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|  | ***MEDA***  ***Mars Environmental Dynamics Analyzer*** |
| *For the NASA’s Mars 2020 mission* |
| **Reduced Data Record (RDR) Software Interface Specification (SIS)**  **CAB-MEDA-SPC-0007**  **Issue 1** |

**Mars Environmental Dynamics Analyzer**

**(MEDA)**

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| Título  *Title* | Reduced Data Record (RDR) Software Interface Specification (SIS) |
| Doc. núm.  *Doc. no.* | CAB-MEDA-xxx-0xxx |
| Edición  *Issue* | Issue 1 |
| Fecha  *Date* |  |

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|  |  |  |
| Preparado por  *Prepared by* | Luis Mora Sotomayor | Fecha  *Date* : |
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**DOCUMENT CHANGE RECORD**

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| Ed.  *Issue* | Fecha  *Date* | Sección –Párrafo afectado  *Section – Paragraph Affected* | Descripción del cambio  *Reason of change - Remarks* |
| 1 |  | All | Initiating Document |
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ACRONYMS AND ABBREVIATIONS

ADC Analog Digital Converter

APSW Application Software

ASCII American Standard Code for Information Interchange

ASIC Application-Specific Integrated Circuit

ATS Air Temperature Sensor

CAB Centro de Astrobiología

CPU Central Processing Unit

CODMAC Committee on Data Management and Computation

DAC Digital Analog Converter

EDAC Error Detection and Correction

EDR Experiment Data Record

ERDP EventReport Data Product

DEF Double Event Failure

FEI File Exchange Interface

GDS Ground Data System

HEPA High Efficiency Particulate air

HK Housekeeping

HPRT Heating Platinum Resistance Thermometer

HS Humidity Sensor

ICU Instrument Control Unit

JPL Jet Propulsion Laboratory

LMST Local Mean Solar Time

LTST Local True Solar Time

MIPL Multi-mission image Processing Laboratory

MEDA Mars Environmental Dynamics Analyzer

MPCS Multi-mission Data Processing and Control System

NAIF Navigation and Ancillary Information Facility

NASA National Aeronautics and Space Administration

ODL Object Description Language

ODS Operations Data Store

OPGS Operations Products Generation Sub-system

OT Observation Table

PCB Printed Circuit Board

PDS Planetary Data System

PRT Platinum Resistance Thermometer

PS Pressure Sensor

PSU Power Supply Unit

RDR Reduced Data Record

RDS Radiation and Dust Sensor

RFB Rover Front Body

RSM Remote Sensing Mast

RTD Resistance Temperature Detector

MEDA Mars Environmental Dynamics Analyzer

RAMP Rover Avionics Mounting Panel

SDF Science Data Frame

SDP Science Data Product

SEF Single Event Failure

SIS Software Interface Specification

SOL It represents 1 (one) solar day (from midnight to midnight)

SUSW Start-up Software

TBD To Be Determined

TIRS Thermal Infrared Sensor

TM Telemetry

UART Universal Asynchronous Receiver/Transmitter

UVS Ultraviolet Sensor

VICAR Video image Communications and Retrieval system

WS Wind Sensor

# Introduction

## Purpose and Scope

The purpose of this data product Software Interface Specification (SIS) is to provide users of the Mars Environmental Dynamics Analyzer (MEDA) Reduced Data Record (RDR) with a detailed description of the product and a description of how it was generated, including data sources and destinations.

This SIS is intended to provide enough information to enable users to understand the MEDA RDR data products. The users for whom this SIS is intended are software developers of the programs used in generating the RDR products and scientists who will analyze the data, including those associated with the Mars 2020 (M2020) Project and those in the general planetary science community.

The MEDA RDR data products described in this document are the temporal series of environmental data. For MEDA SkyCam data products, refer to the Mars2020 Camera Instrument Experiment Data Record (EDR) and Reduced Data Record (RDR) Data Products SIS.

## Contents

This Data Product SIS describes how the MEDA data product is acquired by the instrument, and how it is processed, formatted, labeled, and uniquely identified on the ground. The document discusses standards used in generating the product and software that may be used to access the product. The data product structure and organization are described in sufficient detail to enable a user to read the product.

# Applicable Documents

## Applicable documents

This Data Product SIS is responsive to the following Mars2020 documents:

1. Mars 2020 Project: Archive Generation, Validation, and Transfer Plan. JPL D-95520.
2. JPL D-95521, Rev A: Flight Ground Interface Control Document (FGICD) Volume 1: Downlink
3. Mars 2020 Flight-Ground Interface Control Document (FGICD), "Volume 1, Downlink, Rev A, Version 1.0", Biren Shah, JPL D-95521, October 3, 2017.
4. Mars 2020 Project Software Interface Specification (SIS): MEDA Environmental Experiment Data Record (EDR) Data Products, JPL D-99964

This SIS is also consistent with the following Planetary Data System documents:

1. The PDS4 Data Provider’s Handbook - Guide to Archiving Planetary Data Using the PDS4 Standard, Version 1.12.0, April 1, 2019.
2. Planetary Data System Standards Reference, Version 1.12.0, JPL D-7669, Part 2, April 1, 2019.
3. PDS4 Data Dictionary, Version 1.12.0.0, May 2, 2019.

Finally, this SIS is meant to be consistent with the contract negotiated between the M2020 Project and the Instrument Principal Investigator (PI) in which reduced data records and documentation are explicitly defined as deliverable products.

## Relationships with Other Interfaces

Changes to this MEDA SIS document will affect the following products, software, and/or documents.

Table 1: Product and Software Interfaces to this SIS

| Name | Type  P-product  S-software  D-document | Owner |
| --- | --- | --- |
| MEDA RDRs | P | MEDA Team |
| MEDA RDR generation software (medaproc) | S | MEDA Team |

# Data Product Characteristics and Environment

## Instrument Overview

The MEDA instrument consists of a suite of sensors and a control unit, packaged in eleven enclosures:

* Wind Sensor, WS (two detectors, WS1 and WS2, placed on two booms)
* Air Temperature Sensor, ATS (five detectors: three of them placed on the RSM, and two more at the front of the rover body)
* Thermal Infra-Red Sensor, TIRS
* Relative Humidity Sensor, HS
* Radiation and Dust Sensor, RDS (it also includes the SkyCam imager, not covered in this SIS)
* Pressure Sensor, PS (inside the Instrument Control Unit, ICU)

The principal goal of this sensor suite is to provide continuous measurements that characterize the diurnal to seasonal cycles of the local environmental dust properties (opacity, size distribution, and phase function) and their temporal response to meteorology, and the local near-surface environment (pressure, air and surface temperature, relative humidity, wind, and solar radiative forcing in the UV-visible-IR parts of the spectrum).  Figure 2‑1 shows the MEDA sensors location onboard the rover.

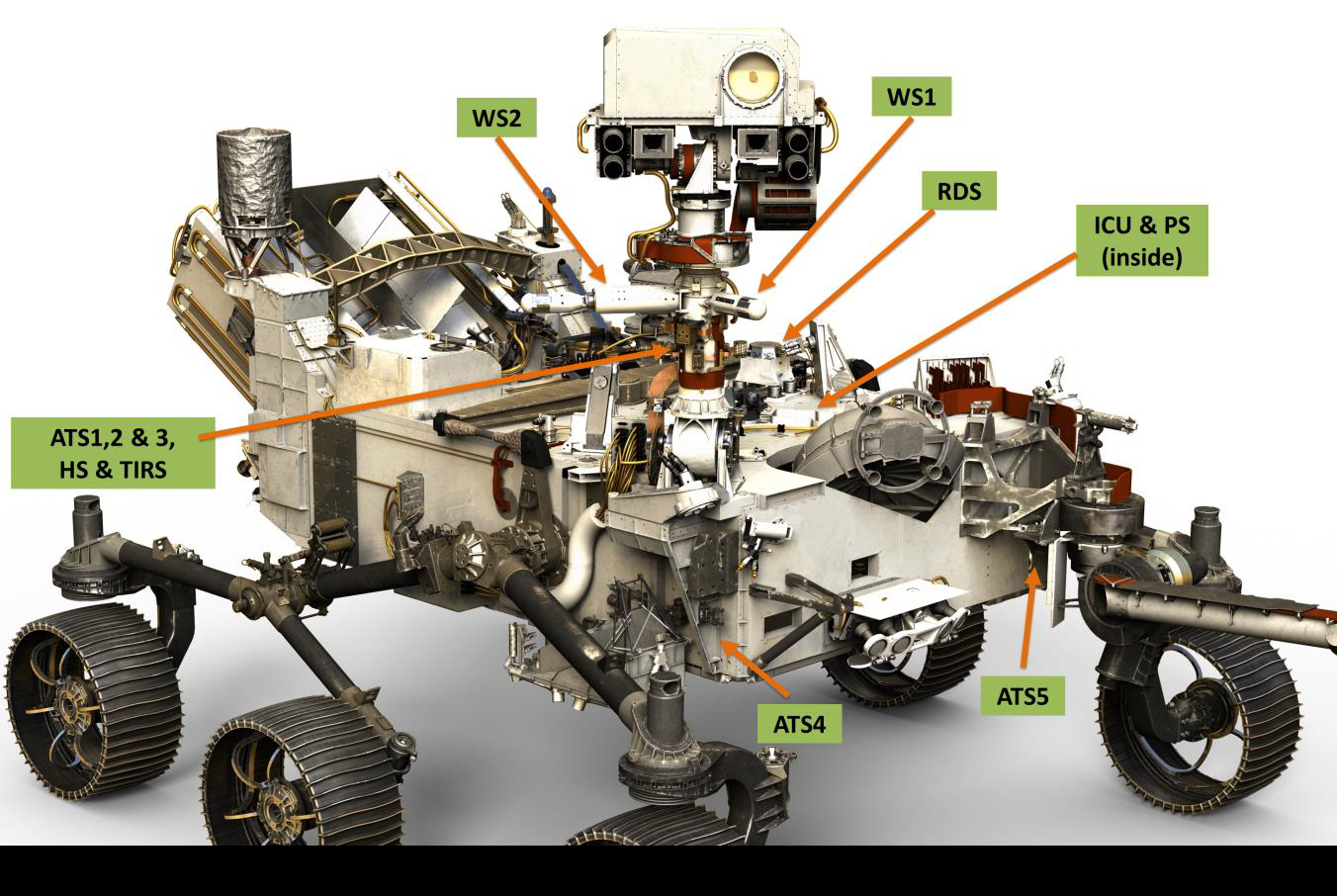


Figure 1 Location of MEDA Sensors onboard the Mars2020 rover

The wind sensors are housed in two small Booms structures mounted orthogonal to the Remote Sensing Mast (RSM) of the Rover. Each Boom provides 6 wind sensor transducer boards on the head of the main boom cylinder. Booms include front-end mixed ASICs to condition and acquire the data from the wind sensors and to communicate serially with the Instrument Control Unit (ICU). This minimizes the number of cables required.

The Thermal-Infrared Radiation Sensor (TIRS) is also mounted on the RSM and it is composed of 5 thermopiles pointing upward and downward to measure different ground and atmosphere temperatures in different infrared bands and the solar radiation reflected on the ground (albedo).

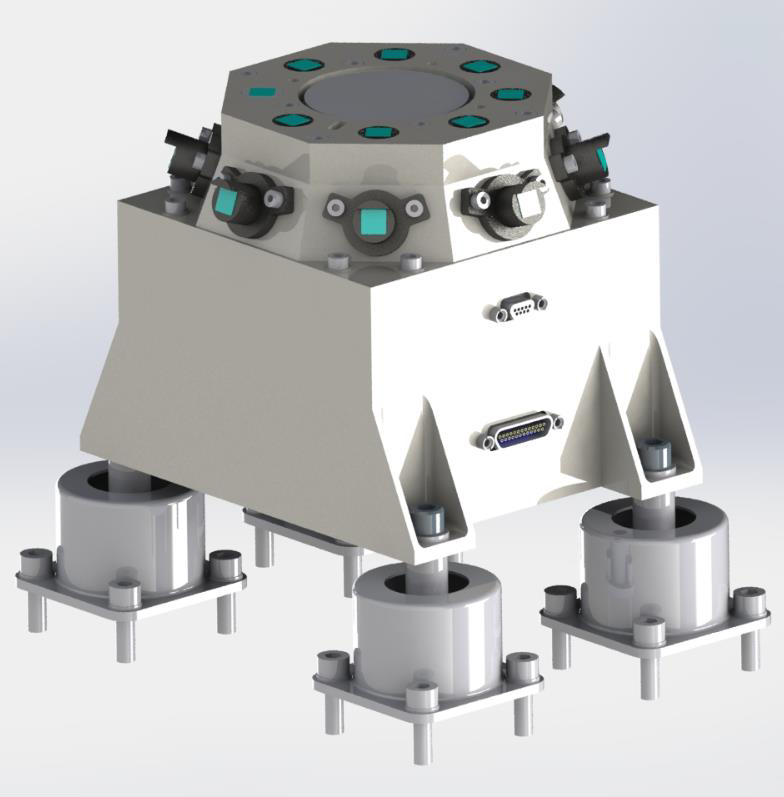
The Humidity Sensor (HS) is directly mounted to the RMS as well. It contains up to three capacitive sensor heads sensitive to the ambient relative humidity.

Figure 2‑2 shows the relative positions of all of the sensors located on the RSM.



Figure 2 WS’s, ATS 1 to 3, TIRS and HS relative positions on the RSM

The Radiation and Dust sensor (RDS) is mounted on the rover top deck and comprises of eight upward viewing UV photodetectors (8 photodiodes), 8 lateral viewing UV photodiodes (every photodiode looking 45º apart from the previous to cover the full 360º around the unit), a reference dark-current photodiode and an upward looking camera. The signals coming from these photodiodes and thermopiles will be routed to the ICU to be conditioned and digitized inside the ICU. The ICU will also control the camera through its power and data interfaces.



RDS-SkyCam sapphire protection and lens set

(JPL HazCam-inherited CCD inside)

RDS-DP: Discrete Photodiodes

Figure 3 RDS illustration

The instrument control unit, the ICU, is mounted upside-down to the Rover Avionics Mounting Panel (RAMP), inside the rover chassis just under the top deck. It plans and controls the sensors’ data acquisition, communicating with Rover Computer Element (RCE) and temporarily storing science and housekeeping data.

The pressure sensor (PS) is located with the ICU analog module but additionally uses a small tube to reach the Martian environment outside the rover. This tube passes through the ICU base plate, the RAMP, and into a cavity in the rover top deck. The opening is protected from dust and for planetary protection reasons by a cover that attaches to the rover top deck

The instrument will regularly make measurements throughout the Martian day and night, over the lifetime of the Mars 2020 mission.  To achieve these measurements, MEDA is designed primarily to operate from an autonomous, low-power “sleep” mode, which can be powered even while the RCE is off.  An internal timer wakes MEDA to take observations according to a pre-determined schedule, saves the data internally, and goes back to sleep. Instrument housekeeping tasks can also be performed to a schedule.

## Data Product Overview

Each MEDA Science Data Product RDR will consist of two files. The first file is an XML formatted detached PDS4 label. The second file is the corresponding data as described in the label file, in ASCII format, comma separated values. The MEDA RDR data file contains science and engineering calibrated data, as processed from the raw data included in MEDA EDRs, which are in turn contain the data as downloaded from MEDA’s internal memory. Mirroring MEDA EDRs, each sensor subsystem will be stored in a separate MEDA RDR. For a description of MEDA EDR format, refer to the Mars2020 Applicable Document 4 (MEDA EDR SIS).

Each MEDA RDR contain one SOL of data. The size of each MEDA RDR data file will depend on the type of data, the measurement strategies and if all data were received, or if only partial data are available. If there are updates to the source raw data or to the calibration processes, the file will be updated and its version number will be incremented. The version number will be indicated in the filename. The latest version of the file should always be used, with previous versions kept only for historical purposes.

Each row within each data product is accompanied by three clock references fields: SCLK (as approximated by MEDA internal clock, without partition and including decimal thousandths of a second), LMST and LTST.

## RDR Product Specification

### RDR Product Types

Descriptions for the various RDR product types are provided in this section. They are broken down into three groupings at incremental processing levels: a) partially processed data products, b) calibrated data products, and c) derived data products. Each MEDA sensor subsystem may have one or more data products in each group. Refer to Table 2.3.1 for a list of MEDA RDR data products.

Table 2 MEDA RDR Data Product list

|  |  |
| --- | --- |
| RDR Data Product TYPE | MEDA Data Product Subtype |
| MEDA Partially Processed Data | Pressure |
| Relative Humidity |
| TIRS |
| ATS |
| Wind |
| RDS |
| MEDA Calibrated Data | Pressure |
| Relative Humidity |
| TIRS |
| ATS |
| Wind |
| RDS |
| Engineering |
| MEDA Derived Data | Pressure |
| Relative Humidity |
| TIRS |
| Wind |
| Ancillary |

### Partially Processed Data Products

These data products contain data from processing at an intermediate step between the raw digital numbers obtained from sensors and the generation of physical environmental magnitudes. The magnitudes provided in these files are mainly voltages, intensities and resistances. Their main purpose is to facilitate engineering evaluation of the sensors’ health and trends.

### Calibrated Data Products

These are the least processed data products at which science environmental magnitudes are provided. These include pressure, humidity, wind, temperatures and radiation. When a sensor subsystem has multiple detectors, the data provided are per individual detector. The processing applied to get the data for these data products is based exclusively on pre-landing calibration and post-landing adjustments (based on observed trends). Little or no assumptions of external conditions or models are made. In the particular cases in which some assumptions are made (the minimal needed to obtain calibrated data), it is so noted in the description of the fields (see Appendix A)

In addition to science data from the sensor, there is also the calibrated engineering data product, derived from the ICU analog engineering MEDA EDR subtype (see M2020 applicable document 4, appendix A). The magnitudes contained within this data product have two purposes: to be used in the generation of calibrated data and to help evaluate the health of MEDA from an engineering point of view.

Some data products have some additional “flag” fields noting additional factors that could have an impact on the reliability of the measurements, such as shadows, noise sources or blocking objects. When those fields exist, a general convention is used in which a value of “1” represents a good condition (e. g. the possible source of noise is off), and “0” represents a bad condition.

### Derived Data Products

Derived data products are processed from calibrated data products using assumptions or models. For some sensors, this is necessary to provide a unique magnitude when there are several detectors involved (e. g. pressure or wind). For other sensors, such as TIRS, there are further assumptions on external conditions not used in calibrated data products. Not all sensors have derived data products.

Derived data are what most users wanting to work MEDA’s data will want, when available for a particular sensor. Users should look into calibrated data products when a particular sensor subsystem has no derived data products, when a provided final magnitude has no equivalent at the derived level (as it is the case of some of the TIRS magnitudes), or if they want to revisit and analyze any model or assumption made to calculate the derived data.

For data products that had flag fields in their calibrated data products, equivalent flags may be replicated at this level.

In addition to science derived data, there is also a special data product, called ancillary data, that contains geometry information that may have an impact in the sensors’ measurements, such as the position of the sun, RSM head or rover speed. This information is calculated using the NAIF SPICE toolkit, and is provided as part of the MEDA dataset for convenience.

## Data Product Generation

MEDA data comes down in Science Data Frames (SDF) which contain a number of Science Data Products (SDP). Each SDP contains data from a specific instrument sensor channel for a period of time. Using the telemetry processing software called M2020EdrGen, IDS processes these SDFs, and converts them into EDRs (process described in Mars2020 applicable document 4). The IDS telemetry processor parses each SDF of MEDA Science and Engineering data, and based on its type and time stamp creates and/or updates the corresponding EDR for the corresponding SOL number derived from the record’s time stamp field.

Once generated, the MEDA EDRs will be stored into the Operations Cloud Store (OCS). The MEDA processing software (medaproc) will retrieve the newly generated data from there, and using SPICE data from NAIF, calibration data and any other ancillary information needed, will generate the RDR processed data products. These products will then be also sent to the OCS. If the RDR data product already existed, it will be updated and its version number incremented. This will happen if the EDR upon which the RDR is based was first generated using partial data. Also, a manual reprocessing of RDRs may be applied if the calibration process is updated.

### Data Processing Level

This documentation uses the “Planetary Data System Standard 4” (PDS4) data level numbering system. The MEDA instrument operations data products referred to in this document as RDRs are considered PDS4 levels “partially processed”, “calibrated” and “derived. The RDRs are to be reconstructed from EDRs, which are PDS4 “raw” processing level.

Refer to Table 3 for a breakdown of the PDS4 data processing levels.

Table 3 PDS4 Processing Levels for Instrument Experiment Data Sets

| Processing Level for PDS4 Archive | Operations Data Product Name | Description |
| --- | --- | --- |
| Telemetry | n/a | An encoded byte stream used to transfer data from one or more instruments to temporary storage where the raw instrument data will be extracted. PDS does not archive telemetry data. |
| Raw | EDR  (Experiment Data Record) | Original data from an instrument. If compression, reformatting, packetization, or other translation has been applied to facilitate data transmission or storage, those processes will be reversed so that the archived data are in a PDS approved archive format. |
| Partially Processed | RDR  (Reduced Data Record) | Data that have been processed beyond the raw stage, but which have not yet reached calibrated status. These and more highly processed products. |
| Calibrated | RDR | Data converted to physical units, which makes values independent of the instrument. |
| Derived | RDR | Results that have been distilled from one or more calibrated data products (for example, maps, gravity or magnetic fields, or ring particle size distributions). Supplementary data, such as calibration tables or tables of viewing geometry, used to interpret observational data should also be classified as “derived” data if not easily matched to one of the other three categories. |

### Data Flow

Telemetry first arrives at JPL, where IDS will convert it to MEDA EDR data, based on a) AMPCS data products b) SPICE kernels, and c) a meta-data database. They are created on the OCS and then made available into IDS’s DataDrive for electronic distribution to remote sites/users via a secure subscription protocol.

As soon as the MEDA EDR are available, the MEDA team will retrieve them and create calibrated and derived RDR data products, which will all be placed back into OCS, for distribution to the rest of the mission team.

After a data validation period, the MEDA EDR and RDR data products are collected with other science data and delivered to the Planetary Data System for archiving. Deliveries take place according to the release schedule agreed upon by the Mars2020 Project and PDS and specified in the Mars2020 Archive Generation, Validation and Transfer Plan (Mars2020 applicable document 1). The Atmospheres Node validates the bundles for PDS4 compliance and for compliance with this SIS document, and makes them available to the public online.

Note that since OCS is used only during the life of the mission, the PDS archives are the official version of all data products.

## Standards Used in Generating Data Products

### File Naming Standards

The primary attributes of the filename nomenclature are:

1. Uniqueness - It must be unique unto itself without the file system’s directory path. This protects against product overwrite as files are copied/moved within the file system and external to the file system, if managed correctly.
2. Metadata - It should be comprised of metadata fields that keep file bookkeeping and sorting intuitive to the human user. Even though autonomous file processing will be managed via databases, there will always be human-in-the-loop that puts a premium on filename intuition. Secondly, the metadata fields should be smartly selected based on their value to ground processing tools, as it is less CPU-intensive to extract information from the filename than from the label. NOTE: Metadata information in the filename also resides in the product label.

The metadata fields have been selected based on MER and PHX lessons learned. In general, the metadata fields are arranged to achieve readability. An effort is made to alternate Integer fields with ASCII character fields to Optimize differentiation of field boundaries for the human user.

### RDR Filename

Each M2020 RDR data product can be uniquely identified by incorporating into the product filename at minimum the Instrument ID, SCLK (or UTC), Product Type identifier, and Version number. The convention is illustrated in Figure 2 below.

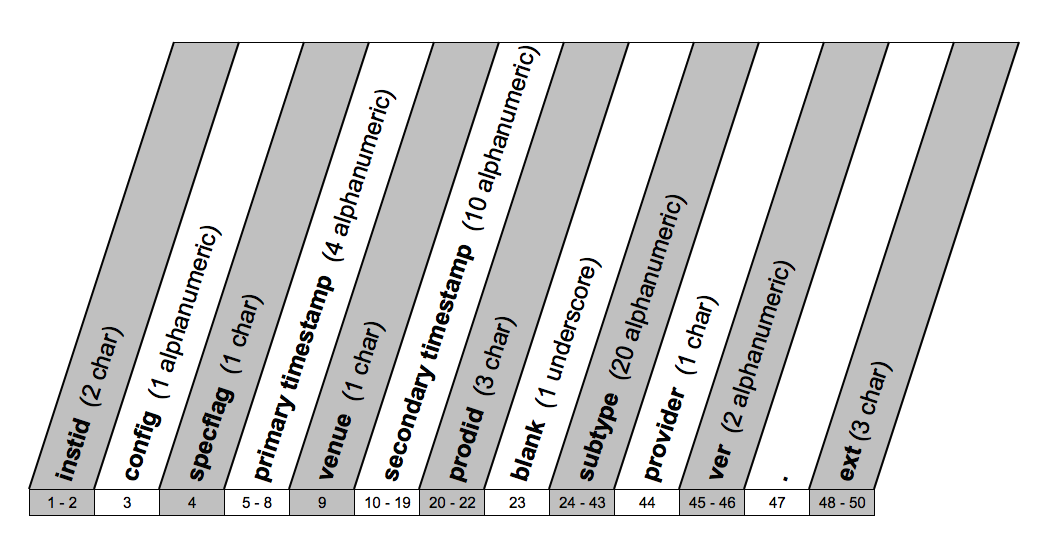


Figure 2 RDR Filename Convention

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| where, | | | | | | | | | | | | | | | | | | | | | |
| ***instid*** | = | (2 character) Instrument ID, denoting the source M2020 science or engineering payload instrument that acquired the data. 1st character is primary Instrument identifier. 2nd character is Instrument state, or simply secondary Instrument identifier if no state.  Valid values for Instrument IDs are: | | | | | | | | | | | | | | | | | | | |
|  | | “**WE**” | | | | - | | MEDA Environmental | | | | | | |  | | | |  |  | |
|  | | Valid values for Instrument IDs not described in this SIS: | | | | | | | | | | | | | | | | | | | |
|  | | “**FL**”  “**FR**”  “**RL**”  “**RR**”  “**ZL**”  “**ZR**”  “**NL**”  “**NR**”  “**ML**”  “**MR**”  “**XM**”  “**XS**”  “**OX**”  “**PC**”  “**PS**”  “**SC**”  “**SS**”  “**SI**” | | | | -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  - | | Front Hazcam Left (String A)  Front Hazcam Right (String A)  Rear Hazcam Left (String A)  Rear Hazcam Right (String A)  Front Hazcam Left (String B)  Front Hazcam Right (String B)  Navcam Left  Navcam Right  Mastcam-Z Left  Mastcam-Z Right  RIMFAX Mobile  RIMFAX Stationary  MOXIE  PIXL Context Cam (MCC)  PIXL Spectrometer  SHERLOC Context Cam (ACI)  SHERLOC Spectrometer  SHERLOC Imaging | | | | | | “**SL**”  “**SP**”  “**SR**”  “**SD**”  “**SM**”  “**SA**”  “**EA**”  “**EB**”  “**EC**”  “**ED**”  “**EU**”  “**EL**”  “**ES**”  “**CC**”  “**HN**”  “**HS**”  “**WS**” | -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  - | | SuperCam Laser  SuperCam Passive  SuperCam RMI (camera)  SuperCam Diagnostic  SuperCam Scan Mode  SuperCam Microphone (Audio)  EDLcam Parachute Uplook Cam A  EDLcam Parachute Uplook Cam B  EDLcam Parachute Uplook Cam C  EDLcam Rover Downlook Cam  EDLcam Rover Uplook Cam  EDLcam Lander Vision System (LVS)  EDLcam Descent Stage Downlook Cam  Sample Cache Cam  MEDA SkyCam | | | | |
| ***config*** | = | (1 alphanumeric) Instrument Configuration, an operational attribute of the Instrument that assists in characterizing the data.  Valid values for MEDA configurations: | | | | | | | | | | | | | | | | | | | |
|  | |  | | **Instrument State** | | | | | | | | **Configuration** | | | | | | | | | |
|  | |  | | **Value** | | | | **Description** | | | | | |
|  | |  | | MEDA Environmental | | | | | | | | **“\_”** | | | | Config is always an underscore. | | | | | |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***specflag*** | = | (1 character) Special Processing flag is always “\_" for MEDA EDRs. | | | | | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***primary time-stamp*** | = | (4 alphanumeric) Primary Timestamp that is of coarser granularity than the Secondary timestamp (documented later). Value type is based on either of four scenarios:  Flight Cruise  Year-DOY (4 alphanumeric) - This field stores two metadata items in the order:   1. One alpha character in range “A-Z” to designate Earth Year portion of the UTC-like time value, representing Years 2017 to 2042 2. Three integers in range “001-366” representing Day-of-Year (DOY)   Flight Surface  Sol (4 integer) - This field stores the 4-integer Sol (Mars solar day) of the first (i.e., lowest Clock time) acquired instrument data.  Ground Test in which SCLK in NOT reset  When SCLK continuously increments and does NOT repeat, there are two variants:   1. Year-DOY (4 alphanumeric) - This field stores two metadata items in the order:    1. One alpha character in range “A-Z” to designate Earth Year portion of the UTC-like time value, representing Years 2017 to 2042    2. Three integers in range “001-366” representing Day-of-Year (DOY)   – OR –   1. Sol (4 integer) - This field stores the 4-integer Sol (Mars solar day) of the first (i.e.,   lowest Clock time) acquired instrument data.  Ground Test in which SCLK is reset  When SCLK is reset and repeats, we lose time “uniqueness”. So, we have to change  from SCLK to using “wall clock” derived from ERT and represent with a UTC-like format:  DOY-Year (4 alphanumeric) - This field stores two metadata items in reverse order  compared to the previous “Year-DOY” cases, indicating that the Secondary Time field  (described later) contains ERT   1. Three integers in range “001-366” representing Day-of-Year (DOY) 2. One alpha character in range “A-Z” to designate Earth Year portion of the UTC-like time value, representing Years 2017 to 2042 | | | | | | | | | | | | | | | | | | | |
|  | | The valid values, in their progression, are as follows (non-Hex):   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Scenario** | **Time Type** | **Value Format** | **Valid Values** | **Time Range** | | Flight Cruise | Year-DOY | [A-Z]<ddd> | “**A001**”,“**A002**”, **…** “**A365**”, “**B001**”,“**B002**”, **…** “**B365**”,  **•**  **•**  **•**  “**Z001**”,“**Z002**”, **…** “**Z365**” | 2017 - Days 1 to 366,  2018 - Days 1 to 366,  **•**  **•**  **•**  2042 - Days 1 to 366 | | <aaaa> | “**\_ \_ \_ \_**” (4 underscores) | Value is out of range | | Flight Surface | Sol | <nnnn> | “**0000**”,“**0001**”, **…** “**9999**” | 0 thru 9999 | | <aaaa> | “**\_ \_ \_ \_**” (4 underscores) | Value is out of range | | Ground Test  where SCLK  is NOT reset | Year-DOY | (same as Flight Cruise) | (same as Flight Cruise) | (same as Flight Cruise) | | Sol | <nnnn> | “**0000**”,“**0001**”, **…** “**9999**” | 0 thru 9999 | | <aaaa> | “**\_ \_ \_ \_**” (4 underscores) | Value is out of range | | Ground Test  where SCLK  is reset | DOY-Year | <ddd>[A-Z] | “**001A**”,“**002A**”, **…** “**365A**”, “**001B**”,“**002B**”, **…** “**365B**”,  **•**  **•**  **•**  “**001Z**”,“**002Z**”, **…** “**365Z**” | Days 1 to 366 - 2017,  Days 1 to 366 - 2018,  **•**  **•**  **•**  Days 1 to 366 - 2042 | | <aaaa> | “**\_ \_ \_ \_**” (4 underscores) | Value is out of range | | | | | | | | | | | | | | | | | | | | |
| ***venue*** | = | (1 character) Venue type denoting the data processing context or activity. Valid types are Flight (Cruise, Surface), Test / VSTB, Testbed, ATLO, Thread Test, Design Sim, ORT.  Venue also denotes the Instrument Model type (Flight vs Engineering).  NOTE: Characters “I” and “O” are NOT used to avoid confusion in readability with Numeric  Values “1” and “0” in adjacent Filename fields. | | | | | | | | | | | | | | | | | | | |
|  | | See the following table of valid values: | | | | | | | | | | | | | | | | | | | |
|  | |  | | **Venue** | | | | | | | | | | **Value** | | | | **Instrument Model** | | |  |
|  | |  | | Flight (see Sol field) | | | | | | | | | | “**\_**” | | | | Flight | | |  |
|  | |  | | Test / VSTB | | | | | | | | | | “**A**” | | | | Flight | | |  |
|  | |  | | “**B**” | | | | Engineering | | |  |
|  | |  | | Testbed | | | | | | | | | | “**C**” | | | | Flight | | |  |
|  | |  | | “**D**” | | | | Engineering | | |  |
|  | |  | | ATLO | | | | | | | | | | “**E**” | | | | Flight | | |  |
|  | |  | | “**F**” | | | | Engineering | | |  |
|  | |  | | Thread Test (TT) | | | | | | | | | | “**G**” | | | | Flight | | |  |
|  | |  | | “**H**” | | | | Engineering | | |  |
|  | |  | | Design Sim | | | | | | | | | | “**J**” | | | | Flight | | |  |
|  | |  | | “**K**” | | | | Engineering | | |  |
|  | |  | | Ops Readiness Test (ORT) | | | | | | | | | | “**L**” | | | | Flight | | |  |
|  | |  | | “**M**” | | | | Engineering | | |  |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***second-ary time-stamp*** | = | | (10 integer) Secondary Timestamp that is of finer granularity than the Primary timestamp. Value type is based on either of four scenarios:  Flight Cruise  SCLK – This field stores the 10-integer SCLK (seconds). Which specific SCLK count  (Start or End) is used depends on the instrument, but nominally it is the starting  count of the first (i.e., lowest Clock time) acquired instrument data.  Flight Surface  SCLK – Same as for “Flight Cruise”  Ground Test in which SCLK in NOT reset  SCLK – Same as for “Flight Cruise”  Ground Test in which SCLK is reset  ERT - This field stores the ERT time portions Month, Day-of-month, Hour and Seconds  as 10 integers in a UTC-like format | | | | | | | | | | | | | | | | | | |
|  | | The valid value formats are as follows:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Scenario** | **Time Type** | **Value Format** | **Valid Values** | **Time Range** | | Flight Cruise | SCLK | <aaaaaaaaaa>  (Alphabetic) | “**\_ \_ \_ \_ \_ \_ \_ \_ \_ \_**”  (10 underscores) | Value is out of range | | Flight Surface | SCLK | <aaaaaaaaaa>  (Alphabetic) | “**\_ \_ \_ \_ \_ \_ \_ \_ \_ \_**”  (10 underscores) | Value is out of range | | Ground Test  where SCLK  is NOT reset | SCLK | <aaaaaaaaaa>  (Alphabetic) | “**\_ \_ \_ \_ \_ \_ \_ \_ \_ \_**”  (10 underscores) | Value is out of range | | Ground Test  where SCLK  is reset | ERT | MMDDHHmmss  (Month, Day-of-month, Hour, Minute, Second) | “**0101010000**”,  “**0101010001**”,  **•**  **•**  **•**  “**1231235959**” | January 1, 01:00:00  thru  December 31, 23:59:59 | | <aaaaaaaaaa>  (Alphabetic) | “**\_ \_ \_ \_ \_ \_ \_ \_ \_ \_**”  (10 underscores) | Value is out of range | | | | | | | | | | | | | | | | | | | | |
| ***prodid*** | | = (3 character) Product Type identifier.  This field has the following rule-of-thumb:  Beginning “**E**” - Type of EDR, which is the first-order product with no processing applied, with the exception of decompression in the case that Instrument applied onboard compression.  If no beginning “E”, then product is an RDR.  Valid values for Prodid are: | | | | | | | | | | | | | | | | | | | |  | |
|  |  | “**ESD**” | | | | | - | | | Science Data Product | | | | | | | | | | | |
|  |  | “**EER**” | | | | | - | | | Event Report Data Product | | | | | | | | | | | |
|  |  | “**PAR**” | | | | | - | | | Partially Processed Data Product | | | | | | | | | | | |
|  |  | “**CAL**” | | | | | - | | | Calibrated Data Product | | | | | | | | | | | |
|  |  | “**DER**” | | | | | - | | | Derived Data Product | | | | | | | | | | | |
| ***subtype*** | = | (20 character) Product Subtype identifier.  There is a product subtype attending to the list defined in section 3.3.1 | | | | | | | | | | | | | | | | | | | |
|  | | Valid values for Product Subtype identifiers are listed below: | | | | | | | | | | | | | | | | | | | |
|  | |  | | **Values** | | | | | | | | **Subtype** | | | | | | | | | |
|  | |  | | “**PS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**” | | | | | | | | Pressure Sensor data | | | | | | | | | |
|  | |  | | “**RHS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**” | | | | | | | | Relative Humidity Sensor data | | | | | | | | | |
|  | |  | | **“TIRS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Thermal and Infrared Sensor data | | | | | | | | | |
|  | |  | | **“ATS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Air Temperature Sensor data | | | | | | | | | |
|  | |  | | **“WS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Wind Sensor data | | | | | | | | | |
|  | |  | | **“RDS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Radiation and Dust Sensor data | | | | | | | | | |
|  | |  | | **“ENG\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Engineering data | | | | | | | | | |
|  | |  | | **“ANCILLARY\_\_\_\_\_\_\_\_\_\_\_”** | | | | | | | | Ancillary data | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***provider*** | = | (1 character) Product Provider ID, identifying the institution that generated the EDR or RDR product. | | | | | | | | | | | | | | | | | | | |
|  | | See the following table of valid values: | | | | | | | | | | | | | | | | | | | |
|  | |  | | | **Values** | | | | | | **Description** | | | | | | | | | | |
|  | |  | | | “**J**” | | | | | | IDS at JPL | | | | | | | | | | |
|  | |  | | | “**P**” | | | | | | Principal Investigator of Instrument … | | | | | | | | | | |
|  | |  | | | Instrument | | | | Principal Investigator | | | | | | |
|  | |  | | | MEDA | | | | CAB CSIC-INTA (Spain) | | | | | | |
|  | |  | | | “**A**” - “**I**”,  “**K**” - “**O**”,  “**Q**” - “**Z**”, | | | | | | Co-Investigators (to be identified per Instrument at discretion of P.I.) | | | | | | | | | | |
|  | |  | | | Value | | | | Co-Investigator | | | | | | |
|  | |  | | |  | | | |  | | | | | | |
|  | | See the following table of Instruments not covered by this SIS: | | | | | | | | | | | | | | | | | | | |
|  | |  | | | **Values** | | | | | | **Description** | | | | | | | | | | |
|  | |  | | | “**P**” | | | | | | Principal Investigator of Instrument … | | | | | | | | | | |
|  | |  | | |  | | | | | | Instrument | | | | Principal Investigator | | | | | | |
|  | |  | | |  | | | | | | EECAM | | | | JPL | | | | | | |
|  | |  | | |  | | | | | | Mastcam-Z | | | | ASU (Tempe, AZ) | | | | | | |
|  | |  | | |  | | | | | | SuperCam spectroscopy | | | | LANL (Los Alamos, NM) | | | | | | |
|  | |  | | |  | | | | | | SuperCam imaging | | | | IRAP (France) | | | | | | |
|  | |  | | |  | | | | | | PIXL spectroscopy | | | | JPL | | | | | | |
|  | |  | | |  | | | | | | PIXL imaging | | | | TBD | | | | | | |
|  | |  | | |  | | | | | | SHERLOC spectroscopy | | | | JPL | | | | | | |
|  | |  | | |  | | | | | | SHERLOC imaging | | | | JPL | | | | | | |
|  | |  | | |  | | | | | | MOXIE | | | | MIT (Cambridge, MA) | | | | | | |
|  | |  | | |  | | | | | | EDLcam | | | | JPL | | | | | | |
|  | |  | | |  | | | | | | Helicopter camera | | | | JPL | | | | | | |
|  | |  | | | “**A**” - “**I**”,  “**K**” - “**O**”,  “**Q**” - “**Z**”, | | | | | | Co-Investigators (to be identified per Instrument at discretion of P.I.) | | | | | | | | | | |
|  | |  | | |  | | | | | | | | | | |
|  | |  | | |  | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***ver*** | = | (2 alphanumeric) Version identifier. The Version number increments by one whenever an otherwise-identical filename would be produced. | | | | | | | | | | | | | | | | | | | |
|  | | The valid values, in their progression that excludes “**0**” altogether, are as follows (non-Hex): | | | | | | | | | | | | | | | | | | | |
|  | | Range 1 thru 99 | | | | | | | | | | - | “**01**”,“**02**”, **…** “**99”** | | | | | | | | | |
|  | | Range 100 thru 109 | | | | | | | | | | - | “**A0**”,“**A1**”, **…** “**A9”** | | | | | | | | | |
|  | | Range 110 thru 135 | | | | | | | | | | - | “**AA**”,“**AB**”, **…** “**AZ”** | | | | | | | | | |
|  | | Range 136 thru 145 | | | | | | | | | | - | “**B0**”,“**B1**”, **…** “**B9”** | | | | | | | | | |
|  | | Range 146 thru 171 | | | | | | | | | | - | “**BA**”,“**BB**”, **…** “**BZ”** | | | | | | | | | |
|  | | Range 172 thru 181 | | | | | | | | | | - | “**C0**”,“**C1**”, **…** “**C9”** | | | | | | | | | |
|  | | Range 182 thru 207 | | | | | | | | | | - | “**CA**”,“**CB**”, **…** “**CZ”** | | | | | | | | | |
|  | | Note that not every version need exist, e.g. versions 1, 2 and 4 may exist but not 3. In general, the highest-numbered Version represents the “best” version of that product.  NOTE: To be clear, this field increments independently of all fields, including the Special Processing field. | | | | | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | | | | | |
| ***ext*** | = | (2 to 3 characters) Product type extension.  The valid values for MEDA EDR products are: | | | | | | | | | | | | | | | | | | | |
|  | | “**CSV**” | | | | | | - | Comma Separated Value data | | | | | | | | | | | | |
|  | | Valid values for some other data products not covered by this SIS are: | | | | | | | | | | | | | | | | | | | |
|  | | “**IMG**”  “**VIC**”  “**iv**”  “**ht**”  “**rgb**”  “**LBL**”  “**JPG**”  “**TIF**”  “**PNG**”  “**TXT**”  “**tar**”  “**QUB**” | | | | | | -  -  -  -  -  -  -  -  -  -  -  - | Binary image data product, may include embedded IDS-generated VICAR label  Temp binary image EDR/RDR product from IDS’s VICAR image processing SW  Per-XYZ (Wedge) Terrain Mesh in Inventor format  Per-XYZ (Wedge) Height Map in VICAR (IDS image processing SW) format  Per-XYZ (Wedge) “texture” (Terrain Mesh skin) product in RGB format  Detached Ops product label file in ODL (ASCII) format  JPEG-compressed formatted binary product (no label)  TIFF formatted binary product (no label)  PNG formatted binary product (no label)  Text file for Specially-processed file (see Filename field “Special Processing”)  Tar file  Multi-layer spectral cube data | | | | | | | | | | | | |
|  | | Of the above, only “IMG”, “LBL”, “JPG”, “TXT”, “QUB”, “CSV”, “DAT” and “TAB” are currently supported by PDS4. | | | | | | | | | | | | | | | | | | | |

### Time Standards

The MEDA PDS4 label uses attributes containing time values. Each time value standard is defined according to the attribute description within the standard PDS data dictionaries.

### Coordinate Systems

The primary coordinate system defined for surface operations, the Rover Frame, is the one used for surface navigation and mobility. By definition, the frame is attached to the rover, and moves with it when the rover moves while on the surface. Its Y origin is centered on the rover and its X origin is aligned with the middle wheels’ rotation axis for the deployed rover and suspension system on a flat plane. The Z origin is defined to be at the nominal surface, which is a fixed position with respect to the rover body. The actual surface will likely not be at exactly Z = 0 due to the effects of suspension sag, rover tilt, rocker bogie angles, etc. The +X axis points to the front of the rover, +Y to the right side, and +Z down (perpendicular to the chassis deck).

### Data Storage Conventions

The MEDA RDR data files contain comma separated value data. The detached PDS4 labels for MEDA RDRs are stored as ASCII text. The RDR products are described/defined as PDS table objects.

All MEDA RDR data files will contain variable length records, as blank fields will not be padded with zero nor space values. Label attributes will provide necessary information to determine the size and organization of the records.

## Data Validation

The MEDA RDRs, as with all other Mars 2020 data products, are subject to PDS peer review.

Validation of MEDA RDR products during production will be performed according to specifications in the M2020 Archive Plan and the MEDA science team. The MEDA Team will validate the science content of the data products, and the PDS Atmospheres Node will validate the products for compliance with PDS standards and for conformance with the design specified in this SIS.

Validation of the Mars 2020 RDRs will fall into two primary categories: automated and manual. Automated validation will be performed on every RDR product produced for the mission. Manual validation will only be performed on a subset.

Automated validation will be performed as a part of the archiving process, and will be done simultaneously with the archive volume validation. Validations performed will include such things as verification that the checksum in the label matches a calculated checksum for the data product (i.e., that the data product included in the archive is identical to that produced by the real-time process), a validation of the PDS syntax of the label, a check of the label values against the database and against the index tables included on the archive volume, and checks for internal consistency of the label items. The latter include such things as verifying that the product creation date is later than the earth received time. As problems are discovered and/or new possibilities identified for automated verification, they will be added to the validation procedure.

Manual validation of the data will be performed both as spot-checking of data throughout the life of the mission, and comprehensive validation of a subset of the data (for example, a couple of days' worth of data). A human will view these products. The MEDA Team will validate the science content of the data products, and the corresponding PDS Atmospheres node will validate the products for compliance with PDS standards and for conformance with the design specified in this SIS.

# Data Product Specifications

## Data Product Structure and Organization

The structure of the MEDA RDR consists of an ASCII data file and a detached ASCII PDS4 label.

MEDA Data File (ASCII)

Figure 3 The MEDA RDR consists of two files

Detached PDS4 Label (ASCII)

## Data Format Descriptions

MEDA RDR data files are ASCII formatted. A detached ASCII PDS4 label will accompany each EDR data file.

The MEDA ASCII-formatted RDR data files will have a “.csv” extension, while the accompanying detached ASCII PDS4 label will carry a “.xml” extension.

The MEDA ASCII formatted data files can be one of the several types listed in Table 2. They all consist of column comma separated value (csv) table files whereupon each row, or record, denotes a single measurement, and each column, or field, denotes a single datum from that particular measurement. The first row of each file contains the names of the fields. A value of 999999999 in any of the fields means that the calibrated value could not be computed.

See Appendix A for a description of the fields of the data products.

## Label Descriptions

### Detached PDS4 Label

MEDA RDR data products have detached PDS4 labels stored as ASCII. A PDS4 label is object- oriented and describes the objects in the data file. The PDS4 label contains attributes for product identification and for table object definitions. The label also contains descriptive information needed to interpret or process the data objects in the file.

PDS4 labels are written in eXtensible Markup Language (xml). PDS4 label statements have the form of "<attribute>value</attribute>".

### PDS4 Data

The fundamental structure of a MEDA data table (.csv) file is the Parsable\_Byte\_Stream class (a stream of bytes that can be parsed using standardized rules). A simple ASCII text file - the MEDA CSV table - consists of a stream of character data; one or more records delimited by a standard set of characters (the carriage-return line-feed pair). This is called the Delimiter Separated Value Format,

aaa,bbb,ccc<CR><LF>

zzz,yyy,xxx<CR><LF>

More specifically, a MEDA .csv file is characterized by the Table\_Delimited class, which inherits attributes from the Parsable\_Byte\_Stream class, and it adds several more.

Each Table\_Delimited class requires one Record\_Delimited class, which describes the structure of all records in the delimited table.

Although the individual fields may vary in size from one record to the next, the number of fields, their names, and their data types must remain the same from line to line. There must be one Field\_Delimited class present in the label to describe each field in the table record, except when Group\_Field\_Delimited can be used. Field definitions within the label must be in the same order as the physical appearance of the fields in the record.

The attribute <field\_delimiter> must be defined in the Table\_Delimited class. Attribute <maximum\_field\_length> gives the maximum number of bytes in a field. Field delimiters and bracketing double quotes around character strings (if any) are not included in the count.

Repeating sets of fields may be ‘grouped’ within a record, simplifying their definition, using the Group\_Field\_Delimited class.

# Applicable Software

## Utility Programs

The MEDA science team, per request, will provide software and other utility programs.

## Applicable PDS Software Tools

PDS-labeled data can be viewed with PDS4 Viewer, developed by the PDS Small Bodies Node and available for a variety of computer platforms from the PDS web site http://pds.nasa.gov/tools/tool-registry/. There is no charge for PDS4 Viewer.

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# Appendix A - MEDA RDR Data Product Fields

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Pressure Sensor Data | | |  |
|  |  |  |  |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | BAROCAP1\_PRESSURE | ASCII\_Real | NGM type Barocap (transducer 1) / RSP2M type Barocap (transducer 2) data in picofarads |  |
| 5 | BAROCAP2\_PRESSURE | ASCII\_Real | RSP2M type Barocap data in picofarads |  |
| 6 | BAROCAP3\_PRESSURE | ASCII\_Real | NGM type Barocap (transducer 1) data in picofarads |  |
| 7 | THERMOCAP1\_TEMP | ASCII\_Real | Thermocap 1 sensor data in picofarads |  |
| 8 | THERMOCAP2\_TEMP | ASCII\_Real | Thermocap 2 sensor data in picofarads |  |
| 9 | PRESSURE\_MEASUREMENT\_MODE | ASCII\_String | Pressure measurement mode: nominal / high resolution |  |
| 10 | TRANSDUCER | ASCII\_Integer | Transducer used: 1 / 2 |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | BAROCAP1\_PRESSURE | ASCII\_Real | NGM type Barocap (transducer 1) / RSP2M type Barocap (transducer 2) pressure in pascals |  |
| 5 | BAROCAP1\_PRESSURE\_UNCERTAINTY | ASCII\_Real | Barocap 1 pressure uncertainty |  |
| 6 | BAROCAP2\_PRESSURE | ASCII\_Real | RSP2M type Barocap pressure in pascals |  |
| 7 | BAROCAP2\_PRESSURE\_UNCERTAINTY | ASCII\_Real | Barocap 2 pressure uncertainty |  |
| 8 | BAROCAP3\_PRESSURE | ASCII\_Real | NGM type Barocap (transducer 1) pressure in pascals |  |
| 9 | BAROCAP3\_PRESSURE\_UNCERTAINTY | ASCII\_Real | Barocap 3 pressure uncertainty |  |
| 10 | THERMOCAP1\_TEMP | ASCII\_Real | Thermocap 1 temperature in Kelvin |  |
| 11 | THERMOCAP1\_TEMP\_UNCERTAINTY | ASCII\_Real | Thermocap 1 uncertainty |  |
| 12 | THERMOCAP2\_TEMP | ASCII\_Real | Thermocap 2 temperature in Kelvin |  |
| 13 | THERMOCAP2\_TEMP\_UNCERTAINTY | ASCII\_Real | Thermocap 2 uncertainty |  |
| 14 | PRESSURE\_MEASUREMENT\_MODE | ASCII\_String | Pressure measurement mode: nominal / high resolution |  |
| 15 | TRANSDUCER | ASCII\_Integer | Transducer used: 1 / 2 |  |
|  |  |  |  |  |
|  | Derived |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | PRESSURE | ASCII\_Real | Pressure in pascals |  |
| 5 | PRESSURE\_UNCERTAINTY | ASCII\_Real | Pressure uncertainty |  |
| 6 | TRANSDUCER | ASCII\_Integer | Transducer used: 1 / 2 |  |
|  | | | |  |
| Relative Humidity Sensor Data | | | |  |
|  |
|  |
|  |  |  |  |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | HUMICAP\_A\_HUMIDITY | ASCII\_Real | Humicap humidity sensor A data in picofarads |  |
| 5 | HUMICAP\_B\_HUMIDITY | ASCII\_Real | Humicap humidity sensor B data in picofarads |  |
| 6 | THERMOCAP1\_TEMP | ASCII\_Real | Thermocap 1 sensor data in picofarads |  |
| 7 | THERMOCAP2\_TEMP | ASCII\_Real | Thermocap 2 sensor data in picofarads |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | HUMICAP\_A\_HUMIDITY | ASCII\_Real | Humicap humidity sensor A relative humidity |  |
| 5 | HUMICAP\_A\_HUMIDITY\_UNCERTAINTY | ASCII\_Real | Humicap humidity sensor A uncertainty |  |
| 6 | HUMICAP\_B\_HUMIDITY | ASCII\_Real | Humicap humidity sensor B relative humidity |  |
| 7 | HUMICAP\_B\_HUMIDITY\_UNCERTAINTY | ASCII\_Real | Humicap humidity sensor B uncertainty |  |
| 8 | HUMICAP\_TEMP | ASCII\_Real | Humicap sensor in-built PT1000 temperature in kelvin |  |
| 9 | HUMICAP\_TEMP\_UNCERTAINTY | ASCII\_Real | Humicap sensor in-built PT1000 temperature uncertainty |  |
| 10 | THERMOCAP1\_TEMP | ASCII\_Real | Thermocap 1 temperature in Kelvin |  |
| 11 | THERMOCAP1\_TEMP\_UNCERTAINTY | ASCII\_Real | Thermocap 1 temperature uncertainty |  |
| 12 | THERMOCAP2\_TEMP | ASCII\_Real | Thermocap 2 temperature in Kelvin |  |
| 13 | THERMOCAP2\_TEMP\_UNCERTAINTY | ASCII\_Real | Thermocap 2 temperature uncertainty |  |
|  |  |  |  |  |
|  | Derived |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | LOCAL\_RELATIVE\_HUMIDITY | ASCII\_Real | Local relative humidity |  |
| 5 | LOCAL\_RELATIVE\_HUMIDITY\_UNCERTAINTY | ASCII\_Real | Local relative humidity uncertainty |  |
| 6 | HUMIDITY\_LOCAL\_TEMP | ASCII\_Real | Humidity local temperature in Kelvin |  |
| 7 | HUMIDITY\_LOCAL\_TEMP\_UNCERTAINTY | ASCII\_Real | Humidity local temperature uncertainty |  |
| 8 | VOLUME\_MIXING\_RATIO | ASCII\_Real | Volume mixing ratio in ppm |  |
| 9 | VOLUME\_MIXING\_RATION\_UNCERTAINTY | ASCII\_Real | Volume mixing ratio uncertainty |  |
|  |  |  |  |  |
| Thermal Infrared Sensor Data | | | |  |
|  |  |  |  |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | TIRS\_TIRS1\_avg | ASCII\_Real | TIRS downward LW thermopile in volts (6.5-30 μm band) |  |
| 5 | TIRS\_TIRS2\_avg | ASCII\_Real | TIRS Air Temperature thermopile in volts (14.5-15.5 μm band) |  |
| 6 | TIRS\_TIRS3\_avg | ASCII\_Real | TIRS Upward SW thermopile in volts (0.3-3 μm band) |  |
| 7 | TIRS\_TIRS4\_avg | ASCII\_Real | TIRS Upward LW thermopile in volts (6.5-30 μm band) |  |
| 8 | TIRS\_TIRS5\_avg | ASCII\_Real | TIRS Ground Temperature thermopile in volts (8-14 μm band) |  |
| 9 | TIRS\_SUP\_1\_PLATE\_TEMP\_avg | ASCII\_Real | TIRS support plate RTD (rear side) temperature in kelvin |  |
| 10 | TIRS\_SUP\_2\_PLATE\_TEMP\_avg | ASCII\_Real | TIRS support plate RTD (front side) temperature in kelvin |  |
| 11 | TIRS\_CAL\_PLATE\_TEMP\_avg | ASCII\_Real | TIRS calibration plate RTD temperature in kelvin |  |
| 12 | TIRS\_SUPPORT\_PLATE\_HEATER\_POWER | ASCII\_Real | TIRS support plate heater driver power in watts |  |
| 13 | TIRS\_CAL\_PLATE\_STATUS | ASCII\_String | Calibration plate heater: on/off |  |
| 14 | TIRS\_RELAYS\_STATUS | ASCII\_String | Relays status: reset/set |  |
| 15 | TIRS\_SESSION | ASCII\_String | Type of session: Nominal/Cal\_cal\_plate/Cal\_sup\_plate |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | DOWNWARD\_LW\_IRRADIANCE | ASCII\_Real | TIRS Downward LW irradiance inside channel bandpass (6.5-30 μm) in watts/m2 for a hemispherical FOV |  |
| 5 | DOWNWARD\_LW\_IRRADIANCE\_UNCERTAINTY | ASCII\_Real | TIRS Downward LW irradiance inside channel bandpass (6.5-30 μm) uncertainty in watts/m2 (standard deviation) for a hemispherical FOV |  |
| 6 | AIR\_TEMP | ASCII\_Real | TIRS Air Temperature in Kelvin |  |
| 7 | AIR\_TEMP\_UNCERTAINTY | ASCII\_Real | TIRS Air Temperature uncertainty in Kelvin (standard deviation) |  |
| 8 | UPWARD\_SW\_IRRADIANCE | ASCII\_Real | TIRS Upward SW (0.3-3 μm band) in watts/m2, for a hemispherical FoV. |  |
| 9 | UPWARD\_SW\_IRRADIANCE\_UNCERTAINTY | ASCII\_Real | TIRS Upward SW uncertainty in watts/m2 (standard deviation), for a hemispherical FoV. |  |
| 10 | UPWARD\_LW\_IRRADIANCE | ASCII\_Real | TIRS Upward LW irradiance inside channel bandpass (6.5-30 μm) in watts/m2 for a hemispherical FOV |  |
| 11 | UPWARD\_LW\_IRRADIANCE\_UNCERTAINTY | ASCII\_Real | TIRS Upward LW irradiance inside channel bandpass (6.5-30 μm) uncertainty in watts/m2 (standard deviation) for a hemispherical FOV |  |
| 12 | GROUND\_TEMP | ASCII\_Real | TIRS Ground brightness temperature in Kelvin |  |
| 13 | GROUND\_TEMP\_UNCERTAINTY | ASCII\_Real | TIRS Ground brightness temperature uncertainty in Kelvin (standard deviation) |  |
| 14 | RSM\_HEAD\_OUTSIDE\_TIRS\_UPWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = RSM head obstructing the upward looking channels FoV, 1 = RSM head outside the FoV |  |
| 15 | WHEEL\_OUTSIDE\_TIRS\_DOWNWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = Front right wheel obstructing the TIRS downward looking channels FoV, 1 = Rover front right wheel outside the FoV |  |
| 16 | SUN\_OUTSIDE\_TIRS\_UPWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = Sun in the TIRS upward looking channels FoV, 1 = Sun outside the FoV |  |
| 17 | ROVER\_LOW\_TILT | ASCII\_Integer | 0 = high tilt (rover tilt >= ±20º), 1 = low (rover tilt <= ±20º). Rover tilt = (pich2 + roll2)1/2. When low tilt, TIRS channels FoV are completely covered by ground (downward looking) or sky (upward looking) |  |
| 18 | TIRS\_GROUND\_FOOTPRINT\_NOT\_IN\_SHADOW | ASCII\_Integer | 0 = Ground focused area is shadowed by the rover, 1 = Ground focused area not shadowed by the rover |  |
| 19 | ROVER\_HGA\_OFF | ASCII\_Integer | 0 = Antenna HGA is on, 1 = Antenna is off. |  |
| 20 | SKYCAM\_OFF | ASCII\_Integer | 0 = SkyCam is on, 1 = SkyCam is off |  |
|  |  |  |  |  |
|  | Derived |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | DOWNWARD\_LW\_IRRADIANCE | ASCII\_Real | TIRS Downward LW irradiance in watts/m2, for a hemispherical FOV and assuming blackbody model for the sky and Stefan-Boltzmann emission. |  |
| 5 | DOWNWARD\_LW\_IRRADIANCE\_UNCERTAINTY | ASCII\_Real | TIRS Downward LW uncertainty in watts/m2 (standard deviation) for a hemispherical FOV and assuming blackbody model for the sky and Stefan-Boltzmann emission. |  |
| 6 | UPWARD\_LW | ASCII\_Real | TIRS Upward LW in watts/m2, for a hemispherical Fov and assuming Stefan-Blotzmann emission for the ground |  |
| 7 | UPWARD\_LW\_UNCERTAINTY | ASCII\_Real | TIRS Upward LW uncertainty in watts/m2, (standard deviation) for a hemispherical Fov and assuming Stefan-Blotzmann emission for the ground |  |
| 8 | RSM\_HEAD\_OUTSIDE\_TIRS\_UPWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = RSM head obstructing the upward looking channels FoV, 1 = RSM head outside the FoV |  |
| 9 | WHEEL\_OUTSIDE\_TIRS\_DOWNWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = Front right wheel obstructing the TIRS downward looking channels FoV, 1 = Rover front right wheel outside the FoV |  |
| 10 | SUN\_OUTSIDE\_TIRS\_UPWARD\_LOOKING\_FOV | ASCII\_Integer | 0 = Sun in the TIRS upward looking channels FoV, 1 = Sun outside the FoV |  |
| 11 | ROVER\_LOW\_TILT | ASCII\_Integer | 0 = high tilt (rover tilt >= ±20º), 1 = low (rover tilt <= ±20º). Rover tilt = (pich2 + roll2)1/2. When low tilt, TIRS channels FoV are completely covered by ground (downward looking) or sky (upward looking) |  |
| 12 | TIRS\_GROUND\_FOOTPRINT\_NOT\_IN\_SHADOW | ASCII\_Integer | 0 = Ground focused area is shadowed by the rover, 1 = Ground focused area not shadowed by the rover |  |
| 13 | ROVER\_HGA\_OFF | ASCII\_Integer | 0 = Antenna HGA is on, 1 = Antenna is off. |  |
| 14 | SKYCAM\_OFF | ASCII\_Integer | 0 = SkyCam is on, 1 = SkyCam is off |  |
|  | | | |  |
| Air Temperature Sensor Data | | | |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | ATS\_ATS1 | ASCII\_Real | Thermoelectric Voltage difference of the unit mounted on the RSM at 50º in microvolts |  |
| 5 | ATS\_ATS2 | ASCII\_Real | Thermoelectric Voltage difference of the unit mounted on the RSM at 155º in microvolts |  |
| 6 | ATS\_ATS3 | ASCII\_Real | Thermoelectric Voltage difference of the unit mounted on the RSM at 290º in microvolts |  |
| 7 | ATS\_ATS4 | ASCII\_Real | Thermoelectric Voltage difference of the unit mounted on the RFB at Port side/Pilot in microvolts |  |
| 8 | ATS\_ATS5 | ASCII\_Real | Thermoelectric Voltage difference of the unit mounted on the RFB at Starboard/Co-pilot in microvolts |  |
| 9 | ATS\_ATS1\_PRT | ASCII\_Real | Pt1000 resistance of the unit mounted on the RSM at 50º in ohms |  |
| 10 | ATS\_ATS2\_PRT | ASCII\_Real | Pt1000 resistance of the unit mounted on the RSM at 155º in ohms |  |
| 11 | ATS\_ATS3\_PRT | ASCII\_Real | Pt1000 resistance of the unit mounted on the RSM at 290º in ohms |  |
| 12 | ATS\_ATS4\_PRT | ASCII\_Real | Pt1000 resistance of the unit mounted on RFB at Port side/Pilot in ohms |  |
| 13 | ATS\_ATS5\_PRT | ASCII\_Real | Pt1000 resistance of the unit mounted on RFB at Starboard/Co-pilot in ohms |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | ATS\_LOCAL\_TEMP1 | ASCII\_Real | Local air temperature near the unit mounted on the RSM at 50º in Kelvin |  |
| 5 | ATS\_LOCAL\_TEMP2 | ASCII\_Real | Local air temperature near the unit mounted on the RSM at 155º in Kelvin |  |
| 6 | ATS\_LOCAL\_TEMP3 | ASCII\_Real | Local air temperature near the unit mounted on the RSM at 290º in Kelvin |  |
| 7 | ATS\_LOCAL\_TEMP4 | ASCII\_Real | Local air temperature near the unit mounted on the RFB at Port side/Pilot in Kelvin |  |
| 8 | ATS\_LOCAL\_TEMP5 | ASCII\_Real | Local air temperature near the unit mounted on the RFB at Starboard/Co-pilot in Kelvin |  |
|  | | | |  |
| Wind Sensor Data | | | |  |
|  | | | |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | BOOM1\_BOARD1\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 1 in Boom 1 ASIC 1 |  |
| 5 | BOOM1\_BOARD1\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 1 in Boom 1 ASIC 1 |  |
| 6 | BOOM1\_BOARD1\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 1 in Boom 1 ASIC 1 |  |
| 7 | BOOM1\_BOARD1\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 1 in Boom 1 ASIC 1 |  |
| 8 | BOOM1\_BOARD2\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 2 in Boom 1 ASIC 1 |  |
| 9 | BOOM1\_BOARD2\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 2 in Boom 1 ASIC 1 |  |
| 10 | BOOM1\_BOARD2\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 2 in Boom 1 ASIC 1 |  |
| 11 | BOOM1\_BOARD2\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 2 in Boom 1 ASIC 1 |  |
| 12 | BOOM1\_BOARD3\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 3 in Boom 1 ASIC 1 |  |
| 13 | BOOM1\_BOARD3\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 3 in Boom 1 ASIC 1 |  |
| 14 | BOOM1\_BOARD3\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 3 in Boom 1 ASIC 1 |  |
| 15 | BOOM1\_BOARD3\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 3 in Boom 1 ASIC 1 |  |
| 16 | BOOM1\_BOARD4\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 1 in Boom 1 ASIC 2 |  |
| 17 | BOOM1\_BOARD4\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 1 in Boom 1 ASIC 2 |  |
| 18 | BOOM1\_BOARD4\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 1 in Boom 1 ASIC 2 |  |
| 19 | BOOM1\_BOARD4\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 1 in Boom 1 ASIC 2 |  |
| 20 | BOOM1\_BOARD5\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 2 in Boom 1 ASIC 2 |  |
| 21 | BOOM1\_BOARD5\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 2 in Boom 1 ASIC 2 |  |
| 22 | BOOM1\_BOARD5\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 2 in Boom 1 ASIC 2 |  |
| 23 | BOOM1\_BOARD5\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 2 in Boom 1 ASIC 2 |  |
| 24 | BOOM1\_BOARD6\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 3 in Boom 1 ASIC 2 |  |
| 25 | BOOM1\_BOARD6\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 3 in Boom 1 ASIC 2 |  |
| 26 | BOOM1\_BOARD6\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 3 in Boom 1 ASIC 2 |  |
| 27 | BOOM1\_BOARD6\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 3 in Boom 1 ASIC 2 |  |
| 28 | BOOM2\_BOARD1\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 1 in Boom 2 ASIC 1 |  |
| 29 | BOOM2\_BOARD1\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 1 in Boom 2 ASIC 1 |  |
| 30 | BOOM2\_BOARD1\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 1 in Boom 2 ASIC 1 |  |
| 31 | BOOM2\_BOARD1\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 1 in Boom 2 ASIC 1 |  |
| 32 | BOOM2\_BOARD2\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 2 in Boom 2 ASIC 1 |  |
| 33 | BOOM2\_BOARD2\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 2 in Boom 2 ASIC 1 |  |
| 34 | BOOM2\_BOARD2\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 2 in Boom 2 ASIC 1 |  |
| 35 | BOOM2\_BOARD2\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 2 in Boom 2 ASIC 1 |  |
| 36 | BOOM2\_BOARD3\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 3 in Boom 2 ASIC 1 |  |
| 37 | BOOM2\_BOARD3\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 3 in Boom 2 ASIC 1 |  |
| 38 | BOOM2\_BOARD3\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 3 in Boom 2 ASIC 1 |  |
| 39 | BOOM2\_BOARD3\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 3 in Boom 2 ASIC 1 |  |
| 40 | BOOM2\_BOARD4\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 1 in Boom 2 ASIC 2 |  |
| 41 | BOOM2\_BOARD4\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 1 in Boom 2 ASIC 2 |  |
| 42 | BOOM2\_BOARD4\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 1 in Boom 2 ASIC 2 |  |
| 43 | BOOM2\_BOARD4\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 1 in Boom 2 ASIC 2 |  |
| 44 | BOOM2\_BOARD5\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 2 in Boom 2 ASIC 2 |  |
| 45 | BOOM2\_BOARD5\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 2 in Boom 2 ASIC 2 |  |
| 46 | BOOM2\_BOARD5\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 2 in Boom 2 ASIC 2 |  |
| 47 | BOOM2\_BOARD5\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 2 in Boom 2 ASIC 2 |  |
| 48 | BOOM2\_BOARD6\_B1 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 1 of Transducer 3 in Boom 2 ASIC 2 |  |
| 49 | BOOM2\_BOARD6\_B2 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 2 of Transducer 3 in Boom 2 ASIC 2 |  |
| 50 | BOOM2\_BOARD6\_B3 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 3 of Transducer 3 in Boom 2 ASIC 2 |  |
| 51 | BOOM2\_BOARD6\_B4 | ASCII\_Real | Adimensional Thermal Convection Conductance for Die 4 of Transducer 3 in Boom 2 ASIC 2 |  |
| 52 | BOOM1\_BOARD1\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 1 Cold Die in Kelvin |  |
| 53 | BOOM1\_BOARD2\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 2 Cold Die in Kelvin |  |
| 54 | BOOM1\_BOARD3\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 3 Cold Die in Kelvin |  |
| 55 | BOOM1\_BOARD4\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 1 Cold Die in Kelvin |  |
| 56 | BOOM1\_BOARD5\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 2 Cold Die in Kelvin |  |
| 57 | BOOM1\_BOARD6\_TCOLD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 3 Cold Die in Kelvin |  |
| 58 | BOOM2\_BOARD1\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 1 Cold Die in Kelvin |  |
| 59 | BOOM2\_BOARD2\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 2 Cold Die in Kelvin |  |
| 60 | BOOM2\_BOARD3\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 3 Cold Die in Kelvin |  |
| 61 | BOOM2\_BOARD4\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 1 Cold Die in Kelvin |  |
| 62 | BOOM2\_BOARD5\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 2 Cold Die in Kelvin |  |
| 63 | BOOM2\_BOARD6\_TCOLD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 3 Cold Die in Kelvin |  |
| 64 | BOOM1\_BOARD1\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 1 PT1000 in Kelvin |  |
| 65 | BOOM1\_BOARD2\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 2 PT1000 in Kelvin |  |
| 66 | BOOM1\_BOARD3\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 1 Transducer 3 PT1000 in Kelvin |  |
| 67 | BOOM1\_BOARD4\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 1 PT1000 in Kelvin |  |
| 68 | BOOM1\_BOARD5\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 2 PT1000 in Kelvin |  |
| 69 | BOOM1\_BOARD6\_TBOARD | ASCII\_Real | Temperature of Boom 1 ASIC 2 Transducer 3 PT1000 in Kelvin |  |
| 70 | BOOM2\_BOARD1\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 1 PT1000 in Kelvin |  |
| 71 | BOOM2\_BOARD2\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 2 PT1000 in Kelvin |  |
| 72 | BOOM2\_BOARD3\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 1 Transducer 3 PT1000 in Kelvin |  |
| 73 | BOOM2\_BOARD4\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 1 PT1000 in Kelvin |  |
| 74 | BOOM2\_BOARD5\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 2 PT1000 in Kelvin |  |
| 75 | BOOM2\_BOARD6\_TBOARD | ASCII\_Real | Temperature of Boom 2 ASIC 2 Transducer 3 PT1000 in Kelvin |  |
| 76 | BOOM1\_BOARD1\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 1 of Boom 1 ASIC 1 |  |
| 77 | BOOM1\_BOARD2\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 2 of Boom 1 ASIC 1 |  |
| 78 | BOOM1\_BOARD3\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 3 of Boom 1 ASIC 1 |  |
| 79 | BOOM1\_BOARD4\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 1 of Boom 1 ASIC 2 |  |
| 80 | BOOM1\_BOARD5\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 2 of Boom 1 ASIC 2 |  |
| 81 | BOOM1\_BOARD6\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 3 of Boom 1 ASIC 3 |  |
| 82 | BOOM2\_BOARD1\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 1 of Boom 2 ASIC 1 |  |
| 83 | BOOM2\_BOARD2\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 2 of Boom 2 ASIC 1 |  |
| 84 | BOOM2\_BOARD3\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 3 of Boom 2 ASIC 1 |  |
| 85 | BOOM2\_BOARD4\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 1 of Boom 2 ASIC 2 |  |
| 86 | BOOM2\_BOARD5\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 2 of Boom 2 ASIC 2 |  |
| 87 | BOOM2\_BOARD6\_Control\_Alg\_State | ASCII\_Integer | Wind Control Algorithm State for Transducer 3 of Boom 3 ASIC |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | BOOM1\_HORIZONTAL\_WIND\_SPEED | ASCII\_Real | Boom 1 wind horizontal speed, in meters/second |  |
| 5 | BOOM1\_HORIZONTAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Boom 1 wind horizontal speed uncertainty |  |
| 6 | BOOM1\_VERTICAL\_WIND\_SPEED | ASCII\_Real | Boom 1 wind vertical speed, in meters/second |  |
| 7 | BOOM1\_VERTICAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Boom 1 wind vertical speed uncertainty |  |
| 8 | BOOM1\_WIND\_DIRECTION | ASCII\_Real | Boom 1 wind direction |  |
| 9 | BOOM1\_WIND\_DIRECTION\_UNCERTAINTY | ASCII\_Real | Boom 1 wind direction uncertainty |  |
| 10 | BOOM2\_HORIZONTAL\_WIND\_SPEED | ASCII\_Real | Boom 2 wind horizontal speed, in meters/second |  |
| 11 | BOOM2\_HORIZONTAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Boom 2 wind horizontal speed uncertainty |  |
| 12 | BOOM2\_VERTICAL\_WIND\_SPEED | ASCII\_Real | Boom 2 wind vertical speed, in meters/second |  |
| 13 | BOOM2\_VERTICAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Boom 2 wind horizontal speed uncertainty |  |
| 14 | BOOM2\_WIND\_DIRECTION | ASCII\_Real | Boom 2 wind direction |  |
| 15 | BOOM2\_WIND\_DIRECTION\_UNCERTAINTY | ASCII\_Real | Boom 2 wind direction uncertainty |  |
| 16 | BOOM1\_ALG\_IN\_STABLE\_STATE | ASCII\_Integer | 0 = Boom 1 control algorithm is changing state, 1 = Boom 1 control algorithm not changing state |  |
| 17 | BOOM2\_ALG\_IN\_STABLE\_STATE | ASCII\_Integer | 0 = Boom 2 control algorithm is changing state, 1 = Boom 2 control algorithm not changing state |  |
| 18 | ARM\_NOT\_BLOCKING\_BOOM1 | ASCII\_Integer | 0 = Rover arm blocking wind to Boom 1, 1 = Rover arm not blocking wind to Boom 1 |  |
| 19 | ARM\_NOT\_BLOCKING\_BOOM2 | ASCII\_Integer | 0 = Rover arm blocking wind to Boom 2, 1 = Rover arm not blocking wind to Boom 2 |  |
| 20 | ROVER\_STILL | ASCII\_Integer | 0 = Rover is moving, 1 = Rover is motionless |  |
|  |  |  |  |  |
|  | Derived |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | HORIZONTAL\_WIND\_SPEED | ASCII\_Real | Wind horizontal speed, in meters/second |  |
| 5 | HORIZONTAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Wind horizontal speed uncertainty |  |
| 6 | VERTICAL\_WIND\_SPEED | ASCII\_Real | Wind vertical speed, in meters/second |  |
| 7 | VERTICAL\_WIND\_SPEED\_UNCERTAINTY | ASCII\_Real | Wind vertical speed uncertainty |  |
| 8 | WIND\_DIRECTION | ASCII\_Real | Wind direction |  |
| 9 | WIND\_DIRECTION\_UNCERTAINTY | ASCII\_Real | Wind direction uncertainty |  |
| 10 | BOTH\_BOOMS\_USED\_FOR\_RETRIEVAL | ASCII\_Integer | 0 = only one boom was powered on and used to determine wind, 1 = both booms were used to determine wind |  |
| 11 | ROVER\_STILL | ASCII\_Integer | 0 = Rover is moving, 1 = Rover is motionless |  |
|  | | | |  |
| RDS Data | | | |  |
|  | | | |  |
|  | Partially processed |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | RDS\_LAT\_1 | ASCII\_Real | Lateral Mount Photodiode 1 current in amps |  |
| 5 | RDS\_LAT\_2 | ASCII\_Real | Lateral Mount Photodiode 2 current |  |
| 6 | RDS\_LAT\_3 | ASCII\_Real | Lateral Mount Photodiode 3 current |  |
| 7 | RDS\_LAT\_4 | ASCII\_Real | Lateral Mount Photodiode 4 current |  |
| 8 | RDS\_LAT\_5 | ASCII\_Real | Lateral Mount Photodiode 5 current |  |
| 9 | RDS\_LAT\_6 | ASCII\_Real | Lateral Mount Photodiode 6 current |  |
| 10 | RDS\_LAT\_7 | ASCII\_Real | Lateral Mount Photodiode 7 current |  |
| 11 | RDS\_LAT\_8 | ASCII\_Real | Lateral Mount Photodiode 7 current |  |
| 12 | RDS\_TOP\_1 | ASCII\_Real | Top Mount Photodiode 1 current |  |
| 13 | RDS\_TOP\_2 | ASCII\_Real | Top Mount Photodiode 2 current |  |
| 14 | RDS\_TOP\_3 | ASCII\_Real | Top Mount Photodiode 3 current |  |
| 15 | RDS\_TOP\_4 | ASCII\_Real | Top Mount Photodiode 4 current |  |
| 16 | RDS\_TOP\_5 | ASCII\_Real | Top Mount Photodiode 5 current |  |
| 17 | RDS\_TOP\_6 | ASCII\_Real | Top Mount Photodiode 6 current |  |
| 18 | RDS\_TOP\_7 | ASCII\_Real | Top Mount Photodiode 7 current |  |
| 19 | RDS\_TOP\_8 | ASCII\_Real | Top Mount Photodiode 8 current |  |
| 20 | RDS\_LAT\_1\_HG | ASCII\_Real | Lateral Mount Photodiode 1 in High Gain mode current |  |
| 21 | RDS\_LAT\_2\_HG | ASCII\_Real | Lateral Mount Photodiode 2 in High Gain mode current |  |
| 22 | RDS\_LAT\_3\_HG | ASCII\_Real | Lateral Mount Photodiode 3 in High Gain mode current |  |
| 23 | RDS\_LAT\_4\_HG | ASCII\_Real | Lateral Mount Photodiode 4 in High Gain mode current |  |
| 24 | RDS\_LAT\_5\_HG | ASCII\_Real | Lateral Mount Photodiode 5 in High Gain mode current |  |
| 25 | RDS\_LAT\_6\_HG | ASCII\_Real | Lateral Mount Photodiode 6 in High Gain mode current |  |
| 26 | RDS\_LAT\_7\_HG | ASCII\_Real | Lateral Mount Photodiode 7 in High Gain mode current |  |
| 27 | RDS\_LAT\_8\_HG | ASCII\_Real | Lateral Mount Photodiode 7 in High Gain mode current |  |
| 28 | RDS\_TOP\_1\_HG | ASCII\_Real | Top Mount Photodiode 1 in High Gain mode current |  |
| 29 | RDS\_TOP\_2\_HG | ASCII\_Real | Top Mount Photodiode 2 in High Gain mode current |  |
| 30 | RDS\_TOP\_3\_HG | ASCII\_Real | Top Mount Photodiode 3 in High Gain mode current |  |
| 31 | RDS\_TOP\_4\_HG | ASCII\_Real | Top Mount Photodiode 4 in High Gain mode current |  |
| 32 | RDS\_TOP\_5\_HG | ASCII\_Real | Top Mount Photodiode 5 in High Gain mode current |  |
| 33 | RDS\_TOP\_6\_HG | ASCII\_Real | Top Mount Photodiode 6 in High Gain mode current |  |
| 34 | RDS\_TOP\_7\_HG | ASCII\_Real | Top Mount Photodiode 7 in High Gain mode current |  |
| 35 | RDS\_TOP\_8\_HG | ASCII\_Real | Top Mount Photodiode 8 in High Gain mode current |  |
| 36 | RDS\_LAT\_TEMP\_2 | ASCII\_Real | Lateral Mount Photodiode 2 temperature in kelvin |  |
| 37 | RDS\_LAT\_TEMP\_4 | ASCII\_Real | Lateral Mount Photodiode 4 temperature in kelvin |  |
| 38 | RDS\_LAT\_TEMP\_6 | ASCII\_Real | Lateral Mount Photodiode 6 temperature in kelvin |  |
| 39 | RDS\_LAT\_TEMP\_8 | ASCII\_Real | Lateral Mount Photodiode 8 temperature in kelvin |  |
| 40 | RDS\_TOP\_TEMP\_1 | ASCII\_Real | Top Mount Photodiode 1 temperature in kelvin |  |
| 41 | RDS\_TOP\_TEMP\_3 | ASCII\_Real | Top Mount Photodiode 3 temperature in kelvin |  |
| 42 | RDS\_TOP\_TEMP\_5 | ASCII\_Real | Top Mount Photodiode 5 temperature in kelvin |  |
| 43 | RDS\_TOP\_TEMP\_7 | ASCII\_Real | Top Mount Photodiode 7 temperature in kelvin |  |
| 44 | RDS\_5V\_IN | ASCII\_Real | Sensed Input 5V Voltage from ICU |  |
| 45 | RDS\_5V\_DIG | ASCII\_Real | Sensed Internal Digital 5V Voltage |  |
| 46 | RDS\_TEMP\_DD | ASCII\_Real | Displacement Damage sensor temperature in kelvin |  |
| 47 | RDS\_DD | ASCII\_Real | Displacement Damage Sensor voltage |  |
| 48 | RDS\_REF\_DD | ASCII\_Real | Voltage Reference of the Displacement Damage Sensor |  |
| 49 | RDS\_REF\_TIA | ASCII\_Real | Voltage Reference for Trans-Impedance Amplifier |  |
| 50 | RDS\_TEMP\_PE | ASCII\_Real | Processing Electronics temperature in kelvin |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | RDS\_LAT\_1 | ASCII\_Real | Lateral Mount Photodiode 1 temperature corrected current in amps (non-optical channel) |  |
| 5 | RDS\_LAT\_2 | ASCII\_Real | Lateral Mount Photodiode 2 radiance integrated over Field of View in W/m2 |  |
| 6 | RDS\_LAT\_3 | ASCII\_Real | Lateral Mount Photodiode 3 radiance integrated over Field of View in W/m2 |  |
| 7 | RDS\_LAT\_4 | ASCII\_Real | Lateral Mount Photodiode 4 radiance integrated over Field of View in W/m2 |  |
| 8 | RDS\_LAT\_5 | ASCII\_Real | Lateral Mount Photodiode 5 radiance integrated over Field of View in W/m2 |  |
| 9 | RDS\_LAT\_6 | ASCII\_Real | Lateral Mount Photodiode 6 radiance integrated over Field of View in W/m2 |  |
| 10 | RDS\_LAT\_7 | ASCII\_Real | Lateral Mount Photodiode 7 radiance integrated over Field of View in W/m2 |  |
| 11 | RDS\_LAT\_8 | ASCII\_Real | Lateral Mount Photodiode 7 radiance integrated over Field of View in W/m2 |  |
| 12 | RDS\_TOP\_1 | ASCII\_Real | Top Mount Photodiode 1 radiance integrated over Field of View in W/m2 |  |
| 13 | RDS\_TOP\_2 | ASCII\_Real | Top Mount Photodiode 2 radiance integrated over Field of View in W/m2 |  |
| 14 | RDS\_TOP\_3 | ASCII\_Real | Top Mount Photodiode 3 radiance integrated over Field of View in W/m2 |  |
| 15 | RDS\_TOP\_4 | ASCII\_Real | Top Mount Photodiode 4 radiance integrated over Field of View in W/m2 |  |
| 16 | RDS\_TOP\_5 | ASCII\_Real | Top Mount Photodiode 5 radiance integrated over Field of View in W/m2 |  |
| 17 | RDS\_TOP\_6 | ASCII\_Real | Top Mount Photodiode 6 radiance integrated over Field of View in W/m2 |  |
| 18 | RDS\_TOP\_7 | ASCII\_Real | Top Mount Photodiode 7 radiance integrated over Field of View in W/m2 |  |
| 19 | RDS\_TOP\_8 | ASCII\_Real | Top Mount Photodiode 8 radiance integrated over Field of View in W/m2 |  |
| 20 | RDS\_LAT\_1\_HG | ASCII\_Real | Lateral Mount Photodiode 1 in High Gain mode temperature corrected current amps (non-optical channel) |  |
| 21 | RDS\_LAT\_2\_HG | ASCII\_Real | Lateral Mount Photodiode 2 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 22 | RDS\_LAT\_3\_HG | ASCII\_Real | Lateral Mount Photodiode 3 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 23 | RDS\_LAT\_4\_HG | ASCII\_Real | Lateral Mount Photodiode 4 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 24 | RDS\_LAT\_5\_HG | ASCII\_Real | Lateral Mount Photodiode 5 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 25 | RDS\_LAT\_6\_HG | ASCII\_Real | Lateral Mount Photodiode 6 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 26 | RDS\_LAT\_7\_HG | ASCII\_Real | Lateral Mount Photodiode 7 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 27 | RDS\_LAT\_8\_HG | ASCII\_Real | Lateral Mount Photodiode 8 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 28 | RDS\_TOP\_1\_HG | ASCII\_Real | Top Mount Photodiode 1 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 29 | RDS\_TOP\_2\_HG | ASCII\_Real | Top Mount Photodiode 2 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 30 | RDS\_TOP\_3\_HG | ASCII\_Real | Top Mount Photodiode 3 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 31 | RDS\_TOP\_4\_HG | ASCII\_Real | Top Mount Photodiode 4 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 32 | RDS\_TOP\_5\_HG | ASCII\_Real | Top Mount Photodiode 5 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 33 | RDS\_TOP\_6\_HG | ASCII\_Real | Top Mount Photodiode 6 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 34 | RDS\_TOP\_7\_HG | ASCII\_Real | Top Mount Photodiode 7 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 35 | RDS\_TOP\_8\_HG | ASCII\_Real | Top Mount Photodiode 8 in High Gain mode radiance integrated over Field of View in W/m2 |  |
| 36 | RSM\_HEAD\_OUTSIDE\_RDS\_LOOKING\_FOV | ASCII\_Integer | 0 = RSM head obstructing the RDS FoV, 1 = RSM head outside the FoV |  |
| 37 | ARM\_OUTSIDE\_RDS\_LOOKING\_FOV | ASCII\_Integer | 0 = Arm obstructing the RDS FoV, 1 = Arm outside the FoV |  |
| 38 | ROVER\_HGA\_OFF | ASCII\_Integer | 0 = Antenna HGA is on, 1 = Antenna is off. |  |
| 39 | ROVER\_STILL | ASCII\_Integer | 0 = Rover is moving, 1 = Rover is motionless |  |
|  |  |  |  |  |
| ICU Analog Engineering Data | | | |  |
|  |  |  |  |  |
|  | Calibrated |  |  |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | ICU\_Analog\_TH\_HK\_TM | ASCII\_Integer | ICU PSU PCB hot spot temperature in Kelvin |  |
| 5 | ICU\_Analog\_H\_PRT\_TEMP\_1 | ASCII\_Integer | HS HPRT regeneration temperature measurement in Kelvin |  |
| 6 | ICU\_Analog\_TIRS\_ACQ\_TEMP\_TM | ASCII\_Integer | ICU TIRS conditioning amplifier temperature in Kelvin |  |
| 7 | ICU\_Analog\_5V\_CURRENT\_TM | ASCII\_Integer | 5 volts rail current in amps. Used for power supply to WS1, WS2 and ICU CPU |  |
| 8 | ICU\_Analog\_8V\_CURRENT\_TM | ASCII\_Integer | +8 volts rail current in amps. Used for power supply to RDS SkyCam, to RDS and to the HS Heater |  |
| 9 | ICU\_Analog\_11VN\_CURRENT\_TM | ASCII\_Integer | -11 volts rail current in amps. Used for power supply to RDS SkyCam |  |
| 10 | ICU\_Analog\_3V3\_HK\_MUX | ASCII\_Integer | 3V3 voltage HK voltage. ICU CPU supply secondary line |  |
| 11 | ICU\_Analog\_POWER\_H\_SENSE | ASCII\_Integer | Not implemented |  |
| 12 | ICU\_Analog\_POWER\_P1 | ASCII\_Integer | PS oscillator 1 power supply voltage |  |
| 13 | ICU\_Analog\_R1\_CAL\_PRT | ASCII\_Integer | Calibration 1 reference for PRT acquisition in ohms. 1Kohm resistor measurement used for ICU ADC calibrations |  |
| 14 | ICU\_Analog\_POWER\_P2 | ASCII\_Integer | PS oscillator 2 power supply voltage |  |
| 15 | ICU\_Analog\_R2\_CAL\_PRT | ASCII\_Integer | Calibration 2 reference for PRT acquisition in ohms. 499 ohms resistor measurement used for ICU ADC calibrations |  |
| 16 | ICU\_Analog\_8V\_FRANGI\_TM | ASCII\_Integer | Frangibolt driving voltage. Measurement of ICU voltage provided for frangibolt actuation. Measurement performed between the Arming switch and the Firing switches |  |
| 17 | ICU\_Analog\_MEDA\_RDS\_TEMP | ASCII\_Integer | RDS photodetectors electronics internal temperature in Kelvin |  |
| 18 | ICU\_Analog\_B1\_SEC\_PWR\_TLM | ASCII\_Integer | Wind Sensor 1 Power Supply voltage |  |
| 19 | ICU\_Analog\_CAM\_PCB\_PRT | ASCII\_Integer | Skycam electronics PCB temperature in Kelvin |  |
| 20 | ICU\_Analog\_B2\_SEC\_PWR\_TLM | ASCII\_Integer | Wind Sensor 2 Power Supply voltage |  |
| 21 | ICU\_Analog\_CAM\_CCD\_PRT | ASCII\_Integer | Skycam CCD temperature in Kelvin |  |
| 22 | ICU\_Analog\_8V\_H\_PRT\_TM | ASCII\_Integer | HS PRT heater voltage |  |
| 23 | ICU\_Analog\_H\_PRT\_TEMP\_2 | ASCII\_Integer | HS humicap reference temperature in Kelvin (4 wire measurement) |  |
| 24 | ICU\_Analog\_12V\_HTR\_CURRENT\_TM | ASCII\_Integer | TIRS Heaters current in amps |  |
| 25 | ICU\_Analog\_WS1\_PRT | ASCII\_Integer | WS1 platinum thermistor in Kelvin. Measurement of the temperature of the WS1 ASIC reference resistor in WS Acquisition board 2 |  |
| 26 | ICU\_Analog\_WS2\_PRT | ASCII\_Integer | WS2 frangibolt built-in platinum resistor measurement in Kelvin |  |
|  |  |  |  |  |
| Ancillary Data | | | |  |
|  | | | |  |
| **#** | **Column** | **Data Type** | **Description** |  |
| 1 | SCLK | ASCII\_Real | Spacecraft Clock |  |
| 2 | LMST | ASCII\_String | Local Mean Solar Time |  |
| 3 | LTST | ASCII\_String | Local True Solar Time |  |
| 4 | SOLAR\_LONGITUDE\_ANGLE | ASCII\_Real | Solar longitude angle, relative to rover local level frame rotated 180º over the X axis (+Z points up) |  |
| 5 | SOLAR\_ZENITHAL\_ANGLE | ASCII\_Real | Solar angle from the zenith, relative to rover local level frame rotated 180º over the X axis (+Z points up) |  |
| 6 | ROVER\_POSITION\_X | ASCII\_Real | X axis component of the rover position relative to landing site |  |
| 7 | ROVER\_POSITION\_Y | ASCII\_Real | Y axis component of the rover position relative to landing site |  |
| 8 | ROVER\_POSITION\_Z | ASCII\_Real | Z axis component of the rover position relative to landing site |  |
| 9 | ROVER\_VELOCITY | ASCII\_Real | Rover velocity |  |
| 10 | ROVER\_PITCH | ASCII\_Real | Rover pitch |  |
| 11 | ROVER\_YAW | ASCII\_Real | Rover yaw |  |
| 12 | ROVER\_ROLL | ASCII\_Real | Rover roll |  |
| 13 | MASTHEAD\_AZIMUTH | ASCII\_Real | Masthead azimuth angle |  |
| 14 | MASTHEAD\_ELEVATION | ASCII\_Real | Masthead elevation angle |  |