SOLAR ORBITER PROJECT

MAG DATA PRODUCT DESCRIPTION DOCUMENT

MAG
MAGNETOMETER INSTRUMENT

project	Solar Orbiter
instrument	Magnetometer Instrument
code	MAG
organisation	Imperial College London
document title	MAG Data Product Description Document
prepared by	Helen O'Brien
approved by	Tim Horbury
reference	SOL-MAG-DPDD
issue	2
revision	0
date of issue	28 Sep 2020

CHANGE LOG

Date	Issue	Revision	Reason for change
29 Nov 2019	1	0	First release
28 Sep 2020	2	0	Release in line with first public release of inflight data.

Note: List of changes since first release.

CHANGE RECORD

Section(s)	Reason for change
2.2	Detail added
2.3	Detail added
Table 3-1	Table updated to reflect as delivered data products
3	Detail added
4	Detail added
5	Data products matrix added
6	Sample files added

Note: Detailed changes are listed for this issue only. For previous changes, see earlier issues.

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1 Introduction

1.1 Purpose and Scope

This Data Product Definition Document (DPDD) describes the format and content of the Magnetometer (MAG) Science data. It includes descriptions of the data products and associated metadata, including the data format, content, and generation pipeline. These products are stored and distributed from the Solar Orbiter Science Archive (SOAR) of the SOC.

The specifications described in this DPDD apply to all MAG Science products submitted to ESA's Solar Orbiter SOC for further archival and exploitation. This document only includes descriptions of Science products delivered by the Science pipelines run at the MAG Team premises (at Imperial College London). It does not address the Low Latency data (see [RD06]).

1.2 Applicable documents

Item	Reference	Description	Issue/Revision/Date
[AD01]	SOL-SGS-TN-0009	Metadata Definition for Solar Orbiter Science	Issue 2 Revision 4, 2 September 2019

1.3 Reference documents

Item	Reference	Description	Issue/Revision/Date
[RD01]	SOL-SGS-PL-0009	Solar Orbiter Archive Plan	Issue 2 Revision 5, 7 November 2017
[RD02]	SOL-SGS-OTH-004-DPDDT	Solar Orbiter MAG Data Product Description Document, template available from SOL-SGS-OTH-004-TPL_DPDD	Issue 1 Revision 0, 11 March 2016
[RD03]	NA	CDF User's Guide v3.7, available from http://cdf.gsfc.nasa.gov	3.7
[RD04]	SOL-SGS-TN-0003	Solar Orbiter Low-Latency Data - Concept and Implementation	Issue 1 Revision 2, 19 September 2017
[RD05]	SOL-SGS-ICD-0004-LLCDFICD	Solar Orbiter Interface Control Document for Low Latency Data CDF Files	Issue 1 Revision 3, 7 November 2017
[RD06]	SOL-MAG-LLDD	MAG Low Latency Dataset Description Document	Issue 1 Revision 2, 7 July 2017
[RD07]	SOL-MAG-TMTCICD	TM-TC Interface Control Document	Issue 5 Revision 2, 23 November 2018
[RD08]	SO-IGEP-TR-0002	Fluxgate Magnetometer Calibration for Solar Orbiter. Solar Orbiter FGM Calibration of	Issue 3 Revision 1, 23 February 2017

		the OBS FM and IBS FM Sensors Connected to the FM Electronics	
[RD09]	SO-IGEP-TR-0003	Fluxgate Magnetometer Calibration for Solar Orbiter. Solar Orbiter FGM Calibration of the OBS FS and IBS FS Sensors Connected to the FS Electronics	Issue 4 Revision 1, 28 September 2017
[RD10]	SOL.S.ASTR.TN.00099	Solar Orbiter Reference Frames	Issue 5
[RD11]	SOL-MAG-MAGOBS	MAG OBS-FM Assy	Revision 1, 5 January 2017
[RD12]	SOL-MAG-MAGIBS-FM	MAG IBS-FM Assy	Revision 1, 5 January 2017
[RD13]		An advanced approach to finding magnetometer zero levels in the interplanetary magnetic field	Leinweber et al, Published 21 April 2008, MST, Volume 19, Number 5

1.4 Abbreviations and Acronyms

CCSDS	Consultative Committee for Space Data Systems
CDF	Common Data Format
ESAC	European Space Astronomy Centre
FOV	Field Of View
LL	Low Latency
LL01	Low Latency Level 1
LL02	Low Latency Level 2
MAG	Solar Orbiter Magnetometer Instrument
OBT	On Board Time
SC	Spacecraft
SOAR	Solar Orbiter Archive
SOC	Science Operations Centre
TM	Telemetry

2 MAG Instrument Description

The magnetometer (MAG) is a conventional dual fluxgate instrument which measures the magnetic field in the vicinity of the spacecraft. Both sensors are mounted on the instrument boom in shadow, removed from the spacecraft body so as to reduce the effects of artificially-induced magnetic fields.

The MAG configuration on-board the Solar Orbiter PFM is that composed by the MAG Electronic Box Flight Spare model (MAG-EBOX-FS), the MAG OBS Flight Spare (MAG-OBS-FS) and the MAG IBS Flight Model (MAG-IBS-FM).

2.1 Science Objectives

The magnetometer is a unique instrument on Solar Orbiter in that it provides essential information about both the largest scale structures in space around the Sun, as well as the smallest scale kinetic processes in the plasma. Indeed, the magnetic field plays a central role in plasma dynamics since charged particles generally travel along the magnetic field, making it the route from the Sun into space. The accurate measurement of the local magnetic field is therefore central to the scientific success of Solar Orbiter. Magnetometer data are expected to lead to significant advances in our understanding of how the Sun's magnetic field links into space and evolves over the solar cycle; how particles are accelerated and propagate around the solar system, including to the Earth; and how the corona and solar wind are heated and accelerated, among many others.

The MAG team science objectives include:

- How does the Sun's magnetic field link into space?
- How does the heliospheric magnetic field disconnect from the Sun?
- How does the Sun's magnetic field change over time?
- How is the heliospheric current sheet related to coronal structure?
- What is the role of ICMEs in the Sun's magnetic cycle?
- What is the origin of the slow speed solar wind?
- What drives the evolution of the solar wind distribution?
- What are the origins of waves, turbulence and small scale structures?
- How is turbulent energy dissipated?
- What are the properties of near-Sun shocks and the fluctuations around them?
- What is the structure of plasma turbulence and how does it evolve?
- How do large and small scale structures modulate particle fluxes?

In order to achieve these objectives, the magnetometer will measure the magnetic field continuously with sufficient cadence and precision to quantify fluid-scale phenomena throughout the mission and, in burst mode, with sufficient cadence and precision to study ion kinetic phenomena.

Low latency data are generated at a very low cadence compared to normal magnetometer data and are intended for rapid, broad characterisation of solar wind conditions at the spacecraft location.

2.2 Operational Modes

Description of the instrument modes, with references to the type of data products generated (defined in the following sections).

2.2.1 SCIENCE TELEMETRY

Following boot up of the instrument, it transitions into a science mode ~30 minutes later, when science data products are produced. In all science modes, the following science data products are always produced:

1. Low Latency (LL) data: 1 vector from the primary sensor (nominally outboard) every 8 seconds. LL telemetry packets are produced every 5 minutes. First packet sent 5 minutes after transition into science.
2. Normal Mode data: Vectors from the primary and secondary sensors. There are 3 normal mode cadence options as described in the table below. The first packet is produced 4 seconds after transition into science, and then every 4s.

In addition to low latency and normal mode data, when commanded into burst mode, a 3rd science data steam is produced:

3. Burst mode data: Vectors from the primary and secondary sensors. There are 3 burst mode cadence options as described in the table below. These packets are produced every 4s (except for E128 when packets are produced every 2s).

At power down of the instrument, any partially filled packets will be lost, so at power down, the last vectors in the low latency, normal and burst streams may not be at the same timestamp.

Mode type	Name	Primary vectors/s	Secondary vectors/s
Normal	N	16	1
Normal	Equal8	8	8
Normal	Low	1	1
Burst	B	Not used	Not used
Burst	B64	64	8
Burst	E128	128	128

Table 2-1 MAG Science mode vector cadence

2.2.2 INSTRUMENT RANGE

The MAG instrument autonomously chooses the most appropriate range to be in to provide the highest precision data, whilst protecting the instrument from the risk of saturation. The ranges and nominal precision are described in the table below. When transitioning from one range to another, a small number of vectors immediately after the transition are incorrect. These are set to NaN in the processing software for data processed at Imperial College. The inboard and outboard sensors autonomously change range without reference to the other sensor.

Note: As the LL data is not processed at Imperial College, the erroneous mode transition vectors are still present in the data. However, since it is unlikely that the outboard sensor will change from Range 3, so the LL data is unlikely to be affected, except for any autoranging immediately after power on.

Range code	Nominal Range in nT	Nominal Digital Resolution
3	+/-128nT	4pT
2	+/-512nT	16pT
1	+/-2048nT	64pT
0	+/- 60000 nT	1.8nT

Table 2-2 MAG Instrument Ranges

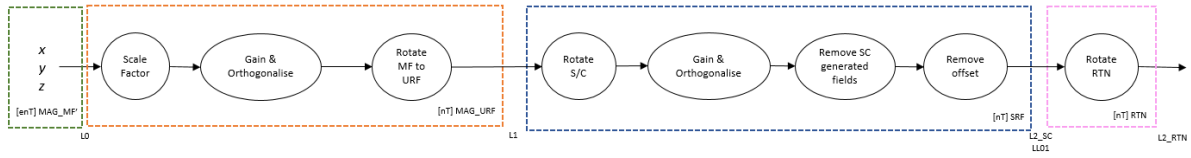
2.3 Calibration

The MAG flight (FM) and flight spare (FS) instruments have been through a ground calibration at the Magnetsrode facility of the Technical University of Braunschweig in Germany [RD08 and RD09]. The flight hardware is a combination of the FM and FS models: Electronics and OBS sensor are FM model, IBS sensor is FS model.

The ground calibration forms the basis of the calibration matrices to be used to produce the L1 products from the raw L0 products. These matrices will not change in flight.

In-flight calibration is then used to produce the matrices and corrections due to spacecraft effects for the L2 products.

The flow is summarised in the figure below:



L1: $\overline{B_{URF}}[nT] = \bar{\bar{R}}_{MF \rightarrow URF}\bar{\bar{w}}\bar{\bar{\sigma}}SF\bar{B}_{MAG\_MF'}[raw]$

L2: $\overline{B_{SRF}}[nT] = \bar{\bar{w}}\bar{\bar{\sigma}}\overline{\overline{SC}}\bar{B}_{URF}[nT] - SC_{SRF}[nT] - \bar{O}_{SRF}[nT]$

Figure 2-1 Rotation and gain matrices required for MAG processing flow. Orange box represents use of the ground calibration to produce L1 data products. The blue and pink boxes represent the manipulations used to generate the L2 products, these are the subject of in-flight calibration.

2.3.1 ON-GROUND CALIBRATION

Description of the on-ground calibration performed on the instrument, and results. Include references to calibration performance reports.

The L0 products are produced from the raw telemetry received from the MAG instrument. The following matrices are required to produce L1 data products from the raw L0 product:

1. Scale factor (SF): Nominal scale factor applied to data from initial lab design.
2. Gain (Sensitivity, σ) & Orthogonality (Misalignment ω) matrix
3. Rotation matrix from sensor measurement frame (MF) to sensor unit reference frame (URF): $R_{MF\text{-}URF}$.

These scale factors and matrices are provided in the monthly MAG calibration file in the Solar Orbiter Archive (solo_CAL_mag-calibration-data.cdf). They are not expected to change for the duration of the mission.

2.3.2 IN-FLIGHT CALIBRATION AND PROCESSING

Description of the in-flight calibration, with references to existing document where applicable.

The following matrices and manipulations are required to produce the L2 data product from the L1:

1. Rotation to SC reference frame. Matrix provided by Airbus, fixed.
2. Gain (σ) & Orthogonality (ω) – corrections to the ground calibration values. Until we have any further information to justify a change, the gain and orthogonality correction for L2 generation will be set to the unity matrix. We do not anticipate changing from the unity matrix.
3. Remove SC generated fields – this step employs several processes developed by the MAG team specifically for this project to detect and remove low frequency (0-64Hz) and dc step changes to the magnetic field generated by the spacecraft and other instruments. They are described in Section 2.3.2.1.
4. Offset in SC coordinates: O_{SRF} – this step aims to detect and remove the dc field offset of the sensor and the quasi stable dc field offset of the spacecraft. Offsets are calculated using the Leinweber method for quantifying magnetometer offsets in the solar wind [RD13]. They are a combination of the sensor offset and the offset generated by the spacecraft and are time varying: the MAG team is monitoring the offsets and it is likely that future updates to data release will include a more accurate measure of the offset.

The rotation matrix, and the offsets used can be found in the MAG calibration file in the Solar Orbiter Archive (solo_CAL_mag-calibration.cdf). The sum correction to the L1 measured field from the cleaning algorithms can be determined by comparing the L1 OBS and L2 data streams: note the streams will have to be rotated to the same reference frame before this correction can be calculated.

2.3.2.1 Implemented Cleaning algorithms

2.3.2.1.1 Spacecraft controlled heater signals

One distinct class of magnetic fields present at the MAG sensors is due to the switching on and off of spacecraft operated heaters, of which there are at least 208. The spacecraft thermal control system operates these heaters on minute boundaries. Given the state of each heater at one minute cadence (this is provided in SC telemetry), it is therefore possible to determine the heater status at any moment in time.

Overview of cleaning algorithm:
Signals from spacecraft controlled heaters manifest as a dc step change in the as-measured magnetic field at the OBS and IBS sensors. By analysing the magnetic field data between 10 May to 9 July 2020, and the heater status, a significant magnetic contamination from 62 heaters out of a total 208 spacecraft heaters has been quantified:

1. Instances of a single heater switch on and switch off are isolated
2. The delta in measured magnetic field in the URF x, y and z axes as a result of the switching event is calculated based on the average field before and after the event. Deltas for many events are averaged.
3. Deltas for a single heater switch on and switch off are compared to check the validity of the calculation.
4. Deltas above a threshold of 50pT are recorded for removal. 62 heaters were quantified as being above this threshold for the May-July analysis.
5. The delta list, and the heater status bits are recorded and used to correct all further instances of this heater from the MAG data.
6. The delta in time between the SC telemetry indicating a heater is on, and the time at which the heater is actually on (and a signal is seen in the MAG data) is estimated. It is assumed this is the same for all heaters. This is an imperfect assumption and can lead to some small spikes in the corrected magnetic field, if the timing of the correction is not completely aligned to the timing of the interference field.

Bitmask flag: None. This cleaning is happening all the time so a flag would not be useful.

2.3.2.1.2 Other instrument related interference which correlates to instrument current consumption

The nine other instruments on the Solar Orbiter spacecraft, during their operation, consume power and hence generate magnetic fields. Some also contain mechanisms, such as filter wheels and doors, whose operation is controlled by motors which can in themselves generate magnetic fields. We have therefore attempted to quantify the magnetic fields from these instruments in order to remove them for routine operation.

Instrument LCL current is telemetered to ground at ~2.5minute cadence routinely during cruise and science phases. During commissioning, this LCL data was telemetered at 1s cadence and an EMC interference campaign was run to quantify signals from all the payload in different modes. This data has yet to be fully analysed. However it is clear that some instrument do generated magnetic signals which correlate to their overall current consumption.

Overview of cleaning algorithm:

1. The spacecraft telemetry indicating the current to the METIS, SoloHI and EUI instruments is obtained.
2. The contaminating field is calculated based on this current and removed from the OBS time series for the final L2 data using the proportionality constants in Table 2-3.
3. Proportionality constants were calculated using data from the EMC interference campaign as follows:

a. The field jumps in IBS-OBS as a result of the change in LCL current were calculated based on the average IBS-OBS field before and after the change in LCL current.
b. This jump is scaled to IBS and OBS and an average nT/A proportionality constant is obtained.

4. Note: the cadence of the instrument LCL current is 2.5minutes, so changes that occur between these samples are not necessarily captured correctly by this cleaning algorithm. This can lead to some small spikes in the corrected magnetic field, if the timing of the correction is not completely aligned to the timing of the interference field.

Instrument	LCL TM	Proportionality OBS (nT/Z x, y, z, URF)	Proportionality IBS (nT/Z x, y, z, URF)
METIS	B_LCL1_14 METIS-A1 TM	(-0.0675 0 -0.0850)	(-0.3375 0 -0.4250)
SoloHI	B_LCL4_09 SoloHI-ADpl TM	(0 0.4400 0.3250)	(0 2.2000 1.6250)
EUI	B_LCL5_17 EUI-A TM	(-0.0625 0.1000 0)	(-0.3125 0.5000 0)

Table 2-3 Instrument current related magnetic interference

Bitmask flag: Whenever the vectors are altered as a result of this algorithm, the INSTRUMENTREMOVED flag is raised.

2.3.2.1.3 Other instrument or spacecraft generated interference which produces sharp tones in the data

There are tones in the data, which are sharp in the frequency domain, and are clearly a result of a spacecraft or instrument operation. This algorithm looks for tones by comparing the power at a given frequency to the median power, to assess if a tone is rising significantly above the noise floor. Tone signals above 10pT is removed and the bit TONEREMOVED is raised.

Bitmask flag: TONEREMOVED

2.3.2.1.4 Spacecraft thruster signals

On the spacecraft there is a bi-propellant propulsion system consisting of 9 thrusters per branch. Each thruster firing represents a different combinations of thruster activations and for a different duration. Therefore, each firing has to be treated individually. Spacecraft thrusters fire on average once per day, although there are days with more than one firing and days with no firings. They cause an interference signal in the IBS sensor of ~7nT and in the OBS magnetic field of order 100pT for ~ 10minutes duration.

Thruster firings are timed within EMC noisy periods, therefore on days with nominal burst mode data collection only during EMC quiet or non-noisy times, the burst mode data will not contain thruster firings.

Overview of cleaning algorithm:

1. Thruster firing is identified via SC telemetry: cumulative firings of thrusters are telemetered, so a delta in these values is used to indicate a thruster has fired.

2. Exact start and end time of the thruster firing influence on the magnetic field is identified from the IBS-OBS time series. The typical shape of the profile can be seen in the Figure 2-2:
3. Profile time series for IBS-OBS is generated. This time series is scaled and then subtracted from the IBS and OBS data to remove the influence of the thruster.

Figure 2-2 Example magnetic field signature from a thruster firing

Bitmask flag: Whenever the vectors are altered as a result of this algorithm, the THRUSTERREMOVED flag is raised.

2.3.2.1.1 MAG heater signal

The MAG sensors heater induces an interference signal on the magnetic field data for the duration of heater operation, and then for some time after the heater is switched off. The signal is not constant, and so an average profile must be determined which varies in time. The MAG team has chosen to generate an average for each day based on a 3-day average of the profile: day of interest plus day before and day after. The heater activates for 1 minute at ~15minutes intervals to maintain the OBS sensor at -90C. The duty cycle is determined by the boom temperature, which varies with spacecraft sun distance and with solar array angle. The influence of the heater lasts for the whole time period from the start of one activation to the start of the next, although the influence is most significant for the actual minute of operation.

The heater operation is controlled by the OBS sensor temperature, however the OBS and IBS heaters operate at the same time. IBS is ~10C warmer than OBS due to being positioned closer to the spacecraft along the boom.

Overview of cleaning algorithm:

Signals from MAG heaters manifest as a quasi-dc step change in the as-measured magnetic field at the OBS and IBS sensors (sensor measurement frame Y and Z axes). However, the profile changes over time and so daily averages are computed.

1. Instances of the MAG heater switch on and switch off are determined using the SC telemetry
2. Delta between the raising of the heater on flag (SC TM) and the heater influence being seen in the mag field data is computed.
3. Profiles for 3 days are averaged to produce a single profile which will be used to clean the data for the middle day of the 3.
4. The end point for the profile is smoothed to zero. In order to take into account the varying duration of the cycles in each group of three days, the chosen end point is at the minimum duration experienced minus 1 second. During the 30 seconds before the endpoint, the profile is smoothed to zero. Example profiles (before the smoothing to zero end points) are shown in the figures below.

Figure 2-3 IBS heater profile. Each line represents the heater profile averaged over three days. The different colours show the 3 day profile for the days from 16/4 to 23/4 2020.

Figure 2-4 OBS heater profile. Each line represents the heater profile averaged over three days. The different colours show the 3 day profile for the days from 16/4 to 23/4 2020.

Bitmask flag: The cleaning profile lasts for the duration of time when heaters are operating (this is the entire cruise period to date). The HEATERON flag is raised for the 1 minute when the heater is activating, and when the largest artificial signal has been removed from the data. Users should be aware of any periodic signal that correlates to the HEATERON flag as it may be indicative of an imperfect cleaning algorithm, and not a physical signal.

2.3.2.1.2 MAG range change incorrect data points

When the MAG instrument changes range, the first few data points after the change as the feedback control loop settles down are incorrect.

Overview of cleaning algorithm:

1. A range change is detected.
2. 1 (NM) or 9 (BM) data points after a range change are set to NaN.

Note in V1.4 of the processing code and below, this algorithm is not picking out all range changes correctly, and is not removing all erroneous points. Therefore users show beware of data around range changes.

Bitmask flag: None. Can be identified as missing data around a sensor range change. Note OBS has been in range 3 for the entire cruise phase, except for a periods shortly after power on, where the instrument autoranges down to Range 3 as part of the power on process. IBS does occasionally change between ranges 2 and 3.

2.3.2.1.3 MAG mode change incorrect data points

When the MAG instrument changes into science mode from config, the first data point after the change is incorrect. During cruise operations, MAG is transitioned into config when the default burst mode for future normal – to – burst transitions is changed. Transitions through config last ~3s and are timed to occur during EMC noisy periods.

Overview of cleaning algorithm:

1. A list of config to normal transition times is compiled based on instrument commanding.
2. 1 data point after the mode change is set to NaN. This is applicable to normal and burst mode data.

The ConfigTimes are in included in the MAG calibration file in the Solar Orbiter Archive (solo_CAL_mag-calibration-data.cdf).

Bitmask flag: None. Can be identified as data gaps.

2.3.2.2 Warning flags: Issues for which no cleaning algorithm has yet been developed

2.3.2.2.1 Spacecraft Interference Gradiometer signal detected

At the end of the cleaning process, the cleaned OBS and cleaned IBS data is compared. Ideally, a cleaned OBS-IBS time series would be zero. However due to our incomplete understanding of spacecraft interference and incomplete cleaning to date, this is not the case. This algorithm flags all cases where the cleaned, smoothed OBS and IBS data differ from each other by more 0.4nT. Users should take care with the data around these times. If you have concerns, plese contact the MAG team.

2.3.2.3 Offset calculation

The combined sensor/spacecraft offset at the sensor locations are calculated using the Leinweber [RD13] method for time periods of a few days at a time. On a timescale of a few days to weeks, the offsets are particularly affected by rebooting the instrument, and by large solar array rotations. These events are used to segregate different offset periods in the data, as they usually result in a step change in the offset. The solar array movements, are also associated with a slow trend in the offsets which likely result from thermal currents, or other thermal effects in the sensors themselves and on the boom where they are located following solar array reconfigurations.

A summary of the offsets used for each month batch of data is included in the Data Delivery Report which accompanies each data release.

2.3.2.4 Quality flags and bitmask

Each vector in L2 cdf files has a quality flag and quality bitmask associated with it. This alerts the user as to any potential issues with using the data. The quality flag is a high level indicator of data quality, it is derived from the quality bitmask and is defined in the table below. The reason for applying the flag as shown will be indicated by the bitmask. Note the flag for any given data point takes the lowest applicable quality level if more than one bit in the bitmask is raised.

Flag	Definition
0	Bad data
1	Known problems use at your own risk
2	Survey data, possibly not publication quality
3	Good for publication, subject to PI approval
4	Excellent data which has received special treatment

Table 2-4 MAG Data Quality Flag definitions

There are 8 bits in the quality bit mask. All are set independently, and evaluated for normal and burst mode data individually. The bit mask exits to alert the user that:

1. The vector has been cleaned. This means that the vector value has been altered from the raw telemetered value due to detection and removal of a spacecraft induced field, OR
2. There is a potential issue with the data. This means that the user should beware that there is the potential of spacecraft contamination to this vector which has not been removed by the MAG team cleaning algorithms.

The quality bit mask bits are defined as follows:

Bit	Binary	Name in Skeleton	Type of Flag	Definition	Impact on Quality Flag	Data source
1	1	INBOARDPRIMARY	Warning	Raise if data is from Inboard sensor.	Set quality flag to 1	MAG HK: Primary sensor is IB.
2	2	SCETUNSYNC	Warning	Raise if onboard time is not synchronised.	Set quality flag to 1	MAG HK: Time is unsynchronised.
3	4	MAGHEATERON	Warning	Raise if MAG heater operational. While the influence of the heater on MAG data has been removed from the time series, periodic signals which correlate to this bitmask flag should be raised with the MAG team.	None	SC HK: MAG Heater status.
4	8	TONEREMOVED	Cleaning has occurred	Raise if interference tones were detected and removed.	None	Tone removal code sets flag.
5	16	THRUSTERREMOVED	Cleaning has occurred	Raise for thruster firing, for duration of cleaning algorithm correction time series.	Set quality flag to 2	Thruster removal code sets flag, based on profile generated from analysis of data around thruster firing. Thruster firing detected from SC HK. OBS and IBS at same cadence required.
6	32	SCINTERFERENCE	Warning	Raise if SC generated interference detected through a large signal in IBS-OBS cleaned data. Covers timescales from around 1 second to 1 minute (algorithm based), time scales >1 hour via human analysis of time series.	Set quality flag to 2	IBS-OBS > threshold. Requires analysis of cleaned IBS-OBS time series.

Bit	Binary	Name in Skeleton	Type of Flag	Definition	Impact on Quality Flag	Data source
7	64	SAMOVEMENT	Warning	Raise at times of solar array movement. Solar array movements cause changes in spacecraft generated offset at the MAG sensors both due to position and due to thermal impact on SC. Impact on offsets is taken into account generating the MAG data, but influence is not yet completely understood, and can last several hours (up to 17 hours following movement). Note this flag is also used to cover solar array lubrications, which usually consist of a 15 degree rotation one way and then back again. These do not have an impact on the data beyond the time when the arrays are moving, so the flag is raised for a shorter period.	Set quality flag to 2	SC HK: SA angle, plus assessment of impact on offset reviewing IBS-OBS data.
8	128	INSTRUMENTREMOVED	Cleaning has occurred	Raise if an interference field signal from instrument operation has been detected and removed. Note that not all signals are detected or removed.	None	Instrument current related removal code.

Table 2-5 Quality bit mask definitions and impact on quality flag

3 Data Generation and Analysis Process

The MAG science products (L0, L1 and L2) are produced by the MAG Instrument Team at Imperial College London. The data generation and analysis process is described in this section.

Science data received by the SOC from the MAG team are made available to end users through the Solar Orbiter archive following the policies described in the Archiving Plan [RD01].

According to the Archiving Plan [RD01], the following table offers a summary of the different data products defined for the MAG instrument. How each data product is generated is further discussed in this section. The description and format of each data product is described is section 4.

Category	Level	Data product	Data type	Brief description
Operational	TBD			
Science	L0	solo_L0_mag-obs-normal	Raw data	• Magnetic field vector measurements in counts • Magnetic field vector timestamps in counts and UTC • Unpacked data from raw telemetry • Includes MAG sensors' status information • One product per sensor, data stream type and UTC
		solo_L0_mag-obs-burst		
		solo_L0_mag-ibs-normal		
		solo_L0_mag-ibs-burst		
	L1	solo_L1_mag-obs-normal	Uncalibrated data	• Magnetic field vector measurements in units of nT • Magnetic field vector timestamps in counts and UTC • Magnetic field vectors in the MAG sensor unit reference frame • Includes MAG sensors' status information • One product per sensor, data stream type and UTC
		solo_L1_mag-obs-burst		
		solo_L1_mag-ibs-normal		
		solo_L1_mag-ibs-burst		
	L2	solo_L2_mag-srf-normal	Calibrated data	• Magnetic field vector measurements in units of nT • Magnetic field vector timestamps in counts and UTC • Magnetic field vectors in SC physical reference frame (-srf) or RTN (-rtn) reference frame • Includes QUALITY_FLAG and BITMASK metadata • One product per data stream type, plus averaged products from the Normal stream
		solo_L2_mag-srf-burst		
		solo_L2_mag-rtn-normal		
		solo_L2_mag- rtn-burst		
		solo_L2_mag- rtn-normal-1-minute		
	L3	solo_L3_mag-normal	Calibrated data, higher science quality	• Magnetic field vector measurements in units of nT • Magnetic field vector timestamps in counts and UTC • Magnetic field vectors in RTN coordinates • Includes QUALITY_FLAG and BITMASK metadata • One product per data stream type, as a subset from L2
		solo_L3_mag-burst		

Category	Level	Data product	Data type	Brief description
	LL01[1]	solo_LL01_mag	LL engineering data	• Magnetic field vector measurements in units of nT • Magnetic field vector timestamps in counts • Magnetic field vectors in SC physical reference frame • Includes QUALITY_FLAG minor or equal to 2 (survey data) • Data from the MAG primary sensor, MAG-OBS by default
	LL02[1]	solo_LL02_mag	Operational LL data	• Magnetic field vector measurements in units of nT • Magnetic field vector timestamps in counts and UTC • Magnetic field vectors in RTN coordinates and SC reference frame • Includes QUALITY_FLAG minor or equal to 2 (survey data) • Data from the MAG primary sensor, MAG-OBS by default
Auxiliary	CAL	solo_CAL_mag-ll[1]	Calibration data for LL	• Calibration data for solo_LL01_mag products generation • Time ranges in counts
	CAL	solo_CAL_mag-calibration-data	Calibration data for Science	• Calibration data for L2 level products generation • Rotation matrices to convert from sensor measurement (L0) to sensor URF (L1) and spacecraft reference frame (L2) • Time ranges in UTC • Produced one per month
	ANC	None currently required		

Table 3-1 Summary of MAG data products

[1] LL products and calibration file are added here for completeness, but are addressed in [RD06] instead of the present document.

3.1 Scientific Measurements

Top-level description of the data acquired by the instrument.

MAG measures the DC magnetic field vector in the vicinity of the spacecraft. The instrument has two sensors, the outboard sensor (OBS) and the inboard sensor (IBS). The OBS sensor is further from the spacecraft body and therefore less influenced by the spacecraft magnetic field. The MAG L2 data products are based on OBS data; IBS data is used to help detect and correct for spacecraft generated fields.

The operational plan of the instrument is:

1. To operate in normal mode all the time, generating 8Hz magnetic field data from both sensors.
2. For part of each day to operate in burst mode, producing 64Hz field data from the outboard sensor in addition to normal mode.

MAG data therefore consists of:

1. Daily files of 24 hours normal mode magnetic field vector data (8Hz cleaned and calibration OBS data) in the spacecraft reference frame (SRF) and in the RTN data frame.
2. Daily files containing a minimum of 2 hours burst mode magnetic field data (64Hz from OBS following cleaning) in the spacecraft reference frame (SRF) and in the RTN data frame.
3. Daily 1-minute average magnetic field data files derived from the normal mode data.
4. Monthly calibration file which contains the rotation matrices and offsets used to generate the L2 data from the raw instrument telemetry.

Notes:

1. For some of the cruise phase the instrument was operating in E128Hz burst mode, and so the burst mode data will be of 128Hz cadence.
2. For some of the cruise phase, the MAG instrument was allocated a higher telemetry rate and so the burst mode daily files contain up to 24 hours burst mode data per day.

3.2 Data Flow Overview

This section will include a top-level description of the data processing workflow.

[Include Block Diagram showing the data sources and the processing steps]

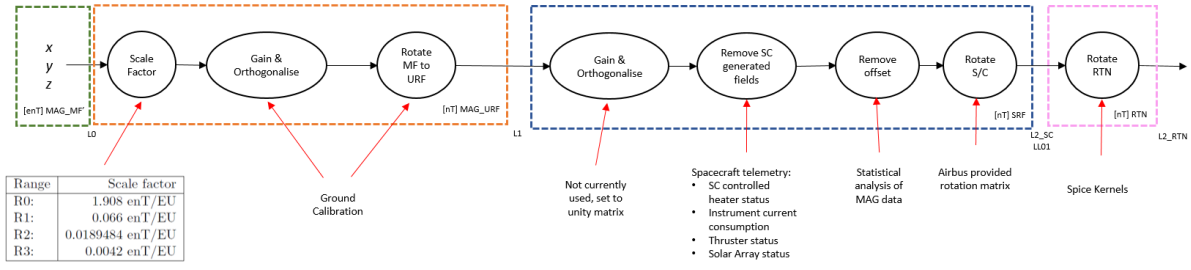


Figure 3-1 Block diagram of MAG processing flow, showing L0, L1 and L2 data products

3.3 Data Generation

The following sections describe the process used to produce the data products described in section 4.

3.3.1 L0 - RAW DATA

Description of the process used to obtain this type of data.
The MAG L0 data products are the magnetic field vectors from the OBS and IBS sensors is the sensor measurement frame in engineering units, plus status information as telemetered to the ground from the spacecraft.

This data is unprocessed.

3.3.2 L1 - ENGINEERING DATA (UNCALIBRATED)

Description of the process used to obtain this type of data.
The MAG L1 data is produced by applying the rotation and ground calibration to convert the raw data from the OBS and IBS sensors to a measurement in nT in the sensor unit reference frame (URF). Note this data containing spacecraft generated artefacts and offsets.

3.3.3 L2 - SCIENCE DATA (CALIBRATED)

Description of the process used to obtain this type of data.
The MAG L2 data is produced by applying cleaning algorithms to the MAG OBS data, and by using solar wind statistical techniques to calculate and remove the offset (zero) level of the sensor. This data is the best estimate of the actual magnetic field vector in the vicinity of the spacecraft and should be used for scientific exploitation.

3.3.4 L3 - HIGHER LEVEL DATA

Description of the process used to obtain this type of data.
MAG is not currently producing L3 data products.

3.3.5 CAL - CALIBRATION DATA

Description of the process used to obtain this type of data.
The calibration data includes:

1. Matrix transforms:
    a. Sensor measurement frame to unit reference frame. Source: on ground calibration, fixed for mission.
    b. Unit reference frame to spacecraft reference frame. Source: Airbus analysis, fixed for mission.
2. Offset data: the offset is a sum of the offset from the sensor itself and from the spacecraft. There is evidence of changes in the spacecraft field with time. This is hard to quantify, but is an active subject of work for the MAG team. The best estimate of the offset, with validity periods, is included in the monthly cal file.
3. Interference times:

   a. An assessment is made of the cleaned OBS and IBS, and times where the dc magnetic field as measured by OBS and IBS differs by more than 0.5nT is highlighted. Details as to what the root cause of this variation might be is included in the monthly Data Release Report.
4. ConfigEvents
   a. The first data point after the instrument transitions from Config mode to science is erroneous. This file highlight the times when the instrument makes this transition and is used by the processing software to remove the subsequent data point from the data.

3.3.6 ANC - ANCILLARY DATA

Description of the process used to obtain this type of data.
None.

3.4 Validation

The following sections describe the process by which the data products are validated.

3.4.1 INSTRUMENT TEAM VALIDATION

To be completed by the Instrument Team.
The cleaned, calibrated data is assessed by the MAG PI and Instrument Manager. All data delivered by the MAG team to the archive has been reviewed. Considerable effort has gone into cleaning the major magnetic field signatures from the spacecraft, however the data is produced by a non-magnetically clean spacecraft so artificial artefacts will remain. Users are therefore encouraged to:

1. View the quality flag and bitmask in parallel to the data. Particularly take note when the quality flag has been dropped from Level 3, to Level 2 (survey quality) or below (known problems).
2. If you see anything strange do contact the MAG team. We can ascertain a lot about the quality of the data by revisiting the IBS data for the period in question to judge if the spacecraft was generating a significant varying field at the time. Variations in the cleaned, calibrated IBS-OBS dataset is the baseline for the SCINTERFERENCE bit which indicates if there is a large signal present in the IBS-OBS time series, which would indicate a signal generated by the spacecraft, but our algorithms do not necessarily capture all events.

3.4.2 SOC VALIDATION

The SOC has assessed sample data of the types MAG will archive and provided feedback to the MAG team.

4 Data Product Descriptions

MAG data products are formatted in accordance with the [AD01] document. This section provides details on the formats used for each of the products included in the MAG science data.

4.1 Primary Products Format

The MAG instrument uses the CDF format for its science data products. This section describes the format and record structure of each of the Science data file types.

MAG CDF files are compliant with CDF V3.7.1.

The file naming follows this format:

solo-l2-mag-yyy-burst

The following information should be given for each of the data products:

- Product name
- Description
- Descriptor
- Free field
- Level
- Dataset dependencies (if any)
- Associated calibration set (if any)
- expected cadence and dataset volume

The definitions of these attributes can be found in the Data Products and Filenames Confluence document ([AD.01], section 2.1)

The definitions below shall include all metadata contained in the product, both Solar Orbiter mandatory metadata [AD.01] and Instrument Specific metadata if any. A description of the data content organization (as described in the aforementioned section of [AD.01]) shall be given as well.

4.1.1 L0 - RAW DATA PRODUCTS

Detailed description of the content and format of the raw data products.
The MAG L0 data products are the magnetic field vectors from the OBS and IBS sensors is the sensor measurement frame in engineering units, plus status information as telemetered to the ground from the spacecraft.

The MAG L1 products follow this naming convention

solo_L0_mag-sss-**mode**_yyyymmdd_Vzz

where:

- sss, indicates the sensor (either OBS for outboard sensoror IBS for inboard sensor)
- **mode** is the mode of the instrument: normal or burst
- yyyymmdd is the year, month and day the data was measured by the instrument
- zz is the file version number. Always use the highest version number available

solo_L0_mag-obs-normal	Raw OBS normal mode data	None	None	1/day	Up to 41MB
solo_L0_mag-obs-burst	Raw OBS burst mode data				Up to 660MB
solo_L0_mag-ibs-normal	Raw IBS normal mode data				Up to 41MB
solo_L0_mag-ibs-burst	Raw IBS burst mode data				Up to 660MB

Table 4-1 L0 Data products description

4.1.2 L1 - ENGINEERING DATA PRODUCTS

Detailed description of the content and format of the partially processed data products.
The MAG L1 products follow this naming convention

solo_L1_mag-sss-**mode**_yyyymmdd_Vzz

where:

- sss, indicates the sensor (either OBS for outboard sensor, IBS for inboard sensor, or PRI for primary sensor – which is nominally OBS)
- **mode** is the mode of the instrument: normal, burst or low latency
- yyyymmdd is the year, month and day the data was measured by the instrument
- zz is the file version number. Always use the highest version number available

solo_L1_mag-obs-normal	Uncalibrated OBS normal mode data	MAG L0 equivalent file	• solo_CAL_mag-calibration-data for rotation to URF • Spice kernel for time correction	1/day	Up to 41MB
solo_L1_mag-obs-burst	Uncalibrated OBS burst mode data				Up to 660MB
solo_L1_mag-ibs-normal	Uncalibrated IBS normal mode data				Up to 41MB
solo_L1_mag-ibs-burst	Uncalibrated IBS burst mode data				Up to 660MB

Table 4-2 L1 Data products description

4.1.3 L2 - SCIENCE DATA PRODUCTS

Detailed description of the content and format of the calibrated data products.

The MAG L2 products follow this naming convention

solo_L2_mag-xxx-**mode**_yyyymmdd_Vzz

where:

- Xxx, indicates the coordinate system: srf=Spacecraft Reference Frame, rtn= Radial-Transverse-Normal reference
- **mode** is the mode of the instrument: normal, burst, or normal-1-minute
- yyyymmdd is the year, month and day the data was measured by the instrument
- zz is the file version number. You should always use the highest version number available

solo_L2_mag-srf-normal	Calibrated primary sensor normal mode data, spacecraft reference frame	• MAG L1 obs and ibs equivalent mode files • Spacecraft heater, solar array, instrument lcl and thruster telemetry • Spice kernels	• solo_CAL_mag-calibration-data • Spice kernel for RTN rotation	1/day	Up to 11MB
solo_L2_mag-rtn-normal	Calibrated primary sensor normal mode data, rtn frame				Up to 11MB
solo_L2_mag-srf-burst	Calibrated primary sensor burst mode data, spacecraft reference frame				Up to 160MB
solo_L2_mag- rtn-burst	Calibrated primary sensor burst mode data, rtn frame				Up to 160MB
solo_L2_mag- rtn-normal-1-minute	Calibrated primary sensor 1 minute average data, rtn frame	Derived from rtn-normal file			35KB

Table 4-3 L2 Data products description

4.1.4 L3 - HIGHER LEVEL DATA PRODUCTS

Detailed description of the content and format of the derived data products.
MAG is not currently generating any L3 data products.

4.1.5 CAL - CALIBRATION DATA PRODUCTS

Detailed description of the content and format of the derived data products.

The MAG calibration data follows this naming convention:

solo_CAL_mag-calibration-data_yyyymmdd_YYYYMMDD_Vzz

where:

- yyyymmdd is the year, month and day the calibration is valid from, Validity starts at 00:00 on this day.
- YYYYMMDD is the year, month and day the calibration is valid to. Validity ends at 23:59:59 on this day
- zz is the file version number. You should always use the highest version number available

solo_CAL_mag-calibration-data	Rotation matrices, calibration data, data cleaning parameters	• None	N/A	1/month	5KB

4.1.6 ANC - ANCILLARY DATA PRODUCTS

Detailed description of the content and format of the derived data products.
None

5 APPENDIX - Data products matrix

The following table summarizes the data products names and description:

Product name, inc level and descriptor	Description	Free_field
solo_L0_mag-obs-normal	Raw OBS normal mode data	None
solo_L0_mag-obs-burst	Raw OBS burst mode data	None
solo_L0_mag-ibs-normal	Raw IBS normal mode data	None
solo_L0_mag-ibs-burst	Raw IBS burst mode data	None
solo_L0_mag-pri-ll	Raw primary sensor low latency data	None
solo_L1_mag-obs-normal	Uncalibrated OBS normal mode data	None
solo_L1_mag-obs-burst	Uncalibrated OBS burst mode data	None
solo_L1_mag-ibs-normal	Uncalibrated IBS normal mode data	None
solo_L1_mag-ibs-burst	Uncalibrated IBS burst mode data	None
solo_L1_mag-pri-ll	Uncalibrated primary sensor low latency data	None
solo_L2_mag-srf-normal	Calibrated primary sensor normal mode data, spacecraft reference frame	None
solo_L2_mag-srf-burst	Calibrated primary sensor burst mode data, spacecraft reference frame	None
solo_L2_mag-rtn-normal	Calibrated primary sensor normal mode data, rtn frame	None
solo_L2_mag- rtn-burst	Calibrated primary sensor burst mode data, rtn frame	None
solo_L2_mag- rtn-normal-1-minute	Calibrated primary sensor 1 minute average data, rtn frame	None
solo_L3_mag-normal	Not used	None
solo_L3_mag-burst	Not used	None

6 APPENDIX - File skeletons

6.1 solo_CAL_mag-calibration-data_skeletontable_V06_21Sep2020

```
  ! Skeleton table for the "solo_CAL_mag-calibration-data_skeletontable_V06_21Sep2020" CDF.
! Generated: Monday, 21-Sep-2020 16:12:06
! CDF created/modified by CDF V3.7.1
! Skeleton table created by CDF V3.7.1_0
!
! ********************************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************************
! ** 01         17/08/2020      V.Evans             - First version.
! ** 02         20/08/2020      V.Angelini          - Added doi and Acknowledgement.
! ** 03         08/09/2020      V.Evans             - Added offsets.
! ** 04         15/09/2020      V.Evans             - Added interference times.
! ** 05         15/09/2020      V.Evans             - Added config times.
! ** 06         21/09/2020      V.Evans             - Remove interference comment, change pad values.
!
#header

                     CDF NAME: solo_CAL_mag-calibration-data_skeletontable_V06_21Sep2020
                DATA ENCODING: NETWORK
                     MAJORITY: COLUMN
                       FORMAT: SINGLE

! Variables  G.Attributes  V.Attributes  Records  Dims  Sizes
! ---------  ------------  ------------  -------  ----  -----
    0/18          24            21         0/z      1     3
! CDF_COMPRESSION: None
! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
! CDF_CHECKSUM: None
```

```
! (Valid checksum: None, MD5)
! CDF_LEAPSECONDLASTUPDATED: 20170101


#GLOBALattributes

! Attribute         Entry       Data
! Name              Number      Type       Value
! ---------         ------      ----       -----

  "Project"             1:    CDF_CHAR     { "Solar Orbiter" } .

  "Source_name"         1:    CDF_CHAR     { "SOLO>Solar Orbiter" } .

  "Discipline"          1:    CDF_CHAR     { "Space " -
                                             "Physics>Interplanetary " -
                                             "Studies" } .

  "Data_type"           1:    CDF_CHAR     { "Calibration Data" } .

  "Descriptor"          1:    CDF_CHAR     { "MAG>Magnetometer" } .

  "Data_version" .

  "Software_version" .

  "Skeleton_version"
                        1:    CDF_CHAR     { "05" } .

  "PI_name"             1:    CDF_CHAR     { "T. Horbury" } .

  "PI_affiliation"      1:    CDF_CHAR     { "The Blackett Laboratory, " -
                                             "Imperial College London" } .

  "Text"                1:    CDF_CHAR     { "Dual-sensor, triaxial " -
```

```
                                                "fluxgate magnetometer" }
                        2:    CDF_CHAR      { "doi:10.1051/0004-6361/2019" -
                                              "37257" } .

"Instrument_type"       1:    CDF_CHAR      { "Magnetic Fields (space)" } .

"Mission_group"         1:    CDF_CHAR      { "Solar Orbiter" } .

"Logical_source"        1:    CDF_CHAR      { "solo_CAL_mag-calibration-d" -
                                              "ata" } .

"Logical_file_id" .

"Logical_source_description"
                        1:    CDF_CHAR      { "Solar Orbiter Magnetometer" -
                                              " Calibration Data" } .

"Generated_by"          1:    CDF_CHAR      { "The Blackett Laboratory, " -
                                              "Imperial College London" } .

"Generation_date" .

"MODS"                  1:    CDF_CHAR      { "V01 2020/08/17 V. Evans: " -
                                              "Initial release" }
                        2:    CDF_CHAR      { "V02 2020/08/20 V. " -
                                              "Angelini: Added DOI" }
                        3:    CDF_CHAR      { "V03 2020/09/08 V. Evans: " -
                                              "Added offsets" }
                        4:    CDF_CHAR      { "V04 2020/09/15 V. Evans: " -
                                              "Added interference times" }
                        5:    CDF_CHAR      { "V05 2020/09/15 V. Evans: " -
                                              "Added config times" }
                        6:    CDF_CHAR      { "V06 2020/09/21 V. Evans: " -
                                              "Removed interference " -
                                              "comment, change pad values" } .
```

```
  "Parents" .

  "Instrument_name"     1:    CDF_CHAR     { "MAG" } .

  "Acknowledgement"     1:    CDF_CHAR     { "Solar Orbiter magnetometer" -
                                             " data was provided by " -
                                             "Imperial College London " -
                                             "and supported by the UK " -
                                             "Space Agency" } .

  "HTTP_LINK"           1:    CDF_CHAR     { "https://www.imperial.ac.uk" -
                                             "/space-and-atmospheric-phy" -
                                             "sics/research/missions-and" -
                                             "-projects/space-missions/s" -
                                             "olar-orbiter/" } .

  "Data_product"        1:    CDF_CHAR     { "MAG-Calibration-Data" } .


#VARIABLEattributes

  "CATDESC"
  "COORDINATE_SYSTEM"
  "DEPEND_0"
  "DETECTOR"
  "DISPLAY_TYPE"
  "FIELDNAM"
  "FILLVAL"
  "FORMAT"
  "LABL_PTR_1"
  "LABLAXIS"
  "REPRESENTATION_1"
  "SCALEMAX"
  "SCALEMIN"
```

```
  "SCALETYP"
  "SI_CONVERSION"
  "TENSOR_ORDER"
  "UNITS"
  "VALIDMAX"
  "VALIDMIN"
  "VAR_NOTES"
  "VAR_TYPE"


#variables

! No rVariables.


#zVariables

! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "MAG_SENSOR_RANGES"
                 CDF_INT1       1       1     4        F         T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -99

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...
```

```
    [1] = 0
    [2] = 1
    [3] = 2
    [4] = 3


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "RANGE_SCALE_FACTOR"
                  CDF_DOUBLE     1       1     4        F         T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "Scale factor for each range" }
    "DEPEND_0"    CDF_CHAR     { "MAG_SENSOR_RANGES" }
    "SCALEMAX"    CDF_FLOAT    { 80000.0 }
    "SCALEMIN"    CDF_FLOAT    { -80000.0 }
    "SCALETYP"    CDF_CHAR     { "linear" }
    "UNITS"       CDF_CHAR     { "enT/EU" }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+10 }
    "VALIDMIN"    CDF_FLOAT    { -1.0e+10 } .

  ! Values follow...
```

```
    [1] = 1.908
    [2] = 0.066
    [3] = 0.0189484
    [4] = 0.0042


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_0"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 1.11346
    [2,1] = -0.00768
    [3,1] = -0.002138
    [1,2] = 0.0
    [2,2] = 1.13372
    [3,2] = 0.004735
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.1116
```

```
! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_1"
                  CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 1.08538
    [2,1] = -0.00712
    [3,1] = -0.002253
    [1,2] = 0.0
    [2,2] = 1.10394
    [3,2] = 0.004204
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.0833


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------
```

```
  "OBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_2"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                         ! Terminating period required.

  ! Values follow...

    [1,1] = 0.973898
    [2,1] = -0.006301
    [3,1] = -0.002364
    [1,2] = 0.0
    [2,2] = 0.990092
    [3,2] = 0.004915
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 0.971295


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_3"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
```

```
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 1.07275
    [2,1] = -0.006679
    [3,1] = -0.001928
    [1,2] = 0.0
    [2,2] = 1.08876
    [3,2] = 0.004212
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.07279


! Variable          Data      Number                   Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "IBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_0"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.
```

```
  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 1.11956
    [2,1] = 0.002764
    [3,1] = -0.003107
    [1,2] = 0.0
    [2,2] = 1.13648
    [3,2] = 0.0097
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.10859


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "IBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_1"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...
```

```
    [1,1] = 1.08503
    [2,1] = 0.002734
    [3,1] = -0.002936
    [1,2] = 0.0
    [2,2] = 1.10301
    [3,2] = 0.009466
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.08534


! Variable          Data      Number                   Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "IBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_2"
                  CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 0.973359
    [2,1] = 0.002764
    [3,1] = -0.00258
    [1,2] = 0.0
    [2,2] = 0.989127
```

```
    [3,2] = 0.008439
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 0.973742


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "IBS_GAIN_AND_ALIGNMENT_MATRIX_RANGE_3"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 1.07366
    [2,1] = -0.000475
    [3,1] = -0.004036
    [1,2] = 0.0
    [2,2] = 1.08769
    [3,2] = 0.00821
    [1,3] = 0.0
    [2,3] = 0.0
    [3,3] = 1.07136
```

```
! Variable          Data      Number                  Record   Dimension
! Name              Type      Elements  Dims  Sizes  Variance  Variances
! --------          ----      --------  ----  -----  --------  ---------

  "ROTATION_MATRIX_MEASUREMENT_FRAME_TO_URF"
                  CDF_INT1       1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -99

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! Values follow...

    [1,1] = 0
    [2,1] = 1
    [3,1] = 0
    [1,2] = -1
    [2,2] = 0
    [3,2] = 0
    [1,3] = 0
    [2,3] = 0
    [3,3] = -1


! Variable          Data      Number                  Record   Dimension
! Name              Type      Elements  Dims  Sizes  Variance  Variances
! --------          ----      --------  ----  -----  --------  ---------
```

```
  "ROTATION_MATRIX_URF_TO_SRF"
                 CDF_DOUBLE     1       2    3 3       F        T T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                         ! Terminating period required.

  ! Values follow...

    [1,1] = 0.95892
    [2,1] = 0.067054
    [3,1] = 0.275638
    [1,2] = 0.069756
    [2,2] = -0.997564
    [3,2] = 0.0
    [1,3] = 0.274966
    [2,3] = 0.019227
    [3,3] = -0.961262


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OFFSET_TIMESTAMP"
             CDF_TIME_TT2000     1       0             T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
```

```
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: 0000-01-01T00:00:00.000000000

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! No values (no records for this variable).


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OFFSET_IBS"    CDF_DOUBLE     1       1     3        T         T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! No values (no records for this variable).


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "OFFSET_OBS"    CDF_DOUBLE     1       1     3        T         T
```

```
  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: -1.0e+30

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! No values (no records for this variable).


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "SC_INTERFERENCE_START_TIME"
             CDF_TIME_TT2000     1       0              T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: 0000-01-01T00:00:00.000000000

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! No values (no records for this variable).


! Variable          Data      Number                  Record   Dimension
```

```
! Name              Type      Elements  Dims  Sizes  Variance  Variances
! --------          ----      --------  ----  -----  --------  ---------

  "SC_INTERFERENCE_END_TIME"
             CDF_TIME_TT2000     1       0             T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: 0000-01-01T00:00:00.000000000

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.

  ! No values (no records for this variable).


! Variable          Data       Number                  Record   Dimension
! Name              Type      Elements  Dims  Sizes  Variance  Variances
! --------          ----      --------  ----  -----  --------  ---------

  "CONFIG_EVENTS"
             CDF_TIME_TT2000     1       0             T

  ! VAR_COMPRESSION: None
  ! (Valid compression: None, GZIP.1-9, RLE.0, HUFF.0, AHUFF.0)
  ! VAR_SPARSERECORDS: None
  ! (Valid sparserecords: None, sRecords.PAD, sRecords.PREV)
  ! VAR_PADVALUE: 0000-01-01T00:00:00.000000000

  ! No variable scope attribute entries for this variable.

  .                        ! Terminating period required.
```

```
  ! No values (no records for this variable).


#end
```

6.2 solo_L0_mag-obs_skeletontable_V03_20Aug2020

```
! Skeleton table for the solo_L0_mag-obs CDF files.
! Version 03 date 2020/08/20
! Compliant with SOL-MAG-DPDD-i1r0_workingcopy
! CDF V3.7.1
!
! ********************************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************************
! ** 01         14/11/2019      I. Carrasco         - Initial release
! ** 02         31/03/2020      V. Evans            - Minor tweaks - capitalisation of 'Instrument_name'
! ** 03         20/08/2020      V. Angelini         - Added doi and Acknowledgement.
!

#header

     CDF NAME: solo_L0_mag-obs_skeletontable_V03.cdf
DATA ENCODING: NETWORK
     MAJORITY: ROW
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
! --------- ------------ ------------ ------- ---- -----
```

```
  0/26      23           20           0/z     1    3


#GLOBALattributes

! Attribute                  Entry   Data
! Name                       Number  Type        Value
! ---------                  ------  ----        -----
"Project"                        1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                    1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                     1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                      1:  CDF_CHAR    { "L0>Level 0 Raw Data" }.
"Descriptor"                     1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
"Software_version".
"Skeleton_version"               1:  CDF_CHAR    { "03" }.
"PI_name"                        1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                 1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Text"                           1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                 2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"                1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                  1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                 1:  CDF_CHAR    { "solo_L0_mag-obs" }.
"Logical_file_id".
"Logical_source_description"     1:  CDF_CHAR    { "Solar Orbiter Magnetometer L0 Data" }.
"Rules_of_use"                   1:  CDF_CHAR    { "Not For Publication" }.
"Generated_by"                   1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"Mods"                           1:  CDF_CHAR    { "V01 2019/11/06 I. Carrasco: Initial release" }
                                 2:  CDF_CHAR    { "V02 2020/03/31 V. Evans: Second release" }
                                 3:  CDF_CHAR    { "V03 2020/08/20 V. Angelini: Third release" }.
"Level"                          1:  CDF_CHAR    { "L0>Level 0 Raw Data" }.
"Parents".
"Instrument_name"                1:  CDF_CHAR    { "MAG" }.
```

```
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                    "and supported by the UK Space Agency"}.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)


#zVariables
```

```
!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes   Variance  Variances
! --------          ----            --------  ----  -----   --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0             T

    ! Attribute             Data
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Terrestrial Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_INT8     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_INT8     { -9223372036854775808 }
      "VALIDMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALEMIN"            CDF_INT8     { -9223372036854775808 }
      "SCALEMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! SCET

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET"                CDF_REAL8   1               0               T

    ! Attribute             Data
```

```
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Spacecraft Elapsed Time" }
      "CATDESC"             CDF_CHAR    { "Elapsed time of the onboard clock" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "Spacecraft Elapsed Time" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"            CDF_REAL8   { 0.0 }
      "SCALEMAX"            CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! SCET_UNSYNC_FLAG

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET_UNSYNC_FLAG"    CDF_UINT1   1               0               T

    ! Attribute           Data
    ! Name                Type        Value
    ! -----------         -------     --------
      "FIELDNAM"          CDF_CHAR    { "Spacecraft Elapsed Time Synchronization Flag" }
      "CATDESC"           CDF_CHAR    { "Whether the instrument time is synchronized (0) or unsynchronized (1)" }
      "DEPEND_0"          CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"      CDF_CHAR    { "time_series" }
      "FORMAT"            CDF_CHAR    { "I1" }
      "LABLAXIS"          CDF_CHAR    { "Scet unsynchronized flag" }
      "VALIDMIN"          CDF_UINT1   { 0 }
      "VALIDMAX"          CDF_UINT1   { 1 }
      "SCALEMIN"          CDF_UINT1   { 0 }
```

```
      "SCALEMAX"            CDF_UINT1    { 4 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }.

! B_OBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "B_OBS"               CDF_INT4    1               1       3       T               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Magnetic Field Vector" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector in the outboard sensor physical frame" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I11" }
      "LABL_PTR_1"          CDF_CHAR    { "LBL1_B_OBS" }
      "UNITS"               CDF_CHAR    { "counts" }
      "VALIDMIN"            CDF_INT4    { -2147483648 }
      "VALIDMAX"            CDF_INT4    { 2147483647 }
      "SCALEMIN"            CDF_INT4    { -2147483648 }
      "SCALEMAX"            CDF_INT4    { 2147483647 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "data" }
      "REPRESENTATION_1"    CDF_CHAR    { "REP1_B_OBS" }
      "TENSOR_ORDER"        CDF_CHAR    { "1" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! LBL1_B_OBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
```

```
! -----------           -------     -------------   -------  -------  ------------     --------------
  "LBL1_B_OBS"          CDF_CHAR    2               1        3        F                T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Axis Label for B" }
      "CATDESC"             CDF_CHAR    { "Axis label for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A2" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "Bx" }
    [2] = { "By" }
    [3] = { "Bz" }

! REP1_B_OBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   -------  -------  ------------     --------------
  "REP1_B_OBS"          CDF_CHAR    1               1        3        F                T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector representation for B" }
      "CATDESC"             CDF_CHAR    { "Vector representation for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A1" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "x" }
    [2] = { "y" }
    [3] = { "z" }

! SEQUENCE_COUNTER
```

```
! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! ----------           -------     -------------   ------- ------- ------------    --------------
  "SEQUENCE_COUNTER"    CDF_UINT2   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Packet Sequence Counter" }
      "CATDESC"            CDF_CHAR    { "Telemetry Source Packet Sequence Counter field" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FORMAT"             CDF_CHAR    { "I5" }
      "LABLAXIS"           CDF_CHAR    { "Packet Sequence Counter" }
      "VALIDMIN"           CDF_UINT2   { 0 }
      "VALIDMAX"           CDF_UINT2   { 16383 }
      "SCALEMIN"           CDF_UINT2   { 0 }
      "SCALEMAX"           CDF_UINT2   { 16383 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

! PACKET_TIME

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! ----------           -------     -------------   ------- ------- ------------    --------------
  "PACKET_TIME"         CDF_REAL8   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Packet Generation Time" }
      "CATDESC"            CDF_CHAR    { "Elapsed time of the onboard clock at packet generation time" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
```

```
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "Packet Generation Time" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"            CDF_REAL8   { 0.0 }
      "SCALEMAX"            CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! VECTOR_TIME_RESOLUTION

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! ----------                -------     -------------   ------- ------- ------------    --------------
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Time Resolution" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector time resolution in number of vectors per second" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "f8.3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Time Resolution" }
      "VALIDMIN"            CDF_REAL4   { 0 }
      "VALIDMAX"            CDF_REAL4   { 1920 }
      "SCALEMIN"            CDF_REAL4   { 0 }
      "SCALEMAX"            CDF_REAL4   { 1920 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! VECTOR_RANGE
```

```
! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Range" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector components' range" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Vector Range" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 3 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 3 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! RAMP_MODE

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "RAMP_MODE"           CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Ramp Mode Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor's Front End Electronics ramp mode flag" }
```

```
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FORMAT"             CDF_CHAR    { "I1" }
      "LABLAXIS"           CDF_CHAR    { "Ramp Mode Enabled" }
      "VALIDMIN"           CDF_UINT1   { 0 }
      "VALIDMAX"           CDF_UINT1   { 1 }
      "SCALEMIN"           CDF_UINT1   { 0 }
      "SCALEMAX"           CDF_UINT1   { 1 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }
      "DETECTOR"           CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_DELAY_VALUE

! Variable                 Data        Number                          Record          Dimension
! Name                     Type        Elements        Dims    Sizes   Variance        Variances
! -----------              -------     -------------   ------- ------- ------------    --------------
  "FEE_DELAY_VALUE"        CDF_UINT1   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Sensor Front End Electronics Delay Value" }
      "CATDESC"            CDF_CHAR    { "Sensor Front End Electronics Delay Value" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FORMAT"             CDF_CHAR    { "I2" }
      "LABLAXIS"           CDF_CHAR    { "FEE Delay Value" }
      "VALIDMIN"           CDF_UINT1   { 0 }
      "VALIDMAX"           CDF_UINT1   { 31 }
      "SCALEMIN"           CDF_UINT1   { 0 }
      "SCALEMAX"           CDF_UINT1   { 31 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }
      "DETECTOR"           CDF_CHAR    { "OBS>Outboard Sensor" }.
```

```
! FEE_AUTORANGE_DELAY

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_AUTORANGE_DELAY"     CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Autorange Delay" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Autorange Delay" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I2" }
      "LABLAXIS"            CDF_CHAR    { "FEE Autorange Delay" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 31 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 31 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_AUTORANGE_ENABLED

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_AUTORANGE_ENABLED"   CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
```

```
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Autorange Enabled Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Autorange Enabled Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Autorange Enabled" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_RANGE_COMMAND_SOURCE

! Variable                      Data        Number                          Record          Dimension
! Name                          Type        Elements        Dims    Sizes   Variance        Variances
! -----------                   -------     -------------   ------- ------- ------------    --------------
  "FEE_RANGE_COMMAND_SOURCE"    CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Range Command Source" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Range Command Source" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Range Command Source" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
```

```
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_ICU_IO_STATUS

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_ICU_IO_STATUS"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics ICU IO Status" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Instrument Control Unit Input " -
                                          "Output Status" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE ICU IO Status" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! X_SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "X_SATURATION_FLAG"       CDF_UINT1   1               0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag X" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! Y_SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Y_SATURATION_FLAG"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag Y" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
```

```
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! Z_SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Z_SATURATION_FLAG"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag Z" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! X_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
```

```
  "X_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis ADC Overflow" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC X" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! Y_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Y_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis ADC Overflow" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC Y" }
```

```
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! Z_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Z_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis ADC Overflow" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC Z" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_X_GAIN

! Variable                  Data        Number                          Record          Dimension
```

```
! Name                      Type        Elements         Dims    Sizes   Variance         Variances
! -----------               -------     -------------    ------- ------- ------------     --------------
  "FEE_X_GAIN"              CDF_UINT1   1                0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE X Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_Y_GAIN

! Variable                  Data        Number                           Record           Dimension
! Name                      Type        Elements         Dims    Sizes   Variance         Variances
! -----------               -------     -------------    ------- ------- ------------     --------------
  "FEE_Y_GAIN"              CDF_UINT1   1                0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
```

```
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Y Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! FEE_Z_GAIN

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_Z_GAIN"              CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Z Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! VECTOR_NUMBER
```

```
! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- -------------   --------------
  "VECTOR_NUMBER"           CDF_UINT2   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Number Within TM Packet" }
      "CATDESC"             CDF_CHAR    { "Vector Number Within TM Packet" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Number" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 512 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 512 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

#end
```

6.3 solo_L0_mag-ibs_skeletontable_V03_20Aug2020

```
! Skeleton table for the solo_L0_mag-ibs CDF files.
! Version 02 date 2020/08/20
! Compliant with SOL-MAG-DPDD-i1r0_workingcopy
! CDF V3.7.1
```

```
!
! ********************************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************************
! ** 01         14/11/2019      I. Carrasco         - Initial release
! ** 02         31/03/2020      V. Evans            - Minor tweaks - capitalisation of 'Instrument_name'
! ** 03         20/08/2020      V. Angelini         - Added doi and Acknowledgement.

#header

     CDF NAME: solo_L0_mag-ibs_skeletontable_V03.cdf
DATA ENCODING: NETWORK
     MAJORITY: ROW
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
! --------- ------------ ------------ ------- ---- -----
  0/26      23           20           0/z     1    3


#GLOBALattributes

! Attribute                 Entry   Data
! Name                      Number  Type        Value
! ---------                 ------  ----        -----
"Project"                       1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                   1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                    1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                     1:  CDF_CHAR    { "L0>Level 0 Raw Data" }.
"Descriptor"                    1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
"Software_version".
"Skeleton_version"              1:  CDF_CHAR    { "03" }.
"PI_name"                       1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
```

```
"Text"                          1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"               1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                 1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                1:  CDF_CHAR    { "solo_L0_mag-ibs" }.
"Logical_file_id".
"Logical_source_description"    1:  CDF_CHAR    { "Solar Orbiter Magnetometer L0 Data" }.
"Rules_of_use"                  1:  CDF_CHAR    { "Not For Publication" }.
"Generated_by"                  1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"Mods"                          1:  CDF_CHAR    { "V01 2019/11/06 I. Carrasco: Initial release" }
                                2:  CDF_CHAR    { "V02 2020/03/31 V. Evans: Second release" }
                                3:  CDF_CHAR    { "V03 2020/08/20 V. Angelini: Third release" }.
"Level"                         1:  CDF_CHAR    { "L0>Level 0 Raw Data" }.
"Parents".
"Instrument_name"               1:  CDF_CHAR    { "MAG" }.
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                  "and supported by the UK Space Agency"}.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
```

```
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)


#zVariables

!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes   Variance  Variances
! --------          ----            --------  ----  -----   --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0             T

    ! Attribute             Data
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Terrestrial Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_INT8     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_INT8     { -9223372036854775808 }
```

```
      "VALIDMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALEMIN"            CDF_INT8     { -9223372036854775808 }
      "SCALEMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! SCET

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET"                CDF_REAL8   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Spacecraft Elapsed Time" }
      "CATDESC"            CDF_CHAR    { "Elapsed time of the onboard clock" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FILLVAL"            CDF_REAL8   { -1.0e31 }
      "FORMAT"             CDF_CHAR    { "f14.3" }
      "LABLAXIS"           CDF_CHAR    { "Spacecraft Elapsed Time" }
      "UNITS"              CDF_CHAR    { "Ticks" }
      "VALIDMIN"           CDF_REAL8   { 0.0 }
      "VALIDMAX"           CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"           CDF_REAL8   { 0.0 }
      "SCALEMAX"           CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

! SCET_UNSYNC_FLAG

! Variable              Data        Number                          Record          Dimension
```

```
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET_UNSYNC_FLAG"    CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Spacecraft Elapsed Time Synchronization Flag" }
      "CATDESC"             CDF_CHAR    { "Whether the instrument time is synchronized (0) or unsynchronized (1)" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Scet unsynchronized flag" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 4 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! B_IBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "B_IBS"               CDF_INT4    1               1       3       T               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Magnetic Field Vector" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector in the inboard sensor physical frame" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I11" }
```

```
      "LABL_PTR_1"          CDF_CHAR    { "LBL1_B_IBS" }
      "UNITS"               CDF_CHAR    { "counts" }
      "VALIDMIN"            CDF_INT4    { -2147483648 }
      "VALIDMAX"            CDF_INT4    { 2147483647 }
      "SCALEMIN"            CDF_INT4    { -2147483648 }
      "SCALEMAX"            CDF_INT4    { 2147483647 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "data" }
      "REPRESENTATION_1"    CDF_CHAR    { "REP1_B_IBS" }
      "TENSOR_ORDER"        CDF_CHAR    { "1" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! LBL1_B_IBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "LBL1_B_IBS"          CDF_CHAR    2               1       3       F               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Axis Label for B" }
      "CATDESC"            CDF_CHAR    { "Axis label for magnetic field vectors" }
      "FORMAT"             CDF_CHAR    { "A2" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

    [1] = { "Bx" }
    [2] = { "By" }
    [3] = { "Bz" }

! REP1_B_IBS

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
```

```
! -----------           -------     -------------   ------- ------- ------------    --------------
  "REP1_B_IBS"          CDF_CHAR    1               1       3       F               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector representation for B" }
      "CATDESC"             CDF_CHAR    { "Vector representation for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A1" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "x" }
    [2] = { "y" }
    [3] = { "z" }

! SEQUENCE_COUNTER

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SEQUENCE_COUNTER"    CDF_UINT2   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Packet Sequence Counter" }
      "CATDESC"             CDF_CHAR    { "Telemetry Source Packet Sequence Counter field" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I5" }
      "LABLAXIS"            CDF_CHAR    { "Packet Sequence Counter" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 16383 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 16383 }
```

```
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! PACKET_TIME

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "PACKET_TIME"         CDF_REAL8   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"            CDF_CHAR    { "Packet Generation Time" }
      "CATDESC"             CDF_CHAR    { "Elapsed time of the onboard clock at packet generation time" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "Packet Generation Time" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"            CDF_REAL8   { 0.0 }
      "SCALEMAX"            CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! VECTOR_TIME_RESOLUTION

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
```

```
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Time Resolution" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector time resolution in number of vectors per second" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "f8.3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Time Resolution" }
      "VALIDMIN"            CDF_REAL4   { 0 }
      "VALIDMAX"            CDF_REAL4   { 1920 }
      "SCALEMIN"            CDF_REAL4   { 0 }
      "SCALEMAX"            CDF_REAL4   { 1920 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! VECTOR_RANGE

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Range" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector components' range" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Vector Range" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 3 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 3 }
```

```
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! RAMP_MODE

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "RAMP_MODE"               CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Ramp Mode Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor's Front End Electronics ramp mode flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Ramp Mode Enabled" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_DELAY_VALUE

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_DELAY_VALUE"         CDF_UINT1   1               0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Delay Value" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Delay Value" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I2" }
      "LABLAXIS"            CDF_CHAR    { "FEE Delay Value" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 31 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 31 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_AUTORANGE_DELAY

! Variable                Data        Number                          Record          Dimension
! Name                    Type        Elements        Dims    Sizes   Variance        Variances
! -----------             -------     -------------   ------- ------- ------------    --------------
  "FEE_AUTORANGE_DELAY"   CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Autorange Delay" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Autorange Delay" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I2" }
      "LABLAXIS"            CDF_CHAR    { "FEE Autorange Delay" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 31 }
```

```
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 31 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_AUTORANGE_ENABLED

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_AUTORANGE_ENABLED"   CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Autorange Enabled Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Autorange Enabled Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Autorange Enabled" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_RANGE_COMMAND_SOURCE

! Variable                      Data        Number                          Record          Dimension
! Name                          Type        Elements        Dims    Sizes   Variance        Variances
! -----------                   -------     -------------   ------- ------- ------------    --------------
```

```
  "FEE_RANGE_COMMAND_SOURCE"    CDF_UINT1   1              0              T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Range Command Source" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Range Command Source" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Range Command Source" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_ICU_IO_STATUS

! Variable                Data        Number                          Record          Dimension
! Name                    Type        Elements        Dims    Sizes   Variance        Variances
! -----------             -------     -------------   ------- ------- ------------    --------------
  "FEE_ICU_IO_STATUS"     CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics ICU IO Status" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Instrument Control Unit Input " -
                                          "Output Status" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
```

```
      "LABLAXIS"            CDF_CHAR    { "FEE ICU IO Status" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! X_SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "X_SATURATION_FLAG"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag X" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! Y_SATURATION_FLAG
```

```
! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Y_SATURATION_FLAG"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag Y" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! Z_SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Z_SATURATION_FLAG"       CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis Saturation Flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
```

```
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag Z" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! X_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "X_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis ADC Overflow" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC X" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.
```

```
! Y_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Y_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis ADC Overflow" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC Y" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! Z_ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "Z_ADC_OVERFLOW"          CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis ADC Overflow" }
```

```
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis ADC Overflow" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Overflow Flag ADC Z" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_X_GAIN

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_X_GAIN"              CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics X Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics X Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE X Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
```

```
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_Y_GAIN

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_Y_GAIN"              CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Y Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Y Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Y Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! FEE_Z_GAIN

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "FEE_Z_GAIN"              CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
```

```
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Sensor Front End Electronics Z Axis Gain" }
      "CATDESC"             CDF_CHAR    { "Sensor Front End Electronics Z Axis Gain" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "FEE Z Gain" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 7 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 7 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! VECTOR_NUMBER

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "VECTOR_NUMBER"           CDF_UINT2   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Number Within TM Packet" }
      "CATDESC"             CDF_CHAR    { "Vector Number Within TM Packet" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Number" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 512 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 512 }
```

```
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

#end
```

6.4 solo_L1_mag-obs_skeletontable_V06_20Aug2020

```
! Skeleton table for the solo_L1_mag-obs CDF files.
! Version 06 date 2020/08/20
! Compliant with SOL-MAG-DPDD-i2r0_workingcopy
! CDF V3.7.1
!
! ********************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************
! ** 01         21/11/2019      I. Carrasco         - Initial release
! ** 02         10/12/2019      I. Carrasco         - Updated B_OBS_URF FORMAT VARIABLEattributes from
! **                                                 f10.3 to f11.4
! ** 03         04/03/2020      H. O'Brien          - Updates to FieldNam, Catdesc, lablaxis, LBL1
! ** 04         27/03/2020      V. Evans            - Updated Catdesc of SCET
! ** 05         31/03/2020      V. Evans            - Minor tweaks: capitalisation of 'Instrument_name';
! **                                                   CDF_NAME, Mods
! ** 06         20/08/2020      V. Angelini         - Added doi and Acknowledgement.
! **
#header

     CDF NAME: solo_L1_mag-obs_skeletontable_V05.cdf
DATA ENCODING: NETWORK
     MAJORITY: ROW
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
```

```
! --------- ------------ ------------ ------- ---- -----
  0/14      23           20           0/z     1    3


#GLOBALattributes

! Attribute                  Entry   Data
! Name                       Number  Type        Value
! ---------                  ------  ----        -----
"Project"                        1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                    1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                     1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                      1:  CDF_CHAR    { "L1>Level 1 Uncalibrated Data" }.
"Descriptor"                     1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
"Software_version".
"Skeleton_version"               1:  CDF_CHAR    { "06" }.
"PI_name"                        1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                 1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Text"                           1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                 2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"                1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                  1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                 1:  CDF_CHAR    { "solo_L1_mag-obs" }.
"Logical_file_id".
"Logical_source_description"     1:  CDF_CHAR    { "Solar Orbiter Magnetometer L1 Data" }.
"Rules_of_use"                   1:  CDF_CHAR    { "Not For Publication" }.
"Generated_by"                   1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"Mods"                           1:  CDF_CHAR    { "V01 2019/11/21 I. Carrasco: Initial release" }
                                 2:  CDF_CHAR    { "V02 2019/12/10 I. Carrasco: Second release" }
                                 3:  CDF_CHAR    { "V03 2020/03/04 H. O'Brien: Third release" }
                                 4:  CDF_CHAR    { "V04 2020/03/27 V. Evans: Fourth release" }
                                 5:  CDF_CHAR    { "V05 2020/03/31 V. Evans: Fifth release" }
                                 6:  CDF_CHAR    { "V06 2020/08/20 V. Angelini: Sixth release" }.
```

```
"Level"                         1:  CDF_CHAR    { "L1>Level 1 Uncalibrated Data" }.
"Parents".
"Instrument_name"               1:  CDF_CHAR    { "MAG" }.
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                  "and supported by the UK Space Agency"}.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)
```

```
#zVariables

!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes  Variance  Variances
! --------          ----            --------  ----  -----  --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0            T

    ! Attribute             Data
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_INT8     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_INT8     { -9223372036854775808 }
      "VALIDMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALEMIN"            CDF_INT8     { -9223372036854775808 }
      "SCALEMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! SCET

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
```

```
  "SCET"                CDF_REAL8   1              0              T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "SCET" }
      "CATDESC"             CDF_CHAR    { "Spacecraft elapsed time" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "SCET" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"            CDF_REAL8   { 0.0 }
      "SCALEMAX"            CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! SCET_UNSYNC_FLAG

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET_UNSYNC_FLAG"    CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "SCET Unsync Flag" }
      "CATDESC"             CDF_CHAR    { "Whether the instrument time is synchronized (0) or unsynchronized (1)" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "SCET Unsync Flag" }
```

```
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 4 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! B_OBS_URF

! Variable             Data        Number                          Record          Dimension
! Name                 Type        Elements        Dims    Sizes   Variance        Variances
! -----------          -------     -------------   ------- ------- ------------    --------------
  "B_OBS_URF"          CDF_REAL8   1               1       3       T               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "B OBS URF" }
      "CATDESC"            CDF_CHAR    { "Magnetic field vector in the outboard sensor unit reference frame" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FILLVAL"            CDF_REAL8   { "NaN" }
      "FORMAT"             CDF_CHAR    { "f11.4" }
      "LABL_PTR_1"         CDF_CHAR    { "LBL1_B_OBS_URF" }
      "UNITS"              CDF_CHAR    { "nT" }
      "VALIDMIN"           CDF_REAL8   { -1.0E10 }
      "VALIDMAX"           CDF_REAL8   { 1.0E10 }
      "SCALEMIN"           CDF_REAL8   { -80000 }
      "SCALEMAX"           CDF_REAL8   { 80000 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "data" }
      "SI_CONVERSION"      CDF_CHAR    { "1.0E-9>T" }
      "REPRESENTATION_1"   CDF_CHAR    { "REP1_B_OBS_URF" }
      "COORDINATE_SYSTEM"  CDF_CHAR    { "SOLO_MAG_OBS" }
      "TENSOR_ORDER"       CDF_CHAR    { "1" }
```

```
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! LBL1_B_OBS_URF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "LBL1_B_OBS_URF"      CDF_CHAR    3               1       3       F               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Axis Label for B" }
      "CATDESC"            CDF_CHAR    { "Axis label for magnetic field vectors" }
      "FORMAT"             CDF_CHAR    { "A2" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

    [1] = { "B_x" }
    [2] = { "B_y" }
    [3] = { "B_z" }

! REP1_B_OBS_URF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "REP1_B_OBS_URF"      CDF_CHAR    1               1       3       F               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Vector representation for B" }
      "CATDESC"            CDF_CHAR    { "Vector representation for magnetic field vectors" }
      "FORMAT"             CDF_CHAR    { "A1" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.
```

```
    [1] = { "x" }
    [2] = { "y" }
    [3] = { "z" }

! SEQUENCE_COUNTER

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SEQUENCE_COUNTER"    CDF_UINT2   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Packet Sequence Counter" }
      "CATDESC"            CDF_CHAR    { "Telemetry Source Packet Sequence Counter field" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FORMAT"             CDF_CHAR    { "I5" }
      "LABLAXIS"           CDF_CHAR    { "Pkt Counter" }
      "VALIDMIN"           CDF_UINT2   { 0 }
      "VALIDMAX"           CDF_UINT2   { 16383 }
      "SCALEMIN"           CDF_UINT2   { 0 }
      "SCALEMAX"           CDF_UINT2   { 16383 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

! PACKET_TIME

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "PACKET_TIME"         CDF_REAL8   1               0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Packet Generation Time" }
      "CATDESC"             CDF_CHAR    { "Elapsed time of the onboard clock at packet generation time" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "Pkt Generation Time" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"            CDF_REAL8   { 0.0 }
      "SCALEMAX"            CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! VECTOR_TIME_RESOLUTION

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Cadence" }
      "CATDESC"             CDF_CHAR    { "Number of mag field vectors per second" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "f8.3" }
      "LABLAXIS"            CDF_CHAR    { "Cadence" }
      "VALIDMIN"            CDF_REAL4   { 0 }
      "VALIDMAX"            CDF_REAL4   { 1920 }
      "SCALEMIN"            CDF_REAL4   { 0 }
```

```
      "SCALEMAX"            CDF_REAL4    { 1920 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DETECTOR"            CDF_CHAR     { "OBS>Outboard Sensor" }.

! VECTOR_RANGE

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"            CDF_CHAR     { "Range" }
      "CATDESC"             CDF_CHAR     { "Magnetic field vector components' range" }
      "DEPEND_0"            CDF_CHAR     { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "FORMAT"              CDF_CHAR     { "I1" }
      "LABLAXIS"            CDF_CHAR     { "Range" }
      "VALIDMIN"            CDF_UINT1    { 0 }
      "VALIDMAX"            CDF_UINT1    { 3 }
      "SCALEMIN"            CDF_UINT1    { 0 }
      "SCALEMAX"            CDF_UINT1    { 3 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DETECTOR"            CDF_CHAR     { "OBS>Outboard Sensor" }.

! RAMP_MODE

! Variable                Data        Number                          Record          Dimension
! Name                    Type        Elements        Dims    Sizes   Variance        Variances
! -----------             -------     -------------   ------- ------- ------------    --------------
  "RAMP_MODE"             CDF_UINT1   1               0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Ramp Mode Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor's Front End Electronics ramp mode flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Ramp Mode Enabled" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "SATURATION_FLAG"         CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "FEE Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Saturation in at least one component on the raw data" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag" }
      "VALIDMIN"            CDF_UINT1   { 0 }
```

```
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "ADC_OVERFLOW"            CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "FEE ADC Overflow Flag" }
      "CATDESC"             CDF_CHAR    { "Overflow detected in Front End Electronics ADC" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "ADC Overflow Flag" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! VECTOR_NUMBER

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
```

```
! -----------                 -------     -------------   ------- ------- ------------     --------------
  "VECTOR_NUMBER"           CDF_UINT2   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Number Within TM Packet" }
      "CATDESC"             CDF_CHAR    { "Vector Number Within TM Packet" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Number" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 512 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 512 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

#end
```

6.5 solo_L1_mag-ibs_skeletontable_V07_20Aug2020

```
! Skeleton table for the solo_L1_mag-ibs CDF files.
! Version 07 date 2020/08/20
! Compliant with SOL-MAG-DPDD-i2r0_workingcopy
! CDF V3.7.1
!
! ********************************************************************************************
! ** Version    Date            Author              Comment
```

```
! ********************************************************************************************************
! ** 01          21/11/2019      I. Carrasco          - Initial release
! ** 02          10/12/2019      I. Carrasco          - Updated B_IBS_URF FORMAT VARIABLEattributes from
! **                                                  f10.3 to f11.4
! ** 03          14/01/2020      I. Carrasco          - Updated variable attribute LABL_PTR_1 from
! **                                                  LBL1_B_OBS_URF to LBL1_B_IBS_URF for the zVariable
! **                                                  B_IBS_URF
! ** 04          04/03/2020      H. O'Brien           - Updates to FieldNam, Catdesc, lablaxis, LBL1
! ** 05          27/03/2020      V. Evans             - Updated Catdesc of SCET
! ** 06          31/03/2020      V. Evans             - Minor tweaks: capitalisation of 'Instrument_name';
! **                                                    CDF_NAME, Mods
! ** 07          20/08/2020      V. Angelini          - Added doi and Acknowledgement.


#header

     CDF NAME: solo_L1_mag-ibs_skeletontable_V07.cdf
DATA ENCODING: NETWORK
     MAJORITY: ROW
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
! --------- ------------ ------------ ------- ---- -----
  0/14      23           20           0/z     1    3


#GLOBALattributes

! Attribute                Entry   Data
! Name                     Number  Type        Value
! ---------                ------  ----        -----
"Project"                      1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                  1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                   1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                    1:  CDF_CHAR    { "L1>Level 1 Uncalibrated Data" }.
```

```
"Descriptor"                    1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
"Software_version".
"Skeleton_version"              1:  CDF_CHAR    { "07" }.
"PI_name"                       1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Text"                          1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"               1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                 1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                1:  CDF_CHAR    { "solo_L1_mag-ibs" }.
"Logical_file_id".
"Logical_source_description"    1:  CDF_CHAR    { "Solar Orbiter Magnetometer L1 Data" }.
"Rules_of_use"                  1:  CDF_CHAR    { "Not For Publication" }.
"Generated_by"                  1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"Mods"                          1:  CDF_CHAR    { "V01 2019/11/21 I. Carrasco: Initial release" }
                                2:  CDF_CHAR    { "V02 2019/12/10 I. Carrasco: Second release" }
                                3:  CDF_CHAR    { "V03 2020/01/14 I. Carrasco: Third release" }
                                4:  CDF_CHAR    { "V04 2020/03/04 H. O'Brien: Fourth release" }
                                5:  CDF_CHAR    { "V05 2020/03/27 V. Evans: Fifth release" }
                                6:  CDF_CHAR    { "V06 2020/03/31 V. Evans: Sixth release" }
                                7:  CDF_CHAR    { "V07 2020/08/20 V. Angelini: Seventh release" }.
"Level"                         1:  CDF_CHAR    { "L1>Level 1 Uncalibrated Data" }.
"Parents".
"Instrument_name"               1:  CDF_CHAR    { "MAG" }.
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                  "and supported by the UK Space Agency"}.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
```

```
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)


#zVariables

!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes   Variance  Variances
! --------          ----            --------  ----  -----   --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0             T

    ! Attribute            Data
```

```
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_INT8     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_INT8     { -9223372036854775808 }
      "VALIDMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALEMIN"            CDF_INT8     { -9223372036854775808 }
      "SCALEMAX"            CDF_INT8     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! SCET

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET"                CDF_REAL8   1               0               T

    ! Attribute          Data
    ! Name               Type        Value
    ! -----------        -------     --------
      "FIELDNAM"         CDF_CHAR    { "SCET" }
      "CATDESC"          CDF_CHAR    { "Spacecraft elapsed time" }
      "DEPEND_0"         CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"     CDF_CHAR    { "time_series" }
      "FILLVAL"          CDF_REAL8   { -1.0e31 }
      "FORMAT"           CDF_CHAR    { "f14.3" }
      "LABLAXIS"         CDF_CHAR    { "SCET" }
```

```
      "UNITS"              CDF_CHAR    { "Ticks" }
      "VALIDMIN"           CDF_REAL8   { 0.0 }
      "VALIDMAX"           CDF_REAL8   { 4294967295.999 }
      "SCALEMIN"           CDF_REAL8   { 0.0 }
      "SCALEMAX"           CDF_REAL8   { 4294967295.999 }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

! SCET_UNSYNC_FLAG

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SCET_UNSYNC_FLAG"    CDF_UINT1   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "SCET Sync Flag" }
      "CATDESC"            CDF_CHAR    { "Time is synchronized (0) or unsynchronized (1)" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FORMAT"             CDF_CHAR    { "I1" }
      "LABLAXIS"           CDF_CHAR    { "SCET Unsync flag" }
      "VALIDMIN"           CDF_UINT1   { 0 }
      "VALIDMAX"           CDF_UINT1   { 1 }
      "SCALEMIN"           CDF_UINT1   { 0 }
      "SCALEMAX"           CDF_UINT1   { 4 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }.

! B_IBS_URF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
```

```
  "B_IBS_URF"           CDF_REAL8   1              1       3       T              T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "B IBS URF" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector in the inboard sensor unit reference frame" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { "NaN" }
      "FORMAT"              CDF_CHAR    { "f11.4" }
      "LABL_PTR_1"          CDF_CHAR    { "LBL1_B_IBS_URF" }
      "UNITS"               CDF_CHAR    { "nT" }
      "VALIDMIN"            CDF_REAL8   { -1.0E10 }
      "VALIDMAX"            CDF_REAL8   { 1.0E10 }
      "SCALEMIN"            CDF_REAL8   { -80000 }
      "SCALEMAX"            CDF_REAL8   { 80000 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "data" }
      "SI_CONVERSION"       CDF_CHAR    { "1.0E-9>T" }
      "REPRESENTATION_1"    CDF_CHAR    { "REP1_B_IBS_URF" }
      "COORDINATE_SYSTEM"   CDF_CHAR    { "SOLO_MAG_IBS" }
      "TENSOR_ORDER"        CDF_CHAR    { "1" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! LBL1_B_IBS_URF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "LBL1_B_IBS_URF"      CDF_CHAR    3               1       3       F               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
```

```
      "FIELDNAM"            CDF_CHAR    { "Axis Label for B" }
      "CATDESC"             CDF_CHAR    { "Axis label for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A2" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "B_x" }
    [2] = { "B_y" }
    [3] = { "B_z" }

! REP1_B_IBS_URF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "REP1_B_IBS_URF"      CDF_CHAR    1               1       3       F               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector representation for B" }
      "CATDESC"             CDF_CHAR    { "Vector representation for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A1" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "x" }
    [2] = { "y" }
    [3] = { "z" }

! SEQUENCE_COUNTER

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "SEQUENCE_COUNTER"    CDF_UINT2   1               0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Packet Sequence Counter" }
      "CATDESC"             CDF_CHAR    { "Telemetry Source Packet Sequence Counter field" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I5" }
      "LABLAXIS"            CDF_CHAR    { "Pkt Counter" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 16383 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 16383 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

! PACKET_TIME

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "PACKET_TIME"         CDF_REAL8   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Packet Generation Time" }
      "CATDESC"             CDF_CHAR    { "Elapsed time of the onboard clock at packet generation time" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL8   { -1.0e31 }
      "FORMAT"              CDF_CHAR    { "f14.3" }
      "LABLAXIS"            CDF_CHAR    { "Pkt Generation Time" }
      "UNITS"               CDF_CHAR    { "Ticks" }
      "VALIDMIN"            CDF_REAL8   { 0.0 }
      "VALIDMAX"            CDF_REAL8   { 4294967295.999 }
```

```
      "SCALEMIN"            CDF_REAL8    { 0.0 }
      "SCALEMAX"            CDF_REAL8    { 4294967295.999 }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }.

! VECTOR_TIME_RESOLUTION

! Variable                  Data         Number                          Record          Dimension
! Name                      Type         Elements         Dims    Sizes  Variance        Variances
! -----------               -------      -------------    ------- ------- ------------    --------------
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4    1                0               T

    ! Attribute             Data
    ! Name                  Type         Value
    ! -----------           -------      --------
      "FIELDNAM"            CDF_CHAR     { "Cadence" }
      "CATDESC"             CDF_CHAR     { "Number of mag field vectors per second" }
      "DEPEND_0"            CDF_CHAR     { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "FORMAT"              CDF_CHAR     { "f8.3" }
      "LABLAXIS"            CDF_CHAR     { "Cadence" }
      "VALIDMIN"            CDF_REAL4    { 0 }
      "VALIDMAX"            CDF_REAL4    { 1920 }
      "SCALEMIN"            CDF_REAL4    { 0 }
      "SCALEMAX"            CDF_REAL4    { 1920 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DETECTOR"            CDF_CHAR     { "IBS>Inboard Sensor" }.

! VECTOR_RANGE

! Variable              Data         Number                          Record          Dimension
! Name                  Type         Elements         Dims    Sizes  Variance        Variances
! -----------           -------      -------------    ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1    1                0               T
```

```
    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Range" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector components' range" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Range" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 3 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 3 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! RAMP_MODE

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "RAMP_MODE"               CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Ramp Mode Flag" }
      "CATDESC"             CDF_CHAR    { "Sensor's Front End Electronics ramp mode flag" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Ramp Mode Enabled" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
```

```
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! SATURATION_FLAG

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "SATURATION_FLAG"         CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "FEE Saturation Flag" }
      "CATDESC"             CDF_CHAR    { "Saturation in at least one component on the raw data" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "Saturation Flag" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! ADC_OVERFLOW

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
```

```
  "ADC_OVERFLOW"            CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "FEE ADC Overflow Flag" }
      "CATDESC"             CDF_CHAR    { "Overflow detected in Front End Electronics ADC" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I1" }
      "LABLAXIS"            CDF_CHAR    { "ADC Overflow Flag" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 1 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 1 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "IBS>Inboard Sensor" }.

! VECTOR_NUMBER

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "VECTOR_NUMBER"           CDF_UINT2   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector Number Within TM Packet" }
      "CATDESC"             CDF_CHAR    { "Vector Number Within TM Packet" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FORMAT"              CDF_CHAR    { "I3" }
      "LABLAXIS"            CDF_CHAR    { "Vector Number" }
```

```
      "VALIDMIN"            CDF_UINT2    { 0 }
      "VALIDMAX"            CDF_UINT2    { 512 }
      "SCALEMIN"            CDF_UINT2    { 0 }
      "SCALEMAX"            CDF_UINT2    { 512 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DETECTOR"            CDF_CHAR     { "IBS>Inboard Sensor" }.

#end
```

6.6 solo_L2_mag-srf_skeletontable_V11_11Sept2020

```
! Skeleton table for the solo_L2_mag-srf CDF files.
! Version 11 date 2020/09/11
! Compliant with SOL-MAG-DPDD-i2r0_workingcopy
! CDF V3.7.1
!
! ********************************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************************
! ** 01         10/12/2019      I. Carrasco         - Initial release
! ** 02         18/12/2019      I. Carrasco         - Deleted zVariables SCET_UNSYNC_FLAG, SEQUENCE_COUNTER,
! **                                                  PACKET_TIME and VECTOR_NUMBER.
! **                                                - Added variable attribute VAR_NOTES.
! ** 03         17/03/2020      H. O'Brien           - Updates to FieldNam, Catdesc, lablaxis, LBL1
! ** 04         27/03/2020      V. Evans            - Updates to Catdesc, lablaxis of SCET
! **                                                - Updates to FieldNam, Catdesc of VECTOR_TIME_RESOLUTION
! **                                                - Updated VarNotes, QUALITY_BITMASK
! ** 05         30/03/2020      V. Evans            - Removed SCET
! ** 06         31/03/2020      V. Evans            - Minor tweaks to: 'CDF_NAME'; capitalisation of
! **                                                  'Instrument_name'; 'Mods'; 'VarNotes' of QUALITY_BITMASK;
! **                                                  'Skeleton_version'
! ** 07         01/05/2020      V. Angelini         - B_SRF is now single (float) instead of double (real8)
```

```
! ** 08         18/06/2020      V.Angelini          - Changed VALIDMIN and MAX EPOCH. Added FILLVAL and UNIT
! **                                                  to VECTOR_TIME_RESOLUTION, VECTOR_RANGE, QUALITY_BITMASK,
! **                                                  QUALITY_FLAG. Added spase_DatasetResourceID.
! ** 09         27/07/2020      V. Angelini         - Added GAttributes Acknowledgement, HTTP_LINK, Data_product,
SOOP-TYPE, OBS_ID.
! ** 10         18/08/2020      V. Angelini         - Rules of use, Acknoledgement, QUALITY_BITMASK VAR_NOTES and
QUALITY_FLAG
! **                                                  VAR_NOTES, modified doi.
! ** 11         11/09/2020      V.Angelini          - Rules of use and Data_product modified after pre release CDF
review


#header

     CDF NAME: solo_L2_mag-srf_skeletontable_V10.cdf
DATA ENCODING: NETWORK
     MAJORITY: COLUMN
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
! --------- ------------ ------------ ------- ---- -----
  0/8       28           21           0/z     1    3


#GLOBALattributes

! Attribute                 Entry   Data
! Name                      Number  Type        Value
! ---------                 ------  ----        -----
"Project"                       1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                   1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                    1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                     1:  CDF_CHAR    { "L2>Level 2 Calibrated Data" }.
"Descriptor"                    1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
```

```
"Software_version".
"Skeleton_version"              1:  CDF_CHAR    { "11" }.
"PI_name"                       1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Text"                          1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"               1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                 1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                1:  CDF_CHAR    { "solo_L2_mag-srf" }.
"Logical_file_id".
"Logical_source_description"    1:  CDF_CHAR    { "Solar Orbiter Magnetometer L2 Data" }.
"Rules_of_use"                  1:  CDF_CHAR    { "Publication quality. Take note of Quality Flag and" -
                                                  " refer to SOL-MAG-DPDD for exceptions" }.
"Generated_by"                  1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"MODS"                          1:  CDF_CHAR    { "V01 2019/12/10 I. Carrasco: Initial release" }
                                2:  CDF_CHAR    { "V02 2019/12/18 I. Carrasco: Second release" }
                                3:  CDF_CHAR    { "V03 2020/03/17 H. O'Brien: Third release" }
                                4:  CDF_CHAR    { "V04 2020/03/27 V. Evans: Fourth release" }
                                5:  CDF_CHAR    { "V05 2020/03/30 V. Evans: Fifth release" }
                                6:  CDF_CHAR    { "V06 2020/03/31 V. Evans: Sixth release" }
                                7:  CDF_CHAR    { "V07 2020/03/31 V. Angelini: Seventh release" }
                                8:  CDF_CHAR    { "V08 2020/06/18 V. Angelini: Eighth release" }
                                9:  CDF_CHAR    { "V09 2020/07/27 V. Angelini: Ninth release" }
                                10:  CDF_CHAR   { "V10 2020/08/18 V. Angelini: Tenth release" }
                                11: CDF_CHAR    { "V11 2020/09/11 V. Angelini: Eleventh release" }.
"Level"                         1:  CDF_CHAR    { "L2>Level 2 Calibrated Data" }.
"Parents".
"Instrument_name"               1:  CDF_CHAR    { "MAG" }.
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                  "and supported by the UK Space Agency"}.
"HTTP_LINK"                     1:  CDF_CHAR    { "https://www.imperial.ac.uk/space-and-atmospheric-physics/" -
                                                  "research/missions-and-projects/space-missions/solar-orbiter/"}.
"SOOP_TYPE"                     1:  CDF_CHAR    { "SOOP_TYPE" }.
```

```
"OBS_ID"                        1:  CDF_CHAR    { "OBS_ID" }.
"Data_product"                  1:  CDF_CHAR    { "SRF > Data in SRF coordinates" }.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_NOTES"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)


#zVariables
```

```
!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes  Variance  Variances
! --------          ----            --------  ----  -----  --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0             T

    ! Attribute             Data
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_TIME_TT2000     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_TIME_TT2000     { 5541512069184000000 }
      "VALIDMAX"            CDF_TIME_TT2000     { 12665808691840000000 }
      "SCALEMIN"            CDF_TIME_TT2000     { -9223372036854775808 }
      "SCALEMAX"            CDF_TIME_TT2000     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! B_SRF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "B_SRF"               CDF_FLOAT   1               1       3       T               T

    ! Attribute             Data
```

```
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "B SRF" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector in spacecraft reference frame" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_FLOAT   { "NaN" }
      "FORMAT"              CDF_CHAR    { "f11.4" }
      "LABL_PTR_1"          CDF_CHAR    { "LBL1_B_SRF" }
      "UNITS"               CDF_CHAR    { "nT" }
      "VALIDMIN"            CDF_FLOAT   { -1.0E10 }
      "VALIDMAX"            CDF_FLOAT   { 1.0E10 }
      "SCALEMIN"            CDF_FLOAT   { -80000 }
      "SCALEMAX"            CDF_FLOAT   { 80000 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "data" }
      "SI_CONVERSION"       CDF_CHAR    { "1.0E-9>T" }
      "REPRESENTATION_1"    CDF_CHAR    { "REP1_B_SRF" }
      "COORDINATE_SYSTEM"   CDF_CHAR    { "SOLO_SRF" }
      "TENSOR_ORDER"        CDF_CHAR    { "1" }
      "DETECTOR"            CDF_CHAR    { "PRI>Primary Sensor" }.

! LBL1_B_SRF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "LBL1_B_SRF"          CDF_CHAR    3               1       3       F               T

    ! Attribute          Data
    ! Name               Type        Value
    ! -----------        -------     --------
      "FIELDNAM"         CDF_CHAR    { "Axis Label for B" }
      "CATDESC"          CDF_CHAR    { "Axis label for magnetic field vectors" }
      "FORMAT"           CDF_CHAR    { "A2" }
```

```
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "B_x" }
    [2] = { "B_y" }
    [3] = { "B_z" }



! REP1_B_SRF

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "REP1_B_SRF"          CDF_CHAR    1               1       3       F               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Vector representation for B" }
      "CATDESC"             CDF_CHAR    { "Vector representation for magnetic field vectors" }
      "FORMAT"              CDF_CHAR    { "A1" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }.

    [1] = { "x" }
    [2] = { "y" }
    [3] = { "z" }

! VECTOR_TIME_RESOLUTION

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4   1               0               T

    ! Attribute             Data
```

```
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Cadence" }
      "CATDESC"             CDF_CHAR    { "Number of mag field vectors per second" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL4   { "NaN" }
      "FORMAT"              CDF_CHAR    { "f8.3" }
      "UNITS"               CDF_CHAR    {"None"}
      "LABLAXIS"            CDF_CHAR    { "Vector Time Resolution" }
      "VALIDMIN"            CDF_REAL4   { 0 }
      "VALIDMAX"            CDF_REAL4   { 1920 }
      "SCALEMIN"            CDF_REAL4   { 0 }
      "SCALEMAX"            CDF_REAL4   { 1920 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! VECTOR_RANGE

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1   1               0               T

    ! Attribute           Data
    ! Name                Type        Value
    ! -----------         -------     --------
      "FIELDNAM"          CDF_CHAR    { "Vector Range" }
      "CATDESC"           CDF_CHAR    { "Magnetic field vector components' range" }
      "DEPEND_0"          CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"      CDF_CHAR    { "time_series" }
      "FILLVAL"           CDF_UINT1   { 254 }
      "FORMAT"            CDF_CHAR    { "I1" }
      "UNITS"             CDF_CHAR    {"None"}
```

```
      "LABLAXIS"            CDF_CHAR    { "Vector Range" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 3 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 3 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! QUALITY_BITMASK

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "QUALITY_BITMASK"     CDF_UINT2   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"            CDF_CHAR    { "Quality bitmask" }
      "CATDESC"             CDF_CHAR    { "Detailed information about the quality" -
                                          " of the magnetic field vector" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_UINT2   { 65534 }
      "FORMAT"              CDF_CHAR    { "I5" }
      "UNITS"               CDF_CHAR    {"None"}
      "LABLAXIS"            CDF_CHAR    { "Quality bitmask" }
      "VALIDMIN"            CDF_UINT2   { 0 }
      "VALIDMAX"            CDF_UINT2   { 65535 }
      "SCALEMIN"            CDF_UINT2   { 0 }
      "SCALEMAX"            CDF_UINT2   { 2 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "VAR_NOTES"           CDF_CHAR    { "This is a bitwise variable, meaning that multiple flags"-
```

```
                                        "can be set for a single time, by adding flag values."-
                                        "Single bit flags for this data Bit1: INBOARDPRIMARY,"-
                                        "L2 data is from inboard sensor; Bit2: SCETUNSYNC, instrument"-
                                        " time not synchronised with SC time; Bit3: MAGHEATERON, "-
                                        "MAG heater operating; Bit4: TONEREMOVED, interference"-
                                        " tones were detected and removed from this data point;"-
                                        " Bit5: THRUSTERREMOVED thrusters were firing and influence "-
                                        "has been removed from this data point; Bit6: SCINTERFERENCE,"-
                                        " SC generated interference detected but not removed; Bit7:"-
                                        " SAMOVEMENT, solar array movement occurred; Bit8: INSTRUMENTREMOVED,"-
                                        " interference field signal from another instrument operation "-
                                        "has been detected and removed; Refer to SOL-MAG-DPDD for more"-
                                        " information on how these flags are generated." }.

! QUALITY_FLAG

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "QUALITY_FLAG"        CDF_UINT1   1               0               T

    ! Attribute              Data
    ! Name                   Type        Value
    ! -----------            -------     --------
      "FIELDNAM"             CDF_CHAR    { "Quality flag" }
      "CATDESC"              CDF_CHAR    { "High level information about the quality" -
                                           " of the magnetic field vector" }
      "DEPEND_0"             CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"         CDF_CHAR    { "time_series" }
      "FILLVAL"              CDF_UINT1   { 254 }
      "FORMAT"               CDF_CHAR    { "I1" }
      "LABLAXIS"             CDF_CHAR    { "Quality flag" }
      "UNITS"                CDF_CHAR    {"None"}
      "VALIDMIN"             CDF_UINT1   { 0 }
      "VALIDMAX"             CDF_UINT1   { 4 }
```

```
      "SCALEMIN"            CDF_UINT1    { 0 }
      "SCALEMAX"            CDF_UINT1    { 4 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "VAR_NOTES"           CDF_CHAR     { "Flag setting: 0:Bad data; 1: Known problems use at your own risk;"-
                                           " 2: Survey data, possibly not publication quality; 3: Good for "-
                                           "publication subject to PI approval; 4: Excellent data which has"-
                                           " received special treatment; refer SOL-MAG-DPDD for more information"-
                                           " on how these flags are generated."}.

#end
```

6.7 solo_L2_mag-rtn_skeletontable_V11_11Sept2020

```
! Skeleton table for the solo_L2_mag-rtn CDF files.
! Version 11 date 2020/09/11
! Compliant with SOL-MAG-DPDD-i2r0_workingcopy
! CDF V3.7.1
!
! ********************************************************************************************************
! ** Version    Date            Author              Comment
! ********************************************************************************************************
! ** 01         11/12/2019      I. Carrasco         - Initial release
! ** 02         18/12/2019      I. Carrasco         - Deleted zVariables SCET_UNSYNC_FLAG, SEQUENCE_COUNTER,
! **                                                  PACKET_TIME and VECTOR_NUMBER.
! **                                                - Added variable attribute VAR_NOTES.
! ** 03         17/03/2020      H. O'Brien           - Updates to FieldNam, Catdesc, lablaxis, LBL1
! ** 04         27/03/2020      V. Evans            - Updates to Catdesc of SCET and VECTOR_TIME_RESOLUTION **
! **                                                - Updated VarNotes, QUALITY_BITMASK
! ** 05         30/03/2020      V. Evans            - Removed SCET
! ** 06         31/03/2020      V. Evans            - Minor tweaks to: 'CDF_NAME'; capitalisation of
```

```
! **                                                    'Instrument_name'; 'Mods'; 'VarNotes' of QUALITY_BITMASK;
! **                                                    'Skeleton_version'
! ** 07         01/05/2020      V. Angelini         - B_RTN is now single (float) instead of double (real8)
! ** 08         18/06/2020      V.Angelini          - Changed VALIDMIN and MAX EPOCH. Added FILLVAL and UNIT
! **                                                    to VECTOR_TIME_RESOLUTION, VECTOR_RANGE, QUALITY_BITMASK,
! **                                                    QUALITY_FLAG. Added spase_DatasetResourceID.
! ** 09         27/07/2020      V. Angelini         - Added GAttributes Acknowledgement, HTTP_LINK, Data_product,
SOOP-TYPE, OBS_ID.
! ** 10         18/08/2020      V. Angelini         - Rules of use, Acknoledgement, QUALITY_BITMASK VAR_NOTES and
QUALITY_FLAG
! **                                                    VAR_NOTES, modified doi.
! ** 11         11/09/2020      V.Angelini          - Rules of use and Data_product modified after pre release CDF
review

#header

     CDF NAME: solo_L2_mag-rtn_skeletontable_V11.cdf
DATA ENCODING: NETWORK
     MAJORITY: COLUMN
       FORMAT: SINGLE

! Variables G.Attributes V.Attributes Records Dims Sizes
! --------- ------------ ------------ ------- ---- -----
  0/8       28           21           0/z     1    3


#GLOBALattributes

! Attribute                 Entry   Data
! Name                      Number  Type        Value
! ---------                 ------  ----        -----
"Project"                       1:  CDF_CHAR    { "Solar Orbiter" }.
"Source_name"                   1:  CDF_CHAR    { "SOLO>Solar Orbiter" }.
"Discipline"                    1:  CDF_CHAR    { "Space Physics>Interplanetary Studies" }.
"Data_type"                     1:  CDF_CHAR    { "L2>Level 2 Calibrated Data" }.
```

```
"Descriptor"                    1:  CDF_CHAR    { "MAG>Magnetometer" }.
"Data_version".
"Software_version".
"Skeleton_version"              1:  CDF_CHAR    { "11" }.
"PI_name"                       1:  CDF_CHAR    { "T. Horbury" }.
"PI_affiliation"                1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"TEXT"                          1:  CDF_CHAR    { "Dual-sensor, triaxial fluxgate magnetometer" }
                                2:  CDF_CHAR    { "doi:10.1051/0004-6361/201937257" }.
"Instrument_type"               1:  CDF_CHAR    { "Magnetic Fields (space)" }.
"Mission_group"                 1:  CDF_CHAR    { "Solar Orbiter" }.
"Logical_source"                1:  CDF_CHAR    { "solo_L2_mag-rtn" }.
"Logical_file_id".
"Logical_source_description"    1:  CDF_CHAR    { "Solar Orbiter Magnetometer L2 Data" }.
"Rules_of_use"                  1:  CDF_CHAR    { "Publication quality. Take note of Quality Flag and" -
                                                  " refer to SOL-MAG-DPDD for exceptions" }.
"Generated_by"                  1:  CDF_CHAR    { "The Blackett Laboratory, Imperial College London" }.
"Generation_date".
"MODS"                          1:  CDF_CHAR    { "V01 2019/12/11 I. Carrasco: Initial release" }
                                2:  CDF_CHAR    { "V02 2019/12/18 I. Carrasco: Second release" }
                                3:  CDF_CHAR    { "V03 2020/03/17 H. O'Brien: Third release" }
                                4:  CDF_CHAR    { "V04 2020/03/27 V. Evans: Fourth release" }
                                5:  CDF_CHAR    { "V05 2020/03/30 V. Evans: Fifth release" }
                                6:  CDF_CHAR    { "V06 2020/03/31 V. Evans: Sixth release" }
                                7:  CDF_CHAR    { "V07 2020/05/01 V. Angelini: Seventh release" }
                                8:  CDF_CHAR    { "V08 2020/06/18 V. Angelini: Eighth release" }
                                9:  CDF_CHAR    { "V07 2020/07/27 V. Angelini: Ninth release" }
                                10: CDF_CHAR    { "V10 2020/08/18 V. Angelini: Tenth release" }
                                11: CDF_CHAR    { "V11 2020/09/11 V. Angelini: Eleventh release" }.
"Level"                         1:  CDF_CHAR    { "L2>Level 2 Calibrated Data" }.
"Parents".
"Instrument_name"               1:  CDF_CHAR    { "MAG" }.
"Acknowledgement"               1:  CDF_CHAR    { "Solar Orbiter magnetometer data was provided by Imperial College
London" -
                                                  "and supported by the UK Space Agency"}.
"HTTP_LINK"                     1:  CDF_CHAR    { "https://www.imperial.ac.uk/space-and-atmospheric-physics/" -
```

```
                                                    "research/missions-and-projects/space-missions/solar-orbiter/"}.
"SOOP_TYPE"                     1:  CDF_CHAR    { "SOOP_TYPE" }.
"OBS_ID"                        1:  CDF_CHAR    { "OBS_ID" }.
"Data_product"                  1:  CDF_CHAR    { "RTN > Data in RTN coordinates" }.


#VARIABLEattributes

    "CATDESC"
    "COORDINATE_SYSTEM"
    "DEPEND_0"
    "DETECTOR"
    "DISPLAY_TYPE"
    "FIELDNAM"
    "FILLVAL"
    "FORMAT"
    "LABL_PTR_1"
    "LABLAXIS"
    "REPRESENTATION_1"
    "SCALEMAX"
    "SCALEMIN"
    "SCALETYP"
    "SI_CONVERSION"
    "TENSOR_ORDER"
    "UNITS"
    "VALIDMAX"
    "VALIDMIN"
    "VAR_NOTES"
    "VAR_TYPE"


#variables

! rVariables section is intentionally empty (no rVariables for solo_LL01_mag)
```

```
#zVariables

!EPOCH

! Variable          Data            Number                  Record   Dimension
! Name              Type            Elements  Dims  Sizes  Variance  Variances
! --------          ----            --------  ----  -----  --------  ---------
  "EPOCH"           CDF_TIME_TT2000 1         0             T

    ! Attribute             Data
    ! Name                  Type        Value
    ! --------              ----        -----
      "FIELDNAM"            CDF_CHAR     { "EPOCH (Time)" }
      "CATDESC"             CDF_CHAR     { "Epoch encoded as Terrestrial Time on " -
                                           "rotating Earth geoid, ns since J2000" }
      "FILLVAL"             CDF_TIME_TT2000     { -9223372036854775808 }
      "FORMAT"              CDF_CHAR     { "I" }
      "LABLAXIS"            CDF_CHAR     { "EPOCH" }
      "UNITS"               CDF_CHAR     { "ns" }
      "VALIDMIN"            CDF_TIME_TT2000     { 5541512069184000000 }
      "VALIDMAX"            CDF_TIME_TT2000     { 12665808691840000000 }
      "SCALEMIN"            CDF_TIME_TT2000     { -9223372036854775808 }
      "SCALEMAX"            CDF_TIME_TT2000     { 9223372036854775807 }
      "SCALETYP"            CDF_CHAR     { "linear" }
      "VAR_TYPE"            CDF_CHAR     { "metadata" }
      "DISPLAY_TYPE"        CDF_CHAR     { "time_series" }
      "SI_CONVERSION"       CDF_CHAR     { "1.0E-9>s" } .

! B_RTN

! Variable          Data        Number                  Record      Dimension
! Name              Type        Elements    Dims  Sizes Variance    Variances
! --------          ----        --------    ----  ----- --------    ---------
```

```
  "B_RTN"           CDF_FLOAT   1           1     3     T           T

  ! Attribute           Data
  ! Name                Type        Value
  ! --------            ----        -----

    "FIELDNAM"          CDF_CHAR    { "B RTN" }
    "CATDESC"           CDF_CHAR    { "Magnetic field vector in RTN coordinates" }
    "DEPEND_0"          CDF_CHAR    { "EPOCH" }
    "DISPLAY_TYPE"      CDF_CHAR    { "time_series" }
    "FILLVAL"           CDF_FLOAT   { "NaN" }
    "FORMAT"            CDF_CHAR    { "f11.4" }
    "LABL_PTR_1"        CDF_CHAR    { "LBL1_B_RTN" }
    "UNITS"             CDF_CHAR    { "nT" }
    "VALIDMIN"          CDF_FLOAT   { -1.0e+10 }
    "VALIDMAX"          CDF_FLOAT   { 1.0e+10 }
    "SCALEMIN"          CDF_FLOAT   { -80000.0 }
    "SCALEMAX"          CDF_FLOAT   { 80000.0 }
    "SCALETYP"          CDF_CHAR    { "linear" }
    "VAR_TYPE"          CDF_CHAR    { "data" }
    "SI_CONVERSION"     CDF_CHAR    { "1.0E-9>T" }
    "REPRESENTATION_1"  CDF_CHAR    { "REP1_B_RTN" }
    "COORDINATE_SYSTEM" CDF_CHAR    { "RTN" }
    "TENSOR_ORDER"      CDF_CHAR    { "1" }
    "DETECTOR"          CDF_CHAR    { "PRI>Primary Sensor" }.

! LBL1_B_RTN

! Variable        Data      Number                      Record      Dimension
! Name            Type      Elements    Dims    Sizes   Variance    Variances
! --------        ----      --------    ----    -----   --------    ---------
  "LBL1_B_RTN"    CDF_CHAR  3           1       3       F           T

  ! Attribute     Data
  ! Name          Type       Value
```

```
  ! --------      ----       -----
    "FIELDNAM"    CDF_CHAR   { "Axis Label for B in RTN coordinates" }
    "CATDESC"     CDF_CHAR   { "Axis label for magnetic field vectors" }
    "FORMAT"      CDF_CHAR   { "A2" }
    "VAR_TYPE"    CDF_CHAR   { "metadata" }.

    [1] = { "B_r" }
    [2] = { "B_t" }
    [3] = { "B_n" }

! REP1_B_RTN

! Variable        Data      Number                    Record      Dimension
! Name            Type      Elements    Dims  Sizes Variance    Variances
! --------        ----      --------    ----  ----- --------    ---------
  "REP1_B_RTN"    CDF_CHAR  1           1     3     F           T

  ! Attribute     Data
  ! Name          Type       Value
  ! --------      ----       -----
    "FIELDNAM"    CDF_CHAR   { "Vector representation for B" }
    "CATDESC"     CDF_CHAR   { "Vector representation for magnetic " -
                               "field vectors" }
    "FORMAT"      CDF_CHAR   { "A1" }
    "VAR_TYPE"    CDF_CHAR   { "support_data" }.

    [1] = { "r" }
    [2] = { "t" }
    [3] = { "n" }

! VECTOR_TIME_RESOLUTION

! Variable                  Data        Number                          Record          Dimension
! Name                      Type        Elements        Dims    Sizes   Variance        Variances
! -----------               -------     -------------   ------- ------- ------------    --------------
```

```
  "VECTOR_TIME_RESOLUTION"  CDF_REAL4   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Cadence" }
      "CATDESC"             CDF_CHAR    { "Number of mag field vectors per second" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
      "FILLVAL"             CDF_REAL4   { "NaN" }
      "FORMAT"              CDF_CHAR    { "f8.3" }
      "UNITS"               CDF_CHAR    {"None"}
      "LABLAXIS"            CDF_CHAR    { "Cadence" }
      "VALIDMIN"            CDF_REAL4   { 0 }
      "VALIDMAX"            CDF_REAL4   { 1920 }
      "SCALEMIN"            CDF_REAL4   { 0 }
      "SCALEMAX"            CDF_REAL4   { 1920 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! VECTOR_RANGE

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "VECTOR_RANGE"        CDF_UINT1   1               0               T

    ! Attribute             Data
    ! Name                  Type        Value
    ! -----------           -------     --------
      "FIELDNAM"            CDF_CHAR    { "Range" }
      "CATDESC"             CDF_CHAR    { "Magnetic field vector components' range" }
      "DEPEND_0"            CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"        CDF_CHAR    { "time_series" }
```

```
      "FILLVAL"             CDF_UINT1   { 254 }
      "FORMAT"              CDF_CHAR    { "I1" }
      "UNITS"               CDF_CHAR    {"None"}
      "LABLAXIS"            CDF_CHAR    { "Vector Range" }
      "VALIDMIN"            CDF_UINT1   { 0 }
      "VALIDMAX"            CDF_UINT1   { 3 }
      "SCALEMIN"            CDF_UINT1   { 0 }
      "SCALEMAX"            CDF_UINT1   { 3 }
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "DETECTOR"            CDF_CHAR    { "OBS>Outboard Sensor" }.

! QUALITY_BITMASK

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "QUALITY_BITMASK"     CDF_UINT2   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Quality bitmask" }
      "CATDESC"            CDF_CHAR    { "Detailed information about the quality" -
                                         " of the magnetic field vector" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FILLVAL"            CDF_UINT2   { 65534 }
      "FORMAT"             CDF_CHAR    { "I5" }
      "UNITS"              CDF_CHAR    {"None"}
      "LABLAXIS"           CDF_CHAR    { "Quality bitmask" }
      "VALIDMIN"           CDF_UINT2   { 0 }
      "VALIDMAX"           CDF_UINT2   { 65535 }
      "SCALEMIN"           CDF_UINT2   { 0 }
      "SCALEMAX"           CDF_UINT2   { 2 }
```

```
      "SCALETYP"            CDF_CHAR    { "linear" }
      "VAR_TYPE"            CDF_CHAR    { "metadata" }
      "VAR_NOTES"           CDF_CHAR    { "This is a bitwise variable, meaning that multiple flags"-
                                          "can be set for a single time, by adding flag values."-
                                          "Single bit flags for this data Bit1: INBOARDPRIMARY,"-
                                          "L2 data is from inboard sensor; Bit2: SCETUNSYNC, instrument"-
                                          " time not synchronised with SC time; Bit3: MAGHEATERON, "-
                                          "MAG heater operating; Bit4: TONEREMOVED, interference"-
                                          " tones were detected and removed from this data point;"-
                                          " Bit5: THRUSTERREMOVED thrusters were firing and influence "-
                                          "has been removed from this data point; Bit6: SCINTERFERENCE,"-
                                          " SC generated interference detected but not removed; Bit7:"-
                                          " SAMOVEMENT, solar array movement occurred; Bit8: INSTRUMENTREMOVED,"-
                                          " interference field signal from another instrument operation "-
                                          "has been detected and removed; Refer to SOL-MAG-DPDD for more"-
                                          " information on how these flags are generated." }.

! QUALITY_FLAG

! Variable              Data        Number                          Record          Dimension
! Name                  Type        Elements        Dims    Sizes   Variance        Variances
! -----------           -------     -------------   ------- ------- ------------    --------------
  "QUALITY_FLAG"        CDF_UINT1   1               0               T

    ! Attribute            Data
    ! Name                 Type        Value
    ! -----------          -------     --------
      "FIELDNAM"           CDF_CHAR    { "Quality flag" }
      "CATDESC"            CDF_CHAR    { "High level information about the quality" -
                                         " of the magnetic field vector" }
      "DEPEND_0"           CDF_CHAR    { "EPOCH" }
      "DISPLAY_TYPE"       CDF_CHAR    { "time_series" }
      "FILLVAL"            CDF_UINT1   { 254 }
      "FORMAT"             CDF_CHAR    { "I1" }
      "LABLAXIS"           CDF_CHAR    { "Quality flag" }
```

```
      "UNITS"              CDF_CHAR    {"None"}
      "VALIDMIN"           CDF_UINT1   { 0 }
      "VALIDMAX"           CDF_UINT1   { 4 }
      "SCALEMIN"           CDF_UINT1   { 0 }
      "SCALEMAX"           CDF_UINT1   { 4 }
      "SCALETYP"           CDF_CHAR    { "linear" }
      "VAR_TYPE"           CDF_CHAR    { "metadata" }
      "VAR_NOTES"          CDF_CHAR    { "Flag setting: 0:Bad data; 1: Known problems use at your own risk;"-
                                         " 2: Survey data, possibly not publication quality; 3: Good for "-
                                         "publication subject to PI approval; 4: Excellent data which has"-
                                         " received special treatment; refer SOL-MAG-DPDD for more information"-
                                         " on how these flags are generated."}.

#end
```