VEET 2.1 Log Interpretation Guide

Introduction

This guide provides keys and examples that help researchers understand the log file of the Visual Environment Evaluation Tool (VEET). With the log file, you can identify when the device changes states—when the VEET was charged, when it ran out of power, whether it was connected to a computer, etc.

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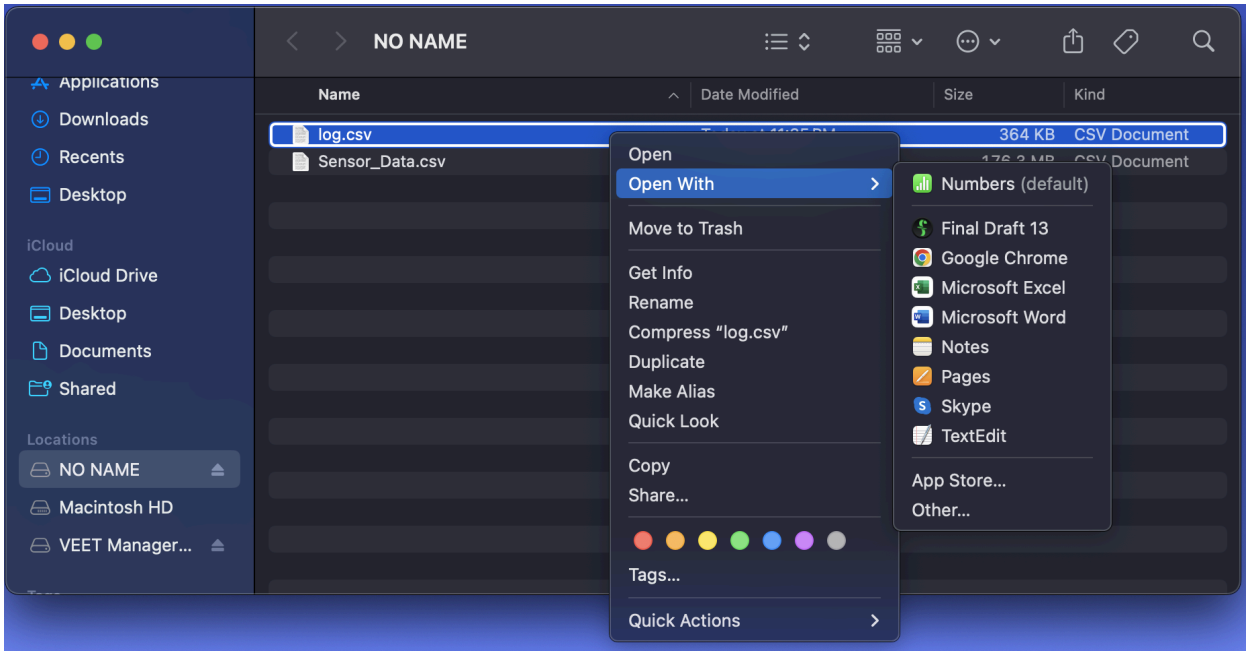
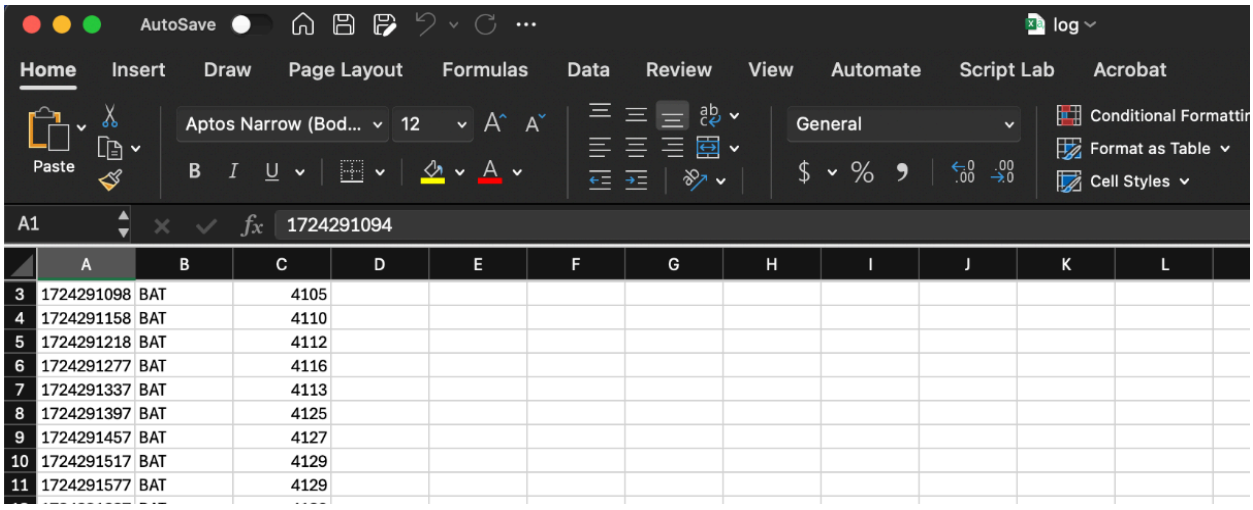
Accessing the Log File

Follow these steps to access your VEET's log file:

1. Connect one VEET temple arm to your computer (make sure your VEET is sufficiently charged).
2. Select the external hard drive (usually titled "NO NAME").
3. As a best practice, copy and paste both the log and sensor data files to your computer.
4. Use your tool of choice to open the log file.



Selecting the VEET's log file



	A	B	C
3	1724291098	BAT	4105
4	1724291158	BAT	4110
5	1724291218	BAT	4112
6	1724291277	BAT	4116
7	1724291337	BAT	4113
8	1724291397	BAT	4125
9	1724291457	BAT	4127
10	1724291517	BAT	4129
11	1724291577	BAT	4129

Sample VEET log file opened with Excel

Interpretation of Data in the Log File

While the VEET is actively logging data, the log line reports the device's charge level and its basic system state every 60 seconds—except for when the VEET is connected to a PC and, hence, not logging data. The log line records a reboot every time the system restarts. Knowing how to read and interpret a reboot line, helps you identify when the device is in the following states:

- Connected to wall power or a computer
- Disconnected and operating on battery power
- Entering Deep Sleep
- Manually restarted, such as for a configuration update
- Undergoing a firmware update

Below, you'll find a table that helps you quickly identify different VEET states, followed by more detailed explanations of what the different values mean.

VEET States Based on Log Values

VEET State	Example Log Line (with telltale values in **blue**)
Connected to Wall Power	1755044144,REBOOT,SOFTWARE 1755044144,STATE,CPUSpeed_12MHz_ExternPower,Fast Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
Disconnected from Wall Power or PC	1755099623,REBOOT,SOFTWARE 1755099623,STATE,CPUSpeed_12MHz,Fast Charge,VBUS=0,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
Connected to PC	1755197415,REBOOT,SOFTWARE 1755197415,STATE,CPUSpeed_300MHz,Slow Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
Deep Sleep	1755205362,BAT,Deep Sleep
Manual Reboot	1755032147,REBOOT,USER
Transport Mode	1755027929,calib.json,calib_timestamp,2025-03-13T17:34:57Z 1755032147,REBOOT,USER 1755032147,STATE,CPUSpeed_300MHz,Slow Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1

Connected to Wall Power

When connected to wall power, the VEET indicates the following:

- REBOOT: device initiates a reboot.
- 12MHZ: device enters low speed mode to log data while charging from wall power.
- ExternPower: device is charging from external power.
- Fast Charge: device is charging at a normal rate.
- VBUS 1: USB voltage is present.

Note that the VEET continues to log data while connected to wall power.

Disconnected from Wall Power or from PC

When disconnected from wall power, the VEET indicates the following:

- REBOOT: device initiates a reboot.
- 12MHZ: device maintains low speed mode to log data while running on battery power.
- Fast Charge: device is operating in default mode—the VEET only switches from Fast to Slow Charge if it's connected to a computer or if it's over operating temperature (45°C).
- VBUS 0: USB voltage is not present.

The VEET continues to log data while disconnected and running on battery power.

Connected to PC

When connected to a computer, the VEET indicates the following:

- REBOOT: device initiates a reboot.
- 300MHZ: device enters high speed mode to enable data transfer.
- Slow Charge: device has limited charging speed because it's connected to a computer.
- VBUS 1: USB voltage is present.

The VEET does not log data while connected to a computer.

Deep Sleep

If the VEET’s battery drops below 3500mV, the device switches to “Deep Sleep” to preserve the system clock. While in Deep Sleep, the VEET sensors are inactive and the device doesn’t log data.

The VEET transitions from this state when connected to a computer or wall power. If the VEET is not sufficiently charged when disconnected from power, it may reenter Deep Sleep within 1 minute.

Rebooting while Connected into PC

Since the VEET does not log data while connected to a computer, reboot events are not recorded if they occur during this time.

Manual Reboot

The VEET system includes ‘USER’ in the reboot line when it has been rebooted manually.
A user can initiate a reboot by doing the following:

- By selecting Reboot Device from the VEETManager drop-down menu, in which case the reboot is not logged, since the device is connected to a PC
- ExitingTransport Mode (see below)

Transport Mode (TM)

In Transport Mode, the VEET stops logging data to preserve battery power. This setting is designed so a researcher can charge the VEET, set the device in Transport Mode, and send the device to a user while the device maintains enough battery power to begin logging upon arrival.

To use Transport Mode, connect the VEET to a PC, open the VEETManager, and select **File**, **Transport Mode**. To exit Transport mode, the user simply connects the VEET to any USB (either to wall power or PC).

Since Transport Mode is a manual reboot initiated through a computer, it’s not captured in the Log file but instead appears as a time gap after a PC connection.

When transitioning from Transport Mode, the VEET indicates the following:

- TIME GAP: there’s a gap between the time the device was set to Transport Mode (logged as a connection to a PC) and the time it was connected to USB.
- REBOOT, USER: device initiates a reboot (after said time gap) and indicates the reboot was initiated by the user.
- 12MHZ / 300MHZ: device maintains low speed mode if connected to wall power or switches to high speed mode if connected to a computer to enable data transfer.
- Fast Charge / Slow Charge: device is operating in default mode if connected to wall power or switches to slow charge if connected to a computer.
- VBUS 1: USB voltage is present.

VEET Battery Voltage

VEET State	Battery Behavior	Notes

Connected to Wall Power	Battery voltage increases to 4200 mV (full charge) and then ranges between 4080-4200 mV until the VEET is disconnected. Full Charge typically takes 2 hrs.	In adverse conditions (when very hot), it may take the device up to 3 hours to fully charge.
Running on Battery	Battery voltage decreases 20-26 mV/h when logging at two-second intervals. When the battery falls below 3500mV, it goes into Deep Sleep.	As batteries age, drain can increase to 34 mV/h. Since battery discharge is non-linear, normal voltage discharge rates may drop up as much as 45 mV/h for a given time period.
Connected to PC	Battery voltage may initially decrease (if device is connected to an unpowered USB port) or very slowly increase until fully charged (4200 mV); then, battery voltage ranges between 4080mV-4200mV until disconnected.	The VEET does not log battery information while connected to a PC, so there is a gap in voltage records in the log file. Device temperature may rise more than 20°C when connected to a PC.

Example log line when VEET is connected to wall power:

```
1755044144,REBOOT,SOFTWARE
1755044144,STATE,CPUSpeed_12MHz_ExternPower,Fast
Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
1755044144,Firmware_Version, FW2.2.4
1755044144,config.json,imuInterval,2000
1755044144,config.json,phoInterval,2000
1755044144,config.json,tofInterval,2000
1755044144,config.json,alsInterval,2000
1755044144,calib.json,deviceID,25020452
1755044144,calib.json,calib_fw_version,2.1.3
1755044144,calib.json,calib_version,4.0
1755044144,calib.json,calib_timestamp,2025-03-13T17:34:57Z
1755044148,ALS sensor initialized: (0) TSL2585_SUCCESS
1755044150,Sensor Power Cycle Duration = 400ms
1755044152,BAT,4161,IMU_TEMP,0.000000,CPU_TEMP,32,VDD_REF,3.300000
1755044212,BAT,4162,IMU_TEMP,0.000000,CPU_TEMP,32,VDD_REF,3.300000
1755044272,BAT,4164,IMU_TEMP,0.000000,CPU_TEMP,32,VDD_REF,3.300000
```

Example VEET log values before and after device was connected to a PC:

1755197404,BAT,3533,IMU_TEMP,27.000000,CPU_TEMP,28,VDD_REF,3.300000

.
.
.

1755197816,BAT,3544,IMU_TEMP,0.000000,CPU_TEMP,46,VDD_REF,3.300000

Common VEET Recording Errors

Ambient Light Sensor Saturations and Infrared Cross-Talk

If a VEET sensor fails to read and record a value, the “ERROR” is recorded in the Log file rather than in the Sensor file.

Much like our eyes, the Ambient Light Sensor (ALS) is saturated and takes a moment to readjust when hit by very bright light, or when the surrounding light conditions change within milliseconds. Examples include the following:

- Infrared (IR) bursts for smartphone face ID, especially in low light
- IR bursts emitted by the Time of Flight Sensor from other VEETs, especially within 50mm or in low light conditions

ALS saturations are recorded as errors.

Example Log line with error in blue:

1755023214,ERR,ALS_Saturation,1755023214,ALS,100,4096,256,1024,11612,16470191,523170,NAN,5242

Normal Data Gap / Recording Errors

Data gaps or recording errors in the Log and Sensor Data files are normal in the following cases:

Log File

- Time gap while VEET was connected and disconnected from a computer.
- Time gap while VEET was in Deep Sleep or Transport Mode.

Sensor Data File

- There are missing intervals in the ALS sensor line when the sensor was saturated (such as during IR bursts).

Abnormal Data Gaps / Recording Errors

The following cases could indicate a device error:

- The Log file is logging but the Sensor Data file is not logging during the same time period.
- Either Log or Sensor Data files are not logging after the last STATE reported was 12MHZ and no Deep Sleep followed.
- The Log file is missing after the VEET was disconnected from a computer and more than one minute has passed.

Clock Reset

The VEET's system clock resets to 1325376000 (Jan 1, 2012 00:00:00) if the system power is lost, which can occur in the following cases:

- Battery is physically disconnected
- Battery is depleted below its ability to maintain voltage in Deep Sleep (<3200mV).
- System Processor error

If system power is lost and the system clock resets to 1325376000 (or just above this number), the VEET continues logging data with the reset time; however, the timestamps of this newly recorded data have to be manually realigned with the local time for that testing period. If the reset occurred during a known time, the timestamps can be easily realigned. If the reset occurred due to a depleted or disconnected battery, the reset time is typically unknown and timestamps are difficult to realign.

Example Log line with clock reset in blue:

1755197404,BAT,3503,IMU_TEMP,27.000000,CPU_TEMP,28,VDD_REF,3.300000
1325376002,REBOOT,SOFTWARE

If the VEET's system clock is changed intentionally through the VEETManager, the subsequent log lines reflect the time change while the prior, existing log lines retain their prior timestamps.

Organization of Data in the Log File

Note on Data Firmware Versions

The format of the VEET Log file (log.csv) was updated with Firmware version 2.2.4 or above. You can find your log's Firmware version in the Firmware_Version in the Log file, as shown in **bold** below:

```
1753464359,Firmware_Version,FW2.2.4
```

If there is an already existing Log file on the VEET when you update to FW2.2.4 or later, the existing Log file won't be updated or deleted; however, all new log entries are logged in the updated log format. To avoid logging mixed-format data, delete the log.csv file from the device after the update.

File example: log.csv

When you view your VEET's Log file it looks like this following example (red dots added to show time was skipped / omitted):

```
1755044142,REBOOT,SOFTWARE
1755044142,STATE,CPUSpeed_300MHz,Slow
Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
1755044142,Firmware_Version, FW2.2.4
1755044142,config.json,imuInterval,2000
1755044142,config.json,phoInterval,2000
1755044142,config.json,tofInterval,2000
1755044142,config.json,alsInterval,2000
1755044142,calib.json,deviceID,25020452
1755044142,calib.json,calib_fw_version,2.1.3
1755044142,calib.json,calib_version,4.0
1755044142,calib.json,calib_timestamp,2025-03-13T17:34:57Z
1755044144,REBOOT,SOFTWARE
1755044144,STATE,CPUSpeed_12MHz_ExternPower,Fast
Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
1755044144,Firmware_Version, FW2.2.4
1755044144,config.json,imuInterval,2000
1755044144,config.json,phoInterval,2000
1755044144,config.json,tofInterval,2000
1755044144,config.json,alsInterval,2000
1755044144,calib.json,deviceID,25020452
1755044144,calib.json,calib_fw_version,2.1.3
1755044144,calib.json,calib_version,4.0
1755044144,calib.json,calib_timestamp,2025-03-13T17:34:57Z
1755044148,ALS sensor initialized: (0) TSL2585_SUCCESS
1755044150,Sensor Power Cycle Duration = 400ms
1755044152,BAT,4161,IMU_TEMP,0.000000,CPU_TEMP,32,VDD_REF,3.300000
1755044152,BAT,4162,IMU_TEMP,0.000000,CPU_TEMP,32,VDD_REF,3.300000
1755197409,BAT,4162,IMU_TEMP,0.000000,CPU_TEMP,28,VDD_REF,3.300000
1755032157,BAT,4195,IMU_TEMP,0.000000,CPU_TEMP,38,VDD_REF,3.300000
1755032217,BAT,4195,IMU_TEMP,0.000000,CPU_TEMP,37,VDD_REF,3.300000
1755032277,BAT,4197,IMU_TEMP,34.000000,CPU_TEMP,36,VDD_REF,3.300000
1755032337,BAT,4198,IMU_TEMP,33.000000,CPU_TEMP,34,VDD_REF,3.300000
```

```
1755023214,ERR,ALS_Saturation,1755023214,ALS,100,4096,256,1024,11612,
16470191,523170,NAN,5242
1755032157,BAT,4195,IMU_TEMP,0.000000,CPU_TEMP,38,VDD_REF,3.300000
1755099615,BAT,4196,IMU_TEMP,0.000000,CPU_TEMP,38,VDD_REF,3.300000
1755099623,REBOOT,SOFTWARE
1755099623,STATE,CPUSpeed_12MHz,Fast
Charge,VBUS=0,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
1755099623,Firmware_Version, FW2.2.4
1755099623,config.json,imuInterval,2000
1755099623,config.json,phoInterval,2000
1755099623,config.json,tofInterval,2000
1755099623,config.json,alsInterval,2000
1755099623,calib.json,deviceID,25020452
1755099623,calib.json,calib_fw_version,2.1.3
1755099623,calib.json,calib_version,4.0
1755099623,calib.json,calib_timestamp,2025-03-13T17:34:57Z
1755099628,Sensor Power Cycle Duration = 400ms
1755099628,ALS sensor initialized: (0) TSL2585_SUCCESS
1755099629,BAT,4169,IMU_TEMP,0.000000,CPU_TEMP,28,VDD_REF,3.300000
1755099629,BAT,4162,IMU_TEMP,0.000000,CPU_TEMP,28,VDD_REF,3.300000
.
.
.
1755205302,BAT,3502,IMU_TEMP,26.000000,CPU_TEMP,26,VDD_REF,3.300000
1755205362,BAT,3499,IMU_TEMP,26.000000,CPU_TEMP,26,VDD_REF,3.300000
1755205362,BAT,Deep Sleep
1755206149,REBOOT,USER
1755206149,STATE,CPUSpeed_300MHz,Slow
Charge,VBUS=1,isDiskMounted=0,USBIsConnected=0,APP_DISK_Ready=1
1755206149,Firmware_Version, FW2.2.4
1755206149,config.json,imuInterval,2000
1755206149,config.json,phoInterval,2000
1755206149,config.json,tofInterval,2000
1755206149,config.json,alsInterval,2000
1755206149,calib.json,deviceID,25020452
1755206149,calib.json,calib_fw_version,2.1.3
1755206149,calib.json,calib_version,4.0
1755206149,calib.json,calib_timestamp,2025-03-13T17:34:57Z
```

Observations on the structure of the log.csv file:

- Time sequences recorded on the Log file may not be perfectly linear: the device processor records events in system time, which may be different from local time or may have shifted if the device time was adjusted.

- Time in the VEET is recorded in Epoch time and, hence, not affected by changing time zones in the device configuration.
- Time in the Log file timestamps is recorded in whole seconds only, while the VEET's internal clock time is kept in milliseconds. As a result, Log sequences may report drift by up to a second if the internal clock rolls over the next second before writing to the disk.
- Depending on the events recorded, the size and number of lines of the Log file can vary significantly. This behavior is normal.

Reboot Line

The VEET generates a reboot line every time the system restarts, such as when the device is connected or disconnected from wall power or a computer, waking from Deep Sleep, manually restarted or undergoing a firmware update.

The reboot line reports the following sequence of information:

- Reboot event
- System State
- Configuration Information
- Calibration Information
- Ambient Light Sensor (ALS) State (after state change reboot)
- Sensor Reboot Timelength (after state change reboot)

Organization of Data in a REBOOT Line

```
[time_stamp],REBOOT,[initiator]
```

Key for REBOOT Line

Item	Detail
`time_stamp`	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: `1325376002` to `1893484800+` Data type: `uint32`
`REBOOT`	The current line marks a Reboot event. Only value: `REBOOT`
`initiator`	The source of the Reboot event. Possible values: `SOFTWARE, USER`

System State (STATE)

A System State (STATE) line reports key system conditions at the time of logging.

Organization of Data in STATE Line

```
[time_stamp],STATE,[Processor_Mode],[Charge_Rate],[USB_Power],[Internal_Drive],
[USB_Comm],[Application_Write]
```

Key for STATE Line

Item	Detail
time_stamp	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: 1325376002 to 1893484800+ Data type: uint32
STATE	The current line marks a STATE report. Only value: STATE
Processor_Mode	The selected CPU operation mode. Possible values: CPUSpeed_300MHz: High Speed Mode to enable data transfer CPUSpeed_12MHz: Low Speed Mode to log data while running on battery CPUSpeed_12MHz ExternPower: Low Speed Mode to log while charging
Charge_Rate	The charge rate selected. Possible values: Fast Charge: normal charging and operating mode Slow Charge: limited charge to maintain power level, typically while plugged into PC or the device is over 45˚C
USB_Power	The detection of voltage over USB connection. Possible values: VBUS=1, VBUS=0
Internal_Drive	The presence of the device drive.. Possible values: isDiskMounted=1: Internal drive is available to log internally isDiskMounted=0: Internal drive is unavailable to log internally *Note: After a reboot, the timing is such that the drive is not yet mounted and, hence, this line reports "0"; however, the disk mounts within 10 seconds after a reboot.*
USB_Comm	The status of USB communication to PC. Possible values: USBIsConnected=1,USBIsConnected=0
Application_Write	The readiness of device writing to internal drive. Possible values: APP_DISK_Ready=1, APP_DISK_Ready=0

Configuration Information (config.json)

Organization of Data in config.json Line

```
[time_stamp],config.json,[config_entry],[interval]
```

Key for config.json Line

Item	Detail
time_stamp	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: 1325376002 to 1893484800+ Data type: uint32
config.json	The current line marks a config.json report. Only value: config.json
config_entry	The specific config entry reported. Possible values: imuInterval,phoInterval,tofInterval, alsInterval
interval	The time between sensor reads in milliseconds.

Calibration Information (calib.json)

Organization of Data in calib.json Line

```
[time_stamp],calib.json,[calib_entry],[value]
```

Key for calib.json Line

Item	Detail
time_stamp	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: 1325376002 to 1893484800+ Data type: uint32
calib.json	The current line marks a calib.json report. Only value: calib.json
calib_entry	The specific calib entry reported. Possible values: deviceID,calib_fw_version,calib_version,calib_timestamp
value	The value of the specific entry.

Ambient Light Sensor State (ALS sensor initialized)

Organization of Data in 'ALS sensor initialized' Line

```
[time_stamp],ALS sensor initialized,[status]
```

Key for 'ALS sensor initialized' Line

Item	Detail
time_stamp	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: 1325376002 to 1893484800+ Data type: uint32
ALS sensor initialized:	The current line marks the ALS state report. Only value: 'ALS sensor initialized:'
status	The ALS readiness. Possible values: "TSL2585_SUCCESS", "TSL2585_CLI_FAILURE", "TSL2585_I2C_INIT_ERROR", "TSL2585_DEVICE_INIT_FAILURE", "TSL2585_DEVICE_VALIDATE_ERROR", "TSL2585_DEVICE_NULL_PTR", "TSL2585_DEVICE_OUT_OF_BOUNDS", "TSL2585_DEVICE_FIFO_NOT_EMPTY", "TSL2585_INVALID_CALIBRATION_DATA", "TSL2585_COMPRESS_DECODE_FAILURE", "TSL2585_FFT_FAILURE", "TSL2585_UNKNOWN_ERROR"

ALS Sensor Reboot Timelength (Sensor Power Cycle Duration)

Organization of Data in 'ALS sensor initialized' Line

`[time_stamp],Sensor Power Cycle Duration =,[timelength]`

Key for ‘ALS sensor initialized’ Line

Item	Detail
`time_stamp`	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: `1325376002` to `1893484800+` Data type: `uint32`
`Sensor Power Cycle Duration =`	The current line marks the Sensor Power Cycle timelength report. Only value: ‘`ALS sensor initialized:`’
`timelength`	The time for sensor power cycling in milliseconds

Battery and Operation State (BAT)

A Battery and Operation State (BAT) line reports key system running conditions at the time of logging. Rather than being reported only during device state change events, the battery and operation state line is logged every minute while the device is recording to disk. If the device enters Deep Sleep to preserve battery, the event is logged through this line as well.

Organization of Data in BAT Line

`[time_stamp],BAT,[bat_voltage],IMU_TEMP,[IMU_Temp],CPU_TEMP,[CPU_Temp],VDD_REF,[VDD_REF]`

Key for BAT Line

Item	Detail
`time_stamp`	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: `1325376002` to `1893484800+` Data type: `uint32`
`BAT`	The current line marks a Battery & Operation State report. Only value: `BAT`
`bat_voltage`	The measured voltage of the battery, as measured by the system in millivolts. If the system enters deep sleep - such as below operating threshold - will report “Deep Sleep” and end line.
`IMU_TEMP`	The temperature reported by the mainboard IMU sensor in degrees C
`CPU_TEMP`	The temperature reported by the mainboard CPU in degrees C
`VDD_REF`	The measured system voltage, as measured in millivolts

Error Event (ERR)

If a VEET sensor fails to read and record a value, the error is recorded in the Log file rather than in the Sensor file. Currently, the device captures ALS saturation events.

Organization of Data in STATE Line

`[time_stamp],ERR,[error_condition],[error_data]`

Key for STATE Line

Item	Detail
`time_stamp`	The Unix time since 1970-01-01 00:00:00 UTC in seconds. Possible values: `1325376002` to `1893484800+` Data type: `uint32`
`ERR`	The current line marks an Error event. Possible value: `ERR`
`error_condition`	The Error event logged. Possible value: `ALS_Saturation`
`error_data`	The original line value which failed error check. See Data Interpretation Guide for interpreting specific sensor lines.