



## **HyperOCR Data Logger Integration**

*Data Requirements*

*SAT-DN-00507, Rev. A, 2008-03-10*

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# 1. Introduction

## 1.1 Purpose

This document is provided to WET Labs engineering to describe data format requirements for integration of two Satlantic HyperOCR instruments (HPE 307 and HPL 262) with a WET Labs DH-4, such that HyperOCR data logged by DH-4 is in a format that can be processed by Satlantic ProSoft processing software.

## 1.2 Scope

Satlantic ProSoft requires input data files logged from Satlantic instruments conform to the following:

1. the file must begin with a standard **Satlantic log file header** section,
2. each sensor data frame must be **logged in its original form** as emitted by the Satlantic instrument, and
3. each sensor data frame must be followed by a **7-byte Satlantic time stamp** that indicates the time the frame was logged.

This document describes the structure of the compliant log file format and it details the file header, applicable HyperOCR data frames (SATHED0309, SATHSE0309, SATHPL0262, SATPLD0262) and 7-byte Satlantic time stamp.

## 1.3 Definitions, Acronyms and Abbreviations

DH-4	WET Labs data logger
HyperOCR	Satlantic Hyperspectral Ocean Color Radiometer
ProSoft	Satlantic optical sensor data processing software application
SatView	Satlantic data logging and display software application

## 1.4 Referenced Documents

The following documents of the exact issue shown are referenced herein.

RD1	ProSoft 7.7 User Manual; SAT-DN-00228, Rev E; 31 Oct. 2007; Satlantic Inc.
RD2	Satlantic Instrument File Standard; SAT-DN-00134, Rev 6.1; 30 Aug. 2007; Satlantic Inc.
RD3	Satlantic Log File Standard; SAT-DN-00135, Rev A; 21 Jan, 2001; Satlantic Inc.
RD4	HyperOCR Operation Manual; SAT-DN-00249, Rev B; 3 May 2007; Satlantic Inc.
RD5	SatView 2.8 Data Logging and Display System User Guide; SAT-DN-00028, Rev

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## 2. Log File Requirements

### 2.1 Satlantic Log File Format

Satlantic ProSoft [RD1] expects all input data log files to conform to the Satlantic Log File Standard [RD3]. For HPE 307 and HPL 262, the file will appear as below with a standard log file header (128 bytes) followed by a number of 427-byte data frames (logged exactly as emitted by the instrument, each immediately followed by a Satlantic 7-byte time stamp added by the logger).

<b>Satlantic Log File Header</b> <b>128 Bytes</b> (See below section 2.2)
<b>HyperOCR 427-byte Data Frame #1</b> (See below section 2.3)
<b>Satlantic 7-byte Time Stamp #1</b> (See below section 2.4)
<b>HyperOCR 427-byte Data Frame #2</b>
<b>Satlantic 7-byte Time Stamp #2</b>
...
...
<b>HyperOCR 427-byte Data Frame #N</b>
<b>Satlantic 7-byte Time Stamp #N</b>

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## 2.2 Log File Header

### 2.2.1 SATHDR Record Format

The Satlantic log file header consists of a series of header records that must be located at the beginning of a log file, before instrument or other data source telemetry is recorded. The data logger implementation must ensure that no header records are found after the first frame of telemetry. The purpose of each header record is to record specific information relevant to the log file.

Some header records are mandatory in a log file while some are dependent on the application. There is no specific order in which header frames must be recorded. Ordering of these frames is up to the data logger implementation.

All header records are exactly **128 bytes** in length. All fields are ASCII formatted character strings. Each record starts with the character string "SATHDR" and conforms the following template:

SATHDR<SPACE><DATA><SPACE> (<IDENTIFIER>)

The following table describes the fields of each SATHDR record.

FIELD	DESCRIPTION
<SPACE>	A one-byte space character (ASCII 20 hexadecimal).
<DATA>	The application-defined data for the record. This is also known as the Data field.
<IDENTIFIER>	This delimiter indicates the type of record the data field is in reference. This is also known as the Identifier field.

*Table 1: SATHDR record fields*

Because **the record must be exactly 128 bytes in length**, NULL characters (ASCII 00 hexadecimal) may need to be appended to the end of the record until the correct frame size is reached.

### 2.2.2 Compulsory SATHDR Records

Every Satlantic log file has compulsory header records. Most compulsory header record data fields do not have strictly controlled contents. The content of these fields may be determined directly from the operator or by the data logger implementation itself. The

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following table describes the compulsory header records of a Satlantic Log File:

IDENTIFIER	DATA DESCRIPTION
CRUISE-ID	Identifies the cruise on which the current series of log files is taken. Some instruments run autonomously, or they are not controlled from a ship. In these cases, the data field is just an identifier representing the experiment, session, or deployment of the log series.
INVESTIGATOR	Identifies the principal investigator for whom the current series of log files is taken.
AFFILIATION	Identifies the affiliation of the principal investigator.
OPERATOR	Identifies the operator of the data acquisition system (DAS) for the current log file.
LATITUDE	Identifies the latitude coordinates of the instrumentation for the current log file. The format of this field must be in decimal degrees with either a <b>[+/-]</b> character preceding the value or a <b>[N/E/W/S]</b> character after the value, indicating hemisphere. Examples are "23.3456 N" and "+45.4".
LONGITUDE	Identifies the longitude coordinates of the instrumentation for the current log file. The format of this field is the same as the LATITUDE record.
ZONE	Identifies the DAS time zone of the current log. Most time specific information recorded in a log file is in local time. This field gives a reference to the time zone in use at the time of the log.

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IDENTIFIER	DATA DESCRIPTION
TIME-STAMP	<p>Identifies the time on the DAS computer as of the beginning of the current log file. The format for this field must be in the following format:</p> <p>"AAA BBB DD HH:MM:SS YYYY"</p> <p>where:</p> <p>AAA    abbreviated weekday name</p> <p>BBB    abbreviated month name</p> <p>DD     day of the month</p> <p>HH     hour of the day (24 hour format)</p> <p>MM     minutes</p> <p>SS     seconds</p> <p>YYYY   year</p>
STATION-ID	Identifies the station for the current series of log files. This field must be a maximum of 31 characters.
CAST	Identifies the current log file in a series of related log files. This field must be one letter only.
TIMETAG	This is an obsolete header record. <b>The data field must always be "OFF".</b>
MODE	Identifies the logging mode. For DH-4 operation, <b>this should always be set to "NONE"</b>
COMMENT	This field is for general comments. Comments can be any pertinent information such as weather conditions, cloud cover, winds, water conditions, etc.

*Table 2: Compulsory SATHDR records*



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The following additional header records are required to indicate that the DH-4 will be time stamping each logged frame with a trailing Satlantic 7-byte time stamp:

IDENTIFIER	DATA DESCRIPTION
TIMETAG2	Indicates that Satlantic 7-byte time tag follows each frame. Should be set to <b>ON</b> .
DATETAG	Indicates that Satlantic 7-byte time tag follows each frame. Should be set to <b>ON</b> .

*Table 3: Additional SATHDR records*

## 2.3 HyperOCR Data

The log file(s) must contain the unaltered frames emitted by the HyperOCRs. There are four frames types that must be logged, each identified by the leading 10 byte identifier and serial number:

- **SATHED0309**
- **SATHSE0309**
- **SATHPL0262**
- **SATPLD0262**

Each of the above listed frame types are emitted at a **variable rate** and at a **fixed length of 427 bytes**. These instruments have a custom wavelength range and therefore have different frame lengths than the standard HyperOCR configuration.

The telemetry format for the HyperOCR [RD4], as with all Satlantic instrumentation, follows the Satlantic Data Format Standard [RD2]. This standard defines how Satlantic telemetry can be generated and interpreted. For every sample taken of the spectrometer, the instrument will compose and transmit one frame of telemetry containing all the necessary sensor information for that sample. The specific format of this frame, including the center wavelengths represented by the spectrometer channels, is defined by the instrument's calibration file. The format is the same for autonomous and network operation. Internally, the HyperOCR generates a frame of telemetry with the following components:

Seq	Field Name	Size	Offset	Description
1	INSTRUMENT	6	1	A six character AS formatted string denoting the start of a frame of telemetry. One of <b>SATHPE</b> , <b>SATHPD</b> , <b>SATHPL</b> , <b>SATPLD</b> .
2	SN	4	7	A four character AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. Either <b>0307</b> or <b>0269</b>
3	INTTIME	2	11	This field contains a BU formatted value representing the current integration time used for the spectrometer sample. The value is in milliseconds.
4	Sample Delay	2	13	A BS formatted value representing the number of milliseconds to offset the Timer value to give an accurate indication of when the frame's sensors were sampled.
5	Channel ( $\lambda_1$ )	2	15	A BU formatted value representing the sampled A/D counts of the start channel from the spectrometer.
...	...	...		...
199	Channel ( $\lambda_n$ )	2	403	A BU formatted value representing the sampled A/D counts of the end channel from the spectrometer.

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Seq	Field Name	Size	Offset	Description
200	DARK_SAMP	1	404	A BU formatted value representing the number of dark channels used for the dark approximation of the DARK_AVE field.
201	DARK_AVE	2	405	A BU formatted value representing the average of the dark channel values used for the dark approximation. Dark channels are spectrometer sensors with low sensitivity that may be used for baseline measurements.
202	AUX	6	407	This is the auxiliary portion of the frame, reserved for sensors that may be implemented in future versions of the instrument.
203	FRAME COUNTER	1	413	A BU formatted data integrity sensor that maintains a count of each frame transmitted. The count increments by one for each frame transmitted from 0 to 255, at which point it rolls back to zero again.
204	TIMER	10	414	The field is an AF formatted string indicating the number of seconds that have passed since the end of the initialization sequence. This field is left padded with zeros and is precise to two digits after the decimal.
205	CHECK SUM	1	424	This is a BU formatted data integrity sensor which implements a check sum on the telemetry frame.

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Seq	Field Name	Size	Offset	Description
206	TERMINATOR	2	425	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair (0D <sub>hex</sub> and 0A <sub>hex</sub> ).
	<b>TOTAL BYTES</b>		<b>427</b>	

*Table 4: HyperOCR Data Frame Format*

## 2.4 Satlantic 7-byte Time Stamp

When the **DATETAG** and **TIMETAG2** log file header records are both set to **ON**, all frames in the log file must be immediately followed by a 7-byte time stamp as described in the the Satlantic Log File Standard [RD3].

The first three (3) bytes comprise the **DATETAG** portion of the time stamp. These three bytes form a binary unsigned integer that, in decimal, represents the date in a **YYYYDDD** format where **YYYY** is the year and **DDD** is the day of the year (January 1 is '001'). For example, to represent March 4, 2008 (the 64<sup>th</sup> day of 2008), the bytes written would be 0x1E 0xA3 0x00, which is 2008064 decimal.

The next four (4) bytes comprise the **TIMETAG2** portion of the time stamp. These four bytes form a binary unsigned integer that, in decimal, represents the time of day in a **HHMMSSmmm** format where **HH** are hours, **MM** are minutes, **SS** are seconds, and **mmm** are milliseconds. For example, to represent a time of 13:45:09.023, the bytes written would be 0x08 0x04 0x71 0xDF, which is 134509023 decimal.