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# **MRO Mission Data Dictionary**

**NASA Planetary Data System**

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# USER GUIDE

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The Mars Reconnaissance Orbiter Mission Dictionary (mro) contains classes, attributes and rules specific to the MRO mission and its instruments.

PDS4 Mars Reconnaissance Orbiter Mission Dictionary User's Guide  
2024-01-09 Jennifer Ward



## INTRODUCTION

### 1. Purpose of this User's Guide

- This User's Guide provides an overview of the MRO Mission Data Dictionary. It details how to include the dictionary in a PDS4 label, describes the organization of classes and attributes, provides definitions of the classes and attributes, and lists examples of labels that use it.

### 2. Audience

- This User's Guide should be useful to data providers intending to archive MRO data with PDS as well as PDS Nodes who are working with these data providers.





## **OVERVIEW OF THE MRO MISSION DATA DICTIONARY**

The MRO Mission Data Dictionary contains classes, attributes, and rules specific to the MRO mission and its instruments. Steward: Jennifer Ward, PDS Geosciences Node, [geosci@wunder.wustl.edu](mailto:geosci@wunder.wustl.edu)



## HOW TO INCLUDE THE MRO MISSION DATA DICTIONARY IN A PDS4 LABEL

The dictionary consists of a set of files with names in the form PDS4\_MRO\_xxxx\_yyyy.ext, where

- xxxx = the PDS4 Information Model version, e.g. 1I00
- yyyy = the MRO Mission Dictionary version, e.g. 1300

and the file extensions are

- .csv = A comma-separated value table of dictionary attributes
- .JSON = The dictionary contents in JSON format
- .sch = The dictionary “rules” as an XML Schematron file
- .txt = The report generated when the dictionary was built
- .xml = The PDS4 label that describes this set of files
- .xsd = The dictionary contents as an XML schema file

Only the schema and Schematron files are needed for validating a PDS4 label.

The latest version of this dictionary may be found on the PDS web site at <https://pds.nasa.gov/datastandards/dictionaries/index-missions.shtml#mro>.

The following is an example showing the use of this dictionary in a PDS4 label.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1I00.sch" schematypens=
↪ "http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="https://pds.nasa.gov/pds4/mission/mro/v1/PDS4_MRO_1I00_1300.sch"
↪ schematypens="http://purl.oclc.org/dsdl/schematron"?>
<Product_Observational xmlns="http://pds.nasa.gov/pds4/pds/v1"
  xmlns:mro="http://pds.nasa.gov/pds4/mission/mro/v1"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://pds.nasa.gov/pds4/pds/v1      https://pds.nasa.
↪ gov/pds4/pds/v1/PDS4_PDS_1I00.xsd
                        http://pds.nasa.gov/pds4/mission/mro/v1      https://pds.nasa.
↪ gov/pds4/mission/mro/v1/PDS4_MRO_1I00_1300.xsd">
```

The following is an example showing the location of the MRO dictionary classes and attributes in a PDS4 label.

```
<Observation_Area>
  ...
  <Mission_Area>
```

(continues on next page)

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```
<mro:MRO_Parameters>
  <mro:product_type>
  <mro:product_version_id>
  <mro:release_id>
  <mro:observation_rationale>
  <mro:orbit_number>
  <mro:mission_phase_name>
  <mro:spacecraft_clock_count_partition>
  <mro:spacecraft_clock_start_count>
  <mro:spacecraft_clock_stop_count>
  <mro:producer_institution_name>
  <mro:HiRISE_Time_Parameters>
  ...
  <mro:HiRISE_Instrument_Setting_Parameters>
  ...
  <mro:HiRISE_Temperature_Parameters>
  ...
  <mro:HiRISE_Power_Parameters>
  ...
  <mro:HiRISE_RDR_Parameters>
  ...
  <mro:CRISM_Parameters>
  ...
  <mro:SHARAD_Parameters>
  ...
  <mro:CRISM_ATO_Parameters>
  ...
```

The namespace for the MRO Mission Dictionary is <http://pds.nasa.gov/pds4/mission/mro/v1>, abbreviated “mro:”.

## ORGANIZATION OF CLASSES AND ATTRIBUTES

See the schematic for a visual representation of the classes and attributes.

Below is a list showing the hierarchy of classes in order of appearance in the PDS4 label. See the Definitions section for complete definitions.

- MRO\_Parameters class
  - HiRISE\_Time\_Parameters class
  - HiRISE\_Instrument\_Setting\_Parameters class
  - HiRISE\_Temperature\_Parameters class
  - HiRISE\_Power\_Parameters class
  - HiRISE\_RDR\_Parameters class
  - CRISM\_Parameters class
    - \* CRISM\_Temperatures subclass
    - \* CRISM\_Band subclass
  - SHARAD\_Parameters class
    - \* SHARAD\_Observation\_Parameters
    - \* Array\_Sampled subclass
  - CRISM\_ATO\_Parameters class

Below are lists showing the hierarchy of class attributes in order of appearance in the PDS4 label. See the Definitions section for complete definitions.

### 4.1 MRO\_Parameters Class

- product\_type
- product\_version\_id
- release\_id
- observation\_rationale
- orbit\_number
- mission\_phase\_name
- spacecraft\_clock\_count\_partition

- spacecraft\_clock\_start\_count
- spacecraft\_clock\_stop\_count
- producer\_institution\_name
- HiRISE\_Time\_Parameters
- HiRISE\_Instrument\_Setting\_Parameters
- HiRISE\_Temperature\_Parameters
- HiRISE\_Power\_Parameters
- HiRISE\_RDR\_Parameters
- CRISM\_Parameters
- SHARAD\_Parameters
- CRISM\_ATO\_Parameters

### 4.2 HiRISE\_Time\_Parameters Class

- observation\_start\_time
- readout\_start\_time
- readout\_start\_count

### 4.3 HiRISE\_Instrument\_Setting\_Parameters Class

- cpmm\_number
- channel\_number
- scan\_exposure\_duration
- line\_exposure\_duration
- image\_exposure\_duration
- delta\_line\_timer\_count
- powered\_cpmm\_flag\_01
- powered\_cpmm\_flag\_02
- powered\_cpmm\_flag\_03
- powered\_cpmm\_flag\_04
- powered\_cpmm\_flag\_05
- powered\_cpmm\_flag\_06
- powered\_cpmm\_flag\_07
- powered\_cpmm\_flag\_08
- powered\_cpmm\_flag\_09
- powered\_cpmm\_flag\_10
- powered\_cpmm\_flag\_11

- powered\_cpmm\_flag\_12
- powered\_cpmm\_flag\_13
- powered\_cpmm\_flag\_14
- binning
- tdi
- trim\_lines
- focus\_position\_count
- felics\_compression\_flag
- stimulation\_lamp\_flag\_01
- stimulation\_lamp\_flag\_02
- stimulation\_lamp\_flag\_03
- heater\_control\_mode
- heater\_control\_flag\_01
- heater\_control\_flag\_02
- heater\_control\_flag\_03
- heater\_control\_flag\_04
- heater\_control\_flag\_05
- heater\_control\_flag\_06
- heater\_control\_flag\_07
- heater\_control\_flag\_08
- heater\_control\_flag\_09
- heater\_control\_flag\_10
- heater\_control\_flag\_11
- heater\_control\_flag\_12
- heater\_control\_flag\_13
- heater\_control\_flag\_14
- lookup\_table\_type
- lookup\_table\_minimum
- lookup\_table\_maximum
- lookup\_table\_median
- lookup\_table\_k\_value
- lookup\_table\_number
- adc\_timing\_settings\_image
- adc\_timing\_settings\_reset
- dll\_locked\_flag\_01
- dll\_locked\_flag\_02

- dll\_locked\_once\_flag\_01
- dll\_locked\_once\_flag\_02
- dll\_reset\_count
- dll\_frequency\_correct\_count

## **4.4 HiRISE\_Temperature\_Parameters Class**

- opt\_bnch\_flexure\_temperature
- opt\_bnch\_mirror\_temperature
- opt\_bnch\_fold\_flat\_temperature
- opt\_bnch\_fpa\_temperature
- opt\_bnch\_fpe\_temperature
- opt\_bnch\_living\_rm\_temperature
- opt\_bnch\_box\_beam\_temperature
- opt\_bnch\_cover\_temperature
- field\_stop\_temperature
- fpa\_positive\_y\_temperature
- fpa\_negative\_y\_temperature
- fpe\_temperature
- primary\_mirror\_mnt\_temperature
- primary\_mirror\_temperature
- primary\_mirror\_baf\_temperature
- ms\_truss\_leg\_0\_a\_temperature
- ms\_truss\_leg\_0\_b\_temperature
- ms\_truss\_leg\_120\_a\_temperature
- ms\_truss\_leg\_120\_b\_temperature
- ms\_truss\_leg\_240\_a\_temperature
- ms\_truss\_leg\_240\_b\_temperature
- barrel\_baffle\_temperature
- sun\_shade\_temperature
- spider\_leg\_30\_temperature
- spider\_leg\_150\_temperature
- spider\_leg\_270\_temperature
- sec\_mirror\_mtr\_rng\_temperature
- sec\_mirror\_temperature
- sec\_mirror\_baffle\_temperature



- `iea_temperature`
- `focus_motor_temperature`
- `ie_pws_board_temperature`
- `cpmm_pws_board_temperature`
- `mech_tlm_board_temperature`
- `inst_cont_board_temperature`

## 4.5 HiRISE\_Power\_Parameters Class

- `cpmm_positive_29_voltage`
- `cpmm_positive_29_current`
- `cpmm_positive_10_voltage`
- `cpmm_positive_10_current`
- `cpmm_positive_5_voltage`
- `cpmm_positive_5_current`
- `cpmm_positive_3_3_voltage`
- `cpmm_positive_3_3_current`
- `cpmm_positive_2_5_voltage`
- `cpmm_positive_2_5_current`
- `cpmm_positive_1_8_voltage`
- `cpmm_positive_1_8_current`
- `cpmm_negative_5_voltage`
- `cpmm_negative_5_current`
- `heater_current`
- `inst_cont_fpga_pos_2_5_voltage`
- `mech_tlm_fpga_pos_2_5_voltage`
- `iea_positive_28_voltage`
- `iea_negative_15_voltage`
- `iea_positive_15_voltage`
- `iea_positive_5_voltage`

## 4.6 HiRISE\_RDR\_Parameters Class

- ccd\_flag\_red0
- ccd\_flag\_red1
- ccd\_flag\_red2
- ccd\_flag\_red3
- ccd\_flag\_red4
- ccd\_flag\_red5
- ccd\_flag\_red6
- ccd\_flag\_red7
- ccd\_flag\_red8
- ccd\_flag\_red9
- ccd\_flag\_ir10
- ccd\_flag\_ir11
- ccd\_flag\_bg12
- ccd\_flag\_bg13
- binning\_red0
- binning\_red1
- binning\_red2
- binning\_red3
- binning\_red4
- binning\_red5
- binning\_red6
- binning\_red7
- binning\_red8
- binning\_red9
- binning\_ir10
- binning\_ir11
- binning\_bg12
- binning\_bg13
- tdi\_red0
- tdi\_red1
- tdi\_red2
- tdi\_red3
- tdi\_red4
- tdi\_red5

- tdi\_red6
- tdi\_red7
- tdi\_red8
- tdi\_red9
- tdi\_ir10
- tdi\_ir11
- tdi\_bg12
- tdi\_bg13
- special\_processing\_flag\_red0
- special\_processing\_flag\_red1
- special\_processing\_flag\_red2
- special\_processing\_flag\_red3
- special\_processing\_flag\_red4
- special\_processing\_flag\_red5
- special\_processing\_flag\_red6
- special\_processing\_flag\_red7
- special\_processing\_flag\_red8
- special\_processing\_flag\_red9
- special\_processing\_flag\_ir10
- special\_processing\_flag\_ir11
- special\_processing\_flag\_bg12
- special\_processing\_flag\_bg13
- minimum\_stretch
- maximum\_stretch

## 4.7 CRISM\_Parameters Class

- observation\_type
- observation\_id
- observation\_number
- activity\_id
- sensor\_id
- CRISM\_Temperatures
- CRISM\_Band

#### 4.7.1 CRISM\_Temperatures Class

- detector\_temperature
- optical\_bench\_temperature
- spectrometer\_housing\_temperature
- sphere\_temperature
- fpe\_temperature

#### 4.7.2 CRISM\_Band Class

- band\_name
- band\_sequence\_number
- scaling\_factor
- value\_offset

### 4.8 SHARAD\_Parameters Class

- SHARAD\_Observation\_Parameters
- Array\_Sampled

#### 4.8.1 SHARAD\_Observation\_Parameters Class

- synthetic\_aperture\_duration
- multilook\_doppler\_bandwidth
- number\_of\_looks
- chirp\_frequency\_envelope
- range\_compression\_window
- azimuth\_processing\_window

#### 4.8.2 Array\_Sampled Class

- name
- array\_interval
- array\_unit
- array\_first\_value
- array\_last\_value
- array\_scale

## 4.9 CRISM\_ATO\_Parameters Class

- ato.min\_line
- ato.max\_line
- ato.min\_sample
- ato.max\_sample



## DEFINITIONS

Classes (in alphabetical order)

### *Array\_Sampled*

- The *Array\_Sampled* class provides parameters for a uniformly sampled array.
- Minimum occurrences: 0
- Maximum occurrences: \*

### *CRISM\_ATO\_Parameters*

- The *CRISM\_ATO\_Parameters* class is the container for observation parameters specific to the CRISM ATO (Along-Track Oversampled) reprocessing project..
- Minimum occurrences: 0
- Maximum occurrences: 1

### *CRISM\_Band*

- The *CRISM\_Band* class contains parameters describing a single band in CRISM Browse Product 3D image array or in the CRISM data cube containing refined spectral summary parameters..
- Minimum occurrences: 0
- Maximum occurrences: \*
- 

### *CRISM\_Parameters*

- The *CRISM\_Parameters* class is the container for CRISM-specific observation parameters.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *CRISM\_Temperatures*

- The *CRISM\_Temperatures* class is the container for CRISM-specific temperature-related parameters.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *HiRISE\_Instrument\_Setting\_Parameters*

- The *HiRISE\_Instrument\_Setting\_Parameters* class contains attributes specific to HiRISE EDRs.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *HiRISE\_Power\_Parameters*

- The HiRISE\_Power\_Parameters class contains attributes specific to HiRISE EDRs.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *HiRISE\_RDR\_Parameters*

- The HiRISE\_RDR\_Parameters class contains attributes specific to HiRISE RDRs.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *HiRISE\_Temperature\_Parameters*

- The HiRISE\_Temperature\_Parameters class contains attributes specific to HiRISE EDRs.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *HiRISE\_Time\_Parameters*

- The HiRISE\_Time\_Parameters class contains attributes specific to HiRISE EDRs.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *MRO\_Parameters*

- The MRO\_Parameters class is the container for mission-specific metadata elements.
- Minimum occurrences: 0
- Maximum occurrences: 1

### *SHARAD\_Observation\_Parameters*

- The SHARAD\_Observation\_Parameters class provides parameters for SHARAD radar observations.
- Minimum occurrences: 0
- Maximum occurrences: \*

### *SHARAD\_Parameters*

- The SHARAD\_Parameters class contains attributes specific to SHARAD data.
- Minimum occurrences: 0
- Maximum occurrences: 1

### Attributes (in alphabetical order)

*activity\_id* The *activity\_id* attribute describes the type of measurement contained in a CRISM EDR or other data product, and provides indication of how the observation is commanded. The format of the value is AC### where AC is a 2-letter designation of the type of measurement made, and ### is a 3-numeral designation of the instrument command macro that was executed to acquire the data. Macro numbers are in the range 0-255. For EDRs, BI is measurement of detector bias, DF is a measurement of background including dark current and thermal background, LP is measurement of a focal plane lamp, SP is measurement of the internal integrating sphere, and SC is measurement of an external scene. TP indicates that the EDR contains any test pattern produced by instrument electronics. T1 through T7 specify the test pattern, test pattern 1 through test pattern 7. UN indicates that the EDR contains data in which housekeeping does not match the commanded instrument configuration. For an RDR, RA indicates that the file contains values in units of radiance ( $\text{W m}^{-2} \text{nm}^{-1} \text{sr}^{-1}$ ). IF indicates that the file contains values in units of I/F, or radiance divided



by solar flux scaled for heliocentric distance. AL indicates that the file contains values as estimated Labert albedo, which is I/F corrected for cosine of incidence angle and for atmospheric and thermal effects. SU indicates that the files contains summary parameters, unitless values derived from Lambert albedo. For an RDR or a DDR, DE indicates that the files contains derived values related to observation geometry or independently characterized properties of the scene.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*adc\_timing\_settings\_image* *adc\_timing\_settings\_image* attribute provides the HiRISE Channel 0 analog-to-digital conversion timing settings for the readout of the video waveform.

- PDS4 data type: ASCII\_Integer
- Valid values: 4, 5, 6
  - 4 - 4
  - 5 - 5
  - 6 - 6
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*adc\_timing\_settings\_reset* *adc\_timing\_settings\_reset* attribute provides the HiRISE Channel 0 analog-to-digital conversion timing settings for the reset of the video waveform.

- PDS4 data type: ASCII\_Integer
- Valid values: 4, 5, 6
  - 4 - 4
  - 5 - 5
  - 6 - 6
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*array\_first\_value* The *array\_first\_value* element provides the first value in an ascending series and is therefore the minimum value at which a given data item was sampled.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*array\_interval* The *array\_interval* attribute provides the spacing of points at which data are sampled and at which values for an instrument or other parameter are available. If  $x_1$  and  $x_n$  are the first and last sampling parameter values, respectively,  $x_n$  is larger than  $x_1$ ,  $n$  is the number of sampling parameters, the caret symbol (^) denotes exponentiation, and  $b$ , a positive real number, is the base for exponentiation, then the value of *sampling\_parameter\_interval* is:  $(x_n - x_1)/(n-1)$  (for *sampling\_parameter\_scale* = Linear),  $(x_n/x_1)^{1/(n-1)}$  (for *sampling\_parameter\_scale* = Logarithmic),  $(b^{x_n} - b^{x_1})/(n-1)$  (for *sampling\_parameter\_scale* = Exponential).

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*array\_last\_value* The *array\_last\_value* element provides the last value in an ascending series and is therefore the maximum value at which a given data item was sampled.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*array\_scale* The *array\_scale* attribute specifies whether the sampling interval is linear or something other such as logarithmic.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: Linear, Exponential, Logarithmic
  - Linear - Values of Uniformly Sampled are given at uniform (linear) spacings of an independent variable - for example, 1, 2, 3, 4, ...
  - Exponential - The values of the independent variable in exponential uniformly sampled data are given at uniform spacing of the exponential of some base  $b$ , a positive real number. That is, for independent variable  $x$  in the range  $[x_1, x_n]$ , the sampling points  $x_j$  satisfy:  $b^{x_j} = b^{x_1} + (j-1)(b^{x_n} - b^{x_1})/(n-1)$  for  $j = 1 \dots n$  where the caret symbol (^) denotes exponentiation. For example, if the independent variable has values 0., 0.30103, 0.47712, 0.60206, ... and the base is 10, then the Exponential Uniformly Spaced data are given at  $10^{0.}$ ,  $10^{0.30103}$ ,  $10^{0.47712}$ ,  $10^{0.60206}$ , ... or 1, 2, 3, 4, ...
  - Logarithmic - The values of the independent variable,  $x$ , in logarithmic uniformly sampled data are given at uniform spacing of the logarithm of  $x$  in some base,  $b$ , a positive real number. That is, for independent variable  $x$  in the range  $[x_1, x_n]$ , the sampling points  $x_j$  satisfy:  $\log_b(x_j) = \log_b(x_1) + (j-1)(\log_b(x_n) - \log_b(x_1))/(n-1)$  for  $j = 1 \dots n$  where  $\log_b(x)$  is the log of  $x$  in base  $b$ . For example, if the independent variable has values 1, 10, 100, 1000, ... and the base is 10, then the Logarithmic Uniformly Spaced data are given at 0, 1, 2, 3 ...
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*array\_unit* The *array\_unit* element specifies the unit of measure of associated data sampling parameters.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A

- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*azimuth\_processing\_window* The windowing function used to reduce sidelobes resulting from azimuth (along-track) synthetic aperture processing of the raw echo records. All radargrams in the SHARAD radargram archive use a Hann function.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*band\_name* Identifies the name of the CRISM band associated with the specific scaling and offset parameters used in a CRISM browse product.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*band\_sequence\_number* Defines the order of the CRISM bands along the Axis\_Array when axis\_name is band.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 1

*barrel\_baffle\_temperature* The barrel\_baffle\_temperature attribute provides the temperature of the HiRISE instrument's barrel baffle in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*binning* binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $mro:line\_exposure\_duration = mro:binning * mro:scan\_line\_duration$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16

- 1 - bin 1
- 2 - bin 2
- 3 - bin 3
- 4 - bin 4
- 8 - bin 8
- 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*binning\_bg12* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16

- 1 - bin 1
- 2 - bin 2
- 3 - bin 3
- 4 - bin 4
- 8 - bin 8
- 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_bg13* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16

- 1 - bin 1
- 2 - bin 2
- 3 - bin 3
- 4 - bin 4
- 8 - bin 8
- 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_ir10* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_ir11* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red0* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red1* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red2* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red3* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0

- Maximum occurrences: 1
- Nillable: Yes

*binning\_red4* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red5* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red6* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8

- 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red7* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red8* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3
  - 4 - bin 4
  - 8 - bin 8
  - 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*binning\_red9* The binning element provides the HiRISE observation binning mode; i.e., the number of lines binned in an observation.  $\text{mro:line\_exposure\_duration} = \text{mro:binning} * \text{mro:scan\_line\_duration}$

- PDS4 data type: ASCII\_Integer
- Valid values: 1, 2, 3, 4, 8, 16
  - 1 - bin 1
  - 2 - bin 2
  - 3 - bin 3



- 4 - bin 4
- 8 - bin 8
- 16 - bin 16

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*ccd\_flag\_bg12* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_bg13* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_ir10* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_ir11* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF

- ON - the CCD was actively acquiring data during the observation.
- OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red0* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red1* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red2* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red3* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.

- OFF - the CCD was turned off during the observation.

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red4* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red5* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red6* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red7* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red8* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*ccd\_flag\_red9* The *ccd\_flag* elements identify which CCDs were operating at the time of an observation. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - the CCD was actively acquiring data during the observation.
  - OFF - the CCD was turned off during the observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*channel\_number* *channel\_number* attribute provides the HiRISE CCD channel number.

- PDS4 data type: ASCII\_Integer
- Valid values: 0, 1
  - 0 - channel 0
  - 1 - channel 1
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*chirp\_frequency\_envelope* The frequency-dependent amplitude variation used in range compression of the raw echo data. All radargrams in the SHARAD radargram archive use a uniform-amplitude model.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*cpmm\_negative\_5\_current* The *cpmm\_negative\_5\_current* attribute provides the negative 5 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_negative\_5\_voltage* The *cpmm\_negative\_5\_voltage* attribute provides the negative 5 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_number* *cpmm\_number* attribute provides the HiRISE CCD Processing/Memory Module number.

- PDS4 data type: ASCII\_Integer
- Valid values: 0-13
  - 0 - Module 0
  - 1 - Module 1
  - 2 - Module 2
  - 3 - Module 3
  - 4 - Module 4
  - 5 - Module 5
  - 6 - Module 6
  - 7 - Module 7
  - 8 - Module 8
  - 9 - Module 9
  - 10 - Module 10
  - 11 - Module 11
  - 12 - Module 12
  - 13 - Module 13
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No

*cpmm\_positive\_10\_current* The *cpmm\_positive\_10\_current* attribute provides the positive 10 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_10\_voltage* The *cpmm\_positive\_10\_voltage* attribute provides the positive 10 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_positive\_1\_8\_current* The *cpmm\_positive\_1\_8\_current* attribute provides the positive 1\_8 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_1\_8\_voltage* The *cpmm\_positive\_1\_8\_voltage* attribute provides the positive 1\_8 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_positive\_2\_5\_current* The *cpmm\_positive\_2\_5\_current* attribute provides the positive 2\_5 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_2\_5\_voltage* The *cpmm\_positive\_2\_5\_voltage* attribute provides the positive 2\_5 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_positive\_29\_current* The *cpmm\_positive\_29\_current* attribute provides the positive 29 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_29\_voltage*

The *cpmm\_positive\_29\_voltage* attribute provides the positive 29 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_positive\_3\_3\_current* The *cpmm\_positive\_3\_3\_current* attribute provides the positive 3\_3 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_3\_3\_voltage*

The *cpmm\_positive\_3\_3\_voltage* attribute provides the positive 3\_3 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*cpmm\_positive\_5\_current* The *cpmm\_positive\_5\_current* attribute provides the positive 5 current of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*cpmm\_positive\_5\_voltage*

The *cpmm\_positive\_5\_voltage* attribute provides the positive 5 voltage state of the HiRISE CCD Processing/Memory Module.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V



*cpmm\_pws\_board\_temperature* The *cpmm\_pws\_board\_temperature* attribute provides the temperature of the HiRISE instrument's CCD Processing/Memory Module Power Supply Board in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*delta\_line\_timer\_count* *delta\_line\_timer\_count* element provides the commanded count given to the HiRISE instrument to set the scan line duration.  $mro:scan\_line\_duration = 74 + mro:delta\_line\_timer\_count/16$

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 0
- Maximum value: 16777216

*detector\_temperature* The *detector\_temperature* attribute provides the temperature of the CRISM IR detector (if *sensor\_id* = 'L'), or the VNIR detector (if *SENSOR\_ID* = 'S'). On each detector there are two temperature sensors. The primary source of IR detector temperature is IR temperature sensor 1 (column 50 in the EDR list file). The backup source of IR detector temperature is IR temperature sensor 2 (column 51 in the EDR list file). The primary source of VNIR detector temperature is VNIR temperature sensor 2 (column 65 in the EDR list file). The backup source of VNIR detector temperature is VNIR temperature sensor 1 (column 64 in the EDR list file).

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: K

*dll\_frequency\_correct\_count* *dll\_frequency\_correct\_count* attribute provides a count of the number of times the HiRISE 96 MHz clock frequency was observed to be correct. This is used with the recursive Digital Lock Loop reset circuit.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No
- Minimum value: 0
- Maximum value: 255

*dll\_locked\_flag\_01* *dll\_locked\_flag\_01* attribute provides the state of the 1st 96 Mhz Digital Lock Loop flag for a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NO, YES
  - NO - Lock off
  - YES - Lock on
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*dll\_locked\_flag\_02* *dll\_locked\_flag\_02* attribute provides the state of the 2nd 96 Mhz Digital Lock Loop flag for a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NO, YES
  - NO - Lock off
  - YES - Lock on
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*dll\_locked\_once\_flag\_01* *dll\_locked\_once\_flag\_01* attribute indicates if the 1st DigitalbLock Loop ever locked during a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NO, YES
  - NO - did not lock
  - YES - locked at least once
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*dll\_locked\_once\_flag\_02* *dll\_locked\_once\_flag\_02* attribute indicates if the 2nd Digital Lock Loop ever locked during a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NO, YES
  - NO - did not lock
  - YES - locked at least once
- Minimum occurrences: 0

- Maximum occurrences: 1
- Nillable: No

*dll\_reset\_count* `dll_reset_count` attribute provides the count of the number of times during a HiRISE observation the 96 MHz Digital Lock Loop had to be reset in order to lock to the incoming 48 Mhz clock and produce an 96 MHz clock.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 0
- Maximum value: 255

*felics\_compression\_flag* `felics_compression_flag` element identifies whether FELICS data compression was applied to a HiRISE image.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NO, YES
  - NO - felics compression
  - YES - felics compression applied
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*field\_stop\_temperature* The `field_stop_temperature` attribute provides the temperature of the HiRISE instrument's focus mechanism field stop in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*focus\_motor\_temperature* The `focus_motor_temperature` attribute provides the temperature of the HiRISE instrument's focus mirror in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature

- Specified unit id: C

*focus\_position\_count* *focus\_position\_count* attribute provides the raw count of the focus mechanism position in a HiRISE observation.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

### *fpa\_negative\_y\_temperature*

The *fpa\_negative\_y\_temperature* attribute provides the temperature of the HiRISE instrument's Focal Plane Array -Y location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*fpa\_positive\_y\_temperature* The *fpa\_positive\_y\_temperature* attribute provides the temperature of the HiRISE instrument's Focal Plane Array +Y side location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*fpe\_temperature* The *fpe\_temperature* attribute provides the temperature of the HiRISE or CRISM instrument's Focal Plane Electronics in degrees Celsius. For HiRISE, see Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004. For CRISM, the value refers to the focal plane electronics board mounted in the base of the gimbal. The values represents IR focal plane electronics if *SENSOR\_ID* = 'L', and to the VNIR focal plane electronics if *SENSOR\_ID* = 'S'. The source of CRISM IR focal plane electronics temperature is column 60 in the EDR list file. The source of VNIR focal plane electronics temperature is column 71 in the EDR list file.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

- Unit of measure type: Units\_of\_Temperature
- Specified unit id: K

*heater\_control\_flag\_01* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_02* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_03* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_04* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No

*heater\_control\_flag\_05* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_06* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_07* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_08* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_09* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_10* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_11* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_12* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_13* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_flag\_14* heater\_control\_flag element is a set of 14 on/off flags that indicate which of the 14 heater control areas were on at the time of a HiRISE observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - heater on
  - OFF - heater off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_control\_mode* heater\_control\_mode attribute provides the state of the HiRISE heater control, either closed-loop or duty-cycle. Normally the closed-loop mode is used to keep nominal operating temperatures of the instrument. A duty-cycle mode is enabled during periods of high EM emissions from other MRO instruments.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: CLOSED LOOP, DUTY CYCLE
  - CLOSED LOOP - closed-loop mode
  - DUTY CYCLE - duty cycle mode
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*heater\_current* The heater\_current attribute provides the HiRISE heater current in amps.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Current
- Specified unit id: A

*iea\_negative\_15\_voltage*

The iea\_negative\_15\_voltage attribute provides the negative 15 voltage state of the HiRISE Interface Electronics Assembly.

- PDS4 data type: ASCII\_Real



- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*iea\_positive\_15\_voltage*

The *iea\_positive\_15\_voltage* attribute provides the positive 15 voltage state of the HiRISE Interface Electronics Assembly.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*iea\_positive\_28\_voltage*

The *iea\_positive\_28\_voltage* attribute provides the positive 28 voltage state of the HiRISE Interface Electronics Assembly.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*iea\_positive\_5\_voltage* The *iea\_positive\_5\_voltage* attribute provides the positive 5 voltage state of the HiRISE Interface Electronics Assembly.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*ie\_pws\_board\_temperature* The *ie\_pws\_board\_temperature* attribute provides the temperature of the HiRISE instrument's Instrument Electronics Power Supply Board in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*iea\_temperature* The *iea\_temperature* attribute provides the temperature of the HiRISE instrument's Instrument Electronics Assembly in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*image\_exposure\_duration* *image\_exposure\_duration* attribute provides the total time of a HiRISE observation from the start of the first line to the end of the last line computed by multiplying the total number of lines in the array times the line exposure duration. Units of microseconds.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Time

*inst\_cont\_board\_temperature*

The *inst\_cont\_board\_temperature* attribute provides the temperature of the HiRISE instrument control board in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*inst\_cont\_fpga\_pos\_2\_5\_voltage* The *inst\_cont\_fpga\_pos\_2\_5\_voltage* attribute provides the positive 2\_5 voltage state of the HiRISE instrument control Field-Programmable Gate Array.

- PDS4 data type: ASCII\_Real

- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*line\_exposure\_duration* line\_exposure\_duration attribute provides the time from the start of exposure of one binned line to the start of exposure of the next binned line in a HiRISE image. Units of microseconds.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Time

*lookup\_table\_k\_value* lookup\_table\_k\_value attribute provides the 'pixel spread' value in a HiRISE image. This parameter is used only for the HiRISE SQUARE-ROOT LUT table mode. A -9998 value indicates a K value was not used.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: -9998
- Maximum value: 32

*lookup\_table\_maximum* lookup\_table\_maximum attribute provides the maximum 14-bit pixel value mapped to the 254 DN 8-bit pixel in a HiRISE image. This parameter is used only for the HiRISE LINEAR LUT table mode. A -9998 value indicates that the maximum value was not used.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: -9998
- Maximum value: 16384

*lookup\_table\_median* lookup\_table\_median attribute provides the median 14-bit pixel value mapped to the 254 DN 8-bit pixel in a HiRISE image. This parameter is used only for the HiRISE SQUARE-ROOT LUT table mode. A -9998 value indicates that the table median value was not used.

- PDS4 data type: ASCII\_Integer

- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: -9998
- Maximum value: 16384

*lookup\_table\_minimum* lookup\_table\_minimum attribute provides the minimum 14-bit pixel value mapped to the 0 DN output pixel in a HiRISE image. This parameter is used only for the HiRISE LINEAR LUT table mode. A -9998 value indicates that the maximum value was not used.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: -9998
- Maximum value: 16384

*lookup\_table\_number* lookup\_table\_number attribute provides the number of the stored LUT used in a HiRISE image. This parameter is used only for the HiRISE STORED LUT table mode. A value of -9998 indicates that a table number was not used.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: -9998
- Maximum value: 28

*lookup\_table\_type* lookup\_table\_type attribute provides the type of lookup table that was applied to convert 14-bit pixels to 8-bit pixels in a HiRISE image.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Value values: LINEAR, N/A, SQUARE ROOT, STORED
  - LINEAR - linear LUT
  - N/A - no LUT
  - SQUARE ROOT - square root LUT
  - STORED - stored LUT
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*\*maximum\_stretch* The *maximum\_stretch* attribute provides a contrast stretch value to be used in the display of a HiRISE Image. The *mro.maximum\_stretch* parameter specifies the DN value to map to the 255 DN value of the display. For color images, there will be three values, one for each color.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 0
- Maximum value: 1024

*max\_line* The index of the highest-numbered row/line of this product relative to the original CRISM scene. The first line of the original CRISM scene corresponds to a value of 1.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*max\_sample* The index of the highest-numbered column/sample of this product relative to the original CRISM scene. The first sample of the original CRISM scene corresponds to a value of 1.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*mech\_tlm\_board\_temperature* The *mech\_tlm\_board\_temperature* attribute provides the temperature of the HiRISE instrument's Mech/TLM Board in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*mech\_tlm\_fpga\_pos\_2\_5\_voltage* The *mech\_tlm\_fpga\_pos\_2\_5\_voltage* attribute provides the positive 2\_5 voltage state of the HiRISE Mech/TLM Field-Programmable Gate Array.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0

- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Voltage
- Specified unit id: V

*\*minimum\_stretch* The *minimum\_stretch* attribute provides a contrast stretch value to be used in the display of a HiRISE Image. The *mro.minimum\_stretch* parameter specifies the DN value to map to the 0 DN value of the display. For color images, there will be three values, one for each color.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 0
- Maximum value: 1024

*min\_line* The index of the lowest-numbered row/line of this product relative to the original CRISM scene. The first line of the original CRISM scene corresponds to a value of 1.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*min\_sample* The index of the lowest-numbered column/sample of this product relative to the original CRISM scene. The first sample of the original CRISM scene corresponds to a value of 1.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*mission\_phase\_name* The *mission\_phase\_name* attribute provides the mission-defined name of a time period within the mission.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: Launch, Cruise, Approach and Orbit Insertion, Aerobraking, Primary Science, Extended Science, Extended Mission 1, Extended Mission 2, Extended Mission 3, Extended Mission 4, Extended Mission 5, Extended Mission 6
  - Launch - 2005-08-12 to 2005-08-12
  - Cruise - 2005-08-12 to 2006-01-10
  - Approach and Orbit Insertion - 2006-01-10 to 2006-03-10
  - Aerobraking - 2006-03-17 to 2006-11-07

- Primary Science - 2006-11-08 to 2008-11-08
- Extended Science - 2008-11-09 to 2010-09-30
- Extended Mission 1 - 2010-10-01 to 2012-09-30
- Extended Mission 2 - 2012-10-01 to 2014-09-30
- Extended Mission 3 - 2014-10-01 to 2016-09-30
- Extended Mission 4 - 2016-10-01 to 2019-09-30
- Extended Mission 5 - 2019-10-01 to 2022-09-30
- Extended Mission 6 - 2022-10-01 to 2025-09-30

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*multilook\_doppler\_bandwidth* The frequency span over which radar echoes are averaged, following synthetic aperture processing for each spatial footprint along the ground track. This frequency span is measured to either side of the zero-frequency component of the Doppler spectrum.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Frequency

*ms\_truss\_leg\_0\_a\_temperature*

The *ms\_truss\_leg\_0\_a\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 0-A leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*ms\_truss\_leg\_0\_b\_temperature*

The *ms\_truss\_leg\_0\_b\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 0-B leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*ms\_truss\_leg\_120\_a\_temperature* The *ms\_truss\_leg\_120\_a\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 120-A leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*ms\_truss\_leg\_120\_b\_temperature* The *ms\_truss\_leg\_120\_b\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 120-B leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*ms\_truss\_leg\_240\_a\_temperature*

The *ms\_truss\_leg\_240\_a\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 240-A leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*ms\_truss\_leg\_240\_b\_temperature*

The *ms\_truss\_leg\_240\_b\_temperature* attribute provides the temperature of the HiRISE instrument's metering structure truss 240-B leg in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1



- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*name* The name element provides the name of the parameter which determines the sampling interval of a particular instrument or dataset parameter. For example, magnetic field intensity is sampled in time increments, and a spectrum is sampled in wavelength or frequency.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 1
- Maximum occurrences: 1
- Nillable: No

*number\_of\_looks* The number of frequency-resolved cells included in the multi-look averaging. This varies with the chosen frequency span and the Doppler resolution set by the inverse of the coherent integration time.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*observation\_id* The observation\_id attribute is a 8-byte hexadecimal integer uniquely identifying the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*observation\_number* The observation\_number attribute gives the monotonically increasing ordinal counter of the EDRs generated for a particular CRISM observation\_id. CRISM generates several EDRs for a given observation\_id.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*observation\_rationale* The observation\_rationale attribute identifies the name of the specific feature on Mars that was targeted by the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*observation\_start\_time* The *observation\_start\_time* attribute provides the UTC start time of a HiRISE image acquisition sequence.

- PDS4 data type: ASCII\_Date\_Time\_YMD\_UTC
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*observation\_type* The *observation\_type* attribute identifies the general type of observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed Valid values: FRT, HRL, HRS, FRS, ATO, ATU, EPF, TOD, LMB, MSP, HSP, HSV, MSV, MSW, FFC, CAL, ICL, FUN, UNK, STO
  - FRT - Full Resolution Targeted Observation
  - HRL - Half Resolution Long Targeted Observation
  - HRS - Half Resolution Short Targeted Observation
  - FRS - Full Resolution Short Targeted Observation
  - ATO - Along-track Oversampled Targeted Observation
  - ATU - Along-track Undersampled Targeted Observation
  - EPF - Atmospheric Survey Emission Phase Function
  - TOD - Tracking Optical Depth Observation
  - LMB - Limb Scan Observation
  - MSP - Multispectral Survey, losslessly compressed
  - HSP - Hyperspectral Survey, losslessly compressed
  - HSV - Hyperspectral Survey, VNIR only, pixels 10x-binned
  - MSV - Hyperspectral Survey, VNIR only, pixels 5x-binned
  - MSW - Multispectral Window
  - FFC - Flat Field Calibration
  - CAL - Radiometric Calibration
  - ICL - Calibration source intercalibration
  - FUN - Functional test
  - UNK - No valid EDRs within observation that indicate class type
  - STO - Star Observation
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*opt\_bnch\_box\_beam\_temperature*

The *opt\_bnch\_box\_beam\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench near the box beam (+Y face) in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real

- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*opt\_bnch\_cover\_temperature* The *opt\_bnch\_cover\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench cover (external) in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*opt\_bnch\_flexure\_temperature*

The *opt\_bnch\_flexure\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench near the +X MDR flexure in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*opt\_bnch\_fold\_flat\_temperature* The *opt\_bnch\_fold\_flat\_temperature* attribute provides the temperature of the HiRISE instrument's optical fold flat mirror location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*opt\_bnch\_fpa\_temperature*

The *opt\_bnch\_fpa\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench near the Focal Plane Array in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

### *opt\_bnch\_fpe\_temperature*

The *opt\_bnch\_fpe\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench near the Focal Plane Electronics in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

### *opt\_bnch\_living\_rm\_temperature*

The *opt\_bnch\_living\_rm\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench in the sunken living room location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

### *opt\_bnch\_mirror\_temperature*

The *opt\_bnch\_mirror\_temperature* attribute provides the temperature of the HiRISE instrument's optical bench near the tertiary mirror in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*optical\_bench\_temperature* The *optical\_bench\_temperature* attribute provides the temperature of the CRISM optical bench. It is a backup to *sphere\_temperature* for modeling the output radiance of the onboard integrating sphere as a function of sphere temperature.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: K

*orbit\_number* The *orbit\_number* attribute identifies the orbit number when the observation was taken.

- PDS4 data type: ASCII\_NonNegative\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_01* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_02* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_03* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_04* powered\_cpmm\_flag attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_05* powered\_cpmm\_flag attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_06* powered\_cpmm\_flag attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_07* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_08* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_09* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_10* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No

*powered\_cpmm\_flag\_11* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_12* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_13* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*powered\_cpmm\_flag\_14* *powered\_cpmm\_flag* attribute provides a set of 14 values that identify which HiRISE CCD Processing/Memory Modules were commanded to acquire imaging during the observation. The first element is for CPMM 0 and the last element is for CPMM 13.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - CPMM powered on
  - OFF - CPMM powered off
- Minimum occurrences: 0



- Maximum occurrences: 1
- Nillable: No

*primary\_mirror\_baf\_temperature*

The *primary\_mirror\_baf\_temperature* attribute provides the temperature of the HiRISE instrument's primary mirror baffle near the base (external) in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*primary\_mirror\_mnt\_temperature*

The *primary\_mirror\_mnt\_temperature* attribute provides the temperature of the HiRISE instrument's primary mirror mount in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*primary\_mirror\_temperature*

The *primary\_mirror\_temperature* attribute provides the temperature of the HiRISE instrument's primary mirror at its maximum thickness in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*producer\_institution\_name* The *producer\_institution\_name* attribute identifies the name of the institution that created the data product.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No

*product\_type* The product\_type attribute identifies the type of data product.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: EDR, RDR, CDR, DDR, MTRDR, TER, TRDR, LDR, MRDR, MTRDR\_Browse, MTRDR\_Extras, TER\_Browse, TER\_Extras, TRDR\_Browse
  - EDR - Experiment Data Record
  - RDR - Reduced Data Record
  - CDR - Calibrated Data Record
  - DDR - Derived Data Record
  - MTRDR - Map-Projected Targeted Reduced Data Record
  - TER - Targeted Empirical Record
  - TRDR - Targeted Reduced Data Record
  - LDR - Limb Data Record
  - MRDR - Multispectral Reduced Data Record
  - MTRDR\_Browse - Map-Projected Targeted Reduced Data Record - Browse
  - MTRDR\_Extras - Map-Projected Targeted Reduced Data Record - Extras
  - TER\_Browse - Targeted Empirical Record - Browse
  - TER\_Extras - Targeted Empirical Record - Extras
  - TRDR\_Extras - Targeted Reduced Data Record - Extras
  - TRDR\_Browse - Targeted Reduced Data Record - Browse
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*product\_version\_id* The product\_version\_id element identifies the version of an individual data product.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*range\_compression\_window* The windowing function used to reduce sidelobes resulting from range compression of the raw echo records. All radargrams in the SHARAD radargram archive use a Hann function.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*readout\_start\_count* readout\_start\_count attribute provides the spacecraft clock count when the HiRISE CCD Process/Memory Module begins transferring image data out of its buffer memory.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*readout\_start\_time* readout\_start\_time attribute provides the UTC time when the HiRISE CCD Process/Memory Module begins transferring image data out of buffer memory.

- PDS4 data type: ASCII\_Date\_Time\_YMD\_UTC
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*release\_id* release\_id is the identifier of a scheduled release of MRO data from PDS. The first MRO data release has release\_number “0001”. The release\_number for a given product is always the first release in which it appears, and does not change if the product is revised later.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum characters: 1

*scaling\_factor* The scaling\_factor attribute is the scaling factor to be applied to each stored value in order to recover an original value. The observed value (Ov) is calculated from the stored value (Sv) thus:  $Ov = (Sv * scaling\_factor) + value\_offset$ .

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*scan\_exposure\_duration* scan\_exposure\_duration attribute provides the unbinned line readout rate of the HiRISE instrument in microseconds. This corresponds to the time between successive steps in the Time Delay Integration (TDI) process. The adjustment of this parameter is used to match image line acquisition to the boresight ground velocity. The value is the same for all CCDs for a given observation.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No
- Minimum value: 74
- Maximum value: 1048650
- Unit of measure type: Units\_of\_Time

### *sec\_mirror\_baffle\_temperature*

The *sec\_mirror\_baffle\_temperature* attribute provides the temperature of the HiRISE instrument's secondary mirror baffle near the base (external) in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*sec\_mirror\_mtr\_rng\_temperature* The *sec\_mirror\_mtr\_rng\_temperature* attribute provides the temperature of the HiRISE instrument's secondary mirror metering ring in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*sec\_mirror\_temperature* The *sec\_mirror\_temperature* attribute provides the temperature of the HiRISE instrument's secondary mirror in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*sensor\_id* The *sensor\_id* attribute identifies the CRISM focal plane from which data in an EDR or RDR were returned; S = short-wavelength or VNIR, L = long-wavelength or IR, J = joint where a data product is applicable to either.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*spacecraft\_clock\_count\_partition* The spacecraft\_clock\_count\_partition attribute indicates the clock partition active for the spacecraft\_clock\_start\_count and spacecraft\_clock\_stop\_count attributes.

- PDS4 data type: ASCII\_NonNegative\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*spacecraft\_clock\_start\_count* The spacecraft\_clock\_start\_count attribute provides the value of the spacecraft clock at the beginning of a time period of interest.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Pattern: ([0-9]{1,2}/)?[0-9]{1,10}(:[0-9]{3,6})?

*spacecraft\_clock\_stop\_count* The spacecraft\_clock\_stop\_count attribute provides the value of the spacecraft clock at the end of a time period of interest.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Pattern: ([0-9]{1,2}/)?[0-9]{1,10}(:[0-9]{3,6})?

*special\_processing\_flag\_bg12* The special\_processing\_flag elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1

- Nillable: No

*special\_processing\_flag\_bg13* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_ir10* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_ir11* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red0* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red1* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red2* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red3* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red4* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red5* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No



*special\_processing\_flag\_red6* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red7* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red8* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*special\_processing\_flag\_red9* The *special\_processing\_flag* elements indicate if special calibration processing was applied to a HiRISE CCD image. The HiRISE instrument may experience instability problems or a low-signal image may have been poorly calibrated requiring an alternate calibration strategy. There is a special processing flag for each CCD used in the observation.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: NOMINAL, CUBENORM, NONE
  - NOMINAL - the standard calibration processing was used for the CCD image.
  - CUBENORM - the calibration processing used a columnar gain correction based on columnar statistics of the image.
  - NONE - the CCD was not operating or was missing for this observation.
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*spectrometer\_housing\_temperature* The *spectrometer\_housing\_temperature* attribute gives the temperature of the CRISM spectrometer housing. This is a backup to direct determination, using measurements with the shutter closed, of the thermal background measured by the IR detector. The primary source of this temperature is a measurement digitized by the VNIR focal plane electronics, column 58 in the EDR list file. The backup source of this temperature is a measurement digitized by the IR focal plane electronics, column 69 in the EDR list file.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: K

*sphere\_temperature* The *sphere\_temperature* attribute gives the temperature of the CRISM onboard integrating sphere. It is used for modeling the output radiance of the sphere as a function of sphere temperature.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: K

*spider\_leg\_150\_temperature* The *spider\_leg\_150\_temperature* attribute provides the temperature of the HiRISE instrument's spider leg at the 150 degree location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0

- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*spider\_leg\_270\_temperature*

The *spider\_leg\_270\_temperature* attribute provides the temperature of the HiRISE instrument's spider leg at the 270 degree location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*spider\_leg\_30\_temperature* The *spider\_leg\_30\_temperature* attribute provides the temperature of the HiRISE instrument's spider leg at the 30 degree location in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*stimulation\_lamp\_flag\_01* *stimulation\_lamp\_flag* attribute is a set of three flags that identify which of the three HiRISE stimulation lamps have been turned on or off. Stimulation lamps are used to evaluate relative changes in instrument calibration throughout the mission. Stimulation lamps are always turned off for science observation data.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - stim lamp on
  - OFF - stim lamp off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*stimulation\_lamp\_flag\_02* The *stimulation\_lamp\_flag* attribute is a set of three flags that identify which of the three HiRISE stimulation lamps have been turned on or off. Stimulation lamps are used to evaluate relative changes in instrument calibration throughout the mission. Stimulation lamps are always turned off for science observation data.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF

- ON - stim lamp on
- OFF - stim lamp off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*stimulation\_lamp\_flag\_03* The *stimulation\_lamp\_flag* attribute is a set of three flags that identify which of the three HiRISE stimulation lamps have been turned on or off. Stimulation lamps are used to evaluate relative changes in instrument calibration throughout the mission. Stimulation lamps are always turned off for science observation data.

- PDS4 data type: ASCII\_Short\_String\_Collapsed
- Valid values: ON, OFF
  - ON - stim lamp on
  - OFF - stim lamp off
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No

*sun\_shade\_temperature* The *sun\_shade\_temperature* attribute provides the temperature of the HiRISE instrument's sun shade under the MLI in degrees Centigrade. See Figure 2.3, MRO HiRISE EDR SIS, REFKEYID JPLD-32004.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Temperature
- Specified unit id: C

*synthetic\_aperture\_duration* The coherent integration time for SHARAD signals processed using the synthetic aperture technique. Multiplication of this value by the MRO tangential velocity tabulated in the SHARAD radargram GEOM.TAB files yields an approximate physical length of the aperture.

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Unit of measure type: Units\_of\_Time

*tdi* The *tdi* attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0

- Maximum occurrences: 1
- Nillable: No
- Minimum value: 8
- Maximum value: 128

*tdi\_bg12* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_bg13* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_ir10* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_ir11* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red0* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red1* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red2* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128

- 8 - 8 stages
- 32 - 32 stages
- 64 - 64 stages
- 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red3* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red4* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red5* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages

- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red6* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red7* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*tdi\_red8* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes



*tdi\_red9* The tdi attribute provides the number of time delay and integration (TDI) stages used to increase the exposure time of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: 8, 32, 64, 128
  - 8 - 8 stages
  - 32 - 32 stages
  - 64 - 64 stages
  - 128 - 128 stages
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: Yes

*trim\_lines* The trim\_lines attribute provides the number of lines that have been trimmed at the beginning of a HiRISE observation.

- PDS4 data type: ASCII\_Integer
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No
- Minimum value: 0

*value\_offset* The value\_offset attribute is the offset to be applied to each stored value in order to recover an original value. The observed value (Ov) is calculated from the stored value (Sv) thus:  $Ov = (Sv * scaling\_factor) + value\_offset$ .

- PDS4 data type: ASCII\_Real
- Valid values: N/A
- Minimum occurrences: 0
- Maximum occurrences: 1
- Nillable: No



## EXAMPLES

Example PDS4 label snippet for MRO CRISM MTRDR data product:

```

<Mission_Area>
  <mro:MRO_Parameters>
    <mro:product_type>MTRDR</mro:product_type>
    <mro:product_version_id>V1.0</mro:product_version_id>
    <mro:release_id>0001</mro:release_id>
    <mro:orbit_number>3152</mro:orbit_number>
    <mro:spacecraft_clock_start_count>2/0859685149:21592</mro:spacecraft_clock_start_
↪count>
    <mro:spacecraft_clock_stop_count>2/0859685269:04176</mro:spacecraft_clock_stop_
↪count>
    <mro:producer_institution_name>Johns Hopkins University Applied Physics_
↪Laboratory</mro:producer_institution_name>
    <mro:CRISM_Parameters>
      <mro:observation_type>FRT</mro:observation_type>
      <mro:observation_id>16#000050F2#</mro:observation_id>
      <mro:observation_number>16#07#</mro:observation_number>
      <mro:activity_id>IF165</mro:activity_id>
      <mro:sensor_id>J</mro:sensor_id>
      <mro:CRISM_Temperatures>
        <mro:detector_temperature unit="degC">-165.516</mro:detector_temperature>
        <mro:optical_bench_temperature unit="degC">-47.999</mro:optical_bench_
↪temperature>
        <mro:spectrometer_housing_temperature unit="degC">-72.188</mro:spectrometer_
↪housing_temperature>
        <mro:sphere_temperature unit="degC">-47.687</mro:sphere_temperature>
        <mro:fpe_temperature unit="degC">0.811</mro:fpe_temperature>
      </mro:CRISM_Temperatures>
      <mro:CRISM_Band>
        <mro:band_name>D2300</mro:band_name>
        <mro:band_sequence_number>1</mro:band_sequence_number>
        <mro:scaling_factor>2.1657E-04</mro:scaling_factor>
        <mro:value_offset>0</mro:value_offset>
      </mro:CRISM_Band>
      <mro:CRISM_Band>
        <mro:band_name>BD2500_2</mro:band_name>
        <mro:band_sequence_number>2</mro:band_sequence_number>
        <mro:scaling_factor>1.5899E-05</mro:scaling_factor>
        <mro:value_offset>0</mro:value_offset>

```

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```
</mro:CRISM_Band>
<mro:CRISM_Band>
  <mro:band_name>BD1900_2</mro:band_name>
  <mro:band_sequence_number>3</mro:band_sequence_number>
  <mro:scaling_factor>1.8481E-04</mro:scaling_factor>
  <mro:value_offset>0</mro:value_offset>
</mro:CRISM_Band>
</mro:CRISM_Parameters>
</mro:MRO_Parameters>
</Mission_Area>
```

Example PDS4 label snippet for MRO CRISM ATO data product:

```
<Mission_Area>
  <mro:MRO_Parameters>
    <mro:CRISM_ATO_Parameters>
      <mro:min_line>2</mro:min_row>
      <mro:max_line>172</mro:max_row>
      <mro:min_sample>26</mro:min_column>
      <mro:max_sample>626</mro:max_column>
    </mro:CRISM_ATO_Parameters>
  </mro:MRO_Parameters>
</Mission_Area>>
```