Contents..... | 2 |
| 2 | Trending Snapshot Data File Format | 3 |
| 2.1 | TSD file..... | 3 |
| 2.1.1 | Header Section..... | 3 |
| 2.1.2 | Data Section | 4 |
| 2.1.3 | Events (EA300 and ERSP300 Only) | 4 |
| 2.1.4 | Example | 5 |
| 2.1.5 | Disk Space Requirements (ERSP300 Controller) | 6 |
| 2.2 | DAT File | 7 |
| 2.2.1 | Example | 7 |

2 TRENDING SNAPSHOT DATA FILE FORMAT

2.1 TSD file

The trending data shall be stored to a text file with a TSD extension. This file is divided into header and data sections.

2.1.1 Header Section

The header section is in the form of an INI file (see SKF document 994-0118-003) with the following sections, parameters and values. The data interpretation format and an example of a typical value, is also provided for each parameter.

| Section | Parameter | Description | Format | Valid Options | Example | Controller Types |
|--------------|------------------------------|--|-----------------|--|-------------------------|------------------|
| [File Info] | Version | Trending file version | float | 2.0, 3.0, 3.1, 4.2 | 4.2 | All |
| | Type | Always set to "Trending" | string | Trending | Trending | All |
| | Creation Date (PC) | File creation date (local system time) | time | | 2008/10/15 17:15:35.001 | All |
| | Creation Date (PC-UTC) | File creation date (UTC time) | time | | 2008/10/15 21:15:35.001 | All |
| [Trend Info] | Architecture | A string describing the type of architecture from which the trend file was generated | string | <linked to an MBScope enumerated type> | EA300 | All |
| | Controller Type | A string describing the type of controller from which the trend file was generated | string | <linked to an MBScope enumerated type> | EA300 | All |
| | Sample Frequency (Low Speed) | Trending sample frequency in Hz for Low Speed Trending Selection | float OR string | 5, 1, 0.2, 0.1, N/A | 5 | All |
| | Window Size ⁽¹⁾ | Sample window size in ms. Window size is automatically selected for high speed trending | uint | | 200 | All |
| | Statistic ⁽¹⁾ | Statistic applied to the windowed samples | string | "Mean", "StdDev", "Peak" | Mean | All |
| | Number of Channels | Number of channels sampled [n] | uint | | 16 | All |
| | Start Time (DSP) | Sampling start time in DSP ticks | long | | 14405063598633 | G3/G4 Only |
| | Trigger Condition | Condition on which sampling was triggered | string | "None", "MaxMin", "Alarm" | Alarm Trigger | All |
| | Trigger Channel | MBScope enumerated channel type on which sampling was triggered. | int | <linked to an MBScope enumerated channel>, -1 (if none selected) | 0 | All |
| | Trigger Time (RT) | Time that the trigger event occurred. (Indicates the time of the first sample if no trigger condition was specified.) | time | | 2008/10/15 17:16:35.001 | All |
| | Trigger Time (RT-UTC) | Time that the trigger event occurred. (Indicates the time of the first sample if no trigger condition was specified.) | time | | 2008/10/15 21:16:35.001 | All |
| | Trigger Time | Time of trigger event in ticks. (Indicates the time of the first sample if no trigger condition was specified.) | long | | 785971140000 | All |
| | Trigger Mode | Defines the temporal position of the trigger event with respect to the rest of the sampled data. | string | "None", "Pre", "Post" | None | All |
| | Trigger Min | Lower trigger threshold | float | | -20 | All |
| | Trigger Max | Upper trigger threshold | float | | 20 | All |
| | Number of Frames | Number of frames sampled [K] | uint | | 1000 | All |
| | FSV Scope Channels On | Flag indicating if only scope channels are displayed in FSV units. Default configuration of scope channels is not changed. | int | 0 (no), 1 (yes) | 1 | All |

| | | | | | | |
|---|---------|---|-------------------------|---|--|-------------|
| [Channels] – MBG3, 4 and EA300 controllers | Ch0 | Associates each channel in the data section with an MBScope enumerated channel type | Int | <linked to an MBScope enumerated channel> , | 0, 5, ... 23 | G3/G4/EA300 |
| | Ch1 | | | | | |
| | ... | | | | | |
| | Ch[n-1] | | | | | |
| [Channels] – ERSP300 controller | Ch0 | Associates each channel in the data section with an MBScope enumerated channel type – For ERSP300 controllers additional information is included: original sample frequency, down sampling factor, and down sampled frequency | Int, Int, Int, Float | <linked to an MBScope enumerated channel> , <14000, 2000, 1000> , <2, 4, 5, 6, 8, 9, 10> , <XXXX or XXXXX.XX> | 0, 14000, 1, 14000 5, 14000, 2, 7000 ... 23, 1000, 1, 3333.33 | ERSP300 |
| | Ch1 | | | | | |
| | ... | | | | | |
| | Ch[n-1] | | | | | |

⁽¹⁾This parameter is only used when the “Sample Frequency” is not defined as “Max”. To be ignored otherwise.

2.1.2 Data Section

The data section shall be in the form of a tab-delimited table. The start of the data section is denoted by the section tag [data] and is followed on the next line by the column headers. Each proceeding line contains data related to the column headers defined in the table below. **If there is no data for a particular channel in a given frame, the cell will be left empty.**

| Column Header | Description | Data Format |
|-----------------|---|-------------|
| Time | Frame time in ticks (real-time) | long |
| Scope | Reserved for G3/G4 and EA300 controllers and Flag indicating if default configuration of scope channels has changed for ERSP300 controllers | int |
| {NameOfCh0} | Channel 1 data in engineering units (2 decimal digits of precision) | float |
| {NameOfCh1} | Channel 2 data in engineering units (2 decimal digits of precision) | float |
| {NameOfCh2} | Channel 3 data in engineering units (2 decimal digits of precision) | float |
| ... | ... | ... |
| {NameOfCh[n-1]} | Channel [n-1] data in engineering units (2 decimal digits of precision) | float |

2.1.3 Events (EA300 and ERSP300 Only)

Events are stored in a separate TXT file that is stored with the same file prefix as the TSD file. The Event Log format is the same as described in SKF document 994-0118-002 (MBScope Specification, Alarm Snapshot Data (ASD) File Format).

2.1.4 Example

The following is an example of a TSD file, captured from an EA300 controller at maximum sample frequency, no triggering.

```
[File Info]
Version=4.2
Type=Trending
Creation Date (PC)=2013/12/03 16:56:46.908
Creation Date (PC-UTC)=2013/12/03 15:56:46.908
[Trend Info]
Architecture=ERSP300
Controller Type=ERSP300
Sample Frequency (Low Speed)=N/A
Window Size=200
Statistic=Mean
Number of Channels=16
Start Time (DSP)=0
Trigger Condition=None
Trigger Channel=-1
Trigger Time (RT)=2008/01/01 08:37:44.212
Trigger Time (RT-UTC)=2008/01/01 07:37:44.212
Trigger Time=2208658642120000
Trigger Mode=None
Trigger Min=0
Trigger Max=0
Number of Frames=75600
FSV Scope Channels On=0
[Channels]
CH0=0, 14000, 1, 14000
CH1=1, 14000, 1, 14000
CH2=2, 14000, 1, 14000
CH3=3, 14000, 1, 14000
CH4=71, 14000, 1, 14000
CH5=72, 14000, 1, 14000
CH6=201, 14000, 1, 14000
CH7=4, 14000, 1, 14000
CH8=5, 2000, 1, 2000
CH9=6, 2000, 1, 2000
CH10=7, 2000, 1, 2000
CH11=8, 2000, 1, 2000

[data]
Time Scope Position_V13 Position_W13 Position_V24 Position_W24 Position_V57 Position_W57 Position_Z1 Position_Z2 Current_V1 Current_W1 Current_V2 Current_W2
2208658642120000 0 -42.06 -31.18 -14.86 10.68 6.28 -22.81 -75.18 -507.47 0 0 0 0
2208658642120714 0 -42.06 -30.96 -15.28 10.88 6.28 -22.6 -76.07 -520.44 0 0 0 0
2208658642121428 0 -42.68 -31.6 -15.69 10.47 6.07 -23.43 -78.23 -529.34 0 0 0 0
2208658642122142 0 -42.68 -32.22 -15.07 10.04 6.28 -23.65 -75.64 -529.34 0 0 0 0
2208658642122857 0 -42.27 -31.81 -15.69 11.93 6.07 -23.02 -74.75 -520.44 0 0 0 0
2208658642123571 0 -42.68 -32.65 -14.86 9.42 6.49 -23.22 -75.18 -503.15 0 0 0 0
2208658642124285 0 -42.27 -31.81 -15.07 10.68 6.49 -23.02 -76.07 -520.44 0 0 0 0
2208658642125000 0 -42.68 -31.6 -15.9 9.83 5.44 -23.86 -76.07 -529.34 0 0 0 0
...
```

2.1.5 Disk Space Requirements (ERSP300 Controller)

The disk space required for trending all sampled data channels can be calculated as shown below. Each data sample is stored to disk as approximately a 12 character long string (i.e. 0.2861328125) when storing in text format or a float precision number (4 bytes) when storing in binary format. The example below shows the file size calculation based on full high speed trending of all channels. (Note, the calculation doesn't include the TSD header, or event logs that will be generated. However, this will be only a small part of the file space).

ERSP300 Full Speed Sampling:

DSP Data (high speed channels): $f_{DSP} = 14000, n_{DSP} = 23, s_{DSP} = 4$

SPV Data (low speed channels): $f_{SPV} = 2000, n_{SPV} = 14, s_{SPV} = 4$

$f_{SPV} = 1000, n_{SPV} = 79, s_{SPV} = 4$

$size = f_{DSP} \cdot n_{DSP} \cdot s_{DSP} + f_{SPV} \cdot n_{SPV} \cdot s_{SPV}$

Estimated data size: $size = 14000[Hz] \cdot 23 \cdot 4[B] + 2000[Hz] \cdot 14 \cdot 4[B] + 1000[Hz] \cdot 79 \cdot 4[B]$

$size = 1,716,000B / s$

| Time Span | Data Size (Text Mode) | Data Size (Binary Mode) |
|-----------|-----------------------|-------------------------|
| 1 second | 4.77 MB | 1.59 MB |
| 1 minute | 294.57 MB | 98.19 MB |
| 1 hour | 17.25 GB | 5.75 GB |
| 1 day | 414.24 GB | 138.08 GB |
| 1 week | 2.83 TB | 966.56 GB |
| 1 month | 12.12 TB | 4.04 TB |
| 1 year | 147.63 TB | 49.21 TB |

Given a 10 TB hard drive, data files should be transferred out of the drive at least once per week when saving in text mode or once per month when saving in binary mode to avoid data loss.

2.2 DAT File

As MBScope collects the data from the controller it will save it to the hard drive with a DAT extension. The format of this DAT file is the same as the TSD data section (i.e., a TSD file without the header – see Section 2.1.2 for more details). When the file size reaches the file size split limit specified by the user before the trend starts, MBScope will append the header section (as well as the [data]) and begin a new DAT file.

2.2.1 Example

The following is an example of a DAT file, before MBScope has appended the header to create a proper TSD file.

| | | | | | | | | |
|--------------------|---|------|-------|-------|------|------|-------|------|
| 634496306524931202 | 0 | 0.59 | -0.2 | -0.58 | 0.21 | 0.3 | -0.4 | 0.02 |
| 634496306524934101 | 0 | 0.61 | -0.22 | -0.6 | 0.23 | 0.31 | -0.44 | 0.02 |
| 634496306524937000 | 0 | 0.59 | -0.22 | -0.58 | 0.23 | 0.3 | -0.44 | 0.02 |
| 634496306524939899 | 0 | 0.57 | -0.22 | -0.56 | 0.23 | 0.29 | -0.44 | 0.02 |
| 634496306524942798 | 0 | 0.56 | -0.23 | -0.55 | 0.24 | 0.28 | -0.47 | 0.02 |
| 634496306524945697 | 0 | 0.56 | -0.25 | -0.55 | 0.26 | 0.28 | -0.51 | 0.02 |
| 634496306524948596 | 0 | 0.56 | -0.25 | -0.55 | 0.26 | 0.28 | -0.51 | 0.02 |
| 634496306524951495 | 0 | 0.54 | -0.31 | -0.53 | 0.32 | 0.27 | -0.62 | 0.02 |
| ... | | | | | | | | |