NISTAR Data Format Control Book Specification
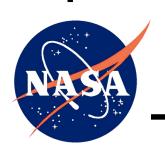
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1 INTRODUCTION

1.1 IDENTIFICATION

This document is the Data Format Control Book (DFCB) for the DSCOVR NISTAR instrument science data products. It describes the two levels of data products and defines their contents. Both products are written in the Hierarchical Data Format 5 (HDF5) standard and are archived at the Atmospheric Science Data Center (ASDC). Information about HDF and official documentation may be found at the HDF web site (http://www.hdfgroup.org).
This document is based on the "Triana NISTAR Data Format Control Book".

1.2 PRODUCTS OVERVIEW

The National Institute of Standards and Technology Advanced Radiometer (NISTAR) instrument collects irradiance data of the Earth from three radiometer sensors and one photodiode sensor and packs them into the "AppID 82" section of the DSCOVR telemetry downlink. It also records miscellaneous engineering data and packs them into "AppID 86" of the DSCOVR telemetry downlink. These data, combined with instrument temperature data from the spacecraft packed into "AppID 37", are converted into engineering units and stored as the level 1A NISTAR data products. An additional group of engineering data is packed into "AppID Misc." The data are further processed into level 1B products. *These products contain data on the solar reflected and Earth emitted radiation along the Earth-Sun line".* From the DSCOVR spacecraft's unique and distance vantage point, the NISTAR instrument can collect data from nearly the entire sunlit surface of the Earth. Unlike the products from other prior and current Earth science missions, the DSCOVR NISTAR products contain data for a nearly whole disc image of the Earth at a given moment in time. NISTAR product files contain data for an entire Julian Earth day. A Julian day is defined as the interval of time from 12:00:00.00h to 11:59:59.99h the following day UTC. The level 1B products also contain summary data from previous days' products in the form of ten-minute, hourly and daily tabulations. The level 1A and level 1B data products are stored in separate HDF file as the ASDC.

The time scale in most of the data objects described here is "DSCOVR epoch time." This is the number of seconds since 00:00:00.00 hours, 24, May, 1968 UTC or Julian day number 2,440,000.5.

1.3 PURPOSE

This DFCB provides the user with a detailed description of the format and contents of the DSCOVR NISTAR instrument science data products. It contains descriptions of the irradiance, telemetry, calibration, and other ancillary data and their organization into HDF data objects. This document is the specification to which the developers of the NISTAR instrument science data processing systems will develop their systems and serves as a guide to end users who will use the data.

1.4   NAMING CONVENTION FOR THE HDF PRODUCT FILES

All of the data collected by the NISTAR instrument for a given day and all associated ancillary data shall be written to a single HDF file. The following file naming convention is followed when creating NISTAR level 1a or 1b product files. Each filename shall be of the form "nist_ll_yyyymmdd_aapbbbs_vv.h5", where:

nist indicates the NISTAR instrument

ll indicate the level of processing, 1a or 1b

yyyy indicates the year (eg 2015 for the year 2015)

mm indicates the number of the month of the year when obtained (eg, 04 for April) in UTC

dd indicates the day of the month (eg 07 for the 7th day of the month),

aa indicates the noontime latitude coordinate of the centroid in degrees (eg 37) rounded to the nearest integer

p indicates whether the coordinate is north or south latitude (n for north, s for south)

bbb indicates the noontime longitude of the centroid in degrees (eg 072) round to the nearest integer

s indicates the sign of the coordinate, i.e. whether the longitude is east or west (e for east, w for west),

vv indicates the version number of the product (range 01…99),

h5 indicates that this is a HDF 5 file.

NISTAR products contain data for a full day. The 24-hour collection period spans a Julian day, which begins at noon UTC and ends twenty-four hours later at noon UTC of the following day. The date portion of the file name represents the UTC day in which data collection ended. The centroid values in the file name are the longitude/latitude coordinates for the centroid of the Earth disk as seen from the DSCOVR spacecraft at 00:00:00h UTC.

For example: nist_1a_20150417_37n072w_01.h5. This is a Level 1 processed NISTAR data product, which contains data for 17 April 2015 UTC. It contains Earth data with a noon-time centroid at 37N, 72W and is version 01 of the product.

2   NISTAR LEVEL 1A DATA PRODUCT

2.1   PRODUCT OVERVIEW

Each NISTAR instrument science data product consists of one full (24 hour) day's worth of data from four sensors, three active cavity radiometers and a photodiode which will serve both as a calibration reference for the radiometers and filters, and as a detector in the range from 320nm to 1100nm. One full day is defined as the interval of time from 12:00:00.00h UTC to 11:59:59.99h UTC the following day (i.e., "Noon" to "Noon"). The data are primarily from the nearly full Earth, but can also contain lunar and star field data. Ancillary data associated with the science data include data collection time, Earth centroid coordinates (for 00:00:00h UTC), and spacecraft attitude and ephemeris. The products shall be written using the HDF 5 libraries. The data objects are grouped into seven HDF groups: Science_data, Engineering_Data, Thermistor_Data, Photodiode_Current, Ground_Calibration, On-orbit_Calibration, and Geolocation.

Table 1 – Data Group Types

Group	Contents
Science_Data	Contains the raw science data converted into engineering units
Engineering_Data	Contains the Housekeeping data also converted into engineering units
Thermistor_Data	Contains the Thermistor temperature data converted into engineering units
Photodiode_Current	Contains tabulations of the raw photodiode currents of the celestial object in NISTAR's view. Separate items are created for Lunar, Earth, EarthLunar (when Earth and Moon are in view), and "other" (usually "deep space" views for calibration)
Ground_Calibration	Contains 17 datasets, each with laboratory-determined calibration information for the instrument. This ground-calibration information is used to convert instrument readings into irradiances.
On-orbit_Calibration	Contains calibration data used in converting instrument readings to irradiances. One example of on-orbit calibration data is the photodiode "dark-current" which has to be measured regularly over the lifetime of the mission because it can change.
Geolocation	Contains tabulations of all the geolocation information from the spacecraft, lunar, and solar ephemeris to lunar and Earth sub-satellite points.
Attributes	Contains the attributes data for all data sets

2.2 DATA VOLUMES

Below are the estimated data volumes for the NISTAR groups and data types. Note that these sizes are without compression, therefore the actual physical storage size will vary. These sizes are also listed as the maximum possible for each object. If there is less available data the sizes can be much lower. For example, the sum of all four photodiode current records will be a maximum of 864,000 records. The calibration data record counts listed here are particularly conservative.

Table 2 - Data volumes by group

Object Description	Record Size (bytes)	Number Records	Count	Object Size (bytes)
ScienceData	209	86,400	1	18,057,600
EngineeringData	367	8,640	1	3,170,880
ThermistorData	19	8,649	1	164,160
EarthCurrent	16	864,000	1	13,824,000
LunarCurrent	16	864,000	1	13,824,000
EarthLunarCurrent	16	864,000	1	13,824,000
OtherCurrent	16	864,000	1	13,824,000
EarthCentroidCoord	24	8,640	1	207,360
LunarCentroidCoord	24	8,640	1	207,360
PrimaryApertureDimensions	16	1	1	16

SecondaryApertureDimensions	16	1	1	16
ApertureSeparation	4	1	1	4
FilterPositions	6	12	1	72
ThermistorResistance-50to60C	8	181	1	1,408
PTCThermistorResistance-35to50C	20	58	1	1,160
NetTempCoefReceiver1	12	11	1	220
NetTempCoefReceiver2	12	11	1	220
NetTempCoefReceiver3	12	11	1	220
NetTempCoefHeatSink	12	11	1	220
VoltageScaleAdjustments	28	3	1	84
ReceiverPowerResponsivity	28	1	1	28
SpectraIrradianceResponsivity	28	1	1	28
SiliconPhotodiodeBOLResponsivity	12	28	1	336
SiliconPhotodiodeBOLDarkCurrent group	8	80	1	640
FilterTransmissionCurves	28	115	1	3,220
ShutterTransmissionFunction	5	211	1	1,055
InstrumentPointingCorrections	80	1	1	80
PhotodiodeDarkCurrent	12	1,000	1	12,000
ShutterTransmissionFunctionOnOrbit	5	45	1	225
PhotodiodeFilterIntercomparisonOnOrbit	14	1,000	1	14,000
ReceiversFilterIntercomparison	22	1,000	1	22,000
TotalFluxIntercomparison	42	1,000	1	42,000
CavityPowerLossToSpace	34	1,000	1	34,000
SpacecraftEphemeris	56	1,440	1	80,640
InstrumentAttitudeMatrix	80	17,280	1	1,382,400
LunarEphemeris	56	1,440	1	80,640
EarthSubsatellitePoint	24	1,440	1	34,560
LunarSubsatellitePoint	24	1,440	1	34,560
NISTARView	9	17,280	1	155,520
SolarEphemeris	56	1,440	1	80,640
Metadata Attribute	707	1	1	707
ScienceData Attribute	3,729	1	1	3,729
EngineeringData Attribute	4,942	1	1	4,942
ThermistorData Attribute	307	1	1	307
EarthCurrent Attribute	75	1	3 (sum to 75)	75
LunarCurrent Attribute	75	1	3 (sum to 75)	75
EarthLunarCurrent Attribute	75	1	3 (sum to 75)	75
OtherCurrent Attribute	75	1	3 (sum to 75)	75
EarthCentroidCoord Attribute	117	1	4 (sum	117

			to 117)	
LunarCentroidCoord Attribute	117	1	4 (sum to 117)	117
PrimaryApertureDimensions Attribute	237	1	1	237
SecondaryApertureDimensions Attribute	237	1	1	237
ApertureSeparation Attribute	148	1	1	148
FilterPositions Attribute	233	1	1	233
ThermistorResistance-50to60C Attribute	183	1	1	183
PTCThermistorResistance-35to50C Attribute	275	1	1	275
NetTempCoefReceiver1 Attribute	215	1	1	215
NetTempCoefReceiver2 Attribute	215	1	1	215
NetTempCoefReceiver3 Attribute	215	1	1	215
NetTempCoefHeatSink Attribute	213	1	1	213
VoltageScaleAdjustments Attribute	437	1	1	437
ReceiverPowerResponsivity Attribute	447	1	1	447
SpectraIrradianceResponsivity Attribute	531	1	1	531
SiliconPhotodiodeBOLResponsivity Attribute	287	1	1	287
SiliconPhotodiodeBOLDarkCurrent Attribute	195	1	1	195
FilterTransmissionCurves Attribute	283	1	1	283
ShutterTransmissionFunction Attribute	174	1	1	174
InstrumentPointingCorrections Attribute	331	1	1	331
PhotodiodeDarkCurrent Attribute	186	1	1	186
ShutterTransmissionFunctionOnOrbit Attribute	174	1	1	174
PhotodiodeFilterIntercomparisonOnOrbit Attribute	213	1	1	213
ReceiversFilterIntercomparison Attribute	292	1	1	292
TotalFluxIntercomparison Attribute	563	1	1	563
CavityPowerLossToSpace Attribute	466	1	1	466
SpacecraftEphemeris Attribute	272	1	1	272
InstrumentAttitudeMatrix Attribute	332	1	1	332
LunarEphemeris Attribute	267	1	1	267
EarthSubsatellitePoint Attribute	235	1	1	235
LunarSubsatellitePoint Attribute	235	1	1	235
NISTARView Attribute	263	1	1	263

SolarEphemeris Attribute		269	1	1	269

2.3 GROUPS

The HDF data objects contained in the NISTAR level 1 data products are organized into Groups. The table below defined the Groups and specified the data objects, which are written to each group. The data objects themselves are described in the later sections of this document.

Table 3 - HDF group contents

Group Name	Group Class	Descriptions
Science_Data	Mnemonics	Contains the data extracted from AppID 82 of the DSCOVR telemetry.
Engineering_Data	Mnemonics	Contains the data extracted from AppID 86 of the DSCOVR telemetry.
Photodiode_Current	Irradiances	Contains currents measured by the photodiode and the associated target centroids
Ground_Calibration	Calibration	Contains the objects, which store the instrument calibrations obtained from ground-based measurements
On-orbit_Calibration	Calibration	Contains the objects, which store the instrument calibrations obtained from on-orbit-based measurements.
Geolocation_Data	Geolocation	Contains the data objects which store the information needed to geolocated the product science data
Thermistor_Data	Mnemonics	Contains the data extracted from AppID37 of the DSCOVR telemetry
Attributes	Attributes	Contains the attribute data for all other groups

2.4 THE SCIENCE DATA

The irradiances collected by the radiometers and photodiode sensors are extracted by the data processing system from AppId 82 of the telemetry received from the DSCOVR spacecraft. Each data element is directly associated with a data item in AppId 82 of the raw telemetry identified by a mnemonic. The data in the level 1A products have been converted to engineering units, but retain their one to one associations with the items in the raw telemetry from which they were derived. Each section of data includes at its beginning the data items from mnemonics H05TIME and H052CNT. Each record in these Datasets represents the data collected in one second of instrument time. In other words, these data come down from the instrument once per second.

Table 4 – Science_Data group contents

Field Name	Data Type	Order	Units	Range	Description

H052TIME	float64	1	Seconds	0…5.E9	DSCOVR Epoch Time
ITOSQUALITY	char8	1	N/A	' ' or 'Q'	Data quality factor computed by ITOS. ASCII numerical equivalent of ' ' = good 'Q'=bad
H052CNT	uint16	1	N/A	0…16383	Packet Sequence Control Source Sequence Count
NIMJRFRMCNT	uint32	1	N/A	0…2e32-1	Major Frame Count (Time Reference)
NIERRCNT	uint8	1	N/A	0…255	Command Reject Count
NICMDCNT	uint8	1	N/A	0…255	Command Accept Count
NIPDFLTRTYPE	uint8	1	N/A	0…2	Si photodiode Filter Type
NIRC3FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 3 Filter Type
NIRC2FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 2 Filter Type
NIRC1FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 1 Filter Type
NIAUTOSAFE	uint8	1	N/A	0…1	Auto Safe Condition
NIMODECMD	uint8	1	N/A	0..1	Arm Mode
NIAUTOCYCLE	uint8	1	N/A	0…1	Is autocycling on
NIINSTMODE	uint8	1	N/A	0…1	Instrument Mode
NIRC1HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 1 Heater Built In Test
NIRC2HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 2 Heater Built in Test
NIRC3HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 3 Heater Built in Test
NIHSHTRBIT	uint8	1	N/A	0…1	Heat Sink Heater Built In Test
NIPDBIT	uint8	1	N/A	0…1	Si Photodiode Build In Test
NIQHSSHKBIT	uint8	1	N/A	0…1	QHSS Housekeeping Built In Test
NIQHSSSCIBIT	uint8	1	N/A	0…1	QHSS Science Built In Test
NIQHSSMTRBIT	uint8	1	N/A	0…1	QHSS Motor Built In Test
NITSCBIT	uint8	1	N/A	0…1	DSCOVR Spacecraft Computer Built In Test
NIFWBIT	uint8	1	N/A	0…1	Filter Wheel Built In

					Test
NIPDSHTRBIT	uint8	1	N/A	0…1	Shutter Speed Built In Test
NIRC3SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 3 Shutter Built In Test
NIRC2SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 2 Shutter Built In Test
NIRC1SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 1 Shutter Built In Test
NI1553BIT	uint8	1	N/A	0…1	1553 Built In Test
NIOSBIT	uint8	1	N/A	0…1	Operating System Built In Test
NIPREFWPOSNUM	uint16	1	N/A	0..1104	Predicted Filter Wheel Position Number
NIRC1PRESHPOSNUM	uint8	1	N/A	0…201	Receiver Cavity 1 Predicted Shutter Position Number
NIRC2PRESHPOSNUM	uint8	1	N/A	0...201	Receiver Cavity 2 Predicted Shutter Position Number
NIRC3PRESHPOSNUM	uint8	1	N/A	0…201	Receiver Cavity 3 Predicted Shutter Position Number
NIPDPRESHPOSNUM	uint8	1	N/A	0…201	Si Photodiode Predicted Shutter Position Number
NIINSTTIME1	uint16	1	N/A	0…65535	NISTAR Instrument time 1
NIINSTTIME2	uint16	1	N/A	0…65535	NISTAR Instrument time 2
NIRC1HDACCMDAVG	float32	1	Watts	0…6.60E-05	Receiver Cavity 1 Heater DAC Command Average
NIRC1HADCMFLAVG	float32	1	Watts	0…6.60E-05	Receiver Cavity 1 Heater ADC Measure Filter Average
NIRC1PTCMRESAVG	float32	1	Ohms	0…23685	Receiver Cavity 1 PTC Measured Resistance Average
NIRC1CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 1 Current Cal Tick
NIRC1DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 1 Differential Control Mode
NIRC1ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 1 ADC Calibration Status

NIRC1HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 1 Heater Calibration Status
NIRC1PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 1 Positive Temp coeff calibration status
NIRC1PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 1 precharge mode
NIRC1PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 1 PTC bridge nulled status
NIRC1PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 1 PTC in saturated status
NIRC1TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 1 close loop control status
NIRC2HDACCMDAVG	float32	1	Watts	0…6.60E-05	Receiver cavity 2 heater DAC command average
NIRC2HADCMFLAVG	float32	1	Watts	0…6.60E-05	Receiver Cavity 2 Heater ADC Measure Filter Average
NIRC2PTCMRESAVG	float32	1	Ohms	0…23685	Receiver Cavity 2 PTC Measured Resistance Average
NIRC2CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 2 Current Cal Tick
NIRC2DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 2 Differential Control Mode
NIRC2ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 2 ADC Calibration Status
NIRC2HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 2 Heater Calibration Status
NIRC2PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 2 Positive Temp coeff calibration status
NIRC2PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 2 precharge mode
NIRC2PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 2 PTC bridge nulled status
NIRC2PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 2 PTC in saturated status
NIRC2TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 2 close loop control status
NIRC3HDACCMDAVG	float32	1	Watts	0…6.60E-05	Receiver cavity 3 heater DAC command average
NIRC3HADCMFLAVG	float32	1	Watts	0…6.6	Receiver Cavity 3

				0E-05	Heater ADC Measure Filter Average
NIRC3PTCMRESAVG	float32	1	Ohms	0…236 85	Receiver Cavity 3 PTC Measured Resistance Average
NIRC3CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 3 Current Cal Tick
NIRC3DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 3 Differential Control Mode
NIRC3ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 3 ADC Calibration Status
NIRC3HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 3 Heater Calibration Status
NIRC3PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 3 Positive Temp coeff calibration status
NIRC3PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 3 precharge mode
NIRC3PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 3 PTC bridge nulled status
NIRC3PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 3 PTC in saturated status
NIRC3TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 3 close loop control status
NIHSHDACCMDAVG	float32	1	Watts	0..3.50	Heat sink heater digital/analog converter command average
NIHSPTCMRESAVG	float32	1	Ohms	0…236 85	Heat sink PTC measured resistance average
NIHSCURRCALTIC	uint8	1	N/A	0…15	Heat sink current cal tick
NIHSADCCALST	uint8	1	N/A	0…1	Heat sink analog/digital converter calibration status
NIHSHTRCALST	uint8	1	N/A	0…1	Heat sink heater calibration status
NIHSPTCCALST	uint8	1	N/A	0…1	Heat sink positive temp coeff calibration status
NIHSPTCBRGNLST	uint8	1	N/A	0…1	Heat sink PTC bridge nulled status
NIHSPTCINSATST	uint8	1	N/A	0…1	Heat sink close loop control status
NIHSTEMPCTRL	uint8	1	N/A	0…1	Heat Sink Close Loop

					Control Status
NIPDADCAVG10HZ1	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 1
NIPDADCAVG10HZ2	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 2
NIPDADCAVG10HZ3	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 3
NIPDADCAVG10HZ4	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 4
NIPDADCAVG10HZ5	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 5
NIPDADCAVG10HZ6	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 6
NIPDADCAVG10HZ7	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 7
NIPDADCAVG10HZ8	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 8
NIPDADCAVG10HZ9	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 9

NIPDADCAVG10HZ10	int32	1	N/A	-214748 3748… 214783 647	Si photodiode ADC average 10 Hz sample 10
NIPDDACAVG10HZ1	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 1
NIPDDACAVG10HZ2	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 2
NIPDDACAVG10HZ3	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 3
NIPDDACAVG10HZ4	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 4
NIPDDACAVG10HZ5	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 5
NIPDDACAVG10HZ6	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 6
NIPDDACAVG10HZ7	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 7
NIPDDACAVG10HZ8	int32	1	N/A	-214748 3748… 214783 647	Si photodiode DAC average 10 Hz sample 8
NIPDDACAVG10HZ9	int32	1	N/A	-214748	Si photodiode DAC average 10 Hz sample 9

				3748…214783647	
NIPDDACAVG10HZ10	int32	1	N/A	-2147483748…214783647	Si photodiode DAC average 10 Hz sample 10

The following attributes (1) are defined for the science data:

ScienceDataAttr = Science AppID82 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>
Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.5   THE INSTRUMENT ENGINEERING DATA

The engineering data contains status information about the NISTAR instrument. They are extracted by the data processing system from AppId 86 of the telemetry received from the DSCOVR spacecraft. Each data element is directly associated with a data item in AppId 86 of the raw telemetry identified by a mnemonic. The data in the level 1 products have been converted to engineering units, but retain their one to one associations with the items in the raw telemetry from which they were derived. Each section of data includes at its beginning the data items from mnemonics H056TIME and H056CNT.

Table 5 – Engineering_Data group data contents

Field Name	Data Type	Order	Units	Range	Description
H056TIME	float64	1	Seconds	0…5.E9	System time when packet was formed (DSCOVR Epoch)
ITOSQUALITY	char8	1	N/A	' ' or 'Q'	Data quality factor computed by ITOS, ' ' =good 'Q'=bad
H056CNT	uint16	1	N/A	0…16383	Packet sequence control source sequence count
NIRADHOUSTMP	float32	1	Celsius	-50…120	Heat sink temperature
NIRC1MTRTMP	float32	1	Celsius	-50…120	RC1 motor temperature
NIRC2MTRTMP	float32	1	Celsius	-50…120	RC2 motor temperature
NIRC3MTRTMP	float32	1	Celsius	-50…120	RC3 motor temperature

NIPDMTRTMP	float32	1	Celsius	-50… 120	Si photodiode motor temperature
NIFWMTRTMP	float32	1	Celsius	-50… 120	Filter wheel motor temp
NIPWA11TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-1 temperature
NIPWA12TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-2 temperature
NIPWA13TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-3 temperature
NIPWA14TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-4 temperature
NIPWA21TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-1 temperature
NIPWA22TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-2 temperature
NIPWA23TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-3 temperature
NIPWA24TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-4 temperature
NILVPSTMP	float32	1	Celsius	-50… 120	Low voltage power supply temperature
NITLMPWATMP	float32	1	Celsius	-50… 120	Telemetry printed wiring assembly temperature
NIMTRDRPWATMP	float32	1	Celsius	-50… 120	Motor driver printed wiring assembly temperature
NIP5VDC	float32	1	Volts	0...20	+5 VDC
NIP15VDC	float32	1	Volts	0…40	+15 VDC
NIN15VDC	float32	1	Volts	-40…0	-15 VDC
NIP30VDC	float32	1	Volts	0… 100	+30 VDC
NITSKORID	uint8	1	N/A	0…15	ID number of last task to have an overrun
NITSKORCNT	uint16	1	N/A	0… 65535	Last task overrun count
NITSKMGROR	uint8	1	N/A	0…1	Task manager overrun status
NISCPDOR	uint8	1	N/A	0…1	Subsystem control SI photodiode overrun status
NIMMMDOR	uint8	1	N/A	0…1	Mission management mode overrun status
NISCSHTROR	uint8	1	N/A	0…1	Subsystem control shutter overrun status
NISCHTROR	uint8	1	N/A	0…1	Subsystem control heater overrun status

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NISCFPGAOR	uint8	1	N/A	0…1	Subsystem control field programmable gate array overrun stat
NISCFWOR	uint8	1	N/A	0…1	Subsystem control filter wheel overrun status
NISCTSCOR	uint8	1	N/A	0…1	Subsystem control DSCOVR spacecraft computer overrun status
NIRC1SHTROSC	uint16	1	N/A	0…65535	RC1 shutter open switch counter
NIRC1SHTRCSC	uint16	1	N/A	0…65535	RC1 shutter close switch counter
NIRC2SHTROSC	uint16	1	N/A	0…65535	RC2 shutter open switch counter
NIRC2SHTRCSC	uint16	1	N/A	0…65553	RC2 shutter close switch counter
NIRC3SHTROSC	uint16	1	N/A	0…65535	RC3 shutter open switch counter
NIRC3SHTRCSC	uint16	1	N/A	0…65535	RC3 shutter close switch counter
NIPDSHTROSC	uint16	1	N/A	0…65535	Si photodiode open switch counter
NIPDSHTRCSC	uint16	1	N/A	0…65535	Si photodiode close switch counter
NIFWCWSC	uint16	1	N/A	0…65535	Filter wheel clockwise switch counter
NIFWCCWSC	uint16	1	N/A	0…65535	Filter wheel counter clockwise switch counter
NIPDBRDGNULL	uint8	1	N/A	0…1	Si photodiode bridge nulled status
NIPDINSAT	uint8	1	N/A	0…1	Si photodiode in saturation status
NIPDFZDACCMD	uint8	1	N/A	0…1	Si photodiode freeze DAC command status
NIPDPID2P	float32	1	N/A	0…50.0	Si photodiode proportional integral derivative 2 P
NIPDPID2I	float32	1	N/A	0…50.0	Si photodiode proportional integral derivative 2 I
NIPDPID2D	float32	1	N/A	0…50.0	Si photodiode proportional integral derivative 2 D
NIPDPID2KLP	float32	1	N/A	0…1.0E8	Si photodiode proportional integral derivative 2K loop

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NIPDCAL	uint8	1	N/A	0…9	Si photodiode shutter calibration state
NIRC3CAL	uint8	1	N/A	0…9	RC3 Shutter calibration state
NIRC2CAL	uint8	1	N/A	0…9	RC2 Shutter calibration state
NIRC1CAL	uint8	1	N/A	0…9	RC1 Shutter calibration state
NIRC1SHCYCLE	uint8	1	N/A	0…1	RC1 Shutter Cycle
NIRC2SHCYCLE	uint8	1	N/A	0…1	RC2 Shutter Cycle
NIRC3SHCYCLE	uint8	1	N/A	0…1	RC3 Shutter Cycle
NIPDSHCYCLE	uint8	1	N/A	0…1	Photodiode shutter cycle
NIFWCAL	uint8	1	N/A	0…9	Filter wheel calibration state
NIRC1PTCRSP	float32	1	Ohms	0…23000	RC1 PTC resistance set point command
NIRC1PID2P	float32	1	N/A	0…50.0	RC1 proportional integral derivative 2 P
NIRC1PID2I	float32	1	N/A	0…50.0	RC1 proportional integral derivative 2 I
NIRC1PID2D	float32	1	N/A	0…50.0	RC1 proportional integral derivative 2 D
NIRC1PID2K	float32	1	N/A	0…1.0E8	RC1 proportional integral derivative 2 K loop
NIRC1BNOMSF	float32	1	N/A	0…2.0	RC1 bridge null offset measurement scale factor
NIRC1MDACSF	float32	1	N/A	0…2.0	RC1 MDAC scale factor
NIRC1HTRSF	float32	1	N/A	0…2.0	RC1 heater scale factor
NIRC1DIFFMDSF	float32	1	N/A	0…10.0	RC1 differential mode scale factor
NIRC1BNOMOFFST	float32	1	N/A	-65536…65535	RC1 bridge null offset measurement offset
NIRC1HTROFFST	float32	1	N/A	-65536…65535	RC1 heater offset
NIRC1MDACOFFST	float32	1	N/A	-65536…65535	RC1 MDAC offset
NIRC1CMDOLPWR	float32	1	Watts	0…6.60e-5	RC1 commanded open loop power
NIRC1SINWVFRQ	uint8	1	Hz	34…156	RC1 sine wave frequency
NIRC2PTCRSP	float32	1	Ohms	0…23000	RC2 PTC resistance set point command
NIRC2PID2P	float32	1	N/A	0…50.0	RC2 proportional integral derivative 2 P
NIRC2PID2I	float32	1	N/A	0…50.0	RC2 proportional integral derivative 2 I

NIRC2PID2D	float32	1	N/A	0…50.0	RC2 proportional integral derivative 2 D
NIRC2PID2K	float32	1	N/A	0…1.0E8	RC2 proportional integral derivative 2 K loop
NIRC2BNOMSF	float32	1	N/A	0…2.0	RC2 bridge null offset measurement scale factor
NIRC2MDACSF	float32	1	N/A	0…2.0	RC2 MDAC scale factor
NIRC2HTRSF	float32	1	N/A	0…2.0	RC2 heater scale factor
NIRC2DIFFMDSF	float32	1	N/A	0…10.0	RC2 differential mode scale factor
NIRC2BNOMOFFST	float32	1	N/A	-65536…65535	RC2 bridge null offset measurement offset
NIRC2HTROFFST	float32	1	N/A	-65536…65535	RC2 heater offset
NIRC2MDACOFFST	float32	1	N/A	-65536…65535	RC2 MDAC offset
NIRC2CMDOLPWR	float32	1	Watts	0…6.60e-5	RC2 commanded open loop power
NIRC2SINWVFRQ	uint8	1	Hz	34…156	RC2 sine wave frequency
NIRC3PTCRSP	float32	1	Ohms	0…23000	RC3 PTC resistance set point command
NIRC3PID2P	float32	1	N/A	0…50.0	RC3 proportional integral derivative 2 P
NIRC3PID2I	float32	1	N/A	0…50.0	RC3 proportional integral derivative 2 I
NIRC3PID2D	float32	1	N/A	0…50.0	RC3 proportional integral derivative 2 D
NIRC3PID2K	float32	1	N/A	0…1.0E8	RC3 proportional integral derivative 2 K loop
NIRC3BNOMSF	float32	1	N/A	0…2.0	RC3 bridge null offset measurement scale factor
NIRC3MDACSF	float32	1	N/A	0…2.0	RC3 MDAC scale factor
NIRC3HTRSF	float32	1	N/A	0…2.0	RC3 heater scale factor
NIRC3DIFFMDSF	float32	1	N/A	0…10.0	RC3 differential mode scale factor
NIRC3BNOMOFFST	float32	1	N/A	-65536…65535	RC3 bridge null offset measurement offset
NIRC3HTROFFST	float32	1	N/A	-65536…65535	RC3 heater offset
NIRC3MDACOFFST	float32	1	N/A	-65536…65535	RC3 MDAC offset
NIRC3CMDOLPWR	float32	1	Watts	0…6.60e-5	RC3 commanded open loop power
NIRC3SINWVFRQ	uint8	1	Hz	34…156	RC3 sine wave frequency

NIHSPTCRSP	float32	1	Ohms	0…23000	Heat sink PTC resistance set point command
NIHSPID2P	float32	1	N/A	0…50.0	Heat sink proportional integral derivative 2 P
NIHSPID2I	float32	1	N/A	0…50.0	Heat sink proportional integral derivative 2 I
NIHSPID2D	float32	1	N/A	0…50.0	Heat sink proportional integral derivative 2 D
NIHSPID2K	float32	1	N/A	0…1.0E8	Heat sink proportional integral derivative 2 K loop
NIHSBNOMSF	float32	1	N/A	0…2.0	Heat sink bridge null offset measurement scale factor
NIHSMDACSF	float32	1	N/A	0…2.0	Heat sink MDAC scale factor
NIHSDIFFMDSF	float32	1	N/A	0…10.0	Heat sink differential mode scale factor
NIHSBNOMOFFST	float32	1	N/A	0…65535	Heat sink bridge null offset measurement offset
NIHSMDACOFFST	float32	1	N/A	0…6553	Heat sink MDAC offset
NIHSCMDOLPWR	float32	1	Watts	0…3.5	Heat sink Commanded open loop power
NIHSSINWVFRQ	uint8	1	Hz	34…156	Heat sink commanded sine wave frequency
NIRC3HTRCALEN	uint8	1	N/A	0…1	RC3 heater calibration enabled
NIHSPTCCALEN	uint8	1	N/A	0…1	Heat sink PTC calibration enabled
NIRC3PTCCALEN	uint8	1	N/A	0…1	RC3 calibration enabled
NIRC2HTRCALEN	uint8	1	N/A	0…1	RC2 heater calibration enabled
NIRC1HTRCALEN	uint8	1	N/A	0…1	RC1 heater calibration enabled
NIRC2PTCCALEN	uint8	1	N/A	0…1	RC2 calibration enabled
NIRC1PTCCALEN	uint8	1	N/A	0…1	RC1 calibration enabled
NISCEXTWDT	uint8	1	N/A	0…1	External watch dog timer (science analog board)
NISCLOCWDT	uint8	1	N/A	0…1	Local watch dog timer (science analog board)

The following attributes (1) are defined for the engineering data:

EngineeringDataAttr = Engineering AppID86 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>

Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.6 THE NISTAR THERMISTOR DATA

The NISTAR thermistor data contains information on the temperature of the NISTAR instrument. These data come down in AppId 37 and are stored separately from the AppId 82 and AppId 86 data. Also included are mnemonics H025CNT and H025TIME which are packet count and packet time respectively. UHNISTEMP1 is in ICE box on a aluminum block (the block also houses thermostats). UHNISTEMP2 is on the interface plate between the heat sink and the radiometer housing.

Table 6 – Thermistor_Data group data contents

Field Name	Data Type	Order	Units	Range	Description
H025TIME	float64	1	Seconds	0…5E9	System time when packet was formed (DSCOVR Epoch)
ITOSQUALITY	char8	1	N/A	' ' or 'Q''	Data quality factor compiled by ITOS. ' '=good 'Q'-bad
H025CNT	uint16	1	N/A	0…16383	Packet sequence control source sequence count
UHNISTTEMP1	float32	1	Celsius	-50…120	Temperature as measured by thermistor 1
UHNISTTEMP2	float32	1	Celsius	-50…120	Temperature as measured by thermistor 2

The following attributes (1) are defined for the thermistor data:

ThermistorDataAttr = Thermistor AppID37 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>
Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.7 MISCELLANEOUS NISTAR DATA

A new AppID was generated to help diagnose instrument performance on the ground, called AppId Misc. This included both science and engineering data that did not appear in any of the other AppId's. The data given in the table below are not written into the HDF file, and are only processed through Level 0. In many cases an integer data type is used on a mnemonic which has units. This is because this group is only used for Level 0 processing, and the data is still in digital numbers which are always integers. Conversion to engineering units occurs during post processing.

Table 7 – Miscellaneous_Data contents

Field Name	Data Type	Order	Units	Range	Description
H052TIME	float64	1	Seconds	0...5.E9	Triana Epoch Time
NIRC1BNOMMESAVG	int32	1	N/A	-2^31...2^31-1	RC1 BNOM Measured Average
NIRC1PREDITMDAC	int32	1	N/A	0...65535	RC1 Pre Dither MDAC Command
NIRC1PTCRERRAVG	int32	1	Ohms	-2^31...2^31-1	RC1 PTC Resistance Error Average
NIRC1FZMDACCMD	int32	1	N/A	0...1	RC1 Freeze MDAC Command
NIRC2BNOMMESAVG	int32	1	N/A	-2^31...2^31-1	RC2 BNOM Measured Average
NIRC2PREDITMDAC	int32	1	N/A	0...65535	RC2 Pre Dither MDAC Command
NIRC2PTCRERRAVG	int32	1	Ohms	-2^31...2^31-1	RC2 PTC Resistance Error Average
NIRC2FZMDACCMD	int32	1	N/A	0...1	RC2 Freeze MDAC Command
NIRC3BNOMMESAVG	int32	1	N/A	-2^31...2^31-1	RC3 BNOM Measured Average
NIRC3PREDITMDAC	int32	1	N/A	0...65535	RC3 Pre Dither MDAC Command
NIRC3PTCRERRAVG	int32	1	Ohms	-2^31...2^31-1	RC3 PTC Resistance Error Average
NIRC3FZMDACCMD	int32	1	N/A	0...1	RC3 Freeze MDAC Command
NIHSBNOMMESAVG	int32	1	N/A	-2^31...2^31-1	HS BNOM Measured Average
NIHSPREDITMDAC	int32	1	N/A	0...65535	HS Pre Dither MDAC

					Command
NIHSPTCRERRAVG	int32	1	Ohms	-2^31...2^31-1	HS PTC Resistance Error Average
NIHSFZMDACCMD	int32	1	N/A	0…1	HS Freeze MDAC Command
NILASTCMD	int32	1	N/A	0...65535	Last Command
NILASTCMDFLD	int32	1	N/A	0...65535	Last Command Field
NIPDCMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC1 Load Phase Status
NIPDCMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC1 Motor Enabled Status
NIRC2CMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC2 Load Phase Status
NIRC2CMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC2 Motor Enabled Status
NIRC3CMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC3 Load Phase Status
NIRC3CMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC3 Motor Enabled Status
NIRC1CMDFWLDPHS	int32	1	N/A	0…1	RC1 Motor Control Command FW Load Phase Status
NIRC1CMDFWMTREN	int32	1	N/A	0…1	RC1 Motor

					Control Command FW Motor Enabled Status
NIRC1CMDLDSTPCTR	int32	1	N/A	0…1	RC1 Motor Control Command Load Step Counter Status
NIRC1CMDMTRCTRRS	int32	1	N/A	0…1	RC1 Motor Control Command Motor Counter Reset Status
NIRC1CMDMTRDIR	int32	1	N/A	0…1	RC1 Motor Control Command Motor Direction
NIRC1CMDMTRHLDOF	int32	1	N/A	0...65535	RC1 Motor Control Command Motor Hold Off
NIRC1CMDMTRPHSA	int32	1	N/A	0…1	RC1 Motor Control Command Motor Phase A Status
NIRC1CMDMTRPHSB	int32	1	N/A	0…1	RC1 Motor Control Command Motor Phase B Status
NIRC1CMDMTRSPD	int32	1	N/A	0...7	RC1 Motor Control Command Motor Speed
NIRC1CMDMTRSTOP	int32	1	N/A	0…1	RC1 Motor Control Command Stop Motor Status
NIRC1CMDMTRSTPCT	int32	1	N/A	0...65535	RC1 Motor Control Command Motor Step Count
NIRC1CMDSTPCLKEN	int32	1	N/A	0…1	RC1 Motor

					Control Command Step Clock Enable Status
NIRC1MTRGOCMD	int32	1	N/A	0…1	RC1 Motor Go Command
NIPDCMDRC2LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC2 Load Phase Status
NIPDCMDRC2MTREN	int32	1	N/A	0…1	PD Motor Control Command RC2 Motor Enabled Status
NIRC1CMDRC2LDPHS	int32	1	N/A	0…1	RC1 Motor Control Command RC2 Load Phase Status
NIRC1CMDRC2MTREN	int32	1	N/A	0…1	RC1 Motor Control Command RC2 Motor Enabled Status
NIRC3CMDRC2LDPHS	int32	1	N/A	0…1	RC3 Motor Control Command RC2 Load Phase Status
NIRC3CMDRC2MTREN	int32	1	N/A	0…1	RC3 Motor Control Command RC2 Motor Enabled Status
NIRC2CMDFWLDPHS	int32	1	N/A	0…1	RC2 Motor Control Command FW Load Phase Status
NIRC2CMDFWMTREN	int32	1	N/A	0…1	RC2 Motor Control Command FW Motor Enabled Status

NIRC2CMDLDSTPCTR					RC2 Motor Control Command Load Step Counter Status
	int32	1	N/A	0…1	
NIRC2CMDMTRCTRRS					RC2 Motor Control Command Motor Counter Reset Status
	int32	1	N/A	0…1	
NIRC2CMDMTRDIR					RC2 Motor Control Command Motor Direction
	int32	1	N/A	0…1	
NIRC2CMDMTRHLDOF					RC2 Motor Control Command Motor Hold Off
	int32	1	N/A	0...65535	
NIRC2CMDMTRPHSA					RC2 Motor Control Command Motor Phase A Status
	int32	1	N/A	0…1	
NIRC2CMDMTRPHSB					RC2 Motor Control Command Motor Phase B Status
	int32	1	N/A	0…1	
NIRC2CMDMTRSPD					RC2 Motor Control Command Motor Speed
	int32	1	N/A	0...7	
NIRC2CMDMTRSTOP					RC2 Motor Control Command Stop Motor Status
	int32	1	N/A	0…1	
NIRC2CMDMTRSTPCT					RC2 Motor Control Command Motor Step Count
	int32	1	N/A	0...65535	
NIRC2CMDSTPCLKEN					RC2 Motor Control Command Step Clock Enable Status
	int32	1	N/A	0…1	

NIRC2MTRGOCMD	int32	1	N/A	0…1	RC2 Motor Go Command
NIPDCMDRC3LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC3 Load Phase Status
NIPDCMDRC3MTREN	int32	1	N/A	0…1	PD Motor Control Command RC3 Motor Enabled Status
NIRC1CMDRC3LDPHS	int32	1	N/A	0…1	RC1 Motor Control Command RC3 Load Phase Status
NIRC1CMDRC3MTREN	int32	1	N/A	0…1	RC1 Motor Control Command RC3 Motor Enabled Status
NIRC2CMDRC3LDPHS	int32	1	N/A	0…1	RC2 Motor Control Command RC3 Load Phase Status
NIRC2CMDRC3MTREN	int32	1	N/A	0…1	RC2 Motor Control Command RC3 Motor Enabled Status
NIRC3CMDFWLDPHS	int32	1	N/A	0…1	RC3 Motor Control Command FW Load Phase Status
NIRC3CMDFWMTREN	int32	1	N/A	0…1	RC3 Motor Control Command FW Motor Enabled Status
NIRC3CMDLDSTPCTR	int32	1	N/A	0…1	RC3 Motor Control Command Load Step Counter Status

NIRC3CMDMTRCTRRS					RC3 Motor Control Command Motor Counter
	int32	1	N/A	0…1	Reset Status
NIRC3CMDMTRDIR					RC3 Motor Control Command
	int32	1	N/A	0…1	Motor Direction
NIRC3CMDMTRHLDOF					RC3 Motor Control Command
	int32	1	N/A	0...65535	Motor Hold Off
NIRC3CMDMTRPHSA					RC3 Motor Control Command Motor Phase A
	int32	1	N/A	0…1	Status
NIRC3CMDMTRPHSB					RC3 Motor Control Command Motor Phase B
	int32	1	N/A	0…1	Status
NIRC3CMDMTRSPD					RC3 Motor Control Command
	int32	1	N/A	0...7	Motor Speed
NIRC3CMDMTRSTOP					RC3 Motor Control Command Stop
	int32	1	N/A	0…1	Motor Status
NIRC3CMDMTRSTPCT					RC3 Motor Control Command Motor Step
	int32	1	N/A	0...65535	Count
NIRC3CMDSTPCLKEN					RC3 Motor Control Command Step Clock Enable
	int32	1	N/A	0…1	Status
NIRC3MTRGOCMD					RC3 Motor Go
	int32	1	N/A	0…1	Command
NIRC1CMDPDLDPHS					RC1 Motor Control
	int32	1	N/A	0…1	Command PD

					Load Phase Status
NIRC1CMDPDMTREN	int32	1	N/A	0…1	RC1 Motor Control Command PD Motor Enabled Status
NIRC2CMDPDLDPHS	int32	1	N/A	0…1	RC2 Motor Control Command PD Load Phase Status
NIRC2CMDPDMTREN	int32	1	N/A	0…1	RC2 Motor Control Command PD Motor Enabled Status
NIRC3CMDPDLDPHS	int32	1	N/A	0…1	RC3 Motor Control Command PD Load Phase Status
NIRC3CMDPDMTREN	int32	1	N/A	0…1	RC3 Motor Control Command PD Motor Enabled Status
NIPDCMDFWLDPHS	int32	1	N/A	0…1	PD Motor Control Command FW Load Phase Status
NIPDCMDFWMTREN	int32	1	N/A	0…1	PD Motor Control Command FW Motor Enabled Status
NIPDCMDLDSTPCTR	int32	1	N/A	0…1	PD Motor Control Command Load Step Counter Status
NIPDCMDMTRCTRRS	int32	1	N/A	0…1	PD Motor Control Command Motor Counter Reset Status

NIPDCMDMTRDIR					PD Motor Control Command Motor Direction
	int32	1	N/A	0…1	
NIPDCMDMTRHLDOFF					PD Motor Control Command Motor Hold Off
	int32	1	N/A	0...65535	
NIPDCMDMTRPHSA					PD Motor Control Command Motor Phase A Status
	int32	1	N/A	0…1	
NIPDCMDMTRPHSB					PD Motor Control Command Motor Phase B Status
	int32	1	N/A	0…1	
NIPDCMDMTRSPD					PD Motor Control Command Motor Speed
	int32	1	N/A	0...7	
NIPDCMDMTRSTOP					PD Motor Control Command Stop Motor Status
	int32	1	N/A	0…1	
NIPDCMDMTRSTPCNT					PD Motor Control Command Motor Step Count
	int32	1	N/A	0...65535	
NIPDCMDSTPCLCKEN					PD Motor Control Command Step Clock Enable Status
	int32	1	N/A	0…1	
NIPDMTRGOCMD					PD Motor Go Command
	int32	1	N/A	0…1	
NIRC1POSCLSD					RC1 Position Closed
	int32	1	N/A	0…1	
NIRC1POSOPN					RC1 Position Open
	int32	1	N/A	0…1	
NIRC2POSCLSD					RC2 Position Closed
	int32	1	N/A	0…1	
NIRC2POSOPN					RC2 Position Open
	int32	1	N/A	0…1	

NIRC3POSCLSD	int32	1	N/A	0…1	RC3 Position Closed
NIRC3POSOPN	int32	1	N/A	0…1	RC3 Position Open
H056TIME	float64	1	Seconds	0...5.E9	System time when packed was formed (Triana epoch)
NIRC1PHAMTRI	int32	1	milliAmps	-50...175	RC1 Phase A Motor Current
NIRC1PHBMTRI	int32	1	milliAmps	-50...175	RC1 Phase B Motor Current
NIRC2PHAMTRI	int32	1	milliAmps	-50...175	RC2 Phase A Motor Current
NIRC2PHBMTRI	int32	1	milliAmps	-50...175	RC2 Phase B Motor Current
NIRC3PHAMTRI	int32	1	milliAmps	-50...175	RC3 Phase A Motor Current
NIRC3PHBMTRI	int32	1	milliAmps	-50...175	RC3 Phase B Motor Current
NIPDPHAMTRI	int32	1	milliAmps	-50...175	PD Phase A Motor Current
NIPDPHBMTRI	int32	1	milliAmps	-50...175	PD Phase B Motor Current
NIFWPHAMTRI	int32	1	milliAmps	-50...175	FW Phase A Motor Current
NIFWPHBMTRI	int32	1	milliAmps	-50...175	FW Phase B Motor Current
NIRC1PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC1 Phase A Motor Current
NIRC1PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC1 Phase B Motor Current
NIRC2PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC2 Phase A Motor Current
NIRC2PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC2 Phase B Motor Current
NIRC3PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC3 Phase A Motor Current
NIRC3PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC3 Phase B Motor Current

NIPDPHAMTRIPV	int32	1	milliAmps	-50...175	Peak PD Phase A Motor Current
NIPDPHBMTRIPV	int32	1	milliAmps	-50...175	Peak PD Phase B Motor Current
NIFWPHAMTRIPV	int32	1	milliAmps	-50...175	Peak FW Phase A Motor Current
NIFWPHBMTRIPV	int32	1	milliAmps	-50...175	Peak FW Phase B Motor Current
NIRADHOUSTMPPV	int32	1	Celsius	-50...120	Peak Heat Sink Temperature
NIRC1MTRTMPPV	int32	1	Celsius	-50...120	Peak RC1 Motor Temperature
NIRC2MTRTMPPV	int32	1	Celsius	-50...120	Peak RC2 Motor Temperature
NIRC3MTRTMPPV	int32	1	Celsius	-50...120	Peak RC3 Motor Temperature
NIPDMTRTMPPV	int32	1	Celsius	-50...120	Peak PD Motor Temperature
NIFWMTRTMPPV	int32	1	Celsius	-50...120	Peak FW Motor Temperature
NIPWA11TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-1 Temperature
NIPWA12TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-2 Temperature
NIPWA13TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-3 Temperature
NIPWA14TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-4 Temperature
NIPWA21TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-1 Temperature
NIPWA22TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-2 Temperature
NIPWA23TMPPV	int32	1	Celsius	-50...120	Peak Wire

					Assembly 2-3 Temperature
NIPWA24TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-4 Temperature
NILVPSTMPPV	int32	1	Celsius	-50...120	Peak Low Voltage Power Supply Temp
NITLMPWATMPPV	int32	1	Celsius	-50...120	Peak Telemetry Wire Assembly Temp
NIMTRDRPWATMPPV	int32	1	Celsius	-50...120	Peak Motor Driver Wire Assembly Temp
NIP5VDCPV	int32	1	Volts	0...20	Peak +5 VDC
NIP15VDCPV	int32	1	Volts	0...40	Peak +15 VDC
NIN15VDCPV	int32	1	Volts	-40...0	Peak -15 VDC
NIP30VDCPV	int32	1	Volts	0...100	Peak +30 VDC
NIRC1AREA	int32	1	Percent	0...100	RC1 Area
NIRC2AREA	int32	1	Percent	0...100	RC2 Area
NIRC3AREA	int32	1	Percent	0...100	RC3 Area
NIPDAREA	int32	1	Percent	0...100	SiPD Area
NISPARE1	float32	1	N/A	0...2^32-1	NISTAR Spare 1
NISPARE2	float32	1	N/A	0...2^32-1	NISTAR Spare 2
NISPARE3	float32	1	N/A	0...2^32-1	NISTAR Spare 3
NISPARE4	float32	1	N/A	0...2^32-1	NISTAR Spare 4
NISPARE5	float32	1	N/A	0...2^32-1	NISTAR Spare 5
NISPARE6	float32	1	N/A	0...2^32-1	NISTAR Spare 6
NIRC1FCPRECHRGA	float32	1	N/A	0...2^32-1	RC1 Fixed Close Precharge Type A Filter
NIRC1FCPRECHRGB	float32	1	N/A	0...2^32-1	RC1 Fixed Close Precharge Type B Filter
NIRC1FCPRECHRGC	float32	1	N/A	0...2^32-1	RC1 Fixed Close Precharge Type C Filter
NIRC2FCPRECHRGA	float32	1	N/A	0...2^32-1	RC2 Fixed Close Precharge Type A Filter

NIRC2FCPRECHRGB	float32	1	N/A	0...2^32-1	RC2 Fixed Close Precharge Type B Filter
NIRC2FCPRECHRGC	float32	1	N/A	0...2^32-1	RC2 Fixed Close Precharge Type C Filter
NIRC3FCPRECHRGA	float32	1	N/A	0...2^32-1	RC3 Fixed Close Precharge Type A Filter
NIRC3FCPRECHRGB	float32	1	N/A	0...2^32-1	RC3 Fixed Close Precharge Type B Filter
NIRC3FCPRECHRGC	float32	1	N/A	0...2^32-1	RC3 Fixed Close Precharge Type C Filter
NIRC1FOPRECHRGA	float32	1	N/A	0...2^32-1	RC1 Fixed Open Precharge Type A Filter
NIRC1FOPRECHRGB	float32	1	N/A	0...2^32-1	RC1 Fixed Open Precharge Type B Filter
NIRC1FOPRECHRGC	float32	1	N/A	0...2^32-1	RC1 Fixed Open Precharge Type C Filter
NIRC2FOPRECHRGA	float32	1	N/A	0...2^32-1	RC2 Fixed Open Precharge Type A Filter
NIRC2FOPRECHRGB	float32	1	N/A	0...2^32-1	RC2 Fixed Open Precharge Type B Filter
NIRC2FOPRECHRGC	float32	1	N/A	0...2^32-1	RC2 Fixed Open Precharge Type C Filter
NIRC3FOPRECHRGA	float32	1	N/A	0...2^32-1	RC3 Fixed Open Precharge Type A Filter
NIRC3FOPRECHRGB	float32	1	N/A	0...2^32-1	RC3 Fixed Open Precharge Type B Filter
NIRC3FOPRECHRGC	float32	1	N/A	0...2^32-1	RC3 Fixed Open Precharge Type C Filter
NIRC1AOPRECHRG0	float32	1	N/A	0...2^32-1	RC1 Auto Open Precharge Type A Filter
NIRC1AOPRECHRG1	float32	1	N/A	0...2^32-1	RC1 Auto Open

					Precharge Type B Filter
NIRC1ACPRECHRG0	float32	1	N/A	0...2^32-1	RC1 Auto Close Precharge Type A Filter
NIRC1ACPRECHRG1	float32	1	N/A	0...2^32-1	RC1 Auto Close Precharge Type B Filter
NIRC2AOPRECHRG0	float32	1	N/A	0...2^32-1	RC2 Auto Open Precharge Type A Filter
NIRC2AOPRECHRG1	float32	1	N/A	0...2^32-1	RC2 Auto Open Precharge Type B Filter
NIRC2ACPRECHRG0	float32	1	N/A	0...2^32-1	RC2 Auto Close Precharge Type A Filter
NIRC2ACPRECHRG1	float32	1	N/A	0...2^32-1	RC2 Auto Close Precharge Type B Filter
NIRC3AOPRECHRG0	float32	1	N/A	0...2^32-1	RC3 Auto Open Precharge Type A Filter
NIRC3AOPRECHRG1	float32	1	N/A	0...2^32-1	RC3 Auto Open Precharge Type B Filter
NIRC3ACPRECHRG0	float32	1	N/A	0...2^32-1	RC3 Auto Close Precharge Type A Filter
NIRC3ACPRECHRG1	float32	1	N/A	0...2^32-1	RC3 Auto Close Precharge Type B Filter
NISCRC1PTCBSY	int32	1	N/A	0...1	RC1 PTC Busy (Science Analog Board)
NISCRC2PTCBSY	int32	1	N/A	0...1	RC2 PTC Busy (Science Analog Board)
NISCRC3PTCBSY	int32	1	N/A	0...1	RC3 PTC Busy (Science Analog Board)
NISCHSPTCBSY	int32	1	N/A	0...1	HS PTC Busy (Science Analog Board)
NIRC1BNOMRW	int32	1	N/A	0...65535	RC1 Bridge Null Offset

					Measurement Raw
NIRC2BNOMRW	int32	1	N/A	0...65535	RC2 Bridge Null Offset Measurement Raw
NIRC3BNOMRW	int32	1	N/A	0...65535	RC3 Bridge Null Offset Measurement Raw
NIRC1MDACCMD	int32	1	N/A	0...65535	RC1 MDAC Command
NIRC2MDACCMD	int32	1	N/A	0...65535	RC2 MDAC Command
NIRC3MDACCMD	int32	1	N/A	0...65535	RC3 MDAC Command
PNNISTARCUR	int32	1	Amps	-3...3.5	NISTAR Instrument Current
NIPDBRDGNULL	int32	1	N/A	0...1	PD Bridge Nulled Status
NIHSBNOMRW	int32	1	N/A	0...65535	HS Bridge Null Offset Measurement Raw

2.8 PHOTODIODE CURRENT DATA

These values are the Earth or Moon's irradiance values as measured by the NISTAR instrument's photodiode sensor. The NISTAR instrument can view either the Earth or the Moon alone or both together. It may also view bright planets. The epoch times are expressed in the number of seconds since 24 May 1968, 00:00:00.00h UTC accurate to 0.01 seconds. Lunar irradiances and centroid coordinates are included only in products that contain lunar data. The irradiance and centroid data are scaled to NISTAR epoch time using HDF dimension scaling. The NISTAR instrument has a 7 degree acceptance angle. This wide field will result in samplings that contain irradiances from both the Earth and the Moon together about 15% of the time. Modeled Lunar irradiances may not be included at all times. Centroid coordinates are not included with data of objects other that the Earth or Moon.

Table 8 - Photodiode_Current group contents

Group	Data type	Description
EarthCurrent	Group	Contains the Earth currents
LunarCurrent	Group	Contains the Lunar currents
EarthLunarCurrent	Group	Contains the currents of the Earth and Moon together
OtherCurrent	Group	Contains other currents

EarthCentroidCoord	Group	Contains Earth centroid coordinates
LunarCentroidCoord	Group	Contains Lunar centroid coordinates

2.8.1   Earth Currents

These data sets contain the Earth currents as measured by the photodiode at 0.1 second samplings. This is produced when only the Earth is in the field of regard.

Table 9 - Earth Irradiance group data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0…5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0…1E-5	Earth irradiance values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when only the Earth is in the field of regard.

The following attributes (3) are defined for the Earth currents data:

long_name = Photodiode_current_data: Epoch Time, Current;
units = Seconds, Amps;
valid_range = 0.0, 1.0E-5;

2.8.2   Lunar Currents

These data sets contain the lunar and modeled lunar currents as measured by the photodiode at 0.1 second samplings. This is produced when only the moon is in the field of regard.

Table 10 - Lunar Irradiance group data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0…5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0…1E-5	Lunar irradiance values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when only the Moon is in the field of regard.

The following attributes (3) are defined for the Earth currents data:

long_name = Photodiode_current_data: Epoch Time, Current;

units = Seconds, Amps;
valid_range = 0.0, 1.0E-5;

2.8.3   Earth/Lunar Irradiances

This data set contains the combined Earth and Lunar irradiance values as measured by the photodiode. This is produced when both bodies are in the field of regard.

Table 11 - Earth/Lunar Irradiance group data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0…5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0…1E-5	Combined Earth and Lunar irradiance values at 0.1 second sampling interval in amperes as measured by the photodiode. Produced when both bodies appear in the field of regard.

The following attributes (3) are defined for the Earth currents data:

long_name = Photodiode_current_data: Epoch Time, Current;
units = Seconds, Amps;
valid_range = 0.0, 1.0E-5;

2.8.4   Other Object Irradiances

This data set contains the irradiances of objects other than the Earth or the Moon, such as bright planets, as measured by the photodiode at 0.1 second samplings. This data set will not be included in products that do not contain data from such objects.

Table 12 - Other Irradiance group data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0…5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0…1E-5	Other Object irradiance values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when neither Earth nor Moon is in the field of regard.

The following attributes (3) are defined for the Earth currents data:

long_name = Photodiode_current_data: Epoch Time, Current;

units = Seconds, Amps;
valid_range = 0.0, 1.0E-5;

2.8.5   Earth Centroid Coordinates

This group contains the Earth Centroid Coordinates that map to the photodiode current values.
The terrestrial geographic coordinates map to their respective current data sets with a cardinality
of 1:100. In other words, One coordinate data point maps to each 100 current data points or
every 10 seconds of time. If the Moon is also included in the field of view, only the centroid
coordinates of the Earth are given.

Table 13 - Earth centroid group data

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	8,640	Seconds	0…5E9	DSCOVR epoch time Earth
Latitude	float64	8,640	Degrees	-90.0…90.0	Latitude values
Longitude	float64	8,640	Degrees	-180.0…180.0	Longitude values

The following attributes (4) are defined for the Earth currents data:

long_name = Centroid_latlong_data: Epoch Time, Latitude, Longitude;
units = Seconds, Degrees, Degrees;
coordsys = Geographic lat/long;
valid_range = -180.0, 180.0;

2.8.6   Lunar Centroid Coordinates

This group contains the Lunar Centroid Coordinates, which map to the photodiode current data.
The lunar geographic coordinates map to their respective current data sets with a cardinality of
1:100. In other words, one coordinate data point maps to each 100 current data points or every 10
seconds of time.

Table 14 - Lunar centroid group data

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	8,640	Seconds	0…5E9	DSCOVR epoch time Earth
Latitude	float64	8,640	Degrees	-90.0…90.0	Latitude values
Longitude	float64	8,640	Degrees	-180.0…180.0	Longitude values

The following attributes (4) are defined for the Earth currents data:

long_name = Centroid_latlong_data: Epoch Time, Latitude, Longitude;
units = Seconds, Degrees, Degrees;
coordsys = Geographic lat/long;
valid_range = -180.0, 180.0;

2.9 GROUND CALIBRATION DATA

This group contains the data used to calibrate the level 1 science data. The data in this section has been determined on the ground and will not change over the course of the mission. Included in this section is such information as the sizes of the apertures, the transmission properties of the filters, and the temperature sensitivity of various optical and electronic components.

Table 15 - Ground_Calibration group contents

Group	Data type	Description
ApertureSeparation	Group	Contains the distance between the primary and secondary apertures
FilterPositions	Group	Contains the filter positions vs motor step
FilterTransmissionCurves	Group	Contains the filter transmission curves for each filter pair
NetTempCoefHeatSink	Group	Contains the table of gain and offset corrections versus temperature for the heat sink
NetTempCoefReceiver1	Group	Contains the table of gain and offset corrections versus temperature for the receiver 1
NetTempCoefReceiver2	Group	Contains the table of gain and offset corrections versus temperature for the receiver 2
NetTempCoefReceiver3	Group	Contains the table of gain and offset corrections versus temperature for the receiver 3
PTCThermistorResistance-35to50C	Group	Contains the table of resistance versus temperature for PTC thermistors between -35C and 50C.
PrimaryApertureDimensions	Group	Contains the physical size of the primary apertures for the four detectors
ReceiverPowerResponsivity	Group	Contains the table of responsivity values s. incident power for receiver 1 through 3 and the corresponding uncertainties
SecondaryApertureDimensions	Group	Contains the physical size of the secondary apertures for the four detectors
ShutterTransmissionFunction	Group	Contains the table of exposed aperture area versus motor step for the shutter

SiliconPhotodiodeBOLDarkCurrent	Group	Contains the table of the dark current of the photodiode in amperes versus temperature
SiliconPhotodiodeBOLResponsivity	Group	Contains the table of responsivity values s. incident power for receiver 1 through 3 and the corresponding uncertainties
SpectralIrradianceResponsivity	Group	Contains the table of spectral irradiance responsivity values vs. wavelength for receiver 1 through 3
ThermalResistance-50to60C	Group	Contains the thermistor resistance versus temperature for the range from -50C to 60C
VoltageScaleAdjustments	Group	Contains the voltage scale adjustments (gain and offset) that need to be made to the instrument based on the ambient temperature of the instrument

2.9.1   Primary Aperture Dimensions

This object contains the physical size of the primary apertures for the four detectors. This data is determined on the ground and does not changes.

Group Name: "PrimaryApertureDimensions"
Class: "Calibration"

Table 16 - PrimaryApertureDimensions group data contents

Field Name	Data Type	Order	Units	Range	Description
Receiver1Area	float32	1	cm^2	0…1	Area of receiver 1 primary aperture
Receiver2Area	float32	1	cm^2	0…1	Area of receiver 2 primary aperture
Receiver3Area	float32	1	cm^2	0…1	Area of receiver 3 primary aperture
PhotodiodeArea	float32	1	cm^2	0…1	Area of photodiode primary aperture

The following attributes (1) are defined for the PrimaryApertureDimensions data:

PrimaryApertureDimensionsAttr = Calibration data;
Fields = Receiver1Area, Receiver2Area, Receiver3Area, PhotodiodeArea;<LF>
Units = cm^2, cm^2, cm^2, cm^2;<LF>
Range = [0.0…1.0], [0.0…1.0], [0.0…1.0], [0.0…1.0];<LF>
Coordinate System = N/A;<LF>

2.9.2   Secondary Aperture Dimensions

This object contains the physical sizes of the secondary apertures for the four detectors. This data is determined on the ground and does not change.

Group Name: "SecondaryApertureDimensions"
Class: "Calibration"

Table 17 - SecondaryApertureDimensions group data contents

Field Name	Data Type	Order	Units	Range	Description
Receiver1Area	float32	1	cm^2	0…2	Area of receiver 1 secondary aperture
Receiver2Area	float32	1	cm^2	0…2	Area of receiver 2 secondary aperture
Receiver3Area	float32	1	cm^2	0…2	Area of receiver 3 secondary aperture
PhotodiodeArea	float32	1	cm^2	0…2	Area of photodiode secondary aperture

The following attributes (1) are defined for the SecondaryApertureDimensions data:

SecondaryApertureDimensionsAttr = Calibration data;
Fields = Receiver1Area, Receiver2Area, Receiver3Area, PhotodiodeArea;<LF>
Units = cm^2, cm^2, cm^2, cm^2;<LF>
Range = [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.3   Primary and Secondary Aperture Separation
This object contains the distance between the primary and secondary apertures. This distance is the same for all four detectors, and is determined on the ground.

Group Name: "ApertureSeparation"
Class: "Calibration"

Table 18 - ApertureSeparation group data contents

Field Name	Data Type	Order	Units	Range	Description
ApertureSeparation	float32	1	cm	10…20	Distance between primary and secondary apertures

The following attributes (1) are defined for the ApertureSeparation data:

ApertureSeparationAttr = Calibration data;
Fields = ApertureSeparation;<LF>
Units = Centimeters;<LF>
Range = [10.0…20.0];<LF>
Coordinate System = N/A;<LF>

2.9.4   Filter Position versus Filter Motor Steps
This object contains the filer position versus motor step. The stepping motor rotates the filer wheel until a set of filters is in place over the detectors (there are 12 filters on the wheel, but only

2-40

four detectors). This data is determined on the ground and does not change. The table below indicates which filter is in front of which detector for a given step.

Table 19 - Filter positions relative to motor step

FilterWheelStep	Receiver 1	Receiver 2	Receiver 3	Photodiode
002	1C1	4A1	7B1	10A2
102	12A5	3A3	6A6	9A4
202	11B2	2B3	5C2	8C3
302	10A2	1C1	4A1	7B1
402	8C3	11B2	2B3	6A6
502	8C3	11B2	2B3	5C2
602	7B1	10A2	1C1	4A1
702	6A6	9A4	12A5	3A3
802	5C2	8C3	11B2	2B3
902	4A1	7B1	10A2	1C1
1002	3A3	6A6	9A4	12A5
1102	2B3	5C2	8C3	11B2

This object contains the filter position versus motor step. In the data description below we use 1=1C1, 2=2B3, 3=3A3, 4=4A1, 5=5C2, 6=6A6, 7=7B1 8=8C3, 9=9A4, 10=10A2, 11=11B2, 12=12A5.

Group: "FilterPositions"
Class: "Calibration"

Table 20 – FilterPositions group data contents

Field Name	Data Type	Order	Units	Range	Description
MotorStep	uint16	1	N/A	0…1,110	Filter wheel motor step count
Receiver1	uint8	1	N/A	1…12	Filter number versus motor step for receiver 1
Receiver2	uint8	1	N/A	1…12	Filter number versus motor step for receiver 2
Receiver3	uint8	1	N/A	1…12	Filter number versus motor step for receiver 3
Photodiode	uint8	1	N/A	1…12	Filter number versus motor step for photodiode

The following attributes (1) are defined for the FilterPositions data:

FilterPositionsAttr = Calibration data;
Fields = MotorStep, Receiver1, Receiver2, Receiver3, Photodiode;<LF>
Units = N/A, N/A, N/A, N/A, N/A;<LF>

Range = [0…1105], [1…12], [1…12], [1…12], [1…12];<LF>
Coordinate System = N/A;<LF>

2.9.5   Thermistors resistance versus temperature

This object contains the table of resistance versus temperature for the thermistors at temperatures from -50C to 60C. These data are determined on the ground and do not change.

Group: "ThermistorResistance-50to60C"
Class: "Calibration"

Table 21 - Thermistors resistance versus temperature group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of thermistor
ThermistorResistance	float32	1	Ohms	0…1.0e7	Thermistor resistance

The following attributes (1) are defined for the ThermistorResistance-50to60C data:

ThermistorResistance-50to60CAttr = Calibration data;
Fields = Temperature, ThermistorResistance;<LF>
Units = Celsius, Ohms;<LF>
Range = [-100.0…100.0], [0.0…1.0e7];<LF>
Coordinate System = N/A;<LF>

2.9.6   Positive Temperature Coefficient (PTC) Thermistors

This object contains the table of resistance versus temperature for PTC thermistors between -35C and 50C. This data is determined on the ground and does not change.

Group: "PTCThermistorResistance-35to50C"
Class: "Calibration"

Table 22 - Positive temperature coefficient (PTC) thermistors group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of thermistor
Receiver1	float32	1	Ohms	0…25000	Electrical resistance
Receiver2	float32	1	Ohms	0…25000	Electrical resistance
Receiver3	float32	1	Ohms	0…25000	Electrical resistance
HeatSink	float32	1	Ohms	0…25000	Electrical resistance

The following attributes (1) are defined for the PTCThermistorResistance-35to50C data:

PTCThermistorResistance-35to50CAttr = Calibration data;
Fields = Temperature, Receiver1, Receiver2, Receiver3, HeatSink;<LF>
Units = Celsius, Ohms, Ohms, Ohms, Ohms;<LF>
Range = [-100.0…100.0], [0.0…25000.0], [0.0…25000.0], [0.0…25000.0], [0.0…25000.0];<LF>
Coordinate System = N/A;<LF>

2.9.7 Net temperature coefficient for electronics - Receiver 1

The datasets defined below describe the net temperature coefficients (gain and offset corrections versus temperature) for the printed wiring assemblies (PWA) to the power measurement circuits for the receiver 1. These data are determined on the ground and do not change.

This object contains the table of gain and offset corrections versus temperature of the printed wiring assemblies (PWA's) to the power measurement circuits for Receiver 1.
Group: "NetTempCoefReceiver1"
Class: "Calibration"

Table 23 – NetTempCoefReceiver1 group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
Receiver1PWAGain	float32	1	N/A	0…2	Gain
Receiver1PWAOffset	float32	1	N/A	-2…2	Offset

The following attributes (1) are defined for the NetTempCoefReceiver1 data:

NetTempCoefReceiver1Attr = Calibration data;
Fields = Temperature, Receiver1PWAGain, Receiver1PWAOffset;<LF>
Units = Celsius, N/A, N/A;<LF>
Range = [-100.0…100.0], [0.0…2.0], [-2.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.8 Net temperature coefficient for electronics - Receiver 2

The datasets defined below describe the net temperature coefficients (gain and offset corrections versus temperature) for the printed wiring assemblies (PWA) to the power measurement circuits for the receiver 2. These data are determined on the ground and do not change.

This object contains the table of gain and offset corrections versus temperature of the printed wiring assemblies (PWA's) to the power measurement circuits for Receiver 2.
Group: "NetTempCoefReceiver2"
Class: "Calibration"

Table 24 – NetTempCoefReceiver2 group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
Receiver2PWAGain	float32	1	N/A	0…2	Gain
Receiver2PWAOffset	float32	1	N/A	-2…2	Offset

The following attributes (1) are defined for the NetTempCoefReceiver2 data:

NetTempCoefReceiver2Attr = Calibration data;
Fields = Temperature, Receiver2PWAGain, Receiver2PWAOffset;<LF>
Units = Celsius, N/A, N/A;<LF>
Range = [-100.0…100.0], [0.0…2.0], [-2.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.9   Net temperature coefficient for electronics - Receiver 3

The datasets defined below describe the net temperature coefficients (gain and offset corrections versus temperature) for the printed wiring assemblies (PWA) to the power measurement circuits for the receiver 3. These data are determined on the ground and do not change.

This object contains the table of gain and offset corrections versus temperature of the printed wiring assemblies (PWA's) to the power measurement circuits for Receiver 3.
Group: "NetTempCoefReceiver3"
Class: "Calibration"

Table 25 – NetTempCoefReceiver3 group data contents

Field Name	HDF Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
Receiver3PWAGain	float32	1	N/A	0…2	Gain
Receiver3PWAOffset	float32	1	N/A	-2…2	Offset

The following attributes (1) are defined for the NetTempCoefReceiver3 data:

NetTempCoefReceiver3Attr = Calibration data;
Fields = Temperature, Receiver3PWAGain, Receiver3PWAOffset;<LF>
Units = Celsius, N/A, N/A;<LF>
Range = [-100.0…100.0], [0.0…2.0], [-2.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.10 Net temperature coefficient for electronics - Heat Sink

The datasets defined below describe the net temperature coefficients (gain and offset corrections versus temperature) for the printed wiring assemblies (PWA) to the power measurement circuits for the receiver 3. These data are determined on the ground and do not change.

This object contains the table of gain and offset corrections versus temperature of the printed wiring assemblies (PWA's) to the power measurement circuits for Heat Sink.

Group: "NetTempCoefHeatSink"

Class: "Calibration"

Table 26 - NetTempCoefHeatSink group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
HeatSinkPWAGain	float32	1	N/A	0…2	Gain
HeatSinkPWAOffset	float32	1	N/A	-2…2	Offset

The following attributes (1) are defined for the NetTempCoefHeatSink data:

NetTempCoefHeatSinkAttr = Calibration data;
Fields = Temperature, HeatSinkPWAGain, HeatSinkPWAOffset;<LF>
Units = Celsius, N/A, N/A;<LF>
Range = [-100.0…100.0], [0.0…2.0], [-2.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.11 Ambient Temperature Absolute Electronic Scale Corrections

This object contains the voltage scale adjustments (gain and offset) that need to be made to the instrument based on the ambient temperature of the instrument. These data are determined once on the ground in the laboratory.

Group: "VoltageScaleAdjustments"
Class: "Calibration"

Table 27 - VoltageScaleAdjustments group data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
Receiver1ADCVoltageScaleGain	float32	1	N/A	0…2	Receiver 1 ambient temperature absolute voltage scale gain adjustment
Receiver1ADCVoltageScaleOffset	float32	1	N/A	-2…2	Receiver 1

					ambient temperature absolute voltage scale offset adjustment
Receiver2ADCVoltageScaleGain	float32	1	N/A	0…2	Receiver 2 ambient temperature absolute voltage scale gain adjustment
Receiver2ADCVoltageScaleOffset	float32	1	N/A	-2…2	Receiver 2 ambient temperature absolute voltage scale offset adjustment
Receiver3ADCVoltageScaleGain	float32	1	N/A	0…2	Receiver 3 ambient temperature absolute voltage scale gain adjustment
Receiver3ADCVoltageScaleOffset	float32	1	N/A	-2…2	Receiver 3 ambient temperature absolute voltage scale offset adjustment

The following attributes (1) are defined for the VoltageScaleAdjustments data:

VoltageScaleAdjustmentsAttr = Calibration data;
Fields = Temperature, Receiver1ADCVoltageScaleGain, Receiver1ADCVoltageScaleOffset, Receiver2ADCVoltageScaleGain, Receiver2ADCVoltageScaleOffset, Receiver3ADCVoltageScaleGain, Receiver3ADCVoltageScaleOffset;<LF>
Units = Celsius, N/A, N/A, N/A, N/A, N/A, N/A;<LF>
Range = [-100.0…100.0], [0.0…2.0], [-2.0…2.0], [0.0…2.0], [-2.0…2.0], [0.0…2.0], [-2.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.12 Receiver Power Responsivity at 532nm
This object contains the table of responsivity values s. incident power for receiver 1 through 3 and the corresponding uncertainties. This data is determined once on the ground in the laboratory. The responsivity is the ratio of the measured power to the (carefully calibrated) input power.

Group: "ReceiverPowerResponsivity"
Class: "Calibration"

Table 28 - ReceiverPowerResponsivity group data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentPower	float32	1	Watts	0…1E-4	Incident power in Watts
Reciever1PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 1 power responsivity
Receiver1PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 1 power responsivity uncertainty
Reciever2PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 2 power responsivity
Receiver2PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 2 power responsivity uncertainty
Reciever3PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 3 power responsivity
Receiver3PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 3 power responsivity uncertainty

The following attributes (1) are defined for the ReceiverPowerResponsivity data:

ReceiverPowerResponsivityAttr = Calibration data;
Fields = IncidentPower, Receiver1PowerResponsivity, Receiver1PowerResponsivityUncertainty, Receiver2PowerResponsivity, Receiver2PowerResponsivityUncertainty, Receiver3PowerResponsivity, Receiver3PowerResponsivityUncertainty;<LF>
Units = Watts, N/A, N/A, N/A, N/A, N/A, N/A;<LF>
Range = [0.0…1.0E-4], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.13 Spectral Irradiance Responsivity
This object contains the table of spectral irradiance responsivity values vs. wavelength for receiver 1 through 3. The responsivity is the ratio of the measured irradiance to the input irradiance and the uncertainties as function of the wavelength of input. These data are determined once on the ground in the laboratory.

Group: "SpectralIrradianceResponsivity"
Class: "Calibration"

Table 29 - SpectralIrradianceResponsivity group data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentWavelength	float32	1	Meters	0… 1E-4	Incident wavelength in meters
Receiver1SpectralIrradianceResponsitivity	float32	1	N/A	0…2	Radius of Receiver 1 spectral irradiance responsivity
Receiver1SpectralIrradianceResponsivityUncertainty	float32	1	N/A	0…2	Radius of Receiver 1 spectral irradiance responsivity uncertainty
Receiver2SpectralIrradianceResponsitivity	float32	1	N/A	0…2	Radius of Receiver 2 spectral irradiance responsivity
Receiver2SpectralIrradianceResponsivityUncertainty	float32	1	N/A	0…2	Radius of Receiver 2 spectral irradiance responsivity uncertainty
Receiver3SpectralIrradianceResponsitivity	float32	1	N/A	0…2	Radius of Receiver 3 spectral irradiance responsivity
Receiver3SpectralIrradianceResponsivityUncertainty	float32	1	N/A	0…2	Radius of Receiver 3 spectral irradiance responsivity uncertainty

The following attributes (1) are defined for the SpectralIrradianceResponsivity data:

SpectralIrradianceResponsivityAttr = Calibration data;
Fields = IncidentWavelength, Receiver1SpectralIrradianceResponsivity,
Receiver1SpectralIrradianceResponsivityUncertainty, Receiver2SpectralIrradianceResponsivity,

Receiver2SpectralIrradianceResponsivityUncertainty, Receiver3SpectralIrradianceResponsivity,
Receiver3SpectralIrradianceResponsivityUncertainty;<LF>
Units = Meters, N/A, N/A, N/A, N/A, N/A, N/A;<LF>
Range = [0.0…1.0E-4], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0],
[0.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.14 Silicon Photodiode BOL Spectral Responsivity (A/W)
This object contains the table of the responsivity (in Amperes per Watt) of the Silicon
Photodiode as a function of the wavelength of the light (and the uncertainty) for wavelengths
between 200 nm and 1 micron. These data are determined once on the ground in the laboratory.
"BOL" means "beginning of life".

Group: "SiliconPhotodiodeBOLResponsivity"
Class: "Calibration"

Table 30 - SiliconPhotodiodeBOLResponsivity group data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentWavelength	float32	1	Meters	0…1E-4	Incident wavelength in meters
SiliconPhotodiodeBOLSpectralResponsivity	float32	1	Amps /Watt	0…1	Silicon photodiode BOL spectral responsivity
SiliconPhotodiodeBOLSpectralResponsivityUncertainty	float32	1	Amps /Watt	0…1	Silicon photodiode BOL spectral responsivity uncertainty

The following attributes (1) are defined for the SiliconPhotodiodeBOLResponsivity data:

SiliconPhotodiodeBOLResponsivityAttr = Calibration data;
Fields = IncidentWavelength, SiliconPhotodiodeBOLSpectralResponsivity,
SiliconPhotodiodeBOLSpectralResponsivityUncertainty;<LF>
Units = Meters, Amps/Watt, Amps/Watt;<LF>
Range = [0.0…1.0E-4], [0.0…1.0], [0.0…1.0];<LF>
Coordinate System = N/A;<LF>

2.9.15 Silicon Photodiode BOL Dark Current (A)

This object contains the table of the dark current of the photodiode in amperes versus temperature (-30 to +50C). These data are determined once on the ground in the laboratory.

Group: "SiliconPhototdiodeBOLDarkCurrent"
Class: "Calibration"

Table 31 - SiliconPhotodiodeBOLDarkCurrent group data contents

Field Name	HDF Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of PWA
SiliconPhotodiodeBOLDarkCurrent	float32	1	Amps	0…12E-6	Silicon photodiode BOL dark current

The following attributes (1) are defined for the SiliconPhototdiodeBOLDarkCurrent data:

SiliconPhototdiodeBOLDarkCurrentAttr = Calibration data;
Fields = Temperature, SiliconPhotodiodeBOLDarkCurrent;<LF>
Units = Celsius, Amps;<LF>
Range = [-100.0…100.0], [0.0…2.0E-6];<LF>

2.9.16 Filter Transmission Curves

This object contains the table of filter transmission curves covering 250 nanometers to 20 micrometers for each of the six filter pairs (Note that each "filter," e.g. 1C1 has 2 filters – one for bandpass filtering, and one for thermal filtering). The names in the table correspond to the code xyz where x-wheel position (1-12), y=filter band (A-C) and z=the number of the filter (there are 3 B filters, and 3 C filters, and 6 slots with no filter). Note that the B's are 200 nm to 4 microns, and the C's are 720 to 4 microns. These data are determined once on the ground in the laboratory. Also note that each filter is fixed in its wheel position. So wheel position 1 always has filter C1 in it.

Group: "FilterTransmissionCurves"
Class: "Calibration"

Table 32 - FilterTransmissionCurves group data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentWavelength	float32	1	Meters	0…1E-4	Incident wavelength in meters
1C1	float32	1	N/A	0…1	Transmission ratio
2B3	float32	1	N/A	0…1	Transmission ratio
5C2	float32	1	N/A	0…1	Transmission ratio
7B1	float32	1	N/A	0…1	Transmission ratio

| 8C3 | float32 | 1 | N/A | 0…1 | Transmission ratio |
| 11B2 | float32 | 1 | N/A | 0…1 | Transmission ratio |

The following attributes (1) are defined for the FilterTransmissionCurves data:

FilterTransmissionCurvesAttr = Calibration data;
Fields = IncidentWavelength, 1C1, 2B3, 5C2, 7B1, 8C3, 11B2;<LF>
Units = Meters, N/A, N/A, N/A, N/A, N/A, N/A;<LF>
Range = [0.0…1.0E-4], [0.0…1.0], [0.0…1.0], [0.0…1.0], [0.0…1.0], [0.0…1.0],
[0.0…1.0];<LF>

2.9.17 Shutter transmission function
This object contains the table of exposed aperture area versus motor step for the shutter. This
data is determined once on the ground in the laboratory.

Group: "ShutterTransmissionFunction"
Class: "Calibration"

Table 33 - Shutter Transmission Function group data contents

Field Name	Data Type	Order	Units	Range	Description
MotorStep	uint8	1	N/A	0…210	Motor step count (zero-based).
ShutterApertureTransmission	float32	1	N/A	0…1	What fraction (normalized to 1) of the aperture is open versus motor step

The following attributes (1) are defined for the ShutterTransmissionFunction data:

ShutterTransmissionFunctionAttr = Calibration data;
Fields = MotorStep, ShutterApertureTransmission;<LF>
Units = N/A, N/A<LF>
Range = [0…210], [0.0…1.0];<LF>

2.10 ON-ORBIT CALIBRATION DATA
These data are used to calibrate the level 1 science data. These calibration tables are created and
modified based on measurements taken while the spacecraft is in operation (as opposed to the
ground-based calibration data described in the previous section).

2.10.1 Pointing Corrections with Respect to EPIC
This object contains the pointing corrections between the NISTAR and the EPIC instruments in
the spacecraft reference frame. These values are measured once at the beginning of the mission
and again when the spacecraft reaches its final destination orbit (so at least 2 records).

Group: "InstrumentPointingCorrections"
Class: "Calibration"

Table 34 - InstrumentPointingCorrections group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
AttitudeMatrixRow1	float64	3	N/A	-1…1	Row 1 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow2	float64	3	N/A	-1…1	Row 2 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow3	float64	3	N/A	-1…1	Row 3 of the Euler form of the attitude matrix as calculated from the quaternion

The following attributes (1) are defined for the InstrumentPointingCorrections data:

InstrumentPointingCorrectionsAttr = Calibration data;
Fields = Epoch Time, Row 1 of Matrix {(1,1), (1,2), (1,3)}, Row 2 of Matrix {(2,1), (2,2), (2,3)}, Row 3 of Matrix {(3,1), (3,2), (3,3)};<LF>
Units = Seconds, N/A, N/A, N/A<LF>
Range = [0.0…5.0E9], [-1.0…1.0], [-1.0…1.0], [-1.0…1.0];<LF>

2.10.2 Photodiode Dark Current Measurements
This object contains photodiode dark current measured versus time. These data are sampled once a week. This group contains the measurements from the most recent sampling.

Group: PhotodiodeDarkCurrent
Class: Calibration

Table 35 - PhotodiodeDarkCurrent measurements group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
PhotodiodeDarkCurrent	float64	1	Amps	0…6E-5	Current when photodiode is looking at the back of the shutter

The following attributes (1) are defined for the PhotodiodeDarkCurrent data:

PhotodiodeDarkCurrentAttr = Calibration data;
Fields = DSCOVREpochTime, PhotodiodeDarkCurrent;<LF>
Units = Seconds, Amps<LF>
Range = [0.0…5.0E9], [0.0…6.0E-5];<LF>

2.10.3 Shutter Transmission Function

This object contains a table of exposed aperture area versus motor step for the shutter, as determined by the photodiode channel viewing the Earth. These values are measured once at the beginning of the mission and again when the spacecraft reaches its final destination orbit (so at least 2 records).

Group: ShutterTransmissionFunctionOnOrbit
Class: Calibration

Table 36 - ShutterTransmissionFunctionOnOrbit group data contents

Field Name	Data Type	Order	Units	Range	Description
MotorStep	uint8	1	N/A	0…210	Motor step count (zero-based)
ShutterApertureTransmission	float32	1	N/A	0…1	What fraction (normalized to 1) of the aperture is open versus motor step

The following attributes (1) are defined for the ShutterTransmissionFunctionOnOrbit data:

ShutterTransmissionFunctionOnOrbitAttr = Calibration data;
Fields = MotorStep, ShutterApertureTransmission;<LF>
Units = N/A, N/A<LF>
Range = [0…210], [0.0…1.0];<LF>

2.10.4 Silicon Photodiode Channel Filter Intercomparison

This object contains a table of transmission values versus time for each filter as measured by the silicon photodiode channel.

Group: PhotodiodeFilterIntercomparisonOnOrbit
Class: Calibration

Table 37 - PhotodiodeFilterIntercomparisonOnOrbit group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
FilterWheelStep	uint16	1	N/A	0…1105	Filter wheel motor step count.

FilterTransmission	float32	1	N/A	0…1	Transmission reading through filter by photodiode

The following attributes (1) are defined for the PhotodiodeFilterIntercomparisonOnOrbit data:

PhotodiodeFilterIntercomparisonOnOrbitAttr = Calibration data;
Fields = DSCOVREpochTime, FilterWheelStep, FilterTransmission;<LF>
Units = Seconds, N/A, N/A<LF>
Range = [0.0…5.0E9], [0…1105], [0.0…1.0];<LF>

2.10.5 Receivers Filter Intercomparison

This object contains a table of transmission values versus time for each filter as measured by the three receivers. The motor step tells which filter is over each receiver – use the Filter Position versus FilterMotor Steps table to do the translation

Group: ReceiversFilterIntercomparison
Class: Calibration

Table 38 - ReceiversFilterIntercomparison group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
FilterWheelStep	uint16	1	N/A	0…1105	Filter wheel motor step count
Receiver1Transmission	float32	1	N/A	0…1	Transmission through filter by receiver 1
Receiver2Transmission	float32	1	N/A	0…1	Transmission through filter by receiver 2
Receiver3Transmission	float32	1	N/A	0…1	Transmission through filter by receiver 3

The following attributes (1) are defined for the ReceiversFilterIntercomparison data:

ReceiversFilterIntercomparisonAttr = Calibration data;
Fields = DSCOVREpochTime, FilterWheelStep, Receiver1Transmission,
Receiver2Transmission, Receiver3Transmission;<LF>
Units = Seconds, N/A, N/A, N/A, N/A<LF>
Range = [0.0…5.0E9], [0…1105], [0.0…1.0], [0.0…1.0], [0.0…1.0];<LF>

2.10.6 Total Flux Intercomparison Between all Four Channels

This object contains a table of total flux versus time as measured by the photodiode channel and three radiometer channels.

Group: TotalFluxIntercomparison

Class: Calibration

Table 39 - TotalFluxIntercomparison between all four channels data group contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
MotorStep	uint16	1	N/A	0…1105	Filter wheel motor step count
Receiver1TotalFlux	float32	1	Watts	0…1.E-4	Power reading through filter by receiver 1
Receiver1TotalFluxUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in power reading through filter by receiver 1
Receiver2TotalFlux	float32	1	Watts	0…1.E-4	Power reading through filter by receiver 2
Receiver2TotalFluxUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in power reading through filter by receiver 2
Receiver3TotalFlux	float32	1	Watts	0…1.E-4	Power reading through filter by receiver 3
Receiver3TotalFluxUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in power reading through filter by receiver 3
PhotodiodeTotalFlux	float32	1	Amps	0…2.E-6	Power reading through filter by photodiode
PhotodiodeTotalFluxUncertainty	float32	1	Amps	0…2.E-6	Uncertainty in power reading through filter by photodiode

The following attributes (1) are defined for the TotalFluxIntercomparison data:

TotalFluxIntercomparisonAttr = Calibration data;
Fields = DSCOVREpochTime, FilterWheelStep, Receiver1TotalFlux,
Receiver1TotalFluxUncertainty, Receiver2TotalFlux, Receiver2TotalFluxUncertainty,

Receiver3TotalFlux, Receiver3TotalFluxUncertainty, PhotodiodeTotalFlux,
PhotodiodeTotalFluxUncertainty;<LF>
Units = Seconds, N/A, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps<LF>
Range = [0.0…5.0E9], [0…1105], [0.0…1.0E-4], [0.0…1.0E-4], [0.0…1.0E-4], [0.0…1.0E-4],
[0.0…1.0E-4], [0.0…1.0E-4], [0.0…2.0E-6], [0.0…2.0E-6];<LF>

2.10.7 Cavity Power Lost to Space
This object contains a table of the amount of power the cavity loses to space

Group: CavityPowerLostToSpace
Class: Calibration

Table 40 – CavityPowerLostToSpace group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
FilterWheelStep	uint16	1	N/A	0…1105	Filter wheel motor step count
Receiver1PowerLost	float32	1	Watts	0…1.E-4	Space view power reading through filter by receiver 1
Receiver1PowerLostUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in space view power reading through filter by receiver 1
Receiver2PowerLost	float32	1	Watts	0…1.E-4	Space view power reading through filter by receiver 2
Receiver2PowerLostUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in space view power reading through filter by receiver 2
Receiver3PowerLost	float32	1	Watts	0…1.E-4	Space view power reading through filter by receiver 3
Receiver3PowerLostUncertainty	float32	1	Watts	0…1.E-4	Uncertainty in space view power reading through filter by receiver 3

The following attributes (1) are defined for the CavityPowerLostToSpace data:

CavityPowerLostToSpaceAttr = Calibration data;

Fields = DSCOVREpochTime, FilterWheelStep, Receiver1PowerLost,
Receiver1PowerLostUncertainty, Receiver2 PowerLost, Receiver2 PowerLostUncertainty,
Receiver3PowerLost, Receiver3PowerLost Uncertainty;<LF>
Units = Seconds, N/A, Watts, Watts, Watts, Watts, Watts, Watts;<LF>
Range = [0.0…5.0E9], [0…1105], [0.0…1.0E-4], [0.0…1.0E-4], [0.0…1.0E-4], [0.0…1.0E-4],
[0.0…1.0E-4], [0.0…1.0E-4], [0.0…2.0E-6], [0.0…2.0E-6];<LF>

2.11 GEOLOCATION DATA

The geolocation data are sets of ephemeris and attitude information which are used as input to
several algorithms which compute Earth and Moon subsatellite points, Earth and Moon gibbous
fractions, and the object in the NISTAR view (earth, Moon, Earth and Moon, other). The
geolocation data consists of seven groups as described in the following tables.

2.11.1 DSCOVR Ephemeris

The DSCOVR Ephemeris data comes from either the definitive ephemeris file, which is one
record per minute, or the predicted ephemeris file (which is one record every 10 minutes). Each
of the geolocation tables should have one days' worth of data, so once per minute would give
14400 records and once per 10 minutes would give 144 records. The requirements on the
predicted ephemeris put the irradiances within the tolerance (so one does not gain anything by
waiting for the definitive ephemeris).

Data specifies the DSCOVR spacecraft position and velocity in geocentric rectangular inertial
J2000 coordinates.

Group: SpacecraftEphemeris
Class: Geolocation

Table 41 - SpacecraftEphemeris data group contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
Position	float64	3	Km	-3E6…3E6	X, y, z components of position
Velocity	float64	3	Km/s	-11…11	X, y, z, components of velocity

The following attributes (1) are defined for the SpacecraftEphemeris data:

SpacecraftEphemerisAttr = Spacecraft Ephemeris data;
Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-3.0E6…3.0E6], [-11.0…11.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.11.2 Instrument Attitude Matrices

The attitude matrix, which describes the pointing direction of the NISTAR instrument in geocentric rectangular inertial J2000 coordinates at the image exposure time. These data form a 3x3 matrix where each record in the dataset is a row of its respective matrix. Each field contains the three values for the column of the respective matrix. Earth field contains the three values for the column for the respective matrix. These data indicate the direction that the instrument is pointing.

Group: InstrumentAttitudeMatrix
Class: Geolocation

Table 42 - InstrumentAttitudeMatrix group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
AttitudeMatrixRow1	float64	3	N/A	-1…1	Row 1 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow2	float64	3	N/A	-1…1	Row 2 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow3	float64	3	N/A	-1…1	Row 3 of the Euler form of the attitude matrix as calculated from the quaternion

The following attributes (1) are defined for the InstrumentAttitudeMatrix data:

InstrumentAttitudeMatrixAttr = Attitude Matrix data;
Fields = Epoch Time, Row 1 of Matrix {(1,1), (1,2), (1,3)}, Row 2 of Matrix {(2,1), (2,2), (2,3)}, Row 3 of Matrix {(3,1), (3,2), (3,3)};<LF>
Units = Seconds, N/A, N/A, N/A;<LF>
Range = [0.0…5.0E9], [-1.0…1.0] , [-1.0…1.0] , [-1.0…1.0];<LF>
Coordinate System = Local Spacecraft Axes;<LF>

2.11.3 Lunar Ephemeris

Describes the Moon's position and velocity in geocentric rectangular inertial J2000 coordinates interpolated to the image collection time.

Group: LunarEphemeris
Class: Geolocation

Table 43 - LunarEphemeris data group contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
Position	float64	3	Km	-2E6…2E6	X, y, z components of position
Velocity	float64	3	Km/s	-11…11	X, y, z, components of velocity

The following attributes (1) are defined for the LunarEphemeris data:

LunarEphemerisAttr = Spacecraft Ephemeris data;
Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-2.0E6…2.0E6], [-11.0…11.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.11.4 Earth Subsatellite Location

This object contains the latitude and longitude of the spacecraft's subsatellite point, i.e., the latitude and longitude of the point on the surface of the Earth through which a straight line connecting the center of the Earth and the spacecraft passes. The longitude angle has a range of -180 to 180 degrees where -180 corresponds to 180 degrees west longitude. Similarly, -90 degrees latitude corresponds to 90 degrees south latitude.

Group: EarthSubsatellitePoint
Class: Geolocation

Table 44 - EarthSubsatellitePoint group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
Latitude	float64	1	Degrees	-90…90	Latitude of the subsatellite point as calculated from ephemeris data
Longitude	float64	1	Degrees	-180…180	Longitude of the subsatellite point as calculated from ephemeris data

The following attributes (1) are defined for the EarthSubsatellitePoint data:

EarthSubsatellitePointAttr = Subsatellite Lat/Long data;
Fields = Epoch Time, Latitude, Longitude;<LF>

Units = Seconds, Degrees, Degrees;<LF>
Range = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0];<LF>
Coordinate System = Geographic lat/long;<LF>

2.11.5 Lunar Subsatellite Location

This object contains the latitude and longitude of the spacecraft's subsatellite point, i.e., the latitude and longitude of the point on the surface of the Moon through which a straight link connecting the center of the Moon and the spacecraft passes. The latitude and longitude are given in lunar geographic (a.k.a, Selenographic) coordinates. See Escobal (1965).

Group: LunarSubsatellitePoint
Class: Geolocation

Table 45 - LunarSubsatellitePoint group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
Latitude	float64	1	Degrees	-90…90	Latitude of the subsatellite point as calculated from ephemeris data
Longitude	float64	1	Degrees	-180…180	Longitude of the subsatellite point as calculated from ephemeris data

The following attributes (1) are defined for the LunarSubsatellitePoint data:

LunarSubsatellitePointAttr = Subsatellite Lat/Long data;
Fields = Epoch Time, Latitude, Longitude;<LF>
Units = Seconds, Degrees, Degrees;<LF>
Range = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0];<LF>
Coordinate System = Geographic lat/long;<LF>

2.11.6 NISTAR View

Information in this object will tell what is in the instrument's field of view. In order for NISTAR to take data, the object (e.g. Earth) needs to be within a 1 degree angle of the direction in which the instrument is pointing. Furthermore, there can be no other objects (e.g. the Moon) within 3.5 degrees of the pointing direction. The NISTARView parameter below has a value of 1 when the Earth is "in position" and no other objects are in the field. Similarly, the view is 2 when only the moon is in the field. 3 indicates deep space. 4 indicates a problem (e.g. the earth and the moon are both within the 3.5 degree window. We are allowing additional values in case a decision is made to trap for certain conditions such as the Moon passing in front of the Earth.

Group: NISTARView

Class: Geolocation

Table 46 - NISTARView group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
NISTARView	uint8	1	N/A	0…4	An integer representing what object(s) is in the NISTAR field of view

The following attributes (1) are defined for the NISTARView data:

NISTARViewAttr = NISTAR View data;
Fields = Epoch Time, NISTARView;<LF>
Units = Seconds, N/A;<LF>
Range = [0.0…5.0E9], [0…4];<LF>
Coordinate System = N/A;<LF>

2.11.7 Solar Ephemeris

Describes the Sun's apparent position and velocity in geocentric rectangular inertial J2000 coordinates interpolated to the image collection time

Group: SolarEphemeris
Class: Geolocation

Table 47 - SolarEphemeris group data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.E9	DSCOVR Epoch time
Position	float64	3	Km	-3E6…3E6	X, y, z components of position
Velocity	float64	3	Km/s	-11…11	X, y, z, components of velocity

The following attributes (1) are defined for the SolarEphemeris data:

SolarEphemerisAttr = Spacecraft Ephemeris data;
Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-3.0E8…3.0E8], [-100.0…100.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.12 METADATA

Each file shall have a global attribute called "metadata" attached to it. This is an HDF attribute. The metadata attribute shall contain information about the product. It is a single character string with each *name=value* parameter is delimited by a ";<LF>" character set. The <LF> character is defined as ASCII code 0A (hexadecimal). The metadata items are stored in a single HDF attribute in one continuous string delimited by ";\n".

The values in the latitude and longitude fields shall be the geographic coordinates of the specified pixels in the Earth image. The centroids of the images are defined as the center of the Earth disk as it appears in the image.
The values are stored under the root Attributes of the HDF file.

With the spaces, field names, values, and line breaks, the attributes string is a total of 389 characters, or 389 bytes.

Attibute: metadata

Table 48 - Level 1A product metadata

Field Name	Data Type	Order	Units	Range	Description
Producer_granule_id	String	34	N/A	N/A	The name of the HDF file (no null terminator at the end of string).
File_creation_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the time that the file was created, the time that the data was processed.
Beginning_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the beginning time of the view period, i.e., the start point of the 24hr period that the product contains data for. Approximately the Noon hour.
End_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the end time of the view period, i.e., the end point of the 24hr period that the product contains data for. Approximately the Noon hour.

Granule_version	String	4	N/A	01…99	The processing version number of the product
Comment	String	40	N/A	N/A	The miscellaneous text comment on the product. Null value="NULL".
Centroid_latitude	String	7	Degrees	-90…90	The latitude of the image centroid, E.g., 37.25. Null value="NULL"
Centroid_longtidue	String	8	Degrees	-180…180	The longitude of the image centroid E.g., -173.28. Null value="NULL"
Percent_data_available	String	4	Percentage	0…100	Indicates the percentage of data expected in a 24-our interval actually available in the product
Data_quality	String	5	N/A	GOOD or BAD	Indicates if the quality of the data in the product is good enough for scientific analysis (GOOD) or not (BAD)
Location_data_present	String	1	N/A	0…1	Indicates if there was ephemeris data available for this day and if it was processed successfully
Calibration_data_present	String	1	N/A	0…1	Indicates if there was calibration data available for this day and if it was processed successfully
Attitude_data_present	String	1	N/A	0…1	Indicates if there was quaternion data available for this day and if it was processed successfully
Engineering_data_present	String	1	N/A	0…1	Indicates if there was AppID 86 data available for this day and if it was processed successfully
Science_data_present	String	1	N/A	0…1	Indicates if there was AppID 82 data available for this day and if it was processed successfully
Photodiode_data_present	String	1	N/A	0…1	Indicates if there was photodiode data available for this day and if it was processed successfully

Radiometer_data_present	String	1	N/A	0…1	Indicates if there was radiometer data available for this day and if it was processed successfully
Centroid_data_present	String	1	N/A	0…1	Indicates if there was centroid data available for this day and if it was processed successfully
Thermistor_data_present	String	1	N/A	0…1	Indicates if there was AppID 37 data available for this day and if it was processed successfully

Metadata Text Format
Producer_granule_id=nist_1a_xxxxxxxx_xxxxxxx_xx.h5;<LF>
File_creation_date=yyyy-mm-dd+hh:mm:ss;<LF>
Beginning_of_data_date=yyyy-mm-dd+hh:mm:ss;<LF>
End_of_data_date=yyyy-mm-dd+hh:mm:ss;<LF>
Granule_version=xx;<LF>
Comment=NULL;<LF>
Centroid_latitude=+/-xx.xx;<LF>
Centroid_longitude=+/-xxx.xx;<LF>
Percent_data_available=xxx;<LF>
Data_quality=GOOD/BAD;<LF>
Location_data_available=x;<LF>
Calibration_data_available=x;<LF>
Attitude_data_available=x;<LF>
Engineering_data_available=x;<LF>
Science_data_available=x;<LF>
Photodiode_data_available=x;<LF>
Radiometer_data_available=x;<LF>
Centroid_data_available=x;<LF>
Thermistor_data_available=x;<LF>

3 NISTAR L1B DATA FORMAT

NISTAR products files contain data for an entire Julian Earth day. A Julian day is defined as the interval of time from 12:00:00.00h to 11:59:59.99h the following day URTC. The level 1B products also contain summary data from previous days' products in the form of ten-minute, hourly, and daily tabulations. The level 1A and level 1B data products are stored in separate HDF files at the ASDC.

The time scale in most of the data objects described here is "DSCOVR epoch time." This is the number of seconds since 00:00:00.00 hours, 24, May, 1968 UTC or Julian day number 2,440,000.5.

3.1 DATA VOLUMES

Each NISTAR level 1B product will contain approximately 8 Kb of data. The size of the FourPeriod mean irradiances will depend on the shutter cycle period. Early on in the operation of the spacecraft the shutter cycle was set to 10 minutes, however, the instrument performance was found to be improved when the period was increased to 30 minutes. The values here are the maximum possible sizes.

Table 49 - Level 1B data volumes

Object Description	Record Size (bytes)	Number Records	Count	Object Size (bytes)
Demodulated_Radiometer_ Irradiance	52	100,800	1	5,241,600
Manual_Demodulated_Radiometer_ Irradiance	52	100,800	1	5,241,600
EarthIrradiances_FourPeriod	128	24	1	3,072
EarthIrradiances_FourHour	128	21	1	2,688
EarthIrradiances_Daily	128	1	1	128
DeepSpaceIrradiances_FourPeriod	128	24	1	3,072
DeepSpaceIrradiances_FourHour	128	21	1	2,688
Demodulated_Radiometer_ Irradiance_Decimated	52	16,800	1	873,600
Manual_Demodulated_Radiometer_ Irradiance_Decimated	52	16,800	1	873,600
EarthIrradiances_FourPeriod_ Decimated	128	24	1	3,072
EarthIrradiances_FourHour_ Decimated	128	21	1	2,688
EarthIrradiances_Daily_Decimated	128	1	1	128
DeepSpaceIrradiances_FourPeriod_ Decimated	128	24	1	3,072
DeepSpaceIrradiances_FourHour_ Decimated	128	21	1	2,688
Metadata Attribute	471	1	1	471
Demodulated_Radiometer_ Irradiance Attributes	655	1	4	2,620
Level1B Averages Attributes	951	1	10	9,510

3.2 IRRADIANCES

These quantities are calculated on several time scales: four shutter periods, four hours, and daily. The radiometer readings (irradiance measurements) are taken every second. There are two operating modes which have been explored during the mission. For the first year the shutters were opened and closed with a specified period (10, 20, 30, and 40 minute periods were used at

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various points during operation). This is called "shutter autocycle on" mode. The result is a "noisy" square wave power signal. An accurate extraction of the Earth's irradiance from the data requires an accurate measurement of the amplitude of this square wave. Modern techniques for carrying out this analysis involve performing a Fourier transform on the data and extracting the wave, which has a frequency at the fundamental frequency. The amplitude of this Fourier component has a direct relationship to the height of the square wave, and hence to the Earth's irradiance.

In the other operating mode ("shutter autocycle off" mode) the shutters remain constantly open. In this mode a demodulation as described above is not applicable. In lieu of this, a running mean (default width is 4 minutes) is employed to filter out some of the noise in the power signal. This filtered signal is still called "demodulated" for the purposes of data handling.

"Manual demodulation" refers to the process of only using data points which are close to thermal stability for computation of a demodulation. To accomplish this only the latter half of each shutter half-period (during which time the shutter is not moving) is used for demodulation. Again for shutter autocycle off mode this is not applicable, and the manual demodulated data is simply a copy of the demodulated data, which is itself a running mean as described above.

"Decimated" data refers to data which has been forced to the VC1 1/6 Hz data rate by eliminating data points. The demodulation routine is not accurate when the data rate changes significantly within a day. When VC0 (1 Hz) data is not available for a stretch of time the data rate reverts to the VC1 cadence. Decimated data ensures that there are no large changes in samples per shutter cycle. This is particularly important during winter months prior to the spacecraft being fully operational in terms of back orbit coverage.

3.3   DEMODULATED IRRADIANCE DATA

These data are the result of demodulating the input power signal to extract the amplitude of the square wave. As described above, in the case of autocycle off mode the data is simply a running mean of the input signal.

3.3.1   <u>Demodulated Irradiances</u>

This object contains the demodulated irradiances as measured by the three active cavity detectors. The data rate is the nominal best available rate, and the data is not manually filtered for thermal stability. For autocycle on data, the data is a result of the phase sensitive four boxcar demodulation, and for autocycle off data, the data is a running mean of the input signal.

Table 50 – Demodulated_Radiometer_Irradiance group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval

DemodulatedRadiometerPower1	float64	Watts	0.0…6.6 E-5	Receiver Cavity 1 demodulated irradiance
DemodulatedRadiometerPower2	float64	Watts	0.0…6.6 E-5	Receiver Cavity 2 demodulated irradiance
DemodulatedRadiometerPower3	float64	Watts	0.0…6.6 E-5	Receiver Cavity 3 demodulated irradiance
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps

The following attributes (1) are defined for the Demodulated_Radiometer_Irradiance data:

Demodulated_Radiometer_Irradiance_Attr = Demodulated Radiometer Irradiance data;
Fields = Epoch Time, Demodulated Radiometer 1 Power, Demodulated Radiometer 2 Power, Demodulated Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step;
Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A;
Range = [0.0...5.0E9], [0.0...6.6000E-5], [0.0...6.6000E-5], [0.0...6.6000E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105];
Coordinate System = N/A;

3.3.2   Manual Demodulated Irradiances

This object contains the manual demodulated irradiances as measured by the three active cavity detectors. The data rate is the nominal best available rate, and the data is manually filtered for thermal stability. For autocycle on data, the data is a result of the phase sensitive four boxcar demodulation, and for autocycle off data, the data is a running mean of the input signal and will be a copy of the "demodulated irradiance".

Table 51 – Manual_Demodulated_Radiometer_Irradiance group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
DemodulatedRadiometerPower1	float64	Watts	0.0…6.6 E-5	Receiver Cavity 1 demodulated irradiance
DemodulatedRadiometerPower2	float64	Watts	0.0…6.6 E-5	Receiver Cavity 2 demodulated irradiance
DemodulatedRadiometerPower3	float64	Watts	0.0…6.6 E-5	Receiver Cavity 3 demodulated irradiance
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps

The following attributes (1) are defined for the Manual_Demodulated_Radiometer_Irradiance data:

Manual_Demodulated_Radiometer_Irradiance_Attr = Manual Demodulated Radiometer Irradiance data;
Fields = Epoch Time, Demodulated Radiometer 1 Power, Demodulated Radiometer 2 Power, Demodulated Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step;
Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A;

Range = [0.0...5.0E9], [0.0...6.6000E-5], [0.0...6.6000E-5], [0.0...6.6000E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105];
Coordinate System = N/A;

3.3.3   Demodulated Irradiances (Decimated Data Rate)

This object contains the decimated demodulated irradiances as measured by the three active cavity detectors. The data rate is the decimated 1/6 Hz, and the data is not manually filtered for thermal stability. For autocycle on data, the data is a result of the phase sensitive four boxcar demodulation, and for autocycle off data, the data is a running mean of the input signal.

Table 52 – Demodulated_Radiometer_Irradiance_Decimated group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
DemodulatedRadiometerPower1	float64	Watts	0.0…6.6 E-5	Receiver Cavity 1 demodulated irradiance
DemodulatedRadiometerPower2	float64	Watts	0.0…6.6 E-5	Receiver Cavity 2 demodulated irradiance
DemodulatedRadiometerPower3	float64	Watts	0.0…6.6 E-5	Receiver Cavity 3 demodulated irradiance
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps

The following attributes (1) are defined for the Demodulated_Radiometer_Irradiance_Decimated data:

Demodulated_Radiometer_Irradiance_Decimated_Attr = Decimated Demodulated Radiometer Irradiance data;
Fields = Epoch Time, Demodulated Radiometer 1 Power, Demodulated Radiometer 2 Power, Demodulated Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step;
Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A;
Range = [0.0...5.0E9], [0.0...6.6000E-5], [0.0...6.6000E-5], [0.0...6.6000E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105];
Coordinate System = N/A;

3.3.4   Manual Demodulated Irradiances (Decimated Data Rate)

This object contains the decimated manual demodulated irradiances as measured by the three active cavity detectors. The data rate is the decimated 1/6 Hz, and the data is manually filtered for thermal stability. For autocycle on data, the data is a result of the phase sensitive four boxcar demodulation, and for autocycle off data, the data is a running mean of the input signal and will be a copy of the "decimated demodulated irradiance".

Table 53 – Manual_Demodulated_Radiometer_Irradiance_Decimated group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
DemodulatedRadiometerPower1	float64	Watts	0.0…6.6 E-5	Receiver Cavity 1 demodulated irradiance
DemodulatedRadiometerPower2	float64	Watts	0.0…6.6 E-5	Receiver Cavity 2 demodulated irradiance
DemodulatedRadiometerPower3	float64	Watts	0.0…6.6 E-5	Receiver Cavity 3 demodulated irradiance
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view

ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps

The following attributes (1) are defined for the Manual_Demodulated_Radiometer_Irradiance_Decimated data:

Manual_Demodulated_Radiometer_Irradiance_Decimated_Attr = Decimated Manual Demodulated Radiometer Irradiance data;
Fields = Epoch Time, Demodulated Radiometer 1 Power, Demodulated Radiometer 2 Power, Demodulated Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step;
Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A;
Range = [0.0...5.0E9], [0.0...6.6000E-5], [0.0...6.6000E-5], [0.0...6.6000E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105];
Coordinate System = N/A;

3.4 EARTH IRRADIANCES DATA

These data are the irradiance values computed from level 1a data collected while the instrument was aimed at the Earth. These data are collected at one second intervals and are averaged for larger intervals of time. The subsatellite longitude angle has a range of -180 to 180 degrees where -180 corresponds to 180 degrees west longitude. Similarly, -90 degrees subsatellite latitude corresponds to 90 degrees south latitude.

3.4.1 Measurements at Four Shutter-Period Resolutions

This object contains the Earth irradiances as measured by the four detectors at four shutter-period samplings. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Name: EarthIrradiances_FourPeriod
Class: Irradiances

Table 54 – EarthIrradiances_FourPeriod group data contents

Field Name	Data	Units	Range	Description

	Type			
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A

PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the EarthIrradiances_FourPeriod data:

EarthIrradiances_FourPeriod_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

This object contains the Earth irradiances as measured by the four detectors at four shutter-period samplings. The data has been decimated to the 1/6 Hz date rate. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Name: EarthIrradiances_FourPeriod_Decimated
Class: Irradiances

Table 55 – EarthIrradiances_FourPeriod_Decimated group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval

EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B

PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the EarthIrradiances_FourPeriod_Decimated data:

EarthIrradiances_FourPeriod_Decimated_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

3.4.2 Average Measurements at Four Hour Resolutions

This object contains averages of the Earth irradiances as summed over a given four hour period. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group EarthIrradiances_FourHour
Class: Irradiances

Table 56 – EarthIrradiances_FourHour data group

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval

EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999…	Irradiance reading of photodiode

			2E-06	Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the EarthIrradiances_FourHour data:

EarthIrradiances_FourHour_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

This object contains averages of the Earth irradiances as summed over a given four hour period. The data has been decimated to the 1/6 Hz date rate. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group EarthIrradiances_FourHour_Decimated
Class: Irradiances

Table 57 – EarthIrradiances_FourHour_Decimated data group

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0…	Uncertainty in irradiance reading

			1E-05	of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the EarthIrradiances_FourHour_Decimated data:

EarthIrradiances_FourHour_Decimated_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>

Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

3.4.3 Average Daily Measurements

This object contains the average of the Earth irradiances for the current day. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group: EarthIrradiances_Daily
Class: Irradiances

Table 58 – EarthIrradiances_Daily group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading

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				of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the EarthIrradiances_Daily data:

EarthIrradiances_Daily_Attr = Level 1B Irradiance data;<LF>

Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>
This object contains the average of the Earth irradiances for the current day. The data has been decimated to the 1/6 Hz data rate. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group: EarthIrradiances_Daily
Class: Irradiances

Table 59 – EarthIrradiances_Daily_Decimated group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180…180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999…	Irradiance reading

			1E-05	of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

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The following attributes (1) are defined for the EarthIrradiances_Daily_Decimated data:

EarthIrradiances_Daily_Decimated_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

3.5   DEEP SPACE IRRADIANCES DATA

These data are the irradiance values computed from level 1 data collected while the instrument was aimed at the Deep Space. The data are collected at four shutter-period intervals and are averaged for the day.

3.5.1   Measurements at Four Shutter-Period Resolutions

This object contains the Deep Space irradiances as measured by the four detectors at four shutter-period samplings. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group: DeepSpaceIrradiances_FourPeriod
Class: Irradiances

Table 60 - DeepSpaceIrradiances_FourPeriod group data contents

Field Name	Data Type	Units	Range	Description
Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than

				about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999…	Irradiance reading of photodiode

		2E-06	Band C

The following attributes (1) are defined for the DeepSpace Irradiances_FourPeriod data:

DeepSpaceIrradiances_FourPeriod_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

This object contains the Deep Space irradiances as measured by the four detectors at four shutter-period samplings. The data has been decimated to the 1/6 Hz date rate. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group: DeepSpaceIrradiances_FourPeriod_Decimated
Class: Irradiances

Table 61 - DeepSpaceIrradiances_FourPeriod_Decimated group data contents

Field Name	Data Type	Units	Range	Description
Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval

SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C

The following attributes (1) are defined for the DeepSpace Irradiances_FourPeriod_Decimated data:

DeepSpaceIrradiances_FourPeriod_Decimated_Attr = Level 1B Irradiance data;<LF>

Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

3.5.2   Average Measurements at Four Hour Resolutions

This object contains averages of the Deep Space irradiances as summed over a given four hour period. A value of -999 indicates that there were not enough data points within the time bin for a useful average to be computed.

Group: DeepSpaceIrradiances_FourHour
Class: Irradiances

Table 62 – DeepSpaceIrradiances_FourHour group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999… 1E-05	Irradiance reading of Band A

BandAUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999… 1E-05	Irradiance reading of Band B
BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the DeepSpaceIrradiances_FourHour data:

DeepSpaceIrradiances_FourHour_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B

Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode
Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps,
Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-
4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6],
[0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>
Coordinate System = Geographic lat/long; <LF>

This object contains averages of the Deep Space irradiances as summed over a given four hour
period. The data has been decimated to the 1/6 Hz data rate. A value of -999 indicates that there
were not enough data points within the time bin for a useful average to be computed.

Group: DeepSpaceIrradiances_FourHour_Decimated
Class: Irradiances

Table 63 – DeepSpaceIrradiances_FourHour_Decimated group data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.E9	DSCOVR Epoch time at the midpoint of the ten minute interval
EarthSolarAngle	float32	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the ten minute interval. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float32	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the ten minute interval
SubsatelliteLongitude	float32	Degrees	-180…180	The longitude of the subsatellite point at the midpoint of the ten minute interval
BandA	float32	Watts	-999…1E-05	Irradiance reading of Band A
BandAUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band A
BandB	float32	Watts	-999…1E-05	Irradiance reading of Band B

BandBUncertainty	float32	Watts	0… 1E-05	Uncertainty in irradiance reading of Band B
BandC	float32	Watts	-999… 1E-05	Irradiance reading of Band C
BandCUncertainty	float32	Watts	0…1E-05	Uncertainty in irradiance reading of Band C
PhotodiodeBandA	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band A
PhotodiodeBandAUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band A
PhotodiodeBandB	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band B
PhotodiodeBandBUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band B
PhotodiodeBandC	float32	Amps	-999… 2E-06	Irradiance reading of photodiode Band C
PhotodiodeBandCUncertainty	float32	Amps	0… 2E-06	Uncertainty in irradiance reading of photodiode Band C

The following attributes (1) are defined for the DeepSpaceIrradiances_FourHour_Decimated data:

DeepSpaceIrradiances_FourHour_Decimated_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Sun Angle, Latitude, Longitude, Average Band A Radiometry, Band A Radiometry Uncertainty, Average Band B Radiometry, Band B Radiometry Uncertainty, Average Band C Radiometry, Band C Radiometry Uncertainty, Average Band A Photodiode Current, Band A Photodiode Current Uncertainty, Average Band B Photodiode Current, Band B Photodiode Current Uncertainty, Average Band C Photodiode Current, Band C Photodiode Current Uncertainty; <LF>
Units = Seconds, Degrees, Degrees, Degrees, Watts, Watts, Watts, Watts, Watts, Watts, Amps, Amps, Amps, Amps, Amps, Amps; <LF>
Range = [0.0...5.0E9], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...1.0E-4], [0.0...1.0E-4], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6], [-999.0...2.0E-6], [0.0...2.0E-6]; <LF>

Coordinate System = Geographic lat/long; <LF>

3.6 METADATA

Each file shall have a global attribute called "metadata" attached to it. This is an HDF attribute. The metadata attribute shall contain information about the product. It is a single character string with each name=value parameter pair delimited by a ";\n" character set. The <LF> character is defined as ASCII code 0A (hexadecimal). The metadata items are stored in a single HDF attribute in one continuous string delimited by ";\n".

The values in the latitude and longitude fields shall be the geographic coordinates of the specified pixels in the Earth image. The centroids of the images are defined as the center of the Earth disk as it appears in the image.

The metadata string has a total length of 463 characters, or 463 bytes.

Table 64 - L1B metadata attributes

Field Name	Data Type	Order	Units	Range	Description
Producer_granule_id	String	34	N/A	N/A	The name of the HDF file.
Level1A_Product_File_Name	String	34	N/A	N/A	The name of the HDF file that contains the level 1a product from which this level 1b product was derived
File_creation_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the current day
Beginning_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the beginning day from which level 1b data was tabulated
End_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the final day up to which level 1b data was tabulated. Normally, this day will be the same as the urrent_date
Granule_version	String	3	N/A	01…99	The processing version number of the product

Comment	String	40	N/A	N/A	The miscellaneous text comment on the product. Null value is "NULL".
Centroid_latitude	String	7	Degrees	-90… 90	The latitude of the image centroid, E.g., 37.25. Null value="NULL"
Centroid_longtidue	String	8	Degrees	-180… 180	The longitude of the image centroid E.g., -173.28. Null value="NULL"
Percent_data_available	String	4	Percentage	0… 100	Indicates the percentage of data expected in a 24-our interval actually available in the product
Data_quality	String	5	N/A	GOOD or BAD	Indicates if the quality of the data in the product is good enough for scientific analysis (GOOD) or not (BAD)

Metadata Text Format
Producer_granule_id=nist_1b_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Level1A_product_file_name=nist_1a_xxxxxxxx_xxxxxxx_xx.h5;<LF>
File_creation_date=yyyy-mm-dd_hh:mm:ss;<LF>
Beginning_of_data_date=yyyy-mm-dd_hh:mm:ss;<LF>
End_of_data_date=yyyy-mm-dd_hh:mm:ss;<LF>
Granule_version=xx;<LR>
Comment=NULL;<LF>
Centroid_latitude=+/-xx.xx;<LF>
Centroid_longitude=+/-xxx.xx;<LF>
Percent_data_available=xxx;<LF>
Data_quality=GOOD/BAD;<LF>

4 **REFERENCES**

Pedro Ramon Escobal, *Methods of Orbit Determination,* John Wiley & Sons, Inc. 1965

Triana NISTAR Instrument Levels 1 and 2 Science Data Products Data Format Control Book

Appendix A. Abbreviations and Acronyms

Abbreviation/ Acronym	DEFINITION
ADC	Analog to Digital Converter
AppID	Application ID
ASCII	American Standard Code for Information Interchange
ASDC	Atmospheric Science Data Center
BOL	Beginning of Life
BNOM	Bridge Null Offset Measurement
cm	Centimeters
DAC	Digital to Analog Converter
DFCB	Data Format Control Book
DSCOVR	Deep Space Science Observatory
DSOC	DSCOVR Science Operations Center
FW	Filter Wheel
HDF	Hierarchical Data Format
HS	Heat Sink
Hz	Hertz
ITOS	Integrated Test and Operations System
L1A	Level 1A
L1B	Level 1B
MDAC	Multiplying Digital to Analog Converter
N/A	Not Applicable
NIST	National Institute of Standard and Technology
NISTAR	NIST Advanced Radiometer
nm	Nanometers
PD	Photodiode
PID2	Proportional Integral Derivative 2
PTC	Positive temperature coefficient
PWA	Printed Wiring Assembly
QHSS	Quad High Speed Serial
RC	Receiver Cavity, usually followed by 1, 2, or 3
SI or Si	Silicon
UTC	Universal Time, Coordinated
VDC	Volts of direct current
W	Watts